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## Research article

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# Revision of the Nearctic species of the *Lasioglossum (Dialictus) gemmatum* species complex (Hymenoptera: Halictidae)

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**Abstract.** The *Lasioglossum (Dialictus) gemmatum* species complex, also known as the *L. tegulare* species group and the *L. parvum* species complex, is a very common, widespread, diverse, and recognisable lineage of sweat bees, containing 22 previously described species and several known undescribed species. The species were recently revised for the eastern Nearctic region and the Greater Antilles, but remain poorly known in the western Nearctic along with most other *L. (Dialictus)*. These characteristics make it a prime candidate for revision in ongoing taxonomic work on the western Nearctic *L. (Dialictus)*. Here we present the results of this revision, including 10 new species descriptions, one new synonymy, a preliminary phylogeny, and keys to known Nearctic species. Species of the eastern Nearctic and a few primarily Neotropical species which can occur in the Nearctic are also included. We report that the *L. (D.) gemmatum* species complex is likely a monophyletic group arising from the *L. (D.) comulum* group, but that the enlarged tegula has arisen independently in at least two other *L. (Dialictus)* lineages, and it contains multiple cases of allopatric speciation. The following species are described as new: *Lasioglossum (Dialictus) angelicum* sp. nov., *L. (D.) deludens* sp. nov., *L. (D.) diabolicum* sp. nov., *L. (D.) eremum* sp. nov., *L. (D.) gloriosum* sp. nov., *L. (D.) indagator* sp. nov., *L. (D.) holzenthali* sp. nov., *L. (D.) magnitegula* sp. nov., *L. (D.) profundum* sp. nov., and *L. (D.) rufodeludens* sp. nov. Previously undescribed males of *L. (D.) perparvum* (Ellis, 1914) and *L. (D.) pseudotegulare* (Cockerell, 1896) and the female of *L. (D.) gaudiale* (Sandhouse, 1924) are diagnosed and figured for the first time. *Lasioglossum (Dialictus) hunteri* (Crawford, 1932) is a new subjective junior synonym of *L. (D.) ellisiae* (Sandhouse, 1924). Pre-2022 specimen records of *L. (D.) hunteri* and *L. (D.) regulariforme* (Crawford, 1907) are attributable to a heterogeneous mix of species, and records of *L. (D.) perparvum* are likely attributable to *L. (D.) deludens*.

**Keywords.** Apoidea, new species, phylogeny, taxonomy, tegula.

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## Introduction

The *Lasioglossum gemmatum* species complex is a lineage of *Lasioglossum* (*Dialictus*) Robertson, 1902 primarily characterized by the enlarged and often punctate tegula of both sexes. It was previously treated as the *L. tegulare* species group (Ellis 1914; Gibbs 2009a) and the *L. parvum* species complex (Gibbs 2018b; Gardner & Gibbs 2020) before it was recognised that *L. gemmatum* (Smith, 1853), as the oldest available name, should have precedence. The function of the enlarged tegula is unknown, but it has arisen frequently enough and persists in enough extant species to suppose that it has some adaptive value. In locusts, the tegula is an important proprioceptor for regulation of flight mechanics (Fischer & Ebert 1999). In bees, the tegula covers the basalare system, which is involved in wing movement (Snodgrass 1935; Pfau 2018). The shape of the tegula may be related to enhanced protection of the basalare and axillaries at the forewing base or a modified role in proprioception. Enlarged tegulae have evolved multiple times in distantly related Halictidae Thomson, 1869, including in the genera *Augochloropsis* Cockerell, 1897, *Dieunomia* Cockerell, 1899, and *Pseudapis* s. lat., at least one undescribed species of *Sphecodes*<sup>1</sup>, in the *Lasioglossum* species *L. (Hemihalictus) glabriventre* (Crawford, 1907) and *L. (H.) kincaidii* (Cockerell, 1898), in *L. moffati* (Cockerell, 1920) and *L. trimeni* (Cockerell, 1920) of uncertain subgeneric placement and *L. (Chilalictus) albopilosum* Walker, 1995 within the series of ‘strong-veined’ *Lasioglossum*, and in some *L. (Dialictus)*. All of these *Lasioglossum* are restricted to the Western Hemisphere except for *L. moffati* and *L. trimeni* from Africa and *L. albopilosum* from Australia. Modified and enlarged tegulae are also seen in representatives of other bee families (Michener 2007). We hypothesize that the *L. gemmatum* species complex is a monophyletic group, but we notably exclude several other species of *L. (Dialictus)* with enlarged tegulae. These species are distinguishable by other characters and DNA barcodes, indicating that the enlarged tegula has multiple origins within *L. (Dialictus)* as it does in Halictidae.

This group is extremely widespread in the Western Hemisphere, ranging throughout most of North America (only absent from northern Canada) (Gardner & Gibbs 2022) and western South America from Colombia to Argentina and Chile (Engel 2000; unpublished data). It occurs even on remote islands including Hawaii (Tabor & Koch 2021), the Greater Antilles (Gibbs 2018b), Isla Socorro (unpublished data), and the Archipiélago de Juan Fernández (Engel 2000). This suggests a great dispersal ability, although the species occurring in Hawaii are known to be non-native there and may have been introduced by humans (Magnacca *et al.* 2013).

Species in the *L. gemmatum* complex generally follow the same patterns seen in *L. (Dialictus)* as a whole, including great abundance (especially with pan traps; see for example Campbell *et al.* 2007; Minckley 2008), recent and rapid evolution (Gibbs *et al.* 2012; Grab *et al.* 2019), and associated difficulties with cytochrome *c* oxidase subunit 1 (COI) barcode-based identification (Gibbs 2018a). Prior to 2021, there were 27 available names in the *L. gemmatum* complex (including 5 synonyms), suggesting a relatively high level of diversity. There are very few published descriptions of the biology, nest construction, or social behaviour of any species in the *L. gemmatum* complex, but those that exist indicate that species may have both eusocial and solitary nests. *Lasioglossum gemmatum* (Smith, 1853) and *L. parvum* (Cresson, 1865) were both found nesting in loose aggregations in sandy soil, with a single mated queen and 2–5 unmated workers per nest (Eickwort 1988). In contrast, Corbin *et al.* (2021) inferred *L. ellisiae* (Sandhouse, 1924) to have solitary nests based on wear and ovarian development in trapped specimens. *Lasioglossum* is ancestrally primitively eusocial (Gibbs *et al.* 2012), so the *L. gemmatum* complex as a rule likely makes eusocial nests, with the switch to solitary behaviour in *L. ellisiae* being derived or a

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<sup>1</sup> This species was discovered by J. Gardner in collections from southern California at LACM. The tegula is shaped and densely punctured in both sexes in much the same way as in *L. regulariforme* (Crawford, 1907). Mike Arduser (Missouri Department of Conservation), who has seen most of the *Sphecodes* type material, confirmed in personal communication that he has also seen specimens at UCRC and that no described species known to him has such a tegula, although some Palaearctic species have the tegula modified in other ways.



variable trait. However, the timing and frequency of reversions to solitary behaviour are impossible to determine without a known taxonomy, more studies of nesting behaviour, and a robust phylogeny.

The applied taxonomy of the *L. gemmatum* species complex in the Nearctic region has, historically, been treated as fairly simple. Despite the abundance of available names, only a few were frequently used and published in the literature. Prior to 2009, these included *L. hunteri* (Crawford, 1932) (for any specimen with a red metasoma), *L. tegulare* (Robertson, 1890) (for any specimen in the eastern United States), and *L. tegulariforme* (Crawford, 1907) (for most specimens in the western United States or Mexico). Some easily recognisable species from the southwestern United States and northern Mexico were also determined as *L. coactus* (Cresson, 1872) and *L. perparvum* (Ellis, 1914) in museum collections. The rest of the species were only known from the type material and, at most, a handful of other specimens.

It was suspected early on that the name *L. tegulariforme* was over-applied and included multiple species (Cockerell 1937). Michener (1937) made an effort to address this problem by describing *L. albuquerquense* Michener, 1937 and noting that the species included in Sandhouse (1924) as *L. tegulariforme* was probably actually this species. However, *L. albuquerquense* was not often identified after its description, and most western Nearctic specimens continued to be called *L. tegulariforme*. Over the next 70 years, species in the *L. gemmatum* complex continued to be consolidated into just the 3–5 most frequently used names. Michener (1951) (with input from P.H. Timberlake) synonymized *L. gaudiale* (Sandhouse, 1924) and *L. helianthi* (Cockerell, 1916) with *L. tegulariforme*, and Mitchell (1960) synonymized *L. ellisiae* (Sandhouse, 1924) and *L. lepidii* (Graenicher, 1927) with *L. tegulare*. Mitchell (1960) also described *L. suriana* (Mitchell, 1960), but apparently did not recognise it as a member of the *L. gemmatum* species complex and made no reference to the (admittedly only slightly) enlarged tegula.

It was not until a thorough revision of the *L. gemmatum* complex in the eastern United States and Canada by Gibbs (2009a) that its true diversity and complexity began to be revealed. Gibbs (2009a) resurrected *L. ellisiae* and *L. lepidii* from synonymy and described two new species which had previously been identified as *L. tegulare*. A revision of the *L. (Dialictus)* of Canada by Gibbs (2010) described one new species, *L. imbrex* Gibbs, 2010, which had previously been identified as *L. tegulariforme*. An update to that work (Gardner & Gibbs 2022) resurrected *L. gaudiale* and *L. helianthi* from synonymy, while recognising *L. imbrex* as a junior synonym of *L. helianthi* and *L. albuquerquense* as a junior synonym of *L. stictaspis* (Sandhouse, 1923), and defining *L. tegulariforme* in a much more restricted sense.

Based on this recent work, it is reasonable to expect *L. hunteri* and *L. tegulariforme*, as traditionally recognised, to contain multiple species. Examination of specimens from the western Nearctic region confirmed this expectation and revealed several undescribed species, some of which are surprisingly common and easily recognisable, yet have gone largely unnoticed. A revision of the *L. gemmatum* complex in the western Nearctic region was therefore considered a high priority in ongoing taxonomic work on *L. (Dialictus)*. Here we present results from that revision. Species in the eastern Nearctic region are also included because many of them also occur in the west, or there is some evidence that they may do so.

## Material and methods

### Taxon concept

The taxon concept for *L. (Dialictus)* follows the classification in Gibbs (2018b), and Gardner & Gibbs (2020, 2022). Species were delimited using an evolutionary species concept (Wiley & Mayden 2000) and integrative taxonomy (DeSalle *et al.* 2005); that is, species were considered as independent evolutionary lineages and were tested in a hypothesis-driven approach using at least two sources of data. The three most readily available data types, and the ones used in this work, are morphology, DNA, and geographic distributions.

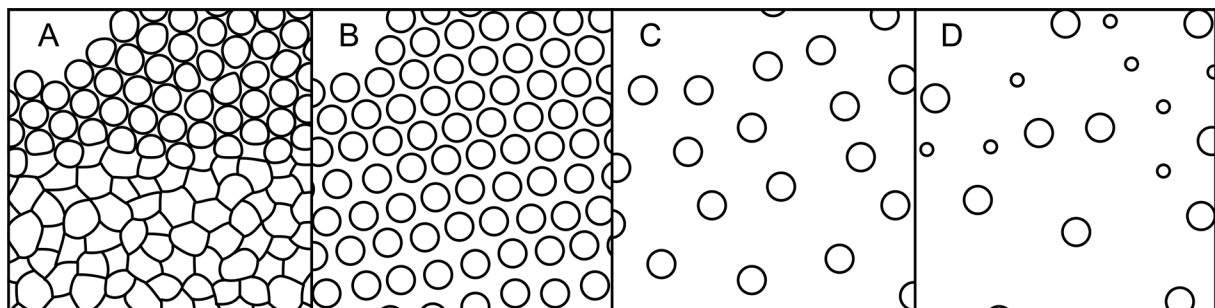
### Morphological examination and descriptions

Specimens were examined under a dissecting microscope at about  $40\times$  magnification and illuminated with a standard desk lamp with a 13W fluorescent bulb (60W incandescent equivalent) set to one side. These bulbs provide very diffuse light, which is ideal for seeing punctures and surface sculpture, in contrast to more focused fibre optics or LEDs which often create too much glare on shiny integuments. Morphometric measurements were made with an ocular micrometer with both ends of the structure being measured kept in focus. Characters measured were a subset of those in Gardner & Gibbs (2020), with the addition of tegula maximum width and maximum length. Intertegular span (ITS), defined as the minimum distance between the tegulae (Cane 1987), was sometimes ambiguous due to the large posterior projection in some species which curves inward past the mesoscutum posterior margin, such that the minimum distance is far from the point at which ITS is usually measured. To facilitate comparisons with species with smaller tegulae, ITS was measured excluding any such projections.

Morphological terms and measurements follow standard usage in Michener (2007), with *Lasioglossum*-specific additions by Gibbs (2010) and Gardner & Gibbs (2020). Surface sculpture terms follow Harris (1979). Pubescence length and a few other characters are given in units of median ocellus diameters (OD) unless specified as lateral OD.

Puncture density is given in terms of the range of interspaces (IS) between punctures, in units of puncture diameters (PD). Punctures are said to be ‘crowded’ when there are few or no distinct interspaces; often this tight packing results in some punctures becoming polygonal rather than round, and this condition can blend into reticulate, rugulose, or areolate sculpture (Fig. 1A). This is contrasted with ‘dense (IS < 1 PD)’, in which all punctures are round and separated by at least narrow interspaces (Fig. 1B). The terms ‘dense’ and ‘sparse’ are an indication of whether most interspaces are toward the upper or lower end of the given range. ‘Moderately dense (IS = 1–2 PD)’ punctures are therefore separated mostly by about 1 PD, with a few interspaces up to 2 PD, and ‘moderately sparse (IS = 1–2 PD)’ punctures are mostly separated by about 2 PD (Fig. 1C). There are almost always a few punctures separated by only 1 or 2 PD, so a large range such as ‘sparse (IS = 1–3 PD)’ should be interpreted as closer to 3 PD on average (Fig. 1D).

Species accounts are organized into the following sections: 1) nomenclatural summary including synonymies; 2) **Diagnosis** for identification confirmation and comparison with similar species; 3) **Etymology** of the specific epithet; 4) **Material examined**; 5) **Description** (omitted for previously described species); 6) **Range** summarizing known occurrence records; 7) **Floral hosts**, sorted alphabetically by family, genus, species, and subspecies (note that records were obtained from specimen labels and do not distinguish pollen and nectar use); 8) **DNA barcodes** including barcode gap analysis and list of diagnostic



**Fig. 1.** Examples of punctation in *Lasioglossum* (*Dialictus*) Robertson, 1902. **A.** Crowded (IS = 0 PD) with few or no distinct interspaces in upper half to ruguloso-punctate in lower half. **B.** Dense (IS < 1 PD) but distinct. **C.** Moderately dense in upper half to moderately sparse in lower half (IS = 1–2 PD). **D.** Sparse (IS = 1–3 PD) and diversopunctate in upper half.

nucleotides; 9) **Comments** for any additional discussion. For the material examined, label data is given in a standardized format. Estimates and author interpretations of missing or uncertain information are indicated by enclosure in square brackets ('[]'). Verbatim label data is only given for newly designated type material. New rows on a label are indicated with a single forward slash ('/') and additional labels are indicated with a double forward slash ('//'). Plant classification was updated for floral host lists using the World Flora Online database (WFO 2022).

Face, lateral and dorsal habitus, and metasoma images of all included species were generated with a Canon EOS 7D camera with MPE-65 lens (Canon, Ōta, Tokyo, Japan). Three wireless flash units were arranged at approximately 120° intervals around the specimen. Two tubes of diffusion paper were placed between the flash units and the specimen to scatter the light and reduce glare on the specimen. The camera was mounted on a StackShot system (Cognisys Inc., Traverse City, Michigan, United States) to obtain several images at varying focal depths, which were then processed for focus stacking in Helicon Focus software (Helicon Soft Ltd., Kharkiv, Ukraine). Male genitalia were illustrated in Illustrator CS5 software (Adobe Inc., San Jose, California, United States), while examining the genitalia using a microscope with ocular grid for scale reference.

### **DNA barcoding**

DNA was extracted from hind legs of preserved specimens (or a hind leg and mid-leg for small specimens) by placing the tissue in individual tubes or wells, and then crushing it with a sterile pestle. Tubes or the pestle (for 96-well plates) were dipped in liquid nitrogen to cool the tissue and make it brittle. For small numbers of specimens (less than 30), DNA was extracted using DNeasy Blood & Tissue silica membrane spin column kits (Qiagen, Hilden, Germany) and a modified protocol developed for dried museum specimens by Crane (2013). For sets of 96 specimens, DNA was extracted using KingFisher Cell and Tissue DNA kits (Thermo Fisher Scientific Inc., Waltham, Massachusetts, United States), or MagMAX-96 DNA Multi-Sample kits (Thermo Fisher Scientific Inc., Waltham, Massachusetts, United States), on a KingFisher Flex magnetic particle processor (Thermo Fisher Scientific Inc., Waltham, Massachusetts, United States) and the manufacturer's default program. In all cases, the amount of elution buffer in the final step was reduced to increase the concentration of DNA.

PCR was run with 8.4–9.4 µL dH<sub>2</sub>O, 5 µL 5X PCR buffer (Promega, Madison, Wisconsin, United States), 2.5 µL MgCl<sub>2</sub> (25 mM) (Promega, Madison, Wisconsin, United States), 5 µL dNTPs (1 mM each) (Promega, Madison, Wisconsin, United States), 0.125 µL GoTaq Flexi DNA polymerase (5 units/µL) (Promega, Madison, Wisconsin, United States), 1–2 µL DNA, and 1 µL of each primer (forward and reverse) (Integrated DNA Technologies, Coralville, Iowa, United States) for a 25 µL final reaction volume. Primers used were the BEEf-BEEr primer pair designed by Creedy *et al.* (2020) or the BarBeeF-MtD9 pair designed by Françoso & Arias (2013) for some older specimens, both of which amplify the standard 658 bp COI barcode region (Folmer *et al.* 1994). Reaction conditions followed those in Creedy *et al.* (2020) or Françoso & Arias (2013).

PCR products were checked for success by gel electrophoresis. Samples showing visible bands in the expected size range were purified with 0.4 µL of ExoSAP-IT (Thermo Fisher Scientific Inc., Waltham, Massachusetts, United States) per 1 µL DNA and sent for Sanger sequencing. Sequencing was performed by Eurofins MWG Operon (Toronto, Ontario, Canada) or University Core DNA Services at the University of Calgary (Alberta, Canada) prior to June 2019. Sequencing was performed in both forward and reverse directions. During early 2021, some samples were also sent to the Canadian Centre for DNA Barcoding (Guelph, Ontario, Canada) for complete processing from PCR to sequencing, due to a shortage of supplies.

Successful sequences were trimmed and aligned in Geneious ver. 8.1.7 (Kearse *et al.* 2012) and uploaded to the Barcode of Life Data System (BOLD; <http://www.boldsystems.org>) (Ratnasingham & Hebert 2007),

along with trace files and collection information. Distance metrics for DNA barcodes were calculated and diagnostic individual nucleotides were found using the `maxInDist`, `nonConDist`, and `nucDiag` functions in the `spider` package ver. 1.4-2 (Brown *et al.* 2012) in R ver. 4.0.0 (R Core Team 2020). All available *L. gemmatum* complex sequences  $\geq 600$  bp in length and with  $\leq 5$  ambiguous nucleotides were used for these analyses, after aligning the sequences first in BOLD and then making corrections by hand in Mesquite ver. 3.61 (Maddison & Maddison 2019). These sequences are available in the public BOLD dataset DS-GARDTEG ([10.5883/DS-GARDTEG](https://doi.org/10.5883/DS-GARDTEG)).

Some DNA barcodes were available from previous studies (Gibbs 2009a, 2010) and unpublished data from Jason Gibbs. These data were generated following the protocols in Gibbs (2009b).

### Geographic distributions

Distribution maps were generated from all georeferenced specimen records included in Material examined, with some additional records extracted from Gibbs (2009a and 2010). For records without associated GPS coordinates, coordinates were estimated from the location written on the label by searching in Google Earth or Fuzzy Gazetteer (Kohlschütter [Internet]) and measuring distances from landmarks in Google Earth as necessary. Coordinates were usually estimated to two decimal degree digits, but up to three are given for localities that were possible to locate more precisely, or fewer for very vague localities such as entire counties.

To reduce bias from well-collected ‘hot spots’, each coordinate was rounded to the nearest 0.5 degree, duplicate records were removed, and then original unrounded coordinates associated with the remaining records were restored, except for species with  $\leq 10$  unique records, for which only exact duplicates were removed. These coordinates were imported into Maxent ver. 3.4.1 (Phillips *et al.* [Internet]), which plots known records in addition to a predicted distribution generated by maximizing entropy (more uniform spread) of a probability distribution of ecological niche occupancy, within constraints inferred from species presence records and environmental data (Phillips *et al.* 2006). Environmental data used included the 19 bioclimatic variables (based on temperature and precipitation), solar radiation, wind speed, and elevation available from WorldClim (Fick & Hijmans 2017) and soil classification available from the FAO/UNESCO Digital Soil Map of the World (FAO/UNESCO 2007). These variables were thought to be most relevant to *L. (Dialictus)* foraging and nesting. All environmental data were at the 2.5 minute spatial scale, as this is close to the maximum estimated precision of most of the georeferenced specimen records. Solar radiation and wind speed data were converted from 12 monthly averages to yearly mean, minimum, maximum, range, and standard deviation  $\times 100$  in QGIS software (QGIS.org 2020) to be consistent with the WorldClim bioclimatic variables. The soil map was downloaded in vector format and rasterized to the 2.5 minute spatial scale in QGIS (QGIS.org 2020).

Maxent was run with soil type as categorical and all other variables as continuous, a regularization multiplier of 1, and complementary log-log (cloglog; the probability that at least one individual is present in a quadrat/pixel (Phillips *et al.* 2017)) as output. Soil classifications were unavailable for coastal regions near sea level and small islands. Records missing any environmental data were automatically excluded by Maxent but were manually added back on to the final maps (the model was not changed; only individual record markers were added). For three species with many records lacking soil data, such that excluding them drastically altered the predicted distribution, Maxent was instead run with all records but without soil classification as an environmental variable. Final maps were modified by recolouring and adding lakes, national borders, and state/province borders downloaded from Natural Earth (<https://www.naturalearthdata.com>; accessed 31 July 2020).



## Phylogeny

To test the monophyly of the *L. gemmatum* species complex, a phylogenetic tree was generated using representatives of all species of the *L. gemmatum* complex, all species of the *L. comulum* group (see diagnosis of the *L. gemmatum* species complex below for a definition of this group), all other species of *Lasioglossum* having an enlarged tegula, and representatives of other major lineages of *L. (Dialictus)* from which high-quality COI sequences ( $\geq 600$  bp and  $\leq 5$  ambiguous nucleotides) and morphological data were available. *Lasioglossum (Austrevylaeus) sordidum* (Smith, 1853) was also included as an outgroup and *L. (Hemihalictus) lustrans* (Cockerell, 1897) was included as a representative of *L. (Hemihalictus)* Cockerell, 1897. Sequences were downloaded and aligned from BOLD and the alignment was inspected and manually corrected in Mesquite ver. 3.61 (Maddison & Maddison 2019). Fifteen morphological characters were coded in a matrix ([Supp. file 1](#)) and added to the COI data.

A Markov Chain Monte Carlo (MCMC) tree search was performed in MrBayes ver. 3.2.7 (Ronquist *et al.* 2012) with the data partitioned by type (DNA or morphology). The DNA data used a GTR+I+ $\Gamma$  with 4 rate parameters model of evolution (selected by ModelFinder (Kalyaanamoorthy *et al.* 2017)) and the morphological data used gamma-distributed rate variation. The MCMC search was performed with two simultaneous runs, 8 chains (1 cold chain and 7 heated chains), a temperature of 0.0375, and was run for 20 000 000 generations until convergence was achieved (standard deviation of split frequencies  $< 0.004$ ). Other settings were the program defaults (sampling/diagnostics every 500/5000 generations with the first 25% of trees discarded as burn-in). The final 50% majority-rule consensus tree was rooted at the outgroup node.

## Specimens examined

Type material and other specimens were examined from the following institutions and individuals. Abbreviations used throughout the rest of the text are given first, with the full name and curator/lender (if applicable) given in parentheses afterward.

AMNH	=	American Museum of Natural History, New York, USA (Jerome G. Rozen)
ANSP	=	Academy of Natural Sciences of Drexel University, Philadelphia, USA (Jason Weintraub)
ASUHC	=	Arizona State University, Hasbrouck Insect Collection, Tempe, USA (Desirée Narango)
BBSL	=	USDA Agricultural Research Service Pollinating Insect Research Unit, Utah State University, Logan, USA (H. Ikerd, Terry Griswold)
CAS	=	California Academy of Sciences, San Francisco, USA (Chris Grinter)
CCBER	=	University of California-Santa Barbara Cheadle Center for Biodiversity and Ecological Restoration, Santa Barbara, USA (Katja Seltmann)
CMNC	=	Canadian Museum of Nature, Ottawa, Canada (Thomas Onuferko)
CNC	=	Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Canada (A. Bennett)
CSUC	=	Colorado State University, C.P. Gillette Museum of Arthropod Diversity, Fort Collins, USA (Boris Kondratieff)
CTMI	=	Central Texas Melittological Institute, Austin, USA (Jack Neff)
CUIC	=	Cornell University Insect Collection, Ithaca, USA (Jason Dombroskie)
DEBU	=	University of Guelph, Guelph, Canada
ECOAB	=	El Colegio de Frontera Sur, Equipo Abejas collection, San Cristóbal de las Casas, Mexico (Philippe Sagot, Jorge Mérida, Rémy Vandame)
EMEC	=	University of California-Berkeley, Essig Museum of Entomology, Berkeley, USA (Pete Oboyski)
FCSA	=	Florida Department of Agriculture and Consumer Services, Gainesville, USA
FWSE	=	US Fish and Wildlife Service, Vancouver, USA (Joe Engler)
GEH	=	personal collection of Gord E. Hutchings, Meadow Creek, Canada

GSNP	=	Great Smoky Mountains National Park, Gatlinburg, USA (A. Mayor)
INHS	=	Illinois Natural History Survey, Champaign, USA (Tommy McElrath)
LACM	=	Natural History Museum of Los Angeles County, Los Angeles, USA (Lisa Gonzalez, Weiping Xie)
LRF	=	personal collection of Liliana Ramírez Freire, Monterrey, Mexico
MTEC	=	Montana Entomology Collection, Bozeman, USA (Casey Delphia, Michael Ivie)
NAUF	=	Northern Arizona University, Flagstaff, USA
NMSU	=	New Mexico State University Arthropod Museum, Las Cruces, USA (Helen Vessels)
OSAC	=	Oregon State Arthropod Collection, Corvallis, USA (Gail Langellotto)
PCYU	=	Packer collection at York University, Toronto, Canada (Laurence Packer)
PWRC	=	Patuxent Wildlife Research Center Native Bee Inventory and Monitoring Lab, Patuxent, USA (Sam Droege)
RBCM	=	Royal British Columbia Museum, Victoria, Canada
RLM	=	personal collection of Robert L. Minckley, University of Rochester, Rochester, USA
SEMC	=	University of Kansas Biodiversity Institute and Natural History Museum, Lawrence, USA (Jennifer Thomas, Michael Engel)
SOUM	=	Southern Oregon University Insect Museum, Ashland, USA
TAMU	=	Texas A&M University Insect Collection, College Station, USA (Karen Wright)
UAIC	=	University of Arizona Insect Collection, Tucson, USA (Gene Hall)
UCDC	=	University of California-Davis, R.M. Bohart Museum of Entomology, Davis, USA (Lynn Kimsey, Tom Zavortink)
UCFC	=	University of Central Florida, Orlando, USA (S.M. Fullerton, S. Kelly)
UCMC	=	University of Colorado Museum of Natural History, Boulder, USA (Virginia Scott)
UCRC	=	University of California-Riverside Entomology Research Museum, Riverside, USA (Doug Yanega, Lauren Ponisio)
UMSP	=	University of Minnesota Insect Collection, St. Paul, USA (Robin Thomson)
USNM	=	Smithsonian Institution National Museum of Natural History, Washington D.C., USA (Seán Brady, Brian Harris)
WRME	=	J.B. Wallis/R.E. Roughley Museum of Entomology, Winnipeg, Canada (Jason Gibbs)

## Results

### Phylogeny

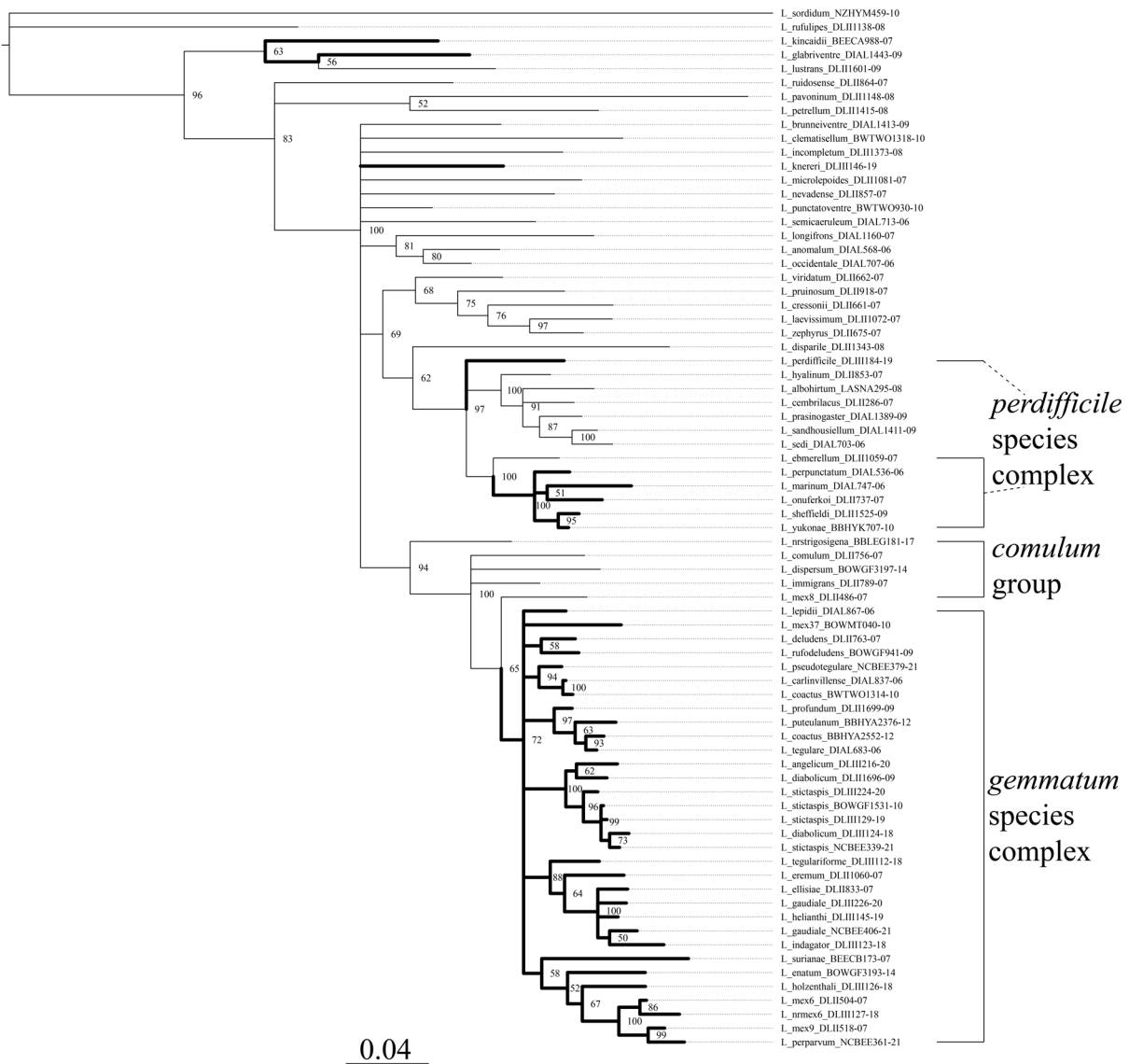
The *L. gemmatum* species complex and *L. comulum* group together form a monophyletic group supported with 94% posterior probability (Fig. 2). Within this clade, the *L. gemmatum* species complex is also monophyletic, but with only 65% posterior probability. The *L. comulum* group is paraphyletic with respect to the *L. gemmatum* species complex.

Enlarged tegulae had at least four independent origins within *Lasioglossum*: once in *Hemihalictus*, once in *L. knereri* Gibbs, 2010, once in the *L. perdifficile* species complex, and once in the *L. gemmatum* species complex (Fig. 2). The *L. perdifficile* species complex may be para- or polyphyletic with respect to the clade including *L. hyalinum* (Crawford, 1907), which could imply a loss or a fifth origin of the enlarged tegula, but more data are needed to resolve the polytomy at the base of these clades.

### Taxonomy

Ten new species in the *L. gemmatum* species complex from the western Nearctic region are here recognised and described. In total, 31 world species are recognised as valid in the *L. gemmatum* species complex, 18 of which occur in the continental western Nearctic region (19 including Hawaii). Fifteen of these have a dark metasoma and could have been determined as *L. tegulariforme* in the past (including the true *L. tegulariforme*), and seven have a red metasoma and were likely determined as *L. hunteri* in the past

(Table 1). Four species have variable metasoma colouration and could have been determined as either species in the past. The list below includes all 31 known species while the following revision treats only the 24 Nearctic species.



**Fig. 2.** 50% majority-rule consensus tree of species of *Lasioglossum* Curtis, 1833 with enlarged tegulae and representatives of other major lineages, based on 654-bp COI sequences and 15 morphological characters. MCMC tree search was performed in MrBayes ver. 3.2.7 using a GTR+I+ $\Gamma$ 4 model for the molecular data, gamma-distributed rate variation for the morphological data, partitioning by data type, two simultaneous runs with 8 chains each, temperature of 0.0375, 20 000 000 generations, and *L. sordidum* (Smith, 1853) set as the outgroup (other settings program defaults). Node labels are posterior probabilities. Taxa names are followed by their BOLD accession numbers. **Bold** branches on the tree are species with enlarged tegulae.

**Table 1.** Currently recognised species in the *L. gemmatum* species complex of the western Nearctic region, according to metasoma colour and which species each would have most likely been determined as prior to 2010.

Dark metasoma (traditional ‘ <i>L. tegulariforme</i> ’)	<i>L. angelicum</i> sp. nov., <i>L. coactus</i> , <i>L. deludens</i> sp. nov., <i>L. diabolicum</i> sp. nov., <i>L. ellisiae</i> , <i>L. eremum</i> sp. nov., <i>L. gaudiale</i> , <i>L. helianthi</i> , <i>L. holzenthali</i> sp. nov., <i>L. magnitegula</i> sp. nov., <i>L. perparvum</i> , <i>L. profundum</i> sp. nov., <i>L. pseudotegulare</i> , <i>L. stictaspis</i> , <i>L. tegulariforme</i>
Red metasoma (traditional ‘ <i>L. hunteri</i> ’)	<i>L. diabolicum</i> sp. nov., <i>L. ellisiae</i> , <i>L. gaudiale</i> , <i>L. gloriosum</i> sp. nov., <i>L. indagator</i> sp. nov., <i>L. stictaspis</i> , <i>L. rufodeludens</i> sp. nov.

Class Insecta Linnaeus, 1758  
 Order Hymenoptera Linnaeus, 1758  
 Family Halictidae Thomson, 1869  
 Genus *Lasioglossum* Curtis, 1833

*Lasioglossum gemmatum* species complex

**Species included**

*Lasioglossum angelicum* sp. nov., *L. busckiellum* (Cockerell, 1915), *L. carlinvillense* Gibbs, 2009, *L. coactus* (Cresson, 1872), *L. cupreicollis* (Friese, 1917), *L. deludens* sp. nov., *L. diabolicum* sp. nov., *L. ellisiae* (Sandhouse, 1924), *L. enatum* Gibbs, 2018, *L. eremum* sp. nov., *L. fernandezis* Engel, 2000, *L. gaudiale* (Sandhouse, 1924), *L. gemmatum* (Smith, 1853), *L. gloriosum* sp. nov., *L. helianthi* (Cockerell, 1916), *L. holzenthali* sp. nov., *L. indagator* sp. nov., *L. lepidii* (Graenicher, 1927), *L. magnitegula* sp. nov., *L. monense* Gibbs, 2018, *L. parvum* (Cresson, 1865), *L. paululum* (Sandhouse, 1924), *L. perparvum* (Ellis, 1914), *L. profundum* sp. nov., *L. pseudotegulare* (Cockerell, 1896), *L. puteulanum* Gibbs, 2009, *L. rufodeludens* sp. nov., *L. stictaspis* (Sandhouse, 1923), *L. surianae* (Mitchell, 1960), *L. tegulare* (Robertson, 1890), and *L. tegulariforme* (Crawford, 1907).

**Diagnosis**

Both sexes in the *L. gemmatum* complex have the tegula enlarged (reaching the posterior margin of the mesoscutum in dorsal view or nearly so), usually strongly punctate, and with the inner posterior margin straight or concave; about 50% of clypeus projecting below suborbital tangent; and T1 without tomentum. Additionally, females have the propodeum with a distinct oblique carina, and males have the mesepisternum and often propodeum lateral face shiny with large, distinct punctures, and metasomal sterna with moderately sparse plumose pubescence 1–2 OD long.

Some members of the *L. perdifficile* complex (defined in Gardner & Gibbs 2022) have a similar tegula, but these have more than 50% of the clypeus projecting below the suborbital tangent, females with propodeum oblique carina absent, and T1 with lateral tomentum. Some atypical specimens of *L. knereri* Gibbs, 2010 from California (possibly representing a cryptic species) also have a similar tegula, but have the propodeum without a distinct oblique carina, the metasomal terga all without appressed tomentum, and males have the metasomal sterna with very long and dense scopa-like pubescence (>2 OD).

*Lasioglossum comulum* Michener, 1951, *L. dispersum* Gibbs, 2018, *L. immigrans* Gardner & Gibbs, 2022, *L. strigosigena* Michener, 1954, and several undescribed species have the tegula small, ovoid, and impunctate, which is standard for most *L. (Dialictus)*, but resemble the *L. gemmatum* complex in most other characters. Additionally, DNA barcodes of these two species groups are very similar and suggest a close relationship. These species are informally defined as the *L. comulum* group. The *L. comulum*



group appears to be an evolutionary grade from which the *L. gemmatum* complex is derived (Fig. 2), but additional taxon sampling and more molecular data are needed to resolve their relationship with more certainty.

### *Lasioglossum stictaspis* species complex

#### Species included

*Lasioglossum angelicum* sp. nov., *L. cupreicollis* (Friese, 1917), *L. diabolicum* sp. nov., *L. paululum* (Sandhouse, 1924), and *L. stictaspis* (Sandhouse, 1923).

#### Diagnosis

The *L. stictaspis* species complex is a subset of the *L. gemmatum* complex defined by a cluster of highly similar DNA barcodes (BOLD BINs: ABX4912, AEC8768) containing numerous ‘mixture’ associations (as in Ratnasingham & Hebert 2013). No single combination of morphological characters reliably distinguishes the group, but most members have the tegula relatively large compared to most other species of *L. gemmatum* complex (maximum length half or more ITS and reaching or exceeding posterior margin of mesoscutum in dorsal view) and densely punctate (IS < 1 PD) (except *L. diabolicum* sp. nov.), face short (length/width ratio usually < 0.83 in females and < 0.86 in males), gena narrower than eye in lateral view, mesoscutum with abundant plumose pubescence about 1 OD long, T2–T4 with abundant tomentum and dense simple setae, and males with dense tomentum covering the face up to level of eye emargination.

*Lasioglossum cupreicollis* is included in this group with some trepidation, as the holotype was not available for examination and no known DNA barcodes are available. However, images of the holotype of *Halictus goethalsi* Cockerell, 1928 (considered a junior synonym of *L. cupreicollis* by Michener 1954) were seen, and it closely resembles some members of the *L. stictaspis* complex. One male specimen from Colombia also has a DNA barcode available and clearly belongs to this group, indicating that its distribution extends into South America.

*Lasioglossum pseudotegulare* is morphologically similar to the *L. stictaspis* complex except for its longer face (length/width ratio usually  $\geq 0.83$  in females and  $\geq 0.86$  in males), but its DNA barcodes are unique and highly divergent, and it is therefore excluded.

### *Lasioglossum (Dialictus) angelicum* sp. nov.

[urn:lsid:zoobank.org:act:7D4DB588-1714-46C7-AAC0-8E44E2AF44A5](https://zoobank.org/urn:lsid:zoobank.org:act:7D4DB588-1714-46C7-AAC0-8E44E2AF44A5)

Figs 3–5, 76A, 78C, 86B, 87A, 90B, 92B, 93B, 110B

#### Diagnosis

Females of *L. angelicum* sp. nov. have the tegula very large (exceeding posterior margin of mesoscutum in dorsal view) and densely punctate (IS < 1 PD), with inner posterior margin strongly concave and forming a posterior projection about the size of 1 lateral OD; scutellum densely punctate (IS < 1 PD); metapostnotum shiny with strong anastomosing rugae reaching posterior margin; T1 shiny and distinctly, moderately densely punctate (IS = 1–2 PD), usually with some fine punctures extending onto apical rim; face short (length/width ratio  $\leq 0.83$ ); gena slightly shorter than eye in lateral view; and tegula and metasoma black. Often, the mesoscutum is relatively sparsely and coarsely punctate (posterior half with IS = 1–3 PD in centre and only 2–3 punctures present between posterior end of parapsidal line and lateral edge of mesoscutum) and shiny at least on lateral and posterior margins, but a few specimens have the mesoscutum dull and more densely punctate; these specimens are difficult to distinguish from *L. helianthi*.

Females of *L. angelicum* sp. nov. are most similar to those of *L. gaudiale*, *L. helianthi*, *L. pseudotegulare*, and *L. tegulariforme*. Females of *L. gaudiale* and *L. helianthi* have the tegula slightly smaller (reaching but not exceeding posterior margin of mesoscutum in dorsal view) and sometimes more sparsely punctate ( $IS \geq 1$  PD laterally at midlength). In addition, females of *L. gaudiale* have the gena about as wide as eye in lateral view, scutellum often moderately sparsely punctate ( $IS = 1-2$  PD), and metapostnotum usually with subparallel rugae not reaching posterior margin. Females of *L. helianthi* have the T1 anterior slope usually coriarius and mesoscutum posterior half entirely densely punctate ( $IS < 1$  PD). Females of *L. pseudotegulare* have the face slightly longer (length/width ratio  $\geq 0.83$ ) and metapostnotum dull with fine, subparallel rugae. Females of *L. tegulariforme* have T1 with an impunctate median line about 1 OD wide and mesoscutum posterior half entirely densely punctate ( $IS < 1$  PD). Some females of other, unknown species in the *L. stictaspis* species complex can be very similar, but all have the T1 disc more finely and sparsely punctate ( $IS = 1-4$  PD) and/or coriarius, and often have the tegula and metasoma red-orange.

Males of *L. angelicum* sp. nov. have the tegula very large (as in the female); metapostnotum shiny with strong rugae; mesepisternum densely punctate ( $IS < 1$  PD) at least in ventral half; mesoscutum usually moderately densely punctate ( $IS = 1-2$  PD); T1 shiny; discs of T1–T2 uniformly finely and moderately densely punctate ( $IS = 1-2$  PD) with some punctures extending onto apical rims; face short (length/width ratio  $\leq 0.86$ ); and tegula black.

Males of *L. angelicum* sp. nov. are most similar to those of *L. helianthi*, *L. pseudotegulare*, and *L. tegulariforme*. Males of *L. helianthi* have the tegula smaller (not exceeding posterior margin of mesoscutum in dorsal view) with a narrow posterior point much smaller than 1 lateral OD and mesoscutum densely punctate ( $IS \leq 1$  PD). Males of *L. pseudotegulare* have the face slightly longer (length/width ratio usually  $> 0.86$ ) and discs of T1–T2 more densely punctate ( $IS \leq 1$  PD). Males of *L. tegulariforme* have the disc of T1 more sparsely punctate than T2, T1–T2 apical rims impunctate, and mesoscutum densely punctate ( $IS \leq 1$  PD). Some males of other, unknown species in the *L. stictaspis* species complex can be very similar, but usually have the mesepisternum ventral half more sparsely punctate ( $IS = 1-2$  PD), T1 coriarius at base, or tegula red-orange. A few specimens may be morphologically indistinguishable and can only be separated by geography, DNA barcodes, or associated females.

### Etymology

The specific epithet ‘*angelicum*’ is a Latin adjective derived from the noun ‘*angelus*’ (angel) plus the adjectival suffix ‘*-icum*’ (having the quality of). It is a reference to the type locality of the Los Angeles basin, where this species is common. An appropriate translation would be the angelic sweat bee.

### Material examined

#### Holotype

UNITED STATES – **California** • ♀; Los Angeles Co., Expo Park Nature Gardens, NHMLA; 34.02° N, 118.29° W; elev. 54 m; 18–20 Jul. 2018; H. Hayes leg.; LACM ENT 376858.

[Verbatim label: USA: CA, Los Angeles / Expo Park Nature Gardens, / NHMLA 34.02°N118.29°W / 54m, 18–20 July 2018, / H. Hayes 408 // LACM ENT 376858 // BOLD / gard0266-CA / DLIII216-20 // HOLOTYPE / *Lasioglossum (Dialictus) angelicum* Gardner and Gibbs]

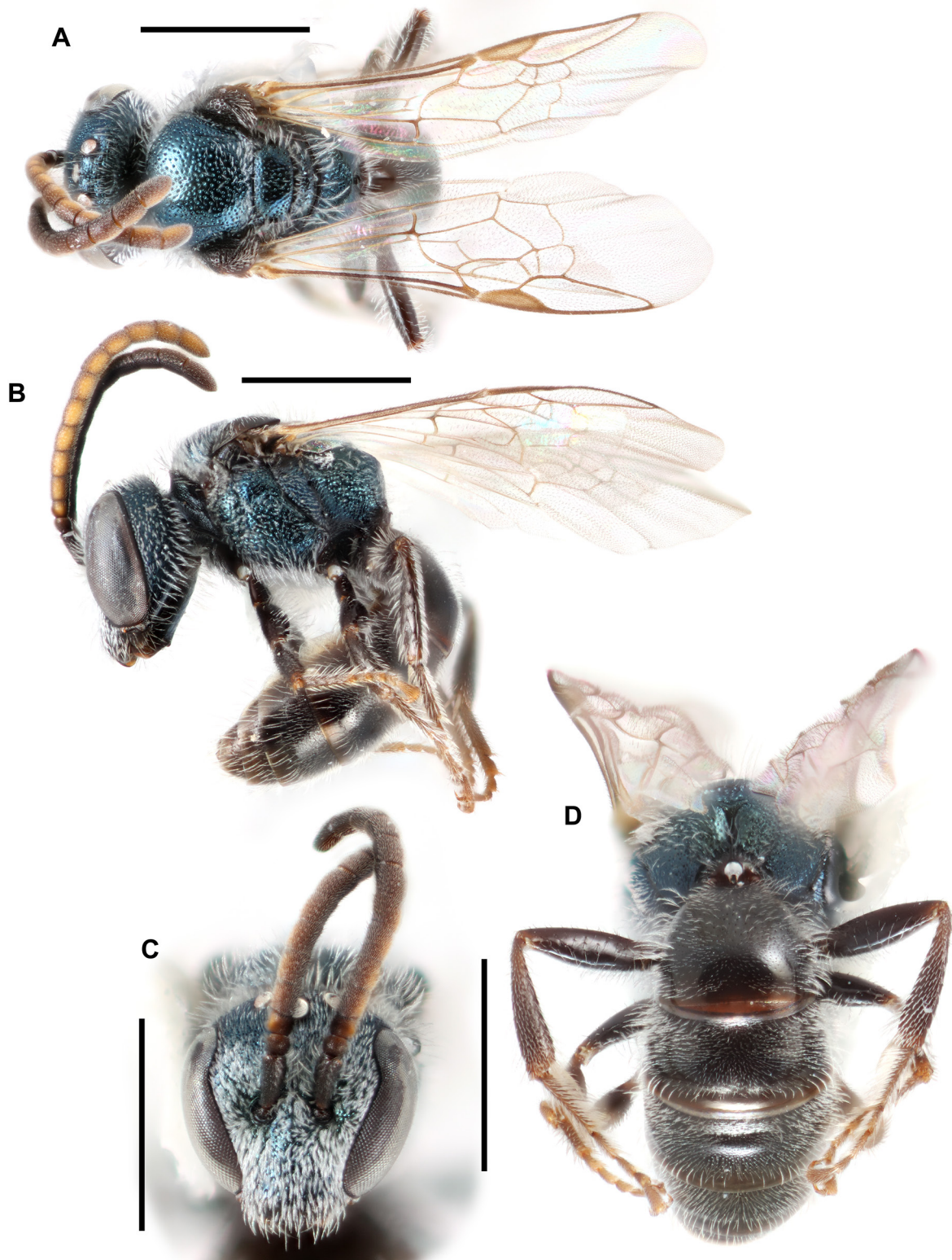
#### Paratypes

UNITED STATES – **California** • 1 ♀; Los Angeles Co., 5700 Tobias Avenue; 34.1739° N, 118.4518° W; elev. 209 m; 3 May 2018; S.B. Lerman leg.; ASUHIC LA-WF-2-BB-2 881 • 1 ♀; Los Angeles Co., 5831 Norwich Avenue; 34.1767° N, 118.4611° W; elev. 212 m; 11 Apr. 2018; S.B. Lerman leg.; ASUHIC LA-XS-3-BB-1 496 • 1 ♀; Los Angeles Co., Atwater Village; 34.114° N, 118.251° W; 28 May–4 Jun. 2014;



**Fig. 3.** *Lasioglossum (D.) angelicum* sp. nov., ♀, holotype (LACM ENT 376858). **A.** Lateral habitus. **B.** Dorsal habitus. **C.** Face. **D.** Metasoma and propodeum. Scale bars = 1 mm.





**Fig. 4.** *Lasioglossum (D.) angelicum* sp. nov., ♂ (LACM ENT 394542). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma. Scale bars = 1 mm.



Sidney Higgins leg.; LACM ENT 394539 • 1 ♂; Los Angeles Co., Ballona Wetlands near Playa del Rey; [33.97° N, 118.44° W]; 16 Jun. 1981; R.R. Snelling leg.; CUIIC • 4 ♀♀, 1 ♂; Los Angeles Co., Chatsworth; 34.26° N, 118.601° W; 1–8 May 2017; LACM • 21 ♀♀, 5 ♂♂; *ibid.*; 1–8 Jul. 2017; LACM • 3 ♀♀, 5 ♂♂; Los Angeles Co., Claremont; 34.0894° N, 117.7111° W; 1–8 Jul. 2016; LACM • 4 ♀♀, 3 ♂♂; *ibid.*; 1–8 Aug. 2016; LACM • 1 ♀; Los Angeles Co., Eagle Rock; 34.129° N, 118.215° W; 3–10 May 2014; Eric Keller leg.; LACM ENT 394537 • 1 ♀; Los Angeles Co., Eagle Rock; 34.13° N, 118.23° W; elev. 169.9 m; 15–21 Jul. 2018; Hannah Hayes leg.; LACM ENT 380968 • 1 ♀; Los Angeles Co., Expo Park; 34.018° N, 118.289° W; elev. 55 m; 30 May–6 Jul. 2014; D. Pentcheff, L. Gonzalez leg.; LACM ENT 394536 • 2 ♂♂; same locality as for holotype; 18 Jul. 2018; Hannah Hayes leg.; LACM ENT 376863, 376871 • 1 ♀; same locality as for holotype; 13–15 Aug. 2018; Hannah Hayes leg.; LACM ENT 381174 • 14 ♀♀, 3 ♂♂; Los Angeles Co., Gardena; 33.876° N, 118.288° W; 2–9 Oct. 2018; LACM • 5 ♀♀, 1 ♂; *ibid.*; 1–8 Nov. 2018; LACM • 9 ♀♀, 1 ♂; Los Angeles Co., Gardena; 33.8843° N, 118.2866° W; 1–8 Jul. 2016; LACM • 1 ♂; Los Angeles Co., Glendale; 34.159° N, 118.247° W; 31 May–7 Jun. 2014; Celeste Armstrong leg.; LACM ENT 394543 • 1 ♀; Los Angeles Co., Mid-City; 34.047° N, 118.334° W; 31 May–7 Jun. 2014; Sharon Oxborough leg.; LACM ENT 394538 • 2 ♂♂; Los Angeles Co., Pasadena; [34.15° N, 118.14° W]; 24 Jun. 2000; John S. Ascher leg.; AMNH • 2 ♀♀; Los Angeles Co., Pasadena, Arroyo Park; [34.15° N, 118.165° W]; 7 Mar. 2001; John S. Ascher leg.; AMNH • 1 ♀; Los Angeles Co., Silverlake; 34.093° N, 118.274° W; 31 May–7 Jun. 2014; Walter Renwick leg.; LACM ENT 394540 • 11 ♀♀; Los Angeles Co., Torrance; 33.8712° N, 118.331° W; 13–23 Jul. 2017; LACM • 6 ♂♂; *ibid.*; 13–23 Jul. 2017; LACM • 1 ♂; Los Angeles Co., University Park; 34.034° N, 118.281° W; 28 May–4 Jun. 2014; Peggy Hentschke leg.; LACM ENT 394542 • 22 ♀♀, 11 ♂♂; Los Angeles Co., Valley Village; 34.171° N, 118.398° W; 1–8 Jul. 2017; LACM • 3 ♀♀, 1 ♂; Riverside Co., Norco; 33.912° N, 117.5702° W; 1–8 Jun. 2016; LACM • 1 ♀; San Diego Co., 2 km E of Pine Valley; 32.8247° N, 116.5042° W; elev. 1300 m; 31 May–5 Jun. 2002; F.D. Parker, M.E. Irwin leg.; BBSL FDP195086 • 1 ♀; Santa Barbara Co., CCBER Greenhouse, 61M NW Parking Lot 38, UCSB; 34.4209° N, 119.8581° W; 14 May 2019; CCBER UCSB-IZC00036859 • 1 ♀; Santa Barbara Co., Isla Vista, San Joaquin Restoration Project; 34.4177° N, 119.8655° W; 8–10 Mar. 2016; Elaine Tan leg.; CCBER UCSB-IZC00034561 • 1 ♀; Santa Barbara Co., UCSB North Parcel; 34.4224° N, 119.8794° W; 7 Feb. 2019; CCBER UCSB-IZC00036899 • 1 ♂; Ventura Co., Santa Clara River; 34.3891° N, 118.8853° W; 20 May 2019; CCBER UCSB-IZC00037014 • 1 ♀; Newport Beach; [33.62° N, 117.93° W]; 19 Aug. 1920; Philip H. Timberlake leg.; *ex anise*; UCRC ENT 525678 • 1 ♂; Riverside; [33.97° N, 117.32° W]; 31 Aug. 1924; Philip H. Timberlake leg.; *ex on wing*; UCMC • 1 ♀; *ibid.*; 10 Feb. 1925; Philip H. Timberlake leg.; *ex Encelia farinosa*; UCMC • 1 ♀; San Diego; [32.71° N, 117.16° W]; 22 Apr. 2004; DB leg.; WRME 518949.

## Description

### Female

COLOURATION. Head and mesosoma blue to blue-green; clypeus apex black; labrum black; mandible orange with black base and red apex; flagellum black dorsally, orange ventrally. Pronotal lobe black; legs black with femur-tibia joints and tarsi dark reddish brown; tegula dark reddish brown; wing membrane hyaline, veins with subcosta dark brown, otherwise lighter brown. Metasoma black with rims of terga and sterna broadly translucent yellow.

PUBESCENCE. Body pile colour white to pale yellow. Tomentum dense on lower paraocular area, gena adjacent to compound eye, pronotal collar and lobe, space between pronotal lobe and tegula, T2–T3 basolaterally, and T4 throughout. Mesoscutum pubescence thin to moderately plumose. Wing setae dark, short and dense. Acarinarial fan complete, dense. T2 fringes dense, T3 fringes dense.

SURFACE SCULPTURE. Clypeus shiny, with punctures moderately sparse (IS = 1–2 PD), becoming larger in apical half; supraclypeal area shiny, with punctures moderately dense (IS = 1–2 PD); paraocular area shiny, with punctures dense (IS < 1 PD), sparser around antenna socket (IS ≤ 1 PD); frons reticulate, with

punctures fine, crowded (IS = 0 PD); vertex shiny, with punctures dense laterally (IS < 1 PD), sparse medially (IS = 1–3 PD); gena shiny, with punctures fine, sparse (IS = 1–3 PD); postgena lineolate, becoming shiny anteriorly. Tegula punctures dense (IS < 1 PD); mesoscutum weakly tessellate, with punctures moderately dense (IS = 1–2 PD), becoming dense on lateral and posterior margins (IS < 1 PD); scutellum weakly tessellate, with punctures dense marginally (IS < 1 PD), moderately sparse submedially (IS = 1–2 PD); metapostnotum shiny, becoming tessellate posteriorly, with rugae strong, anastomosing, reaching posterior margin; preëpisternum rugulose; hypoepimeron shiny, with punctures crowded (IS = 0 PD); mesepisternum imbricate, with punctures dense (IS ≤ 1 PD); metepisternum weakly rugulose; propodeum lateral surface weakly tessellate, becoming weakly rugulose dorsally and anteriorly, posterior surface weakly tessellate. T1 anterior slope shiny, disc shiny, with punctures fine, moderately dense (IS = 1–2 PD), absent in large subapicolateral boss and on rim; T2 disc shiny, with punctures fine, moderately dense (IS = 1–2 PD), apical rim shiny, with punctures minute, sparse (IS = 1–4 PD).

STRUCTURE. Face length/width ratio 0.81 (±0.02 SD); clypeus apicolateral denticles low rounded knobs; gena/eye width ratio 0.88 (±0.07 SD). Pronotal angle slightly obtuse, nearly right-angled; intertegular span 0.85 (±0.05 SD) mm; mesoscutum length/width ratio 0.9 (±0.03 SD); mesoscutum/scutellum length ratio 2.87 (±0.08 SD); scutellum/metanotum length ratio 1.62 (±0.1 SD); metanotum/metapostnotum length ratio 0.77 (±0.06 SD); forewing with 3 submarginal cells; tegula enlarged, exceeding posterior margin of mesoscutum; inner margin concave; tegula length 0.46 (±0.03 SD) mm, width 0.23 (±0.02 SD) mm; propodeum lateral carinae not reaching dorsal margin; oblique carina strong, straight. T2 depressed apical rim less than 50% of tergum. (n = 10)

VARIATION. The mesoscutum is occasionally completely tessellate and/or densely punctate in posterior half (IS ≤ 1 PD); the mesepisternum can vary from shiny to dull and imbricate; the T1 anterior slope is sometimes weakly coriarius; and the T1 apical rim is often punctate below the subapicolateral boss.

### Male

COLOURATION. Head and mesosoma blue to blue-green; clypeus apex black; labrum black; mandible orange, becoming red at apex and black at base; flagellum black dorsally, light brown or orange ventrally. Pronotal lobe black; legs black with tarsi dark brown; tegula black; wing membrane hyaline, veins dark brown. Metasoma black with depressed apical rims of terga and sterna translucent brown.

PUBESCENCE. Body pile colour white. Tomentum dense on face below eye emargination, pronotal angle and lobe, and space between pronotal lobe and tegula; sparse on metepisternum. Mesoscutum pubescence simple to sparsely plumose. Wing setae dark, short and dense. Sterna pubescence short (0.5–1.5 OD), moderately plumose, sparse.

SURFACE SCULPTURE. Clypeus shiny, with punctures dense (IS < 1 PD); supraclypeal area shiny, with punctures dense (IS ≤ 1 PD); paraocular area shiny, with punctures dense (IS < 1 PD); frons reticulate, with punctures crowded (IS = 0 PD); vertex shiny to imbricate, with punctures crowded laterally (IS = 0 PD), moderately dense medially (IS = 1–2 PD); gena shiny anteriorly, imbricate-lineate posteriorly, with punctures dense anteriorly (IS ≤ 1 PD), obscure posteriorly; postgena imbricate-lineate, becoming shiny anteriorly. Tegula punctures crowded (IS = 0 PD), sometimes slightly sparser medially; mesoscutum shiny, becoming weakly tessellate anteromedially, with punctures moderately dense (IS = 1–2 PD), becoming crowded marginally (IS = 0 PD); scutellum shiny, with punctures dense (IS < 1 PD), becoming sparser medially (IS = 1–2 PD); metanotum areolate; metapostnotum shiny to finely reticulate, with rugae strong, subparallel, reaching posterior margin; preëpisternum areolate; hypoepimeron shiny, with punctures crowded (IS = 0 PD); mesepisternum shiny, with punctures dense (IS < 1 PD); metepisternum areolate; propodeum lateral surface weakly rugulose, with punctures dense (IS < 1 PD), posterior surface rugulose, becoming shiny and densely punctate medially (IS < 1 PD). T1 anterior slope shiny, disc shiny,

with punctures fine, moderately sparse (IS = 1–2 PD), absent in large subapicolateral boss and on rim medially; T2 disc shiny, with punctures fine, moderately sparse (IS = 1–2 PD), apical rim shiny, with punctures absent.

STRUCTURE. Face length/width ratio 0.83 ( $\pm 0.02$  SD); gena/eye width ratio 0.77 ( $\pm 0.06$  SD). Pronotal angle obtuse; intertegular span 0.71 ( $\pm 0.04$  SD) mm; mesoscutum length/width ratio 0.95 ( $\pm 0.03$  SD); mesoscutum/scutellum length ratio 2.8 ( $\pm 0.14$  SD); scutellum/metanotum length ratio 1.76 ( $\pm 0.14$  SD); metanotum/metapostnotum length ratio 0.7 ( $\pm 0.09$  SD); forewing with 3 submarginal cells; tegula enlarged, exceeding posterior margin of mesoscutum in dorsal view; inner posterior margin strongly concave, with broadly rounded projection angled toward axilla posteriorly; tegula length 0.44 ( $\pm 0.02$  SD) mm, width 0.22 ( $\pm 0.01$  SD) mm; propodeum lateral carinae not reaching dorsal margin; oblique carina absent. (n = 10)

GENITALIA. As in Fig. 76A. Gonocoxite about 1.8 times as broad as gonostylus. Gonostylus weakly boot-shaped, with a small sharply angled concavity on outer margin and straight on inner margin, with sparse short setae apically. Penis valves parallel, with moderately long appressed setae dorsolaterally in basal half. Retrorse lobe rounded, about 2.75 times as long as broad, with sparse short setae on apical and dorsal margins.

VARIATION. The mesoscutum punctation can vary from mostly dense (IS  $\leq 1$  PD) to sparse (IS = 1–3 PD), the mesepisternum dorsal half is sometimes more sparsely punctate (IS = 1–2 PD), and the T2 apical rim is often punctate on the centre of the basal margin.



**Fig. 5.** Georeferenced collection records of *Lasioglossum (D.) angelicum* sp. nov. (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence.

### Range

Los Angeles basin and south along the Pacific coast to San Diego, west to Malibu (Fig. 5).

### Floral hosts

APIACEAE Lindl.: *Pimpinella* L.: *P. anisum* L. • ASTERACEAE Bercht. & J.Presl: *Encelia* Adans.: *E. farinosa* A.Gray ex Torr.

### DNA barcodes

Five confirmed sequences available (BOLD process IDs: DLIII214-20, DLIII215-20, DLIII216-20, DLIII223-20, NCBE465-21). These sequences are identical (0% maximum intraspecific p-distance). They are closest in terms of p-distance to *L. diabolicum* sp. nov. (1.84% minimum interspecific p-distance). Four fixed nucleotide substitutions distinguish *L. angelicum* sp. nov. from all other Nearctic species of the *L. gemmatum* complex: 222(C), 237(A), 420(G), and 525(C) (Supp. file 2).

### *Lasioglossum (Dialictus) carlinvillense* Gibbs, 2009

Figs 6–8

*Lasioglossum (Dialictus) carlinvillense* Gibbs, 2009a: 28 (holotype, ♀, deposited in PCYU, examined).

*Lasioglossum (Dialictus) carlinvillense* – Gibbs 2011: 25, 32 (key to species), 65 (review).

### Diagnosis

Females of *L. carlinvillense* have the tegula relatively small (reaching but not exceeding posterior margin of mesoscutum), moderately densely punctate ( $IS \leq 1$  PD), and with inner posterior margin straight or weakly concave; mesoscutum entirely dull and tessellate; metapostnotum with strong subparallel rugae reaching posterior margin; mesepisternum strongly imbricate with crowded punctures ( $IS = 0$  PD), inner metatibial spur with only two branches, and T1–T3 flat in lateral view. They are most similar to those of *L. coactus* and *L. tegulare*, both of which have the inner metatibial spur with 3–4 branches. Females of *L. coactus* also have T1–T3 distinctly convex in lateral view.

The male of *L. carlinvillense*, if correctly associated, may be morphologically indistinguishable from *L. tegulare* (see Comments).

### Etymology

Gibbs (2009a) named this species after the type locality of Carlinville, Illinois, combined with the Latin adjectival suffix ‘-ense’ (indicating association with a place).

### Material examined

#### Holotype

UNITED STATES – Illinois • ♀; Macoupin Co., east of Carlinville; 39.2787° N, 89.7961° W; 25 Jun. 2006; J. Gibbs and C. Sheffield leg.; PCYU.

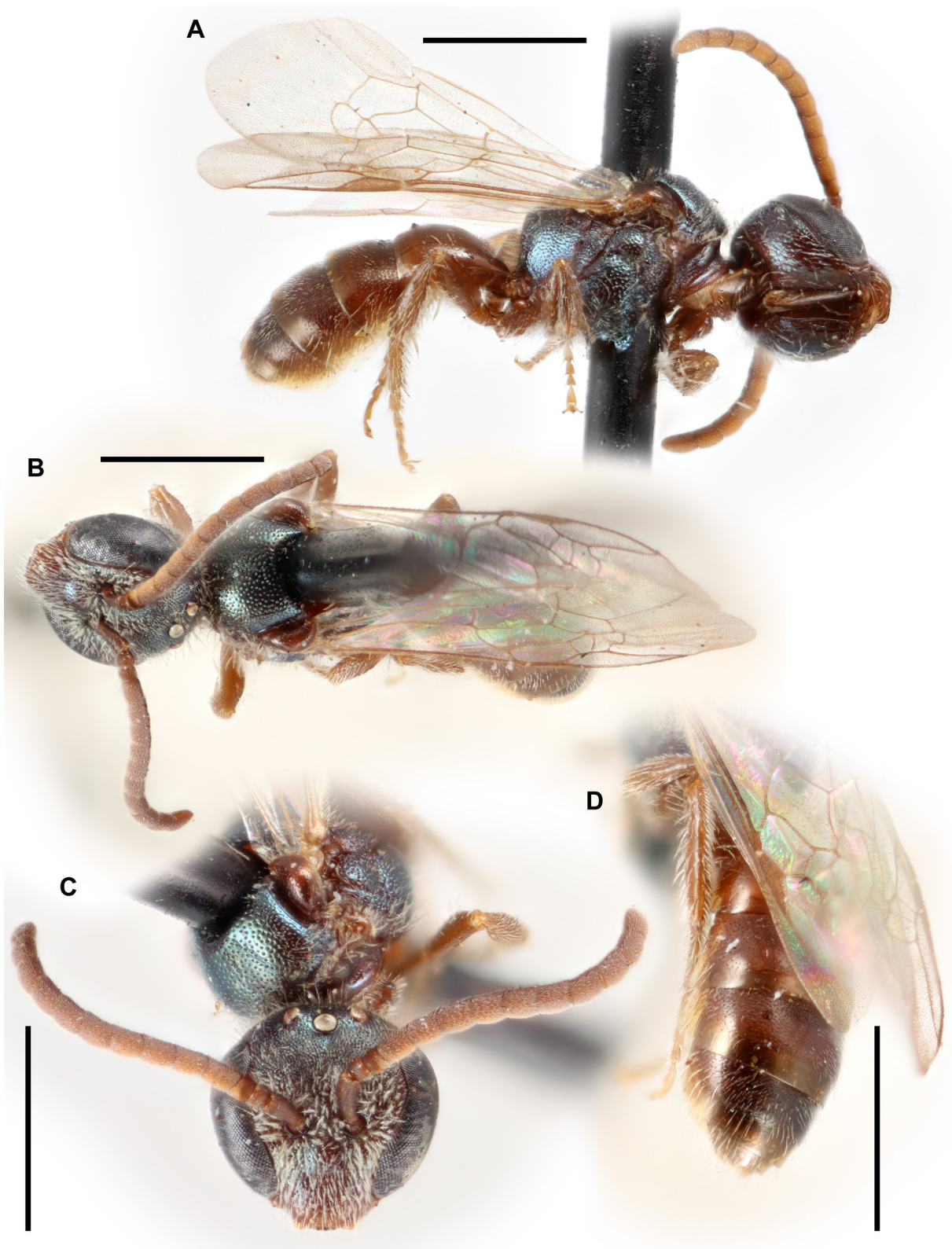
#### Other material

UNITED STATES – Alabama • 1 ♀; Sheffield; [34.77° N, 87.7° W]; 4 Aug. 1944; G.E. Bohart leg.; BBSL700639 • 1 ♂; *ibid.*; 4 Aug. 1944; G.E. Bohart leg.; BBSL700633. – Illinois • 1 ♀; Carlinville; 39.2787° N, 89.8898° W; 24 Jun. 2006; J. Gibbs leg.; PCYU • 1 ♀; Dubois; [38.22° N, 89.21° W]; 8 Aug. 1917; INHS • 1 ♀; Litchfield; 39.1484° N, 89.66696° W; 25 Jun. 2006; C. Sheffield leg.; PCYU.





**Fig. 6.** *Lasioglossum (D.) carlinvillense* Gibbs, 2009, ♀, holotype (PCYU). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma and propodeum. Scale bars = 1 mm.



**Fig. 7.** *Lasioglossum* (*D.*) *carlinvillense* Gibbs, 2009, possible ♂ (based on a single male associated with a single female) (BBSL700633). **A.** Lateral habitus. **B.** Dorsal habitus. **C.** Face. **D.** Metasoma. Scale bars = 1 mm.



**Range**

Illinois to Alabama (Fig. 8).

**Floral hosts**

None recorded.

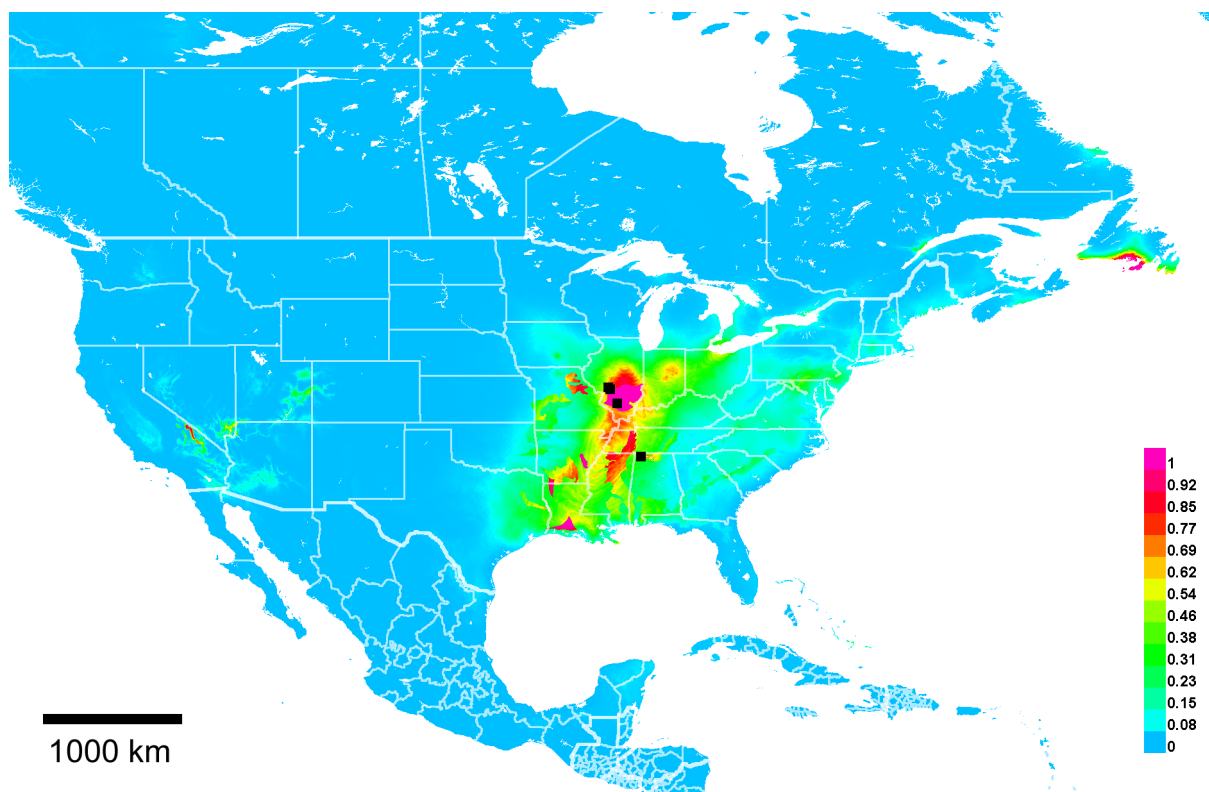
**DNA barcodes**

Three confirmed sequences available (BOLD process IDs: DIAL728-06, DIAL832-06, DIAL837-06). These sequences are identical (0% maximum intraspecific p-distance). They are closest in terms of p-distance to *L. coactus* (0.15% minimum interspecific p-distance). No fixed nucleotide substitutions distinguish *L. carlinvillense* from all other species of the *L. gemmatum* complex or closely related species.

**Comments**

Rare. *Lasioglossum carlinvillense* was described from only four female specimens, all from Illinois. These specimens have similar DNA barcodes to several sequences from Colorado and Texas for which the associated specimens could not be located and examined. These sequences probably belong to *L. coactus*, which shares the same BIN as *L. carlinvillense*, but the possibility that *L. carlinvillense* ranges further west into Colorado cannot be ruled out.

Two additional female specimens with only two metatibial spur branches were discovered in the current work, both from Alabama. One of these is much larger than the other known specimens of *L. carlinvillense* and is believed to be an atypical *L. puteulanum*. The other is morphologically indistinguishable from



**Fig. 8.** Georeferenced collection records of *Lasioglossum (D.) carlinvillense* (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence.

other *L. carlinvillense* and may truly be a new record. There is one male from the same collection event as this specimen, but it is morphologically indistinguishable from *L. tegulare*, and whether it is the hitherto unknown male of *L. carlinvillense* is uncertain. These specimens are far too old to attempt DNA barcoding, but fresh material from Alabama could help resolve their status.

It is possible that *L. carlinvillense* is merely an aberrant form of *L. tegulare* or a hybrid of *L. tegulare* and *L. coactus*. *Lasioglossum carlinvillense* and *L. tegulare* are apparently morphologically indistinguishable except by the metatibial spur and the slightly smaller size of the former. The fact that *L. coactus* also shares a BIN with *L. tegulare* suggests that introgression could have occurred between these two species. A possible explanation, then, is that the BIN corresponding to *L. carlinvillense* is the “natural” COI sequence for *L. coactus*, and the *L. coactus* sequences in the *L. tegulare* BIN are a result of introgression. Similarly, the *L. carlinvillense* sequences could then be *L. tegulare* which acquired *L. coactus* COI sequences through introgression. More evidence is needed to test this hypothesis.

***Lasioglossum (Dialictus) coactus* (Cresson, 1872)**

Figs 9–11, 76B, 82B, 85A, 86A, 106A, 107A

*Halictus coactus* Cresson, 1872: 254 (lectotype designated in Cresson (1916), ♀, deposited in ANSP, type no. 2123, examined).

*Halictus coactus* – Cresson 1887: 292 (catalogue); 1916: 107 (lectotype designation). — Dalla Torre 1896: 58 (catalogue).

*Halictus (Chloralictus) coactus* – Ellis 1914: 100, 101 (comparison to *jamaicae* = *gemmatum* and *tegulare*), 103 (comparison to *perparvum*).

*Lasioglossum (Chloralictus) coactum* (!) – Michener 1951: 1112 (catalogue). — Scott *et al.* 2011: 29 (checklist).

*Dialictus coactus* – Hurd 1979: 1965 (catalogue). — Moure & Hurd 1987: 95 (catalogue).

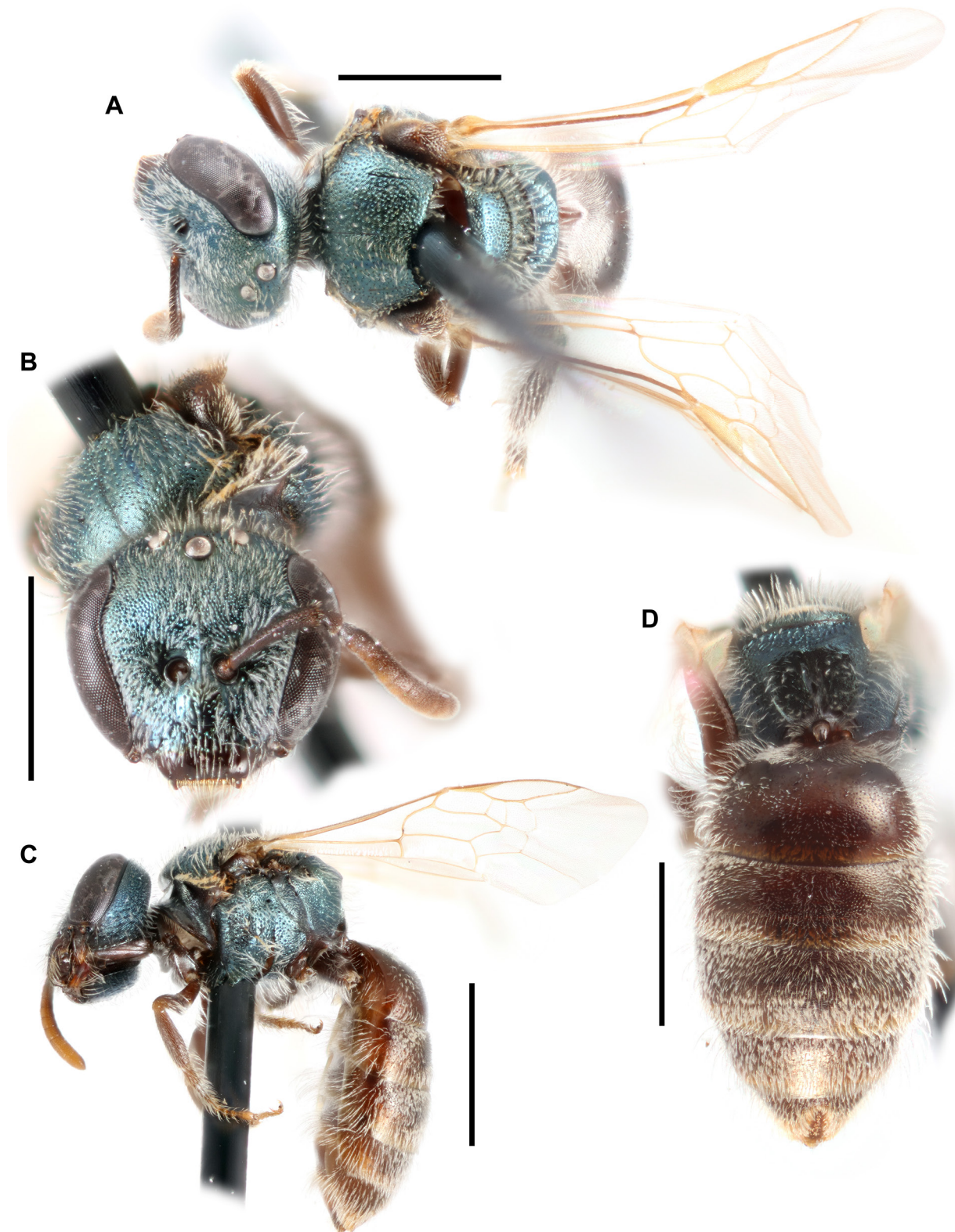
**Diagnosis**

Females of *L. coactus* have T1–T3 distinctly convex in lateral view (although not as strongly so as in the male), with apical rims strongly depressed, shiny, and impunctate or very sparsely punctate, contrasting with densely punctate discs ( $IS \leq 1$  PD); T3 with dense and complete subapical band of tomentum; tegula relatively small (reaching but not exceeding posterior margin of mesoscutum) and densely punctate ( $IS \leq 1$  PD); metapostnotum usually shiny with strong anastomosing rugae reaching posterior margin (rarely dull with fine rugae); mesepisternum imbricate with punctures often dense ( $IS < 1$  PD) but distinctly separated and round (sometimes crowded ( $IS = 0$  PD)); and inner metatibial spur with 3–4 branches.

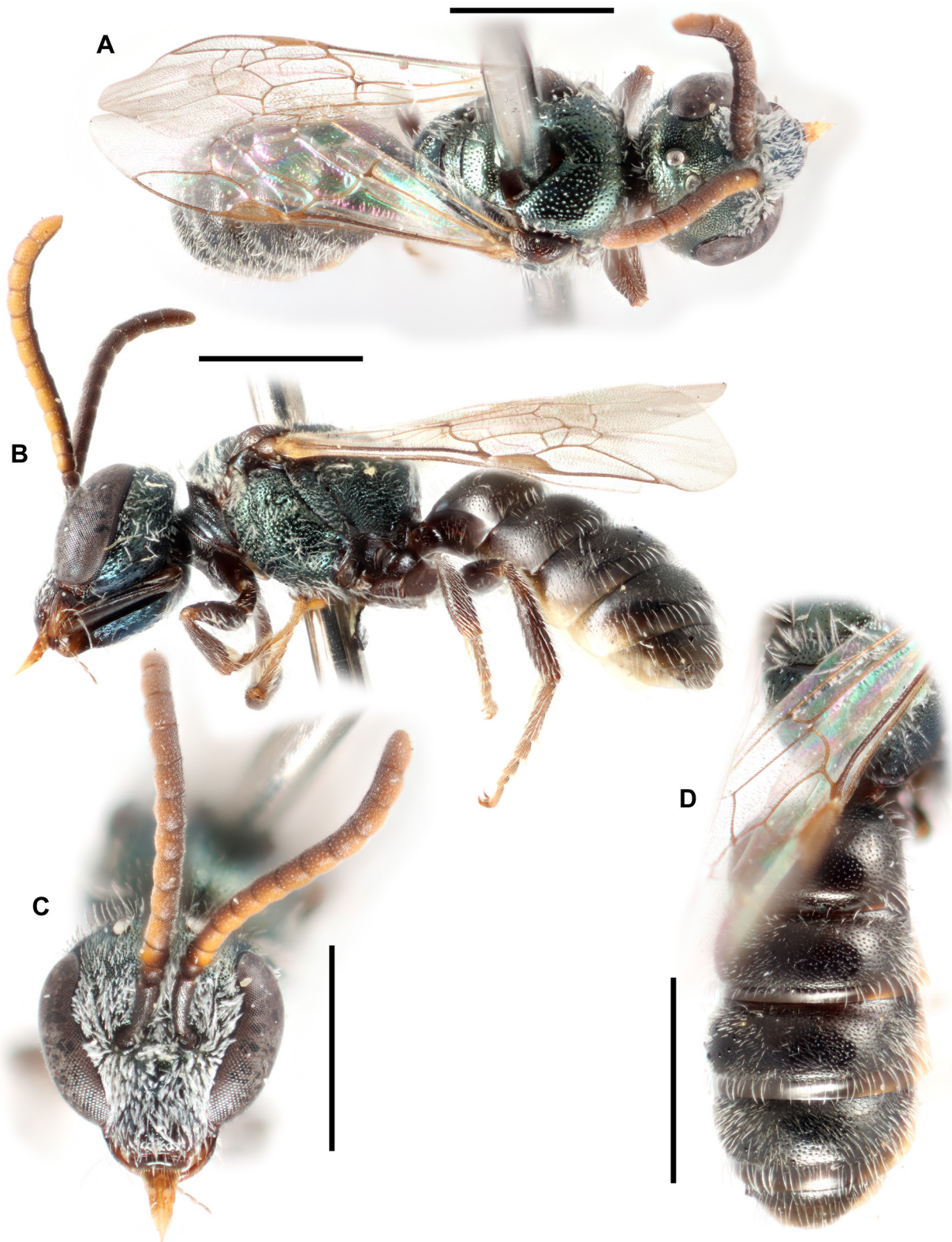
Females of *L. coactus* are most similar to those of *L. carlinvillense* and *L. tegulare*, both of which have T1–T3 flat in lateral view. In addition, females of *L. carlinvillense* have the inner metatibial spur with only 2 branches and *L. tegulare* have the mesepisternum with crowded indistinct punctures ( $IS = 0$  PD) or rugulose. Some species in the *L. stictaspis* species complex (particularly *L. stictaspis* s. str.) are also similar, but have T1–T3 flat in lateral view and more finely and sparsely punctate ( $IS = 1–3$  PD), the mesepisternum shiny, and/or metapostnotum dull with fine, subparallel rugae.

Males of *L. coactus* have T1–T4 very strongly convex, with abruptly depressed, shiny, impunctate apical rims contrasting with densely punctate discs ( $IS < 1$  PD); tegula relatively small (reaching but not exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin weakly concave, and somewhat densely punctate ( $IS \leq 1$  PD); and mesepisternum densely punctate ( $IS < 1$  PD). They are not likely to be confused with any other species so long as T1–T4 are visible, but specimens with broken metasomas may be indistinguishable from *L. tegulare*.





**Fig. 9.** *Lasioglossum (D.) coactus* (Cresson, 1872), ♀. **A.** Dorsal habitus. **B.** Face. **C.** Lateral habitus. **D.** Metasoma and propodeum. Scale bars = 1 mm.



**Fig. 10.** *Lasioglossum (D.) coactus* (Cresson, 1872), ♂. A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma. Scale bars = 1 mm.



**Etymology**

The specific epithet ‘*coactus*’ could be either a Latin noun (compulsion, constraint) or a perfect participle (forced, compelled). Because Cresson (1872) did not specify the intended grammar, according to Article 31.2.2 of the *International Code of Zoological Nomenclature* (ICZN 1999), the epithet is treated as a noun and is therefore not declinable to ‘*coactum*’ in combination with ‘*Lasioglossum*’, as has been done in the past.

**Material examined****Holotype**

UNITED STATES – **Texas** • ♀; ANSP.

**Other material**

MEXICO – **Chihuahua** • 1 ♀; 83 km N of Chihuahua; [29.38° N, 106.07° W]; 29 Aug. 1991; Terry L. Griswold leg.; ex *Coreopsis tinctoria*; BBSL849296. – **Coahuila** • 1 ♂; 61 mi. N of Saltillo; [26.31° N, 101° W]; elev. 853 m; 8 Sep. 1972; Byers, Thornhill leg.; SEMC • 1 ♀; San Juan de Sabinas; [27.93° N, 101.3° W]; elev. 354 m; 22 May 1952; P.S. Chrapliwy leg.; SEMC. – **Hidalgo** • 1 ♀; Grutas Tolantongo, 30 km NW of Cardonal (Barranco del Tolantongo); [20.65° N, 98.96° W]; elev. 1230 m; 13 Jul. 1990; Robert L. Minckley leg.; ex mimosoid legume; SEMC. – **Nuevo León** • 1 ♀; 12 mi. W of Linares; 24.8537° N, 99.7244° W; 21 Sep. 1974; George E. Bohart, W.J. Hanson leg.; BBSL1101070 • 1 ♀, 1 ♂; 15 mi. SW of China; [25.54° N, 99.41° W]; 19 Jul. 1954; SEMC • 1 ♀; 16 mi. S of Montemorelos; [24.96° N, 99.84° W]; 19 Jul. 1951; University of Kansas Mexico Expedition leg.; SEMC • 1 ♀; 4 km S of Linares; [24.81° N, 99.55° W]; elev. 400 m; 22 Mar. 1991; R.W. Brooks, R. Leschen leg.; ex *Cercidium macrum*; SEMC • 1 ♀; *ibid.*; 22 Mar. 1991; R.W. Brooks, R. Leschen leg.; ex yellow flower *Opuntia*; SEMC • 1 ♀; Ciudad Universitaria, San Nicolás de Garza, Jardín Desértico; [25.73° N, 100.31° W]; elev. 520 m; 4 Jun. 2009; Liliana Ramírez Freire leg.; LRF • 1 ♀; Ciudad Universitaria, San Nicolás de Garza, Jardín Desértico; [25.73° N, 100.31° W]; elev. 529 m; 1 Jun. 2009; Liliana Ramírez Freire leg.; ex *Leucophyllum frutescens*; LRF • 2 ♀♀; Parque Estatal El Cuchillo, China; [25.66° N, 99.27° W]; elev. 205 m; 27 Jun. 2009; Liliana Ramírez Freire leg.; LRF. – **San Luis Potosí** • 3 ♀♀, 3 ♂♂; 3.4 mi. NE of El Naranjo; [22.56° N, 99.3° W]; elev. 244 m; 5 Sep. 1962; University of Kansas Mexico Expedition leg.; SEMC • 1 ♀; Salinas; [22.63° N, 101.72° W]; Apr. 1982; R. Del Castillo leg.; SEMC • 1 ♂; Xilitla; [21.385° N, 98.975° W]; elev. 400 m; 7 Jul. 1990; Robert L. Minckley leg.; SEMC. – **Tamaulipas** • 1 ♂; 15 mi. N of Llera; [23.53° N, 99.03° W]; 24 Feb. 1972; F.D. Parker, D. Miller leg.; BBSL1101048 • 2 ♀♀; 3 mi. S of San Fernando; [24.8° N, 98.15° W]; 9 Jul. 1966; SEMC • 16 ♀♀; 8 mi. S of Jiménez; [24.1° N, 98.49° W]; 15 Jun. 1953; ex *Parthenium hysterophorus*; SEMC • 1 ♀; Antigua Morelos; [22.55° N, 99.08° W]; elev. 300 m; 6 Jul. 1990; Ilan Yarom leg.; SEMC • 1 ♂; Forlon; [23.24° N, 98.8° W]; 30 Sep. 1938; L.J. Lipovsky leg.; SEMC • 1 ♀, 2 ♂♂; Jiménez; [24.22° N, 98.49° W]; 19 Jul. 1962; University of Kansas Mexico Expedition leg.; SEMC • 1 ♀; Matamoros; [25.87° N, 97.5° W]; 27 Sep. 1954; SEMC • 3 ♀♀, 1 ♂; Padilla; [24.05° N, 98.9° W]; 15 Jun. 1953; University of Kansas Mexico Expedition leg.; SEMC • 1 ♀; Playa Altamira; [22.4° N, 97.845° W]; 5 Jul 1967; M.S. Wasbaner, J.E. Slansky leg.; UCDC • 1 ♂; Rio Conchos, San Fernando; [24.84° N, 98.16° W]; 9 Jun. 1966; University of Kansas Mexico Expedition leg.; SEMC • 1 ♀; Tampico; [22.23° N, 97.86° W]; 27 Mar. 1951; W.P. Stephen leg.; SEMC. – **Veracruz** • 5 ♀♀; Llave Panuco; 22.0504° N, 98.185° W; 26 Feb. 1972; F.D. Parker, D. Miller leg.; BBSL1101039, BBSL1101040, BBSL1101041, BBSL1101042, BBSL1101043.

UNITED STATES – **Colorado** • 1 ♀; Boulder Co., Palisades, “L. H. Can.” [Lefthand Canyon]; [40.11° N, 105.305° W]; 25 Jul. 1942; Hugo G. Rodeck leg.; ex *Carduus*; UCMC • 2 ♀♀; Jefferson Co.; 39.7433° N, 105.2365° W; 22 Aug. 2001; Sam W. Droege leg.; PCYU USGS-DRO 020468, USGS-DRO 020471 • 1 ♂; Las Animas Co., Model; 37.493° N, 103.8345° W; 23 Jul. 2009; J. Newton leg.; PCYU • 1 ♂; Grand Junction; [39.06° N, 108.55° W]; 4 Sep. 1938; D.E. Hardy leg.; SEMC. – **Kansas** • 2 ♀♀; Barber Co.; 37.0873° N, 98.379° W; 29 Apr. 2013; S. Griffin leg.; WRME. – **New Mexico** • 1 ♀; De Baca Co., Old

Fort Sumner; [34.402° N, 104.194° W]; 17 Jun. 1999; W.F. Chamberlain leg.; ex *Melilotus*; TAMU-ENTO X1400068 • 1 ♀; Doña Ana Co., New Mexico State University campus; [32.28° N, 106.75° W]; elev. 1189 m; 11 Jun. 1979; G.S. Forbes leg.; ex *Santolina*; NMSU • 2 ♂♂; Eddy Co., Carlsbad; [32.42° N, 104.23° W]; 31 May 1979; Carrola, D.R. Delorme, Friedlander leg.; TAMU-ENTO X1365290, X1399323 • 1 ♀; Eddy Co., Carlsbad; [34.42° N, 104.23° W]; 20 May 1969; D.J. Brothers, Krueger, Charles D. Michener leg.; ex *Lepidium integrifolium*; SEMC • 1 ♂; Eddy Co., Pecos River at Highway 31; [32.31° N, 104.06° W]; 13 Jul. 1979; D.R. Delorme, C.P. McHugh leg.; TAMU-ENTO X1365429 • 1 ♀; Eddy Co., Rattlesnake Springs; 32.1095° N, 104.4716° W; elev. 1115 m; 18 Jun. 2010; J.D. Herndon leg.; BBSL CAVE2826 • 1 ♂; Otero Co., Alamogordo Dam; [32.93° N, 105.95° W]; 6 Jun. 1969; D. Liesnee leg.; ex *Tamarix*; NMSU • 1 ♀; Quay Co., Tucumcari; [35.17° N, 103.73° W]; 10 Jul. 1963; R.M. Bohart leg.; UCDC • 2 ♀♀; Sandoval Co., Corrales; [35.24° N, 106.61° W]; 23 Apr. 2000; R. Fagerlund leg.; PCYU • 2 ♀♀; 3 miles west of Cimarron, “Ovka? Kenton”; [36.51° N, 104.97° W]; 23 Jun. 1970; D. Liesnee leg.; ex *Tamarix*; NMSU • 11 ♀♀; Carrizozo; [33.64° N, 105.88° W]; 9 Jun. 1950; L.D. Beamer leg.; ex *Asclepias galloides*; SEMC • 27 ♀♀; *ibid.*; 9 Jun. 1950; L.D. Beamer leg.; ex *Dasylyrion wheeleri*; SEMC • 1 ♀; *ibid.*; 9 Jun. 1950; L.D. Beamer leg.; ex *Marrubium vulgare*; SEMC • 14 ♀♀, 5 ♂♂; *ibid.*; 9 Jun. 1950; L.D. Beamer leg.; ex *Pyrrhopappus multicaulis*; SEMC • 37 ♀♀, 1 ♂; *ibid.*; 9 Jun. 1950; L.D. Beamer leg.; SEMC. – **Texas** • 1 ♀; Anderson Co., 10 mi. SW of Elkhart; [31.52° N, 95.7° W]; 5–6 Jun. 1976; H.R. Burke leg.; TAMU-ENTO X1365914 • 1 ♀; Anderson Co., Salmon; [31.57° N, 95.5° W]; 17 May–6 Jun. 1975; H.R. Burke leg.; TAMU-ENTO X1365410 • 1 ♀; Bandera Co., 10 miles west of Medina; [29.8° N, 99.42° W]; 17 May 2004; W.F. Chamberlain leg.; TAMU-ENTO X1416743 • 1 ♀; Bastrop Co., Camp Swift; 30.2833° N, 97.3233° W; 2 May 2002; J.L. Neff leg.; ex *Coreopsis basalis*; CTMI 23406 • 1 ♀; Bastrop Co., Camp Swift; 30.284° N, 97.323° W; 2 Oct. 2003; J.L. Neff leg.; ex *Heterotheca subaxillaris*; CTMI 26042 • 1 ♀; *ibid.*; 2 Apr. 2004; J.L. Neff leg.; ex *Ilex vomitoria*; CTMI 26762 • 1 ♀; Bastrop Co., Camp Swift; 30.296° N, 97.31° W; 2 Oct. 2003; J.L. Neff leg.; ex *Croptilon divaricatum*; CTMI 26078 • 4 ♀♀, 1 ♂; Bastrop Co., Stengl Biological Station, 6 mi. N of Smithville; [30.09° N, 97.17° W]; 12 May 2000; J.C. Abbott, R. Caesar leg.; PCYU • 2 ♀♀; Bexar Co., Ebony Hill Research Station (Kendall residence); [29.488° N, 98.696° W]; 12 May 2003; Roy O. Kendall leg.; TAMU-ENTO X0408802.1, X0408802.2 • 1 ♀; Bexar Co., San Antonio; [29.42° N, 98.49° W]; 29 Aug. 1964; A.H. Alex leg.; ex *Helianthus annuus*; TAMU-ENTO X1400725 • 2 ♀♀; *ibid.*; 12 Jul. 2018; Richard S. Peigler leg.; ex *Astrophytum myriostigma*; TAMU-ENTO X1600774, X1602051 • 1 ♀; *ibid.*; 13 Jul. 2018; Richard S. Peigler leg.; ex *Astrophytum ornatum*; TAMU-ENTO X1597095 • 1 ♀; *ibid.*; 13 Jul. 2018; Richard S. Peigler leg.; ex *Leuchtenbergia principis*; TAMU-ENTO X1601105 • 1 ♀; *ibid.*; 14 Jul. 2018; Richard S. Peigler leg.; ex *Leuchtenbergia principis*; TAMU-ENTO X1599632 • 1 ♀; Bexar Co.; [29.4° N, 98.5° W]; 20 Oct. 1928; H.B. Parks leg.; TAMU-ENTO X1387356 • 1 ♀; *ibid.*; 3 Apr. 1929; H.B. Parks leg.; TAMU-ENTO X1418300 • 1 ♀; *ibid.*; 9 May 1930; H.B. Parks leg.; TAMU-ENTO X1370844 • 1 ♀; *ibid.*; 24 Aug. 1930; H.B. Parks leg.; TAMU-ENTO X1386235 • 1 ♀; *ibid.*; 30 Sep. 1931; H.B. Parks leg.; TAMU-ENTO X1370854 • 1 ♀; Bosque Co., 2 mi. W of Iredell; [31.98° N, 97.91° W]; 21 Apr. 1972; J.C. Schaffner leg.; TAMU-ENTO X1362257 • 1 ♂; Brazos Co., 0.3 mi. N of Jones Road & Highway 60 junction; [30.586° N, 96.391° W]; 12 Jul. 1975; S.J. Merritt leg.; TAMU-ENTO X1276417 • 1 ♀; Brazos Co., 9 km SSE of College Station, 15889 Woodlake Drive; 30.5314° N, 96.2817° W; elev. 90 m; 3 Sep. 2013; J.D. Oswald leg.; TAMU-ENTO X1003142 • 1 ♂; Brazos Co., Bryan; [30.67° N, 96.37° W]; 1–2 May 1976; H.R. Burke leg.; TAMU-ENTO X1405850 • 9 ♀♀; *ibid.*; 29–30 May 1976; H.R. Burke leg.; TAMU-ENTO X1364704, X1364839, X1365258, X1365688, X1398752, X1398831, X1399013, X1399406, X1399493 • 2 ♂♂; *ibid.*; 29–30 May 1976; H.R. Burke leg.; TAMU-ENTO X1365317, X1399226 • 1 ♀; Brazos Co., College Station; [30.63° N, 96.33° W]; 21 Oct. 1954; A.H. Alex leg.; ex *Aster*; TAMU-ENTO X1386948 • 3 ♀♀; *ibid.*; 5 Jun. 1955; A.H. Alex leg.; ex *Leucophyllum frutescens*; TAMU-ENTO X1389396, X1389399, X1389440 • 1 ♀; *ibid.*; 13 Jul. 1962; A.H. Alex leg.; ex *Leucophyllum frutescens*; TAMU-ENTO X1386731 • 1 ♀; *ibid.*; 15 Jun. 1963; A.H. Alex leg.; ex *Lactuca sativa*; TAMU-ENTO X1312803 • 3 ♀♀; *ibid.*; 16 Jun. 1963; A.H. Alex leg.; ex *Melilotus alba*; TAMU-ENTO X1312806, X1312916, X1313021 • 1 ♀; *ibid.*; 27 Jun.



1963; A.H. Alex leg.; ex *Melilotus alba*; TAMU-ENTO X1313095 • 1 ♂; *ibid.*; 29 Jun. 1963; A.H. Alex leg.; ex *Mentha spicata*; TAMU-ENTO X1399190 • 1 ♀; *ibid.*; 15 Jul. 1963; A.H. Alex leg.; ex *Chrysopsis pilosa*; TAMU-ENTO X1365181 • 1 ♀; *ibid.*; 28 Mar. 1964; J.C. Schaffner leg.; TAMU-ENTO X1393271 • 1 ♀; *ibid.*; 11 May 1964; A.H. Alex leg.; ex *Opuntia macrorrhiza*; TAMU-ENTO X1313206 • 1 ♀; *ibid.*; 15–22 May 1977; S.J. Merritt leg.; TAMU-ENTO X1365222 • 1 ♀; *ibid.*; 27 Apr. 1979; R. Krenek leg.; TAMU-ENTO X1370547 • 1 ♀; *ibid.*; 9 Mar. 1985; S.J. Merritt leg.; ex *Lamium*; TAMU-ENTO X1404418 • 1 ♀; Brazos Co., College Station, Church Avenue; [30.62° N, 96.346° W]; 17 Mar. 2000; B. Rodriguez-Velez leg.; TAMU-ENTO X1404670 • 2 ♀♀; Brazos Co., College Station, Riley Estate; [30.5885° N, 96.2537° W]; 14 Apr. 2001; E.G. Riley leg.; TAMU-ENTO X1315282, X1419587 • 1 ♀; Brazos Co., College Station, Riley Estate; 30.5885° N, 96.2537° W; 1–3 Apr. 2011; E.G. Riley, M. T. leg.; TAMU-ENTO X1428008 • 1 ♀; *ibid.*; 9–10 Apr. 2011; E.G. Riley, M. T. leg.; TAMU-ENTO X1428075 • 2 ♀♀; *ibid.*; 18–19 May 2011; E.G. Riley, M. T. leg.; TAMU-ENTO X1428021, X1428040 • 2 ♀♀; *ibid.*; 4–21 Mar. 2013; E. Dinh, K. Henson, E. Riley leg.; TAMU-ENTO X1370402, X1414696 • 1 ♂; Brazos Co., Jones Road, 1.6 mi. N of Highway 60; [30.597° N, 96.408° W]; 1 Jun. 1975; S.J. Merritt leg.; TAMU-ENTO X1401125 • 1 ♀; Brazos Co., Lick Creek Park; [30.56° N, 96.21° W]; 9 Aug. 2018; Karen W. Wright leg.; TAMU-ENTO X1600920 • 2 ♀♀; Brazos Co., near College Station, TAMU Range Sci. Area; [30.58° N, 96.37° W]; 18 Jun. 1978; S.J. Merritt leg.; ex *Cassia* sp.; TAMU-ENTO X1393258, X1395177 • 8 ♀♀; *ibid.*; 30 Jul. 1978; S.J. Merritt leg.; ex *Euphorbia*; TAMU-ENTO X1391760, X1393557, X1395215, X1395805, X1395980, X1396015, X1397381, X1397397 • 1 ♀; Brazos Co., on FM 2154 6.9 miles south of Wellborn; [30.47° N, 96.22° W]; 12 Sep. 1981; S.J. Merritt leg.; ex *Euphorbia* sp.; TAMU-ENTO X1397470 • 3 ♀♀; Brazos Co., Southwest Parkway and Wellborn Road; [30.59° N, 96.33° W]; 10 Jun. 1979; S.J. Merritt leg.; ex *Monarda* sp.; TAMU-ENTO X1393434, X1395788, X1397468 • 1 ♀; Brazos Co., TAMU-Riverside Campus; 30.6428° N, 96.4935° W; elev. 80 m; 19 Sep. 2013; J.D. Oswald leg.; TAMU-ENTO X1000976 • 2 ♀♀; *ibid.*; 28 Sep. 2013; K. Fryer leg.; TAMU-ENTO X1014172, X1015505 • 1 ♀; Brazos Co.; [30.6° N, 96.3° W]; 23 Jul. 1955; A.H. Alex leg.; ex sesame; TAMU-ENTO X1312589 • 1 ♀; Brazos Co.; 30.5922° N, 96.2727° W; elev. 88 m; 8–26 Feb. 2017; Karen W. Wright leg.; TAMU-ENTO X1534944 • 1 ♀; *ibid.*; 26 Feb.–8 Mar. 2017; Karen W. Wright leg.; TAMU-ENTO X1533805 • 1 ♀; *ibid.*; 25–31 Mar. 2017; Karen W. Wright leg.; TAMU-ENTO X1534899 • 2 ♀♀; *ibid.*; 16–23 Apr. 2017; Karen W. Wright leg.; TAMU-ENTO X1534915, X1534949 • 3 ♀♀; *ibid.*; 23–30 Apr. 2017; Karen W. Wright leg.; TAMU-ENTO X1534926, X1534945, X1534950 • 12 ♀♀; *ibid.*; 30 Apr.–13 May 2017; Karen W. Wright leg.; TAMU-ENTO X1533803, X1533804, X1533808, X1533822, X1533827, X1534913, X1534922, X1534955, X1534958, X1534971, X1534974, X1534975 • 1 ♀; Burleson Co., Highway 50 1.8 mi. N of Highway 60 junction; [30.558° N, 96.47° W]; 30 May 1975; S.J. Merritt leg.; TAMU-ENTO X1400784 • 2 ♀♀; Burnet Co., 5 mi. SE of Marble Falls; [30.53° N, 98.33° W]; 9 Sep. 2017; Karen W. Wright leg.; ex *Argemone albiflora*; TAMU-ENTO X1520087, X1520473 • 1 ♀; *ibid.*; 9 Sep. 2017; Karen W. Wright leg.; ex *Polanisia dodecandra*; TAMU-ENTO X1519455 • 2 ♂♂; Burnet Co., Inks Lake State Park; [30.73° N, 98.36° W]; 2 May 1987; J.B. Woolley leg.; TAMU-ENTO X1314946, X1417609 • 1 ♀; Caldwell Co., 4 mi. W of Luling; [29.68° N, 97.71° W]; 27 Sep. 1965; George E. Bohart leg.; ex *Chrysopsis viscida*; BBSL700725 • 1 ♀; Cameron Co., Brownsville; [25.9° N, 97.5° W]; 10–13 Mar. 1979; T.P. Friedlander leg.; TAMU-ENTO X1365387 • 1 ♀; Comanche Co., DeLeon; [32.11° N, 98.54° W]; 7 Jun. 1978; F.L. Mitchell leg.; TAMU-ENTO X1364763 • 4 ♀♀; Denton Co.; 33.2043° N, 97.0816° W; 27 Apr.; H.W. Ikerd leg.; PCYU USGS-DRO 004828, USGS-DRO 004837, USGS-DRO 004913, USGS-DRO 004960 • 1 ♂; Eastland Co., 3 miles north of Desdemona; [32.31° N, 98.55° W]; 1 Jun. 1998; W.F. Chamberlain leg.; TAMU-ENTO X1398711 • 1 ♀; Edwards Co., 2 mi. NW of Camp Wood; 29.6826° N, 100.0277° W; 14 Apr. 2018; Karen W. Wright leg.; ex *Salvia farinacea*; TAMU-ENTO X1601179 • 1 ♂; Edwards Co., 23 mi. W of Rocksprings; [30.02° N, 100.59° W]; 6 Aug. 1982; J.C. Schaffner leg.; ex *Rhus* sp.; TAMU-ENTO X1393599 • 10 ♀♀; Erath Co., 3 mi. W of Bluff Dale, bank of Paluxy River; [32.33° N, 98.07° W]; 8–15 Jul. 1976; R.L. Sams leg.; TAMU-ENTO X1364558, X1365416, X1365671, X1365893, X1366146, X1400758, X1400803, X1400873, X1401168, X1401183 • 4 ♀♀; *ibid.*; 29 Jul.–4 Aug. 1976; R.L. Sams

leg.; TAMU-ENTO X1398534, X1399137, X1401145, X1401178 • 1 ♀; Erath Co., 5 mi. N of Stephenville; [32.29° N, 98.2° W]; 21–23 May 1980; P.T. Riherd leg.; TAMU-ENTO X1365904 • 4 ♀♀; *ibid.*; 27–30 May 1980; P.T. Riherd leg.; TAMU-ENTO X1312282, X1314928, X1386058, X1386231 • 1 ♂; *ibid.*; 30 May 1980; P.T. Riherd leg.; TAMU-ENTO X1366121 • 5 ♀♀; *ibid.*; 1–6 Jun. 1980; P.T. Riherd leg.; TAMU-ENTO X1312347, X1365493, X1399026, X1420881, X1422490 • 2 ♀♀; Erath Co., Bluff Dale; [32.35° N, 98.02° W]; 13–20 May 1978; R.L. Sams leg.; TAMU-ENTO X1395228, X1417326 • 2 ♀♀; Erath Co., Bluff Dale, 1 mi. N of Paluxy River; [32.37° N, 98.03° W]; 21–27 Apr. 1978; R.L. Sams leg.; TAMU-ENTO X1365448, X1366157 • 6 ♀♀; *ibid.*; 28 Apr.–4 May 1978; R.L. Sams leg.; TAMU-ENTO X1391859, X1393360, X1399245, X1399334, X1399353, X1399485 • 8 ♀♀; *ibid.*; 5–13 May 1978; R.L. Sams leg.; TAMU-ENTO X1313256, X1388076, X1388078, X1388210, X1391955, X1392376, X1397504, X1400009 • 2 ♂♂; *ibid.*; 5–13 May 1978; R.L. Sams leg.; TAMU-ENTO X1393257, X1395802 • 7 ♀♀; *ibid.*; 19–26 May 1978; R.L. Sams leg.; TAMU-ENTO X1392365, X1393152, X1393435, X1396001, X1396075, X1397414, X1397524 • 2 ♂♂; *ibid.*; 19–26 May 1978; R.L. Sams leg.; TAMU-ENTO X1397525, X1397529 • 1 ♀; *ibid.*; 13–20 Jun. 1978; R.L. Sams leg.; TAMU-ENTO X1362234 • 1 ♀; Erath Co., Bluff Dale, Paluxy River; [32.35° N, 98.02° W]; 25–29 Mar. 1977; R.L. Sams leg.; TAMU-ENTO X1400161 • 5 ♀♀; Erath Co., FM 1188 3 miles west of Bluff Dale; [32.36° N, 98.06° W]; 16–23 Jul. 1976; R.L. Sams leg.; TAMU-ENTO X1365188, X1365505, X1365517, X1398865, X1399298 • 2 ♂♂; *ibid.*; 16–23 Jul. 1976; R.L. Sams leg.; TAMU-ENTO X1365131, X1413145 • 5 ♀♀; *ibid.*; 22–29 Jul. 1976; R.L. Sams leg.; TAMU-ENTO X1365458, X1365579, X1398636, X1398887, X1399390 • 1 ♂; *ibid.*; 22–29 Jul. 1976; R.L. Sams leg.; TAMU-ENTO X1365178 • 1 ♀; Fayette Co., Schulenburg; [29.68° N, 96.9° W]; 28 Sep. 1965; George E. Bohart leg.; ex *Baccharis*; BBSL700732 • 1 ♀; Fayette Co.; 29.897° N, 98.8379° W; 23 Jul. 2016; Sam W. Droege leg.; WRME 376569 • 2 ♀♀; Frio Co., 6 mi. SE of Pearsall; [28.83° N, 99.02° W]; 7 Jul. 1972; E.E. Grissell, J. Smith leg.; TAMU-ENTO X1362222, X1396247 • 2 ♂♂; *ibid.*; 7 Jul. 1972; E.E. Grissell, J. Smith leg.; TAMU-ENTO X1362225, X1393179 • 1 ♀; Galveston Co., Texas A&M University at Galveston; [29.32° N, 94.82° W]; 14 May 2000; J.C. Abbott, R. Caesar leg.; PCYU • 1 ♀; Garza Co.; [33.2° N, 101.3° W]; 9 Jun. 1980; Thieband leg.; TAMU-ENTO X1388272 • 1 ♀; Gillespie Co., Morris Ranch; [30.22° N, 99.01° W]; 11 Sep. 1994; W.F. Chamberlain leg.; TAMU-ENTO X1416318 • 1 ♀; Harris Co., Houston, University of Houston; 29.7245° N, 95.3451° W; 27 Jul. 2017; Scott Gilb. leg.; ex *Croton capitatus*; TAMU-ENTO X1576029 • 2 ♀♀; Hidalgo Co., 3 mi. E of Hargill; [26.44° N, 97.96° W]; 4 May 1983; D.A. Dean leg.; ex cotton; TAMU-ENTO X1382605, X1386601 • 1 ♂; Hidalgo Co., Bentsen-Rio Grande Valley State Park; [26.175° N, 98.385° W]; 16 Jun. 1978; C.C. Porter leg.; TAMU-ENTO X1386607 • 1 ♂; *ibid.*; 25 Aug. 1982; C.C. Porter leg.; TAMU-ENTO X1388263 • 1 ♀; Hidalgo Co., McAllen Botanical Garden; [26.2062° N, 98.2663° W]; 21 Aug. 1982; C.C. Porter leg.; TAMU-ENTO X1387872 • 1 ♀; Hill Co., 6 mi. S of Hillsboro; [31.92° N, 97.13° W]; 9 Aug. 1983; D.A. Dean leg.; TAMU-ENTO X1395167 • 1 ♂; Hockley Co.; [33.6° N, 102.4° W]; 11 Jun. 1981; L. Berger leg.; ex sunflower; TAMU-ENTO X1388815 • 1 ♀; Kendall Co., Boerne City Park; [29.785° N, 98.71° W]; 19 Apr. 1984; J.C. Schaffner leg.; TAMU-ENTO X1417011 • 1 ♀; Kenedy Co., Rest Stop #2, 4 mi. N of Raymondville; [27.13° N, 97.79° W]; 2 Aug. 1978; M. Stiller leg.; TAMU-ENTO X1418448 • 4 ♂♂; Kerr Co., “3.3 mi. N” [E] of Hunt on S. R. 39 Bumblebee Creek; [30.1° N, 99.3° W]; 22 Jul. 1974; H. Greenbaum leg.; TAMU-ENTO X0283941, X1386577, X1387035, X1387359 • 1 ♀; Kerr Co., 9 miles west of Mountain Home; [30.17° N, 99.52° W]; 16 Jun. 1997; W.F. Chamberlain leg.; TAMU-ENTO X1395186 • 2 ♀♀; Kerr Co., Center Point; [29.95° N, 99.04° W]; 20–26 May 1987; Wharton, Praetorius leg.; TAMU-ENTO X1388019, X1388477 • 4 ♂♂; *ibid.*; 20–26 May 1987; Wharton, Praetorius leg.; TAMU-ENTO X1312365, X1387784, X1388547, X1388732 • 1 ♀; *ibid.*; 5–11 Jun. 1987; Wharton, Praetorius leg.; TAMU-ENTO X1386942 • 2 ♀♀; *ibid.*; 12–18 Jun. 1987; Wharton, Praetorius leg.; TAMU-ENTO X1386333, X1386474 • 1 ♂; *ibid.*; 12–18 Jun. 1987; Wharton, Praetorius leg.; TAMU-ENTO X1386275 • 8 ♀♀; *ibid.*; 25 Jun.–3 Jul. 1987; Wharton, Praetorius leg.; TAMU-ENTO X1386045, X1386375, X1386585, X1387684, X1388548, X1388824, X1388972, X1389066 • 3 ♂♂; *ibid.*; 25 Jun.–3 Jul. 1987; Wharton, Praetorius leg.; TAMU-ENTO X1383867, X1387373, X1388916 • 1 ♂; *ibid.*;

24–30 Jul. 1987; Wharton, Praetorius leg.; TAMU-ENTO X1388122 • 2 ♀♀; *ibid.*; 7–13 Aug. 1987; Wharton, Praetorius leg.; TAMU-ENTO X1312283, X1386811 • 1 ♀; Kerr Co., Kerrville; [30.05° N, 99.14° W]; 28 Apr. 1965; TAMU-ENTO X1405137 • 2 ♂♂; Kleberg Co., 20 miles southeast of Kingsville; [27.31° N, 97.62° W]; 4–5 Jun. 1983; W.J. Pulawski leg.; CAS • 1 ♀; *ibid.*; 6–8 Jun. 1983; W.J. Pulawski leg.; CAS • 4 ♂♂; *ibid.*; 6–8 Jun. 1983; W.J. Pulawski leg.; CAS • 1 ♀; Kleberg Co., Leo Kaufer Memorial Park; [27.315° N, 97.68° W]; 2 Aug. 1978; M. Stiller leg.; TAMU-ENTO X1416758 • 4 ♀♀; Lavaca Co., 15 mi. S of Hallettsville; [29.22° N, 96.97° W]; 28 Aug. 1965; George E. Bohart leg.; BBSL700728, BBSL700733, BBSL700774, BBSL700775 • 1 ♀; *ibid.*; 28 Sep. 1965; George E. Bohart leg.; ex *Croton*; BBSL700721 • 1 ♀; Leon Co., 2.8 mi. N of Normangee; [31.07° N, 96.12° W]; 12 Jun. 1976; S.J. Merritt leg.; ex *Monarda*; TAMU-ENTO X1398606 • 1 ♀; Live Oak Co., 8 miles south of George West; [28.22° N, 98.11° W]; 22 Aug. 1975; D.W. Plitt leg.; ex Garza pasture; TAMU-ENTO X1399068 • 1 ♂; *ibid.*; 25 Aug. 1975; D.W. Plitt leg.; TAMU-ENTO X1399237 • 1 ♀; Llano Co., 10 mi. W of Llano; 30.709° N, 98.824° W; 2 Mar. 2009; J.L. Neff leg.; ex *Rhus trilobata*; CTMI 33372 • 1 ♀; Milam Co., 14.6 miles NW of junction of Highway 79 and FM 487; [30.75° N, 97.18° W]; 10 Jun. 1978; S.J. Merritt leg.; ex *Coreopsis* sp.; TAMU-ENTO X1402200 • 1 ♂; Palo Pinto Co., Possum Kingdom Reservoir; [32.9° N, 98.5° W]; 31 Aug. 1990; J.L. Tracy leg.; TAMU-ENTO X1498264 • 9 ♀♀; Potter Co., Bushland; [35.19° N, 102.06° W]; 17–24 Jul. 1983; T.J. Kring leg.; TAMU-ENTO X1392217, X1392366, X1393210, X1393614, X1395180, X1395920, X1397321, X1397441, X1397460 • 1 ♂; *ibid.*; 17–24 Jul. 1983; T.J. Kring leg.; TAMU-ENTO X1395872 • 10 ♀♀; *ibid.*; 7–15 Aug. 1983; T.J. Kring leg.; TAMU-ENTO X1383647, X1383683, X1386832, X1386845, X1387976, X1388196, X1388344, X1388354, X1388721, X1388886 • 1 ♂; *ibid.*; 7–15 Aug. 1983; T.J. Kring leg.; TAMU-ENTO X1388693 • 1 ♀; Reeves Co., 11 mi. W of Balmorhea State Park (“Route 290” [3078?]); [31° N, 103.94° W]; 18 Aug. 1980; T.P. Friedlander, T.A. Friedlander, P.W. Kovarik leg.; TAMU-ENTO X1386814 • 1 ♀; Reeves Co., TAMU Research Station at Pecos; [31.37° N, 103.62° W]; 17 Aug. 1976; S.J. Merritt leg.; ex alfalfa; TAMU-ENTO X1400891 • 1 ♀; Robertson Co., 3.4 miles east of junction of Highway 6 and OSR; [30.75° N, 96.4° W]; 14 Aug. 1976; S.J. Merritt leg.; ex *Euphorbia*; TAMU-ENTO X1365218 • 3 ♀♀; Robertson Co., Salter Research Farms; 31.0333° N, 96.7725° W; elev. 88 m; 23 Apr. 2017; Karen W. Wright leg.; TAMU-ENTO X1533744, X1533769, X1533775 • 3 ♀♀; San Patricio Co., Welder Wildlife Refuge; [28.11° N, 97.42° W]; 28 Jun. 1984; J.C. Schaffner leg.; ex hackberry motte; TAMU-ENTO X1391640, X1391716, X1391878 • 1 ♀; San Patricio Co., Welder Wildlife Refuge; 28.1122° N, 97.4167° W; elev. 20 m; Mar. 2004; Sty Reed leg.; PCYU • 1 ♀; Somervell Co., 3 mi. S of Glen Rose; [32.19° N, 97.76° W]; 4 May 1973; J.C. Schaffner leg.; TAMU-ENTO X1362253 • 3 ♀♀; Somervell Co., 6 mi. N of Glen Rose, Comanche Peak Electric Station; [32.3° N, 97.8° W]; 16–17 Jun. 1979; J.P. Cuda leg.; TAMU-ENTO X1393570, X1395851, X1396070 • 1 ♂; Starr Co., Falcon State Park; [26.58° N, 99.14° W]; 10 Jun. 1969; Veryl V. Board leg.; TAMU-ENTO X1395821 • 1 ♂; *ibid.*; 19 Jun. 1969; Veryl V. Board leg.; TAMU-ENTO X1396041 • 2 ♀♀; *ibid.*; 18 May 1978; C.C. Porter, A. Cerbone leg.; TAMU-ENTO X1313681, X1385482 • 1 ♂; *ibid.*; 18 May 1978; C.C. Porter, A. Cerbone leg.; TAMU-ENTO X1387384 • 3 ♂♂; *ibid.*; 20 Apr. 1985; J.B. Woolley leg.; TAMU-ENTO X1387994, X1388896, X1416975 • 2 ♀♀; Taylor Co., Dyess Air Force Base; 32.4072° N, 99.829° W; 12–13 Apr. 2001; H.W. Ikerd leg.; TAMU-ENTO X1387947, X1388030 • 1 ♀; Taylor Co., Dyess Air Force Base; 32.4415° N, 99.8111° W; 12–13 Apr. 2001; H.W. Ikerd leg.; TAMU-ENTO X1312644 • 1 ♀; *ibid.*; 9–10 May 2001; H.W. Ikerd leg.; TAMU-ENTO X1387955 • 2 ♀♀; Travis Co., Austin; [30.26° N, 97.74° W]; 28 Sep.–10 Oct. 1975; Bob Henderson leg.; TAMU-ENTO X1398967, X1399473 • 1 ♀; Travis Co., Austin, Barton Creek Park; [30.26° N, 97.82° W]; 8 Oct. 1983; L.E. Carroll leg.; TAMU-ENTO X1401177 • 5 ♂♂; *ibid.*; 8 Oct. 1983; L.E. Carroll leg.; TAMU-ENTO X1385439, X1386250, X1388246, X1400810, X1401157 • 2 ♀♀; Travis Co., Austin, Zilker Park; [30.27° N, 97.77° W]; 8 Oct. 1983; J.B. Woolley leg.; TAMU-ENTO X1415630, X1418344 • 2 ♂♂; *ibid.*; 8 Oct. 1983; J.B. Woolley leg.; TAMU-ENTO X1314578, X1316273 • 1 ♀; Travis Co., Heep Farm, 11 mi. S of Austin; [30.11° N, 97.8° W]; 27 Jul. 1972; E.E. Grissell leg.; TAMU-ENTO X1362335 • 1 ♀; Uvalde Co., Garner State Park; [29.59° N, 99.74° W]; 22 May 1979; W.P. Foerster leg.; TAMU-ENTO X1418161 • 1 ♀; Val Verde



Co., Dolan Creek Camp Ground; 29.9° N, 100.8833° W; 14 Jun. 1975; J.S. Ashe leg.; TAMU-ENTO X1365716 • 1 ♀; Walker Co., Ellis Prison; [30.88° N, 95.46° W]; 23 Jul. 1977; W.L. Sterling leg.; TAMU-ENTO X1396331 • 1 ♀; *ibid.*; 25 Jul. 1977; W.L. Sterling leg.; TAMU-ENTO X1396334 • 5 ♀♀; Williamson Co., CR 278 3.5 mi. SE of Liberty Hill; [30.63° N, 97.89° W]; 9 Sep. 2017; Karen W. Wright leg.; TAMU-ENTO X1519447, X1519897, X1519918, X1519935, X1520149 • 1 ♀; Williamson Co., Highway 183 4 mi. N of Leander; [30.64° N, 97.87° W]; 9 Sep. 2017; Karen W. Wright leg.; TAMU-ENTO X1536161 • 1 ♂; 10 miles east of Sonora; [30.57° N, 100.48° W]; 25 Jul. 1986; W.F. Chamberlain leg.; *ex Rhus*; TAMU-ENTO X1387486 • 1 ♀; 10 miles NW of Ballinger; [31.84° N, 100.07° W]; 15 Jul. 1993; G.M. Chamberlain leg.; TAMU-ENTO X1388634 • 1 ♀; 10 miles S of Austin; [30.11° N, 97.74° W]; 28 Sep. 1965; George E. Bohart leg.; BBSL700645 • 1 ♂; *ibid.*; 28 Sep. 1965; George E. Bohart leg.; BBSL700808 • 1 ♀; 10 miles west of Port Mansfield; [26.55° N, 97.59° W]; 9 Mar. 2001; W.F. Chamberlain leg.; TAMU-ENTO X1488468 • 3 ♀♀; 11 miles SW of Kerrville; [29.93° N, 99.27° W]; 21 May 1989; W.F. Chamberlain leg.; TAMU-ENTO 1395661, X1313963, X1370712 • 1 ♂; *ibid.*; 21 May 1989; W.F. Chamberlain leg.; TAMU-ENTO X1409734 • 1 ♀; 13 miles NE of Fredricksburg; [30.41° N, 98.72° W]; 20 Apr. 1997; W.F. Chamberlain leg.; TAMU-ENTO X1400248 • 1 ♀; 5 miles east of Lampasas; [31.06° N, 98.1° W]; 21 Apr. 1997; W.E. Chamberlain leg.; TAMU-ENTO X1393218 • 1 ♀; 5 miles north of Hondo; [29.42° N, 99.14° W]; 8 May 1988; W.F. Chamberlain leg.; TAMU-ENTO X1417885 • 1 ♀; 5 miles north of Utopia; [29.69° N, 99.53° W]; 22 Apr. 1994; W.F. Chamberlain leg.; TAMU-ENTO X1403909 • 1 ♀; 6 miles east of Doss; [30.44° N, 99.03° W]; 27 Aug. 1995; W.F. Chamberlain leg.; TAMU-ENTO X1400060 • 1 ♀; 9 miles SE of Hondo; [29.25° N, 99.04° W]; 17 Mar. 1994; W.F. Chamberlain leg.; TAMU-ENTO X1420319 • 1 ♂; Austin; [30.26° N, 97.74° W]; 11 Sep. 1975; W.P. Foerster leg.; TAMU-ENTO X1365304 • 1 ♀; *ibid.*; 25 Mar. 1976; W.P. Foerster leg.; TAMU-ENTO X1401264 • 1 ♀; *ibid.*; 17 May 1976; W.P. Foerster leg.; TAMU-ENTO X1398517 • 1 ♀; *ibid.*; 14 Jun. 1976; W.P. Foerster leg.; *ex dandelion*; TAMU-ENTO X1365981 • 1 ♂; *ibid.*; 27 Jun. 1976; W.P. Foerster leg.; *ex Gaillardia*; TAMU-ENTO X1399165 • 1 ♀; *ibid.*; 1 Jul. 1976; W.P. Foerster leg.; *ex cult. camphor*; TAMU-ENTO X1365509 • 1 ♂; *ibid.*; 5 Jul. 1976; W.P. Foerster leg.; TAMU-ENTO X1365939 • 1 ♀; Enchanted Rock; 30.51° N, 98.82° W; 20 May 2015; Paul A. Rude leg.; EMEC • 1 ♀; Kerrville; [30.05° N, 99.14° W]; 18 Jul. 1981; W.F. Chamberlain leg.; TAMU-ENTO X1387184 • 1 ♀; *ibid.*; 13 Sep. 1996; G.M. Chamberlain leg.; TAMU-ENTO X1422788 • 1 ♀; *ibid.*; 27 May 1999; G.M. Chamberlain leg.; TAMU-ENTO X1400002 • 1 ♀; New Braunfels; [29.7° N, 98.12° W]; 23 Apr. 1977; W.F. Chamberlain leg.; TAMU-ENTO X1388564 • 1 ♂; Presidio; [29.56° N, 104.37° W]; 4 May 1979; W.F. Chamberlain leg.; TAMU-ENTO X1312628 • 1 ♀; Ratcliff Lake Recreation Area; [31.39° N, 95.16° W]; 6 Jun. 1994; W.F. Chamberlain leg.; TAMU-ENTO X1415799 • 1 ♂; Taylor; [30.57° N, 97.41° W]; 16 Sep. 1933; J.E. Gillaspay leg.; TAMU-ENTO X1387673 • 9 ♂♂; Texas A&M Campus, College Station; [30.62° N, 96.34° W]; 29 Jul. 1995; John W. Wenzel leg.; PCYU • 1 ♂; Waco; [31.55° N, 97.15° W]; 10 Aug. 1939; P.A. Glick leg.; *ex cotton*; TAMU-ENTO X1386262.

**Note:** During final preparation of the manuscript some Montana specimens were discovered in MTEC.

### Range

Chihuahuan Desert and western Great Plains from eastern Colorado to northern Veracruz, rarely occurring in western Colorado and New Mexico (Fig. 11).

### Floral hosts

ANACARDIACEAE R.Br.: *Rhus* L.: *R. trilobata* Nutt. • APOCYNACEAE Juss.: *Asclepias* L.: *A. verticillata* L. • AQUIFOLIACEAE Bercht. & J.Presl: *Ilex* L.: *I. vomitoria* Aiton • ASPARAGACEAE Juss.: *Dasylyrion* Zucc.: *D. wheeleri* S.Watson ex Rothr. • ASTERACEAE: *Aster* L. • *Baccharis* L. • *Bradburia* Torr. & A.Gray: *B. pilosa* (Nutt.) Semple • *Carduus* L. • *Coreopsis* L.: *C. basalis* (A.Dietr.) S.F.Blake • *C. tinctoria* Nutt. • *Croptilon* Raf.: *C. divaricatum* (Nutt.) Raf. • *Gaillardia* Foug. • *Helianthus* L. : *H. annuus* L. • *Heterotheca* Cass.: *H. subaxillaris* (Lam.) Britton & Rusby • *H. viscida* (A.Gray) V.L. Harms • *Lactuca* L.: *L. sativa* L. • *Parthenium* L.: *P. hysterophorus* L. • *Pyrrhoppappus* DC.: *P. pauciflorus* (D.Don) DC. • BRASSICACEAE Burnett: *Lepidium* L.: *L. integrifolium*

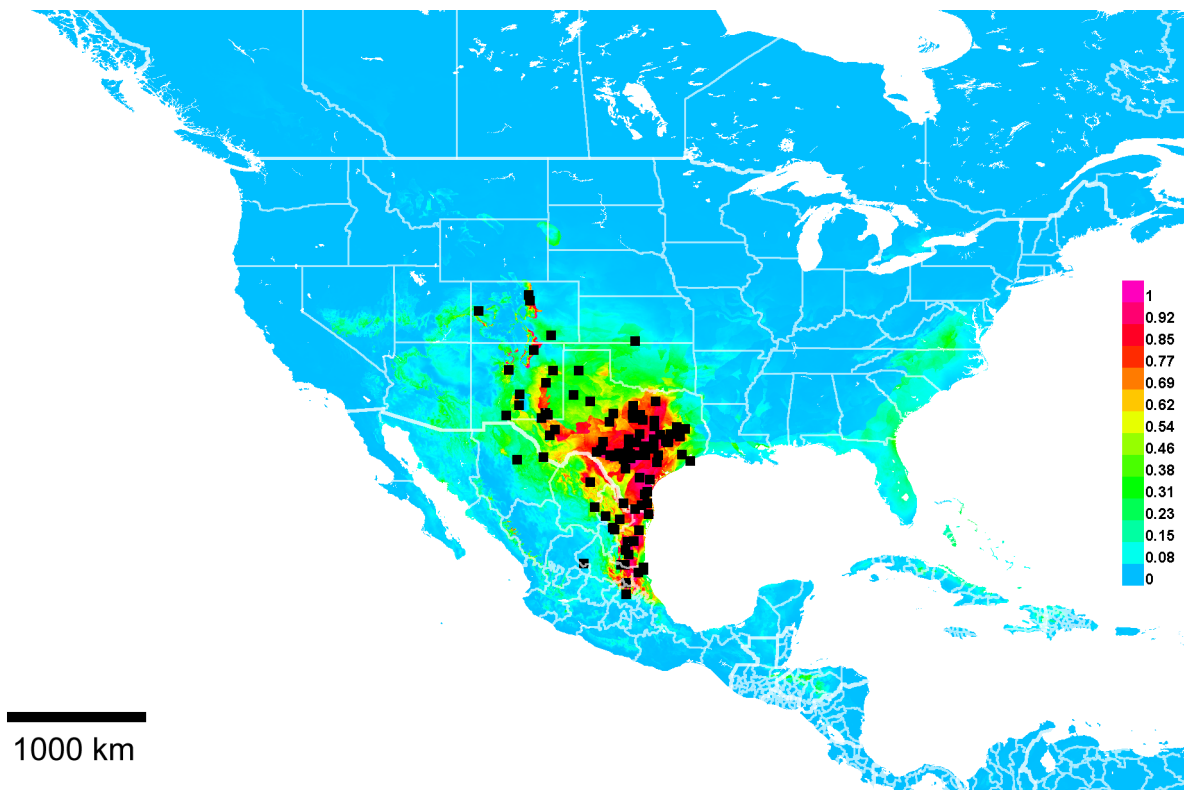


Nutt. • CACTACEAE Juss.: *Astrophytum* Lem.: *A. myriostigma* Lem. • *A. ornatum* (DC.) Britton & Rose • *Leuchtenbergia* Hook.: *L. principis* Hook. • *Opuntia* Mill.: *O. macrorhiza* Engelm. • CLEOMACEAE Bercht. & J.Presl: *Polanisia* Raf.: *P. dodecandra* (L.) DC. • EUPHORBIACEAE Juss.: *Croton* L.: *C. capitatus* Michx. • *Euphorbia* L. • FABACEAE Lindl.: *Cassia* L. • *Cercidium* Tul.: *C. macrum* I.M.Johnst. • *Medicago* L.: *M. sativa* L. • *Melilotus* (L.) Mill.: *M. officinalis* (L.) Lam.: *M. o.* subsp. *alba* (Medik.) H.Ohashi & Tateishi • LAMIACEAE Martinov: *Lamium* L. • *Marrubium* L.: *M. vulgare* L. • *Mentha* L.: *M. spicata* L. • *Monarda* L. • *Salvia* L.: *S. farinacea* Benth. • MALVACEAE Juss.: *Gossypium* L. • PAPAVERACEAE Juss.: *Argemone* L.: *A. albiflora* Hornem. • PEDALIACEAE R.Br.: *Sesamum* L.: *S. indicum* L. • SCROPHULARIACEAE Juss.: *Leucophyllum* Bonpl.: *L. frutescens* (Berland.) I.M.Johnst. • TAMARICACEAE Link: *Tamarix* L.

Additional records from Moure & Hurd (1987): ASTERACEAE: *Erigeron* L.: *E. philadelphicus* L. • *Gutierrezia* Lag.: *G. texana* (DC.) Torr. & A.Gray: *G. t.* var. *glutinosa* (S.Schauer) M.A.Lane • BORAGINACEAE Juss.: *Phacelia* Juss.: *P. congesta* Hook. • PAPAVERACEAE: *Argemone*: *A. sanguinea* Greene.

### DNA barcodes

Eight confirmed sequences available, two haplotypes (BOLD process IDs: BWTWO1314-10, DLII051-06, LASNA016-08 (haplotype 1); DIAL1132-07, DLII307-07, DLII318-07, DLII338-07, DLII547-07 (haplotype 2)). Haplotype 1 is very similar to *L. carlinvillense*, and haplotype 2 is very similar to *L. tegulare*. There is a large amount of divergence within these sequences (3.36% maximum intraspecific p-distance). They are closest in terms of p-distance to *L. carlinvillense* (0.15% minimum interspecific p-distance). No fixed nucleotide substitutions distinguish all *L. coactus* from all other Nearctic species of



**Fig. 11.** Georeferenced collection records of *Lasioglossum (D.) coactus* (Cresson, 1872) (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence.

the *L. gemmatum* complex, but one fixed substitution distinguishes haplotype 1, and two fixed substitutions distinguish haplotype 2: 156(C) (haplotype 1); 429(G) and 441(C) (haplotype 2) ([Supp. file 2](#)).

*Lasioglossum (Dialictus) deludens* sp. nov.

[urn:lsid:zoobank.org:act:657A63A6-BF79-4EF1-A2B3-F2BE12AC0E6D](https://zoobank.org/act:657A63A6-BF79-4EF1-A2B3-F2BE12AC0E6D)

Figs 12–14, 76C, 78D, 102C

*Dialictus deludens* (nomen nudum) – De Luca *et al.* 2019: 4879.

### Diagnosis

Females of *L. deludens* sp. nov. have the tegula relatively small (barely reaching posterior margin of mesoscutum in dorsal view if at all), translucent yellow-orange, impunctate, and with inner posterior margin straight; mesoscutum punctures smaller and finer in comparison to mesepisternum punctures, dense (IS < 1 PD) and becoming moderately sparse anteromedially and usually submedially (IS = 1–3 PD); mesoscutum usually becoming shiny posteriorly; metapostnotum shiny with strong anastomosing rugae; mesepisternum densely punctate (IS < 1 PD) and usually shiny; paraocular area with dense tomentum; and metasoma black to brown (rarely somewhat reddish, but never bright red-orange).

Females of *L. deludens* sp. nov. are most similar to those of *L. profundum* sp. nov., *L. rufodeludens* sp. nov., and some *L. diabolicum* sp. nov. Females of *L. profundum* have the tegula dark brown, mesoscutum punctures about as large and coarse as mesepisternum punctures, and mesepisternum imbricate. Females of *L. rufodeludens* have the mesoscutum and mesepisternum completely dull and metasoma red-orange. Females of *L. diabolicum* have the tegula with at least some punctures medially (may be difficult to see if the tegula is very pale yellow) and the mesoscutum punctures about as large and coarse as mesepisternum punctures.

Males of *L. deludens* sp. nov. have the same characters as for females, in addition to the face completely covered with dense appressed tomentum extending above eye emargination but not reaching median ocellus. They are most similar to those of *L. profundum* sp. nov. and *L. rufodeludens* sp. nov. Males of *L. profundum* have the tegula dark brown and, in direct comparison, the mesosoma and metasoma punctures are larger and coarser. Males of *L. rufodeludens* sp. nov. have the mesoscutum mostly or entirely tessellate and slightly more densely punctate (IS = 1–2 PD) and face with dense tomentum not extending above eye emargination.

An undescribed species unrelated to the *L. gemmatum* complex and occurring sympatrically with *L. deludens* sp. nov. is superficially similar in both sexes, but the tegula is small and ovoid and the propodeum lacks an oblique carina.

### Etymology

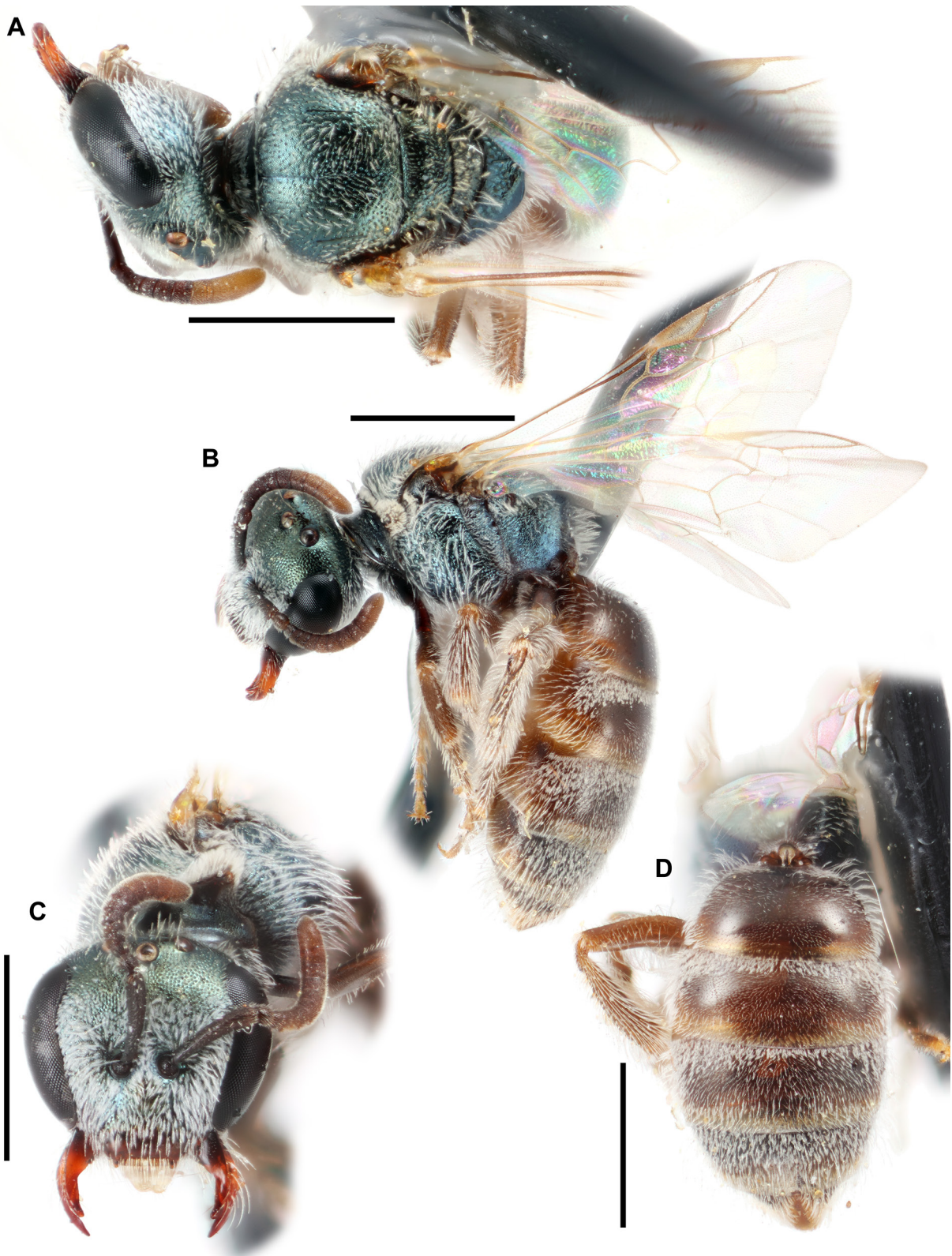
The specific epithet ‘*deludens*’ is the Latin present participle of ‘*deludo*’ (deceive, dupe). It refers to this species’ frequent misidentification in the past. An appropriate translation would be the deceiving sweat bee.

### Material examined

#### Holotype

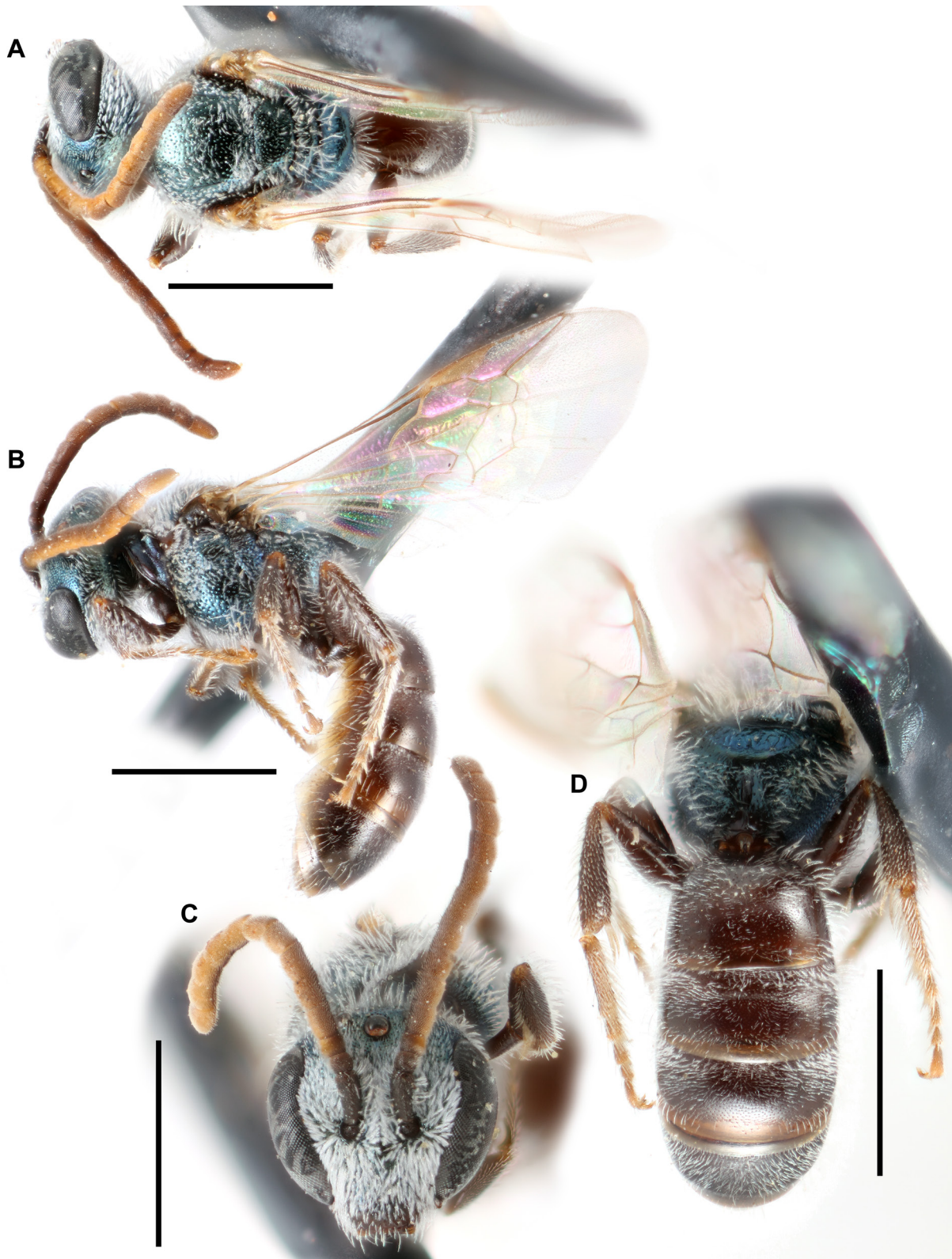
MEXICO – Sonora • ♀; 30 km E of Agua Prieta; 31.30972° N, 109.25417° W; 20 Apr. 2005; R.L. Minckley leg.; PCYU SBV047813.

[Verbatim label: MEXICO: Sonora / 30 km east Agua Prieta / 31°18'35"N109°15'15"W / 20 Apr 2005, RL Minckley / ex. blue bowl / Bw7. SBV047813 // 1849C12 // HOLOTYPE / *Lasioglossum (Dialictus) deludens* Gardner and Gibbs]



**Fig. 12.** *Lasioglossum (D.) deludens* sp. nov., ♀, holotype (PCYU SBV047813). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma. Scale bars = 1 mm.





**Fig. 13.** *Lasioglossum (D.) deludens* sp. nov., ♂. A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma and propodeum. Scale bars = 1 mm.



**Paratypes**

MEXICO – **Coahuila** • 1 ♂; Boquillas; 29.1883° N, 102.9374° W; 19 Jun. 1992; Robert L. Minckley leg.; ex *Phacelia*; SEMC. – **Durango** • 1 ♀; 37 km NW of Ceballos; [26.78° N, 104.38° W]; elev. 1230 m; 16 Mar. 1992; R.W. Brooks leg.; ex *Nama hispida*; SEMC SM0342993 • 1 ♀; 69 mi. N of Durango, Highway #31; [25.03° N, 104.65° W]; 29 Jul. 1956; R.E. Beer *et al.* leg.; SEMC. – **Sonora** • 1 ♀; 30 km E of Agua Prieta; 31.2136° N, 109.2136° W; 11 Aug. 2004; Robert L. Minckley leg.; RLM • 8 ♀♀; 30 km E of Agua Prieta; 31.3086° N, 109.2731° W; 2 May 2001; Robert L. Minckley leg.; RLM SBV011441, SBV011447, SBV011449, SBV011453, SBV011462, SBV011465, SBV011466, SBV011471 • 1 ♀; 30 km E of Agua Prieta; 31.31° N, 109.2778° W; 2 May 2001; Robert L. Minckley leg.; RLM SBV011349 • 3 ♀♀; 30 km E of Agua Prieta; 31.315° N, 109.2728° W; 2 May 2001; Robert L. Minckley leg.; RLM SBV011426, SBV011429, SBV011436 • 5 ♀♀; 30 km E of Agua Prieta; 31.3167° N, 109.2783° W; 2 May 2001; Robert L. Minckley leg.; RLM SBV011357, SBV011372, SBV011381, SBV011400, SBV011405 • 1 ♀; 30 km E of Agua Prieta; 31.3183° N, 109.2514° W; 18 May 2004; Robert L. Minckley leg.; RLM SBV024134 • 2 ♀♀; 30 km E of Agua Prieta; 31.3183° N, 109.2689° W; 30 Mar. 2002; A. Romero leg.; RLM SBV013275, SBV013301 • 1 ♀; 30 km E of Agua Prieta; 31.3189° N, 109.2511° W; 30 Mar. 2002; A. Romero leg.; RLM SBV013237 • 11 ♀♀; 30 km E of Agua Prieta; 31.3222° N, 109.2769° W; 2 May 2001; Robert L. Minckley leg.; RLM SBV011480, SBV011481, SBV011488, SBV011490, SBV011495, SBV011498, SBV011500, SBV011507, SBV011509, SBV011510, SBV011511 • 5 ♀♀; 30 km E of Agua Prieta; 31.3331° N, 109.2272° W; 3 May 2001; Robert L. Minckley leg.; RLM SBV011556, SBV011570, SBV011575, SBV011576, SBV011583 • 1 ♀; 30 km E of Agua Prieta; 31.3331° N, 109.265° W; 21 May 2001; Robert L. Minckley leg.; RLM SBV012912 • 1 ♂; *ibid.*; 21 May 2001; Robert L. Minckley leg.; RLM SBV012924 • 1 ♀; 30 km E of Agua Prieta; 31.3333° N, 109.2653° W; 20 Apr. 2005; Robert L. Minckley leg.; RLM SBV047719 • 1 ♂; *ibid.*; 20 Apr. 2005; Robert L. Minckley leg.; RLM SBV047759 • 1 ♂; 30 km E of Agua Prieta, Rio San Bernardino and Highway 2; [31.312° N, 109.254° W]; 10 May 2002; Robert L. Minckley leg.; ex *Erigeron* sp.; RLM SBV031273 • 1 ♂; 38.6 km south of Ciudad Obregon; [27.13° N, 109.93° W]; 20 Mar. 1990; Robert L. Minckley leg.; SEMC • 2 ♀♀; 5 miles west of Santa Ana; [30.54° N, 111.2° W]; 10 Jun. 1961; F.D. Parker leg.; UCDC • 2 ♀♀; Arrollo El Limón, Rancho Las Lajas, 26 km E of Alamos; 27.0672° N, 108.7245° W; elev. 427 m; 20–22 Jun. 2008; M.E. Irwin leg.; BBSL FDP754275, FDP754288 • 1 ♀; Cócorit; [27.58° N, 109.96° W]; 11 Jun. 1961; F.D. Parker leg.; UCDC • 3 ♂♂; Hermosillo; [29.07° N, 110.96° W]; 18 Jun. 1961; F.D. Parker leg.; UCDC • 1 ♂; Municipio de Agua Prieta; 31.2908° N, 109.2636° W; 16 Apr. 2005; A. Romero leg.; RLM SBV142487 • 1 ♂; Municipio de Agua Prieta; 31.3164° N, 109.2881° W; 3 May 2007; Robert L. Minckley leg.; ex *Prosopis velutina*; RLM SBV073513 • 1 ♂; *ibid.*; 10 May 2007; Robert L. Minckley leg.; ex *Lycium andersonii wrightii*; RLM SBV074220 • 1 ♂; *ibid.*; 14 May 2007; Robert L. Minckley leg.; ex *Lycium berlandieri*; RLM SBV074294 • 3 ♂♂; Municipio de Agua Prieta, Rancho Las Anitas; 31.3139° N, 109.3142° W; 11 Aug. 2007; Robert L. Minckley leg.; RLM SBV076940, SBV076982, SBV077166 • 1 ♂; Municipio de Agua Prieta, Rancho Nogalitos; 31.3118° N, 108.9862° W; 25 May 2008; Robert L. Minckley leg.; RLM SBV083792 • 1 ♀; Nogales; [31.3° N, 110.94° W]; 30 Jun. 1941; USNM • 1 ♂; Rancho Puerta Blanca; 31.3139° N, 109.2503° W; 29 Apr. 2007; Robert L. Minckley leg.; ex *Physaria fendleri*; RLM SBV073048 • 1 ♂; Rancho Puerta Blanca; 31.3222° N, 109.0797° W; 8 May 2007; Robert L. Minckley leg.; ex *Opuntia engelmannii* × *phaeacantha*; RLM SBV074046 • 1 ♂; *ibid.*; 18 May 2007; Robert L. Minckley leg.; ex *Porophyllum gracile*; RLM SBV074434 • 1 ♂; *ibid.*; 25 May 2007; Robert L. Minckley leg.; ex *Dasyliiron wheeleri*; RLM SBV074699 • 1 ♀; Rancho Puerta Blanca; 31.3251° N, 109.0916° W; 8 Apr. 2005; Robert L. Minckley *et al.* leg.; ex *Malacothrix fendleri*; RLM SBV143077 • 1 ♀; Rancho San Bernardino; [31.31° N, 109.25° W]; 22 Jun. 2000; K. Toal *et al.* leg.; RLM SBV001862 • 4 ♀♀; *ibid.*; 7 May 2001; Robert L. Minckley leg.; RLM SBV008452, SBV008472, SBV019814, SBV019842 • 1 ♀; Rancho San Bernardino; [31.32° N, 109.27° W]; 25 Aug. 2001; Robert L. Minckley leg.; RLM SBV137594 • 1 ♂; Rancho San Bernardino; 31.3002° N, 109.2625° W; 3 May 2002; A. Romero leg.; RLM SBV066335 • 1 ♂; *ibid.*; 4 Jul. 2002; Robert L. Minckley leg.; RLM SBV064051 • 1 ♂; Rancho San Bernardino; 31.3002° N, 109.2626° W; 19 Apr. 2002; Robert

L. Minckley leg.; RLM SBV064280 • 1 ♂; Rancho San Bernardino; 31.3071° N, 109.2568° W; 12 Jun. 2004; N. de la Torre leg.; ex *Tamarix ramosissima*; RLM SBV054512 • 1 ♂; Rancho San Bernardino; 31.3072° N, 109.2568° W; 3 Jun. 2004; A. Romero leg.; ex *Tamarix ramosissima*; RLM SBV025649 • 1 ♂; *ibid.*; 12 Jun. 2004; N. de la Torre leg.; ex *Tamarix ramosissima*; RLM SBV054540 • 2 ♂♂; *ibid.*; 12 Jun. 2004; N. de la Torre leg.; RLM SBV054335, SBV054378 • 6 ♂♂; Rancho San Bernardino; 31.3074° N, 109.2569° W; 12 Jun. 2004; N. de la Torre leg.; RLM SBV054389, SBV054397, SBV054399, SBV054405, SBV054431, SBV054432 • 1 ♂; Rancho San Bernardino; 31.3075° N, 109.2572° W; 16 Jun. 2004; A. Romero leg.; RLM SBV079866 • 5 ♀♀; Rancho San Bernardino; 31.3083° N, 109.2736° W; 21 Apr. 2005; A. Romero leg.; PCYU SBV048073, SBV048079, SBV048082, SBV048087, SBV048088 • 9 ♀♀; *ibid.*; 21 Apr. 2005; A. Romero leg.; RLM SBV048075, SBV048076, SBV048078, SBV048080, SBV048081, SBV048086, SBV048091, SBV048092, SBV048093 • 1 ♂; *ibid.*; 12 Aug. 2006; Robert L. Minckley leg.; RLM SBV060698 • 1 ♂; Rancho San Bernardino; 31.3086° N, 109.2731° W; 25 Apr. 2001; Robert L. Minckley leg.; RLM SBV209834 • 1 ♂; *ibid.*; 2 May 2001; Robert L. Minckley leg.; PCYU SBV011472 • 1 ♂; *ibid.*; 22 May 2001; Robert L. Minckley leg.; RLM SBV030151 • 1 ♀; *ibid.*; 19 Jul. 2001; Robert L. Minckley leg.; RLM SBV134259 • 1 ♂; *ibid.*; 6 May 2002; Robert L. Minckley leg.; RLM SBV068366 • 1 ♂; Rancho San Bernardino; 31.3097° N, 109.2542° W; 19 Aug. 2003; A. Nelson leg.; RLM SBV034617 • 3 ♂♂; Rancho San Bernardino; 31.3097° N, 109.2778° W; 19 Aug. 2003; A. Nelson leg.; RLM SBV034551, SBV034572, SBV034573 • 1 ♀; *ibid.*; 8 Aug. 2004; Robert L. Minckley leg.; ex *Lepidium thurberi*; RLM SBV026385 • 1 ♀; *ibid.*; 10 Aug. 2004; Robert L. Minckley leg.; ex *Chenopodium neomexicanum*; RLM SBV026469 • 1 ♀; Rancho San Bernardino; 31.3099° N, 109.2778° W; 2 May 2001; Robert L. Minckley leg.; RLM SBV011344 • 2 ♂♂; *ibid.*; 11 May 2001; A. Romero leg.; RLM SBV029242, SBV029256 • 1 ♂; *ibid.*; 11 Sep. 2001; Robert L. Minckley leg.; RLM SBV018150 • 1 ♂; *ibid.*; 19 May 2004; Robert L. Minckley leg.; RLM SBV024523 • 1 ♂; *ibid.*; 25 Jul. 2007; Robert L. Minckley leg.; RLM SBV075348 • 1 ♀; Rancho San Bernardino; 31.3101° N, 109.2535° W; 11 May 2001; A. Romero leg.; RLM SBV029274 • 1 ♂; *ibid.*; 11 May 2001; A. Romero leg.; RLM SBV029268 • 1 ♀; *ibid.*; 20 Jun. 2001; Robert L. Minckley leg.; RLM SBV016859 • 1 ♂; *ibid.*; 19 Jul. 2001; Robert L. Minckley leg.; RLM SBV134195 • 2 ♀♀; *ibid.*; 1 Aug. 2004; Robert L. Minckley leg.; RLM SBV026094, SBV026097 • 2 ♀♀; Rancho San Bernardino; 31.3112° N, 109.2662° W; 2 May 2001; Robert L. Minckley leg.; RLM SBV011309, SBV011316 • 1 ♂; *ibid.*; 8 Jul. 2001; Robert L. Minckley leg.; RLM SBV133170 • 1 ♂; *ibid.*; 6 May 2002; Robert L. Minckley leg.; RLM SBV068158 • 1 ♀; Rancho San Bernardino; 31.3136° N, 109.2547° W; 18 Apr. 2001; Robert L. Minckley leg.; RLM SBV208414 • 1 ♀; *ibid.*; 6 May 2001; Robert L. Minckley leg.; RLM SBV012240 • 1 ♂; *ibid.*; 12 May 2001; Robert L. Minckley leg.; RLM SBV029363 • 4 ♂♂; *ibid.*; 7 Aug. 2001; Robert L. Minckley leg.; RLM SBV135710, SBV135711, SBV135712, SBV135744 • 1 ♀; *ibid.*; 31 Jul. 2004; Robert L. Minckley leg.; RLM SBV026070 • 1 ♂; Rancho San Bernardino; 31.3139° N, 109.2503° W; 3 Jun. 2002; Robert L. Minckley leg.; RLM SBV016829 • 2 ♂♂; *ibid.*; 25 Aug. 2003; N. de la Torre leg.; RLM SBV035522, SBV035523 • 1 ♂; Rancho San Bernardino; 31.314° N, 109.2553° W; 6 Jun. 2004; A. Romero leg.; ex *Tamarix ramosissima*; RLM SBV025428 • 1 ♂; *ibid.*; 10 Jun. 2004; A. Romero leg.; ex *Tamarix ramosissima*; RLM SBV025742 • 1 ♀; *ibid.*; 10 Jun. 2004; N. de la Torre leg.; RLM SBV025709 • 2 ♂♂; *ibid.*; 10 Jun. 2004; N. de la Torre leg.; RLM SBV025696, SBV025697 • 1 ♀; Rancho San Bernardino; 31.315° N, 109.2729° W; 2 Jul. 2001; Robert L. Minckley leg.; RLM SBV017752 • 1 ♀; *ibid.*; 19 Jul. 2001; Robert L. Minckley leg.; RLM SBV134222 • 5 ♀♀; Rancho San Bernardino; 31.3159° N, 109.2686° W; 9 May 2006; Robert L. Minckley leg.; RLM SBV059140, SBV059142, SBV059148, SBV059152, SBV059153 • 1 ♀; Rancho San Bernardino; 31.316° N, 109.2426° W; 20 Apr. 2001; Robert L. Minckley leg.; RLM SBV208990 • 2 ♀♀; *ibid.*; 28 Apr. 2001; Robert L. Minckley leg.; RLM SBV210324, SBV210325 • 1 ♀; Rancho San Bernardino; 31.3162° N, 109.1872° W; 11 May 2005; Robert L. Minckley leg.; ex *Calycoseris wrightii*; RLM SBV049278 • 3 ♀♀; *ibid.*; 24 May 2005; Q. McFrederick leg.; RLM SBV050681, SBV050683, SBV050692 • 1 ♀; Rancho San Bernardino; 31.3166° N, 109.2784° W; 1 Apr. 2002; A. Romero leg.; RLM SBV014957 • 2 ♂♂; Rancho San Bernardino; 31.3169° N, 109.2592° W; 6 Jun. 2004; N. de la Torre leg.; ex *Tamarix ramosissima*;

RLM SBV025514, SBV025552 • 1 ♂; *ibid.*; 10 Jun. 2004; N. de la Torre leg.; ex *Tamarix ramosissima*; RLM SBV025786 • 1 ♀; Rancho San Bernardino; 31.3179° N, 109.2602° W; 10 Jun. 2004; Robert L. Minckley leg.; RLM SBV025669 • 1 ♂; *ibid.*; 10 Jun. 2004; Robert L. Minckley leg.; RLM SBV025656 • 1 ♂; Rancho San Bernardino; 31.318° N, 109.2603° W; 29 May 2004; N. de la Torre leg.; RLM SBV025090 • 1 ♀; Rancho San Bernardino; 31.3183° N, 109.2514° W; 31 Jul. 2004; Robert L. Minckley leg.; RLM SBV026036 • 1 ♀; Rancho San Bernardino; 31.3189° N, 109.2511° W; 21 May 2001; A. Romero leg.; RLM SBV012662 • 1 ♂; *ibid.*; 10 Aug. 2001; A. Romero leg.; RLM SBV016885 • 1 ♂; *ibid.*; 10 Aug. 2001; Robert L. Minckley leg.; RLM SBV135906 • 1 ♀; Rancho San Bernardino; 31.3194° N, 109.2714° W; 2 Sep. 2003; A. Romero leg.; PCYU SBV036580 • 1 ♀; Rancho San Bernardino; 31.3194° N, 109.2797° W; 11 May 2001; Robert L. Minckley leg.; RLM SBV013083 • 1 ♂; *ibid.*; 20 Jun. 2001; Robert L. Minckley leg.; RLM SBV030925 • 1 ♂; *ibid.*; 19 Jul. 2001; Robert L. Minckley leg.; RLM SBV134250 • 1 ♀; *ibid.*; 1 Apr. 2002; A. Romero leg.; RLM SBV015268 • 2 ♀♀; Rancho San Bernardino; 31.3194° N, 109.2842° W; 27 Apr. 2005; Robert L. Minckley leg.; ex *Eriastrum diffusum*; RLM SBV048511, SBV048614 • 1 ♂; *ibid.*; 7 May 2005; Robert L. Minckley leg.; ex *Cryptantha* sp.?.; RLM SBV049099 • 1 ♂; *ibid.*; 7 May 2005; Robert L. Minckley leg.; ex *Eriogonum abertianum*; RLM SBV049201 • 1 ♀; *ibid.*; 7 May 2005; Robert L. Minckley leg.; ex *Prosopis velutina*; RLM SBV049142 • 2 ♀♀; *ibid.*; 19 May 2005; Robert L. Minckley leg.; ex *Cryptantha* sp.?.; RLM SBV049789, SBV049794 • 12 ♂♂; *ibid.*; 19 May 2005; Robert L. Minckley leg.; ex *Cryptantha* sp.?.; RLM SBV049786, SBV049791, SBV049792, SBV049795, SBV049796, SBV049798, SBV049799, SBV049801, SBV050054, SBV050057, SBV050059, SBV050061 • 3 ♂♂; *ibid.*; 19 May 2005; Robert L. Minckley leg.; ex *Eriogonum abertianum*; RLM SBV049893, SBV049944, SBV049949 • 1 ♂; *ibid.*; 19 May 2005; Robert L. Minckley leg.; ex *Lepidium thurberi*; RLM SBV049925 • 2 ♂♂; *ibid.*; 19 May 2005; Robert L. Minckley leg.; ex *Prosopis velutina*; RLM SBV050009, SBV050020 • 1 ♂; *ibid.*; 19 May 2005; Robert L. Minckley leg.; RLM SBV049787 • 2 ♂♂; Rancho San Bernardino; 31.3195° N, 109.2703° W; 8 May 2001; Robert L. Minckley leg.; ex *Cryptantha* sp.?.; RLM SBV019636, SBV019637 • 1 ♂; Rancho San Bernardino; 31.3196° N, 109.2693° W; 18 Aug. 2003; A. Nelson leg.; RLM SBV035627 • 4 ♂♂; Rancho San Bernardino; 31.3196° N, 109.2703° W; 27 May 2004; B. O'Fallon leg.; RLM SBV025326, SBV025361, SBV025396, SBV025405 • 1 ♂; Rancho San Bernardino; 31.3197° N, 109.1933° W; 16 May 2005; Robert L. Minckley leg.; ex *Malacothrix fendleri*; RLM SBV050065 • 1 ♂; *ibid.*; 30 May 2005; Robert L. Minckley leg.; ex *Prosopis velutina*; RLM SBV052997 • 1 ♀; Rancho San Bernardino; 31.3208° N, 109.276° W; 16 Jul. 2005; N.M. Williams leg.; ex *Salsola tragus*; RLM SBV050983 • 1 ♀; Rancho San Bernardino; 31.3211° N, 109.2114° W; 20 Apr. 2001; Robert L. Minckley leg.; RLM SBV208984 • 2 ♀♀; Rancho San Bernardino; 31.3222° N, 109.2769° W; 25 Apr. 2001; Robert L. Minckley leg.; RLM SBV209863, SBV209866 • 1 ♂; *ibid.*; 2 Sep. 2001; Robert L. Minckley leg.; RLM SBV138810 • 2 ♀♀; Rancho San Bernardino; 31.3222° N, 109.2772° W; 21 May 2001; A. Romero leg.; RLM SBV012750, SBV012803 • 1 ♀; *ibid.*; 22 Aug. 2001; Robert L. Minckley leg.; RLM SBV137203 • 1 ♂; Rancho San Bernardino; 31.3222° N, 109.2778° W; 6 Aug. 2006; Robert L. Minckley leg.; ex *Laennecia coulteri*; RLM SBV062228 • 1 ♂; *ibid.*; 15 Aug. 2006; Robert L. Minckley leg.; ex *Laennecia coulteri*; RLM SBV062409 • 1 ♂; Rancho San Bernardino; 31.3222° N, 109.2931° W; 2 May 2001; Robert L. Minckley leg.; RLM SBV139104 • 1 ♂; *ibid.*; 19 Aug. 2003; A. Romero leg.; RLM SBV034101 • 1 ♀; *ibid.*; 21 Apr. 2005; A. Romero leg.; RLM SBV047945 • 1 ♀; Rancho San Bernardino; 31.3239° N, 109.2686° W; 1 Aug. 2005; Robert L. Minckley leg.; ex *Salsola tragus*; RLM SBV053278 • 1 ♂; Rancho San Bernardino; 31.3241° N, 109.2664° W; 20 Oct. 2004; Robert L. Minckley leg.; RLM SBV026763 • 1 ♂; *ibid.*; 28 Jul. 2006; A.A. Rahi leg.; ex *Physalis acutifolia*; RLM SBV059761 • 1 ♀; Rancho San Bernardino; 31.3242° N, 109.2666° W; 30 Apr. 2001; Robert L. Minckley leg.; RLM SBV011029 • 1 ♂; *ibid.*; 22 Aug. 2001; Robert L. Minckley leg.; RLM SBV137184 • 1 ♂; *ibid.*; 31 Aug. 2001; Robert L. Minckley leg.; RLM SBV138340 • 1 ♂; *ibid.*; 8 Sep. 2001; Robert L. Minckley leg.; RLM SBV139554 • 1 ♂; *ibid.*; 24 Jul. 2005; N.M. Williams leg.; ex *Physalis acutifolia*; RLM SBV052135 • 1 ♀; Rancho San Bernardino; 31.325° N, 109.265° W; 26 May 2005; Robert L. Minckley leg.; ex *Parkinsonia aculeata*; RLM SBV050940 • 2 ♀♀; Rancho San Bernardino; 31.3253° N, 109.223° W; 5 May 2001; Robert



L. Minckley leg.; RLM SBV011997, SBV012026 • 1 ♀; Rancho San Bernardino; 31.3273° N, 109.2636° W; 31 Mar. 2002; A. Romero leg.; RLM SBV014747 • 2 ♀♀; Rancho San Bernardino; 31.3286° N, 109.2684° W; 11 May 2006; Robert L. Minckley leg.; RLM SBV059414, SBV059430 • 2 ♀♀; Rancho San Bernardino; 31.3291° N, 109.2655° W; 10 Jul. 2000; K. Toal *et al.* leg.; RLM SBV002284, SBV002295 • 1 ♀; Rancho San Bernardino; 31.3295° N, 109.2636° W; 1 Sep. 2001; Robert L. Minckley leg.; RLM SBV138387 • 2 ♀♀; *ibid.*; 31 Mar. 2002; Robert L. Minckley leg.; RLM SBV014467, SBV014526 • 1 ♀; Rancho San Bernardino; 31.3296° N, 109.2546° W; 27 Apr. 2001; Robert L. Minckley leg.; RLM SBV210203 • 1 ♂; *ibid.*; 27 Apr. 2001; Robert L. Minckley leg.; RLM SBV210199 • 4 ♀♀; *ibid.*; 5 May 2001; Robert L. Minckley leg.; RLM SBV012139, SBV012186, SBV012191, SBV012418 • 3 ♂♂; *ibid.*; 7 Aug. 2001; Robert L. Minckley leg.; RLM SBV135749, SBV135750, SBV135751 • 3 ♂♂; Rancho San Bernardino; 31.3297° N, 109.2558° W; 20 Aug. 2003; N. de la Torre leg.; RLM SBV035452, SBV035473, SBV035474 • 2 ♀♀; Rancho San Bernardino; 31.3297° N, 109.2559° W; 3 Apr. 2002; A. Romero leg.; RLM SBV016137, SBV016146 • 1 ♀; Rancho San Bernardino; 31.3301° N, 109.2666° W; 6 May 2001; Robert L. Minckley leg.; RLM SBV029324 • 1 ♀; *ibid.*; 14 May 2001; Robert L. Minckley leg.; RLM SBV029746 • 1 ♂; Rancho San Bernardino; 31.3302° N, 109.2601° W; 30 Apr. 2001; Robert L. Minckley leg.; RLM SBV011008 • 3 ♂♂; *ibid.*; 10 Aug. 2001; Robert L. Minckley leg.; RLM SBV135928, SBV135930, SBV135932 • 2 ♂♂; *ibid.*; 22 Aug. 2001; Robert L. Minckley leg.; RLM SBV137268, SBV137288 • 1 ♀; Rancho San Bernardino; 31.3306° N, 109.21° W; 5 Aug. 2004; Robert L. Minckley leg.; ex *Salsola tragus*; RLM SBV037203 • 1 ♀; *ibid.*; 11 Aug. 2004; Robert L. Minckley leg.; ex *Zinnia acerosa*; RLM SBV026701 • 1 ♀; Rancho San Bernardino; 31.331° N, 109.2676° W; 1 Apr. 2006; Robert L. Minckley *et al.* leg.; RLM SBV056383 • 1 ♀; Rancho San Bernardino; 31.3311° N, 109.2661° W; 28 Apr. 2001; Robert L. Minckley leg.; RLM SBV139036 • 1 ♂; Rancho San Bernardino; 31.3312° N, 109.2663° W; 21 May 2001; A. Romero leg.; RLM SBV029896 • 1 ♀; Rancho San Bernardino; 31.3317° N, 109.2582° W; 13 May 2001; A. Romero leg.; RLM SBV029663 • 1 ♂; Rancho San Bernardino; 31.3321° N, 109.2702° W; 1 Sep. 2001; Robert L. Minckley leg.; RLM SBV138537 • 1 ♂; *ibid.*; 10 Sep. 2001; Robert L. Minckley leg.; RLM SBV140236 • 5 ♀♀; *ibid.*; 31 Mar. 2002; Robert L. Minckley leg.; RLM SBV014562, SBV014574, SBV014584, SBV014627, SBV014645 • 1 ♂; *ibid.*; 12 Oct. 2002; A. Romero leg.; RLM SBV045036 • 1 ♂; *ibid.*; 5 Jul. 2005; Robert L. Minckley leg.; RLM SBV132892 • 2 ♀♀; Rancho San Bernardino; 31.333° N, 109.2404° W; 5 May 2001; Robert L. Minckley leg.; PCYU SBV019684, SBV019705 • 1 ♀; *ibid.*; 20 Aug. 2001; Robert L. Minckley leg.; RLM SBV136885 • 1 ♀; Rancho San Bernardino; 31.333° N, 109.265° W; 6 May 2001; Robert L. Minckley leg.; RLM SBV012473 • 2 ♀♀; *ibid.*; 1 Aug. 2004; Robert L. Minckley leg.; RLM SBV026112, SBV026114 • 1 ♀; *ibid.*; 21 Jul. 2005; N.M. Williams leg.; RLM SBV051759 • 1 ♀; Rancho San Bernardino; 31.3333° N, 109.2403° W; 14 Apr. 2005; Robert L. Minckley leg.; ex *Physaria gordonii*; RLM SBV046922 • 1 ♀; *ibid.*; 3 May 2005; Robert L. Minckley leg.; ex *Phacelia crenulata*; RLM SBV048951 • 1 ♂; *ibid.*; 22 May 2005; Robert L. Minckley leg.; ex *Cryptantha* sp?; RLM SBV050175 • 1 ♂; Rancho San Bernardino; 31.3333° N, 109.2597° W; 20 Aug. 2003; Robert L. Minckley leg.; ex *Baccharis sarothroides*; RLM SBV034744 • 3 ♀♀; *ibid.*; 7 Apr. 2006; Robert L. Minckley *et al.* leg.; RLM SBV057021, SBV057037, SBV057053 • 1 ♀; *ibid.*; 13 May 2006; Robert L. Minckley leg.; RLM SBV059628 • 1 ♀; Rancho San Bernardino; 31.3335° N, 109.2601° W; 19 Apr. 2001; Robert L. Minckley leg.; RLM SBV208319 • 1 ♂; *ibid.*; 20 May 2004; Robert L. Minckley leg.; RLM SBV024660 • 1 ♀; Rio San Bernardino and Highway 2, 28 km east of Agua Prieta; 31.322° N, 109.266° W; 7 May 2001; Robert L. Minckley leg.; RLM SBV008588 • 1 ♀; Tónichi; [28.6° N, 109.57° W]; 23 Apr. 1990; R.J. McGinley leg.; USNM.

UNITED STATES – **Arizona** • 1 ♀; Cochise Co., ~25 mi. S of Willcox, Highway 191; 31.9064° N, 109.8118° W; elev. 1342 m; 15 Aug. 2007; Jason J. Gibbs, C. Sheffield leg.; PCYU PYU-6814 • 1 ♀; Cochise Co., 1 mi. E of Apache; [31.69° N, 109.11° W]; 17 Aug. 1995; Jerome G. Rozen, S.A. Budick leg.; AMNH • 1 ♀; Cochise Co., 1 mi. E of Douglas; [31.347° N, 109.507° W]; 20 Aug. 2010; H. Campbell leg.; AMNH • 1 ♀; *ibid.*; 24 Aug. 2011; WRME • 1 ♀; Cochise Co., 10 mi. E of Douglas; [31.35° N,

109.35° W]; 22 Aug. 1994; Jerome G. Rozen, John S. Ascher leg.; AMNH • 1 ♀; Cochise Co., 10 mi. N of Portal Foothills Road; [32.04° N, 109.18° W]; 30 Aug. 2010; H. Campbell leg.; AMNH • 1 ♀; Cochise Co., 13 mi. S of Apache; [31.55° N, 109.27° W]; 20 Aug. 2010; H. Campbell leg.; AMNH • 1 ♀; Cochise Co., 13 mi. SW of Apache; [31.55° N, 109.27° W]; 24 Aug. 2011; WRME • 1 ♀; Cochise Co., 2 mi. E of Apache; [31.69° N, 109.1° W]; 19 Aug. 1998; Jerome G. Rozen, K. Franklin leg.; AMNH • 1 ♀; Cochise Co., 2 mi. NE of Portal; [31.93° N, 109.12° W]; 30 Aug. 1994; Gretchen LeBuhn leg.; AMNH • 1 ♂; Cochise Co., 2 mi. W of Fort Huachuca; [31.55° N, 110.38° W]; 28 Jun. 1983; W.J. Pulawski leg.; CAS • 1 ♀; Cochise Co., 23 mi. SW of Apache at Silver Creek Road; 31.475° N, 109.395° W; 6 Sep. 2012; Jason J. Gibbs leg.; CUIC • 1 ♀; Cochise Co., 27 mi. E of Douglas; [31.35° N, 109.06° W]; 26 Aug. 1995; Jerome G. Rozen, S.A. Budick leg.; AMNH • 1 ♀; Cochise Co., 3.45 mi. S by E of Willcox; 32.2262° N, 109.7822° W; elev. 1273 m; 1 Sep. 2009; Terry L. Griswold leg.; BBSL985430 • 1 ♀; Cochise Co., 30 miles SE of Willcox; [31.94° N, 109.47° W]; 25 Jul. 1970; W.F. Chamberlain leg.; TAMU-ENTO X1495276 • 1 ♀; Cochise Co., 37 km E of Douglas; 31.3713° N, 109.1484° W; 28 Mar. 2009; W. Radke leg.; RLM SBV084592 • 1 ♀; Cochise Co., 4 mi. E of Willcox; [32.25° N, 109.76° W]; 14 Aug. 1994; Jerome G. Rozen leg.; AMNH • 1 ♀; *ibid.*; 27 Aug. 2007; John S. Ascher, C. Dong leg.; AMNH • 1 ♀; *ibid.*; 27 Aug. 2007; PCYU • 1 ♂; *ibid.*; 24 Aug. 2010; H. Campbell leg.; AMNH • 2 ♀♀; Cochise Co., 4–5 mi. NE of Douglas; [31.39° N, 109.49° W]; 26 Aug. 1995; Jerome G. Rozen, S.A. Budick leg.; AMNH • 10 ♀♀, 1 ♂; Cochise Co., 6 mi. NE of Douglas; [31.41° N, 109.47° W]; 6 Sep. 2011; Jerome G. Rozen, Eli S. Wyman leg.; AMNH • 1 ♀; Cochise Co., 7 mile marker Portal Road; [31.9° N, 109.1° W]; 28 Aug. 2004; PCYU • 1 ♀; Cochise Co., Chiricahua Monument/Pinery Canyon Road fork; [32.01° N, 109.39° W]; 3 Sep. 2009; N. Erwin leg.; AMNH • 1 ♂; Cochise Co., Chiricahua Mountains, Desert Scrub Site; [31.9° N, 109.3° W]; J.L. Neff, A.R. Moldenke leg.; CAS • 1 ♀, 4 ♂♂; Cochise Co., Community Road, 9 mi. NE of Portal; [32.01° N, 109.09° W]; 7 Sep. 2011; Jerome G. Rozen, Eli S. Wyman leg.; AMNH • 1 ♀; Cochise Co., Flys Peak Trail; [31.874° N, 109.286° W]; 2 Jun. 1999; Laurence Packer leg.; PCYU • 1 ♀; Cochise Co., near Willcox, Blue Sky Road; 32.232° N, 109.7781° W; elev. 1279 m; 14 Aug. 2007; Jason J. Gibbs, C. Sheffield leg.; PCYU • 1 ♀, 1 ♂; Cochise Co., Portal; [31.91° N, 109.14° W]; 27 May 1983; W.J. Pulawski leg.; CAS • 2 ♀♀; *ibid.*; 28 May 1983; W.J. Pulawski leg.; CAS • 1 ♂; Cochise Co., San Bernardino National Wildlife Refuge; [31.34° N, 109.26° W]; 24 Aug. 2001; Robert L. Minckley leg.; RLM SBV137438 • 1 ♀; *ibid.*; 27 Aug. 2001; Robert L. Minckley leg.; RLM SBV137723 • 1 ♂; Cochise Co., San Bernardino National Wildlife Refuge; 31.334° N, 109.2372° W; 23 May 2001; Robert L. Minckley leg.; RLM SBV030550 • 1 ♂; *ibid.*; 5 Aug. 2003; A. Romero leg.; RLM SBV032144 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3342° N, 109.2332° W; 5 May 2001; Robert L. Minckley leg.; RLM SBV011905 • 1 ♂; *ibid.*; 12 May 2001; A. Romero leg.; RLM SBV029391 • 4 ♀♀; *ibid.*; 18 Jul. 2005; T. Pasqual leg.; RLM SBV051064, SBV051076, SBV051077, SBV051088 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3342° N, 109.2367° W; 24 Apr. 2001; Robert L. Minckley leg.; RLM SBV209689 • 1 ♀; *ibid.*; 5 May 2001; Robert L. Minckley leg.; RLM SBV012278 • 1 ♀; *ibid.*; 12 May 2001; Robert L. Minckley leg.; RLM SBV013102 • 1 ♂; *ibid.*; 10 Jul. 2001; Robert L. Minckley leg.; RLM SBV133129 • 1 ♀; *ibid.*; 18 Jul. 2005; T. Pasqual leg.; RLM SBV051210 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3342° N, 109.2678° W; 1 May 2001; Robert L. Minckley leg.; RLM SBV011088 • 1 ♀; *ibid.*; 24 Aug. 2001; Robert L. Minckley leg.; RLM SBV137469 • 1 ♂; *ibid.*; 24 Aug. 2001; Robert L. Minckley leg.; RLM SBV137464 • 2 ♂♂; *ibid.*; 1 Sep. 2001; Robert L. Minckley leg.; RLM SBV138693, SBV138694 • 4 ♂♂; *ibid.*; 10 Sep. 2001; Robert L. Minckley leg.; RLM SBV140255, SBV140287, SBV140297, SBV140298 • 1 ♂; *ibid.*; 21 Sep. 2001; Robert L. Minckley leg.; RLM SBV019052 • 6 ♀♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3344° N, 109.2681° W; 1 May 2001; Robert L. Minckley leg.; RLM SBV011246, SBV011249, SBV011253, SBV011268, SBV011272, SBV011278 • 1 ♀; *ibid.*; 10 May 2001; A. Romero leg.; RLM SBV028542 • 1 ♀; *ibid.*; 22 May 2001; Robert L. Minckley leg.; RLM SBV042187 • 1 ♂; *ibid.*; 22 May 2001; Robert L. Minckley leg.; RLM SBV042190 • 1 ♂; *ibid.*; 3 Aug. 2001; Robert L. Minckley leg.; RLM SBV134968 • 1 ♂; *ibid.*; 13 Aug. 2001; Robert L. Minckley leg.; RLM SBV136627 • 1 ♀; *ibid.*; 1 Sep. 2001; Robert L. Minckley leg.; RLM SBV138751 • 1 ♂; *ibid.*;

1 Sep. 2001; Robert L. Minckley leg.; RLM SBV138771 • 2 ♂♂; *ibid.*; 10 Sep. 2001; Robert L. Minckley leg.; RLM SBV140009, SBV140016 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3345° N, 109.2524° W; 21 Aug. 2001; Robert L. Minckley leg.; RLM SBV137163 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3349° N, 109.2529° W; 22 Jun. 2001; Robert L. Minckley leg.; RLM SBV031450 • 4 ♂♂; *ibid.*; 7 Aug. 2001; Robert L. Minckley leg.; RLM SBV135650, SBV135682, SBV135688, SBV135692 • 1 ♂; *ibid.*; 21 Aug. 2001; Robert L. Minckley leg.; RLM SBV137040 • 4 ♂♂; *ibid.*; 29 Aug. 2001; Robert L. Minckley leg.; RLM SBV138068, SBV138071, SBV138078, SBV138083 • 1 ♂; *ibid.*; 25 Sep. 2001; Robert L. Minckley leg.; RLM SBV019433 • 6 ♀♀; *ibid.*; 3 Apr. 2002; A. Romero leg.; RLM SBV016297, SBV016304, SBV016320, SBV016337, SBV016396, SBV016398 • 3 ♀♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.335° N, 109.2539° W; 14 May 2004; Robert L. Minckley leg.; RLM SBV022974, SBV023006, SBV023008 • 3 ♀♀; *ibid.*; 31 Jul. 2004; Robert L. Minckley leg.; RLM SBV026041, SBV026050, SBV026052 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3351° N, 109.279° W; 24 Jul. 2004; R.G. Hatfield leg.; ex *Leucophyllum frutescens*; RLM SBV055184 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3353° N, 109.2514° W; 13 Apr. 2001; Robert L. Minckley leg.; RLM SBV208488 • 1 ♀; *ibid.*; 21 May 2001; Robert L. Minckley leg.; RLM SBV012957 • 1 ♂; *ibid.*; 21 May 2001; Robert L. Minckley leg.; RLM SBV012985 • 2 ♂♂; *ibid.*; 22 Aug. 2001; Robert L. Minckley leg.; RLM SBV137207, SBV137228 • 1 ♂; *ibid.*; 31 Aug. 2001; Robert L. Minckley leg.; RLM SBV138310 • 2 ♀♀; *ibid.*; 8 Sep. 2001; Robert L. Minckley leg.; RLM SBV139965, SBV139968 • 1 ♂; *ibid.*; 8 Sep. 2001; Robert L. Minckley leg.; RLM SBV139761 • 3 ♀♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3353° N, 109.2517° W; 19 Jul. 2005; A. Romero leg.; RLM SBV051568, SBV051569, SBV051571 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3353° N, 109.2668° W; 14 May 2001; A. Romero leg.; RLM SBV029725 • 1 ♂; *ibid.*; 10 Aug. 2001; Robert L. Minckley leg.; RLM SBV135785 • 1 ♂; *ibid.*; 22 Aug. 2001; Robert L. Minckley leg.; RLM SBV137235 • 3 ♀♀; *ibid.*; 31 Jul. 2004; Robert L. Minckley leg.; RLM SBV026077, SBV026081, SBV026089 • 3 ♀♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3353° N, 109.2681° W; 13 May 2004; Robert L. Minckley leg.; RLM SBV022438, SBV022449, SBV022456 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3353° N, 109.27° W; 20 Apr. 2005; A. Romero leg.; RLM SBV047699 • 3 ♀♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3357° N, 109.2737° W; 6 Apr. 2006; Robert L. Minckley *et al.* leg.; RLM SBV056602, SBV056605, SBV056631 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3358° N, 109.2629° W; 20 Apr. 2005; Robert L. Minckley leg.; RLM SBV047896 • 2 ♂♂; *ibid.*; 20 Apr. 2005; Robert L. Minckley leg.; RLM SBV047860, SBV047878 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3358° N, 109.2702° W; 10 May 2001; A. Romero leg.; RLM SBV028531 • 1 ♂; *ibid.*; 22 May 2001; Robert L. Minckley leg.; RLM SBV030252 • 1 ♂; *ibid.*; 13 Aug. 2001; Robert L. Minckley leg.; RLM SBV136507 • 3 ♂♂; *ibid.*; 1 Sep. 2001; Robert L. Minckley leg.; RLM SBV138473, SBV138482, SBV138508 • 4 ♀♀; *ibid.*; 31 Mar. 2002; Robert L. Minckley leg.; RLM SBV013792, SBV013796, SBV013815, SBV013830 • 3 ♀♀; *ibid.*; 13 May 2004; Robert L. Minckley leg.; RLM SBV022135, SBV022150, SBV022187 • 1 ♂; Cochise Co., San Bernardino National Wildlife Refuge; 31.3363° N, 109.2675° W; 23 Apr. 2001; A. Romero leg.; PCYU SBV209390 • 1 ♀; *ibid.*; 1 May 2001; Robert L. Minckley leg.; RLM SBV011223 • 1 ♂; *ibid.*; 26 Jun. 2001; A. Romero leg.; RLM SBV017613 • 1 ♂; *ibid.*; 5 Jul. 2001; Robert L. Minckley leg.; RLM SBV132918 • 2 ♀♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3364° N, 109.2675° W; 23 Apr. 2001; A. Romero leg.; RLM SBV209394, SBV209400 • 1 ♂; Cochise Co., San Bernardino National Wildlife Refuge; 31.3369° N, 109.2436° W; 20 Aug. 2001; Robert L. Minckley leg.; RLM SBV136955 • 1 ♀; *ibid.*; 2 Apr. 2002; A. Romero leg.; RLM SBV015592 • 5 ♀♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3372° N, 109.2311° W; 3 May 2001; Robert L. Minckley leg.; RLM SBV011519, SBV011542, SBV011545, SBV011548, SBV011551 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3374° N, 109.231° W; 15 Apr. 2001; Robert L. Minckley leg.; RLM SBV006291 • 1 ♀; *ibid.*; 23 May 2001; Robert L. Minckley leg.; RLM SBV030369 • 1 ♀; *ibid.*; 24 Jul. 2001; Robert L. Minckley leg.; RLM SBV134599 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge;



31.3375° N, 109.2625° W; 13 May 2001; A. Romero leg.; RLM SBV029658 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3381° N, 109.2605° W; 30 Apr. 2001; Robert L. Minckley leg.; RLM SBV010982 • 3 ♂♂; *ibid.*; 10 Aug. 2001; Robert L. Minckley leg.; RLM SBV136366, SBV136368, SBV136379 • 1 ♂; *ibid.*; 19 Sep. 2001; Robert L. Minckley leg.; RLM SBV018739 • 1 ♀; *ibid.*; 30 Mar. 2002; Robert L. Minckley leg.; RLM SBV013559 • 1 ♀; *ibid.*; 16 May 2004; Robert L. Minckley leg.; RLM SBV023798 • 4 ♀♀; *ibid.*; 30 Jul. 2004; A. Romero leg.; RLM SBV055370, SBV055371, SBV055382, SBV055383 • 3 ♀♀; *ibid.*; 19 Jul. 2005; A. Langley leg.; RLM SBV051581, SBV051583, SBV051594 • 1 ♂; Cochise Co., San Bernardino National Wildlife Refuge; 31.3385° N, 109.2531° W; 29 Aug. 2001; Robert L. Minckley leg.; RLM SBV137988 • 1 ♀; *ibid.*; 14 May 2004; Robert L. Minckley leg.; RLM SBV022727 • 2 ♀♀; *ibid.*; 31 Jul. 2004; Robert L. Minckley leg.; RLM SBV026002, SBV026014 • 2 ♀♀; *ibid.*; 18 Jul. 2005; A. Romero leg.; RLM SBV051428, SBV051447 • 1 ♀; *ibid.*; 18 Jul. 2005; T. Pasqual leg.; RLM SBV051388 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3406° N, 109.2575° W; 6 May 2001; A. Romero leg.; RLM SBV028430 • 1 ♂; *ibid.*; 31 Aug. 2001; Robert L. Minckley leg.; RLM SBV138128 • 1 ♀; *ibid.*; 30 Mar. 2002; A. Romero leg.; RLM SBV013183 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3407° N, 109.253° W; 26 Apr. 2001; Robert L. Minckley leg.; RLM SBV209934 • 1 ♂; Cochise Co., San Bernardino National Wildlife Refuge; 31.3411° N, 109.2705° W; 4 May 2002; N. de la Torre leg.; RLM SBV066792 • 1 ♂; Cochise Co., San Bernardino National Wildlife Refuge; 31.3415° N, 109.2728° W; 22 Apr. 2002; Robert L. Minckley leg.; RLM SBV064909 • 1 ♂; *ibid.*; 15 Aug. 2002; Robert L. Minckley leg.; RLM SBV044453 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3417° N, 109.2528° W; 20 Apr. 2005; A. Romero leg.; RLM SBV047614 • 2 ♂♂; Cochise Co., San Bernardino National Wildlife Refuge; 31.3417° N, 109.2582° W; 31 Aug. 2001; Robert L. Minckley leg.; RLM SBV138148, SBV138159 • 1 ♂; *ibid.*; 8 Sep. 2001; Robert L. Minckley leg.; RLM SBV140144 • 2 ♀♀; *ibid.*; 30 Jul. 2004; A. Romero leg.; RLM SBV055324, SBV055340 • 1 ♀; *ibid.*; 19 Jul. 2005; A. Langley leg.; RLM SBV051491 • 2 ♀♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3425° N, 109.27° W; 23 Apr. 2001; Robert L. Minckley leg.; RLM SBV209375, SBV209376 • 1 ♂; Cochise Co., San Bernardino National Wildlife Refuge; 31.3425° N, 109.2745° W; 25 Apr. 2008; Robert L. Minckley leg.; RLM SBV082423 • 3 ♀♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3426° N, 109.2701° W; 1 May 2001; Robert L. Minckley leg.; RLM SBV011126, SBV011133, SBV011173 • 1 ♂; *ibid.*; 1 May 2001; Robert L. Minckley leg.; RLM SBV011181 • 1 ♂; *ibid.*; 22 May 2001; Robert L. Minckley leg.; RLM SBV042177 • 2 ♂♂; *ibid.*; 5 Jul. 2001; Robert L. Minckley leg.; RLM SBV132596, SBV132949 • 2 ♂♂; *ibid.*; 24 Aug. 2001; Robert L. Minckley leg.; RLM SBV137375, SBV137390 • 1 ♂; *ibid.*; 12 Oct. 2002; A. Romero leg.; RLM SBV044986 • 3 ♀♀; *ibid.*; 13 May 2004; Robert L. Minckley leg.; RLM SBV022250, SBV022262, SBV022332 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3427° N, 109.2746° W; 1 May 2001; Robert L. Minckley leg.; RLM SBV011057 • 4 ♂♂; *ibid.*; 1 Sep. 2001; Robert L. Minckley leg.; RLM SBV138410, SBV138411, SBV138412, SBV138460 • 1 ♀; *ibid.*; 13 May 2004; Robert L. Minckley leg.; RLM SBV022007 • 2 ♂♂; *ibid.*; 13 May 2004; Robert L. Minckley leg.; RLM SBV022002, SBV022009 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3428° N, 109.2747° W; 23 Apr. 2001; Robert L. Minckley leg.; RLM SBV209431 • 1 ♀; Cochise Co., Sunsites; [31.94° N, 109.83° W]; 23 May 1992; W.F. Chamberlain leg.; TAMU-ENTO X1495775 • 1 ♀; Cochise Co., Willcox; [32.25° N, 109.83° W]; 2005; Laurence Packer leg.; PCYU • 1 ♀; Graham Co., Roper Lake State Park 6 mi. S of Safford; [32.75° N, 109.7° W]; 26 May 1983; W.J. Pulawski leg.; CAS • 5 ♀♀; Maricopa Co., 1100 W Mission Drive, Chandler; 33.346° N, 111.8599° W; elev. 367 m; 27 Mar. 2017; S.J. Hall *et al.* leg.; ASUHC 0112713, 0112714, 0112717, 0113161, 0113165 • 1 ♀; Maricopa Co., 115 E Country Gables Drive, Phoenix; 33.6223° N, 112.0718° W; elev. 412 m; 12 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 113541 • 10 ♀♀; *ibid.*; 18 May 2017; S.J. Hall *et al.* leg.; ASUHC 0113089, 0113091, 0113092, 0113093, 0113094, 0113095, 0113100, 0113103, 0113106, 0113108 • 1 ♀; Maricopa Co., 1414 E Libra Drive, Tempe; 33.3656° N, 111.9163° W; elev. 365 m; 3 May 2017; S.J. Hall *et al.* leg.; ASUHC 112608 • 1 ♂; *ibid.*; 3 May 2017; S.J. Hall *et al.* leg.; ASUHC 112455 • 1 ♂; Maricopa Co., 15 km W of Maricopa; [33.06° N, 112.21° W]; 3 May 1994; Robert L. Minckley leg.; ex *Larrea tridentata*; SEMC

• 3 ♀♀; Maricopa Co., 1615 E Fremont Drive, Tempe; 33.3823° N, 111.9128° W; elev. 361 m; 4 May 2017; S.J. Hall *et al.* leg.; ASUHC 0114782, 0114786, 0114787 • 2 ♀♀; Maricopa Co., 1738 E Palmcroft Drive, Tempe; 33.4044° N, 111.9099° W; elev. 361 m; 16 May 2017; S.J. Hall *et al.* leg.; ASUHC 0113366, 0113377 • 2 ♂♂; *ibid.*; 16 May 2017; S.J. Hall *et al.* leg.; ASUHC 0113390, 0113392 • 1 ♀; Maricopa Co., 1863 E Geneva Drive, Tempe; 33.3945° N, 111.9058° W; elev. 362 m; 26 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 112673 • 1 ♂; *ibid.*; 26 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 112684 • 10 ♀♀; Maricopa Co., 1926 E Calle De Caballos, Tempe; 33.3401° N, 111.9069° W; elev. 362 m; 10 May 2017; S.J. Hall *et al.* leg.; ASUHC 0113142, 0113145, 0113146, 0113148, 0113150, 0113152, 0113153, 0113154, 0113156, 0113157 • 3 ♂♂; *ibid.*; 10 May 2017; S.J. Hall *et al.* leg.; ASUHC 0113187, 0113196, 0113197 • 1 ♀; Maricopa Co., 2031 S Sierra Vista Drive, Tempe; 33.406° N, 111.9308° W; elev. 357 m; 3 May 2017; S.J. Hall *et al.* leg.; ASUHC 112733 • 1 ♀; Maricopa Co., 2721 E Downing Circle, Mesa; 33.4287° N, 111.7723° W; elev. 390 m; 19 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 113170 • 1 ♀; *ibid.*; 11 May 2017; S.J. Hall *et al.* leg.; ASUHC 113625 • 2 ♀♀; *ibid.*; 22 May 2017; S.J. Hall *et al.* leg.; ASUHC 0113572, 0113574 • 12 ♀♀; Maricopa Co., 2814 N 11<sup>th</sup> Avenue, Phoenix; 33.4801° N, 112.0868° W; elev. 335 m; 4 May 2017; S.J. Hall *et al.* leg.; ASUHC 0113504, 0113506, 0113509, 0113514, 0113522, 0113525, 0113527, 0113530, 0113534, 0113535, 0113538, 0113539 • 3 ♂♂; *ibid.*; 4 May 2017; S.J. Hall *et al.* leg.; ASUHC 0113578, 0113588, 0113589 • 10 ♀♀; *ibid.*; 22 May 2017; S.J. Hall *et al.* leg.; ASUHC 0112824, 0112834, 0112837, 0112838, 0112841, 0112842, 0112843, 0112853, 0112854, 0112860 • 9 ♀♀; Maricopa Co., 302 E Fairmont Drive, Tempe; 33.3964° N, 111.9346° W; elev. 358 m; 30 Mar. 2017; S.J. Hall *et al.* leg.; ASUHC 0113443, 0113444, 0113445, 0113447, 0113451, 0113453, 0113454, 0113455, 0113457 • 14 ♀♀; *ibid.*; 27 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 0113461, 0113462, 0113463, 0113466, 0113468, 0113469, 0113470, 0113471, 0113480, 0113482, 0113483, 0113484, 0113485, 0113490 • 1 ♀; Maricopa Co., 3346 E Downing Street, Mesa; 33.4293° N, 111.7585° W; elev. 395 m; 3 May 2017; S.J. Hall *et al.* leg.; ASUHC 112592 • 1 ♀; Maricopa Co., 8201 E Windsor Avenue, Scottsdale; 33.4783° N, 111.9038° W; elev. 373 m; 19 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 113567 • 5 ♀♀; *ibid.*; 11 May 2017; S.J. Hall *et al.* leg.; ASUHC 0112599, 0113114, 0113116, 0113130, 0113140 • 4 ♀♀; Maricopa Co., 8433 E Palm Lane, Scottsdale; 33.4686° N, 111.899° W; elev. 369 m; 19 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 0113546, 0113548, 0113549, 0113551 • 5 ♀♀; *ibid.*; 16 May 2017; S.J. Hall *et al.* leg.; ASUHC 0112624, 0112635, 0112636, 0112647, 0112648 • 1 ♀; Maricopa Co., 862 E 9<sup>th</sup> Place, Mesa; 33.4321° N, 111.812° W; elev. 381 m; 11 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 112686 • 17 ♀♀; Maricopa Co., Estrella Mountain Regional Park; 33.3617° N, 112.3414° W; elev. 316 m; 29 Mar. 2017; S.J. Hall *et al.* leg.; ASUHC 0112967, 0112969, 0112970, 0112973, 0112975, 0112976, 0112980, 0112981, 0112982, 0112983, 0112988, 0113412, 0113414, 0113418, 0113419, 0113420, 0113421 • 2 ♂♂; *ibid.*; 29 Mar. 2017; S.J. Hall *et al.* leg.; ASUHC 0112567, 0112568 • 7 ♀♀; Maricopa Co., McDowell Mountain Regional Park; 33.6423° N, 111.7061° W; elev. 511 m; 4 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 0113422, 0113423, 0113424, 0113425, 0113428, 0113431, 0113432 • 1 ♂; *ibid.*; 4 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 113426 • 3 ♀♀; *ibid.*; 16 May 2017; S.J. Hall *et al.* leg.; ASUHC 0112918, 0113009, 0113437 • 1 ♂; *ibid.*; 16 May 2017; S.J. Hall *et al.* leg.; ASUHC 113435 • 11 ♀♀; Maricopa Co., McDowell Sonoran Preserve; 33.644° N, 111.8567° W; elev. 516 m; 12 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 0112456, 0113288, 0113289, 0113290, 0113291, 0113293, 0113295, 0113297, 0113298, 0113300, 0113302 • 3 ♀♀; *ibid.*; 16 May 2017; S.J. Hall *et al.* leg.; ASUHC 0113000, 0113002, 0113007 • 1 ♂; *ibid.*; 16 May 2017; S.J. Hall *et al.* leg.; ASUHC 113010 • 19 ♀♀; Maricopa Co., Mountain View Park; 33.5787° N, 112.0799° W; elev. 401 m; 7 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 0112875, 0112877, 0112880, 0112881, 0112882, 0112883, 0112887, 0112889, 0112890, 0112892, 0112893, 0112895, 0112896, 0112900, 0112901, 0112902, 0112903, 0112904, 0112906 • 4 ♂♂; *ibid.*; 7 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 0112879, 0113011, 0113012, 0113013 • 8 ♀♀; *ibid.*; 18 May 2017; S.J. Hall *et al.* leg.; ASUHC 0112922, 0112923, 0112924, 0112931, 0112942, 0112945, 0112950, 0112962 • 5 ♀♀; Maricopa Co., Papago Park; 33.4571° N, 111.9424° W; elev. 391 m; 30 Mar. 2017; S.J. Hall *et al.* leg.; ASUHC 0112466, 0112558, 0112561, 0113236, 0113241 • 4 ♂♂; *ibid.*; 30 Mar. 2017; S.J. Hall *et al.*

leg.; ASUHC 0112557, 0112559, 0113234, 0113235 • 44 ♀♀; *ibid.*; 3 May 2017; S.J. Hall *et al.* leg.; ASUHC 0112458, 0112462, 0112463, 0112464, 0112467, 0112474, 0112476, 0112477, 0112478, 0112481, 0112482, 0112486, 0112493, 0112495, 0112496, 0112498, 0112502, 0112505, 0112507, 0112508, 0112513, 0112519, 0112520, 0112522, 0112523, 0112525, 0112534, 0112535, 0112537, 0112538, 0112541, 0112544, 0112545, 0112547, 0112552, 0112553, 0112556, 0112565, 0113242, 0113244, 0113248, 0113250, 0113258, 0113259 • 2 ♂♂; *ibid.*; 3 May 2017; S.J. Hall *et al.* leg.; ASUHC 0112485, 0113254 • 2 ♀♀; Maricopa Co., Papago Park; 33.4571° N, 111.9425° W; elev. 391 m; 24 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 0112822, 0113327 • 2 ♀♀; *ibid.*; 8 Jun. 2017; S.J. Hall *et al.* leg.; ASUHC 0113200, 0113225 • 5 ♀♀; Maricopa Co., Phoenix Mountain Preserve; 33.5679° N, 112.0121° W; elev. 452 m; 5 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 0113307, 0113308, 0113309, 0113310, 0113311 • 1 ♂; *ibid.*; 5 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 112756 • 15 ♀♀; *ibid.*; 18 May 2017; S.J. Hall *et al.* leg.; ASUHC 0113015, 0113018, 0113020, 0113024, 0113027, 0113035, 0113044, 0113045, 0113049, 0113050, 0113051, 0113053, 0113067, 0113069, 0113082 • 1 ♀; Maricopa Co., South Mountain Park; 33.3516° N, 112.1023° W; elev. 394 m; 18 May 2017; S.J. Hall *et al.* leg.; ASUHC 112814 • 4 ♀♀; Maricopa Co., South Mountain Park; 33.3565° N, 111.9891° W; elev. 406 m; 22 Mar. 2017; S.J. Hall *et al.* leg.; ASUHC 0113266, 0113405, 0113406, 0113407 • 3 ♂♂; *ibid.*; 22 Mar. 2017; S.J. Hall *et al.* leg.; ASUHC 0112819, 0113265, 0113267 • 14 ♀♀; *ibid.*; 12 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 0112758, 0112759, 0112760, 0112764, 0112767, 0112768, 0112769, 0112770, 0112771, 0113269, 0113270, 0113400, 0113403, 0113411 • 7 ♀♀; *ibid.*; 10 May 2017; S.J. Hall *et al.* leg.; ASUHC 0112774, 0112777, 0112781, 0112789, 0112797, 0112801, 0112802 • 1 ♂; *ibid.*; 10 May 2017; S.J. Hall *et al.* leg.; ASUHC 112809 • 1 ♀; Maricopa Co., Usery Mountain Regional Park; 33.4696° N, 111.6171° W; elev. 588 m; 20 Mar. 2017; S.J. Hall *et al.* leg.; ASUHC 112707 • 1 ♀; Maricopa Co., White Tanks Mountain Regional Park; 33.6049° N, 112.4964° W; elev. 448 m; 22 Mar. 2017; S.J. Hall *et al.* leg.; ASUHC 113276 • 2 ♀♀; *ibid.*; 8 Jun. 2017; S.J. Hall *et al.* leg.; ASUHC 0113317, 0113318 • 3 ♀♀; Mohave Co., 10 mi. S of Lake Havasu City; [34.38° N, 114.2° W]; 14 Mar. 1972; P.F. Torchio, B. Apperson leg.; ex *Phacelia*; BBSL700790, BBSL700791, BBSL700793 • 2 ♀♀; Mohave Co., 15 mi. E of Oatman; [35.03° N, 114.12° W]; 18 Oct. 1973; F.D. Parker, P.F. Torchio leg.; BBSL700785, BBSL700786 • 1 ♀; Pima Co., 2 km NE of Oracle; 32.626° N, 110.7362° W; elev. 1240 m; 20–24 May 2013; M.E. Irwin leg.; BBSL FDP152748 • 1 ♂; Pima Co., 7 km E of Robles Junction; 32.0667° N, 111.25° W; elev. 790 m; 22 Apr. 1995; Robert L. Minckley, R. Gyuro leg.; ex *Prosopis velutina*; SEMC • 1 ♂; Pima Co., 7 km E of Silverbell; 32.3667° N, 111.4333° W; elev. 732 m; 10 Apr. 1994; Robert L. Minckley leg.; ex *Sphaeralcea* sp.; SEMC • 1 ♀; Pima Co., Gardner Canyon Site; [31.74° N, 110.7° W]; J.L. Neff leg.; CAS • 1 ♀; Pima Co., Madera Canyon; [31.74° N, 110.89° W]; 21 Sep. 1982; W.J. Pulawski leg.; CAS • 4 ♀♀, 1 ♂; Pima Co., Mount Lemmon; [32.4° N, 110.8° W]; elev. 1067 m; J.L. Neff leg.; CAS • 2 ♀♀; Pima Co., Sandario Road 7 km N of Highway 86; 32.1833° N, 111.2167° W; elev. 740 m; 2 Apr. 1994; Robert L. Minckley, S. G. Reyes leg.; ex *Sphaeralcea*; SEMC • 1 ♂; Pima Co., Santa Catalina Mountains, Desert Scrub site; [32.4° N, 110.8° W]; J.L. Neff leg.; CAS • 40 ♀♀, 5 ♂♂; Pima Co., Silver Bell Bajada, Int. BioL. Program; [32.4° N, 111.5° W]; J.L. Neff leg.; CAS • 1 ♀; Pima Co., Tucson, Pima Canyon; 32.358° N, 110.933° W; 7 Mar. 2018; T.J. Wood leg.; WRME • 1 ♀; Pima Co., West of Quijotoa; [32.13° N, 112.2° W]; J.L. Neff leg.; CAS • 1 ♀; Santa Cruz Co., 2 miles W of Highway 82 on road to Patagonia Lake Recreation Area; [31.474° N, 110.846° W]; 23–24 Sep. 1982; W.J. Pulawski leg.; CAS • 2 ♀♀, 4 ♂♂; Santa Cruz Co., Patagonia; [31.54° N, 110.76° W]; 16 Jun. 1984; S.L. Buchmann leg.; ex *Sapindus saponaria* var. *drummondii*; SEMC • 1 ♀; Yavapai Co., Congress; [34.16° N, 112.85° W]; elev. 1524 m; 1 Apr. 2002; R.S. Beal leg.; ex *Sphaeralcea*; CSUC • 1 ♀, 1 ♂; Yavapai Co., Wet Beaver Creek Ranger Station; [34.757° N, 111.764° W]; elev. 1219 m; 25 Apr. 2005; R.S. Beal leg.; CSUC • 1 ♂; 11 mi. NW of Fort Huachuca; [31.67° N, 110.48° W]; 10 Jul. 1952; R.H. Beamer, L.D. Beamer, W.E. LaBerge, Cheng Liang leg.; SEMC • 1 ♀; 2 miles west-southwest of Prescott; [34.51° N, 112.48° W]; elev. 1737 m; 13–14 May 2004; R.S. Beal leg.; ex *Heteromeles*; CSUC • 1 ♀; 20 miles west of Tucson; [32.22° N, 111.28° W]; 29 Apr. 1985; W.F. Chamberlain leg.; TAMU-ENTO X1313642 • 1 ♂; 23 mi. E of Kingman; [35.18° N, 113.65° W]; 1 Jul. 1952; Cheng Liang leg.; ex *Calochortus*; SEMC • 1 ♂;



ibid.; 1 Jul. 1952; R.H. Beamer, L.D. Beamer, Cheng Liang, W.E. LaBerge leg.; SEMC • 7 ♀♀; 3 mi. N of Rock Spring [exact location unknown]; 7 Jul. 1952; R.H. Beamer, L.D. Beamer, W.E. LaBerge, Cheng Liang leg.; ex *Eriogonum trichopes*; SEMC • 10 ♀♀; ibid.; 7 Jul. 1952; R.H. Beamer, L.D. Beamer, W.E. LaBerge, Cheng Liang leg.; SEMC • 1 ♀; 3 miles SW of Carrizo; [33.96° N, 110.33° W]; 24 May 1997; W.F. Chamberlain leg.; TAMU-ENTO X1404715 • 4 ♀♀, 4 ♂♂; 5 mi. E of Kingman; [35.19° N, 113.96° W]; 1 Jul. 1952; R.H. Beamer, L.D. Beamer, W.E. LaBerge, Cheng Liang leg.; ex *Eriogonum trichopes*; SEMC • 2 ♂♂; ibid.; 1 Jul. 1952; R.H. Beamer, L.D. Beamer, W.E. LaBerge, Cheng Liang leg.; SEMC • 1 ♀; 7 mi. W of Seligman; [35.32° N, 113° W]; 1 Jul. 1952; R.H. Beamer, L.D. Beamer, W.E. LaBerge, Cheng Liang leg.; SEMC • 6 ♀♀; Barfoot Park, Chiricahua; [31.92° N, 109.28° W]; 12 Jun. 2017; BBSL 24778, 30291, 30296, 30331, 30333, 30462 • 15 ♀♀; ibid.; 17 Jun. 2017; BBSL 30447, 30459, 30470, 30472, 30484, 30486, 30487, 30489, 30493, 30494, 30495, 30496, 30497, 30499, 30509 • 35 ♀♀; ibid.; 23 Jun. 2017; BBSL 21728, 21735, 21737, 21738, 21740, 21741, 21744, 21747, 21749, 21750, 21758, 21759, 21919, 30338, 30340, 30341, 30342, 30344, 30364, 30367, 30368, 30371, 30372, 30375, 30378, 30383, 30385, 30392, 30395, 30396, 30403, 30404, 30406, 30421, 30424 • 4 ♀♀; ibid.; 1 Jul. 2017; BBSL 24624, 24630, 24640, 24654 • 2 ♀♀; ibid.; 7 Jul. 2017; BBSL 30246, 30260 • 3 ♂♂; Huachuca Mountains; [31.4° N, 110.3° W]; 10 Jul. 1952; R.H. Beamer leg.; SEMC • 1 ♂; Oak Creek Canyon; [34.91° N, 111.73° W]; 9 Jul. 1941; R.H. Beamer leg.; SEMC • 4 ♀♀; Rustler Park, Chiricahua; [31.92° N, 109.28° W]; 17 Jun. 2017; BBSL 24042, 24055, 24060, 24061. – **California** • 1 ♀; Los Angeles Co., Chatsworth; 34.26° N, 118.601° W; 1–8 Jul. 2017; LACM • 1 ♀; Los Angeles Co., Claremont; 34.0894° N, 117.7111° W; 1–8 Jul. 2016; LACM • 1 ♀; Riverside Co., 18 mi. W of Blythe; [33.61° N, 114.9° W]; 1 May 1992; Jerome G. Rozen leg.; ex *Nama*; AMNH • 4 ♀♀; Riverside Co., Norco; 33.912° N, 117.5702° W; 1–8 Jun. 2016; LACM • 1 ♂; San Bernardino Co., 20 mi. S of Needles; [34.56° N, 114.61° W]; 3 May 1964; P.F. Torchio, G.E. Bohart leg.; BBSL700834 • 1 ♀; San Bernardino Co., Fort Piute, T12N R19E Sec. 18; [35.11° N, 114.97° W]; elev. 823 m; 29 May 1980; Terry L. Griswold leg.; BBSL FaunalSurvey No. 000094256 • 3 ♀♀; San Bernardino Co., Granite Mountains, T8N R13E Sec. 17; [34.78° N, 115.64° W]; elev. 1234 m; 22–25 May 1983; Terry L. Griswold leg.; BBSL FaunalSurvey No. 000093931, FaunalSurvey No. 000110478, FaunalSurvey No. 000110481 • 1 ♀; San Bernardino Co., Kelso Dunes, T10N R13E Sec. 30; [34.97° N, 115.66° W]; elev. 792 m; 12 May 1982; Terry L. Griswold leg.; BBSL FaunalSurvey No. 000094240 • 2 ♀♀; San Bernardino Co., NE of Granite Mountains, T9N R13E Sec. 33; [34.83° N, 115.62° W]; elev. 1160 m; 21 Sep. 1993; Terry L. Griswold leg.; ex *Eriogonum deflexum*; BBSL FaunalSurvey No. 000093845, FaunalSurvey No. 000093846 • 3 ♀♀, 1 ♂; San Diego Co., Anza-Borrego; 33.108° N, 116.4976° W; 20 Apr. 2013; K.J. Hung, Borchers, Nabors leg.; WRME • 2 ♀♀; San Diego Co., Anza-Borrego; 33.1281° N, 116.4276° W; 23 Mar. 2012; K.J. Hung leg.; WRME • 1 ♀; ibid.; 2 Mar. 2013; K.J. Hung leg.; WRME • 1 ♀; San Diego Co., Anza-Borrego; 33.2114° N, 116.4456° W; 12 Sep. 2013; K.J. Hung leg.; ex *Pectis papposa*; WRME • 1 ♀; San Diego Co., Anza-Borrego; 33.222° N, 116.4547° W; 12 Sep. 2013; K.J. Hung leg.; ex *Chamaesyce* sp.; WRME • 1 ♀; La Mesa; [32.77° N, 117.02° W]; 19 Jun. 2015; K.J. Hung leg.; WRME • 1 ♀; San Diego; [32.71° N, 117.16° W]; 3 Jun. 2015; K.J. Hung leg.; WRME • 1 ♀; ibid.; 5 Apr. 2016; K.J. Hung, Lee leg.; WRME • 1 ♂; ibid.; 11 May 2016; K.J. Hung, Lee leg.; WRME • 1 ♀; ibid.; 2 Jun. 2016; K.J. Hung, Lee leg.; WRME • 1 ♀; ibid.; 14 Jul. 2016; K.J. Hung, Lee leg.; WRME • 2 ♀♀; Spring Valley; [32.74° N, 117° W]; 20 Mar. 2015; K.J. Hung, Cen leg.; WRME • 1 ♀; ibid.; 24 Mar. 2016; K.J. Hung, Lee leg.; WRME • 1 ♀; ibid.; 14 Apr. 2016; K.J. Hung, Lee leg.; WRME • 2 ♀♀; ibid.; 2 May 2016; K.J. Hung, Lee leg.; WRME • 1 ♀; ibid.; 19 May 2016; K.J. Hung, Lee leg.; WRME • 2 ♀♀; ibid.; 8 Jun. 2016; K.J. Hung, Lee leg.; WRME. – **Nevada** • 2 ♂♂; Clark Co., 0.09 mi. NW of McCullough Pass; 35.7362° N, 115.1704° W; 13 Sep. 2005; A. Portoluci leg.; ex *Senecio* sp.; BBSL671758, BBSL671759 • 1 ♂; Clark Co., 0.2 mi. E of Fletcher Spring; 36.2733° N, 115.626° W; elev. 2296 m; 7 Jul. 2004; E. Ahlstrom leg.; ex *Angelica kingii*; BBSL536927 • 1 ♂; Clark Co., 0.22 mi. W of Christmas Tree Pass; 35.2617° N, 114.7466° W; 21 Sep. 2005; E. North leg.; ex *Gutierrezia microcephala*; BBSL671304 • 1 ♂; Clark Co., 0.4 mi. E of St. Thomas Gap; 36.4067° N, 114.0937° W; 8 Jun. 2005; S. Higbee leg.; ex *Stephanomeria exigua*; BBSL670136 • 1 ♀; Clark Co., 0.54 mi. S of Paradise Gap; 36.29° N, 114.1886° W; 24 Aug.

2005; A. Portoluci leg.; ex *Baileya multiradiata*; BBSL676249 • 2 ♀♀; *ibid.*; 24 Aug. 2005; O.I. Messinger leg.; ex *Euphorbia* sp.; BBSL686060, BBSL686062 • 1 ♂; *ibid.*; 24 Aug. 2005; O.I. Messinger leg.; ex *Euphorbia* sp.; BBSL686063 • 1 ♀; Clark Co., 0.6 mi. WSW of Bills Spring; 36.2931° N, 114.1735° W; 25 Aug. 2005; E. North leg.; ex *Eriogonum* sp.; BBSL686664 • 1 ♀; Clark Co., 0.69 mi. N of Beehive Rock; 36.4196° N, 114.5509° W; 23 Aug. 2005; E. North leg.; ex *Croton wigginsii*; BBSL671661 • 1 ♂; Clark Co., 0.71 mi. ENE of Gass Spring; 36.4292° N, 115.1526° W; 31 May 2005; S. Higbee leg.; ex *Eriogonum racemosum*; BBSL675489 • 1 ♀; *ibid.*; 14 Jun. 2005; S. Higbee leg.; ex *Salvia dorrii*; BBSL603861 • 1 ♂; Clark Co., 0.9 mi. E of Indian Ridge; 36.4765° N, 115.6351° W; elev. 1396 m; 16 Jun. 2004; E. Ahlstrom leg.; ex *Sphenosciadium capitellatum*; BBSL535655 • 1 ♂; Clark Co., 1 mi. WNW of Christmas Tree Pass; 35.2653° N, 114.7648° W; 11 Jul. 2005; S. Higbee leg.; BBSL678142 • 1 ♀; Clark Co., 1.5 mi. SE of Buck Spring; 36.3243° N, 115.7625° W; 12 Jul. 2005; S. Higbee leg.; ex *Penstemon palmeri*; BBSL638186 • 1 ♀; Clark Co., 1.6 mi. SSW of Spirit Mountain; 35.2518° N, 114.7301° W; 9 Jun. 2005; BBSL637101 • 1 ♀; *ibid.*; 11 Jul. 2005; S. Higbee leg.; ex *Eriogonum fasciculatum*; BBSL638147 • 2 ♂♂; *ibid.*; 6 Sep. 2005; Terry L. Griswold leg.; ex *Gutierrezia microcephala*; BBSL669833, BBSL669834 • 1 ♀; *ibid.*; 21 Sep. 2005; E. North leg.; ex *Eriogonum deflexum*; BBSL669959 • 3 ♀♀; Clark Co., 1.6 mi. WNW of Whitney Pocket; 36.5314° N, 114.1626° W; 25 May 2005; E. Ahlstrom leg.; ex *Eriastrum diffusum*; BBSL669349, BBSL669350, BBSL669351 • 1 ♀; *ibid.*; 25 May 2005; S. Higbee leg.; ex *Eriastrum diffusum*; BBSL670304 • 1 ♀; *ibid.*; 25 May 2005; S. Higbee leg.; BBSL638920 • 2 ♀♀; Clark Co., 1.61 mi. NE of Sheep Mountain; 35.7699° N, 115.2673° W; 13 Sep. 2005; E. North leg.; ex *Eriogonum* sp.; BBSL685864, BBSL685870 • 1 ♀; Clark Co., 1.81 mi. N of Crescent Peak; 35.5045° N, 115.1417° W; 12 May 2005; E. Ahlstrom leg.; ex *Baileya* sp.; BBSL676449 • 2 ♂♂; Clark Co., 1.89 mi. E of Weiser Ridge; 36.5872° N, 114.5295° W; 7 Jun. 2005; E. Ahlstrom leg.; ex *Eriastrum diffusum*; BBSL669361, BBSL669363 • 3 ♂♂; Clark Co., 1.92 mi. E of Weiser Ridge; 36.581° N, 114.5314° W; 7 Jun. 2005; E. Ahlstrom leg.; ex *Acacia greggii*; BBSL672213, BBSL672214, BBSL672215 • 1 ♀; Clark Co., 16.91 mi. SE of Devils Hole Hills; 36.2433° N, 115.8991° W; 20 Jun. 2005; R. Andrus leg.; ex *Stanleya* sp.; BBSL676677 • 1 ♀; Clark Co., 2.02 mi. NE of Spring Mountain; 35.8181° N, 115.4594° W; 12 Sep. 2005; A. Portoluci leg.; ex *Gutierrezia microcephala*; BBSL671151 • 1 ♂; *ibid.*; 12 Sep. 2005; A. Portoluci leg.; ex *Gutierrezia microcephala*; BBSL671148 • 2 ♀♀; Clark Co., 2.15 mi. N of Piute Valley; 35.554° N, 115.0758° W; 22 Sep. 2005; E. North leg.; BBSL678639, BBSL678657 • 1 ♀; Clark Co., 2.16 mi. SW of Wechech Basin; 36.4559° N, 114.1519° W; 12 May 2005; S. Higbee leg.; ex *Phacelia indecora*; BBSL677594 • 2 ♀♀; Clark Co., 2.34 mi. SE of The Narrows; 36.6064° N, 114.4987° W; 3 May 2005; S. Higbee leg.; ex *Mentzelia involucrata*; BBSL650584, BBSL650585 • 1 ♂; Clark Co., 2.46 mi. SW of Highland Range; 35.5657° N, 115.0804° W; 22 Sep. 2005; E. North leg.; ex *Gutierrezia microcephala*; BBSL671389 • 1 ♀; Clark Co., 2.49 mi. W of Grapevine Canyon; 35.2643° N, 114.7772° W; 11 Oct. 2005; Terry L. Griswold leg.; ex *Pectis papposa*; BBSL686226 • 2 ♀♀; Clark Co., 2.5 km NW of Callville Bay; 36.157° N, 114.7438° W; 12 Mar. 1998; Terry L. Griswold leg.; BBSL277441, BBSL277451 • 1 ♀; Clark Co., 2.5 mi. S of Wheeler Well; 36.336° N, 115.8236° W; 12 Jul. 2005; E. Green leg.; ex *Eriodictyon angustifolium*; BBSL637611 • 1 ♂; Clark Co., 2.5 mi. SE of Rainbow Mountain; 36.0896° N, 115.4493° W; elev. 1138 m; 23 Aug. 2004; S. Higbee leg.; ex *Gutierrezia microcephala*; BBSL542099 • 1 ♀; *ibid.*; 9 Sep. 2004; S. Higbee, Terry L. Griswold leg.; BBSL576731 • 1 ♂; *ibid.*; 21 Sep. 2004; S. Higbee leg.; ex *Gutierrezia microcephala*; BBSL533881 • 1 ♀; Clark Co., 2.85 mi. SE of Rainbow Mountain; 36.0804° N, 115.4587° W; 24 Jun. 2005; S. Higbee leg.; BBSL650810 • 1 ♀; Clark Co., 2.93 mi. NE of McCullough Range; 35.5692° N, 115.124° W; 22 Sep. 2005; E. North leg.; ex *Gutierrezia microcephala*; BBSL671378 • 1 ♂; Clark Co., 3.1 mi. SE of Black Butte; 35.8524° N, 115.6717° W; elev. 820 m; 4 May 2004; S. Higbee leg.; ex *Prosopis glandulosa* var. *torreyana*; BBSL544625 • 3 ♂♂; Clark Co., 3.5 mi. SE of Hiko Spring; 35.1252° N, 114.6432° W; elev. 235 m; 27 Apr. 2004; E. Ahlstrom leg.; BBSL577372, BBSL577379, BBSL577382 • 2 ♀♀; Clark Co., 3.5 mi. W of Christmas Tree Pass; 35.2658° N, 114.8021° W; 21 Apr. 2005; D. Allen leg.; BBSL639553, BBSL639555 • 17 ♀♀; Clark Co., 3.9 mi. SSW of Whitney Pocket; 36.4651° N, 114.1537° W; 26 May 2005; R. Andrus leg.; BBSL650741, BBSL650743, BBSL650744, BBSL650745, BBSL650763,

BBSL650764, BBSL650765, BBSL650768, BBSL650770, BBSL650773, BBSL650774, BBSL650775, BBSL650777, BBSL650790, BBSL650791, BBSL650793, BBSL650794 • 1 ♂; Clark Co., 3.94 mi. SE of Piute Wash; 35.2685° N, 114.8198° W; 11 Oct. 2005; Terry L. Griswold leg.; ex *Pectis papposa*; BBSL686123 • 1 ♀; Clark Co., 4 mi. W of Bunkerville; [36.77° N, 114.2° W]; 14 Jun. 1989; P.F. Torchio leg.; BBSL510006 • 1 ♂; Clark Co., 4.21 mi. SW of Roman Wash; 35.2658° N, 114.8021° W; 21 Sep. 2005; A. Portoluci leg.; ex *Eriogonum deflexum*; BBSL672337 • 1 ♂; Clark Co., 5 mi. NE of Spring Mountains; 35.8167° N, 115.5022° W; 30 Aug. 2005; A. Portoluci leg.; ex *Chamaesyce fendleri*; BBSL676269 • 3 ♀♀; Clark Co., 5 mi. S of Searchlight; [35.39° N, 114.92° W]; 23 Sep. 1983; P.F. Torchio, D.M. Torchio leg.; BBSL510019, BBSL510020, BBSL510021 • 3 ♀♀; Clark Co., Arizona Road; 36.5253° N, 114.0522° W; elev. 1330 m; 9–26 Jun. 2018; G.R. Ballmer leg.; UCRC ENT 519887, 519897, 519902 • 1 ♀; Clark Co., Black Mountain, S.; 35.4838° N, 114.7497° W; 14 Aug. 1998; C. Shultz leg.; BBSL313537 • 1 ♀; Clark Co., Blue Point Spring; 36.3894° N, 114.4295° W; elev. 463 m; 20 Apr. 2005; R. Andrus leg.; ex *Mentzelia involucrata*; BBSL569732 • 1 ♀; Clark Co., Bunkerville; [36.77° N, 114.13° W]; 3 Jun. 1993; P.F. Torchio, Trostle leg.; ex *Baileya*; BBSL510000 • 2 ♀♀; Clark Co., Callville Bay Road; 36.173° N, 114.7653° W; 12 Mar. 1998; Terry L. Griswold leg.; BBSL276200, BBSL276201 • 1 ♂; Clark Co., Christmas Tree Pass; 35.26° N, 114.7418° W; 10 Jun. 1998; C. Shultz, K. Receveur, K. Keen, M. Andres leg.; BBSL304776 • 1 ♂; *ibid.*; 10 Jun. 1998; M. Andres, C. Shultz leg.; BBSL291092 • 1 ♂; Clark Co., Clark Canyon; 36.3252° N, 115.7617° W; 20 Jul. 1998; M. Andres, C. Shultz leg.; ex *Chaenactis*; BBSL304958 • 1 ♀; Clark Co., Cottonwood Cove; 35.4887° N, 114.6943° W; 14 Aug. 1998; C. Shultz, Terry L. Griswold leg.; BBSL316688 • 1 ♂; Clark Co., E of Christmas Tree Pass; 35.2527° N, 114.7297° W; 10 Jun. 1998; M. Andres, C. Shultz leg.; BBSL291058 • 1 ♀; Clark Co., Elbow Canyon; 36.7339° N, 115.0111° W; 10 Jun. 2005; S. Higbee leg.; ex *Baileya multiradiata*; BBSL603733 • 1 ♀; Clark Co., Elbow Canyon; 36.7422° N, 114.9916° W; 10 Jun. 2005; E. Ahlstrom leg.; ex *Arctomecon merriamii*; BBSL672241 • 1 ♂; Clark Co., Gold Butte; 36.2815° N, 114.1933° W; 18 Sep. 1998; W.R. Bowlin leg.; BBSL320873 • 5 ♀♀; Clark Co., Grand Gulch Road, 22 air mi. S of Mesquite; [36.49° N, 114.07° W]; 11–21 May 1983; F.D. Parker, J.H. Parker leg.; BBSL510017, BBSL510018, BBSL510022, BBSL510023, BBSL510024 • 1 ♀; Clark Co., Gypsum Spring; 36.2093° N, 114.912° W; 12 Mar. 1998; Terry L. Griswold leg.; BBSL277461 • 1 ♀; Clark Co., Harris Spring Canyon; 36.2583° N, 115.493° W; 1 Jun. 2005; R. Andrus leg.; ex *Penstemon palmeri*; BBSL639120 • 2 ♂♂; Clark Co., Hidden Valley; 35.819° N, 115.2° W; 11 Aug. 1998; M. Andres, C. Shultz leg.; ex *Sphaeralcea ambigua*; BBSL312600, BBSL312601 • 1 ♂; Clark Co., Horse Spring Wash; 36.3292° N, 114.1457° W; 18 Sep. 1998; W.R. Bowlin leg.; BBSL319631 • 1 ♀; Clark Co., Lovell Canyon; 36.1526° N, 115.5719° W; 7 Jul. 2005; Terry L. Griswold leg.; ex *Helioomeris multiflora*; BBSL637833 • 1 ♂; Clark Co., Lovell Canyon; 36.1648° N, 115.5758° W; elev. 1801 m; 16 Jun. 2004; D. Skandilis leg.; ex *Verbena bracteata*; BBSL536691 • 2 ♀♀; Clark Co., Mesquite; [36.81° N, 114.07° W]; 4 Oct. 1988; R.W. Rust, P.F. Torchio leg.; ex *Eriogonum*; BBSL510007, BBSL510008 • 8 ♀♀; Clark Co., Mesquite Valley, E.; 35.761° N, 115.5832° W; 10 Aug. 1998; M. Andres, C. Shultz, Terry L. Griswold leg.; BBSL312920, BBSL312928, BBSL312932, BBSL312933, BBSL312938, BBSL312940, BBSL312943, BBSL312949 • 6 ♀♀; Clark Co., Mormon Well Road; 36.6253° N, 115.1115° W; 16 Jul. 1998; M. Andres, C. Shultz leg.; BBSL266027, BBSL266029, BBSL266032, BBSL266033, BBSL269761, BBSL269762 • 1 ♂; Clark Co., Mud Wash; 36.433° N, 114.1588° W; 27 Aug. 1998; O.I. Messinge, C. Shultz, S. Messinger leg.; BBSL317239 • 2 ♀♀; Clark Co., N of Devils Throat; 36.4427° N, 114.151° W; 6 Oct. 1998; Terry L. Griswold leg.; BBSL318911, BBSL318930 • 1 ♂; *ibid.*; 6 Oct. 1998; Terry L. Griswold leg.; BBSL318916 • 1 ♂; Clark Co., NE of Little Virgin Peak; 36.6097° N, 114.2167° W; 6 Oct. 1998; Terry L. Griswold leg.; BBSL318672 • 1 ♂; Clark Co., NE of Mica Peak; 36.3348° N, 114.1445° W; 7 Jun. 1998; F.D. Parker, Terry L. Griswold leg.; BBSL278946 • 1 ♂; Clark Co., SE of Black Butte; 35.8627° N, 115.691° W; 15 Sep. 1998; W.R. Bowlin leg.; BBSL324372 • 1 ♂; Clark Co., SE of Little Virgin Peak; 36.59° N, 114.2167° W; 8 Jun. 1998; M. Andres, K. Receveur leg.; ex *Eriogonum*; BBSL294853 • 7 ♀♀; Clark Co., Spring Mountain Ranch; [36.07° N, 115.45° W]; 16 May–16 Jul. 1988; M.J. Verchick leg.; BBSL510009, BBSL510010, BBSL510011, BBSL510012, BBSL510013, BBSL510014, BBSL510016 • 1 ♀; Clark



Co., St. Thomas Gap, T17S R71E Sec. 31; [36.45° N, 114.11° W]; 11 Apr.–10 May 1984; R.C. Bechtel, J.B. Knight leg.; BBSL510026 • 1 ♂; Clark Co., SW of Ireteba Peaks; 35.571° N, 114.8535° W; 9 Jun. 1998; M. Andres, K. Keen leg.; ex *Eriogonum fasciculatum*; BBSL295772 • 1 ♂; Clark Co., Virgin Valley; 36.6868° N, 114.2643° W; 6 Oct. 1998; Terry L. Griswold leg.; BBSL319048 • 12 ♀♀; Clark Co., W of Beehive Rock; 36.4088° N, 114.5803° W; 5 Aug. 1998; M. Andres, C. Shultz leg.; BBSL309738, BBSL309748, BBSL309749, BBSL309765, BBSL309767, BBSL309773, BBSL309775, BBSL309777, BBSL309783, BBSL309787, BBSL309803, BBSL309807 • 1 ♂; Clark Co., W of Virgin Mountains; 36.5768° N, 114.2042° W; 6 Oct. 1998; Terry L. Griswold leg.; BBSL318593 • 1 ♀; Clark Co., W of Wilson Pass; 35.8705° N, 115.541° W; 5 Jun. 1998; F.D. Parker leg.; BBSL279754 • 1 ♀; Clark Co., West End Wash, Lake Mead NRA; [36.15° N, 114.72° W]; elev. 549 m; 31 Mar. 1993; Terry L. Griswold, V.J. Tepedino leg.; ex *Arctomecon californicum*; BBSL Faunal Survey No. 000031403. – **New Mexico** • 1 ♀; Chaves Co., Bitter Lake NWR, trailer north of HQ; 33.4636° N, 104.4066° W; 20 Jul. 2004; D. Richman leg.; NMSU • 1 ♀; Colfax Co., Highway 64; 36.6369° N, 104.6775° W; elev. 1932 m; 6 Aug. 2007; Jason J. Gibbs, C. Sheffield leg.; PCYU • 2 ♀♀, 1 ♂; Doña Ana Co., Las Cruces; [32.32° N, 106.76° W]; 12 Jun. 1950; R.H. Beamer leg.; SEMC • 2 ♀♀; *ibid.*; 17 Jun. 1950; L.D. Beamer leg.; SEMC • 14 ♀♀; *ibid.*; 15 Jul. 1952; R.H. Beamer, L.D. Beamer, W.E. LaBerge, Cheng Liang leg.; SEMC • 3 ♀♀; *ibid.*; 25 Apr. 1954; R.H. Beamer leg.; ex *Salix*; SEMC • 1 ♀; *ibid.*; 25 Jun. 1962; S.R. Race leg.; ex cotton; NMSU • 1 ♀; Doña Ana Co., Leasburg Dam State Park; [32.49° N, 106.92° W]; 25 Jun. 1983; W.J. Pulawski leg.; CAS • 1 ♀; Doña Ana Co., Mesilla Park; [32.27° N, 106.76° W]; 29 Jun. 1962; S.R. Race leg.; ex alfalfa; NMSU • 1 ♀; Doña Ana Co., NMSU Leyendecker Farm, Route 28 at Rio Grande, 5 miles southeast Mesilla; [32.2° N, 106.742° W]; elev. 1189 m; 15 Jul. 2004; ex *Gossypium*; NMSU • 1 ♀; Eddy Co., 1.5 km SSW of Main Cave Entrance; 32.1638° N, 104.4443° W; elev. 1152 m; 31 Aug. 2010; J.D. Herndon, R. Krauss leg.; BBSL CAVE21910 • 1 ♀; Eddy Co., 1.9 km SSW of Main Cave Entrance; 32.1615° N, 104.4494° W; elev. 1161 m; 31 Aug. 2010; R. Krauss, J.D. Herndon leg.; BBSL CAVE21452 • 6 ♀♀; Grant Co., 0.5 km N of Hachita; 31.9233° N, 108.3258° W; elev. 1440 m; 23 Aug. 2001; R.W. Brooks leg.; ex *Chamaesaracha coronopus*; SEMC SM0273737, SM0273739, SM0273747, SM0273756, SM0273759, SM0273764 • 1 ♀; *ibid.*; 23 Aug. 2001; R.W. Brooks leg.; ex *Machaeranthera tanacetifolia*; SEMC SM0274237 • 4 ♀♀; Grant Co., 19 mi. N of Hachita; 32.1822° N, 108.3158° W; elev. 1430 m; 24 Sep. 1999; R.W. Brooks leg.; SEMC SM0150372, SM0150373, SM0150374, SM0150375 • 1 ♀; Hidalgo Co., 1 km N of Animas; [31.96° N, 108.81° W]; 1 Aug. 1988; Bryan N. Danforth leg.; ex *Sphaeralcea*; SEMC • 7 ♀♀; Hidalgo Co., 11.2 km E of Portal, 0.8 km W of Highway 80; 31.8706° N, 109.0433° W; elev. 1250 m; 23 Aug. 2000; R.W. Brooks leg.; SEMC SM0198518, SM0198520, SM0198521, SM0198523, SM0198524, SM0198526, SM0198530 • 1 ♀, 1 ♂; Hidalgo Co., 13 mi. N of Rodeo; [32.02° N, 109.03° W]; elev. 1372 m; 16 Aug. 1964; Charles D. Michener leg.; ex “*Aplopappus spinulosus*”; SEMC • 2 ♀♀, 1 ♂; Hidalgo Co., 20 mi. S of Animas; [31.66° N, 108.81° W]; 23 Aug. 2008; John S. Ascher, Jerome G. Rozen, M.A. Rozen leg.; AMNH • 4 ♀♀; Hidalgo Co., 21.7 km S of Animas; [31.75° N, 108.81° W]; elev. 1400 m; 19 Aug. 2001; Charles D. Michener leg.; SEMC SM0270807, SM0270808, SM0270809, SM0270810 • 1 ♀; Hidalgo Co., 22.6 km S of Animas; [31.74° N, 108.81° W]; 13 Jul. 1987; ex *Berlandiera*; SEMC • 1 ♂; Hidalgo Co., 23.5 mi. S of Animas; 31.6184° N, 108.8674° W; 23 Aug. 2007; Jason J. Gibbs leg.; PCYU • 5 ♂♂; Hidalgo Co., 26 mi. S of Animas; 31.585° N, 108.87° W; 18 Sep. 2012; Jason J. Gibbs leg.; CUIC • 1 ♀; Hidalgo Co., 28 mi. S of Animas; [31.555° N, 108.876° W]; 19 Aug. 2010; H. Campbell leg.; AMNH • 1 ♂; *ibid.*; 19 Aug. 2010; H. Campbell leg.; AMNH • 2 ♀♀; Hidalgo Co., 28 mi. S of Animas; 31.555° N, 108.876° W; 22 Aug. 2019; Jason J. Gibbs leg.; WRME 0500836, 0500837 • 2 ♀♀; Hidalgo Co., 41.8 km S of Animas; [31.58° N, 108.87° W]; elev. 1400 m; 19 Aug. 2001; Charles D. Michener leg.; SEMC SM0270825, SM0270827 • 2 ♀♀; Hidalgo Co., 5.5 mi. E of Animas; [31.96° N, 108.72° W]; 22 Aug. 1995; Jerome G. Rozen, S.A. Budick, Gretchen LeBuhn leg.; AMNH • 2 ♀♀; Hidalgo Co., 5.5 mi. E of Animas; 31.95° N, 108.7114° W; elev. 1390 m; 22 Sep. 1999; R.W. Brooks, Charles D. Michener leg.; ex *Euphorbia*; SEMC SM0149738, SM0149741 • 1 ♂; *ibid.*; 22 Sep. 1999; R.W. Brooks, Charles D. Michener leg.; SEMC SM0149718 • 1 ♀; Hidalgo Co., 5.5 mi. E of Animas; 31.9572° N, 108.7144° W; elev. 1219 m;

19 Aug. 2001; SEMC SM0262458 • 1 ♀; Hidalgo Co., 6 mi. N of Rodeo; [31.92° N, 109.03° W]; 26 Aug. 2011; WRME • 5 ♀♀; Hidalgo Co., 6 mi. S of Animas; [31.86° N, 108.81° W]; 19 Aug. 2010; H. Campbell leg.; AMNH • 1 ♀; Hidalgo Co., 8 km N of Rodeo; [31.91° N, 109.03° W]; 6 Aug. 1988; Bryan N. Danforth leg.; SEMC • 3 ♂♂; Hidalgo Co., Animas; [31.95° N, 108.81° W]; 9 May 1993; Robert L. Minckley, K. Toal leg.; ex *Phacelia*; SEMC • 2 ♀♀; Hidalgo Co., Animas vicinity; [31.95° N, 108.81° W]; 28 Jul. 1976; M. Rothschild leg.; SEMC • 1 ♀; Hidalgo Co., Cienega Ranch; [32.04° N, 109.04° W]; 20 Aug. 1998; Jerome G. Rozen, K. Franklin leg.; AMNH • 1 ♀; Hidalgo Co., E. Animas; [31.95° N, 108.8° W]; 16 May 1987; Bryan N. Danforth leg.; SEMC • 1 ♀; Hidalgo Co., Rodeo; [31.84° N, 109.03° W]; elev. 1268 m; 22 Aug. 1964; Charles D. Michener leg.; SEMC • 2 ♀♀, 1 ♂; Hidalgo Co., Rodeo; [31.84° N, 109.03° W]; 31 Aug. 1970; D.J. Brothers leg.; SEMC • 1 ♂; *ibid.*; 11 Aug. 1975; M. Chabot leg.; SEMC • 5 ♀♀; Hidalgo Co., Rodeo vicinity; [31.84° N, 109.03° W]; 11–12 Jun. 1987; Bryan N. Danforth leg.; ex *Berlandiera*; SEMC • 1 ♀; *ibid.*; 11 Jun. 1987; Bryan N. Danforth leg.; ex *Euphorbia*; SEMC • 3 ♀♀; *ibid.*; 5 Aug. 1987; Bryan N. Danforth leg.; SEMC • 1 ♀; Hidalgo Co., San Simone cienega; [32.3° N, 108.9° W]; 17–24 May 1987; Bryan N. Danforth leg.; ex *Prosopis*; SEMC • 1 ♀; *ibid.*; 1–9 Jun. 1987; Bryan N. Danforth leg.; SEMC • 1 ♀; Luna Co., Columbus; [31.83° N, 107.64° W]; 21 Jul. 1982; W.J. Pulawski leg.; CAS • 1 ♀; *ibid.*; 26 Jun. 1983; W.J. Pulawski leg.; CAS • 1 ♀; Sierra Co., #4, 6 mi. W of Caballo; [32.98° N, 107.38° W]; 30 May 1991; G. W. Byers leg.; ex *Larrea*; SEMC • 1 ♀; Socorro Co., Bosque del Apache National Wildlife Refuge; [33.8° N, 106.89° W]; 24 Mar.–7 Apr. 2008; TAMU • 1 ♀; *ibid.*; 16–30 Jun. 2008; TAMU • 1 ♀; Socorro Co., Sevilleta National Wildlife Refuge; 34.3325° N, 106.6328° W; 17 Jun.–1 Jul. 2010; Karen Wetherill leg.; TAMU • 1 ♀; *ibid.*; 15–29 Jul. 2010; Karen Wetherill leg.; TAMU • 1 ♀; Socorro Co., Sevilleta National Wildlife Refuge; 34.335° N, 106.7219° W; 13–27 Jun. 2012; Karen W. Wright leg.; TAMU • 2 ♀♀; Socorro Co., Sevilleta National Wildlife Refuge; 34.3431° N, 106.7417° W; 21 Apr.–5 May 2009; Karen Wetherill leg.; TAMU • 1 ♀; *ibid.*; 19 May–2 Jun. 2009; Karen Wetherill leg.; TAMU • 2 ♀♀; *ibid.*; 15–29 Jun. 2009; Karen Wetherill leg.; TAMU • 2 ♀♀; 20 mi. W of Las Cruces; [32.33° N, 107.1° W]; 13 Jul. 1952; R.H. Beamer, L.D. Beamer, W.E. LaBerge, Cheng Liang leg.; SEMC • 1 ♂; 35 mi. N of Hot Springs; [36.16° N, 105.29° W]; 22 Jul. 1950; R.H. Beamer leg.; ex *Baileya multiradiata*; SEMC • 1 ♂; Alamogordo; [32.9° N, 105.96° W]; 26 Jun. 1940; L.J. Lipovsky leg.; SEMC • 1 ♂; Cloudcroft; [32.96° N, 105.74° W]; 27 Jun. 1940; E.E. Kenaga leg.; SEMC • 1 ♂; Garfield; [32.76° N, 107.26° W]; 16 Jul. 1952; R.H. Beamer, L.D. Beamer, W.E. LaBerge, Cheng Liang leg.; SEMC • 2 ♀; Hot Springs; [35.65° N, 105.29° W]; 22 Jul. 1950; R.H. Beamer leg.; ex *Chamaesaracha coniodes*; SEMC • 2 ♂♂; *ibid.*; 22 Jul. 1950; W.J. Arnold leg.; SEMC • 1 ♀; Mayhill; [32.89° N, 105.48° W]; 21 Jun. 1967; W.F. Chamberlain leg.; TAMU-ENTO X1312641 • 2 ♀♀; Nogal; [33.56° N, 105.71° W]; 11 Jun. 1959; R.H. Beamer leg.; SEMC • 1 ♀, 1 ♂; Organ; [32.43° N, 106.6° W]; 3 Jul. 1940; D.E. Hardy leg.; SEMC • 1 ♂; *ibid.*; 3 Jul. 1940; L.C. Kuitert leg.; SEMC. – **Texas** • 1 ♀; Brewster Co., Big Bend National Park, Hot Springs; [29.182° N, 102.992° W]; elev. 560 m; 14 Apr. 1986; Terry L. Griswold leg.; ex *Chilopsis*; BBSL FaunalSurvey No. 000109944 • 1 ♂; *ibid.*; 14 Apr. 1986; Terry L. Griswold leg.; ex *Chilopsis*; BBSL FaunalSurvey No. 000109943 • 8 ♂♂; *ibid.*; 14 Apr. 1986; Terry L. Griswold leg.; BBSL FaunalSurvey No. 000109935, FaunalSurvey No. 000109936, FaunalSurvey No. 000109937, FaunalSurvey No. 000109938, FaunalSurvey No. 000109939, FaunalSurvey No. 000109940, FaunalSurvey No. 000109941, FaunalSurvey No. 000109942 • 1 ♀; Brewster Co., Elephant Mountain WMA, campground & vicinity; 30.0482° N, 103.5698° W; 22–23 Apr. 2011; E.G. Riley leg.; TAMU-ENTO X0611399 • 1 ♀; Brewster Co., Terlingua Creek, 32 km N of Study Butte; [29.58° N, 103.69° W]; 16 Apr. 1986; R.T. Griswold leg.; BBSL FaunalSurvey No. 000109945 • 1 ♀; Culberson Co., Hurds Draw Road + Highway 10 intersection; [31.07° N, 104.28° W]; 31 May 1999; Laurence Packer leg.; PCYU • 1 ♀; El Paso Co., Franklin Mountains State Park, McKelligon Canyon Park; [31.84° N, 106.485° W]; 15–30 Jul. 2005; N. Brown leg.; TAMU-ENTO X1359645 • 1 ♀; Hudspeth Co., Indio Mountains Research Station above Squaw Spring; 30.7969° N, 105.0119° W; elev. 1280 m; 12 Apr. 2002; A.R. Gillogly leg.; TAMU-ENTO X1413050 • 1 ♀; Hudspeth Co., Indio Mountains Research Station, Squaw Spring; 30.7969° N, 105.0119° W; 12–13 Apr. 2002; M.J. Yoder leg.; TAMU-ENTO X1408409 • 2 ♀♀; Hudspeth Co., Indio Mountains Research Station, vicinity of Indio Ranch

House; 30.7769° N, 105.0161° W; elev. 1231 m; 12–13 Apr. 2002; M.J. Yoder leg.; TAMU-ENTO X1370805, X1417834 • 1 ♀; Jeff Davis Co., 9 mi. S of Kent; [30.94° N, 104.22° W]; 29 May 1999; Laurence Packer leg.; PCYU • 1 ♀; Jeff Davis Co., Chihuahuan Desert Research Institute; [30.54° N, 103.84° W]; 29 Apr. 2003; Laurence Packer, Fraser leg.; PCYU • 1 ♀; Val Verde Co., Devil's River; 29.7816° N, 100.9932° W; elev. 380 m; 27 Apr. 2019; Karen W. Wright leg.; ex *Argemone*; TAMU-ENTO X1600145 • 1 ♂; Big Bend National Park, Santa Elena Canyon; [29.165° N, 103.612° W]; elev. 640 m; 5 May 1959; W.R.M. Mason leg.; CNC • 1 ♀; [exact location unknown]; TAMU-ENTO X1388663. – **Utah** • 1 ♀; Millard Co., Delta, 2700 S 1700 E; 39.3123° N, 112.5448° W; 8–21 Jun. 2016; M.E. Christman leg.; BBSL • 1 ♀; Washington Co., 0.28 mi. NNE of Spendlove Knoll; 37.3404° N, 113.1059° W; 13 Jun. 2006; B. Hays, F. Nicklen leg.; BBSL ZION22852 • 1 ♂; Washington Co., Beaver Dam Wash; [37.1° N, 114.02° W]; 10–24 Jun. 1987; BBSL700822 • 1 ♀; Washington Co., Paradise Canyon; [37.15° N, 113.62° W]; 8–14 Jul. 1983; Dan Beck leg.; BBSL700674.

## Description

### Female

**COLOURATION.** Head and mesosoma blue to blue-green; clypeus apex black; labrum reddish brown; mandible orange with black base and red apex; flagellum dark reddish brown dorsally, light brown ventrally. Pronotal lobe dark reddish brown; legs reddish brown; tegula translucent orange; wing membrane hyaline, veins with subcosta dark brown, otherwise brown to pale amber. Metasoma dark reddish brown with rims of terga and sterna broadly translucent yellow.

**PUBESCENCE.** Body pile colour white. Tomentum dense on paraocular area, frons lower half, gena, pronotal collar and lobe, space between pronotal lobe and tegula, metanotum anterior margin, metepisternum, T2–T3 basolaterally, and T4 throughout; sparse on clypeus upper half, supraclypeal area, preepisternum, and mesepisternum. Mesoscutum pubescence thin to moderately plumose. Wing setae light and dark, short and dense. Acarinarial fan complete, sparse. T2 fringes sparse, T3 fringes sparse.

**SURFACE SCULPTURE.** Clypeus shiny, with punctures dense in basal half (IS < 1 PD), large and irregularly sparse apically (IS < 2 PD); supraclypeal area shiny, with punctures dense (IS ≤ 1 PD); paraocular area weakly imbricate around antenna socket, otherwise shiny, with punctures dense (IS < 1 PD); frons shiny, with punctures crowded (IS = 0 PD); vertex shiny, with punctures dense laterally (IS < 1 PD), fine and sparse medially (IS = 1–3 PD); gena shiny, with punctures dense (IS ≤ 1 PD); postgena shiny, becoming imbricate posteriorly. Tegula punctures absent; mesoscutum tessellate, becoming shiny posterolaterally, with punctures dense (IS < 1 PD), becoming moderately sparse submedially and anteromedially (IS = 1–2 PD); scutellum tessellate, becoming shiny submedially, with punctures dense (IS < 1 PD); metapostnotum weakly imbricate, becoming tessellate posteriorly, with rugae strong, anastomosing, nearly reaching posterior margin; preepisternum shiny with crowded punctures (IS = 0 PD); hypoepimeron shiny, with punctures dense (IS < 1 PD); mesepisternum shiny, with punctures dense (IS < 1 PD); metepisternum ruguloso-lineate dorsally, ruguloso-punctate medially, tessellate ventrally; propodeum lateral surface tessellate, posterior surface tessellate. T1 anterior slope weakly coriarius, disc shiny, with punctures moderately dense (IS = 1–2 PD), impunctate in large subapicolateral boss and on rim medially; T2 disc shiny, with punctures moderately dense (IS = 1–2 PD), apical rim weakly coriarius, with punctures sparse (IS = 1–3 PD).

**STRUCTURE.** Face length/width ratio 0.81 (±0.01 SD); clypeus apicolateral denticles rounded knobs; gena/eye width ratio 0.9 (±0.06 SD). Pronotal angle slightly obtuse, nearly right-angled; intertegular span 0.84 (±0.03 SD) mm; mesoscutum length/width ratio 0.85 (±0.02 SD); mesoscutum/scutellum length ratio 2.86 (±0.16 SD); scutellum/metanotum length ratio 1.58 (±0.1 SD); metanotum/metapostnotum length ratio 0.68 (±0.09 SD); forewing with 3 submarginal cells; tegula enlarged, reaching posterior margin of mesoscutum; inner margin straight; tegula length 0.37 (±0.03 SD) mm, width 0.19 (±0.02 SD)



mm; propodeum lateral carinae not reaching dorsal margin; oblique carina strong, straight. T2 depressed apical rim less than 50% of tergum. (n = 11)

VARIATION. Various parts of the integument including the clypeus apical margin, labrum, flagellum ventral surface, pronotal lobe, and leg joints can vary from black to orange. The metasoma can vary from black to reddish brown. The tegula is rarely opaque brown but still maintains an orange tint distinct from *L. profundum* sp. nov. (this may be due to liquid accumulating and drying under the tegula). The mesoscutum and mesepisternum are sometimes entirely dull, the mesoscutum is sometimes densely punctate submedially ( $IS \leq 1$  PD), and the metasomal terga can be shiny or coriarius.

### Male

COLOURATION. Head and mesosoma blue to blue-green; clypeus apex reddish brown; labrum reddish brown to orange; mandible orange with black base and red apex; flagellum reddish brown dorsally, orange ventrally. Pronotal lobe dark reddish brown; legs reddish brown with femur-tibia joints and tarsi light brown to orange; tegula orange or reddish brown; wing membrane hyaline, veins with subcosta dark brown, otherwise brown to pale amber. Metasoma black or dark reddish brown with depressed apical rims of terga and sterna lighter reddish brown, downcurved lateral areas of terga becoming translucent yellow.

PUBESCENCE. Body pile colour white. Tomentum dense on face below median ocellus, gena, pronotal angle and lobe, and space between pronotal lobe and tegula; sparse on margins of mesoscutum, episterna, and T2–T3 basolaterally. Mesoscutum pubescence simple to moderately plumose. Wing setae light with dark intermixed apically, long and sparse. Sterna pubescence short (0.5–1.5 OD), moderately plumose, sparse.

SURFACE SCULPTURE. Clypeus shiny, with punctures dense ( $IS < 1$  PD); supraclypeal area shiny, with punctures dense ( $IS \leq 1$  PD); paraocular area shiny, with punctures dense ( $IS < 1$  PD); frons shiny, with punctures crowded ( $IS = 0$  PD); vertex shiny, with punctures dense laterally ( $IS < 1$  PD), moderately sparse medially ( $IS = 1–2$  PD); gena shiny, with punctures dense ( $IS \leq 1$  PD); postgena shiny to weakly imbricate. Tegula punctures absent; mesoscutum shiny, with punctures moderately sparse ( $IS = 1–2$  PD), becoming dense marginally and on median line ( $IS \leq 1$  PD); scutellum shiny, with punctures dense ( $IS \leq 1$  PD); metanotum shiny to weakly imbricate and densely punctate ( $IS < 1$  PD); metapostnotum shiny to imbricate, with rugae strong, anastomosing, reaching or nearly reaching posterior margin; preepisternum shiny with crowded punctures ( $IS = 0$  PD); hypoepimeron shiny, with punctures dense ( $IS < 1$  PD); mesepisternum shiny, with punctures dense ( $IS < 1$  PD); metepisternum ruguloso-lineate dorsally, areolate ventrally; propodeum lateral surface shiny to imbricate, with punctures dense ( $IS \leq 1$  PD) to crowded ( $IS = 0$  PD), posterior surface shiny with dense punctures ( $IS < 1$  PD). T1 anterior slope shiny, disc shiny, with punctures moderately dense ( $IS = 1–2$  PD), sparse in small subapicolateral boss ( $IS = 2–6$  PD) and absent on rim medially; T2 disc shiny, with punctures moderately dense ( $IS = 1–2$  PD), apical rim shiny, with punctures absent.

STRUCTURE. Face length/width ratio 0.86 ( $\pm 0.03$  SD); gena/eye width ratio 0.77 ( $\pm 0.09$  SD). Pronotal angle obtuse; intertegular span 0.71 ( $\pm 0.07$  SD) mm; mesoscutum length/width ratio 0.89 ( $\pm 0.03$  SD); mesoscutum/scutellum length ratio 2.67 ( $\pm 0.14$  SD); scutellum/metanotum length ratio 1.87 ( $\pm 0.17$  SD); metanotum/metapostnotum length ratio 0.71 ( $\pm 0.07$  SD); forewing with 3 submarginal cells; tegula enlarged, reaching or nearly reaching posterior margin of mesoscutum in dorsal view; inner margin weakly concave; tegula length 0.35 ( $\pm 0.03$  SD) mm, width 0.19 ( $\pm 0.01$  SD) mm; propodeum lateral carinae not reaching dorsal margin; oblique carina absent. (n = 10)

GENITALIA. As in Fig. 76C. Gonocoxite about 1.3 times as broad as gonostylus. Gonostylus rounded on outer margin with no concavities, with sparse long setae dorsally and short setae along inner margin. Penis valves divergent apically, with short sparse setae dorsolaterally in basal half. Retrorse lobe rounded, about 2.5 times as long as broad, with sparse short setae apically.

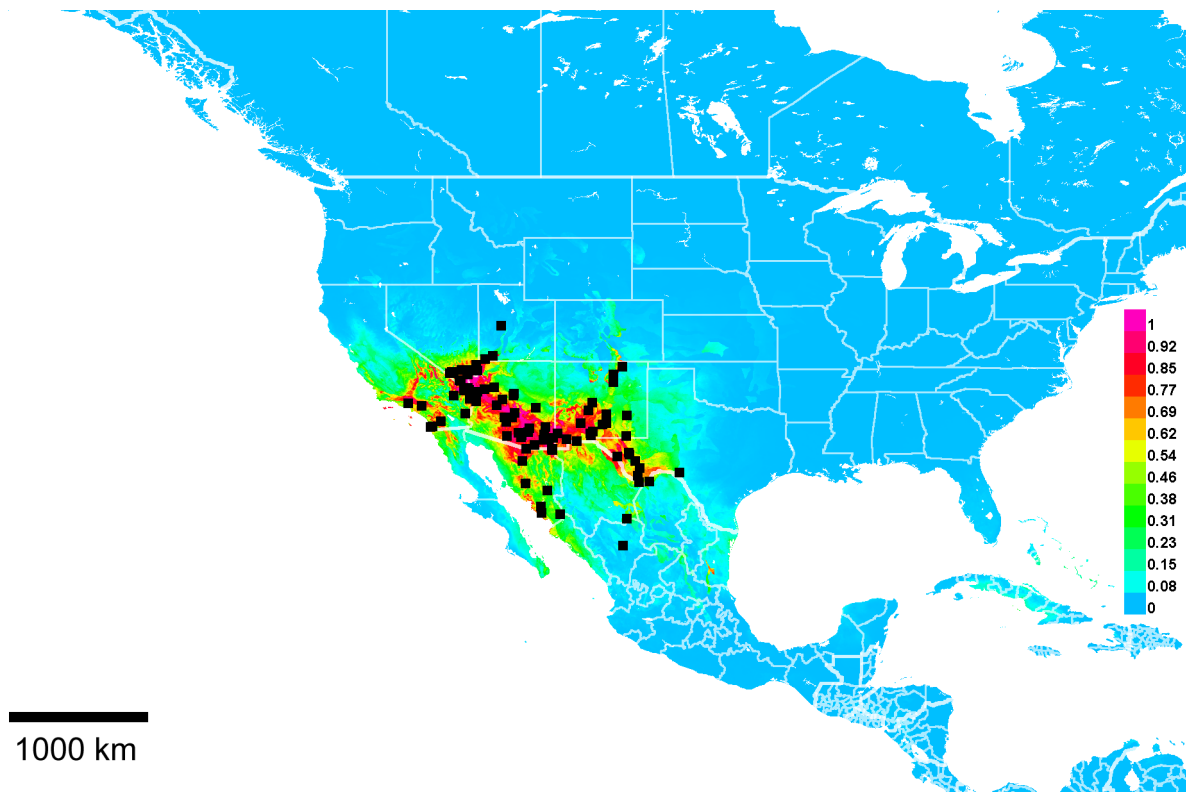
VARIATION. The mesoscutum and scutellum punctures can vary from dense ( $IS \leq 1.5$  PD) to sparse ( $IS = 1-3$  PD), the metapostnotum can vary from mostly shiny to mostly imbricate, and the propodeum lateral face can vary from shiny and distinctly punctate to imbricate and obscurely punctate.

### Range

Sonoran, Chihuahuan, and Mojave Deserts (Fig. 14).

### Floral hosts

AMARANTHACEAE Juss.: *Salsola* L.: *S. kali* L.: *S. k.* subsp. *tragus* (L.) Čelak. • APIACEAE: *Angelica* L.: *A. kingii* (S.Watson) J.M.Coult. & Rose • *Sphenosciadium* A.Gray: *S. capitellatum* A.Gray • ASTERACEAE: *Baileya* Harv. & A.Gray ex Torr.: *B. multiradiata* Harv. & A.Gray ex Torr. • *Berlandiera* DC. • *Chaenactis* DC. • *Erigeron* • *Gutierrezia*: *G. microcephala* (DC.) A.Gray • *Heliomeris* Nutt.: *H. multiflora* Nutt. • *Machaeranthera* Nees: *M. tanacetifolia* (Kunth) Nees • *Malacothrix* DC.: *M. fendleri* A.Gray • *Pectis* L.: *P. papposa* Harv. & A.Gray • *Senecio* L. • *Stephanomeria* Nutt.: *S. exigua* Nutt. • BIGNONIACEAE Juss.: *Chilopsis* D.Don • BORAGINACEAE: *Eriodictyon* Benth.: *E. angustifolium* Nutt. • *Nama* L.: *N. hispida* A.Gray • *Phacelia*: *P. indecora* J.T.Howell • BRASSICACEAE: *Lepidium*: *L. thurberi* Wooton • *Physaria* (Nutt. ex Torr. & A.Gray) A.Gray: *P. gordonii* (A.Gray) O’Kane & Al-Shehbaz • *Stanleya* Nutt. • EUPHORBIACEAE: *Croton*: *C. wigginsii* L.C.Wheeler • *Euphorbia*: *E. fendleri* Torr. & A.Gray • FABACEAE: *Acacia* Mill.: *A. greggii* A.Gray • *Medicago*: *M. sativa* • *Parkinsonia* L.: *P. aculeata* L. • *Prosopis* L.: *P. glandulosa* Torr.: *P. g.* var. *torreyana* (L.D.Benson) M.C.Johnst. • *P. velutina* Wooton • LAMIACEAE: *Salvia*: *S. dorrii* (Kellogg) Abrams • LILIACEAE Juss.: *Calochortus* Pursh • LOASACEAE Juss.: *Mentzelia* L.: *M. involucrata* S.Watson • MALVACEAE:



**Fig. 14.** Georeferenced collection records of *Lasioglossum (D.) deludens* sp. nov. (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence.

*Gossypium* • *Sphaeralcea* A.St.-Hil.: *S. ambigua* A.Gray • PAPAVERACEAE: *Arctomecon* Torr. & Frém.: *A. californicum* Torr. & Frém. • *A. merriamii* Coville • *Argemone* • PLANTAGINACEAE Juss.: *Penstemon* Schmidel: *P. palmeri* A.Gray • POLEMONIACEAE Juss.: *Eriastrum* Wooton & Standl.: *E. diffusum* (A.Gray) H.Mason • POLYGONACEAE Juss.: *Eriogonum* Michx.: *E. abertianum* Torr. • *E. deflexum* Torr. • *E. fasciculatum* Benth. • *E. racemosum* Nutt. • *E. trichopes* Torr. • ROSACEAE Juss.: *Heteromeles* M.Roem. • SALICACEAE Mirb.: *Salix* L. • SAPINDACEAE Juss.: *Sapindus* L.: *S. drummondii* Hook. & Arn. • SCROPHULARIACEAE: *Leucophyllum*: *L. frutescens* • SOLANACEAE Juss.: *Chamaesaracha* Franch. & Sav. ex A.Gray: *C. coniodes* (Dunal) Britton • *C. coronopus* (Dunal) A.Gray • *Physalis* L.: *P. acutifolia* (Miers) Sandwith • TAMARICACEAE: *Tamarix*: *T. ramosissima* Ledeb. • VERBENACEAE J.St.-Hil.: *Verbena* L.: *V. bracteata* Cav. ex Lag. & Rodr. • ZYGOPHYLLACEAE R.Br.: *Larrea* Cav.: *L. tridentata* (Sessé & Moc. ex DC.) Coville.

In addition to the above records, some of the floral hosts reported for *L. perparvum* in Moure & Hurd (1987) are likely attributable to *L. deludens* sp. nov.

### DNA barcodes

Seventeen confirmed sequences available (BOLD process IDs: DLII753-07, DLII763-07, DLII771-07, DLII786-07, DLII793-07, DLII795-07, DLII802-07, DLII806-07, DLII809-07, DLII987-07, DLII1075-07, DLII1077-07, DLII1122-07, DIAL1099-07, DIAL1129-07, DIAL1174-07, DIAL1430-09). There is a moderate amount of divergence within these sequences (0.76% maximum intraspecific p-distance). They are closest in terms of p-distance to *L. profundum* sp. nov. (0.95% minimum interspecific p-distance). Two fixed nucleotide substitutions distinguish *L. deludens* sp. nov. from all other Nearctic species of the *L. gemmatum* complex: 346(C) and 471(C) (Supp. file 2).

### Comments

Very common. In the Sonoran Desert, *L. deludens* sp. nov. is one of the two most abundant species of *L. (Dialictus)* along with *L. microlepidoides* (Ellis, 1914). These two species are about equally abundant and together often comprise 50% or more of collections of *L. (Dialictus)* in this area. Many thousands of additional specimens are known to exist but were not examined in this study.

Most specimens determined as *L. perparvum* in various collections prior to this work were actually *L. deludens* sp. nov. This could be due to an initial misidentification which was then propagated by later workers. After the error was discovered, *L. deludens* was usually referred to as “*L. aff. perparvum*” or “*L. nr. perparvum*”. Alternatively, *L. deludens* could have been called “*L. nr. perparvum*” at first, and later workers disregarded the “near”. Approximate dates of identification (especially by George Eickwort, who determined many specimens) would be necessary to distinguish these scenarios. Morphology and DNA barcodes easily distinguish *L. deludens* and *L. perparvum*.

### *Lasioglossum (Dialictus) diabolicum* sp. nov.

[urn:lsid:zoobank.org:act:2E554E7E-C8BF-49C4-AC08-2EB5886A18E3](https://zoobank.org/act:2E554E7E-C8BF-49C4-AC08-2EB5886A18E3)

Figs 15–17, 76D, 87B, 97B, 98A, 99B, 100A, 117B, 119B, 120B

### Diagnosis

Females of *L. diabolicum* sp. nov. have the tegula relatively small (barely reaching posterior margin of mesoscutum in dorsal view if at all), inner posterior margin straight, with a blunt posterior angle or small bump, and mediolateral area usually somewhat sparsely punctate ( $IS \geq 1 PD$ ); mesepisternum punctures usually larger and slightly sparser than hypoepimeron punctures; mesoscutum and mesepisternum sometimes shiny; metapostnotum usually dull with anastomosing rugae; mesoscutum with dense erect



pubescence (each seta less than its length from the next nearest one with intervening setae short but having measurable length up to 0.5 OD); and tegula and metasoma often red-orange.

Females of *L. diabolicum* sp. nov. are most similar to those of *L. deludens* sp. nov., *L. ellisiae*, and *L. perparvum*. Females of *L. deludens* have the tegula impunctate medially, mesoscutum punctures finer in comparison to mesepisternum, and metasoma black to brown. Females of *L. ellisiae* have the mesepisternum punctures as fine and dense as on hypoepimeron, tegula slightly larger (reaching posterior margin of mesoscutum in dorsal view) with inner posterior margin sinuous, and metapostnotum usually shiny with subparallel rugae. In red-tailed forms, *L. diabolicum* usually have the basal half of T1 dark brown, while in *L. ellisiae* it is entirely red. Females of *L. perparvum* have the mesoscutum with much shorter, sparser pubescence (each long erect seta about its length from the next nearest one, with intervening setae no more than stubble), mesoscutum and mesepisternum dull, and metasoma dark brown to black.

Males of *L. diabolicum* sp. nov. have the tegula relatively small (as in the female); mesoscutum usually shiny and coarsely and moderately sparsely punctate (IS = 1–2 PD); mesepisternum usually densely punctate (IS ≤ 1 PD); T1–T2 with discs finely and moderately sparsely punctate (IS = 1–2 PD) and apical rims impunctate; and mesoscutum with numerous long plumose setae (as in the female).

Males of *L. diabolicum* sp. nov. are most similar to those of *L. ellisiae*, *L. helianthi*, and *L. perparvum*. Males of *L. ellisiae* have the mesoscutum more evenly and densely punctate (IS ≤ 1 PD between parapsidal lines) and disc of T2 sometimes more deeply and densely punctate in basal half (IS ≤ 1 PD). Males of *L. helianthi* have the mesoscutum entirely densely punctate (IS ≤ 1 PD) and T1–T2 more deeply and densely punctate (IS ≤ 1 PD) including apical rims in part. Males of *L. perparvum* have the mesoscutum usually tessellate, more finely and densely punctate (IS ≤ 1 PD), and with sparse erect setae (with gaps 0.5 OD or more visible in lateral view) appearing simple at 40 × magnification.

Some other species in the *L. stictaspis* species complex can also be very similar in both sexes, but have the tegula slightly larger (reaching or exceeding posterior margin of mesoscutum in dorsal view) and inner posterior margin concave with a distinct, rounded posterior projection.

### Etymology

The specific epithet ‘*diabolicum*’ is a Latin adjective meaning ‘devilish’. It is a reference to this species’ close relationship to *L. angelicum* sp. nov. and its variable morphology and DNA barcodes which make delimitation and identification very difficult.

### Material examined

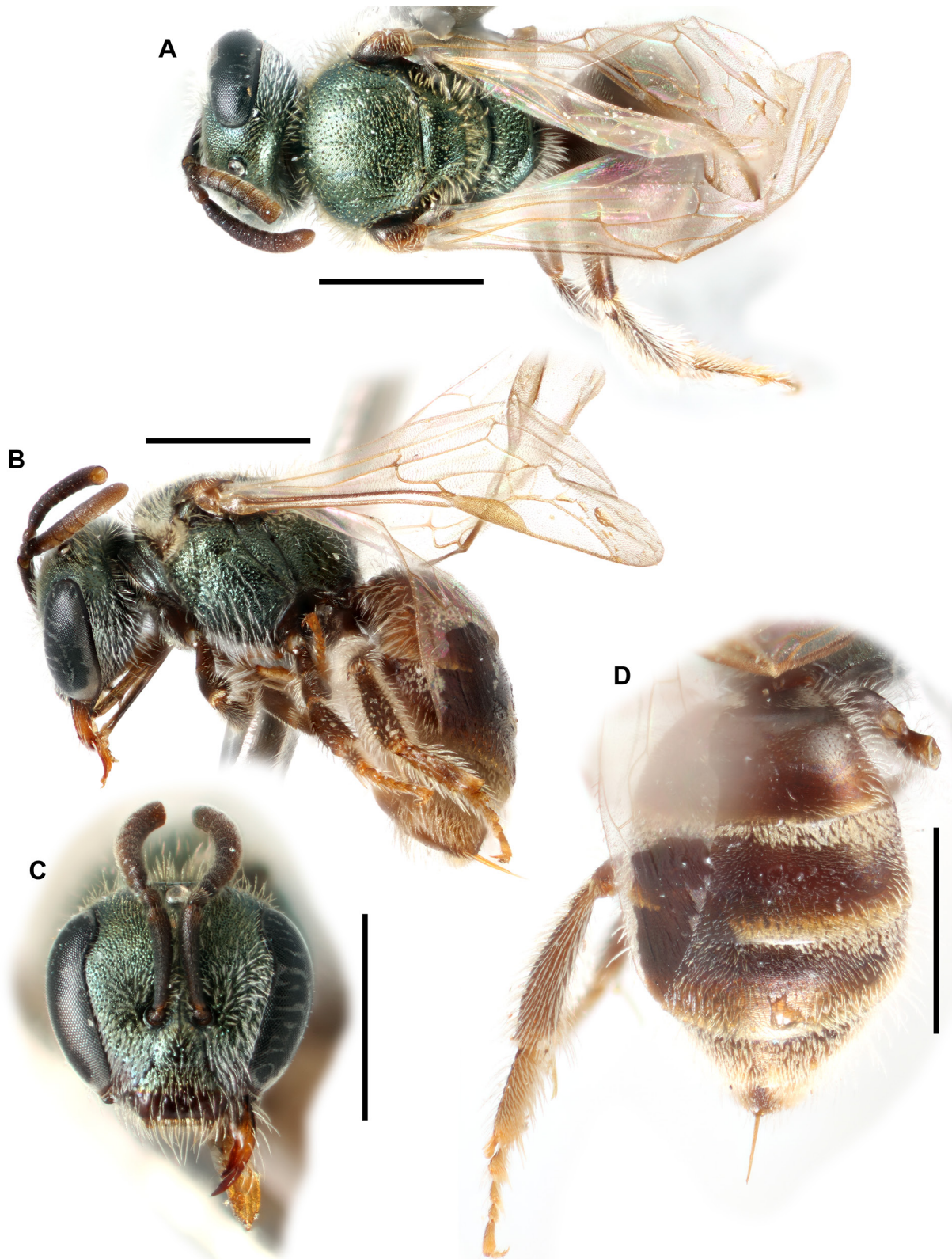
#### Holotype

UNITED STATES – **Utah** • ♀; Garfield Co., The Gulch; 37.8494° N, 111.313° W; 14 Aug. 2001; S. Messinger leg.; ex *Melilotus officinalis* subsp. *alba*; BBSL409921.

[Verbatim label: USA UT Garfield Co. / The Gulch, 12S E4772461 N4189153 // *Melilotus alba* // 14 August 2001 / S. Messinger // NativeBeeSurvey / USDA, Logan, Utah / BBSL409921 // BOLD / BHHT023-09 / B03750811-UT // HOLOTYPE / *Lasioglossum (Dialictus) diabolicum* Gardner and Gibbs]

#### Paratypes

UNITED STATES – **Arizona** • 1 ♀; Yuma; [32.69° N, 114.63° W]; 26 Jun. 1951; L.A. Carruth leg.; UAIC • 1 ♀; *ibid.*; Jun. 1954; J. Ellington leg.; NMSU • 1 ♀; *ibid.*; 13 Apr. 1955; G.D. Butler, F.G. Werner leg.; ex *Pluchea*; UAIC • 1 ♀; *ibid.*; 4 Jun. 1955; G.D. Butler leg.; ex *Solanum* “*elaegnif*”; UAIC. – **California** • 2 ♂♂; Imperial Co., Algodones Dunes, Roadrunner Campground; 32.9° N, 115.1167° W; elev. 66 m; 11–15 Nov. 2007; R.B. Kimsey, L. Kimsey, T.J. Zavortink leg.; UCDC • 1 ♀; Needles;



**Fig. 15.** *Lasioglossum (D.) diabolicum* sp. nov., ♀, holotype (BBSL409921). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma. Scale bars = 1 mm.





**Fig. 16.** *Lasioglossum (D.) diabolicum* sp. nov., ♂ (BBSL488442). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma and propodeum. Scale bars = 1 mm.



[34.85° N, 114.61° W]; “II.III 1922”; J.A. Kusche leg.; CAS CASENT 8416761. – **Colorado** • 2 ♀♀; Mesa Co., 1.34 mi. ESE of Clifton; 39.0832° N, 108.4269° W; 6 Aug. 2015; S.J. Burrows leg.; BBSL983351, BBSL983354 • 1 ♀; Mesa Co., Colorado National Monument, 0.5 mi. inside E entrance; [39.03° N, 108.63° W]; elev. 1524 m; 6 May 1987; U.N. Lanham, M.S. Weissman leg.; ex *Lepidium*; UCMC. – **Nevada** • 1 ♀; Clark Co., 8 mi. S of Overton; [36.42° N, 114.45° W]; 27 Apr. 1972; George E. Bohart, F.D. Parker, P.F. Torchio leg.; ex *Sphaeralcea*; BBSL510025 • 1 ♀; Clark Co., Las Vegas Valley Water District; 36.1756° N, 115.1904° W; elev. 651 m; 10 Jun. 2004; S. Higbee, L. Saul leg.; BBSL537650 • 3 ♀♀; Clark Co., Mesquite; [36.81° N, 114.07° W]; 13 Aug. 1951; E.L. Kessel leg.; CAS • 2 ♀♀; Clark Co., Spring Mountain Ranch; [36.07° N, 115.45° W]; May–Jul. 1988; M.J. Verchick leg.; BBSL700770, BBSL700773 • 2 ♀♀; Las Vegas, 8930 Lansberry Court; 36.1072° N, 115.2863° W; elev. 780 m; 1–20 Jul. 2014; K. Ribardo leg.; UCRC ENT 480495, 480579. – **Utah** • 1 ♀; Emery Co., Bell Canyon, San Rafael Reef; [38.589° N, 110.808° W]; elev. 1524 m; 26 Jul. 1983; F.D. Parker, A. Parker, Terry L. Griswold leg.; BBSL FaunalSurvey No. 000039439 • 1 ♂; *ibid.*; 26 Jul. 1983; F.D. Parker, A. Parker, Terry L. Griswold leg.; BBSL FaunalSurvey No. 000039446 • 2 ♀♀, 1 ♂; *ibid.*; 26 Jul. 1983; F.D. Parker, A. Parker, Terry L. Griswold leg.; CUIC • 1 ♀; Emery Co., Buckskin Spring, north of Goblin Valley; [38.62° N, 110.67° W]; elev. 1554 m; 21 Apr. 1986; Terry L. Griswold leg.; BBSL FaunalSurvey No. 000130265 • 2 ♀♀; Emery Co., Buckskin Spring, north of Goblin Valley; [38.62° N, 110.67° W]; elev. 1570 m; 28 Jul. 1981; F.D. Parker, Terry L. Griswold, D.F. Veirs leg.; BBSL FaunalSurvey No. 000039440, FaunalSurvey No. 000039441 • 1 ♀; Emery Co., Castle Dale; [39.21° N, 111.02° W]; 10 Aug. 1957; Charles D. Michener leg.; ex *Cleome serrulata*; SEMC • 3 ♀♀; Emery Co., Wild Horse Creek north of Goblin Valley; [38.57° N, 110.82° W]; elev. 1494 m; 21–23 Jul. 1981; D.F. Veirs, F.D. Parker, Terry L. Griswold leg.; BBSL FaunalSurvey No. 000039442, FaunalSurvey No. 000039443, FaunalSurvey No. 000039444 • 2 ♀♀; *ibid.*; 21–23 Jul. 1981; D.F. Veirs, F.D. Parker, Terry L. Griswold leg.; CUIC • 1 ♀; *ibid.*; 25–28 Jul. 1983; Parkers, Terry L. Griswold leg.; BBSL FaunalSurvey No. 000039445 • 2 ♂♂; *ibid.*; 25–28 Jul. 1983; Parkers, Terry L. Griswold leg.; CUIC • 1 ♀; Garfield Co., 2.3 mi. S of Hot Canyon; 37.8506° N, 111.3551° W; 19 May 2003; B. Hanson leg.; BBSL516270 • 1 ♀; Garfield Co., Calf Creek; [37.8° N, 111.41° W]; 29 Aug. 1985; F.D. Parker leg.; BBSL700742 • 1 ♀; Garfield Co., Capitol Reef National Park, Sulfur Creek; [38.3° N, 111.3° W]; 26 Jul. 1978; Lindahl leg.; BBSL700743 • 1 ♀; Garfield Co., Escalante River, 1.3 mi. W of Death Hollow junction; 37.7787° N, 111.5326° W; 13 May 2002; J. Richmond leg.; ex *Melilotus officinalis*; BBSL437534 • 1 ♀; Garfield Co., Escalante River, 1.3 mi. W of Death Hollow junction; 37.7808° N, 111.5353° W; 13 May 2001; C. Davidson leg.; ex *Tamarix* sp.; BBSL438836 • 1 ♀; *ibid.*; 24 Aug. 2001; C. Davidson leg.; ex *Melilotus alba*; BBSL419411 • 1 ♀; *ibid.*; 15 Jul. 2002; O.I. Messinge leg.; ex *Tamarix* sp.; BBSL451103 • 1 ♀; Garfield Co., Shooting Canyon; [37.76° N, 110.7° W]; 28 Jul. 1979; Debby Vogt leg.; BBSL700741 • 1 ♀; Grand Co., 3 mi. E of Bartlett Flat; [38.64° N, 109.78° W]; elev. 1524 m; 5 May 1989; Terry L. Griswold leg.; BBSL FaunalSurvey No. 000130266 • 1 ♂; Grand Co., Moab Highway 128, 2 mile marker roadside; [38.6117° N, 109.5513° W]; 15 Aug. 1992; Laurence Packer leg.; PCYU • 1 ♀; Kane Co., 0.22 mi. N of Mudhole Spring; 37.346° N, 111.2135° W; 6 Aug. 2001; K. Moredock leg.; ex *Sphaeralcea* sp.; BBSL410597 • 1 ♀; Kane Co., 0.72 mi. NE of Sunset Natural Arch; 37.3822° N, 111.0374° W; 25 Apr. 2001; Terry L. Griswold leg.; ex *Streptanthella longirostris*; BBSL409348 • 1 ♀; Kane Co., 2 mi. NNW of Duffy Mesa; 37.8507° N, 111.3544° W; 10 May 2001; C. Davidson leg.; ex *Salix exigua*; BBSL401313 • 1 ♂; Kane Co., Paradise Canyon; 37.4048° N, 111.6497° W; 18 Aug. 2003; Terry L. Griswold leg.; ex *Chrysothamnus Greenei*; BBSL488442 • 1 ♀; Millard Co., Oak Creek Canyon; [39.35° N, 112.26° W]; 27 May 1958; G.F. Knowlton leg.; ex *Salix* sp.; SEMC • 1 ♀; San Juan Co., Canyonlands, Box hanging garden; [38.2° N, 109.9° W]; 11 Jul. 1993; J.F. Fowler leg.; BBSL700706 • 2 ♀♀; San Juan Co., Glen Canyon, Camp hanging garden; [37.1° N, 110.9° W]; 26 Jun. 1992; J.F. Fowler leg.; BBSL700843, BBSL700853 • 1 ♀; *ibid.*; 26 Jun. 1992; J.F. Fowler leg.; CUIC • 1 ♂; San Juan Co., Glen Canyon, Hardwood hanging garden; [37.1° N, 110.9° W]; 27 Jul. 1991; J.F. Fowler leg.; ex *Thelypodium integrifolium*; BBSL700845 • 1 ♀; *ibid.*; 31 Jul. 1991; J.F. Fowler leg.; BBSL700849 • 1 ♀; San Juan Co., Glen Canyon, Hook hanging garden; [37.1° N, 110.9° W]; 11 Jun. 1992; J.F. Fowler leg.; ex *Cirsium*

*rydbergii*; BBSL700847 • 1 ♀; San Juan Co., Glen Canyon, Iceberg Canyon; [37.31° N, 110.74° W]; 16 May 1992; J.F. Fowler leg.; CUIC • 4 ♀♀; San Juan Co., Glen Canyon, Pyro hanging garden; [37.1° N, 110.9° W]; 26 Jun. 1992; J.F. Fowler leg.; BBSL700848, BBSL700851, BBSL700852, BBSL700854 • 1 ♀; Washington Co., 0.24 mi. SSW of Angels Landing; 37.266° N, 112.9487° W; 15 May 2006; B. Hays leg.; ex *Tamarix* sp.; BBSL ZION25451 • 1 ♂; Washington Co., 5 mi. Leeds Canyon; [37.31° N, 113.43° W]; 8 Jun. 1964; G.F. Knowlton leg.; SEMC • 1 ♀; Washington Co., Beaver Dam Wash; [37.1° N, 114.02° W]; 10–24 Jun. 1987; BBSL700661 • 2 ♂♂; *ibid.*; 10–24 Jun. 1987; BBSL700819, BBSL700825 • 1 ♀; *ibid.*; 10–24 Jun. 1987; WRME BBSL700669 • 2 ♂♂; *ibid.*; 10–24 Jun. 1987; WRME BBSL700821, BBSL700832 • 2 ♀♀; Washington Co., Hurricane; [37.17° N, 113.29° W]; 29 Apr. 1964; G.F. Knowlton leg.; SEMC • 1 ♂; Washington Co., Leeds; [37.24° N, 113.36° W]; 19 Jul. 1963; G.F. Knowlton leg.; BBSL700841 • 1 ♀; *ibid.*; 28 Apr. 1964; G.F. Knowlton leg.; ex mustard; SEMC • 1 ♀; Washington Co., Mouth E. Virgin River; [37.16° N, 113.016° W]; 8–17 Sep. 1982; C.R. Nelson leg.; BBSL700675 • 1 ♀; Washington Co., Oak Creek Canyon; 37.2113° N, 112.9961° W; 4 May 2006; O.I. Messinge, Terry L. Griswold leg.; BBSL ZION25804 • 2 ♀♀; *ibid.*; 15 May 2006; B. Hays leg.; ex *Penstemon humilis*; BBSL ZION25478, ZION25479 • 1 ♂; Washington Co., Shivwits Indian Reservation; [37.19° N, 113.73° W]; 16 Jun. 1978; Hanson, G.F. Knowlton leg.; BBSL700836 • 1 ♀; Washington Co., St. George; [37.1° N, 113.57° W]; 28 Jun. 1945; G.F. Knowlton leg.; UMSP • 2 ♂♂; *ibid.*; 9 Jun. 1962; G.F. Knowlton leg.; BBSL700839, BBSL700840 • 1 ♂; *ibid.*; 9 Jun. 1962; G.F. Knowlton leg.; WRME BBSL700649 • 1 ♀; *ibid.*; 8 Jun. 1968; G.F. Knowlton leg.; WRME BBSL700677 • 1 ♀; Washington Co., Zion National Park, Birch Creek; [37.32° N, 112.88° W]; 28 Jul. 1965; W.J. Hanson leg.; BBSL700688 • 3 ♀♀; Washington Co., Zion National Park, slide area; [37.3° N, 113° W]; 19–31 Aug. 1982; C.R. Nelson leg.; BBSL700678, BBSL700679, BBSL700680 • 1 ♂; Washington Co., Zion, Snail hanging garden; [37.3° N, 113° W]; 5 Aug. 1991; J.F. Fowler leg.; BBSL700844 • 1 ♀; Wayne Co., Capitol Reef National Park, Freemont River, south of Krueger Orchard; 38.2886° N, 111.2373° W; 24 Jun. 2002; S. Messinger leg.; ex *Melilotus officinalis*; BBSL440041 • 2 ♂♂; *ibid.*; 24 Jun. 2002; S. Messinger leg.; ex *Melilotus officinalis*; BBSL440021, BBSL440040 • 1 ♂; Green River; [39° N, 110.16° W]; 14 Jun. 1945; G.F. Knowlton leg.; UMSP • 1 ♀; Sutherland; [39.39° N, 112.64° W]; 6 May 1958; G.F. Knowlton leg.; SEMC • 1 ♀, 1 ♂; Zion National Park; [37.3° N, 113° W]; 13 Aug. 1929; Paul W. Oman leg.; SEMC.

#### Other material excluded from paratypes

MEXICO – **Sonora** • 1 ♀; Municipio de Agua Prieta; 31.2776° N, 109.0013° W; 28 Apr. 2000; Robert L. Minckley leg.; RLM SBV000588.

UNITED STATES – **Arizona** • 1 ♀; Apache Co., Canyon de Chelly National Monument; [36.13° N, 109.47° W]; 10 Nov. 1968; UCDC • 3 ♀♀; Maricopa Co., Phoenix, Cotton Research Center; [33.404° N, 111.988° W]; 20–21 Sep. 1979; G.D. Butler leg.; ex cotton; UAIC • 1 ♀; Pinal Co., 10 km W of Maricopa; [33.05° N, 112.15° W]; 23 Mar. 1990; Robert L. Minckley, R. Gyuro leg.; SEMC • 2 ♀♀; 3 mi. W of Palo Verde; [33.35° N, 112.73° W]; 21 Feb. 1961; J.C. Bequaert leg.; ex *Dithyrea wislizeni*; UAIC • 1 ♀; Arlington; [33.33° N, 112.76° W]; 9 Jun. 1955; G.D. Butler leg.; ex alfalfa; UAIC • 1 ♀; Cottonwood; [34.74° N, 112.01° W]; 27 Jun. 1957; F.G. Werner, G.D. Butler leg.; ex alfalfa; UAIC • 1 ♀; Gillespie Dam, 5 mi. S of Arlington; [33.25° N, 112.76° W]; 21 Feb. 1961; J.C. Bequaert leg.; ex *Lycium fremontii*; UAIC. – **Nevada** • 2 ♀♀; Nye Co., Ash Meadows National Wildlife Refuge, alkali seep/Devils Hole Road; 36.4126° N, 116.284° W; elev. 701 m; 23 Apr. 2014; Casey M. Delphia leg.; MTEC • 1 ♀; Nye Co., Ash Meadows National Wildlife Refuge, Longstreet Spring; 36.4675° N, 116.3263° W; 23 Apr. 2014; J.B. Runyon leg.; MTEC • 1 ♀; Nye Co., Ash Meadows National Wildlife Refuge, North Entrance; 36.4883° N, 116.3429° W; 26 Mar. 2008; D.A. Tanner leg.; BBSL. – **Utah** • 1 ♂; Emery Co., 2 air mi. W of Little Gilson Butte; [38.59° N, 110.64° W]; 15–17 Sep. 1980; F.D. Parker leg.; BBSL Faunal Survey No. 000039448 • 1 ♀; Utah Co., Provo; [40.23° N, 111.66° W]; 14 Aug. 1950; G.F. Knowlton leg.; BBSL700686 • 1 ♂; Washington Co., Zion National Park, slide area; [37.3° N, 113° W]; 19–31 Aug. 1982; C.R. Nelson leg.; BBSL700838.

## **Description**

### **Female**

**COLOURATION.** Head and mesosoma olive green; clypeus apex black; labrum reddish brown; mandible orange with black base and red apex; flagellum dark brown dorsally, lighter brown ventrally. Pronotal lobe dark brown; legs brown; tegula brown; wing membrane lightly infuscated, veins with subcosta dark brown, otherwise light brown. Metasoma black to reddish brown with rims of terga and sterna narrowly translucent yellow.

**PUBESCENCE.** Body pile colour white to pale yellow. Tomentum dense on pronotal angle and lobe, space between pronotal lobe and tegula, and T2–T3 basolaterally; sparse on gena, metepisternum, and T4. Mesoscutum pubescence moderately to densely plumose. Wing setae dark, short and dense. Acarinarial fan complete, dense. T2 fringes sparse, T3 fringes dense.

**SURFACE SCULPTURE.** Clypeus shiny, with punctures dense in basal third ( $IS < 1$  PD), large and irregularly spaced apically ( $IS < 2$  PD); supraclypeal area shiny, with punctures dense ( $IS \leq 1$  PD); paraocular area weakly imbricate around antenna socket, otherwise shiny, with punctures crowded ( $IS = 0$  PD), irregularly sparser around antenna socket ( $IS < 2$  PD); frons reticulate, with punctures crowded ( $IS = 0$  PD); vertex shiny, with punctures crowded laterally ( $IS = 0$  PD), moderately sparse and obscure medially ( $IS = 1–2$  PD); gena shiny, becoming lineolate posteriorly and ventrally, with punctures fine, moderately dense ( $IS = 1–2$  PD); postgena lineolate. Tegula punctures dense ( $IS < 1$  PD), becoming sparse medially ( $IS = 1–3$  PD); mesoscutum tessellate, with punctures dense ( $IS < 1$  PD), becoming moderately sparse anteromedially ( $IS = 1–2$  PD); scutellum shiny, with punctures dense ( $IS \leq 1$  PD); metapostnotum finely reticulate, with rugae strong, anastomosing, reaching posterior margin; preepisternum ruguloso-punctate; hypopimeron shiny, with punctures crowded ( $IS = 0$  PD); mesepisternum imbricate, with punctures dense ( $IS < 1$  PD); metepisternum finely rugulose; propodeum lateral surface tessellate, posterior surface tessellate. T1 anterior slope coriarius, disc shiny, with punctures fine, moderately sparse ( $IS = 1–3$  PD), absent in large subapicolateral boss and on rim; T2 disc shiny, with punctures fine, moderately dense ( $IS = 1–2$  PD), apical rim weakly coriarius, with punctures minute, sparse ( $IS = 2–4$  PD), obscure.

**STRUCTURE.** Face length/width ratio 0.83 ( $\pm 0.02$  SD); clypeus apicolateral denticles low rounded knobs; gena/eye width ratio 0.88 ( $\pm 0.07$  SD). Pronotal angle obtuse; intertegular span 0.93 ( $\pm 0.08$  SD) mm; mesoscutum length/width ratio 0.86 ( $\pm 0.04$  SD); mesoscutum/scutellum length ratio 2.83 ( $\pm 0.25$  SD); scutellum/metanotum length ratio 1.61 ( $\pm 0.16$  SD); metanotum/metapostnotum length ratio 0.66 ( $\pm 0.06$  SD); forewing with 3 submarginal cells; tegula enlarged, reaching posterior margin of mesoscutum in dorsal view; inner posterior margin straight; tegula length 0.41 ( $\pm 0.03$  SD) mm, width 0.23 ( $\pm 0.02$  SD) mm; propodeum lateral carinae not reaching dorsal margin; oblique carina strong, straight. T2 depressed apical rim less than 50% of tergum. ( $n = 10$ )

**VARIATION.** The tegula punctures can vary from sparse ( $IS = 1–3$  PD) to entirely dense ( $IS < 1$  PD), the mesoscutum punctures can vary from moderately sparse ( $IS = 1–2$  PD) to dense ( $IS < 1$  PD), the mesoscutum and mesepisternum are usually dull and strongly tessellate or imbricate but can be somewhat shiny; the metapostnotum can vary from shiny with coarse rugae to dull with fine rugae, and the tegula and metasoma can vary from dark brown to bright orange.

### **Male**

**COLOURATION.** Head and mesosoma blue to blue-green; clypeus apex black; labrum black; mandible orange with black base and red apex; flagellum dark reddish brown dorsally, light brown ventrally. Pronotal lobe dark reddish brown; legs dark reddish brown with femur-tibia joints and tarsi becoming light brown; tegula reddish brown; wing membrane hyaline, veins dark brown. Metasoma black with



depressed apical rims of terga and sterna reddish brown, downcurved lateral areas of terga becoming translucent brown.

**PUBESCENCE.** Body pile colour white. Tomentum dense on face below eye emargination, pronotal collar and lobe, and space between pronotal lobe and tegula; very sparse on gena, preëpisternum, and T2–T3 basolaterally. Mesoscutum pubescence simple to moderately plumose. Wing setae dark, short and dense. Sterna pubescence short (~1 OD), moderately plumose, sparse.

**SURFACE SCULPTURE.** Clypeus shiny, with punctures dense (IS < 1 PD); supraclypeal area shiny to weakly imbricate, with punctures dense (IS < 1 PD) with impunctate median line 1 PD or more wide; paraocular area shiny, with punctures dense (IS < 1 PD); frons reticulate, with punctures crowded (IS = 0 PD); vertex shiny, with punctures dense laterally (IS < 1 PD), moderately dense medially (IS = 1–2 PD); gena shiny, with punctures fine, moderately sparse (IS = 1–2 PD); postgena shiny to weakly lineate. Tegula punctures dense (IS < 1 PD), becoming fine and moderately sparse laterally (IS = 1–2 PD); mesoscutum shiny, becoming weakly tessellate anteromedially, with punctures dense (IS ≤ 1.5 PD), becoming crowded marginally (IS = 0 PD); scutellum shiny, with punctures dense (IS ≤ 1.5 PD), becoming crowded marginally (IS = 0 PD); metanotum shiny to weakly imbricate and densely punctate (IS ≤ 1 PD); metapostnotum shiny to finely reticulate, with rugae strong, anastomosing, reaching posterior margin; preëpisternum areolate; hypoepimeron shiny, with punctures crowded (IS = 0 PD); mesepisternum shiny, with punctures dense (IS < 1 PD); metepisternum areolate; propodeum lateral surface areolate to rugulose, with punctures crowded (IS = 0 PD), posterior surface shiny with crowded punctures (IS = 0 PD), becoming areolate laterally. T1 anterior slope shiny, disc shiny, with punctures fine, moderately sparse (IS = 1–3 PD), absent in small subapicolateral boss and on rim; T2 disc shiny, with punctures fine, moderately sparse (IS = 1–2 PD), apical rim shiny, with punctures absent.

**STRUCTURE.** Face length/width ratio 0.85 (±0.03 SD); gena/eye width ratio 0.67 (±0.06 SD). Pronotal angle obtuse; intertegular span 0.68 (±0.05 SD) mm; mesoscutum length/width ratio 0.95 (±0.03 SD); mesoscutum/scutellum length ratio 2.68 (±0.09 SD); scutellum/metanotum length ratio 1.84 (±0.13 SD); metanotum/metapostnotum length ratio 0.7 (±0.07 SD); forewing with 3 submarginal cells; tegula enlarged, nearly reaching posterior margin of mesoscutum in dorsal view; inner posterior margin weakly concave; tegula length 0.35 (±0.02 SD) mm, width 0.19 (±0.01 SD) mm; propodeum lateral carinae not reaching dorsal margin; oblique carina absent. (n = 10)

**GENITALIA.** As in Fig. 76D. Gonocoxite nearly 2 times as broad as gonostylus. Gonostylus rounded, slightly concave on outer margin, with sparse long setae dorsally and short setae along inner margin. Penis valves parallel. Retrorse lobe rounded, about 3 times as long as broad, with sparse short setae on basal half and apical margin.

**VARIATION.** The tegula can sometimes be entirely densely punctate (IS < 1 PD), the mesoscutum punctation can vary from mostly dense (IS ≤ 1 PD) to sparse (IS = 1–3 PD), the metapostnotum can vary from shiny with strong rugae to dull with fine rugae, and the head and mesosoma can vary from blue to golden-green.

### Range

Western Colorado, Utah, and southern Nevada, south along the Colorado River valley and east along the Gila River valley to Phoenix, Arizona (Fig. 17).

### Floral hosts

ASTERACEAE: *Chrysothamnus* Nutt.: *C. greenei* (A.Gray) Greene • *Cirsium* Mill.: *C. rydbergii* Petr. • *Pluchea* Cass. • BRASSICACEAE: *Dimorphocarpa* Rollins: *D. wislizeni* (Engelm.) Rollins • *Lepidium* • *Streptanthella* Rydb.: *S. longirostris* (S.Watson) Rydb. • *Thelypodium* Endl.: *T. integrifolium* (Nutt.)

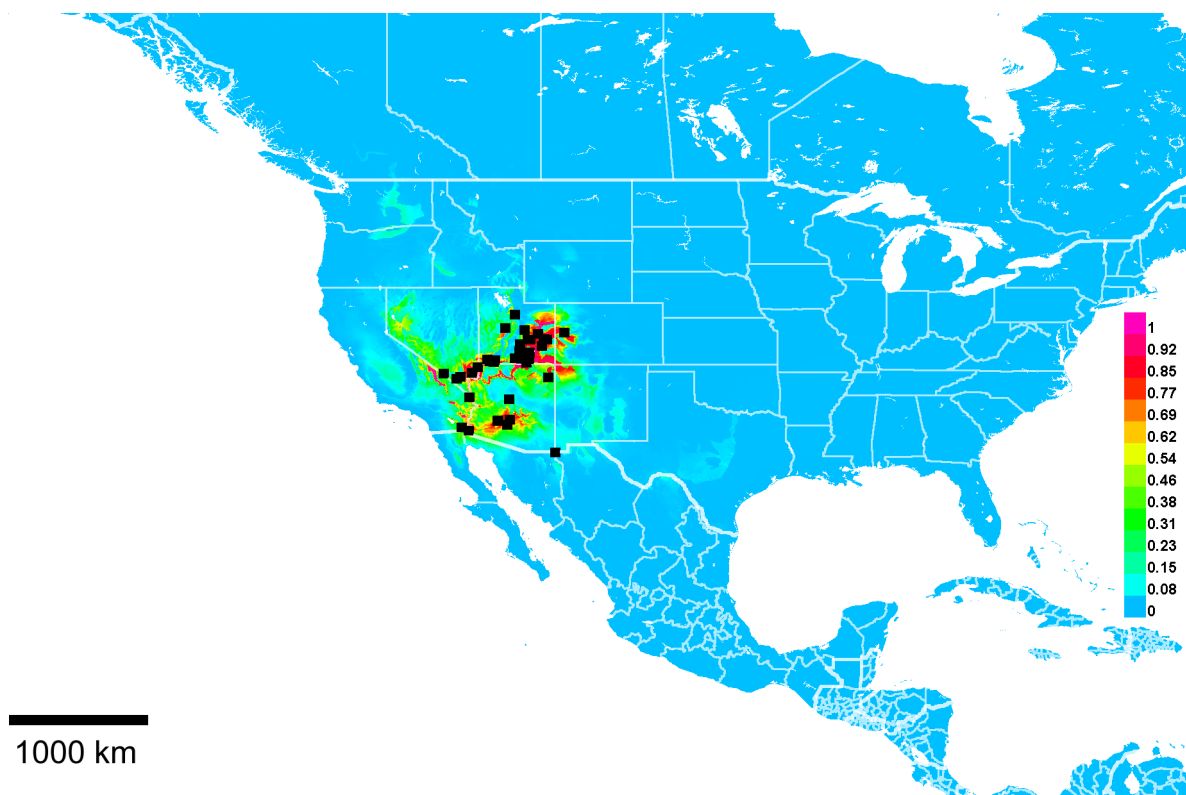
Endl. • CLEOMACEAE: *Cleome* L.: *C. serrulata* Pursh • FABACEAE: *Medicago*: *M. sativa* • *Melilotus*: *M. officinalis*: *M. o.* subsp. *alba* • MALVACEAE: *Gossypium* • *Sphaeralcea* • PLANTAGINACEAE: *Penstemon*: *P. humilis* Nutt. ex A.Gray • SALICACEAE: *Salix*: *S. exigua* Nutt. • SOLANACEAE: *Lycium* L.: *L. fremontii* A.Gray • *Solanum* L.: *S. elaeagnifolium* Cav. • TAMARICACEAE: *Tamarix*.

### DNA barcodes

Eleven confirmed sequences available, three haplotypes (BOLD process IDs: BHTT023-09, DLII890-07, DLII1067-07, DLII1099-07, DLII1232-08, DLII1233-08, DLII1694-09, DLII1696-09 (haplotype 1); DLII940-07, DLII1677-09 (haplotype 2); DLIII124-18 (haplotype 3)). There is a large amount of divergence within these sequences (2.29% maximum intraspecific p-distance). They are closest in terms of p-distance to the *L. stictaspis* species complex (0% minimum interspecific p-distance). No fixed nucleotide substitutions distinguish all *L. diabolicum* sp. nov. from all other Nearctic species of the *L. gemmatum* complex, but three fixed substitutions distinguish haplotype 1: 33(G), 111(C), and 588(C) (Supp. file 2).

### Comments

Some specimens with the tegula slightly larger and more densely punctate than usual are extremely difficult to separate from *L. stictaspis*, and are therefore excluded from paratype status. These specimens may be hybrids or a separate, cryptic species. The barcoded haplotype 3 specimen is one such specimen, but the haplotype 2 specimens are morphologically indistinguishable from haplotype 1 (which includes the holotype). It is thought that haplotype 1 is the ‘natural’ barcode sequence of *L. diabolicum* sp. nov., and the additional haplotypes are a result of introgression or incomplete lineage sorting.



**Fig. 17.** Georeferenced collection records of *Lasioglossum (D.) diabolicum* sp. nov. (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence.

***Lasioglossum (Dialictus) ellisiae*** (Sandhouse, 1924)

Figs 18–20, 95B, 99A, 102B, 113B, 120A

*Halictus (Chloralictus) ellisiae* Sandhouse, 1924: 11 (holotype, ♀, deposited in USNM, type no. 26400, USNMENT01570255, examined).

*Halictus hunteri* Crawford, 1932: 72 (holotype, ♀, deposited in USNM, examined) **syn. nov.**

*Halictus (Chloralictus) ellisiae* – Graenicher 1927: 205 (comparative notes with *lepidii*).

*Lasioglossum (Chloralictus) ellisiae* – Michener 1951: 1113 (catalogue).

*Lasioglossum (Chloralictus) hunteri* – Michener 1951: 1114 (catalogue).

*Dialictus tegularis* – Mitchell 1960: 423 (in part, synonymy, redescription). — Hurd 1979: 1972 (in part, catalogue). — Moure & Hurd 1987: 134 (in part, catalogue).

*Lasioglossum tegulare* – Donovall & vanEngelsdorp 2010: 16 (in part, checklist).

*Lasioglossum (Dialictus) tegulare* – Krombein 1967: 466 (in part, catalogue).

*Dialictus hunteri* – Hurd 1979: 1966 (catalogue). — Moure & Hurd 1987: 104 (catalogue).

*Lasioglossum (Dialictus) ellisiae* – Gibbs 2009a: 18 (resurrection from synonymy, revision); 2010: 37, 45 (key to species), 120 (redescription); 2011: 25, 32 (key to species), 88 (review). — Wolf & Ascher 2009: 143 (checklist). — Gibbs *et al.* 2013: 80 (checklist). — Dibble *et al.* 2017: 13 (checklist). — Kilpatrick *et al.* 2020: 54 (checklist).

### Diagnosis

Females of *L. ellisiae* have the tegula somewhat small (reaching and sometimes slightly exceeding posterior margin of mesoscutum in dorsal view), relatively sparsely punctate laterally at midlength (at least IS = 1 PD, up to IS = 1–3 PD), and inner posterior margin weakly concave, with a gentle S-shaped curve coming to a narrow rounded point posteriorly; mesepisternum punctures distinct, round, and about as fine and dense as those of hypoepimeron; metapostnotum shiny with coarse rugae reaching posterior margin; mesoscutum and mesepisternum usually shiny or with weak microsculpture; T1 anterior slope coriaceous; T3 without subapical band of tomentum (rarely with some sparse tomentum apicolaterally); and tegula and metasoma sometimes red-orange.

Females of *L. ellisiae* are most similar to those of *L. diabolicum* sp. nov., *L. gaudiale*, *L. indagator* sp. nov., and *L. tegulare*. Females of *L. diabolicum* have the tegula slightly smaller (often not reaching posterior margin of mesoscutum in dorsal view) with inner posterior margin usually straight and metapostnotum usually dulled by strong microsculpture. Females of *L. gaudiale* have the T1 anterior slope shiny with microsculpture absent or very weak and the tegula inner posterior margin more strongly concave. Females of *L. indagator* have the metapostnotal rugae usually not reaching posterior margin and more extensive tomentum on the mesoscutum lateral and posterior margins, metanotum, and pleura. Females of *L. tegulare* have the mesoscutum and mesepisternum entirely dull with strong microsculpture and mesepisternum with crowded punctures (IS = 0 PD) some of which are not distinctly round. Some other species in the *L. stictaspis* species complex (particularly *L. stictaspis* s. str.) can also be very similar, but have the mesepisternum punctures larger and slightly sparser than those of hypoepimeron, mesoscutum more irregularly and sparsely punctate (as in *L. diabolicum*), tegula inner posterior margin usually more strongly concave and usually more densely punctate (IS ≤ 1 PD), metapostnotum usually dull with fine rugae, and T3 usually with dense and complete subapical band of tomentum.

Males of *L. ellisiae* have the tegula somewhat small (as in the female); metapostnotum usually shiny with strong subparallel rugae; mesoscutum between parapsidal lines uniformly densely punctate (IS ≤ 1 PD); and discs of T2–T3 becoming more sparsely punctate on premarginal line, not contrasting with impunctate apical rims (punctures in basal half of T2–T3 may be deep and dense (IS ≤ 1 PD) or fine and moderately sparse (IS = 1–2 PD)).



Males of *L. ellisiae* are most similar to those of *L. diabolicum* sp. nov., *L. lepidii*, *L. puteulanum*, and *L. tegulare*. All of these species have the mesoscutum more irregularly and slightly more sparsely punctate between the parapsidal lines (some IS < 1 PD and some IS = 1–2 PD). Males of *L. diabolicum* and *L. lepidii* have the disc of T2 uniformly finely and moderately sparsely punctate (IS = 1–2 PD). In direct comparison, males of *L. lepidii* also have the facial tomentum denser and more tightly appressed (more completely obscuring the surface underneath) and the mesothoracic spiracle more deeply impressed. Males of *L. puteulanum* and *L. tegulare* have the disc of T2 uniformly deeply and densely punctate (IS ≤ 1 PD) including the premarginal line. Some other species in the *L. stictaspis* species complex can also be very similar, but have the tegula slightly larger, with inner posterior margin more strongly concave, and more often entirely densely punctate (IS < 1 PD) and mesoscutum more irregularly and sparsely punctate (as above).

### Etymology

Sandhouse (1924) dedicated this species to her fellow bee taxonomist Marion Durbin Ellis.

### Material examined

#### Holotype

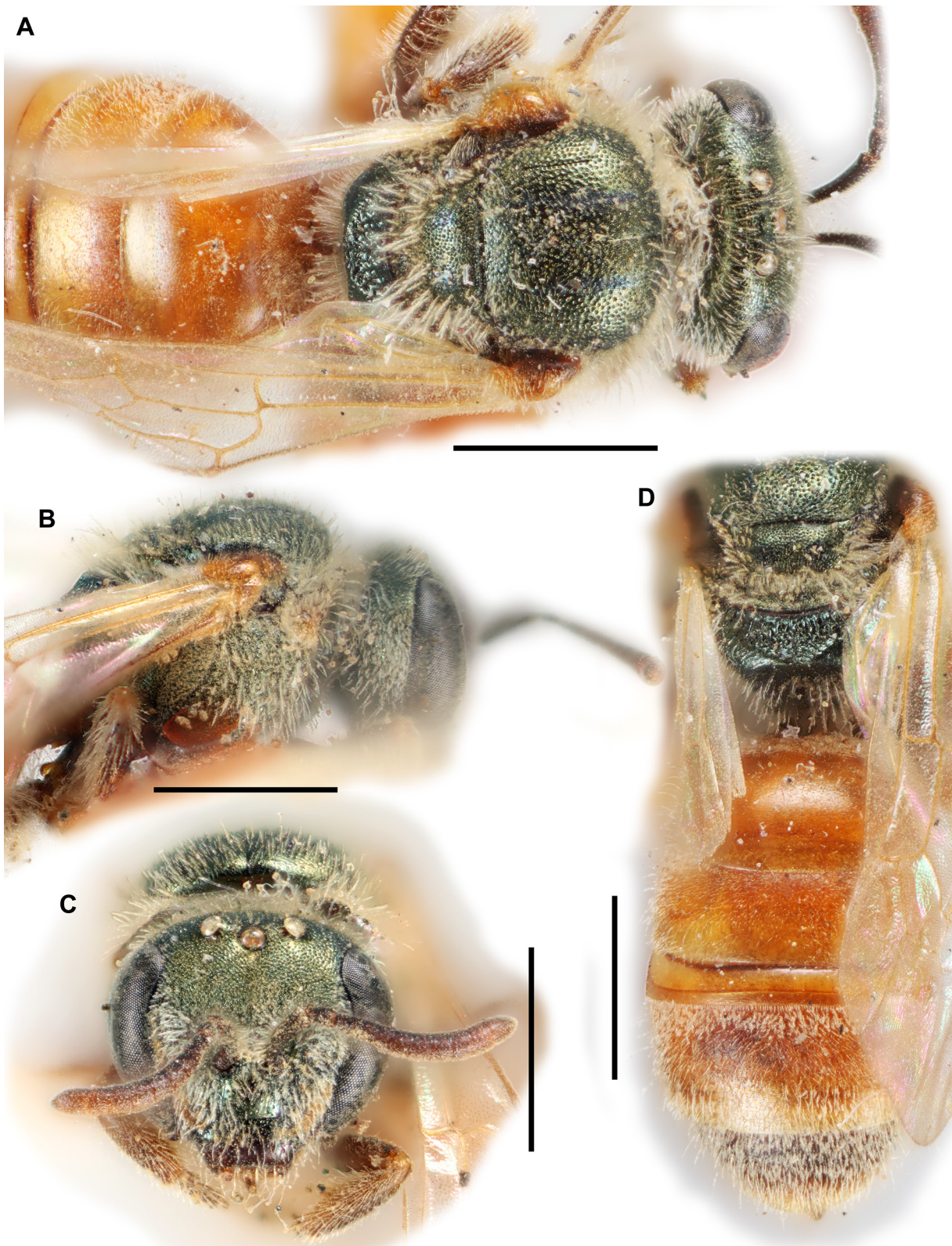
UNITED STATES – **Massachusetts** • 1 ♀; Forest Hills; [42.29° N, 71.11° W]; 5 Aug. 1911; USNM 26400.

#### Other material

CANADA – **Manitoba** • 1 ♀; Delta Beach along Hackberry Road, near Portage La Prairie; 50.18585° N, 98.32591° W; 2–5 Aug. 2007; A.M. Patenaude leg.; WRME • 2 ♀♀; Hadashville; 49.6761° N, 95.8984° W; 28 May 2019; K. Morgan and S. Shukla leg.; WRME 0419384, 0419385 • 1 ♀; Portage La Prairie; 49.93° N, 98.33° W; 27 Jun. 2018; E. Hanuschuk leg.; WRME 0390284. – **Ontario** • 1 ♀; Haldimand-Norfolk Co., Nixon West Pr.; [42.85° N, 80.4° W]; 11 May 1998; H. Douglas leg.; PCYU • 1 ♀; *ibid.*; 28 May 1998; H. Douglas leg.; PCYU • 1 ♀; Leamington; [42.05° N, 82.6° W]; 17 Aug. 1987; T.D. Galloway leg.; WRME 0293748 • 1 ♀; Ottawa; [45.42° N, 75.7° W]; 6 Aug. 1981; L. Masner leg.; TAMU-ENTO X1396609 • 1 ♂; *ibid.*; 6 Aug. 1981; L. Masner leg.; TAMU-ENTO X1383279 • 1 ♀; Pterophylla Plant Nursery; 42.6401° N, 80.573° W; 13–22 Aug. 2006; P.J. Carson leg.; PCYU • 1 ♀; Toronto, Cedarvale Park; 43.69° N, 79.42° W; 30 Aug. 2008; J. Gibbs and Y. Nozoe leg.; WRME 0427965 • 1 ♀; Toronto, Ulster Street; 43.65898° N, 79.41332° W; Oct. 2006; J. Gibbs leg.; PCYU • 1 ♂; Toronto, York campus; 43.773° N, 79.506° W; 11 Aug. 2008; J. Gibbs leg.; WRME 0427964.

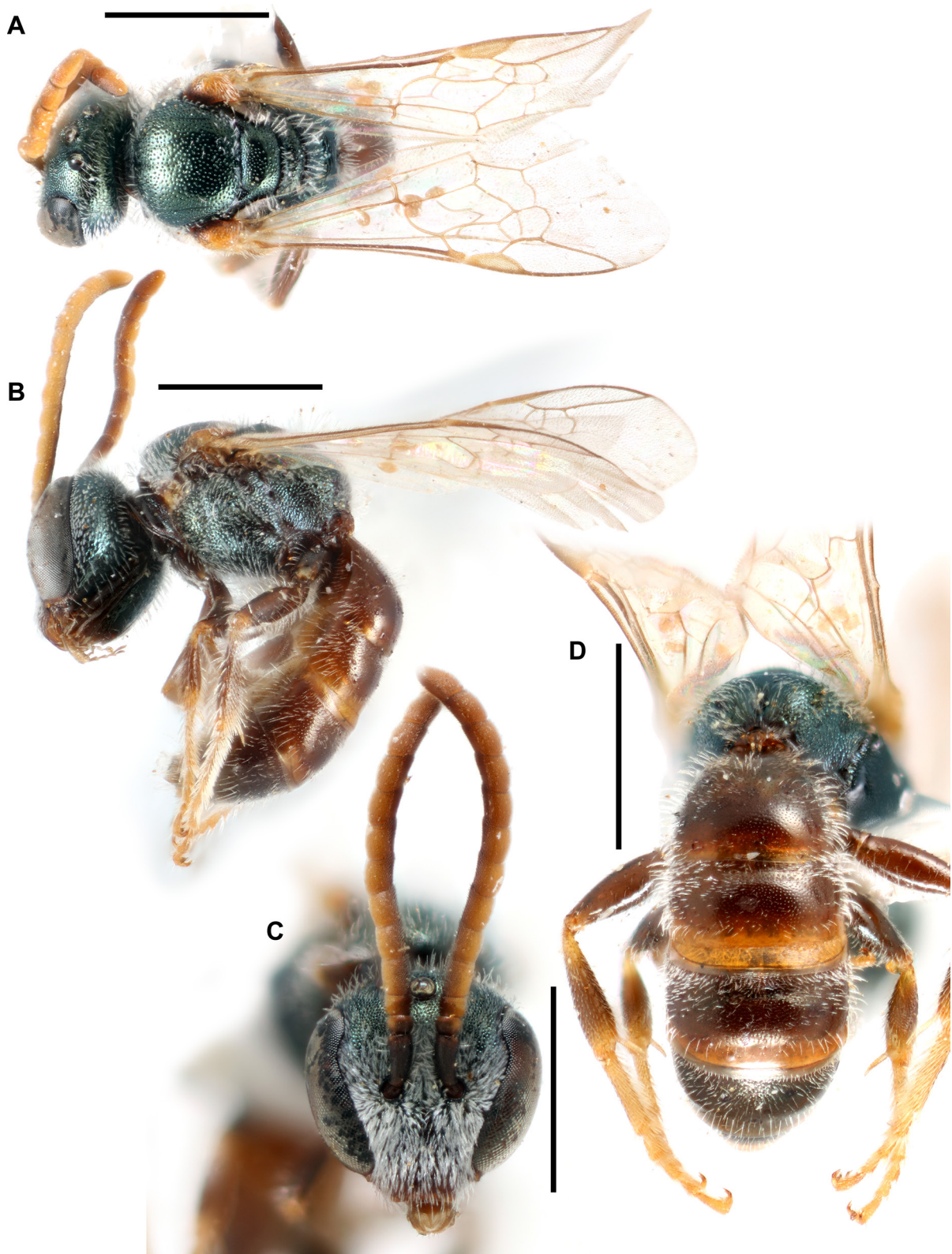
MEXICO – **Tamaulipas** • 1 ♀; 8 mi. NE of San Fernando; [24.93° N, 98.06° W]; 27 Aug. 1954; SEMC.

UNITED STATES – **Colorado** • 5 ♀♀; El Paso Co., Foster Ranch, T15S R65W Sec. 14 S1/2; [38.741° N, 104.637° W]; elev. 1737 m; 30 May 1976; F.M. Brown leg.; ex *Cardaria*; UCMC • 2 ♀♀; *ibid.*; 26 Apr. 1977; F.M. Brown leg.; ex *Cymopterus*; UCMC • 2 ♀♀; *ibid.*; 27 Apr. 1977; F.M. Brown leg.; ex *Cymopterus*; UCMC • 2 ♀♀; *ibid.*; 3 May 1977; F.M. Brown leg.; ex *Cymopterus*; UCMC • 1 ♀; *ibid.*; 31 May 1977; F.M. Brown leg.; ex *Cardaria*; UCMC • 1 ♀; El Paso Co., Foster Ranch, T15S R65W Sec. 14 SW1/4; [38.741° N, 104.642° W]; elev. 1737 m; 29 May 1978; G.H. Kemper leg.; ex *Cardaria*; UCMC • 3 ♀♀; El Paso Co., Foster Ranch, T15S R65W Sec. 22 NE1/4; [38.734° N, 104.651° W]; elev. 1737 m; 10 Jun. 1976; F.M. Brown leg.; ex *Cardaria*; UCMC • 1 ♀; *ibid.*; 29 Apr. 1977; F.M. Brown leg.; ex dandelion; UCMC • 3 ♀♀; *ibid.*; 22 May 1977; F.M. Brown leg.; ex *Cardaria*; UCMC • 3 ♀♀; *ibid.*; 22 May 1977; G.H. Kemper leg.; ex *Cardaria*; UCMC • 1 ♀; *ibid.*; 31 May 1977; F.M. Brown leg.; ex dandelion; UCMC • 3 ♀♀; *ibid.*; 31 May 1977; F.M. Brown leg.; ex *Cardaria*; UCMC • 2 ♀♀; *ibid.*; 14 Apr. 1978; F.M. Brown leg.; ex *Lepidium*; UCMC • 2 ♀♀; *ibid.*; 24 Apr. 1978; F.M. Brown leg.; ex *Lepidium*; UCMC • 1 ♀; *ibid.*; 26 Apr. 1978; F.M. Brown leg.; ex *Prunus*; UCMC • 1 ♀; *ibid.*; 22 May 1978; F.M. Brown leg.; ex dandelion; UCMC • 2 ♀♀; *ibid.*; 22 May 1978; F.M. Brown leg.; ex *Lepidium*;



**Fig. 18.** *Lasioglossum (D.) ellisiae* (Sandhouse, 1924), ♀, holotype of *L. (D.) hunteri* (Crawford, 1932) (USNM). **A.** Mesonotum. **B.** Mesepisternum. **C.** Face. **D.** Metasoma and propodeum. Scale bars = 1 mm.





**Fig. 19.** *Lasioglossum (D.) ellisiae* (Sandhouse, 1924), red-tailed ♂ (BBSL). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma. Scale bars = 1 mm.



UCMC • 1 ♀; *ibid.*; 6 Jun. 1978; F.M. Brown leg.; ex *Cardaria*; UCMC • 1 ♀; *ibid.*; 25 Jul. 1978; F.M. Brown leg.; ex *Melilotus*; UCMC • 1 ♀; *ibid.*; 28 Jul. 1978; F.M. Brown leg.; ex *Melilotus*; UCMC • 1 ♀; *ibid.*; 15 Aug. 1978; F.M. Brown leg.; ex *Eriogonum effusum*; UCMC • 1 ♀; *ibid.*; 29 Sep. 1978; F.M. Brown leg.; ex *Aster*; UCMC • 7 ♀♀; *ibid.*; 10 Jun. 1980; F.M. Brown leg.; ex *Cardaria*; UCMC • 1 ♀; *ibid.*; 2 May 1981; F.M. Brown leg.; ex sandy stream bed; UCMC • 1 ♀; *ibid.*; 22 May 1981; F.M. Brown leg.; ex dandelion; CUIC • 1 ♀; *ibid.*; 22 May 1981; F.M. Brown leg.; ex dandelion; UCMC • 1 ♀; *ibid.*; 25 May 1981; F.M. Brown leg.; ex *Cardaria*; UCMC • 1 ♀; *ibid.*; 25 May 1981; F.M. Brown leg.; UCMC • 9 ♀♀; El Paso Co., Foster Ranch, T15S R65W Sec. 23 N1/2; [38.734° N, 104.638° W]; elev. 1737 m; 13 Jun. 1976; F.M. Brown leg.; ex *Cardaria*; UCMC • 2 ♀♀; *ibid.*; 10 May 1977; F.M. Brown leg.; ex dandelion; UCMC • 2 ♀♀; Logan Co.; 40.56755° N, 103.50417° W; 31 May 2012; M. Vandever *et al.* leg.; CSUC • 1 ♀; Logan Co.; 40.572° N, 103.54303° W; 14 Jun. 2012; M. Vandever *et al.* leg.; CSUC • 1 ♀; Logan Co.; 40.58675° N, 103.54398° W; 12 Jul. 2012; M. Vandever *et al.* leg.; CSUC • 1 ♀; Prowers Co., 1 mi. S of Granada; [38.05° N, 102.31° W]; 28 Aug. 1963; N. and B. Marston leg.; AMNH • 1 ♀; Yuma Co., Bonny Dam State Recreation Area, 21 mi. N of Burlington; [39.61° N, 102.18° W]; 10 Jul. 1976; E.R. Hoebeke leg.; CUIC • 1 ♂; Boulder; [40.01° N, 105.27° W]; 1 Aug. 1903; S.A. Rohwer leg.; UCMC • 2 ♀♀; Fort Lupton; [40.08° N, 104.81° W]; 20 Jun. 1950; C.D. Michener leg.; ex *Rorippa sinuata*; SEMC • 1 ♀; Julesburg; 40.9833° N, 102.25° W; elev. 1055 m; 7 Jun. 1920; AMNH • 1 ♀; Lamar; [38.09° N, 102.62° W]; 22 Jul. 1950; C.D. Michener leg.; ex *Melilotus alba*; SEMC • 1 ♀; Logan City; 40.58675° N, 103.54398° W; 12 Jul. 2012; M. Vandever *et al.* leg.; CSUC • 5 ♀♀; Regnier; 37° N, 102.8333° W; elev. 1372 m; 6–9 Jun. 1919; AMNH. – **Illinois** • 3 ♀♀; Bureau Co., 3 mi. NW of La Moille; [41.56° N, 89.32° W]; 13 May 1970; LaBerge and Molina leg.; ex *Salix*; INHS • 1 ♀; Champaign Co., Brownfield Woods, Urbana; [40.145° N, 88.165° W]; 29 Mar. 1968; LaBerge and Ribble leg.; INHS • 1 ♀; Kankakee Co., Hooper Branch; [41.02° N, 87.54° W]; 2 Jul. 2003; R.P. Jean leg.; ex sumac; PCYU • 1 ♀; Lake Co., 2 mi. NW of Volo; [42.35° N, 88.2° W]; 22 Jun. 1967; LaBerge and Ribble leg.; INHS • 1 ♀; Lake Co., Long Lake, bog; [42.37° N, 88.12° W]; 11 Aug. 1906; ex smartweed; INHS • 1 ♂; Macoupin Co., Plainview; [39.16° N, 89.99° W]; 22 Jul. 1915; INHS • 1 ♀; Mason Co., Bath; [40.19° N, 90.14° W]; 2 Jul. 1968; J.C. Marlin leg.; INHS • 1 ♀; Mason Co., Mason State Forest; [40.39° N, 89.87° W]; 2 Jun. 1966; W.J. Knee leg.; INHS • 1 ♀; McHenry Co., Chain O'Lakes State Park; [42.46° N, 88.19° W]; 22 Jun. 1967; LaBerge and Ribble leg.; INHS • 1 ♀; Whiteside Co., Morrison; [41.81° N, 89.97° W]; 10 Jul. 1968; J.C. Marlin leg.; INHS • 1 ♀; Woodford Co., 9 mi. N of East Peoria; [40.8° N, 89.58° W]; 7 Aug. 1968; J.C. Marlin leg.; INHS • 10 ♀♀; Algonquin; [42.17° N, 88.29° W]; 16 Jun. 1909; Nason leg.; INHS • 2 ♀♀; *ibid.*; 24 Jun. 1909; Nason leg.; INHS. – **Indiana** • 1 ♀; Jackson Co.; 38.8799° N, 86.056° W; 26 Jul. 2003; S.W. Droege leg.; PCYU USGS-DRO 020992 • 2 ♀♀; Jasper Co., Nipsco; [41.22° N, 87.03° W]; 16 Jul. 2003; R.P. Jean leg.; PCYU. – **Iowa** • 1 ♂; Allamakee Co., Weymiller Prairie, 12.5 km N of Lansing; 43.4542° N, 91.3036° W; elev. 323 m; 14 Aug. 2005; J. Krippel leg.; PCYU • 1 ♀; Hamilton Co., Union Pacific Railroad, 0.8 km S of Randall; 42.2228° N, 93.6° W; elev. 311 m; 18 May 2004; C. Hemsley leg.; PCYU • 1 ♀; Story Co.; 42.1138° N, 93.5856° W; 19 Jun. 2007; J. Hopwood leg.; PCYU • 1 ♀; Story Co.; 42.113° N, 93.5894° W; 31 Jul. 2007; J. Hopwood leg.; PCYU • 1 ♀; *ibid.*; 1 Aug. 2007; J. Hopwood leg.; PCYU • 1 ♂; Warren Co., 1.5 miles east of Hartford; [41.46° N, 93.38° W]; 5–6 Jul. 1976; J.C. Schaffner leg.; TAMU-ENTO X1399456. – **Kansas** • 1 ♀; Douglas Co., Lawrence vicinity; [38.96° N, 95.25° W]; 6 Jul. 1957; E. Ordway leg.; SEMC • 1 ♀; Haskell Co., 2 mi. SW of Satanta; [37.42° N, 101.02° W]; 21 Aug. 1966; W.J. Hanson leg.; BBSL700690 • 1 ♀; 15 mi. W of Kalvesta; [38.06° N, 100.56° W]; 12 Jun. 1952; Wille, Michener leg.; ex *Melilotus officinalis*; SEMC • 1 ♂; Kinsley; [37.92° N, 99.41° W]; 27 Jul. 1950; R.H. Beamer leg.; ex *Euphorbia nuttallii*; SEMC • 3 ♀♀; Meade; [37.29° N, 100.34° W]; 16 Jun. 1949; Michener, Beamer leg.; SEMC • 1 ♀; Pierceville; [37.88° N, 100.68° W]; 11 Jun. 1952; Wille, Michener leg.; ex *Thelesperma gracile*; SEMC • 1 ♀; Protection; [37.2° N, 99.48° W]; 17 Jun. 1949; Michener, Beamer leg.; SEMC • 1 ♀; Satanta; [37.44° N, 100.99° W]; 16 Jun. 1949; Michener, Beamer leg.; SEMC. – **Massachusetts** • 1 ♂; Franklin Co., 0.86 mi. SSW of W. Hawley; [42.598° N, 72.932° W]; 19 Jul. 2006; M.F. Veit leg.; PCYU • 2 ♀♀; Middlesex Co., 0.1 mi. E of Airport; [42.694° N, 71.551° W]; 29 Apr. 2006; M.F. Veit leg.; PCYU • 1 ♀;

Middlesex Co., 0.2 mi. S of Townsend Gravel Pit; [42.66° N, 71.71° W]; 27 May 2006; M.F. Veit leg.; PCYU. – **Michigan** • 1 ♀; Ingham Co., Fenner Arboretum; 42.709° N, 84.522° W; 10 Aug. 2013; J. Gibbs leg.; WRME 0413041 • 1 ♂; *ibid.*; 10 Aug. 2013; J. Gibbs leg.; WRME • 1 ♀; Ingham Co., Haslett, Interurban path; 42.741° N, 84.419° W; 21 Jul. 2013; J. Gibbs leg.; WRME 0413042 • 1 ♀; Ingham Co., Lansing River Trail; 42.707° N, 84.528° W; 3 Aug. 2013; J. Gibbs leg.; WRME 0414021 • 1 ♂; *ibid.*; 3 Aug. 2013; J. Gibbs leg.; WRME 0414005 • 1 ♀; Ingham Co., MSU, south campus; 42.72° N, 84.473° W; 23 Aug. 2013; J. Gibbs leg.; WRME • 1 ♂; Van Buren Co., Paw Paw Prairie Fen Nature Preserve; 42.172° N, 85.768° W; 7 Jul. 2018; T.J. Wood leg.; WRME 0401748 • 1 ♀; Washtenau Co., Ann Arbor; [42.28° N, 83.74° W]; Sep. 1976; R.W. Carlson leg.; SEMC. – **Minnesota** • 1 ♀; Clay Co., 3 mi. E, 2 mi. S of Felton, Felton Prairie; 47.0472° N, 96.4379° W; 21 Jul. 2006; R.L. Andres leg.; PCYU • 1 ♀; Swift Co., Bengtson WPA; 45.2593° N, 95.2977° W; 2–3 Jul. 2017; Pennarola and Leone leg.; UMSP USGS-DRO 512761. – **Nebraska** • 1 ♂; Keith Co., Ogallala; [41.13° N, 101.72° W]; 17 Jun. 1963; R.M. Bohart leg.; UCDC • 2 ♀♀; Benkelman; [40.05° N, 101.53° W]; 17 Aug.; Cockerell leg.; ex [*P\* serrulatum?*]; UCMC. – **New Mexico** • 1 ♀; Chaves Co., Bottomless Lakes, 10 mi. E of Roswell; [33.34° N, 104.34° W]; 20 May 1969; Brothers, Krueger, Michener leg.; ex *Tamarix gallica*; SEMC • 1 ♀; Chaves Co., Mescalero Sands; [32.94° N, 103.95° W]; 3 Jun. 1974; H.E. Evans leg.; CSUC • 1 ♀; De Baca Co., Fort Sumner; [34.47° N, 104.25° W]; 20 Aug. 1951; E.L. Kessel leg.; CAS • 2 ♀♀; Eddy Co.; 32.3283° N, 103.7817° W; 23 Jun. 1979; D.R. Delorme and H.L. Carrola leg.; TAMU-ENTO X1388437, X1388582 • 1 ♀; Eddy Co.; 32.3567° N, 103.7817° W; 21 Jul. 1979; D.R. Delorme and C.P. McHugh leg.; TAMU-ENTO X1391808 • 1 ♀; Quay Co., 17 mi. S of Tucumcari; [34.92° N, 103.73° W]; 19 May 1969; Brothers, Krueger, Michener leg.; ex *Quincula lobata*; SEMC • 1 ♀; Quay Co., Tucumcari; [35.17° N, 103.72° W]; 10 Jul. 1963; R.M. Bohart leg.; UCDC • 5 ♀♀; Roosevelt Co., 14 mi. SW of Portales near Boone Draw; [34.05° N, 103.52° W]; 26 May 1972; Saul Frommer and N. Jorgensen leg.; UCRC ENT 525724, 525725, 525726, 525727, 525728 • 2 ♀♀; 7 miles E of Roswell; [33.39° N, 104.4° W]; 18 May 1985; W.F. Chamberlain leg.; TAMU-ENTO X1389042, X1395614 • 1 ♀; Slaughter Canyon, 0.7 km E by S of Slaughter Cave; 32.1117° N, 104.5631° W; elev. 1324 m; 30 Mar. 2011; J.D. Herndon leg.; BBSL CAVE43430 • 1 ♀; *ibid.*; 3 Jun. 2011; J.D. Herndon, N. Klass leg.; BBSL CAVE39619. – **New York** • 1 ♂; Albany Co., 2 mi. NW of Westerlo; [42.54° N, 74.07° W]; 6 Jul. 1969; G.C. Eickwort leg.; CUIC • 2 ♀♀; Cayuga Co., Fair Haven Beach State Park; [43.34° N, 76.68° W]; 27 May 1984; G.C. Eickwort leg.; CUIC • 1 ♀; Greene Co., Stony Clove Creek; 42.1333° N, 74.2528° W; elev. 412 m; 28 Jun. 1978; T.L. McCabe leg.; CUIC • 1 ♀; Kings Co., Brooklyn, Prospect Park; [40.66° N, 73.97° W]; 2 Jul. 2011; J.S. Ascher, C. Dong leg.; AMNH • 4 ♂♂; Nassau Co., Hempstead Lake State Park; [40.69° N, 73.64° W]; 4–6 Jul. 1974; G.C. Eickwort leg.; CUIC • 4 ♀♀; Ontario Co., Selkirk Shores State Park; [43.55° N, 76.2° W]; 12 Jun. 1976; G.C. Eickwort leg.; CUIC • 1 ♀; Otsego Co., East Worcester; [42.62° N, 74.67° W]; 22 Jun. 1971; G. and K. Eickwort leg.; CUIC • 1 ♂; Otsego Co., East Worchester; [42.62° N, 74.67° W]; 13 Aug. 1968; G. and K. Eickwort leg.; CUIC • 2 ♂♂; Schuyler Co., near Reynoldsville; [42.47° N, 76.77° W]; 17 Jul. 1976; G.C. Eickwort leg.; CUIC • 1 ♀; Seneca Co., Junius Ponds, 6 mi. NW of Waterloo; [42.96° N, 76.95° W]; 24 Jun. 1986; G.C. Eickwort leg.; CUIC • 1 ♀; *ibid.*; 12 Aug. 1986; G.C. Eickwort leg.; CUIC • 1 ♂; Tompkins Co., 1 mi. S of McLean; [42.54° N, 76.29° W]; 23 Jun. 1975; M.J. and C.A. Tauber leg.; CUIC • 4 ♂♂; Tompkins Co., Buttermilk Falls State Park, Ithaca; [42.41° N, 76.51° W]; 7 Oct. 1967; G. and K. Eickwort leg.; CUIC • 1 ♂; Tompkins Co., Cornell University campus, Ithaca; [42.45° N, 76.47° W]; 22 Jul. 1971; G. and K. Eickwort leg.; CUIC • 1 ♀; *ibid.*; 9 Jul. 1987; G.C. Eickwort leg.; CUIC • 1 ♂; Tompkins Co., Dryden; [42.49° N, 76.3° W]; 18 Aug. 1968; G. and K. Eickwort leg.; CUIC • 1 ♀; Tompkins Co., Ithaca vicinity; [42.44° N, 76.5° W]; 21 May 1984; G. and K. Eickwort leg.; CUIC • 1 ♀; Tompkins Co., Ithaca vicinity, inlet; [42.45° N, 76.51° W]; 4 Jun. 1976; G. and K. Eickwort leg.; CUIC • 1 ♀; *ibid.*; 14 Jun. 1976; G. and K. Eickwort leg.; CUIC • 2 ♂♂; *ibid.*; 5 Aug. 1976; G. and K. Eickwort leg.; CUIC • 1 ♀; *ibid.*; 21 May 1984; G. and K. Eickwort leg.; CUIC • 2 ♀♀; Tompkins Co., Ithaca, Monkey Run; [42.456° N, 76.451° W]; 1 Jun. 1984; B. Alexander leg.; CUIC • 1 ♀; *ibid.*; 26 Apr. 1986; G.C. Eickwort leg.; CUIC • 1 ♂; Tompkins Co., Michigan Hollow gravel pit, 5 mi. S of Danby; [42.28° N, 76.5° W]; 7 Sep. 1968; G. and K. Eickwort leg.; CUIC • 1 ♀; Tompkins Co., Robert

H. Treman State Park, Ithaca; [42.4° N, 76.57° W]; 14 Aug. 1971; G. and K. Eickwort leg.; CUIC • 1 ♀; Tompkins Co., Six Mile Creek, SE of Ithaca Reservoir; [42.41° N, 76.45° W]; 25 May 1968; G. and K. Eickwort leg.; CUIC • 1 ♂; Tompkins Co., Taughannock Falls State Park, Ithaca; [42.54° N, 76.6° W]; 7 Oct. 1967; G. and K. Eickwort leg.; CUIC • 1 ♀; *ibid.*; 5 Jun. 1976; G. and K. Eickwort leg.; CUIC • 1 ♀; Ithaca; [42.44° N, 76.5° W]; May 1913; CUIC • 1 ♀; *ibid.*; 2 May 1915; CUIC • 1 ♂; *ibid.*; 10 Aug. 1916; CUIC • 1 ♀, 1 ♂; *ibid.*; 22 Jun. 1936; CUIC • 1 ♀; *ibid.*; 6 Jul. 1947; C. Robinson leg.; CUIC • 1 ♂; *ibid.*; 20 Jun. 1962; CUIC • 2 ♂♂; Van Natta's Dam, Ithaca; [42.434° N, 76.485° W]; 14 Aug. 1931; P.P. Babi leg.; CUIC • 1 ♀; *ibid.*; 23 May 1937; Babi leg.; CUIC. – **North Carolina** • 1 ♂; Great Smoky Mountains National Park, Cataloochee overlook; 35.6399° N, 83.06017° W; 6 Aug. 2006; J. Gibbs leg.; GSNP • 1 ♀; S of Bryson City, Bryson City and Queen Branch Roads; 35.28377° N, 83.4872° W; 8 Aug. 2006; J. Gibbs leg.; PCYU. – **North Dakota** • 1 ♀; Ransom Co., 7 miles southeast Sheldon; [46.51° N, 97.39° W]; 24 Sep. 1983; J.R. Powers leg.; EMEC. – **Oklahoma** • 1 ♀; Jefferson Co., 1 mi. N of Terral; [33.91° N, 97.94° W]; 4 Apr. 1954; R.E. Beer and party leg.; ex *Crataegus*; SEMC. – **Pennsylvania** • 1 ♀; Stroud Co., Stroudsburg; [40.99° N, 75.19° W]; 14 Jul. 1976; R.J. Pollack leg.; CUIC • 1 ♂; Lehigh Gap River; [40.78° N, 75.61° W]; 19 Jul. 1903; J.C. Bradley leg.; CUIC • 1 ♂; Roberts [exact location unknown]; Aug. 1905; J.C. Bradley leg.; CUIC. – **South Dakota** • 2 ♀♀; Jackson Co.; 43.6617° N, 101.7683° W; 22–23 Aug. 2011; J. Devalez leg.; PWRC USGS-DRO 266771, USGS-DRO 266784 • 2 ♀♀; Cedar Pass, Bad Lands; [43.757° N, 101.936° W]; 14 Aug. 1940; H.E. Milliron leg.; UMSP. – **Texas** • 2 ♀♀; Anderson Co., 10 mi. SW of Elkhart; [31.52° N, 95.7° W]; 5–6 Jun. 1976; H.R. Burke leg.; TAMU-ENTO X1365630, X1366170 • 1 ♀; Bailey Co., Muleshoe Wildlife Refuge; 33.9302° N, 102.7584° W; 13 May 2013; S.J. Galdek leg.; BBSL917863 • 3 ♀♀; Bailey Co., Muleshoe Wildlife Refuge; 33.963° N, 102.7282° W; 13 May 2013; S.J. Galdek leg.; BBSL916191, BBSL916586, BBSL916596 • 5 ♀♀; *ibid.*; 14 May 2013; S.J. Galdek leg.; BBSL916954, BBSL917894, BBSL917976, BBSL917984, BBSL917997 • 1 ♀; Bastrop Co., Camp Swift - Xrdburn; 30.2817° N, 97.3133° W; 10 May 2002; J.L. Neff leg.; CTMI 23455 • 1 ♀; *ibid.*; 11 Jun. 2002; J.L. Neff leg.; ex *Monarda citriodora*; CTMI 23683 • 1 ♀; Bastrop Co., Camp Swift East; 30.273° N, 97.264° W; 15 Oct. 2003; J.L. Neff leg.; ex *Gutierrezia texana*; PCYU • 1 ♀; Bastrop Co., Sayers; [29.37° N, 98.29° W]; 4 Apr. 1983; J.L. Neff leg.; ex *Salix nigra*; CUIC • 1 ♂; *ibid.*; 14 May 1983; J.L. Neff leg.; ex *Coreopsis basalis*; CUIC • 1 ♀; Bexar Co., Ebony Hill Research Station (Kendall residence); [29.488° N, 98.696° W]; 12 May 2003; Roy O. Kendall leg.; TAMU-ENTO X0408802 • 1 ♀; Bexar Co.; [29.4° N, 98.5° W]; 24 Jun. 1930; H.B. Parks leg.; TAMU-ENTO X1388961 • 1 ♀; *ibid.*; 9 Oct. 1930; H.B. Parks leg.; TAMU-ENTO X1388818 • 1 ♀; *ibid.*; 20 Oct. 1930; H.B. Parks leg.; TAMU-ENTO X1388771 • 1 ♀; *ibid.*; 31 May 1951; H.B. Parks leg.; TAMU-ENTO X1387963 • 1 ♀; Blanco Co., 5 mi. W of Pedernales Falls; [30.34° N, 98.33° W]; 6 Jun. 1987; J. Neff leg.; ex *Aphanostephus*; CUIC • 1 ♀; Blanco Co., Sandy; [30.36° N, 98.47° W]; 9 Jun. 1996; W.F. Chamberlain leg.; ex Mexican hat; TAMU-ENTO X1417301 • 1 ♀; Brazos Co.; [30.6° N, 96.3° W]; 15 Oct. 1962; A.H. Alex leg.; ex "*Aplopappus divaricatus*"; TAMU-ENTO X1388475 • 1 ♀; Burnet Co., 5 mi. SE of Marble Falls; [30.53° N, 98.33° W]; 9 Sep. 2017; K.W. Wright leg.; ex *Argemone albiflora*; TAMU-ENTO X1519857 • 2 ♀♀; *ibid.*; 9 Sep. 2017; K.W. Wright leg.; TAMU-ENTO X1519653, X1519692 • 1 ♀; Collin Co., Allen; [33.1° N, 96.67° W]; 27 May 1978; J.K. Weaver leg.; TAMU-ENTO X1395896 • 1 ♀; Erath Co., 5 mi. N of Stephenville; [32.29° N, 98.2° W]; 21–23 May 1980; P.T. Riherd leg.; TAMU-ENTO X1365230 • 1 ♀; Erath Co., Stephenville; [32.22° N, 98.2° W]; 27 Jul. 1982; Charles W. Agnew leg.; TAMU-ENTO X1399790 • 9 ♀♀; Fayetteville Co., Schulenberg; [29.68° N, 96.9° W]; 28 Sep. 1965; G.E. Bohart leg.; ex *Baccharis*; BBSL700712, BBSL700713, BBSL700714, BBSL700715, BBSL700716, BBSL700717, BBSL700718, BBSL700719, BBSL700726 • 5 ♀♀; Frio Co., 6 mi. SE of Pearsall; [28.83° N, 99.02° W]; 7 Jul. 1972; E. Grissell, J. Smith leg.; TAMU-ENTO X1393566, X1395776, X1398969, X1399388 X1399455 • 2 ♂♂; *ibid.*; 7 Jul. 1972; E. Grissell, J. Smith leg.; TAMU-ENTO X1393544, X1399312 • 1 ♀; Gillespie Co., Morris Ranch; [30.22° N, 99.01° W]; 11 Sep. 1994; W.F. Chamberlain leg.; TAMU-ENTO X1315845 • 1 ♀; Hidalgo Co., Bentsen Rio Grande Valley State Park; [26.175° N, 98.385° W]; 22 Aug. 1978; C. Porter leg.; TAMU-ENTO X1365162 • 1 ♀; Hockley Co., 2 mi. S of Anton; [33.78° N, 102.16° W]; 9 Sep. 1982; D.A. Dean



leg.; ex cotton; TAMU-ENTO X1405014 • 3 ♂♂; Lavaca Co., 15 mi. S of Hallettsville; [29.22° N, 96.97° W]; 28 Aug. 1965; G.E. Bohart leg.; ex *Croton*; BBSL700643, BBSL700644, BBSL700731 • 2 ♀♀; Lavaca Co., 15 mi. S of Hallettsville; [29.22° N, 96.97° W]; 28 Aug. 1965; G.E. Bohart leg.; BBSL700720, BBSL700730 • 6 ♀♀; *ibid.*; 28 Sep. 1965; G.E. Bohart leg.; ex *Croton*; BBSL700708, BBSL700709, BBSL700711, BBSL700722, BBSL700727, BBSL700729 • 1 ♀; Milam Co., 3.5 mi. S of Milano Highway 36; [30.67° N, 96.82° W]; 29 May 1976; S.J. Merritt leg.; ex *Coreopsis*; TAMU-ENTO X1399244 • 1 ♀; Presidio Co., Fort Leaton State Park (2 mi. E of Presidio); [29.54° N, 104.33° W]; 31 May 1983; W.J. Pulawski leg.; CAS • 1 ♀; Randall Co., Palo Duro Canyon State Park; [34.98° N, 101.7° W]; 28 Jul. 1972; G. Eickwort leg.; CUIC • 1 ♀; Reeves Co., TAMU Research Station at Pecos; [31.37° N, 103.62° W]; 17 Aug. 1976; S.J. Merritt leg.; ex alfalfa; TAMU-ENTO X1400844 • 1 ♀; Refugio Co., 10 mi. SW of Woodsboro, Aransas River; [28.14° N, 97.44° W]; 26 Mar. 1973; W.E. Clark leg.; TAMU-ENTO X1313097 • 1 ♀; Robertson Co., 13.9 miles east of junction of Highways 6 and OSR; [30.75° N, 96.22° W]; 11 Jun. 1977; S.J. Merritt leg.; ex *Monarda*; TAMU-ENTO X1395766 • 3 ♀♀; Robertson Co., 2.3 mi. E of junction of Highways 6 and OSR; [30.75° N, 96.42° W]; 25 May 1980; S.J. Merritt leg.; ex *Rudbeckia* sp.; TAMU-ENTO X1405581, X1405750, X1405761 • 1 ♂; Robertson Co., Salter Research Farms; 31.0333° N, 96.7725° W; elev. 88 m; 21 Apr. 2017; K. Wright leg.; ex *Lupinus texensis*; TAMU-ENTO X1533747 • 1 ♀, 1 ♂; San Patricio Co., Welder Preserve 7 mi. NE of Sinton; [28.11° N, 97.42° W]; 25 Apr. 1977; T. Eichlin, M. Wasbauer leg.; CUIC • 2 ♀♀; San Patricio Co., Welder Refuge; 28.1122° N, 97.4167° W; elev. 20 m; Mar. 2004; Sty Reed leg.; PCYU • 1 ♀; San Patricio Co., Welder Wildlife Refuge; [28.11° N, 97.42° W]; 15 Jun. 1974; J.C. Schaffner leg.; TAMU-ENTO X1393448 • 1 ♀; *ibid.*; 28 Jun. 1984; J.C. Schaffner leg.; ex hackberry motte; TAMU-ENTO X1391758 • 1 ♀; Taylor Co., Dyess Air Force Base; 32.4072° N, 99.829° W; 6–9 May 2000; H.W. Ikerd leg.; TAMU-ENTO X1389797 • 1 ♀; Taylor Co., Dyess Air Force Base; 32.4415° N, 99.8111° W; 12–13 Apr. 2001; H.W. Ikerd leg.; TAMU-ENTO X1312735 • 1 ♂; Travis Co., 10 mi. SE of Austin; [30.16° N, 97.86° W]; 27 Sep. 1965; G.E. Bohart leg.; ex *Chrysopsis viscida*; BBSL700642 • 1 ♂; Uvalde Co., Speir Ranch 3 mi. NW of Uvalde; [29.25° N, 99.8° W]; 2 May 1977; T. Eichlin, M. Wasbauer leg.; CUIC • 2 ♀♀; Val Verde Co., Langtry; [29.81° N, 101.56° W]; 14 Jun. 1986; J.L. Neff leg.; ex *Prosopis glandulosa*; CTMI • 1 ♀; Walker Co., Ellis Prison; [30.88° N, 95.46° W]; 13 Jul. 1977; W.L. Sterling leg.; TAMU-ENTO X1395578 • 2 ♀♀; Williamson Co., CR 278 3.5 mi. SE of Liberty Hill; [30.63° N, 97.89° W]; 9 Sep. 2017; K.W. Wright leg.; TAMU-ENTO X1519365, X1520556 • 1 ♀; Williamson Co., Highway 183 4 mi. N of Leander; [30.64° N, 97.87° W]; 9 Sep. 2017; K.W. Wright leg.; ex *Gutierrezia*; TAMU-ENTO X1536156 • 2 ♀♀; 10 miles S of Austin; [30.11° N, 97.74° W]; 28 Sep. 1965; G.E. Bohart leg.; BBSL700723, BBSL700724 • 1 ♂; *ibid.*; 28 Sep. 1965; G.E. Bohart leg.; BBSL700646 • 1 ♀; 10 miles SE of Muleshoe; [34.12° N, 102.6° W]; 17 Jun. 1999; W.F. Chamberlain leg.; TAMU-ENTO X1312786 • 1 ♀; 16 miles east of Sonora; [30.57° N, 100.37° W]; 28 Jul. 1986; W.F. Chamberlain leg.; TAMU-ENTO X1387689 • 1 ♀; 5 mi. east of Riogrande; [26.38° N, 98.74° W]; 12 Apr. 1950; Beamers, Stephen, Michener, Rozens leg.; SEMC • 1 ♀; 5 miles north of Benavides; [27.67° N, 98.41° W]; 9 May 1988; W.F. Chamberlain leg.; TAMU-ENTO X1415318 • 2 ♀♀; 5 miles SE of Hondo; [29.3° N, 99.08° W]; 7 Mar. 1993; W.F. Chamberlain leg.; TAMU-ENTO X1387859, 1388315 • 1 ♀; 7 miles west of Eldorado; [30.86° N, 100.72° W]; 19 May 1985; W.F. Chamberlain leg.; ex *Prosopis*; TAMU-ENTO X1388887 • 1 ♀; Austin; [30.26° N, 97.74° W]; 29 Jun. 1976; Foerster leg.; ex cult. camphor weed; TAMU-ENTO X1365934 • 1 ♀; Edna; [28.98° N, 96.65° W]; 24 Mar. 1907; J.D. Mitchell leg.; USNM • 1 ♀; Runge; [28.88° N, 97.71° W]; 29 Sep. 1904; J.C. Crawford leg.; USNM • 1 ♀; Victoria; [28.8° N, 97° W]; 26 Feb. 1904; J.C. Crawford leg.; USNM 40307 • 1 ♀; *ibid.*; 7 Apr. 1904; J.C. Crawford leg.; USNM • 1 ♀; *ibid.*; 17 Apr. 1904; A.W. Morrill leg.; USNM. – **Wisconsin** • 1 ♂; Iowa Co., Avoca Prairie; 43.19501° N, 90.28733° W; 23 Jul. 2006; A. Wolf leg.; PCYU • 1 ♀; Sauk Co., Spring Green Preserve; 43.19696° N, 90.0605° W; 29 Jul. 2006; A. Wolf leg.; ex sand; PCYU • 1 ♀; Sauk Co., Spring Green Preserve; 43.19785° N, 90.05904° W; 23 Jul. 2006; A. Wolf leg.; WRME 0370768. – **Wyoming** • 1 ♀; Goshen Co., 23 mi. S of Lusk; [42.43° N, 104.45° W]; 11 Jun. 1981; U.N. Lanham leg.; ex *Euphorbia esula*; UCMC.

**Note:** During final preparation of the manuscript some Montana specimens were discovered in MTEC.

### Range

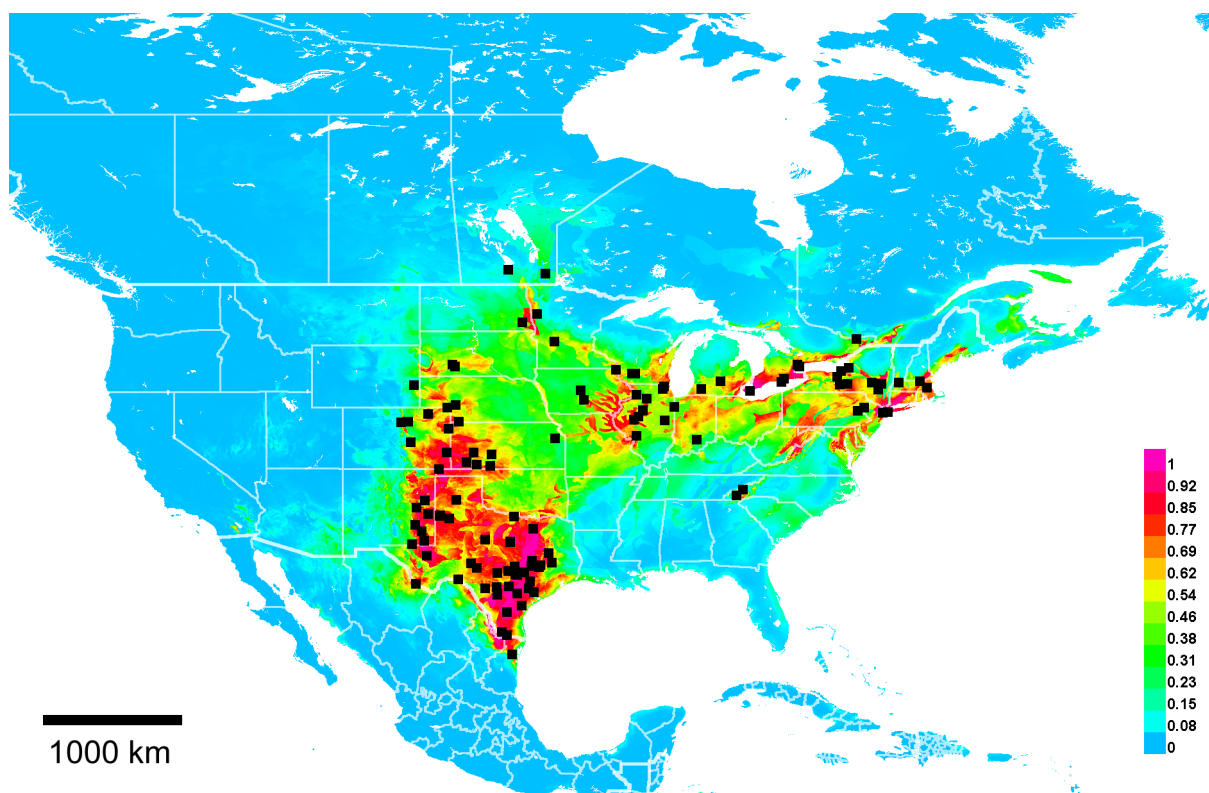
United States and Canada east of the Rocky Mountains and south to the Mexico border (Fig. 20).

### Floral hosts

ANACARDIACEAE: *Rhus* • APIACEAE: *Cymopterus* Raf. • ASTERACEAE: *Aphanostephus* DC. • *Aster* • *Baccharis* • *Coreopsis*: *C. basalis* • *Gutierrezia*: *G. texana* • *Heterotheca*: *H. viscida* • *Ratibida* Raf.: *R. columnifera* (Nutt.) Wootton and Standl. • *Rudbeckia* L. • *Thelesperma* Less.: *T. megapotamicum* (Spreng.) Kuntze • BRASSICACEAE: *Lepidium* • *Rorippa* Scop.: *R. sinuata* (Nutt.) Hitchc. • EUPHORBIACEAE: *Croton* • *Euphorbia*: *E. esula* L. • *E. missurica* Raf. • FABACEAE: *Lupinus* L.: *L. texensis* Hook. • *Medicago*: *M. sativa* • *Melilotus*: *M. officinalis*: *M. o.* subsp. *alba* • *Prosopis*: *P. glandulosa* • LAMIACEAE: *Monarda*: *M. citriodora* Cerv. ex Lag. • MALVACEAE: *Gossypium* • PAPAVERACEAE: *Argemone*: *A. albiflora* • POLYGONACEAE: *Eriogonum*: *E. effusum* Nutt. • *Polygonum* L. • ROSACEAE: *Crataegus* L. • *Prunus* L. • SALICACEAE: *Salix*: *S. nigra* Marshall • SOLANACEAE: *Quincula* Raf.: *Q. lobata* (Torr.) Raf. • TAMARICACEAE: *Tamarix*: *T. gallica* L.

### DNA barcodes

Nineteen confirmed sequences available (BOLD process IDs: BEECB221-07, BOWGF1482-10, BWTWO897-10, BWTWO899-10, BWTWO902-10, DIAL476-06, DIAL888-06, DIAL918-06, DIAL1089-06, DLII031-06, DLII1522-09, DLII1527-09, DLII1559-09, DLII1566-09, DLII1586-09, DLII1590-09, DLIII026-09, DLIII122-18, NCBEE387-21). There is a moderate amount of divergence



**Fig. 20.** Georeferenced collection records of *Lasioglossum (D.) ellisiae* (Sandhouse, 1924) (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence.

within these sequences (0.76% maximum intraspecific p-distance). They are closest in terms of p-distance to *L. helianthi* (1.22% minimum interspecific p-distance). Two fixed nucleotide substitutions distinguish *L. ellisiae* from all other Nearctic species of the *L. gemmatum* complex: 312(A) and 573(C) (Supp. file 2).

### Comments

Specimens of *L. ellisiae* from the southwestern parts of its range usually have the tegula and metasoma red-orange and have been considered a separate species, *L. hunteri*, in the past. However, the geographical boundaries of the dark forms and red-tailed forms are very fuzzy. Dark specimens of *L. ellisiae* are known from New Mexico and Colorado, and red-tailed specimens have been found as far north as Minnesota and Manitoba. No other morphological features can distinguish the two forms; if colour is disregarded, the holotype of *L. hunteri* is a typical *L. ellisiae*. An apparent distribution gap between eastern and western specimens (Fig. 20) is likely due to undersampling in eastern South Dakota, eastern Nebraska, eastern Kansas, Oklahoma, and Missouri. DNA barcodes from across the range of *L. ellisiae*, including red-tailed specimens from Texas and Minnesota, are indistinguishable. No line of evidence can support the hypothesis that *L. hunteri* is a distinct species.

Four unusual red-tailed specimens from southern Texas have the metapostnotum completely dull, smooth, and lacking rugae, even fine ones, in the apical 75%, but otherwise resemble typical *L. ellisiae*. The identification of these specimens is somewhat uncertain. They are tentatively included in *L. ellisiae* as the closest available match and because there is no additional evidence to support consideration of these specimens as a new species.

### *Lasioglossum (Dialictus) eremum* sp. nov.

[urn:lsid:zoobank.org:act:76F04F95-0D86-42FF-A596-C7415D9BB1FF](https://zoobank.org/act:76F04F95-0D86-42FF-A596-C7415D9BB1FF)

Figs 21–23, 94B

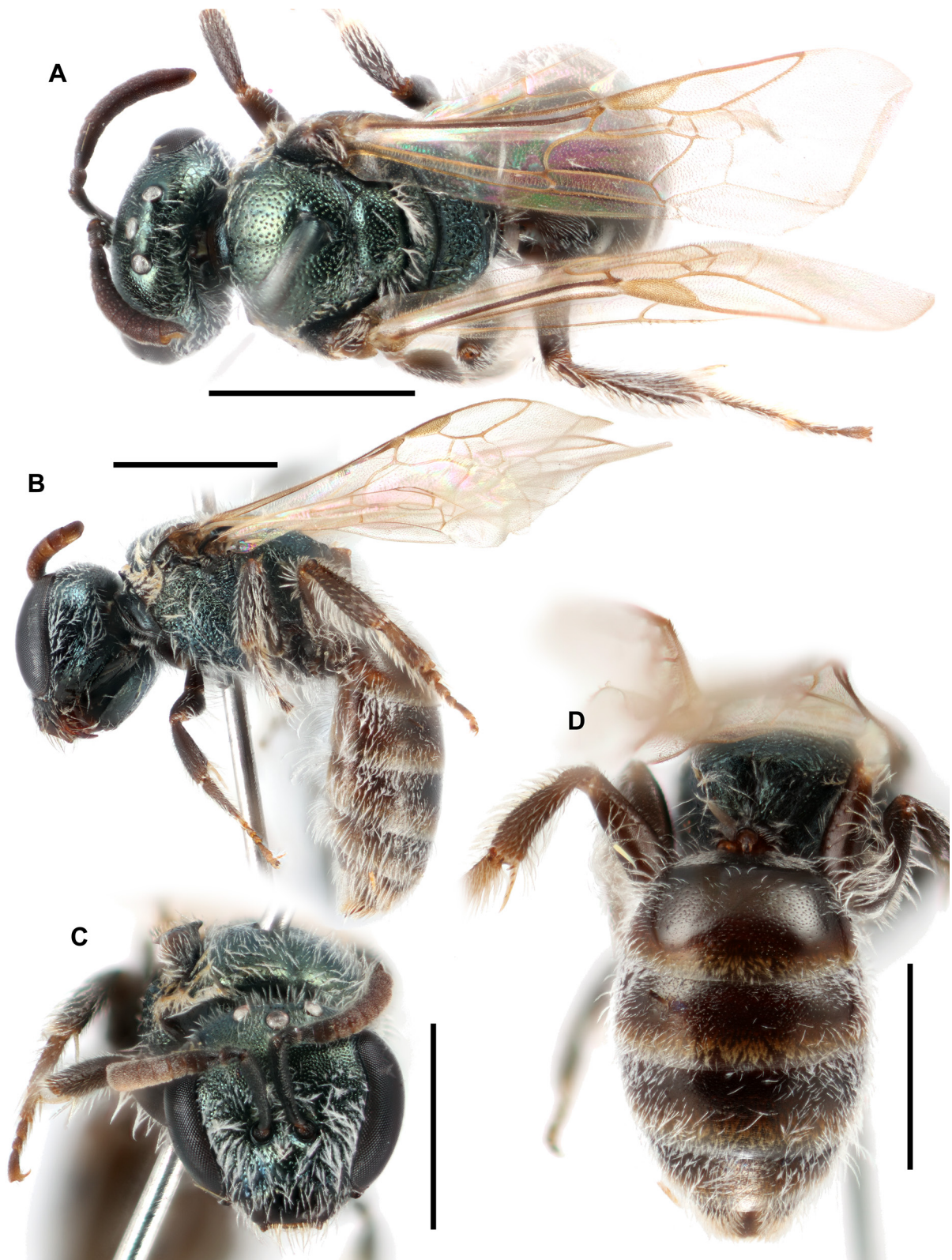
### Diagnosis

Females of *L. eremum* sp. nov. have the tegula relatively small (exceeding posterior margin of mesoscutum in dorsal view by about a seta's breadth if at all), with inner posterior margin straight or very weakly concave, and usually moderately sparsely punctate laterally at midlength (IS = 1–2 PD); metapostnotum rugose due to very strong anastomosing rugae reaching posterior margin; postgena smooth, at most weakly lineolate; mesoscutum and mesepisternum mostly shiny (mesoscutum becoming tessellate anteromedially and mesepisternum sometimes dull dorsally); T1 anterior slope coriarius; and apical rims of T1–T2 distinctly punctate with punctation similar to discs (sometimes slightly sparser).

Females of *L. eremum* sp. nov. are most similar to those of *L. diabolicum* sp. nov., *L. ellisiae*, *L. gaudiale*, and *L. helianthi*. Females of *L. diabolicum* and *L. ellisiae* have the postgena lineate and apical rims of T1–T2 impunctate or with minute, sparse, obscure punctures. Females of *L. gaudiale* have the tegula inner posterior margin more strongly concave and often more densely punctate laterally at midlength (IS < 1 PD); T1 anterior slope very shiny; metapostnotum rugae usually not reaching posterior margin; and postgena sometimes lineate. Females of *L. helianthi* have the mesoscutum entirely tessellate and postgena lineate.

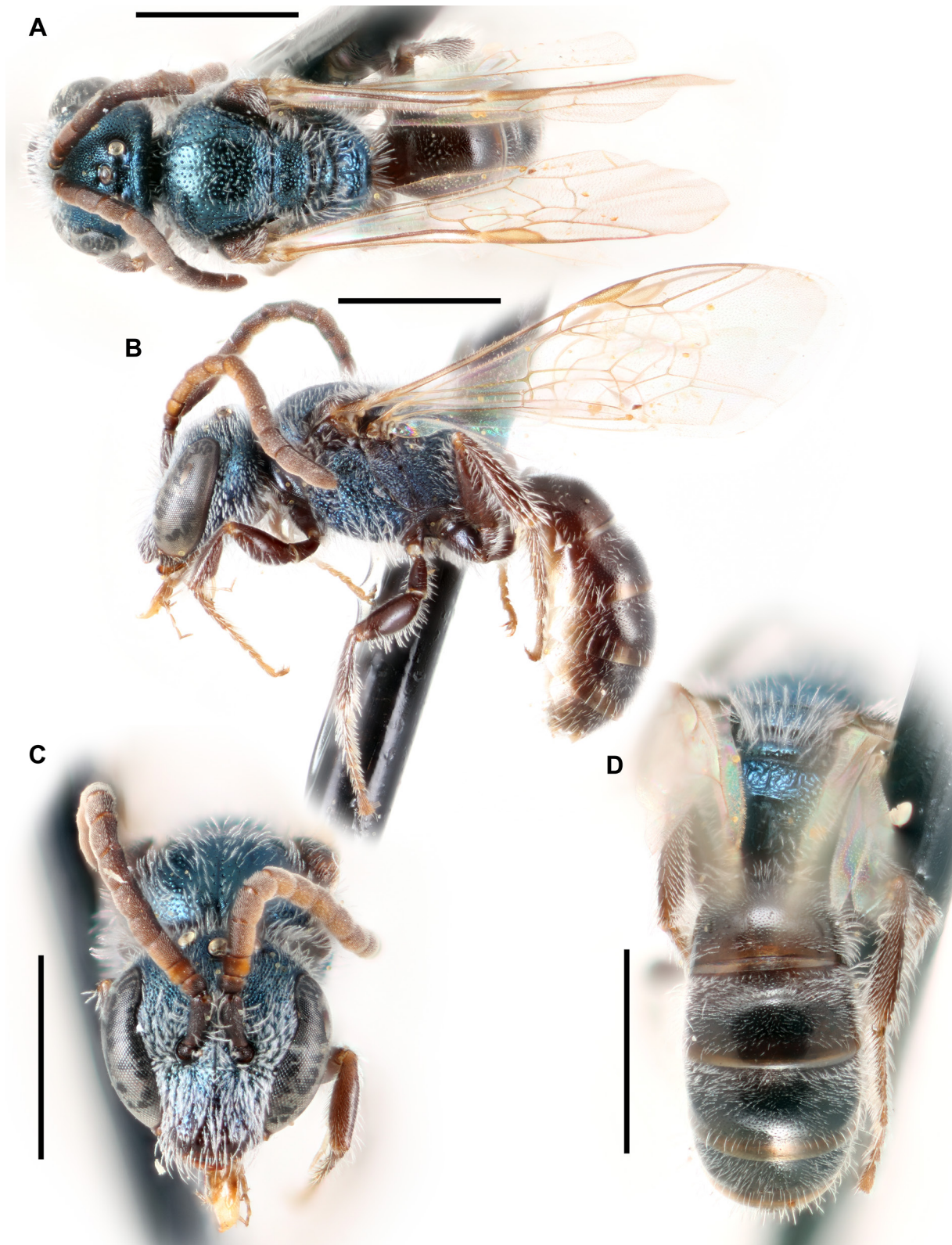
Males of *L. eremum* sp. nov. have the tegula relatively small (reaching but not exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin weakly concave, and entirely covered in deep, crowded punctures (IS = 0 PD) except with some narrow interspaces < 1 PD laterally at midlength; metapostnotum rugose and propodeum lateral surface extensively rugulose due to very strong anastomosing rugae reaching posterior margin; face with sparse tomentum restricted to paraocular area; mesepisternum with crowded punctures (IS = 0 PD); and metasomal terga with depressed apical rims impunctate.





**Fig. 21.** *Lasioglossum (D.) eremum* sp. nov., ♀ (BBSL1070450). **A.** Dorsal habitus. **B.** Lateral habitus. **C.** Face. **D.** Metasoma and propodeum. Scale bars = 1 mm.





**Fig. 22.** *Lasioglossum (D.) eremum* sp. nov., ♂ (SEMC). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma and propodeum. Scale bars = 1 mm.

Males of *L. eremum* sp. nov. are most similar to those of *L. holzenthali* sp. nov. and members of the *L. stictaspis* species complex. Males of *L. holzenthali* have the clypeus and supraclypeal area with sparse tomentum; tegula more sparsely punctate with more distinct interspaces ( $IS \geq 0.5$  PD); metapostnotum with subparallel rugae and propodeum lateral surface smooth and shiny; and metasomal terga with depressed apical rims punctate. Males in the *L. stictaspis* species complex have the face uniformly covered in dense tomentum below the eye emargination and mesepisternum usually more sparsely punctate with distinct interspaces ( $IS \geq 0.5$  PD).

### Etymology

The specific epithet ‘*eremum*’ is the Latinized Greek adjective ‘*eremos*’ (lonely). It refers to the fact that this species is primarily known from singleton specimens in remote locations.

### Material examined

#### Holotype

UNITED STATES – **Utah** • ♀; Washington Co., 0.63 mi. NNW of Lemmon Spring; 37.2953° N, 112.9092° W; 16 Jun. 2006; F. Nicklen, B. Hays leg.; ex *Apocynum androsaemifolium*; BBSL ZION23556.

[Verbatim label: USA UT Washington Co. / 0.63 mi NNW Lemmon Spr. 12S E330774 N4129346 16Jun06 / F.Nicklen, B.Hays / *Apocynum androsaemifolium* / ZION23556 // 2388C04 // HOLOTYPE / *Lasioglossum (Dialictus) eremum* Gardner and Gibbs]

#### Paratypes

UNITED STATES – **Arizona** • 1 ♀; Coconino Co.; 35.35393° N, 111.73061° W; 19 Jun. 2012; Dave Smith leg.; NAUF4A 0087470 • 3 ♀♀; Carrizo Creek; [33.9° N, 110.28° W]; 16 Jun. 1950; R.H. Beamer leg.; SEMC • 34 ♀♀; *ibid.*; 16 Jun. 1950; R.H. Beamer leg.; ex *Euphorbia albomarginata*; SEMC • 1 ♂; Chiricahua Mountains, Southwestern Research Station; [31.883° N, 109.205° W]; elev. 1646 m; 19 Aug. 1964; Charles D. Michener leg.; ex *Heterotheca subaxillaris*; SEMC • 1 ♀; Flagstaff; [35.2° N, 111.65° W]; 14 Jul. 1947; L.D. Beamer leg.; SEMC • 1 ♀, 1 ♂; Huachuca; [31.5° N, 110.4° W]; 1937; W. Benedict leg.; SEMC • 1 ♀; Santa Rita Mountains; [31.7° N, 110.8° W]; elev. 1524–2438 m; July; F.H. Snow leg.; SEMC. – **Nevada** • 1 ♀; Clark Co., Lovell Canyon; 36.1648° N, 115.5758° W; 20 May 2005; E. Ahlstrom leg.; BBSL640067 • 1 ♀; Ely; [39.25° N, 114.87° W]; 30 Jun. 1950; C.D. Michener leg.; ex *Melilotus officinalis*; SEMC. – **New Mexico** • 1 ♀; Socorro Co., Cibola NF: South Baldy meadow (MG2); 33.9911° N, 107.1837° W; elev. 3178 m; 16 Jun. 2017; J.A. Fowler leg.; BBSL1070450 • 1 ♀; Carrizozo; [33.64° N, 105.88° W]; 9 Jun. 1950; L.D. Beamer leg.; SEMC. – **Utah** • 2 ♀♀; Beaver Co., Milford (UT 21, mi. 60); [38.434° N, 113.289° W]; 3 Jun. 1994; G. Bryant leg.; ex *Argemone*; BBSL FaunalSurvey No. 000 085 362, FaunalSurvey No. 000 085 363 • 1 ♀; Washington Co., Central; [37.42° N, 113.62° W]; 19 Sep. 1956; Knowlton and Goodarzi leg.; ex *Chrysothamnus* sp.; SEMC. – **Wyoming** • 1 ♀; Platte Co., Warm Spring, Camp Guernsey; [42.26° N, 104.76° W]; elev. 1372 m; 6 Jun. 2000; P.M. Pineda, J. Schmidt leg.; CSUC.

### Description

#### Female

COLOURATION. Head and mesosoma blue to olive green; clypeus apex black; labrum reddish brown; mandible orange with black base and red apex; flagellum dark reddish brown dorsally, light brown ventrally. Pronotal lobe reddish brown; legs dark reddish brown; tegula black to reddish brown; wing membrane hyaline, veins with subcosta dark brown, otherwise light brown. Metasoma black with rims of terga and sterna broadly translucent brown.

PUBESCENCE. Body pile colour white. Tomentum dense on gena anteriorly, pronotal collar and lobe, space between pronotal lobe and tegula, metanotum anteriorly, T2–T3 basolaterally, and T4 throughout; sparse



on paraocular area and metepisternum. Mesoscutum pubescence thin to moderately plumose. Wing setae dark, short and dense. Acarinarial fan complete, dense. T2 fringes dense, T3 fringes dense.

**SURFACE SCULPTURE.** Clypeus shiny, with punctures dense in basal fourth ( $IS \leq 1$  PD), large and irregularly sparse apically ( $IS < 2$  PD); supraclypeal area shiny, with punctures dense ( $IS \leq 1$  PD); paraocular area shiny, with punctures dense ( $IS < 1$  PD), sparser around antenna socket ( $IS \leq 1$  PD); frons shiny, with punctures dense ( $IS < 1$  PD); vertex shiny, with punctures dense laterally ( $IS < 1$  PD), fine and sparse medially ( $IS = 1-3$  PD); gena shiny, with punctures fine, moderately dense ( $IS = 1-2$  PD); postgena shiny, becoming lineolate posteriorly. Tegula punctures fine, sparse ( $IS = 1-3$  PD); mesoscutum shiny, becoming weakly tessellate anteromedially, with punctures moderately dense ( $IS = 1-2$  PD), becoming dense on lateral and posterior margins ( $IS < 1$  PD); scutellum shiny, with punctures dense ( $IS < 1$  PD); metapostnotum weakly tessellate, with rugae strong, anastomosing, reaching posterior margin; preepisternum shiny with crowded punctures ( $IS = 0$  PD); hypopimeron shiny, with punctures crowded ( $IS = 0$  PD); mesepisternum shiny, with punctures dense ( $IS < 1$  PD); metepisternum weakly rugulose; propodeum lateral surface tessellate, posterior surface tessellate. T1 anterior slope weakly coriaceous, disc shiny, with punctures moderately dense ( $IS = 1-2$  PD), becoming fine and moderately sparse on rim ( $IS = 1-3$  PD) and absent in small subapicolateral boss; T2 disc shiny, with punctures moderately dense ( $IS = 1-2$  PD), apical rim shiny, with punctures fine, moderately sparse ( $IS = 1-3$  PD).

**STRUCTURE.** Face length/width ratio 0.8 ( $\pm 0.01$  SD); clypeus apicolateral denticles rounded acute points; gena/eye width ratio 0.96 ( $\pm 0.06$  SD). Pronotal angle obtuse; intertegular span 0.85 ( $\pm 0.07$  SD) mm; mesoscutum length/width ratio 0.88 ( $\pm 0.03$  SD); mesoscutum/scutellum length ratio 2.88 ( $\pm 0.17$  SD); scutellum/metanotum length ratio 1.6 ( $\pm 0.2$  SD); metanotum/metapostnotum length ratio 0.75 ( $\pm 0.11$  SD); forewing with 3 submarginal cells; tegula enlarged, reaching posterior margin of mesoscutum; inner margin concave; tegula length 0.42 ( $\pm 0.03$  SD) mm, width 0.21 ( $\pm 0.01$  SD) mm; propodeum lateral carinae not reaching dorsal margin; oblique carina strong, straight. T2 depressed apical rim less than 50% of tergum. ( $n = 9$ )

**VARIATION.** The tegula punctures can vary from dense ( $IS \leq 1$  PD) to sparse ( $IS = 1-3$  PD), the inner posterior margin can be straight or weakly concave, the T1–T2 apical rim punctures can vary from moderately dense ( $IS = 1-2$  PD) to sparse ( $IS = 1-3$  PD), and the supraclypeal area is sometimes black or brassy.

### **Male**

**COLOURATION.** Head and mesosoma blue to blue-green; clypeus apex black; labrum black; mandible orange with black base and red apex; flagellum black dorsally, light brown ventrally. Pronotal lobe dark brown; legs brown; tegula dark reddish brown; wing membrane hyaline, veins with subcosta dark brown, otherwise brown to light brown. Metasoma black with depressed apical rims of terga and sterna and downcurved lateral areas of terga translucent brown.

**PUBESCENCE.** Body pile colour white. Tomentum dense on pronotal collar; sparse on paraocular area and gena. Mesoscutum pubescence simple to sparsely plumose. Wing setae dark, short and sparse. Sterna pubescence moderately short (1–2 OD), sparsely plumose, sparse.

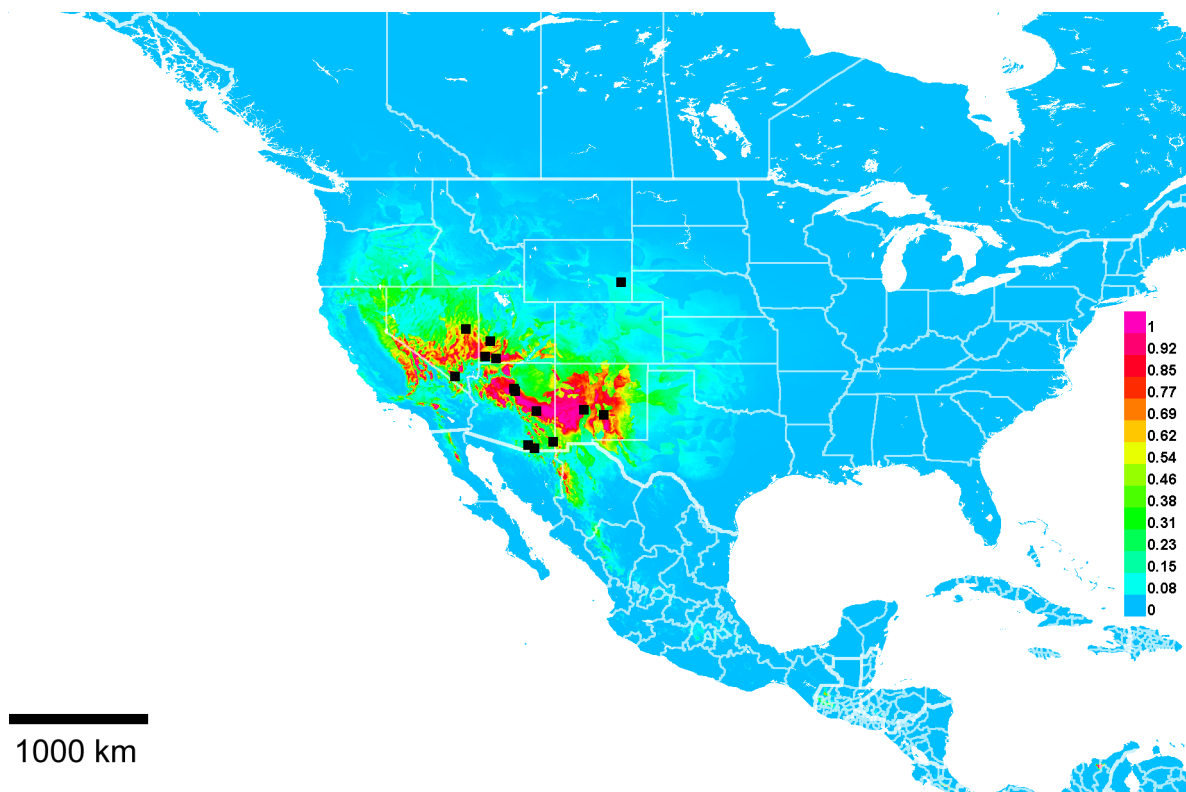
**SURFACE SCULPTURE.** Clypeus shiny, with punctures dense ( $IS < 1$  PD); supraclypeal area shiny, with punctures dense ( $IS < 1$  PD); paraocular area shiny, with punctures dense ( $IS < 1$  PD); frons shiny, with punctures crowded ( $IS = 0$  PD); vertex shiny, with punctures dense laterally ( $IS < 1$  PD), moderately dense medially ( $IS = 1-2$  PD); gena shiny, with punctures fine, moderately sparse ( $IS = 1-2$  PD); postgena lineate. Tegula punctures crowded ( $IS = 0$  PD); mesoscutum shiny, becoming weakly tessellate anteromedially, with punctures dense ( $IS \leq 1$  PD), becoming sparse anteromedially ( $IS = 1-3$  PD); scutellum shiny, with punctures dense ( $IS < 1$  PD), becoming sparser medially ( $IS = 1-2$  PD); metanotum shiny and finely,

densely punctate (IS < 1 PD); metapostnotum shiny, with rugae strong, anastomosing, reaching posterior margin; preepisternum areolate; hypoepimeron shiny, with punctures crowded (IS = 0 PD); mesepisternum shiny, with punctures crowded (IS = 0 PD); metepisternum rugulose; propodeum lateral surface rugulose, becoming smooth and imbricate medially, with punctures crowded (IS = 0 PD), becoming slightly sparser medially (IS < 1 PD), posterior surface shiny with crowded punctures (IS = 0 PD). T1 anterior slope shiny, disc shiny, with punctures sparse (IS = 1–3 PD), becoming very sparse in large subapicolateral boss (IS > 3 PD) and absent on rim; T2 disc shiny, with punctures dense (IS ≤ 1 PD), becoming moderately sparse near premarginal line (IS = 1–3 PD), apical rim shiny, with punctures absent.

STRUCTURE. Face length/width ratio 0.84 (±0.02 SD); gena/eye width ratio 0.8 (±0.05 SD). Pronotal angle obtuse; intertegular span 0.74 (±0.01 SD) mm; mesoscutum length/width ratio 0.95 (±0.06 SD); mesoscutum/scutellum length ratio 2.61 (±0.27 SD); scutellum/metanotum length ratio 1.74 (±0.02 SD); metanotum/metapostnotum length ratio 0.82 (±0.14 SD); forewing with 3 submarginal cells; tegula enlarged, reaching posterior margin of mesoscutum; inner posterior margin weakly concave; tegula length 0.43 (±0.01 SD) mm, width 0.22 (±0.01 SD) mm; propodeum lateral carinae not reaching dorsal margin; oblique carina absent. (n = 2)

GENITALIA. Not examined.

VARIATION. The one other male specimen examined has the mandible completely dark, scutellum entirely densely punctate (IS < 1 PD), and both forewings with only two submarginal cells.



**Fig. 23.** Georeferenced collection records of *Lasioglossum (D.) eremum* sp. nov. (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence.

### Range

Mountains from Nevada to New Mexico and north to Wyoming (Fig. 23).

### Floral hosts

APOCYNACEAE: *Apocynum* L.: *A. androsaemifolium* L. • ASTERACEAE: *Chrysothamnus* • *Heterotheca*: *H. subaxillaris* • EUPHORBIACEAE: *Euphorbia*: *E. albomarginata* Torr. & A.Gray • FABACEAE: *Melilotus*: *M. officinalis* • PAPAVERACEAE: *Argemone*.

### DNA barcodes

Two confirmed sequences available (BOLD process IDs: DLII1060-07, DLIII183-19). There is a small amount of divergence within these sequences (0.16% maximum intraspecific p-distance). They are closest in terms of p-distance to *L. ellisiae* (2.68% minimum interspecific p-distance). Six fixed nucleotide substitutions distinguish *L. eremum* sp. nov. from all other Nearctic species of the *L. gemmatum* complex: 15(C), 63(C), 75(G), 162(C), 199(A), and 573(A) (Supp. file 2).

### Comments

Rare. *Lasioglossum eremum* sp. nov. is evidently restricted to rugged, relatively high elevation terrain. It is not found in flat plains or deserts except for a single specimen from Carrizozo, New Mexico, collected by Raymond Beamer among a very long series of *L. coactus*. It is possible that this specimen is mislabeled and actually belongs to the long series of *L. eremum* from Carrizo Creek, Arizona, which were collected one week later by Lucy Beamer. Alternatively, the mountains or extremely rugged lava fields near Carrizozo may be suitable habitat for this species.

### *Lasioglossum (Dialictus) gaudiale* (Sandhouse, 1924)

Figs 24–26, 76E, 91B, 94A, 103A, 104A, 114A

*Halictus (Chloralictus) gaudialis* Sandhouse, 1924: 23 (holotype, ♂, deposited in USNM, type no. 26418, examined).

*Halictus (Chloralictus) gaudialis* – Michener 1936: 283 (relationship to *helianthi*).

*Lasioglossum (Chloralictus) tegulariforme* – Michener 1951: 1118 (in part, synonymy, catalogue).

*Dialictus tegulariformis* – Hurd 1979: 1972 (in part, catalogue). — Moure & Hurd 1987: 134 (in part, catalogue).

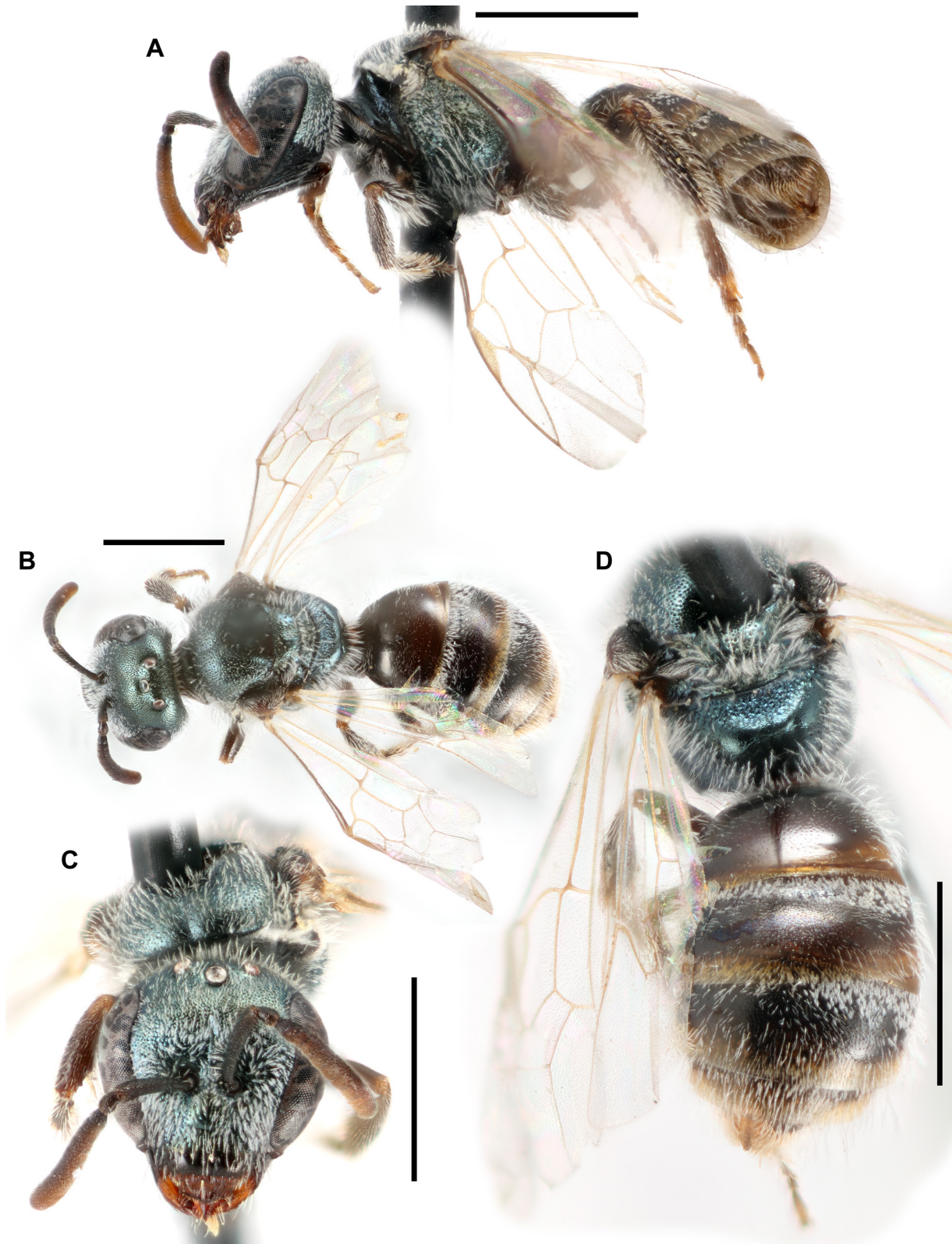
*Lasioglossum (Dialictus) gaudiale* – Gardner & Gibbs 2022: 28 (resurrection from synonymy).

### Diagnosis

Females of *L. gaudiale* have the tegula relatively small (reaching and sometimes slightly exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin strongly concave and a small rounded posterior projection, and usually densely punctate ( $IS \leq 1$  PD, rarely up to 2 PD); T1 anterior slope polished and mirror-smooth (rarely with very weak microsculpture basally); gena about as wide as eye in lateral view; metapostnotum usually shiny basally with strong subparallel rugae not reaching the posterior margin (sometimes dull, with rugae anastomosing, or rugae reaching posterior margin, but never all at once); mesoscutum with no tomentum; T3 without a subapical band of tomentum; and metasoma usually black to brown (rarely red-orange). In many cases, the scutellum is significantly more coarsely and sparsely punctate than the mesoscutum ( $IS = 1-2$  PD), but this is unreliable as a primary diagnostic character.

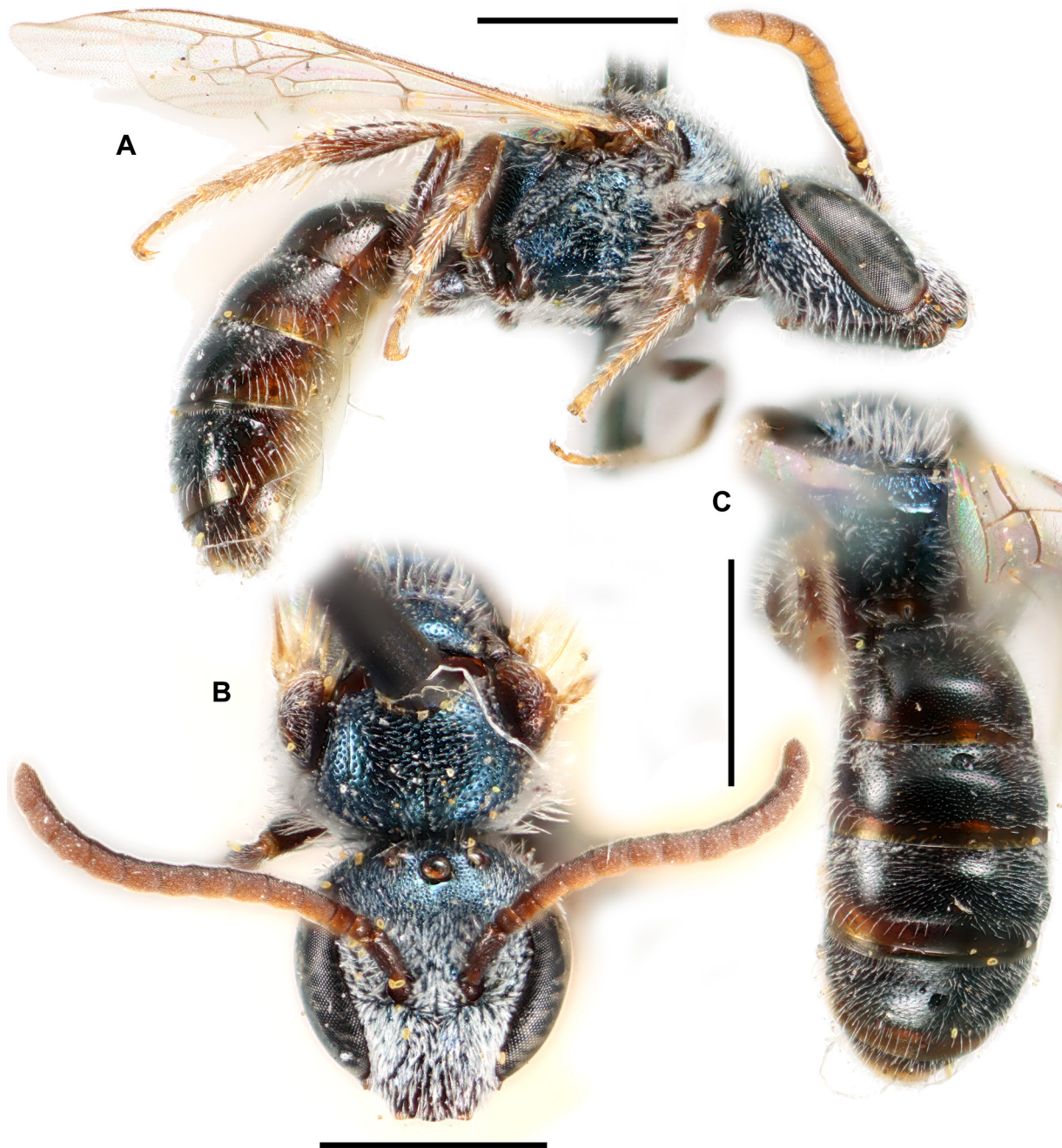
Females of *L. gaudiale* are most similar to those of *L. angelicum* sp. nov., *L. eremum* sp. nov., *L. gloriosum* sp. nov., *L. indagator* sp. nov., and *L. pseudotegulare*, all of which (except *L. indagator*) have the gena





**Fig. 24.** *Lasioglossum (D.) gaudiale* (Sandhouse, 1924), ♀ (UCMC 0260263). **A.** Lateral habitus. **B.** Dorsal habitus. **C.** Face. **D.** Metasoma and propodeum. Scale bars = 1 mm.

narrower than eye in lateral view and scutellum usually finely and densely punctate (IS < 1 PD). In addition, females of *L. eremum* sp. nov. have the metapostnotum with anastomosing rugae reaching the posterior margin and T1 anterior slope coriarius. Females of *L. gloriosum* have the T1 anterior slope coriarius, mesoscutum lateral and posterior margins with dense tomentum, metapostnotum rugae usually reaching the posterior margin, and metasoma red-orange. Females of *L. indagator* have the tegula sparsely punctate (IS = 1–3 PD) and inner posterior margin weakly concave. Females of *L. pseudotegulare* have



**Fig. 25.** *Lasioglossum* (*D.*) *gaudiale* (Sandhouse, 1924), ♂, holotype (USNM 26418). A. Lateral habitus. B. Face and mesonotum. C. Metasoma and propodeum. Scale bars = 1 mm.



the metapostnotum entirely dull with fine rugae and tegula very large (exceeding posterior margin of mesoscutum in dorsal view) and more densely punctate (IS < 1 PD). Females of *L. angelicum* sp. nov. have a similarly large tegula.

Males of *L. gaudiale* have the tegula relatively small (reaching or slightly exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin strongly concave and a narrow posterior point, and usually densely punctate (IS < 1 PD); face relatively narrow (length/width ratio usually > 0.83) with dense tomentum below the upper ocular tangent (often surrounding the median ocellus); metapostnotum usually shiny with strong subparallel rugae not reaching posterior margin; mesoscutum usually densely punctate (IS ≤ 1 PD) and fringed with tomentum; mesepisternum somewhat coarsely punctate with distinct interspaces (IS ≤ 1 PD); preepisternum and metepisternum with sparse appressed tomentum; T2–T3 with abundant basolateral tomentum; and head and mesosoma integument usually deep blue.

Males of *L. gaudiale* are most similar to those of *L. gloriosum* sp. nov. and *L. indagator* sp. nov. Both of these species have the face broad (length/width ratio ≤ 0.83) and preepisternum and metepisternum with more abundant tomentum. In addition, males of *L. gloriosum* have the mesepisternum very densely punctate (IS < 1 PD); metapostnotum usually with anastomosing rugae reaching posterior margin; and integument usually greener. Males of *L. indagator* have the metapostnotum with very short parallel rugae not reaching the posterior margin; tegula inner posterior margin more weakly concave, forming a blunt angle posteriorly, and usually moderately sparsely punctate laterally (IS = 1–2 PD); and mesoscutum usually slightly more sparsely punctate (IS = 1–2 PD).

### Etymology

Sandhouse (1924) formed the specific epithet ‘*gaudialis*’ from the Latin noun ‘*gaudium*’ (joy) and the adjectival suffix ‘*-alis*’ (state or condition of), together meaning ‘joyful’.

### Material examined

#### Holotype

UNITED STATES – **California** • ♂; La Jolla; [32.83° N, 117.27° W]; August [day/year unknown]; Cockerell leg.; USNM 26418.

#### Other material

MEXICO – **Aguascalientes** • 1 ♀; 14 mi. W of Aguascalientes; [21.88° N, 102.51° W]; 10 Jul. 1983; P.W. Kovarik, Harrison, J.C. Schaffner leg.; TAMU-ENTO X1416976. – **Baja California** • 1 ♀; “Gonzales Bay” [Bahía de San Luis Gonzaga]; [29.79° N, 114.4° W]; 29 Apr. 1921; E.P. Van Duzee leg.; UCMC. – **Baja California Sur** • 1 ♀; 2 miles north of Todos Santos; 23.4687° N, 110.2399° W; 20 Oct. 2016; Paul A. Rude leg.; EMEC • 1 ♀; *ibid.*; EMEC • 1 ♀; El Pedrito beach, 3 mi. S of Todos Santos; 23.3941° N, 110.2124° W; 24 Sep. 2016; Paul A. Rude leg.; EMEC • 1 ♂; La Paz; [24.14° N, 110.31° W]; 3 Jun. 1921; E.P. Van Duzee leg.; CAS • 1 ♀; La Paz; 24.1446° N, 110.31° W; 20 Feb. 1974; George E. Bohart leg.; BBSL1101069 • 2 ♀♀, 1 ♂; La Paz; 24.1742° N, 110.304° W; 5 Sep. 2016; Paul A. Rude leg.; EMEC • 1 ♀; La Paz, 2 miles south; [24.08° N, 110.31° W]; 31 Jul. 1966; E.G. Linsley, J.M. Linsley leg.; EMEC • 1 ♀; Monserrate Island, Gulf California; [25.68° N, 111.03° W]; 13 Jun. 1921; E.P. Van Duzee leg.; CAS • 1 ♀; Todos Santos; 23.4587° N, 110.2335° W; 8–12 Oct. 2018; Paul A. Rude leg.; EMEC. – **Chihuahua** • 1 ♀; Juarez; 31.7353° N, 106.4721° W; 22 Jul. 1971; D.W. Davis leg.; BBSL1101081 • 2 ♀♀; Municipio Buenaventura, 9 mi. N of Flores Magón; [30.07° N, 106.96° W]; 29 Jun. 1981; NMSU. – **Coahuila** • 1 ♂; Boquillas; 29.1883° N, 102.9374° W; 19 Jun. 1992; Robert L. Minckley leg.; ex *Haplopappus*; SEMC. – **Sonora** • 1 ♂; 10 mi. S of Guaymas; 27.9102° N, 110.7259° W; 7 Oct. 1968; George E. Bohart leg.; ex *Tecoma stans*; BBSL1100989 • 5 ♀♀; Rancho Puerta Blanca; 31.3119° N, 109.1133° W; 25 May 2008; Robert L. Minckley leg.; RLM SBV083922, SBV083928, SBV083942, SBV083968, SBV083996 • 1 ♀; Rancho San Bernardino; 31.3136° N,



109.2547° W; 29 Aug. 2001; Robert L. Minckley leg.; RLM SBV137953 • 1 ♀; *ibid.*; 13 Aug. 2002; A. Romero leg.; RLM SBV043987 • 1 ♂; Rancho San Bernardino; 31.3139° N, 109.2503° W; 3 Jun. 2002; Robert L. Minckley leg.; RLM SBV016827 • 1 ♀; Rancho San Bernardino; 31.316° N, 109.2576° W; 6 Jun. 2004; Robert L. Minckley leg.; ex *Baileya multiradiata*; RLM SBV025444 • 1 ♀; *ibid.*; 10 Jun. 2004; N. de la Torre leg.; RLM SBV025674 • 1 ♀; Rancho San Bernardino; 31.3169° N, 109.2592° W; 6 Jun. 2004; N. de la Torre leg.; RLM SBV025607 • 1 ♀; *ibid.*; 15 Jun. 2004; N. de la Torre leg.; RLM SBV054797 • 1 ♀; Rancho San Bernardino; 31.3179° N, 109.2602° W; 15 Jun. 2004; N. de la Torre leg.; ex *Baileya multiradiata*; RLM SBV054768 • 3 ♀♀; Rancho San Bernardino; 31.3195° N, 109.2701° W; 18 Aug. 2003; A. Nelson leg.; RLM SBV035698, SBV035715, SBV035722 • 1 ♀; *ibid.*; 19 Aug. 2003; A. Nelson leg.; RLM SBV036076 • 1 ♀; Rancho San Bernardino; 31.3195° N, 109.2703° W; 8 May 2001; Robert L. Minckley leg.; RLM SBV019590 • 1 ♂; *ibid.*; 8 May 2001; Robert L. Minckley leg.; RLM SBV019591 • 1 ♀; Rancho San Bernardino; 31.3196° N, 109.2693° W; 18 Aug. 2003; A. Nelson leg.; RLM SBV035622 • 12 ♀♀; Rancho San Bernardino; 31.32° N, 109.2685° W; 18 Aug. 2003; A. Nelson leg.; RLM SBV035642, SBV035649, SBV035650, SBV035651, SBV035652, SBV035653, SBV035659, SBV035660, SBV035661, SBV035665, SBV035666, SBV035670 • 1 ♀; *ibid.*; 19 Aug. 2003; A. Nelson leg.; RLM SBV035755 • 6 ♀♀; Rancho San Bernardino; 31.3204° N, 109.2681° W; 2 Sep. 2003; A. Romero leg.; RLM SBV036595, SBV036596, SBV036606, SBV036613, SBV036631, SBV036636 • 1 ♀; Rancho San Bernardino; 31.3319° N, 109.2567° W; 11 Jun. 2004; A. Romero leg.; RLM SBV025922. – **Unknown** • 1 ♀; San Luis [exact location unknown]; 30 May 1955; G.D. Butler leg.; ex *Heliotrope*; UAIC.

UNITED STATES – **Arizona** • 3 ♀♀; Cochise Co., 10 mi. E of Douglas; [31.35° N, 109.35° W]; 22 Aug. 1994; Jerome G. Rozen, John S. Ascher leg.; AMNH • 1 ♀; Cochise Co., 2 mi. W of Fort Huachuca; [31.55° N, 110.38° W]; 28 Jun. 1983; W.J. Pulawski leg.; CAS CASENT 8416787 • 1 ♂; Cochise Co., Benson; [31.97° N, 110.29° W]; 12 Jul. 1952; R.H. Beamer, L.D. Beamer, W.E. LaBerge, Cheng Liang leg.; SEMC • 1 ♀; Cochise Co., Portal; 31.8833° N, 109.2055° W; 20 Jul. 2017; S. L. Buchmann leg.; WRME 518956 • 1 ♀; Cochise Co., Rancho San Bernardino; 31.3139° N, 109.2503° W; 16 Aug. 2000; K. Toal leg.; RLM SBV002658 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3369° N, 109.2436° W; 27 Aug. 2001; Robert L. Minckley leg.; RLM SBV137736 • 1 ♀; Maricopa Co., Marquahala; [33.8° N, 113.3° W]; 15 Sep. 1979; J. Haworth, G.D. Butler leg.; UAIC • 10 ♀♀; Maricopa Co., Phoenix, Cotton Research Center; [33.404° N, 111.988° W]; 20–21 Sep. 1979; G.D. Butler leg.; ex cotton; UAIC • 1 ♀; Maricopa Co., Rainbow Valley; [33.2° N, 112.4° W]; 7 May 1980; J. Gillespie leg.; CUIC • 1 ♀; Mohave Co., “L. Havaska” [Lake Havasu] City; [34.48° N, 114.32° W]; 2 Apr. 1973; George E. Bohart leg.; BBSL700789 • 1 ♀; Mohave Co., 0.87 air km ESE of Beaver Dam; 36.8972° N, 113.9242° W; 10 May 2014; M.C. Orr leg.; ex *Tamarix ramosissima*; BBSL907904 • 1 ♀; Mohave Co., 10 mi. S of Lake Havasu City; [34.38° N, 114.2° W]; 14 Mar. 1972; P.F. Torchio, B. Apperson leg.; ex *Phacelia*; BBSL700792 • 2 ♀♀; Mohave Co., 2 mi. N of “Topac” [Topock]; [34.81° N, 114.5° W]; 1 May 1983; P.F. Torchio leg.; ex *Nama*; BBSL700787, BBSL700788 • 1 ♀; Mohave Co., Topock; [34.77° N, 114.49° W]; 15 Mar. 1972; P.F. Torchio, B. Apperson leg.; ex *Cercidium*; BBSL700794 • 1 ♂; Pima Co., 2 km NE of Oracle; 32.626° N, 110.7362° W; elev. 1240 m; 20–24 May 2013; M.E. Irwin leg.; BBSL FDP152841 • 1 ♂; Pima Co., Tucson; [32.2° N, 110.9° W]; 2 Jul. 1991; W.T. Weislo leg.; SEMC • 1 ♀; Santa Cruz Co., near Elgin; [31.66° N, 110.53° W]; 21 Jul. 1998; Michael S. Engel leg.; SEMC SM0262290 • 3 ♀♀; Arivaca; [31.58° N, 111.33° W]; 13 Jul. 1950; Jerome G. Rozen leg.; SEMC • 1 ♀; Canelo; [31.54° N, 110.51° W]; 10 Jul. 1957; G.D. Butler leg.; UAIC • 1 ♀, 2 ♂♂; *ibid.*; 19 Jul. 1958; M.S. Adachi leg.; UAIC • 1 ♀, 2 ♂♂; *ibid.*; 20 Jul. 1958; G.D. Butler leg.; UAIC • 3 ♀♀; *ibid.*; 21 Jul. 1958; G.D. Butler leg.; UAIC • 1 ♂; Continental; [31.85° N, 110.97° W]; 1 Jun. 1960; G.D. Butler leg.; ex cotton; UAIC • 1 ♀; Dewey; [34.52° N, 112.25° W]; 28 Jul. 1956; G.D. Butler, Gerhardt leg.; ex alfalfa; UAIC • 1 ♀; Duncan; [32.72° N, 109.11° W]; 20 Mar. 1956; F.G. Werner, G.D. Butler leg.; ex alfalfa; UAIC • 1 ♀; Lake Mead National Recreation Area; [36.1° N, 114.5° W]; 13 May 1992; Jerome G. Rozen, B.L. Rozen leg.; ex *Eucnide urens*; AMNH • 1 ♂; Roll; [32.75° N, 113.99° W]; 3 Aug. 1954; G.D. Butler

leg.; ex *Bermuda*; UAIC • 1 ♂; *ibid.*; 11 Aug. 1954; Bohart, G.D. Butler leg.; ex *Euphorbia*; UAIC • 1 ♀; S. Tucson; [32.2° N, 110.97° W]; 26 Jul. 1956; C. Williams leg.; ex cotton; UAIC • 1 ♂; Santa Rita Mountains; [31.8° N, 110.8° W]; 10 Jul. 1952; R.H. Beamer, L.D. Beamer, W.E. LaBerge, A. Wolf, Cheng Liang, C. Weiner leg.; SEMC • 1 ♂; Wickenburg; [33.97° N, 112.73° W]; 21 Jun. 1963; F.D. Parker, L.A. Stange leg.; UCDC • 1 ♂; Yuma; [32.69° N, 114.63° W]; 13 Jul. 1953; Haga leg.; ex cotton; UAIC • 2 ♀♀; *ibid.*; Jun. 1954; J. Ellington leg.; NMSU • 1 ♀; *ibid.*; 4 Jun. 1955; G.D. Butler leg.; ex *Solanum "elaegnife"*; CUIC • 1 ♀; *ibid.*; 18 Oct. 1957; D. Tuttle leg.; UAIC. – **California** • 1 ♀; Contra Costa Co., Antioch; [38° N, 121.81° W]; 26 Sep. 1948; W.F. Chamberlain leg.; ex *Solidago*; TAMU-ENTO X1389006 • 1 ♀; Fresno Co., Los Gatos Creek; 36.212° N, 120.4652° W; 22 May 1996; Terry L. Griswold leg.; BBSL FaunalSurvey No. 000160143 • 2 ♀♀; Inyo Co., 0.4 mi. SSW of Keane Spring, Death Valley National Monument; [36.74° N, 116.91° W]; elev. 1128 m; 14 Apr. 1993; Terry L. Griswold, R.T. Griswold leg.; ex *Phacelia fremontii*; BBSL FaunalSurvey No. 000070562, FaunalSurvey No. 000070563 • 1 ♀; Inyo Co., Cucumungo Canyon, Last Chance Range; [37.33° N, 117.77° W]; elev. 1433 m; 22 Sep. 1987; Terry L. Griswold leg.; BBSL700779 • 1 ♀; Inyo Co., Death Valley Junction; [36.3° N, 116.41° W]; 20 Sep. 1993; Terry L. Griswold leg.; ex *Oxystylis lutea*; BBSL700777 • 6 ♀♀; Inyo Co., Death Valley National Park, Cow Creek Ranger Station; [36.5° N, 116.87° W]; 26 Feb. 1999; Terry L. Griswold leg.; BBSL359429, BBSL359431, BBSL359440, BBSL359441, BBSL359442, BBSL359443 • 1 ♀; Inyo Co., Grapevine Canyon, Death Valley National Monument; [37.005° N, 117.356° W]; elev. 760 m; 16 Sep. 1993; Terry L. Griswold leg.; ex *Cleomella obtusifolia*; BBSL FaunalSurvey No. 000070557 • 1 ♀; Inyo Co., Grapevine Canyon, Death Valley National Monument; [37.005° N, 117.356° W]; elev. 820 m; 16 Sep. 1993; Terry L. Griswold leg.; ex *Eriogonum rixfordii*; BBSL FaunalSurvey No. 000070561 • 8 ♀♀, 6 ♂♂; Inyo Co., Keeler; [36.49° N, 117.87° W]; elev. 1111 m; 15 Jun. 1975; E.G. Linsley, J.M. Linsley leg.; ex *Tamarix aralensis*; CUIC • 1 ♀; Inyo Co., Last Chance Range; 37.24° N, 117.64° W; elev. 1230 m; 16 Sep. 1993; ex *Gutierrezia microcephala*; BBSL700776 • 1 ♀; Inyo Co., Wildrose Spring; [36.262° N, 117.212° W]; elev. 1100 m; 19 Sep. 1993; Terry L. Griswold leg.; ex *Gutierrezia microcephala*; BBSL FaunalSurvey No. 000070566 • 1 ♀; Kern Co., Lost Hills; 35.6755° N, 119.9035° W; 15 Apr. 2015; A. Haack leg.; ex *Phacelia ciliata*; UCDC FORB201570531 • 2 ♀♀; Kern Co., Short Canyon; 35.7093° N, 117.9112° W; elev. 1200 m; 21–29 May 2008; M.E. Irwin leg.; BBSL FDP151829, FDP151874 • 1 ♀; Los Angeles Co., Ballona Wetlands near Playa del Rey; [33.97° N, 118.44° W]; 5 Jun. 1981; R.R. Snelling leg.; ex *Cressa truxillensis vallicola*; CUIC • 3 ♀♀; Los Angeles Co., Chatsworth; 34.26° N, 118.601° W; 1–8 Jul. 2017; LACM • 1 ♂; Riverside Co., 18 mi. W of Blythe; 33.6064° N, 114.9022° W; 19 Apr. 2003; Jerome G. Rozen, B.L. Rozen leg.; AMNH • 4 ♀♀; Riverside Co., Deep Canyon alluvial outwash; 33.6783° N, 116.3717° W; elev. 200 m; 4 Jun. 2002; M.E. Irwin leg.; BBSL FDP151744, FDP151751, FDP151755, FDP151742 • 1 ♀; Riverside Co., Indio, 2 miles northwest; [33.74° N, 116.24° W]; 26 Oct. 1952; Ray F. Smith, E.G. Linsley leg.; EMEC • 1 ♀; Riverside Co., Norco; 33.912° N, 117.5702° W; 1–8 Jun. 2016; LACM • 1 ♀; Riverside Co., Palm Springs; 33.6796° N, 116.548° W; 4–9 Apr. 2014; F.D. Parker, T.D. McIntyre leg.; BBSL FDP146595 • 3 ♂♂; *ibid.*; 4–9 Apr. 2014; F.D. Parker, T.D. McIntyre leg.; BBSL FDP146635, FDP146762, FDP146778 • 5 ♀♀; *ibid.*; 14–18 Apr. 2014; F.D. Parker, T.D. McIntyre leg.; BBSL FDP145666, FDP145748, FDP145766, FDP145831, FDP145597 • 3 ♂♂; *ibid.*; 14–18 Apr. 2014; F.D. Parker, T.D. McIntyre leg.; BBSL FDP145644, FDP145837, FDP145845 • 2 ♀♀; *ibid.*; 28 Apr.–1 May 2014; F.D. Parker, T.D. McIntyre leg.; BBSL FDP144390, FDP144445 • 1 ♂; *ibid.*; 28 Apr.–1 May 2014; F.D. Parker, T.D. McIntyre leg.; BBSL FDP144504 • 1 ♂; *ibid.*; 1–5 May 2014; F.D. Parker, T.D. McIntyre leg.; BBSL FDP144809 • 1 ♀; Riverside Co., Sycamore Canyon Park; 33.9542° N, 117.3197° W; elev. 380 m; 17 Oct. 2015; Douglas Yanega leg.; UCRC ENT 458863 • 4 ♀♀; San Bernardino Co., 30 mi. W of Baker; [35.26° N, 116.61° W]; 1 May 1993; P.F. Torchio, D.M. Torchio leg.; ex *Mentzelia*; BBSL700797, BBSL700798, BBSL700799, BBSL700800 • 2 ♀♀; San Bernardino Co., 49 Palms Oasis; 34.1064° N, 116.1053° W; elev. 845 m; 27 Apr. 2012; UCR Team leg.; UCRC ENT 394707, 394712 • 1 ♂; *ibid.*; 27 Apr. 2012; UCR Team leg.; UCRC ENT 394726 • 8 ♀♀; San Bernardino Co., 9 air miles south of Baker, Zzyzx Springs; [35.14° N, 116.1° W]; 20 Apr. 1977; J. Doyen leg.; ex tamarisk; EMEC • 2 ♀♀; *ibid.*; 20–21 Apr. 1977; M.E. Buegler leg.; EMEC • 4 ♀♀, 2 ♂♂; *ibid.*; 22 Apr.

1977; J. Powell leg.; ex *Cleomella obtusifolia*; EMEC • 4 ♀♀; *ibid.*; 23 Apr. 1977; J. Powell leg.; ex *Cleomella obtusifolia*; EMEC • 1 ♀; *ibid.*; 23 Apr. 1977; M.E. Buegler leg.; EMEC • 1 ♂; San Bernardino Co., Clipper Valley, T10N R15E Sec. 30; [34.93° N, 115.45° W]; elev. 930 m; 29 May 1983; Terry L. Griswold leg.; BBSL Faunal Survey No. 000094348 • 1 ♂; San Bernardino Co., Granite Mountains, T8N R13E Sec. 17; [34.78° N, 115.64° W]; elev. 1234 m; 22–25 May 1983; Terry L. Griswold leg.; BBSL Faunal Survey No. 000110468 • 1 ♀; San Bernardino Co., Kelso Dunes; [34.91° N, 115.72° W]; 21 Apr. 1984; S. Hawley leg.; EMEC • 1 ♂; San Bernardino Co., Saratoga Springs; [35.681° N, 116.423° W]; 22–23 Apr. 1977; J. Doyen leg.; EMEC • 1 ♀; *ibid.*; 22 Apr. 1977; R. Cave leg.; EMEC • 2 ♀♀; San Bernardino Co., Twentynine Palms; [34.14° N, 116.05° W]; 14 Apr. 1938; BBSL700795, BBSL700796 • 1 ♂; San Bernardino Co., Yermo; [34.91° N, 116.84° W]; 7 Sep. 1952; ex *Astragalus*; SEMC • 3 ♀♀; San Bernardino Co., Zzyzx Spring; [35.14° N, 116.1° W]; 26 Mar. 1988; S. O’Keefe leg.; EMEC • 1 ♀; San Bernardino Co., Zzyzx Spring; 35.1333° N, 116.1° W; 22–24 May 1982; J.P. Donahue, K.E.S. Donahue leg.; LACMENT 394513 • 1 ♀; San Diego Co., Borrego; [33.22° N, 116.33° W]; 17 ? 1956; F.X. Williams leg.; ex *Eriogonum inflatum*; CAS • 1 ♀; Santa Barbara Co., UCSB North Campus Open Space; 34.4183° N, 119.8776° W; 17 May 2019; CCBER UCSB-IZC00030291 • 3 ♀♀; Ventura Co., Point Mugu State Park, Naval Air Station Area 1; 34.11° N, 119.1° W; 31 Aug.–25 Sep. 1981; C.D. Nagano, J.M. Hogue leg.; LACM • 1 ♀; 0.4 mi. E of Amador City; 38.4208° N, 120.8188° W; 9 Sep. 2017; Paul A. Rude leg.; EMEC • 1 ♀; Anza-Borrego; 33.108° N, 116.4976° W; 23 Mar. 2012; K.J. Hung leg.; WRME • 2 ♀♀; Anza-Borrego; 33.1338° N, 116.3665° W; 2 Mar. 2013; K.J. Hung leg.; WRME • 2 ♀♀; Anza-Borrego; 33.2114° N, 116.4456° W; 12 Sep. 2013; K.J. Hung leg.; ex *Argemone* sp.; WRME • 1 ♀; Anza-Borrego, Lost Valley Road; 33.3746° N, 116.6141° W; 2 May 2015; K.J. Hung, Cen, Davids leg.; WRME • 2 ♂♂; Coronado; 32.6398° N, 117.1423° W; 14 Aug. 2013; K.J. Hung leg.; WRME • 1 ♀; Davis; [38.54° N, 121.74° W]; 29 Sep. 1962; M.E. Irwin leg.; UCDC • 1 ♀; La Mesa; [32.77° N, 117.02° W]; 28 Jun. 2011; K.J. Hung leg.; WRME • 2 ♀♀; Salton City, corner of Service Road and Cleveland Road; 33.2943° N, 115.9763° W; 4 May 2012; Z.M. Portman leg.; BBSL813983, BBSL813984 • 1 ♀; Wineville; [33.98° N, 117.52° W]; 8 Mar. 1933; Philip H. Timberlake leg.; UCDC. – **Colorado** • 1 ♀; Boulder Co., BCPOS Braly; 40.1983° N, 105.2151° W; elev. 1574 m; 2 Jun. 2016; A. C., A. M. leg.; UCMC 0255638 • 2 ♀♀; Boulder Co., BCPOS Bullock; 40.2112° N, 105.2416° W; elev. 1605 m; 25 May 2016; T. S., A. C. leg.; UCMC 0255160, UCMC 0255205 • 1 ♀; Boulder Co., BCPOS Gage; 40.1882° N, 105.1962° W; elev. 1566 m; 3 Jun. 2016; A. C., A. M. leg.; UCMC 255831 • 1 ♂; Boulder Co., BCPOS Keyes; 40.1516° N, 105.0695° W; elev. 1491 m; 27 Jul. 2016; A. C., N. S., L. M. leg.; UCMC 260773 • 1 ♀; Boulder Co., BCPOS Wallace; 40.2111° N, 105.2372° W; elev. 1601 m; 23 Jun. 2016; T. S., A. M. leg.; UCMC 0254900 • 2 ♀♀; Boulder Co., BCPOS Western Mobile; 40.206° N, 105.2241° W; elev. 1598 m; 2 Jun. 2016; A. C., A. M. leg.; UCMC • 1 ♀; *ibid.*; 16 Aug. 2016; A. C., T. S. leg.; UCMC 0260263 • 1 ♂; *ibid.*; 16 Aug. 2016; A. C., T. S. leg.; UCMC 0260264. – **Nevada** • 1 ♂; Clark Co., 0.27 mi. NNE of Toquop Wash; 36.7735° N, 114.1863° W; 23 Sep. 2005; A. Portoluri leg.; ex *Croton wigginsii*; BBSL686049 • 1 ♂; Clark Co., 0.6 mi. E of Calville Point; 36.1335° N, 114.6791° W; elev. 381 m; 7 Apr. 2004; E. Rentz leg.; ex *Cryptantha*; BBSL578738 • 1 ♂; Clark Co., 0.7 mi. S of Wheeler Well; 36.3613° N, 115.8279° W; 12 Jul. 2005; S. Higbee leg.; ex *Eriogonum* sp.; BBSL671656 • 2 ♂♂; Clark Co., 1.4 mi. S of Cottonwood Spring; 36.0256° N, 115.4026° W; elev. 1085 m; 12 May 2004; S. Higbee, L. Saul leg.; BBSL576355, BBSL576393 • 1 ♀; Clark Co., 10 mi. SW of Mesquite; [36.71° N, 114.2° W]; 30 Jun. 1982; F.D. Parker leg.; BBSL700764 • 1 ♀; Clark Co., 2.17 mi. NE of Saddle Island; 36.0969° N, 114.8234° W; 18 Apr. 2005; R. Andrus leg.; ex *Heliotropium curassavicum*; BBSL669659 • 1 ♀; *ibid.*; 18 Apr. 2005; S. Higbee leg.; ex *Euclidia urens*; BBSL677216 • 1 ♀; *ibid.*; 18 Apr. 2005; S. Higbee leg.; BBSL687107 • 1 ♂; Clark Co., 2.2 mi. SSW of Mormon Well; 36.6147° N, 115.1111° W; elev. 2008 m; 14 Jun. 2004; E. Ahlstrom, D. Skandilis leg.; BBSL537618 • 1 ♀; Clark Co., 2.3 mi. E of Sheep Mountain; 35.7473° N, 115.2407° W; elev. 896 m; 12 May 2004; Terry L. Griswold, E. Ahlstrom leg.; BBSL576500 • 1 ♀; Clark Co., 2.34 mi. SE of The Narrows; 36.6064° N, 114.4987° W; 3 May 2005; R. Andrus leg.; ex *Stephanomeria pauciflora*; BBSL670406 • 1 ♀; Clark Co., 3.0 mi. SE of Rainbow Mountain; 36.0814° N, 115.4479° W; elev. 1110 m; 23 Aug. 2004;



Terry L. Griswold leg.; ex *Chamaesyce albomarginata*; BBSL543716 • 1 ♀; Clark Co., 3.23 mi. S of Gale Hills; 36.1913° N, 114.7364° W; 21 Apr. 2005; E. Ahlstrom leg.; BBSL663915 • 1 ♀; *ibid.*; 21 Apr. 2005; R. Andrus leg.; BBSL651024 • 1 ♂; Clark Co., 3.7 mi. NE of Wheeler Pass; 36.4219° N, 115.7417° W; 14 Jul. 2005; S. Higbee leg.; ex *Melilotus alba*; BBSL687034 • 1 ♀; Clark Co., 3.9 mi. SSW of Whitney Pocket; 36.4651° N, 114.1537° W; 26 May 2005; R. Andrus leg.; BBSL650776 • 1 ♀; Clark Co., 4.13 mi. SE of Eldorado Valley; 35.8166° N, 114.9032° W; 13 Apr. 2005; R. Andrus leg.; BBSL650863 • 1 ♀; Clark Co., 5.5 mi. NE of Las Vegas; [36.3° N, 115° W]; 25 Apr. 1993; Terry L. Griswold leg.; BBSL700747 • 1 ♀; Clark Co., 6 mi. SE of Mesquite; [36.74° N, 113.99° W]; 2 May 1986; P.F. Torchio, D.M. Torchio leg.; ex *Eriogonum*; BBSL700745 • 1 ♀; Clark Co., Christmas Tree Pass; 35.26° N, 114.7418° W; 10 Jun. 1998; M. Andrus, K. Receveur, K. Keen, C. Shultz leg.; BBSL282931 • 1 ♀; Clark Co., Gold Butte; 36.2815° N, 114.1933° W; 18 Sep. 1998; W.R. Bowlin leg.; BBSL321011 • 1 ♀; Clark Co., Gypsum Spring; 36.2093° N, 114.912° W; 12 Mar. 1998; Terry L. Griswold leg.; BBSL278167 • 1 ♀; Clark Co., Juanita Spring Ranch, S of Riverside; [36.64° N, 114.25° W]; 12–14 May 1984; F.D. Parker leg.; BBSL700746 • 1 ♂; *ibid.*; 12–14 May 1984; F.D. Parker leg.; BBSL700647 • 1 ♀; Clark Co., Kyle Canyon; 36.2653° N, 115.6584° W; 15 Jul. 2005; E. Green leg.; ex *Mentzelia* sp.; BBSL675756 • 7 ♀♀; Clark Co., Las Vegas Wash; 36.117° N, 114.9023° W; 7 Apr. 1998; M. Andrus, K. Receveur, K. Keen, C. Shultz leg.; BBSL262835, BBSL262836, BBSL262839, BBSL262841, BBSL262842, BBSL262843, BBSL262844 • 1 ♀; Clark Co., Logandale; [36.6° N, 114.48° W]; 27 Apr. 1972; George E. Bohart, P.F. Torchio, F.D. Parker leg.; ex *Heliotropium*; BBSL700765 • 2 ♀♀; Clark Co., Mormon Well Road; 36.4355° N, 115.351° W; 15 Sep. 1998; W.R. Bowlin leg.; BBSL323807, BBSL324859 • 1 ♀; Clark Co., Mormon Well Road; 36.4362° N, 115.352° W; 15 Sep. 1998; W.R. Bowlin leg.; BBSL323764 • 1 ♂; Clark Co., Mormon Well Road; 36.6045° N, 115.1113° W; 1 Jul. 1998; M. Andrus, C. Shultz leg.; ex white composite; BBSL299550 • 1 ♀; Clark Co., N of Devils Throat; 36.438° N, 114.153° W; 12 Aug. 1998; C. Shultz, Terry L. Griswold leg.; BBSL316950 • 1 ♂; Clark Co., N of Devils Throat; 36.4427° N, 114.151° W; 6 Oct. 1998; Terry L. Griswold leg.; BBSL318689 • 1 ♀; Clark Co., N of Jean; 35.8102° N, 115.2998° W; 8 Oct. 1998; Terry L. Griswold leg.; BBSL318803 • 2 ♀♀; Clark Co., N of Mormon Well; 36.689° N, 115.0932° W; 1 Jul. 1998; M. Andrus, C. Shultz leg.; BBSL304351, BBSL304362 • 1 ♀; Clark Co., NW of Sandy Valley; 35.8575° N, 115.689° W; 25 Aug. 1998; O.I. Messinge, C. Shultz leg.; BBSL315266 • 1 ♀; Clark Co., Pahrump; [36.18° N, 115.88° W]; 12 Jun. 1989; P.F. Torchio leg.; BBSL700748 • 3 ♀♀; Clark Co., Peek-A-Boo Canyon; 36.5032° N, 115.1577° W; 16 Jul. 1998; M. Andrus, C. Shultz leg.; BBSL300219, BBSL300518, BBSL300529 • 1 ♂; *ibid.*; 16 Jul. 1998; M. Andrus, C. Shultz leg.; BBSL299774 • 1 ♀; Clark Co., S of Mormon Well; 36.6368° N, 115.109° W; 16 Jul. 1998; M. Andrus, C. Shultz leg.; BBSL302097 • 1 ♀; Clark Co., S of Telephone Canyon; 36.2692° N, 115.4882° W; 16 Jun. 1998; M. Andrus, K. Receveur, K. Keen, C. Shultz leg.; BBSL296574 • 1 ♀; Clark Co., S of Telephone Canyon; 36.2692° N, 115.5548° W; 16 Jun. 1998; M. Andrus, K. Receveur, K. Keen, C. Shultz leg.; BBSL288586 • 1 ♀; Clark Co., Sandy Valley; 35.852° N, 115.6715° W; 25 Aug. 1998; O.I. Messinge, C. Shultz leg.; BBSL314983 • 4 ♀♀; Clark Co., Sandy Valley; 35.8525° N, 115.6717° W; 15 Sep. 1998; W.R. Bowlin leg.; BBSL322334, BBSL322536, BBSL322543, BBSL323244 • 1 ♀; Clark Co., Sandy Valley; 35.855° N, 115.6697° W; 15 Sep. 1998; W.R. Bowlin leg.; BBSL322432 • 1 ♀; Clark Co., Sawmill Road; 36.6962° N, 115.0888° W; 1 Jul. 1998; M. Andrus, C. Shultz leg.; BBSL306318 • 5 ♀♀; Clark Co., SE of Black Butte; 35.8627° N, 115.6903° W; 15 Sep. 1998; W.R. Bowlin leg.; BBSL322255, BBSL323419, BBSL323427, BBSL324439, BBSL324972 • 22 ♀♀; Clark Co., Spring Mountain Ranch; [36.07° N, 115.45° W]; May–Jul. 1988; M.J. Verchick leg.; BBSL700744, BBSL700749, BBSL700750, BBSL700751, BBSL700752, BBSL700753, BBSL700754, BBSL700755, BBSL700756, BBSL700757, BBSL700758, BBSL700759, BBSL700760, BBSL700761, BBSL700762, BBSL700763, BBSL700766, BBSL700767, BBSL700768, BBSL700769, BBSL700771, BBSL700772 • 1 ♂; *ibid.*; May–Jul. 1988; M.J. Verchick leg.; BBSL700651 • 1 ♀; Clark Co., SW of Columbia Pass; 35.8102° N, 115.5185° W; 10 Aug. 1998; M. Andrus, C. Shultz, Terry L. Griswold leg.; BBSL313286 • 1 ♀; Clark Co., SW of Jean; 35.777° N, 115.3232° W; 11 Aug. 1998; M. Andrus, C. Shultz, Terry L. Griswold leg.; BBSL309889 • 2 ♀♀; Clark Co., W of Beehive Rock; 36.4088° N, 114.5803° W;

5 Aug. 1998; M. Andrus, C. Shultz leg.; BBSL309857, BBSL312832 • 1 ♀; Clark Co., W of Calico Hills; 36.1578° N, 115.452° W; 14–15 May 1998; M. Andrus, K. Receveur, K. Keen, C. Shultz leg.; BBSL266228 • 2 ♀♀; Clark Co., W of Sheep Mountain; 35.7598° N, 115.3213° W; 11 Aug. 1998; M. Andrus, C. Shultz, Terry L. Griswold leg.; BBSL313212, BBSL313779 • 1 ♀; Clark Co., W of Wilson Pass; 35.8705° N, 115.541° W; 5 Jun. 1998; F.D. Parker leg.; BBSL275008 • 1 ♀; Clark Co., W of Wilson Pass; 35.8782° N, 115.5187° W; 5 Jun. 1998; F.D. Parker leg.; BBSL274937 • 1 ♀; Clark Co., West End Wash, Lake Mead NRA; [36.15° N, 114.72° W]; elev. 549 m; 31 Mar. 1993; Terry L. Griswold, V.J. Tepedino leg.; ex *Arctomecon californica*; BBSL FaunalSurvey No. 000031400 • 1 ♀; *ibid.*; 31 Mar. 1993; Terry L. Griswold, V.J. Tepedino leg.; ex *Lepidium*; BBSL FaunalSurvey No. 000031138 • 1 ♂; Clark Co., Wheeler Wash; 36.3004° N, 115.824° W; elev. 1722 m; 27 Aug. 2004; E. Rentz leg.; ex *Eriogonum* sp.; BBSL578532 • 2 ♀♀; Mineral Co., Walker Lake, Tamarisk Beach; [38.7° N, 118.77° W]; 7 Jun. 2000; R. Andrus leg.; ex prostrate plant, blossoms purplish in fiddlehead; BBSL358932, BBSL358946 • 7 ♂♂; *ibid.*; 7 Jun. 2000; R. Andrus leg.; ex prostrate plant, blossoms purplish in fiddlehead; BBSL358937, BBSL358938, BBSL358939, BBSL358940, BBSL358942, BBSL358943, BBSL358944 • 5 ♀♀; *ibid.*; 7 Jun. 2000; R. Andrus leg.; ex succulent, prostrate plant, petals five, pink; BBSL358949, BBSL358951, BBSL358952, BBSL358954, BBSL358955 • 2 ♂♂; *ibid.*; 7 Jun. 2000; R. Andrus leg.; ex succulent, prostrate plant, petals five, pink; BBSL358950, BBSL358953 • 1 ♀; Nye Co., 1.3 mi. SW of Crystal Spring; 36.413° N, 115.9889° W; 12 May 2004; E. Rentz leg.; ex *Penstemon fructiformis* ssp. *amargosae*; BBSL533094 • 1 ♀; Nye Co., Pahump; [36.21° N, 115.99° W]; 25 Sep. 1991; G. Trostle leg.; BBSL700778 • 1 ♀; Nye Co., S of Wheeler Wash; 36.1943° N, 115.912° W; 15 Jun. 1998; M. Andrus, K. Receveur, K. Keen, C. Shultz leg.; BBSL304843 • 4 ♀♀; Las Vegas, 8930 Lansberry Court; 36.1072° N, 115.2863° W; elev. 780 m; 1–20 Jul. 2014; K. Ribardo leg.; UCRC ENT 480486, 480503, 480523, 480548 • 7 ♂♂; *ibid.*; 1–20 Jul. 2014; K. Ribardo leg.; UCRC ENT 480493, 480494, 480518, 480531, 480532, 480546, 480554. – **New Mexico** • 1 ♀; Catron Co., Glenwood; [33.32° N, 108.88° W]; 1 Jun. 1965; R.M. Bohart leg.; UCDC • 1 ♀; Doña Ana Co., Las Cruces; [32.32° N, 106.76° W]; 12 Jun. 1950; R.H. Beamer leg.; SEMC • 1 ♀; *ibid.*; 3 Jul. 1962; J.L. Lopez leg.; NMSU • 1 ♀, 1 ♂; *ibid.*; 10 Jul. 1962; J.L. Lopez leg.; NMSU • 2 ♀♀; *ibid.*; 27 Jun. 1963; J.L. Lopez leg.; NMSU • 1 ♀; Eddy Co.; 32.3233° N, 103.74° W; 8 Jun. 1979; D.R. Delorme, H.L. Carrola leg.; TAMU-ENTO X1387860 • 1 ♀; Hidalgo Co., 22.6 km S of Animas; [31.74° N, 108.81° W]; 13 Jul. 1987; ex *Berlandiera*; SEMC • 1 ♀; Otero Co., bottom Alamo Canyon, T16S R10E Sec. 34; [32.87° N, 107.86° W]; elev. 1465–1525 m; 26 Jun. 1992; W.R. Bowlin, M. Juhn leg.; ex *Argemone pleicantha pinnatisecta*; CUIC • 1 ♂; Roosevelt Co., Oasis State Park, near Portales; [34.26° N, 103.35° W]; 17 Sep. 1970; Baker, Kamm, Charles D. Michener leg.; ex *Helianthus petiolaris*; SEMC • 1 ♀; Sierra Co., Highway 27; 32.6803° N, 107.5241° W; elev. 1529 m; 12 Aug. 2007; Jason J. Gibbs, C. Sheffield leg.; PCYU PYU-6681 • 1 ♀; Socorro Co., Bosque del Apache National Wildlife Refuge; [33.8° N, 106.89° W]; 21 Apr.–5 May 2008; TAMU. – **Texas** • 2 ♀♀; Brewster Co., Elephant Mountain WMA, Calamity Creek; 30.0371° N, 103.5653° W; 22–23 Apr. 2011; E.G. Riley leg.; TAMU-ENTO X0610459, X0612033 • 1 ♀; Culberson Co., 26 km N of Van Horn; [31.26° N, 104.84° W]; 9 Apr. 1986; Terry L. Griswold leg.; BBSL700631 • 1 ♀; Culberson Co., SE corner of Guadalupe Mountains National Park; [31.82° N, 104.92° W]; elev. 1400 m; 7 Apr. 1986; R.T. Griswold leg.; BBSL236744 • 3 ♀♀; El Paso Co., Franklin Mountains State Park, McKelligon Canyon Park; [31.84° N, 106.485° W]; 15–30 Jul. 2005; N. Brown leg.; TAMU-ENTO X1359897, X1359934, X1362510 • 1 ♀; Jeff Davis Co., 9 mi. S of Kent; [30.94° N, 104.22° W]; 29 May 1999; Laurence Packer leg.; PCYU PYU-844 • 1 ♀; Jeff Davis Co., 9–18 mi. S of Kent; [30.9° N, 104.22° W]; 29 May 1999; Laurence Packer leg.; PCYU PYU-849 • 1 ♀; Jeff Davis Co., Madera Canyon Park, Davis Mountains; [30.71° N, 104.11° W]; 20 Jul. 1950; Ray F. Smith leg.; AMNH • 1 ♂; Travis Co., Austin; [30.26° N, 97.74° W]; 28 Sep.–10 Oct. 1975; Bob Henderson leg.; TAMU-ENTO X1398814. – **Utah** • 1 ♀; San Juan Co., Glen Canyon, Pyro hanging garden; [37.1° N, 110.9° W]; 26 Jun. 1992; J.F. Fowler leg.; BBSL700850 • 1 ♀; Washington Co., Beaver Dam Slope; [37.1° N, 113.96° W]; 10–12 Aug. 1983; W.J. Hanson leg.; BBSL700676 • 27 ♀♀; Washington Co., Beaver Dam Wash; [37.1° N, 114.02° W]; 10–24 Jun. 1987; BBSL700652, BBSL700653, BBSL700655, BBSL700656, BBSL700657, BBSL700658, BBSL700659,

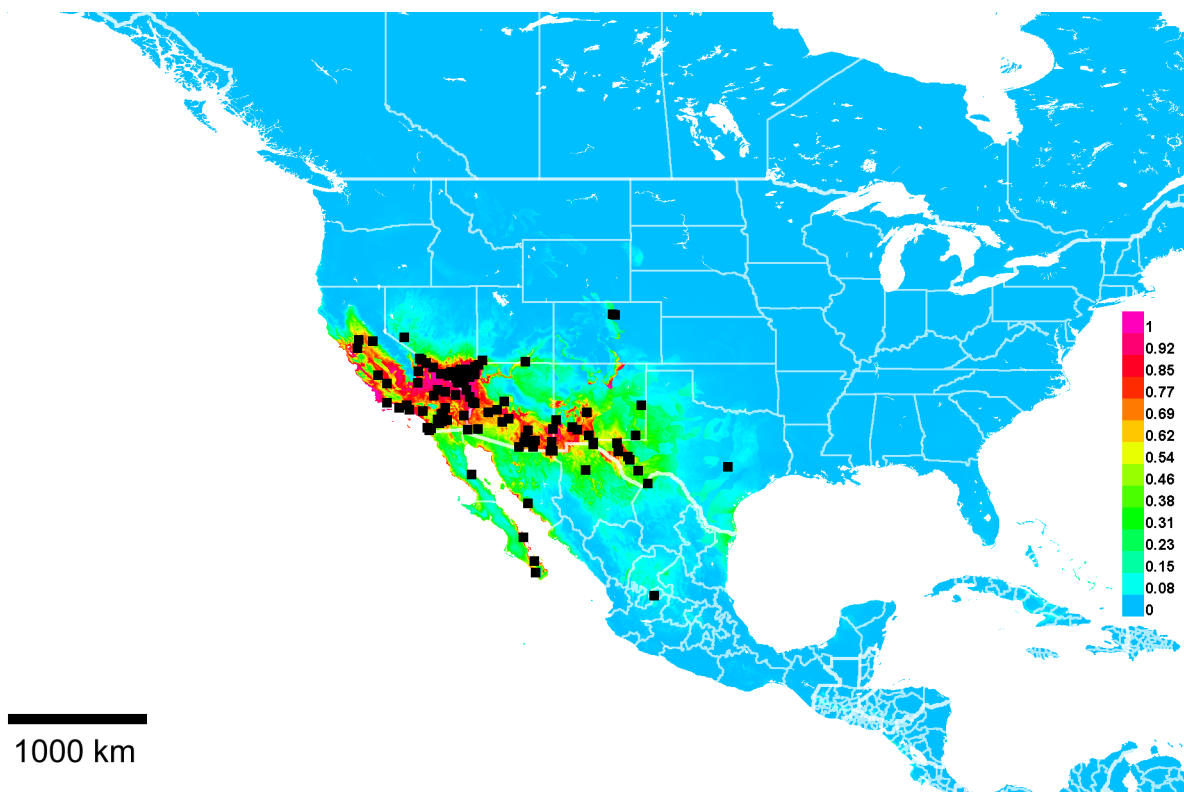
BBSL700660, BBSL700662, BBSL700663, BBSL700664, BBSL700665, BBSL700666, BBSL700667, BBSL700668, BBSL700671, BBSL700672, BBSL700673, BBSL700684, BBSL700781, BBSL700801, BBSL700802, BBSL700803, BBSL700804, BBSL700805, BBSL700806, BBSL700807 • 17 ♂♂; *ibid.*; 10–24 Jun. 1987; BBSL700654, BBSL700810, BBSL700811, BBSL700814, BBSL700815, BBSL700816, BBSL700817, BBSL700818, BBSL700820, BBSL700823, BBSL700824, BBSL700826, BBSL700827, BBSL700828, BBSL700829, BBSL700831, BBSL700833 • 1 ♀; Washington Co., Beaver Dam Wash, Lytle Ranch Preserve; [37.14° N, 114.02° W]; 10–24 Jun. 1987; W.J. Hanson leg.; BBSL700683 • 1 ♂; *ibid.*; 10–24 Jun. 1987; W.J. Hanson leg.; BBSL700812 • 1 ♀; *ibid.*; 20 Jul.–6 Aug. 1987; W.J. Hanson leg.; BBSL700780 • 1 ♂; *ibid.*; 20 Jul.–6 Aug. 1987; W.J. Hanson leg.; BBSL700813 • 1 ♀; *ibid.*; 19 Aug.–10 Sep. 1987; W.J. Hanson leg.; BBSL700682 • 1 ♀; Washington Co., Ivins; [37.17° N, 113.68° W]; 16 Jul. 1980; Hanson, G.F. Knowlton, Clemons leg.; ex *Chrysothamnus*; BBSL700681.

### Range

California and Mojave, Sonoran, and Chihuahuan Deserts, with some outliers in eastern Colorado, eastern Texas, and Aguascalientes (Fig. 26).

### Floral hosts

ASTERACEAE: *Baileya*: *B. multiradiata* • *Chrysothamnus* • *Gutierrezia*: *G. microcephala* • *Haplopappus* Cass. • *Solidago* L. • *Stephanomeria*: *S. pauciflora* (Torr.) A.Nelson • BIGNONIACEAE: *Tecoma* Juss.: *T. stans* (L.) Juss. ex Kunth • BORAGINACEAE: *Cryptantha* Lehm. ex G.Don • *Heliotropium* L.: *H. curassavicum* L. • *Nama* • *Phacelia*: *P. ciliata* Benth. • *P. fremontii* Torr. • BRASSICACEAE: *Lepidium* • CLEOMACEAE: *Cleomella* DC.: *C. obtusifolia* Torr. & Frém. • *Oxystylis* Torr. & Frém.: *O. lutea* Torr. &



**Fig. 26.** Georeferenced collection records of *Lasioglossum (D.) gaudiale* (Sandhouse, 1924) (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence.



Frém. • CONVOLVULACEAE Juss.: *Cressa* L.: *C. truxillensis* Kunth • EUPHORBIACEAE: *Croton*: *C. wigginsii* • *Euphorbia*: *E. albomarginata* • FABACEAE: *Astragalus* L. • *Cercidium* • *Medicago*: *M. sativa* • *Melilotus*: *M. officinalis*: *M. o.* subsp. *alba* • LOASACEAE: *Eucnide* Zucc.: *E. urens* Parry • *Mentzelia* • MALVACEAE: *Gossypium* • PAPAVERACEAE: *Arctomecon*: *A. californicum* • *Argemone*: *A. pleiacantha* Greene: *A. p.* subsp. *pinnatisecta* G.B.Ownbey • PLANTAGINACEAE: *Penstemon*: *P. fruticiformis* Coville • POLYGONACEAE: *Eriogonum*: *E. inflatum* Torr. & Frém. • *E. rixfordii* S.Stokes • SOLANACEAE: *Solanum*: *S. elaeagnifolium* • TAMARICACEAE: *Tamarix*: *T. aralensis* Bunge • *T. ramosissima*.

### DNA barcodes

Twelve confirmed sequences available, two haplotypes (BOLD process IDs: BEECB223-07, BEECB225-07, BEECB226-07, DLII648-07, NCBEE405-21, NCBEE406-21, NCBEE617-21 (haplotype 1); DLIII156-19, DLIII226-20, DLIII228-20, DLIII229-20, DLIII230-20 (haplotype 2)). There is a large amount of divergence within these sequences (2.61% maximum intraspecific p-distance). They are closest in terms of p-distance to *L. helianthi* (1.07% minimum interspecific p-distance). No fixed nucleotide substitutions distinguish all *L. gaudiale* from all other Nearctic species of the *L. gemmatum* complex, but two fixed substitutions distinguish haplotype 1, and two fixed substitutions distinguish haplotype 2: 205(C) and 357(C) (haplotype 1); 408(A) and 411(T) (haplotype 2) (Supp. file 2).

### Comments

Common in Nevada and California, becoming rare further east. *Lasioglossum gaudiale* is especially abundant in the Mojave Desert.

### *Lasioglossum (Dialictus) gloriosum* sp. nov.

urn:lsid:zoobank.org:act:863681D4-D141-45E1-A3F0-E49F2334394B

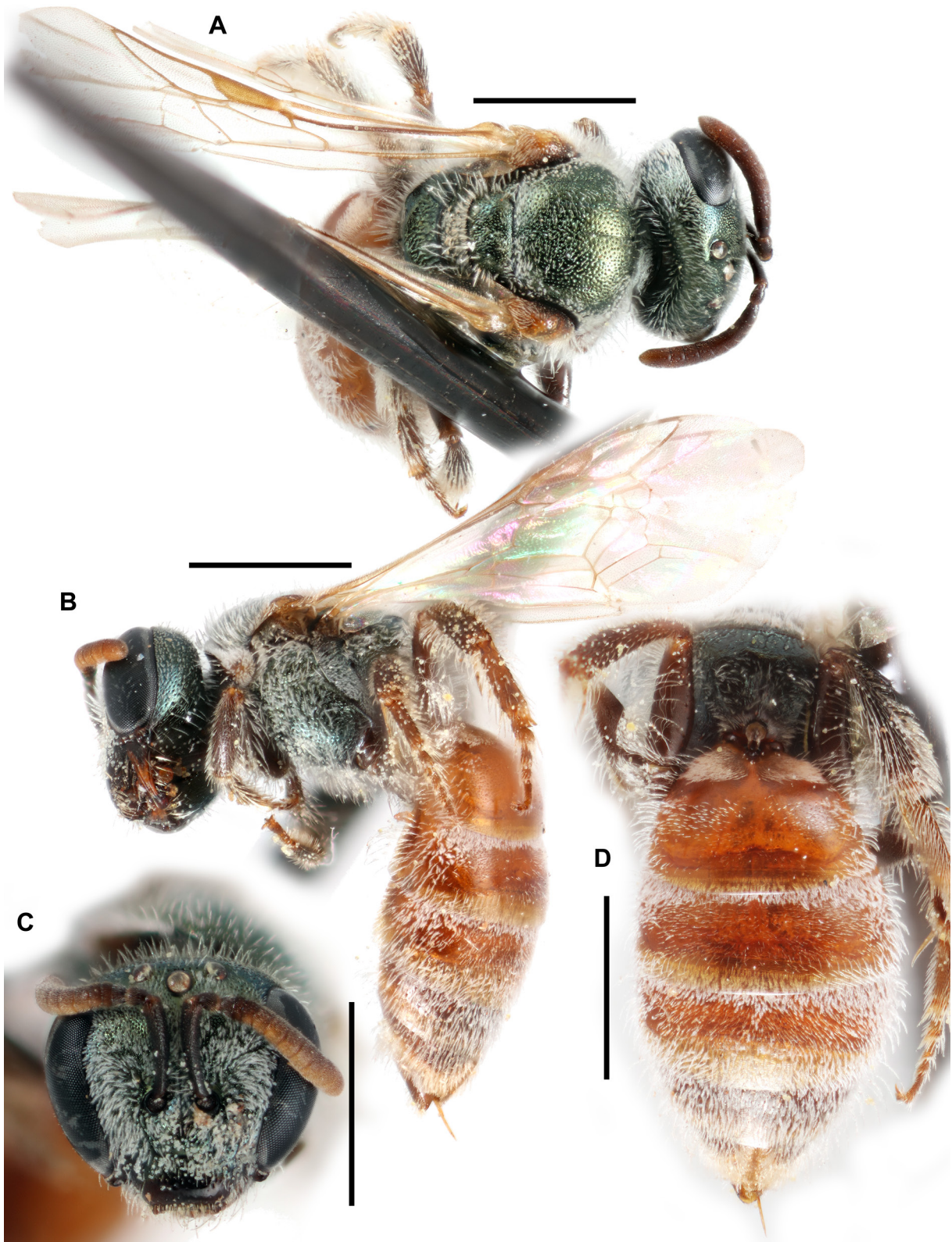
Figs 27–29, 76F, 83A, 84A, 102D, 103B, 104B, 105A

### Diagnosis

Females of *L. gloriosum* sp. nov. have the tegula relatively large (maximum length more than half ITS and exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin weakly concave, and densely punctate ( $IS \leq 1$  PD); mesoscutum, scutellum, and mesepisternum shiny and very densely punctate ( $IS < 1$  PD) (mesoscutum becoming tessellate and slightly more sparsely punctate anteromedially); metapostnotum shiny with coarse rugae reaching posterior margin; mesoscutum lateral and posterior margins, metanotum, and pleura with abundant tomentum; T1 anterior slope coriarius; and metasoma red-orange.

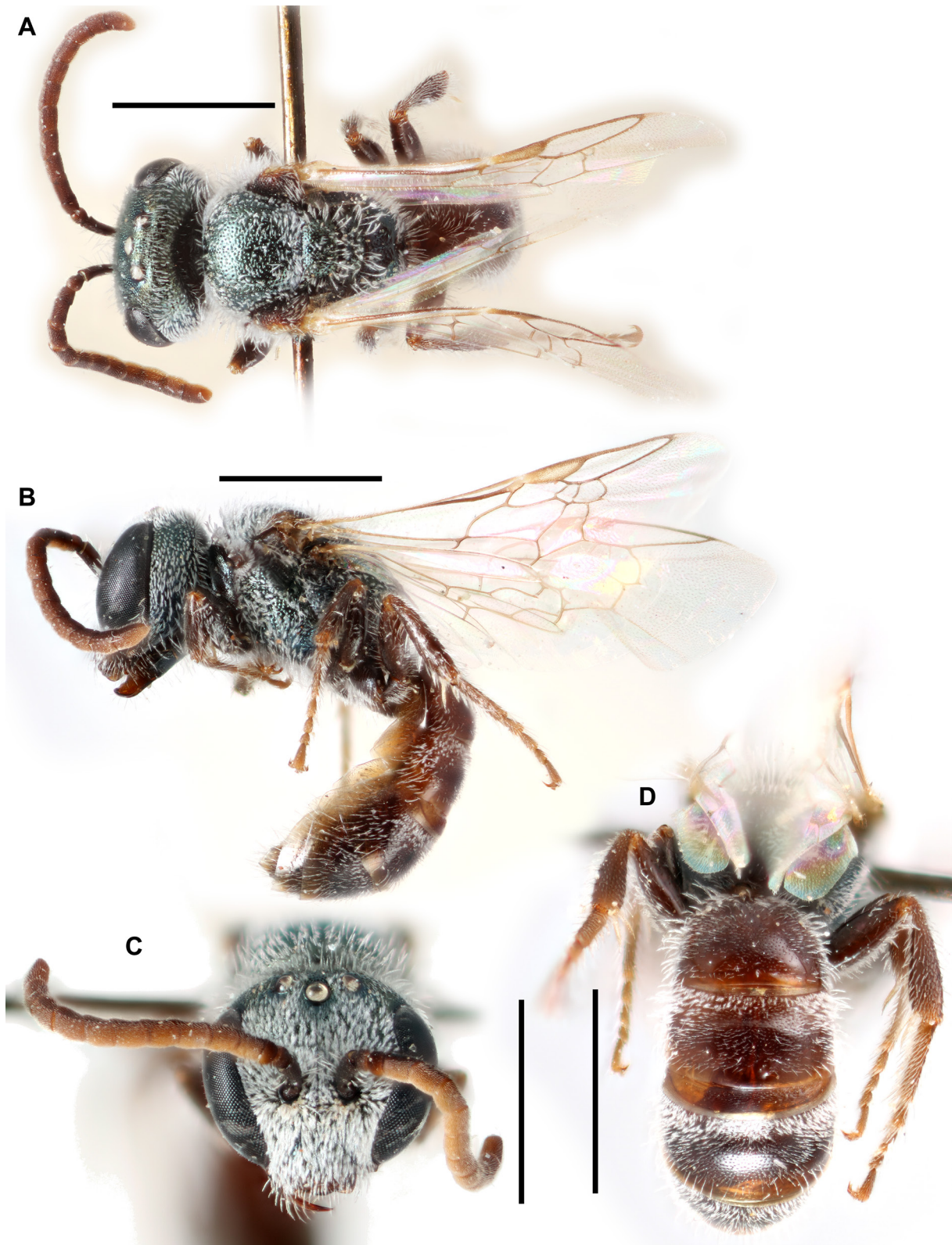
Females of *L. gloriosum* sp. nov. are most similar to those of *L. diabolicum* sp. nov., *L. gaudiale*, and *L. indagator* sp. nov. Females of *L. diabolicum* and *L. gaudiale* have the mesoscutum more sparsely punctate between parapsidal lines (some  $IS > 1$  PD) and the mesoscutum, metanotum, and pleura with tomentum sparse or absent. In addition, females of *L. diabolicum* and *L. indagator* have the tegula smaller (not exceeding posterior margin of mesoscutum in dorsal view) and usually more sparsely punctate laterally at midlength ( $IS \geq 1$  PD). Females of *L. indagator* also have the metapostnotum rugae not reaching posterior margin. Females of *L. gaudiale* have the gena about as wide as eye in lateral view, metapostnotum rugae usually not reaching posterior margin, T1 anterior slope shiny, and scutellum often sparsely punctate ( $IS = 1–2$  PD). Some other species in the *L. stictaspis* species complex can be very similar, but can be separated by the same characters as for *L. diabolicum* except for the tegula.

Males of *L. gloriosum* sp. nov. have the tegula very large (maximum length  $\geq 60\%$  ITS and exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin somewhat strongly concave



**Fig. 27.** *Lasioglossum (D.) gloriosum* sp. nov., ♀, holotype (CUIC). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma and propodeum. Scale bars = 1 mm.





**Fig. 28.** *Lasioglossum* (*D.*) *gloriosum* sp. nov., ♂, from Utah, Bluff (CUIC). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma. Scale bars = 1 mm.



with a rounded posterior projection, and densely punctate (IS < 1 PD); face broad (length/width ratio  $\leq 0.83$ ) and covered with very dense tomentum up to the median ocellus; mesoscutum usually densely punctate (IS  $\leq 1$  PD) and fringed with tomentum; pleura with extensive tomentum; metapostnotum shiny with strong subparallel rugae usually reaching posterior margin; T2–T3 with extensive basolateral tomentum; and head and mesosoma usually blue-green to olive green. They are most similar to those of *L. gaudiale* and *L. indagator* sp. nov. See the diagnosis for *L. gaudiale* for a comparative diagnosis between these three species.

### Etymology

The specific epithet '*gloriosum*' is an adjective derived from the Latin noun '*gloria*' (glory, fame) plus the adjectival suffix '*-osum*' (fullness or abundance). It refers to the numerous distinctive characters possessed by this species which make it highly recognisable. An appropriate translation would be the glorious sweat bee.

### Material examined

#### Holotype

UNITED STATES – **Utah** • ♀; Emery Co., North Temple Wash, San Rafael Desert; [38.667° N, 110.648° W]; elev. 1615 m; 15 Jun. 1983; T. Griswold leg.; CUIC.

[Verbatim label: UTAH EmeryCo 5300' / North Temple Wash / San Rafael Desert / VI-15-83 T Griswold // *DIALICTUS hunteri* (Crawford) det. Eickwort // CORNELL UNIVERSITY INSECT COLLECTION // HOLOTYPE / *Lasioglossum (Dialictus) gloriosum* Gardner and Gibbs]

#### Paratypes

UNITED STATES – **California** • 1 ♂; Los Angeles Co., Chatsworth; 34.26° N, 118.601° W; 1–8 Jul. 2017; LACM. – **Nevada** • 1 ♀; Clark Co., Lovell Canyon; 36.1526° N, 115.5719° W; 2 Jun. 2005; R. Andrus leg.; ex *Lesquerella* sp.; BBSL677120 • 1 ♀; Clark Co., Sandy Valley; 35.855° N, 115.6697° W; 15 Sep. 1998; W. Bowlin leg.; BBSL322996. – **New Mexico** • 1 ♀; Socorro Co., Sevilleta National Wildlife Refuge; 34.3431° N, 106.7417° W; 18 Apr.–2 May 2011; K. Wetherill leg.; TAMU • 1 ♀; Socorro Co., Sevilleta National Wildlife Refuge; 34.335° N, 106.7219° W; 12–26 Jun. 2017; K. W. Wright leg.; TAMU • 1 ♂; Albuquerque; [35.08° N, 106.61° W]; Cockerell leg.; UCMC • 1 ♀; La Joya Wildlife Preserve, 20 mi. N of Socorro; [34.34° N, 106.89° W]; 1–6 Aug. 1976; W. Rubink leg.; CSUC • 1 ♀; *ibid.*; 15–26 Jul. 1976; W. Rubink leg.; CUIC. – **Utah** • 1 ♀; Emery Co., 2 km S of Hatt's Ranch; 38.8417° N, 110.3817° W; elev. 1375 m; 21–26 May 2002; M.E. Irwin, F.D. Parker leg.; BBSL FDP755762 • 1 ♀; Emery Co., Dugout Spring, 2.5 air mi. NE of Big Flat Top; [38.55° N, 110.42° W]; elev. 1463 m; 28 Jul. 1983; F. and A. Parker and T. Griswold leg.; CUIC • 2 ♀♀; Emery Co., Green River; 38.9885° N, 110.162° W; 9 May 2000; F.D. Parker leg.; BBSL389774, BBSL389784 • 1 ♀; Emery Co., North Temple Wash, San Rafael Desert; [38.667° N, 110.648° W]; elev. 1615 m; 15 Jun. 1983; T. Griswold leg.; CUIC • 1 ♀; Emery Co.; [39° N, 110° W]; 12 May 1965; G.F. Knowlton leg.; BBSL • 1 ♀, 2 ♂♂; Garfield Co., Lake Powell, 4 air mi. NNW of Bullfrog; [37.57° N, 110.78° W]; elev. 1158 m; 30 Jul. 1983; F. and A. Parker leg.; CUIC • 1 ♀; Kane Co., Tibbet Canyon; 37.1606° N, 111.5392° W; 13 Jun. 2002; C. Davidson leg.; ex *Salsola paulsenii*; BBSL443161 • 1 ♀; Millard Co., Oak Creek Canyon; [39.35° N, 112.26° W]; 27 May 1958; G.F. Knowlton leg.; ex *Salix*; SEMC • 1 ♂; San Juan Co., Bluff; [37.28° N, 109.55° W]; 15 Jul. 1967; J.H. Davidson, J.M. Davidson, M.A. Cazier leg.; CUIC • 1 ♂; Wayne Co., 4 mi. SE of Hanksville; [38.32° N, 110.68° W]; 28 Aug. 1985; T.L. Griswold leg.; ex *Helianthus annuus*; BBSL Faunal Survey No. 000 039 447.

### Description

#### Female

COLOURATION. Head and mesosoma blue-green to olive green; clypeus apex black; labrum reddish brown; mandible orange with black base and red apex; flagellum reddish brown dorsally, orange ventrally. Pronotal lobe brown; legs reddish brown; tegula brown to orange; wing membrane hyaline, veins with

subcosta dark brown, otherwise brown to pale amber. Metasoma orange with dark spiracular spots on T3–T4 and rims of terga and sterna broadly translucent yellow.

**PUBESCENCE.** Body pile colour white. Tomentum dense on paraocular area, gena, pronotal collar and lobe, space between pronotal lobe and tegula, margins of mesoscutum, metanotum medially, metepisternum, T2–T3 basally, and T4 throughout; sparse on supraclypeal area, upper half of clypeus, preëpisternum, hypoepimeron, and mesepisternum. Mesoscutum pubescence thin to densely plumose. Wing setae light and dark, short and dense. Acarinarial fan complete, dense. T2 fringes dense, T3 fringes dense.

**SURFACE SCULPTURE.** Clypeus shiny, with punctures dense in basal half ( $IS < 1$  PD), nearly impunctate apically; supraclypeal area shiny, with punctures dense ( $IS \leq 1$  PD); paraocular area shiny, with punctures crowded ( $IS = 0$  PD); frons shiny, with punctures crowded ( $IS = 0$  PD); vertex shiny, with punctures crowded laterally ( $IS = 0$  PD), becoming sparse ( $IS = 1–3$  PD) and diversopunctate medially; gena shiny, with punctures dense ( $IS < 1$  PD); postgena lineolate. Tegula punctures crowded ( $IS = 0$  PD), becoming slightly sparser medially ( $IS \leq 1$  PD); mesoscutum shiny, becoming tessellate anteromedially, with punctures dense ( $IS \leq 1$  PD); scutellum shiny, with punctures dense ( $IS \leq 1$  PD); metapostnotum weakly tessellate, with rugae strong, subparallel, reaching posterior margin; preëpisternum areolate; hypoepimeron shiny, with punctures crowded ( $IS = 0$  PD); mesepisternum shiny, with punctures dense ( $IS < 1$  PD); metepisternum ruguloso-lineate dorsally, becoming tessellate ventrally; propodeum lateral surface tessellate, posterior surface weakly tessellate. T1 anterior slope coriarius, disc weakly coriarius, with punctures fine, moderately dense ( $IS = 1–2$  PD), becoming minute and sparse on rim laterally ( $IS = 1–3$  PD) and absent in small subapicolateral boss and on rim medially; T2 disc shiny, with punctures fine, moderately dense ( $IS = 1–2$  PD), apical rim weakly coriarius, with punctures minute, sparse ( $IS = 1–4$  PD).

**STRUCTURE.** Face length/width ratio 0.77 ( $\pm 0.01$  SD); clypeus apicolateral denticles rounded obtuse points; gena/eye width ratio 0.84 ( $\pm 0.08$  SD). Pronotal angle obtuse; intertegular span 0.79 ( $\pm 0.05$  SD) mm; mesoscutum length/width ratio 0.94 ( $\pm 0.03$  SD); mesoscutum/scutellum length ratio 2.89 ( $\pm 0.19$  SD); scutellum/metanotum length ratio 1.52 ( $\pm 0.09$  SD); metanotum/metapostnotum length ratio 0.85 ( $\pm 0.11$  SD); forewing with 3 submarginal cells; tegula enlarged, exceeding posterior margin of mesoscutum; inner margin concave; tegula length 0.45 ( $\pm 0.02$  SD) mm, width 0.24 ( $\pm 0.01$  SD) mm; propodeum lateral carinae not reaching dorsal margin; oblique carina weak, straight. T2 depressed apical rim less than 50% of tergum. ( $n = 10$ )

**VARIATION.** The pronotal lobe can vary from brown to orange, the clypeus apical half can vary from densely punctate ( $IS \leq 1$  PD) to nearly impunctate, the T1–T2 disc punctures can vary from moderately dense ( $IS = 1–2$  PD) to sparse ( $IS = 1–3$  PD), and the T1–T2 apical rims can be punctate or impunctate.

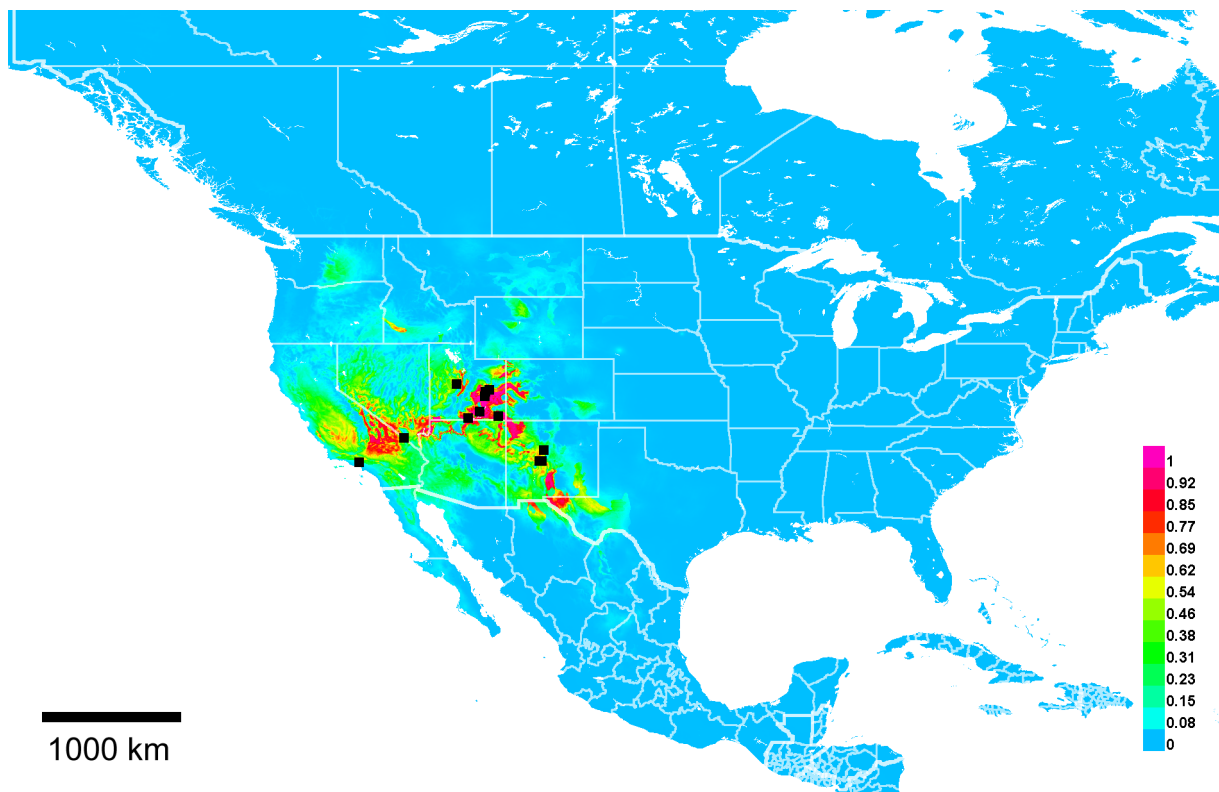
### **Male**

**COLOURATION.** Head and mesosoma blue-green to olive green; clypeus apex black; labrum reddish brown; mandible orange with black base and red apex; flagellum reddish brown dorsally, orange ventrally. Pronotal lobe black; legs reddish brown; tegula reddish brown; wing membrane hyaline, veins with subcosta dark brown, otherwise brown to light brown. Metasoma black with depressed apical rims of terga and sterna and downcurved lateral areas of terga translucent reddish brown.

**PUBESCENCE.** Body pile colour white. Tomentum dense on face below lateral ocelli, pronotal collar and lobe, space between pronotal lobe and tegula, metepisternum, and T2–T3 basally; sparse on gena, scutum lateral and posterior margins, preëpisternum, mesepisternum, and T4 basally. Mesoscutum pubescence mostly densely plumose with sparse simple setae medially. Wing setae dark, short and sparse. Sterna pubescence short (0.5–1.5 OD), moderately plumose, sparse.

**SURFACE SCULPTURE.** Clypeus shiny, with punctures dense (IS < 1 PD); supraclypeal area shiny, with punctures dense (IS ≤ 1 PD); paraocular area shiny, with punctures dense (IS < 1 PD); frons shiny, with punctures crowded (IS = 0 PD); vertex shiny, with punctures dense (IS < 1 PD); gena shiny, with punctures dense (IS < 1 PD); postgena lineate. Tegula punctures crowded (IS = 0 PD) and indistinct, becoming rugulose on inner margin and slightly sparser (IS ≤ 1 PD) and more distinct on outer margin; mesoscutum shiny, with punctures dense (IS < 1 PD); scutellum shiny, with punctures dense (IS < 1 PD); metanotum rugulose; metapostnotum shiny to tessellate, with rugae strong, anastomosing, reaching posterior margin; preëpisternum areolate; hypoepimeron shiny, with punctures crowded (IS = 0 PD); mesepisternum shiny, with punctures dense (IS < 1 PD); metepisternum finely areolate, becoming smooth dorsally; propodeum lateral surface shiny, with punctures dense (IS < 1 PD), becoming crowded dorsally (IS = 0 PD), posterior surface shiny and moderately densely punctate (IS = 1–2 PD). T1 anterior slope shiny, disc shiny, with punctures dense (IS ≤ 1.5 PD), absent in small subapicolateral boss and on rim medially; T2 disc shiny, with punctures dense (IS ≤ 1.5 PD), apical rim shiny, with punctures absent.

**STRUCTURE.** Face length/width ratio 0.8 (±0.02 SD); gena/eye width ratio 0.71 (±0.04 SD). Pronotal angle obtuse; intertegular span 0.7 (±0.04 SD) mm; mesoscutum length/width ratio 0.92 (±0.03 SD); mesoscutum/scutellum length ratio 2.67 (±0.09 SD); scutellum/metanotum length ratio 1.78 (±0.18 SD); metanotum/metapostnotum length ratio 0.73 (±0.08 SD); forewing with 3 submarginal cells; tegula enlarged, exceeding posterior margin of mesoscutum in dorsal view; inner posterior margin strongly concave, with broadly rounded projection angled toward axilla posteriorly; tegula length 0.43 (±0.03 SD) mm, width 0.2 (±0.02 SD) mm; propodeum lateral carinae not reaching dorsal margin; oblique carina absent. (n = 5)



**Fig. 29.** Georeferenced collection records of *Lasioglossum (D.) gloriosum* sp. nov. (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence.



GENITALIA. As in Fig. 76F. Gonocoxite about 1.5 times as broad as gonostylus. Gonostylus boot-shaped, strongly concave on outer margin and sharply angled at inner basal margin, with sparse long setae dorsally and short setae along inner margin. Penis valves parallel, with sparse short setae laterally. Retrorse lobe not examined.

VARIATION. The mesoscutum and metasoma punctures can vary from dense (IS < 1 PD) to moderately dense (IS = 1–2 PD), the metapostnotal rugae can vary from anastomosing to subparallel, sometimes not quite reaching the posterior margin, and the postgena can vary from shiny to lineate.

### Range

Primarily Colorado Plateau with scattered records west to California (Fig. 29).

### Floral hosts

AMARANTHACEAE: *Salsola*: *S. paulsenii* Litv. • ASTERACEAE: *Helianthus*: *H. annuus* • BRASSICACEAE: *Physaria* • SALICACEAE: *Salix*.

### DNA barcodes

None available.

### *Lasioglossum (Dialictus) helianthi* (Cockerell, 1916)

Figs 30–32, 76G, 106B, 107B, 109B, 110A, 115A

*Halictus helianthi* Cockerell, 1916: 77 (holotype, ♀, deposited in USNM, examined).

*Lasioglossum (Dialictus) imbrex* Gibbs, 2010: 153 (holotype, ♀, deposited in PCYU, examined).

*Halictus (Chloralictus) helianthi* – Michener 1936: 283 (male description).

*Lasioglossum (Chloralictus) tegulariforme* – Michener 1951: 1118 (in part, synonymy by Timberlake, catalogue).

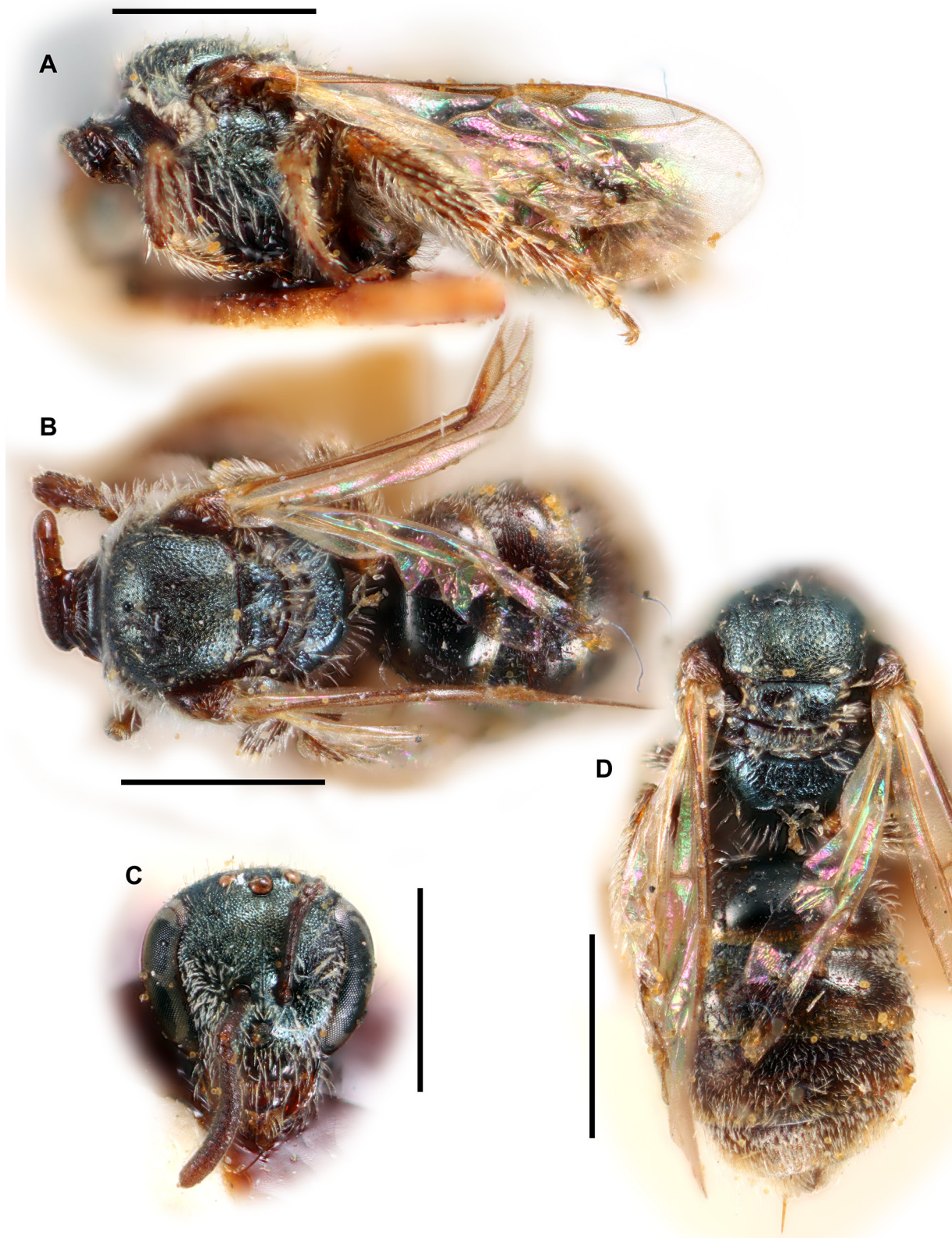
*Dialictus tegulariformis* – Hurd 1979: 1929 (in part, catalogue). — Moure & Hurd 1987: 133 (in part, catalogue).

*Lasioglossum (Dialictus) helianthi* – Gardner & Gibbs 2022: 6 (resurrection from synonymy, synonymy with *L. imbrex*).

### Diagnosis

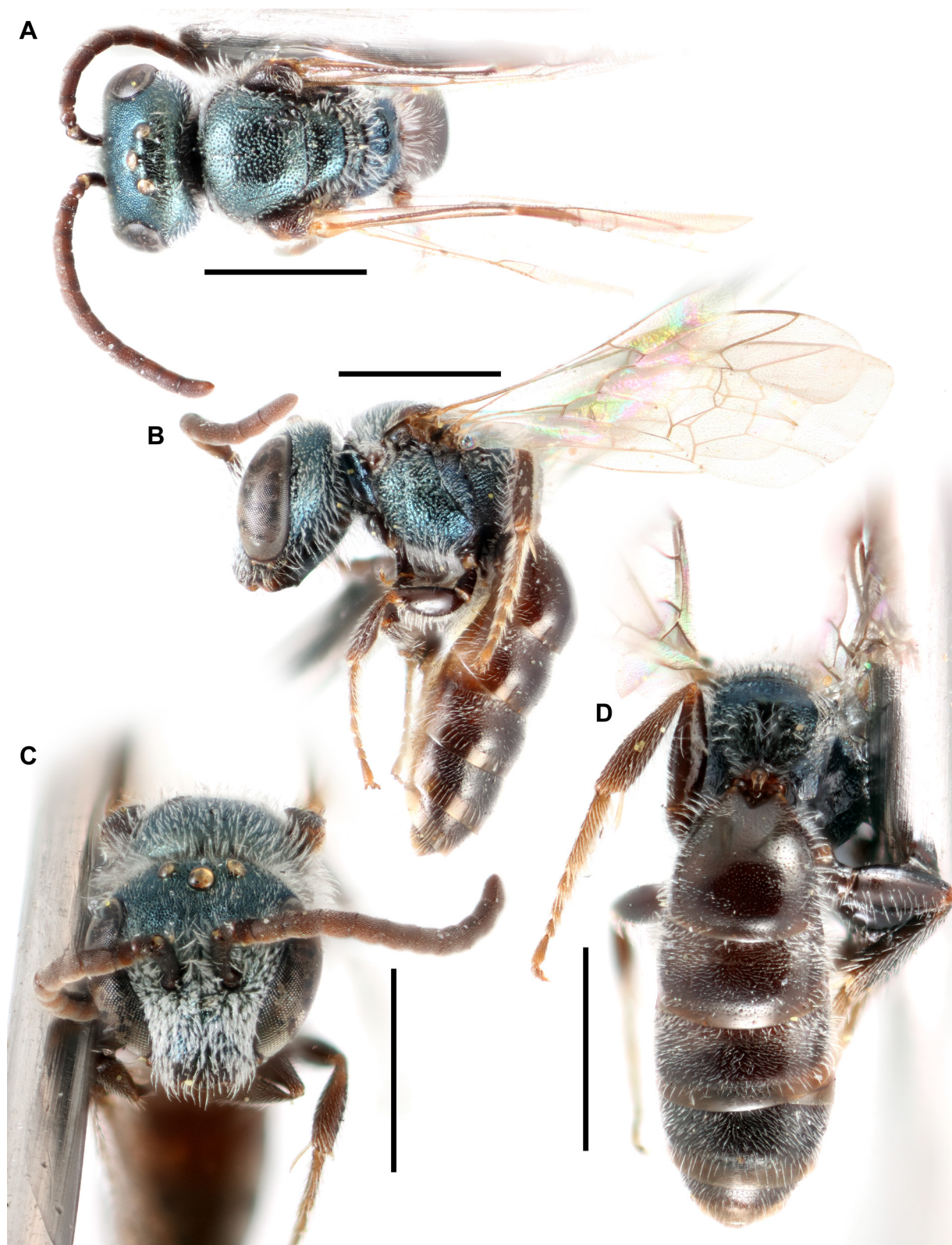
Females of *L. helianthi* have the tegula relatively small (maximum length about half or less ITS and reaching but not exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin weakly concave and a posterior point usually narrower than 0.5 OD, and usually densely punctate (IS ≤ 1 PD); mesoscutum finely, densely punctate (IS ≤ 1 PD in posterior half and 4–5 punctures between posterior end of parapsidal line and lateral edge of mesoscutum) and entirely tessellate; metapostnotum with coarse anastomosing rugae reaching posterior margin; T1–T2 discs moderately densely and uniformly punctate (IS = 1–2 PD); T1 anterior slope usually coriaceous; T3 usually with sparse tomentum throughout disc, paraocular area punctures larger and sparser than frons punctures; and gena narrower than eye in lateral view.

Females of *L. helianthi* are most similar to those of *L. angelicum* sp. nov., *L. ellisiae*, *L. gaudiale*, and *L. tegulariforme*, all of which (except *L. tegulariforme*) have T3 with tomentum limited to basolateral patches and, rarely, a sparse, medially interrupted subapical band. In addition, females of *L. angelicum* have the mesoscutum usually more coarsely or sparsely punctate (IS = 1–2 PD in posterior half and/or 2–3 punctures between posterior end of parapsidal line and lateral edge of mesoscutum), sometimes shiny,



**Fig. 30.** *Lasioglossum (D.) helianthi* (Cockerell, 1916), ♀, holotype (USNM). **A.** Lateral habitus. **B.** Dorsal habitus. **C.** Face. **D.** Metasoma and propodeum. Scale bars = 1 mm.





**Fig. 31.** *Lasioglossum (D.) helianthi* (Cockerell, 1916), ♂ (reproduced from Gardner & Gibbs 2022). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma and propodeum. Scale bars = 1 mm.



and tegula larger (maximum length more than half ITS and exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin strongly concave and a rounded posterior projection close to 1 lateral OD in size, and more densely punctate (IS < 1 PD). Females of *L. ellisiae* have the mesoscutum sometimes shiny posteriorly and slightly more sparsely punctate (most IS = 1 PD). Females of *L. gaudiale* have the mesoscutum more coarsely punctate (as in *L. angelicum*), T1 anterior slope shiny, and gena about as wide as eye in lateral view. Females of *L. tegulariforme* have the tegula larger and more densely punctate (as in *L. angelicum*), paraocular area punctures as large and dense as frons punctures, and T1 with an impunctate median line about 1 OD wide.

Males of *L. helianthi* have the tegula relatively small (as in the female); mesoscutum entirely densely punctate (IS < 1 PD); metapostnotum usually shiny with strong anastomosing rugae; and discs of T1–T2 deeply and moderately densely punctate (IS = 1–2 PD) with some punctures extending onto apical rims.

Males of *L. helianthi* are most similar to those of *L. angelicum* sp. nov., *L. diabolicum* sp. nov., *L. ellisiae*, and *L. tegulariforme*. Males of *L. angelicum* have the tegula larger (exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin strongly concave with a rounded posterior projection close to 1 lateral OD in size, and more densely punctate (IS < 1 PD); and mesoscutum usually more sparsely punctate (IS = 1–2 PD). Males of *L. diabolicum* have the discs of T1–T2 finely and moderately sparsely punctate (IS = 1–2 PD) and the mesoscutum usually more sparsely punctate (IS = 1–2 PD). Males of *L. ellisiae* have the T1–T2 apical rims impunctate and metapostnotum usually with subparallel rugae. Males of *L. tegulariforme* have the tegula larger (as in *L. angelicum*) and discs of T1–T2 (especially T1 medially) more sparsely punctate (IS = 1–3 PD).

### Etymology

Cockerell (1916) named this species after the sunflowers it was collected on, *Helianthus lenticularis* Douglas ex Lindl. (= *Helianthus annuus* L.).

### Material examined

#### Holotype

UNITED STATES – **California** • ♀; Orange; [33.79° N, 117.85° W]; 16 Aug. 1915; Cockerell leg.; ex *Helianthus lenticulatus*; USNM.

#### Other material

CANADA – **British Columbia** • 1 ♀; Haynes Lease Ecological Reserve; 49.0874° N, 119.5178° W; 11 May 2010; S. Elwell leg.; WRME SFU729331 • 3 ♀♀; *ibid.*; 24 May 2010; S. Elwell leg.; WRME SFU729043, SFU729092, SFU729224 • 2 ♀♀; *ibid.*; 8 Jun. 2010; S. Elwell leg.; WRME SFU731264, SFU731988 • 1 ♀; *ibid.*; 23 Jun. 2010; S. Elwell leg.; WRME SFU733517 • 1 ♀; Kennedy Bench Cons. Area; 49.2621° N, 119.5093° W; 10 May 2010; S. Elwell leg.; WRME SFU731005 • 1 ♀; *ibid.*; 8 Jul. 2010; S. Elwell leg.; WRME SFU734663 • 6 ♀♀; *ibid.*; 21 Jul. 2010; S. Elwell leg.; WRME SFU728265, SFU728292, SFU728307, SFU728317, SFU728334, SFU728337 • 1 ♀; Okanagan-Similkameen Reg. Dist., Osoyoos, Mount Kruger, Strawberry Creek Road; 49.0294° N, 119.4948° W; elev. 420 m; 14 Jun. 2008; Lincoln R. Best leg.; PCYU LRB-4507 • 1 ♀; Okanagan-Similkameen Reg. Dist., Osoyoos, Mount Kruger, Strawberry Creek Road; 49.0304° N, 119.4928° W; elev. 420 m; 24 Jul. 2008; Lincoln R. Best leg.; WRME 518950 • 1 ♀; Okanagan-Similkameen Reg. Dist., Osoyoos, Mount Kruger, Strawberry Creek Road; 49.0359° N, 119.5007° W; elev. 390 m; 1–2 May 2009; Lincoln R. Best leg.; PCYU LRB09-2646 • 1 ♀; Okanagan-Similkameen Reg. Dist., Osoyoos, Mount Kruger, Strawberry Creek Road; 49.0382° N, 119.5095° W; elev. 505 m; 15 Jun. 2008; Lincoln R. Best leg.; PCYU LRB-4712 • 1 ♀; Okanagan-Similkameen Reg. Dist., Osoyoos, Mount Kruger, Strawberry Creek Road; 49.0421° N, 119.5114° W; elev. 505 m; 16 Jul. 2008; Lincoln R. Best leg.; PCYU LRB-2325 • 2 ♀♀; Okanagan-Similkameen Reg. Dist., Osoyoos, Road 22, Okanagan River; 49.0895° N, 119.5358° W; elev. 280 m;

22 Apr. 2009; Lincoln R. Best leg.; PCYU • 1 ♀; Okanagan-Similkameen Reg. Dist., Osoyoos, Strawberry Creek Road; 49.0285° N, 119.4931° W; elev. 440 m; 1–3 May 2009; Lincoln R. Best leg.; PCYU • 1 ♀; Okanagan-Similkameen Reg. Dist., Summerland, Garnet Lake; 49.6879° N, 119.7761° W; elev. 650 m; 18 Jul. 2008; Lincoln R. Best leg.; PCYU • 1 ♂; Oliver, Atsiklak Creek; [49.183° N, 119.519° W]; 30 Jun. 1996; Gord E. Hutchings leg.; GEH • 1 ♀; Osoyoos, Inkameep L. R.; [49.04° N, 119.44° W]; 30 Jun. 1996; Gord E. Hutchings leg.; GEH • 1 ♀; Osoyoos, Mount Kobau; [49.11° N, 119.66° W]; elev. 560 m; 30 May–2 Jun. 1991; D. Blades, C. Maier leg.; RBCM ENT992-694 • 1 ♀; Penticton, West Bench pond, 5 km E of Mac's Lake; [49.5° N, 119.6° W]; 28 Apr. 1988; C.S. Guppy leg.; RBCM ENT991-3465.

UNITED STATES – **California** • 1 ♀; Alameda Co., Berkeley, 2601 Milvia Street; [37.8616° N, 122.2694° W]; 13 Jul. 1996; John S. Ascher leg.; AMNH • 1 ♀; Contra Costa Co., Bethel Island, Piper Slough; [38.04° N, 121.64° W]; 1 Sep. 2006; John S. Ascher leg.; AMNH • 4 ♂♂; Contra Costa Co., Urban Martinez; [38.02° N, 122.13° W]; 22 Aug. 2005; G.W. Frankie, M. Urbina, V. Wojcik, N.N. Lanni leg.; BBSL647249, BBSL647251, BBSL647252, BBSL647256 • 1 ♂; *ibid.*; 21 Sep. 2005; G.W. Frankie, M. Urbina, V. Wojcik, N.N. Lanni leg.; BBSL647112 • 1 ♀; El Dorado Co., Crocker Creek area; 38.7406° N, 121.0232° W; elev. 315 m; 17 Aug. 2018; D. Burge leg.; ex *Helianthus californicus*; SOUM • 1 ♀; El Dorado Co., Pine Hill; 38.7199° N, 120.9891° W; elev. 605 m; 6 Aug. 2017; D. Burge leg.; ex *Centaurea solstitialis*; SOUM • 1 ♀; *ibid.*; 4 Sep. 2017; D. Burge leg.; ex *Ericameria arborescens*; SOUM • 2 ♀♀; El Dorado Co., Salmon Falls area; 38.7601° N, 121.032° W; elev. 340 m; 17 Aug. 2018; D. Burge leg.; ex *Perideridia kelloggii*; SOUM • 3 ♀♀; Fresno Co., North of Jacolitos Creek; 36.054° N, 120.4758° W; 22 Apr. 1996; R.T. Griswold, S. Griswold, L. Griswold leg.; BBSL FaunalSurvey No. 000158779, FaunalSurvey No. 000158780, FaunalSurvey No. 000158782 • 1 ♀; Humboldt Co., Garberville; [40.1° N, 123.79° W]; 19 Apr. 1935; ex *Cercocarpus betulifolius*; UCMC • 1 ♀; Inyo Co., Surprise Canyon; [36.11° N, 117.15° W]; 5 May 1972; William P. MacKay leg.; NMSU • 1 ♀; Inyo Co., Surprise Canyon, Panamint Mountains; [36.11° N, 117.15° W]; 24 Apr. 1957; P.D. Hurd leg.; ex *Eriogonum inflatum*; EMEC • 1 ♀; Kern Co., Sand Canyon 3 miles west of Brown; [35.78° N, 117.9° W]; 7 Apr. 1966; R.M. Bohart leg.; UCDC • 3 ♀♀; Kern Co., Short Canyon; 35.7093° N, 117.9112° W; elev. 1200 m; 21–29 May 2008; M.E. Irwin leg.; BBSL FDP151834, FDP151839, FDP151877 • 1 ♀; Kern Co.; 35.5971° N, 118.5056° W; 1 Jun. 2018; A. Anderson, A. James leg.; CUIC • 3 ♀♀; Lake Co., Siegler Canyon Creek, 0.5 miles west Lower Lake; 38.9073° N, 122.6235° W; 29–31 Aug. 2017; Paul A. Rude leg.; EMEC • 1 ♀; Los Angeles Co., Charmlee Wilderness; 34.0613° N, 118.8781° W; elev. 410 m; 12 Apr. 2018; S.B. Lerman leg.; ASUHIC LA-REF-CW-BB-1 848 • 15 ♀♀, 1 ♂; Los Angeles Co., Chatsworth; 34.26° N, 118.601° W; 1–8 Jul. 2017; LACM • 3 ♀♀, 3 ♂♂; Los Angeles Co., Claremont; 34.0894° N, 117.7111° W; 1–8 Jul. 2016; LACM • 4 ♀♀, 2 ♂♂; *ibid.*; 1–8 Aug. 2016; LACM • 1 ♀; Los Angeles Co., Eagle Rock; 34.13° N, 118.23° W; elev. 169.9 m; 15–21 Jul. 2018; Hannah Hayes leg.; LACM ENT 380964 • 4 ♀♀; Los Angeles Co., Eagle Rock; 34.13° N, 118.23° W; 15–21 Jul. 2018; Hannah Hayes leg.; LACM • 1 ♂; Los Angeles Co., Elysian Park; 34.078° N, 118.234° W; 31 May–7 Jun. 2014; Eric Harding, Victoria Harding leg.; LACM ENT 394544 • 1 ♀; Los Angeles Co., Elysian Park; 34.08° N, 118.23° W; elev. 147.9 m; 18–20 Jul. 2018; Hannah Hayes leg.; LACM ENT 376841 • 1 ♀; Los Angeles Co., Elysian Park; 34.08° N, 118.23° W; 18–20 Jul. 2018; Hannah Hayes leg.; LACM • 1 ♀; Los Angeles Co., Glendale; 34.15° N, 118.22° W; 19–21 Jul. 2018; Hannah Hayes leg.; LACM • 1 ♀; Los Angeles Co., Highland Park; 34.13° N, 118.19° W; 20–22 Jul. 2018; Hannah Hayes leg.; LACM • 4 ♀♀, 5 ♂♂; Los Angeles Co., Hollywood sign; [34.13° N, 118.32° W]; LACM • 1 ♂; Los Angeles Co., Larchmont; 34.077° N, 118.32° W; 31 May–7 Jun. 2014; K.T. Wiegman leg.; LACM ENT 394541 • 1 ♀; Los Angeles Co., Pasadena; [34.15° N, 118.14° W]; 8 Apr. 1909; F. Grinnell Jr. leg.; UCMC • 2 ♂♂; Los Angeles Co., Pasadena, Arroyo below 134 bridge; [34.145° N, 118.166° W]; 23 Jun. 1996; John S. Ascher leg.; AMNH • 1 ♀; Los Angeles Co., Torrance; 33.8712° N, 118.331° W; 13–23 Jul. 2017; LACM • 3 ♀♀; Los Angeles Co., Zuma Canyon; 34.0325° N, 118.8119° W; elev. 30 m; 5 May 2018; S.B. Lerman leg.; ASUHIC LA-REF-ZC-BB-2 273, LA-REF-ZC-BB-2 283, LA-REF-ZC-BB-2 295 • 1 ♂; Los Angeles Co.; 34.097° N, 118.714° W; 30 May 2008; M. Caterina leg.; PCYU USGS-DRO 106311 • 1 ♀;

Los Angeles Co.; 34.1116° N, 118.7773° W; 30 May 2008; Sam W. Droege leg.; PCYU USGS-DRO 105625 • 1 ♀; Marin Co., Alpine Lake; [37.95° N, 122.62° W]; elev. 335 m; 22 Apr. 1978; H.E.M. Dobson leg.; ex *Arctostaphylos pungens* var. *montana*; UCDC • 1 ♀; *ibid.*; 7 May 1978; H.E.M. Dobson leg.; ex *Eriodictyon californicum*; UCDC • 1 ♀; *ibid.*; 31 May 1978; H.E.M. Dobson leg.; ex *Adenostoma fasciculatum*; UCDC • 1 ♀; Marin Co., Mount Tamalpais; [37.92° N, 122.6° W]; 6 Apr. 1913; E.C. Van Dyke leg.; CAS • 1 ♀; Mariposa Co., Forest Road, 1.1 mi. S of Eagle Peak; 37.6727° N, 119.7902° W; elev. 576 m; 24 May 2005; L. Fuerst, Jason J. Gibbs, E. Stephens leg.; PCYU • 1 ♂; Monterey Co., 10 miles north of Parkfield; [36.04° N, 120.43° W]; 24 Apr. 1966; D.R. Miller leg.; UCDC • 2 ♀♀; Monterey Co., North of Mill Creek; 36.0002° N, 121.475° W; 30 Apr. 1996; Terry L. Griswold leg.; BBSL FaunalSurvey No. 000157032, FaunalSurvey No. 000157033 • 3 ♀♀; Napa Co., 3.5 mi. E of Calistoga; 38.593° N, 122.521° W; 27 Jun. 2018; Paul A. Rude leg.; EMEC • 2 ♀♀; Napa Co., 5.5 km NW of Moskowite Corner, Capell Creek; [38.48° N, 122.24° W]; elev. 200 m; 12 Jun. 1977; Paul H. Arnaud Jr. leg.; CAS CASENT 8416766, CASENT 8416767 • 1 ♀; Nevada Co., Baxter; [39.21° N, 120.78° W]; 18 Jun. 1999; John S. Ascher leg.; AMNH • 1 ♀; Plumas Co., Lake Almanor; [40.27° N, 121.14° W]; 3 Jul. 1949; W.F. Chamberlain leg.; TAMU-ENTO X1400102 • 1 ♂; Riverside Co., Aguanga; [33.44° N, 116.87° W]; 25 Jul. 1995; W.F. Chamberlain leg.; TAMU-ENTO X1391691 • 1 ♂; Riverside Co., Bautista Canyon; [33.7° N, 116.85° W]; 18 May 1974; UCRC ENT 525722 • 4 ♀♀, 4 ♂♂; Riverside Co., Norco; 33.912° N, 117.5702° W; 1–8 Jun. 2016; LACM • 1 ♀; Sacramento Co., 10 miles northeast of Folsom; [38.78° N, 121.04° W]; 11 May 1960; M.S. Wasbauer leg.; ex *Eriodictyon californicum*; UCDC • 1 ♂; Sacramento Co., Sacramento; [38.58° N, 121.48° W]; 19 May 1960; M.S. Wasbauer leg.; UCDC • 1 ♀; Sacramento Co.; 38.7647° N, 121.5915° W; 18 Jul. 2014; C. McConnell leg.; ex *Eschscholzia californica*; UCDC FORB2014500384 • 1 ♀; San Benito Co., Bear Valley; 36.4957° N, 121.1407° W; 23 Apr. 1996; Terry L. Griswold, R.T. Griswold leg.; ex *Eschscholzia californica*; BBSL FaunalSurvey No. 000157298 • 1 ♀; San Benito Co., Clear Creek; 36.3695° N, 120.7488° W; 23 Apr. 1996; Terry L. Griswold leg.; BBSL FaunalSurvey No. 000155481 • 1 ♀; San Benito Co., Clear Creek; 36.38° N, 120.7057° W; 23 Apr. 1996; Terry L. Griswold leg.; BBSL FaunalSurvey No. 000157198 • 3 ♀♀; San Benito Co., Hernandez Valley; 36.357° N, 120.7825° W; 23 Apr. 1996; Terry L. Griswold leg.; ex *Eschscholzia californica*; BBSL FaunalSurvey No. 000157476, FaunalSurvey No. 000157477, FaunalSurvey No. 000157478 • 1 ♂; San Benito Co., San Benito River; 36.3233° N, 120.7162° W; 22 May 1996; Terry L. Griswold leg.; BBSL FaunalSurvey No. 000162541 • 2 ♀♀; San Benito Co., San Benito River; 36.3785° N, 120.9177° W; 23 Apr. 1996; Terry L. Griswold leg.; ex *Eschscholzia californica*; BBSL FaunalSurvey No. 000157348, FaunalSurvey No. 000157349 • 1 ♀; San Benito Co., San Benito River; 36.401° N, 120.9508° W; 23 Apr. 1996; Terry L. Griswold leg.; BBSL FaunalSurvey No. 000157370 • 1 ♀; San Diego Co., Anza-Borrego, Lost Valley Road; 33.3746° N, 116.6141° W; 2 May 2015; K.J. Hung, Cen, Davids leg.; WRME 518951 • 1 ♂; San Diego Co., Anza-Borrego, Lost Valley Road; 33.378° N, 116.591° W; 13 Jun. 2015; K.J. Hung, Cen, White leg.; WRME 518952 • 3 ♂♂; San Diego Co., Descanso; 32.835° N, 116.6233° W; elev. 1280 m; 30–31 May 2002; F.D. Parker, M.E. Irwin leg.; BBSL586866, BBSL586949, BBSL586967 • 2 ♀♀, 1 ♂; San Mateo Co., Stanford University Campus Experimental Area; [37.42° N, 122.2° W]; 1969–1970; A.R. Moldenke leg.; CAS • 1 ♀; Santa Barbara Co., Cañada del Medio, Santa Cruz Island; [34.01° N, 119.8° W]; 3 May 1968; D.R. Miller leg.; UCDC • 1 ♀; *ibid.*; 5 May 1968; R.O. Schuster leg.; UCDC • 2 ♀♀; Santa Barbara Co., Santa Cruz Island; 33.9973° N, 119.7141° W; elev. 64 m; 15 Mar. 2019; CCBER UCSB-IZC00030321, UCSB-IZC00030522 • 1 ♀; Santa Clara Co., 3 mi. N of San Antonio Junction; [37.43° N, 121.49° W]; 28 May 1999; John S. Ascher leg.; AMNH • 1 ♀; Santa Clara Co., 6 mi. W of San Antonio Junction; [37.48° N, 121.49° W]; 28 May 1999; John S. Ascher leg.; AMNH • 1 ♀; Stanislaus Co., Dry Creek; 37.7061° N, 120.7285° W; 20 Apr. 2015; L. Rowe leg.; ex *Eschscholzia californica*; UCDC FORB201570470 • 1 ♀; Stanislaus Co., rest area, Highway 99 SE of Turlock; 37.4639° N, 120.8272° W; elev. 32 m; 13 Jun. 2010; John S. Ascher leg.; AMNH • 1 ♀; Tehama Co.; [40° N, 122° W]; 26 Apr. 1913; F.W. Nunenmacher leg.; EMEC • 1 ♀; Trinity Co., Weaverville; 40.7223° N, 122.9303° W; 25 Jun. 1981; D.M. Gordon leg.; BBSL1100720 • 1 ♀; Tuolumne Co., Poopenaut Valley, 1.2 mi. SW by S of Dam; 37.9341° N, 119.8005° W; elev. 1060 m;



30 Jun. 2005; L. Fuerst leg.; PCYU • 1 ♀; Ventura Co.; 34.0586° N, 118.9729° W; 1 Jun. 2008; Sam W. Droege leg.; PCYU USGS-DRO 106102 • 1 ♂; *ibid.*; 1 Jun. 2008; Sam W. Droege leg.; PCYU USGS-DRO 106104 • 1 ♀; Ventura Co.; 34.0689° N, 118.9579° W; 1 Jun. 2008; Sam W. Droege leg.; PCYU USGS-DRO 106152 • 1 ♂; *ibid.*; 1 Jun. 2008; Sam W. Droege leg.; PCYU USGS-DRO 106151 • 1 ♀; Yolo Co.; 38.5365° N, 121.7883° W; 25 Mar. 2016; S. Cibotti leg.; ex *Calandrinia menziesii*; UCDC FORB201630020 • 1 ♀; *ibid.*; 28 Sep. 2016; B. Beyer leg.; ex *Eriogonum fasciculatum*; UCDC FORB201631218 • 1 ♀; *ibid.*; 28 Sep. 2016; B. Beyer leg.; ex *Trichostema lanceolatum*; UCDC FORB201631223 • 1 ♀; *ibid.*; 5 Oct. 2016; B. Beyer leg.; ex *Eriogonum fasciculatum*; UCDC FORB201631230 • 2 ♀♀; *ibid.*; 12 Oct. 2016; B. Beyer leg.; ex *Eriogonum fasciculatum*; UCDC FORB201631240, FORB201631243 • 1 ♀; *ibid.*; 20 Oct. 2016; A. Buderer leg.; ex *Eriogonum fasciculatum*; UCDC FORB201631250 • 1 ♂; *ibid.*; 5 Jul. 2017; B. Beyer leg.; ex *Eriogonum fasciculatum*; UCDC FORB201730582 • 1 ♂; *ibid.*; 2 Aug. 2017; B. Beyer leg.; ex *Eriogonum fasciculatum*; UCDC FORB201730942 • 1 ♀; Yolo Co.; 38.5737° N, 121.9363° W; 20 Jul. 2016; R. Deleray leg.; ex *Chenopodium album*; UCDC FORB201663389 • 1 ♀; Yolo Co.; 38.5767° N, 121.9462° W; 25 Aug. 2016; S. Cibotti leg.; ex *Physalis lancifolia*; UCDC FORB201663576 • 1 ♀; Yolo Co.; 38.6239° N, 121.9915° W; 8 Jun. 2011; N.S.L. Pope leg.; ex *Eschscholzia californica*; WRME FORB201101086 • 1 ♀; Yuba Co., Sierra Foothill Range F S, 18 mi. NE of Marysville; 39.2752° N, 121.2929° W; 30 Sep. 1984; D.M. Gordon leg.; BBSL1100721 • 1 ♂; 0.4 mi. E of Amador City; 38.4208° N, 120.8188° W; 9 Sep. 2017; Paul A. Rude leg.; EMEC 1223126 • 1 ♀; Avalon; [33.34° N, 118.33° W]; 1 Sep.; Theodore D.A. Cockerell leg.; ex [Meyundi?]; UCMC • 1 ♀; Berkeley; [37.87° N, 122.27° W]; 13 Sep. 1947; W.F. Chamberlain leg.; TAMU-ENTO X1355326 • 1 ♀; Cape Canyon; [33.354° N, 118.434° W]; 22 Jun.; Theodore D.A. Cockerell leg.; ex *Opuntia*; UCMC • 2 ♀♀; Davis; [38.54° N, 121.74° W]; 29 Sep. 1962; M.E. Irwin leg.; UCDC • 3 ♀♀, 1 ♂; Niles Canyon; [37.59° N, 121.93° W]; 16 Jul.; W.M. Giffard leg.; CAS • 1 ♂; Riverside; [33.97° N, 117.32° W]; 14 Sep. 1924; Philip H. Timberlake leg.; ex annual *Eriogonum*; UCMC • 2 ♀♀; *ibid.*; 17 Feb. 1925; Philip H. Timberlake leg.; ex *Eriogonum fasciculatum*; UCMC • 1 ♀; Santa Barbara; [34.42° N, 119.7° W]; 16 Jul. 1937; Theodore D.A. Cockerell leg.; ex [m\* daisy]; UCMC • 1 ♀; *ibid.*; 20 Jul. 1937; Theodore D.A. Cockerell leg.; ex fennel; CAS • 1 ♀; *ibid.*; 20 Jul. 1937; Theodore D.A. Cockerell leg.; ex fennel; UCMC • 11 ♀♀; Santa Monica Mountains; 34.0464° N, 118.8976° W; 1 Jun. 2008; Sam W. Droege leg.; PCYU USGS-DRO 106081, USGS-DRO 106082, USGS-DRO 106084, USGS-DRO 106085, USGS-DRO 106086, USGS-DRO 106087, USGS-DRO 106088, USGS-DRO 106090, USGS-DRO 106091, USGS-DRO 106095, USGS-DRO 106096 • 1 ♂; *ibid.*; 1 Jun. 2008; Sam W. Droege leg.; PCYU USGS-DRO 106089 • 1 ♀; Santa Monica Mountains; 34.0562° N, 118.8964° W; 1 Jun. 2008; Sam W. Droege leg.; PCYU USGS-DRO 106075 • 7 ♀♀; Santa Monica Mountains; 34.1419° N, 118.7767° W; 31 May 2008; Sam W. Droege leg.; PCYU USGS-DRO 105800, USGS-DRO 105929, USGS-DRO 105945, USGS-DRO 106011, USGS-DRO 106036, USGS-DRO 106055, USGS-DRO 106092 • 3 ♂♂; *ibid.*; 31 May 2008; Sam W. Droege leg.; PCYU USGS-DRO 105985, USGS-DRO 105994, USGS-DRO 106031 • 1 ♀; Santa Ynez; [34.61° N, 120.08° W]; 12 Apr. 1963; M.E. Irwin leg.; UCDC • 1 ♀; Tueeulala Falls; [37.962° N, 119.772° W]; elev. 1225 m; 26 Jul. 2005; E. Stephens leg.; PCYU • 1 ♀; *ibid.*; 26 Jul. 2005; H. Briggs, E. Stephens leg.; PCYU • 1 ♀; Westlake Village (Upper Lake Road); 34.1347° N, 118.8744° W; elev. 312 m; 12 Feb. 2017; T.M. Onuferko leg.; CMNC. – **Hawaii** • 1 ♀; Oahu Co.; 21.3119° N, 157.8879° W; 1–2 Mar. 2012; Sam W. Droege leg.; WRME USGS-DRO 296886 • 1 ♀; Oahu Co.; 21.3152° N, 157.89° W; 1–2 Mar. 2012; Sam W. Droege leg.; WRME USGS-DRO 297489 • 1 ♀; Oahu Co.; 21.3179° N, 157.8912° W; 1–2 Mar. 2012; Sam W. Droege leg.; WRME USGS-DRO 297428 • 1 ♀; Oahu Co.; 21.3213° N, 157.886° W; 1–2 Mar. 2012; Sam W. Droege leg.; WRME USGS-DRO 297300 • 1 ♀; Oahu Co.; 21.5522° N, 158.0527° W; 7–8 Mar. 2012; Sam W. Droege leg.; WRME USGS-DRO 296874. – **Idaho** • 1 ♀; Canyon Co., Deer Flat National Wildlife Refuge; 43.5528° N, 116.6414° W; 5 Jul. 2012; Sabrina Seidel leg.; FWSE • 2 ♀♀; Cassia Co., Minidoka National Wildlife Refuge; 42.6559° N, 113.367° W; 26 May 2016; Ty Matthews leg.; FWSE • 1 ♂; Franklin Co., 3 mi. W of Preston; [42.09° N, 111.93° W]; 6 Aug. 1973; P.F. Torchio leg.; TAMU-ENTO X1600661 • 3 ♀♀, 2 ♂♂; Gooding Co., Wood R. 1 mi. NE of Gooding; [42.95° N,

114.7° W]; 6–7 Jul. 1980; M.S. Wasbauer, K.M. Wasbauer leg.; CUIC • 3 ♀♀; Oneida Co., Rock Creek; [42.2° N, 112.7° W]; 13 Jul. 1972; G.F. Knowlton leg.; BBSL FaunalSurvey No. 000073342, FaunalSurvey No. 000073344 • 2 ♀♀; *ibid.*; 17 Jul. 1972; G.F. Knowlton leg.; BBSL FaunalSurvey No. 000073343, FaunalSurvey No. 000073345 • 1 ♀; *ibid.*; 17 Jul. 1972; G.F. Knowlton leg.; CUIC • 1 ♂; *ibid.*; 28 Aug. 1974; G.F. Knowlton leg.; BBSL FaunalSurvey No. 000073346 • 1 ♀; Oneida Co., Twin Springs on Oregon Trail; [42.26° N, 112.76° W]; 6 Jul. 1972; G.F. Knowlton leg.; UMSP • 1 ♂; Owyhee Co., 6.3 mi. SE of Murphy; [43.15° N, 116.46° W]; 16 Jun. 1962; G.I. Stage leg.; AMNH. – **Montana** • 1 ♀; Missoula; [46.87° N, 113.99° W]; 11 Aug. 1931; R.H. Beamer leg.; SEMC. – **Nevada** • 2 ♀♀; Mineral Co., 4.5 mi. S of Schurz; [38.95° N, 118.81° W]; 20 Jul. 1982; W.J. Pulawski leg.; CAS CASENT 8416785, CASENT 8416786 • 1 ♀; Austin; [39.49° N, 117.07° W]; 12 Aug. 1940; D.E. Hardy leg.; SEMC • 1 ♂; *ibid.*; 12 Aug. 1940; L.C. Kuitert leg.; SEMC. – **Oregon** • 1 ♀; Harney Co., Malheur National Wildlife Refuge; 42.8082° N, 118.8701° W; 17–18 Jun. 2012; Marilyn Kircus leg.; FWSE • 1 ♀; Harney Co., Malheur National Wildlife Refuge; 42.8277° N, 118.8874° W; 14 Jul. 2010; Linda Beck leg.; FWSE • 1 ♂; Hood River Co., near Parkdale, West Fork Hood River; [45.57° N, 121.66° W]; elev. 335 m; 10 Jul. 1978; Nancy L. Herman leg.; AMNH • 2 ♀♀; Jackson Co., Ashland; 42.083° N, 122.7321° W; 15 Jul. 2019; Joe Engler leg.; FWSE • 2 ♀♀; Jefferson Co., Cove Palisades State Park; [44.54° N, 121.28° W]; 25 Jul. 2001; Laurence Packer leg.; PCYU PYU-382, PYU-391 • 1 ♂; *ibid.*; 25 Jul. 2001; Laurence Packer leg.; PCYU PYU-389 • 3 ♀♀; Lane Co., near McCredie Hot Springs, Highway 58 east of Oak Ridge; [43.7° N, 122.28° W]; 27 Jul. 2001; Laurence Packer leg.; PCYU PYU-423, PYU-435, PYU-439 • 1 ♂; *ibid.*; 27 Jul. 2001; Laurence Packer leg.; PCYU PYU-426 • 1 ♀; Multnomah Co., Government Island Habitat Restoration Project; 45.582° N, 122.5336° W; 25 May 2017; M. Blackburn, R. Hatfield leg.; FWSE • 1 ♀; Farewell Bend S. P.; 44.3096° N, 117.2206° W; elev. 659 m; 27 Jun. 2007; Jason J. Gibbs, C. Sheffield leg.; PCYU • 2 ♀♀; Portland; [45.52° N, 122.68° W]; 26 Jul. 2017; Gail Langellotto leg.; OSAC • 3 ♀♀; Portland; [45.52° N, 122.68° W]; 28 Jul. 2017; Gail Langellotto leg.; OSAC • 1 ♀; Tumalo Reservoir near Bend; [44.14° N, 121.42° W]; 23 Jun. 1954; G.F. Knowlton leg.; SEMC. – **Utah** • 1 ♀; Cache Co., Sherwood Hills; 41.5899° N, 111.978° W; 18 May 2007; V.J. Tepedino leg.; ex *Isatis tinctoria*; BBSL766134 • 1 ♀; Weber Co., Roy; [41.16° N, 112.03° W]; 2 Jun. 1967; G.F. Knowlton leg.; BBSL700689 • 1 ♀; Mantua; [41.5° N, 111.95° W]; Jul. 1940; G.F. Knowlton, William P. Nye leg.; BBSL700687 • 1 ♀; Wellsville; [41.64° N, 111.93° W]; 13 May 1954; George E. Bohart leg.; ex *Lomatium dissectum*; SEMC. – **Washington** • 1 ♀; Pierce Co.; 47.105° N, 122.505° W; elev. 88 m; 19 Apr. 2009; C. Fimbel leg.; PCYU-WA:90419627.

### Range

Cascadia bioregion, northern Great Basin, California, and Hawaii (Fig. 32).

### Floral hosts

AMARANTHACEAE: *Chenopodium* L.: *C. album* L. • APIACEAE: *Foeniculum* Mill.: *F. vulgare* Mill. • *Lomatium* Raf.: *L. dissectum* (Nutt.) Mathias & Constance • *Perideridia* Rchb.: *P. kelloggii* (A.Gray) Mathias • ASTERACEAE: *Centaurea* L.: *C. solstitialis* L. • *Ericameria* Nutt.: *E. arborescens* (A.Gray) Greene • *Helianthus*: *H. annuus* • *H. californicus* DC. • BORAGINACEAE: *Eriodictyon*: *E. californicum* (Hook. & Arn.) Torr. • BRASSICACEAE: *Isatis* L.: *I. tinctoria* L. • CACTACEAE: *Opuntia* • ERICACEAE Juss.: *Arctostaphylos* Adans.: *A. hookeri* G.Don: *A. h.* subsp. *montana* (Eastw.) P.V.Wells • LAMIACEAE: *Trichostema* L.: *T. lanceolatum* Benth. • PAPAVERACEAE: *Eschscholzia* Cham.: *E. californica* Cham. • POLYGONACEAE: *Eriogonum*: *E. fasciculatum* • *E. inflatum* • PORTULACACEAE Juss.: *Calandrinia* Kunth: *C. ciliata* (Ruiz & Pav.) DC. • ROSACEAE: *Adenostoma* Hook. & Arn.: *A. fasciculatum* Hook. & Arn. • *Cercocarpus* Kunth: *C. betulaefolius* [ambiguous] • SOLANACEAE: *Physalis*.

Additional records from Gibbs (2010): APOCYNACEAE: *Asclepias* • ASTERACEAE: *Achillea* L.: *A. millefolium* L.

### DNA barcodes

Ten confirmed sequences available (BOLD process IDs: DLII1375-08, DLII1400-08, DLII1416-08, DLII1518-08, DLIII143-19, DLIII144-19, DLIII145-19, BCLRB754-10, BCLRB755-10, BCLRB817-10). There is a small amount of divergence within these sequences (0.16% maximum intraspecific p-distance). They are closest in terms of p-distance to *L. gaudiale* (1.07% minimum interspecific p-distance). One fixed nucleotide substitution distinguishes *L. helianthi* from all other Nearctic *L. gemmatum* complex species: 639(C) (Supp. file 2).

### Comments

*Lasioglossum imbrex* was recorded from Alberta in Gibbs (2010), but all of the Alberta specimens were subsequently re-examined and determined as *L. stictaspis* in Gardner & Gibbs (2022). These specimens were not labelled as paratypes and it was not realised until after publication of Gardner & Gibbs (2022) that they were originally listed as such, and that the *L. imbrex* type series was mixed.

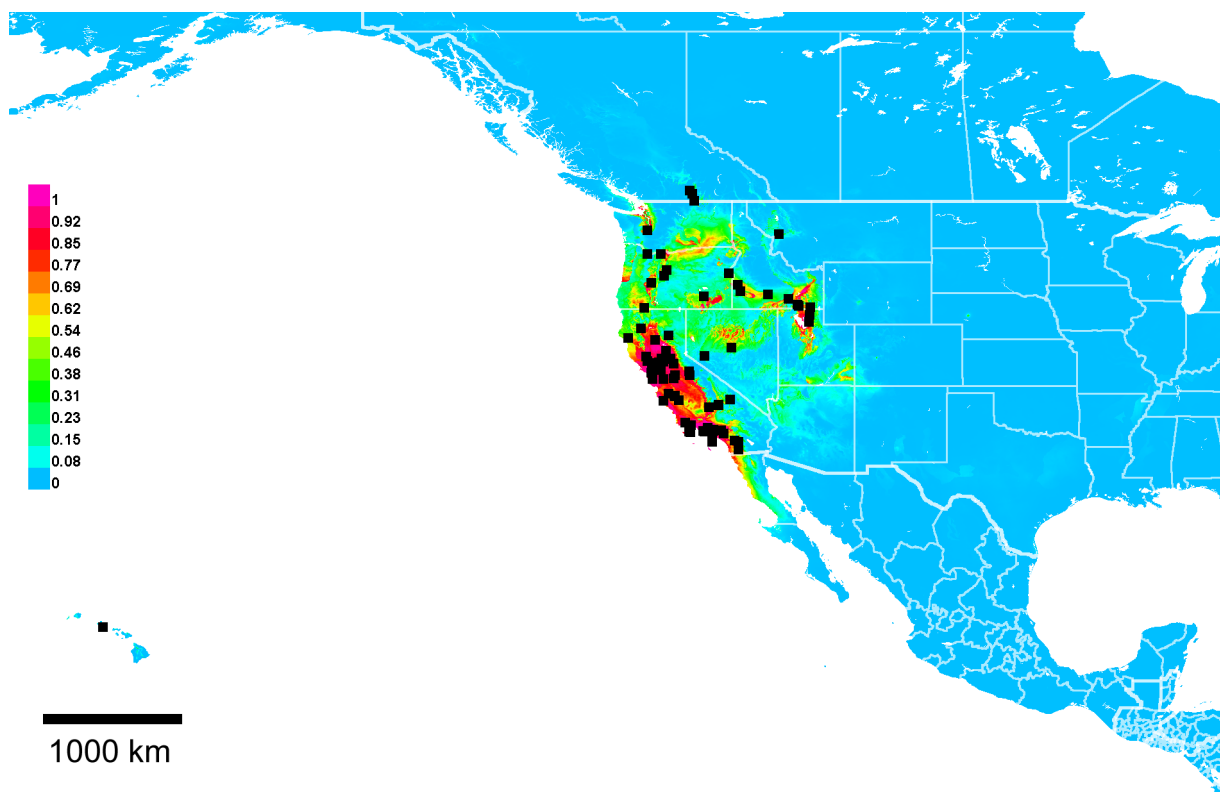
### *Lasioglossum (Dialictus) holzenthali* sp. nov.

urn:lsid:zoobank.org:act:67961059-A459-4E63-9B7A-E519683BBCCA

Figs 33–35, 76H, 81B, 95A, 96A, 97A, 102A, 116A

### Diagnosis

Females of *L. holzenthali* sp. nov. have the tegula very small (maximum length  $\leq 45\%$  ITS and not reaching posterior margin of mesoscutum in dorsal view), with inner posterior margin straight or very



**Fig. 32.** Georeferenced collection records of *Lasioglossum (D.) helianthi* (Cockerell, 1916) (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence.



weakly concave, and usually sparsely punctate ( $IS = 1-4 PD$ ); postgena smooth, shiny to imbricate; metapostnotum shiny with coarse subparallel rugae; mesepisternum very dull, strongly imbricate, with punctures dense but usually distinctly separated ( $IS \leq 1 PD$ ); T1–T3 apical rims usually distinctly punctate with very little change in sculpture across premarginal line; metasomal terga largely lacking tomentum (T2–T3 with very small basolateral patches and T4 with very sparse tomentum), and mesoscutum with dense erect pubescence (each seta less than its length from the one nearest it) and intervening setae short but with distinct length  $0.25 OD$  or more.

Females of *L. holzenthali* sp. nov. are most similar to those of *L. eremum* sp. nov., *L. perparvum*, and *L. profundum* sp. nov. Females of *L. perparvum* and *L. profundum* have the T1–T3 apical rims more sparsely or indistinctly punctate than discs or impunctate. Females of *L. eremum* have the mesoscutum and mesepisternum usually shiny and metapostnotum rugose with strong anastomosing rugae. Females of *L. perparvum* also have the metapostnotum dull with fine rugae and mesoscutum with sparse erect pubescence (each seta separated by about its length from the one nearest it) and intervening setae no more than stubble. Females of *L. profundum* have the tegula entirely impunctate (except anterior margin) and metasomal terga with more extensive tomentum.

Males of *L. holzenthali* sp. nov. have the tegula relatively small (as in the female, but more often densely punctate ( $IS \leq 1 PD$ )); T1–T3 uniformly densely punctate ( $IS \leq 1 PD$ ) with no change in sculpture across premarginal line; metapostnotum shiny with strong parallel rugae; and face below eye emargination with dense tomentum limited to lower paraocular area, sparse elsewhere. The densely punctate apical rims of T1–T3 are unique within the *L. gemmatum* species complex and will readily separate male *L. holzenthali* from other known species. Males of *L. angelicum* sp. nov., *L. helianthi*, *L. pseudotegulare*, and some other species in the *L. stictaspis* species complex can have numerous punctures on the rims of T1–T2, but these punctures are absent on the extreme apical margins, T1 medially, and T2 far sides; in addition, the tegula is usually much larger with the inner posterior margin strongly concave.

### Etymology

The specific epithet ‘*holzenthali*’ is a dedication to Ralph Holzenthal, in recognition for kindling my interest in taxonomy and supporting my work and studies at UMSP.

### Material examined

#### Holotype

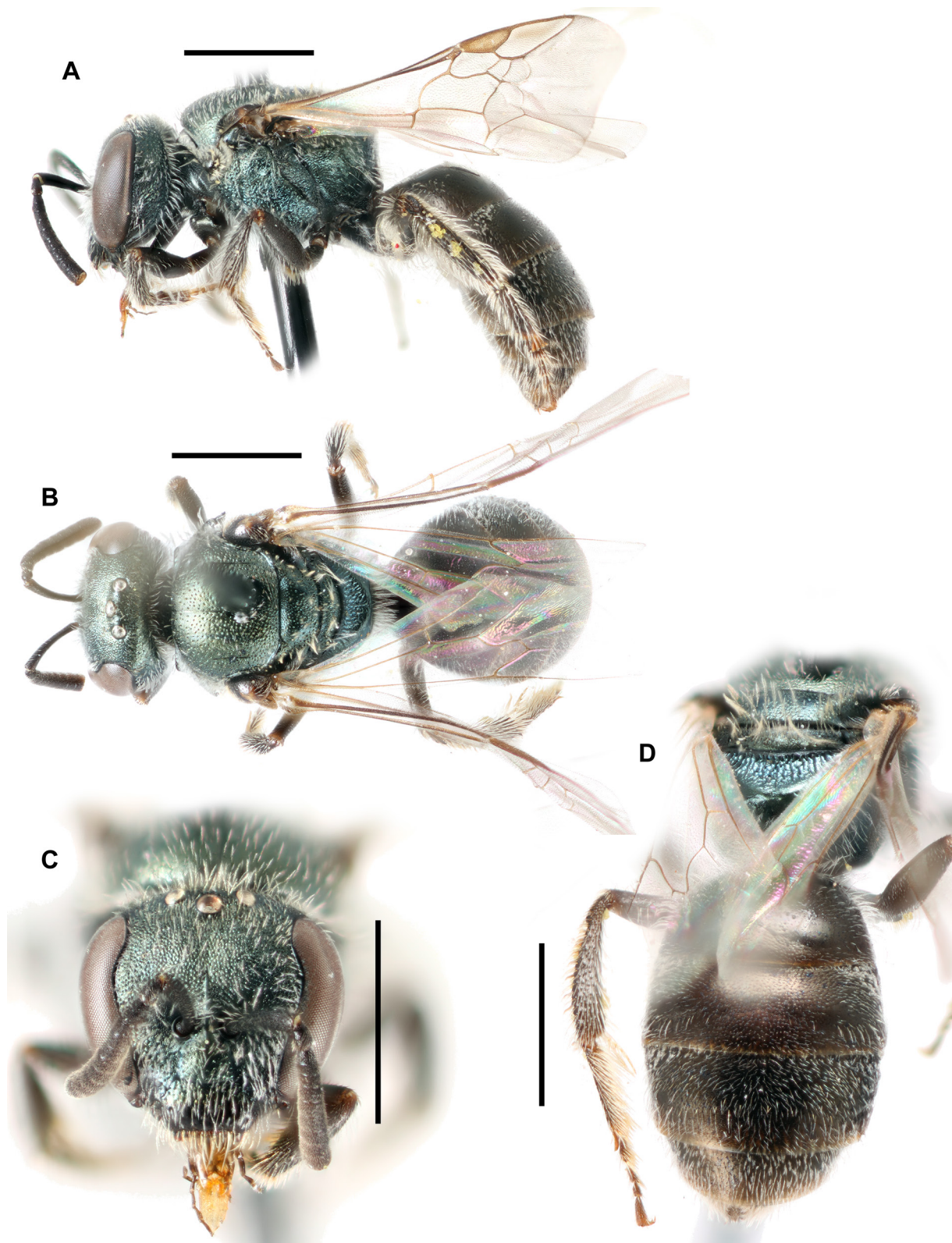
UNITED STATES – **Arizona** • ♀; Pima Co., Tucson, Pima Canyon; 32.358° N, 110.933° W; 7 Mar. 2018; T.J. Wood leg.; WRME.

[Verbatim label: USA: AZ: Pima 7.iii.2018 / Tucson, Pima Canyon / 32.358°, -110.933° / leg. T.J. Wood // BOLD / DLIII126-18 / gard0063-AZ // HOLOTYPE / *Lasioglossum (Dialictus) holzenthali* Gardner and Gibbs]

#### Paratypes

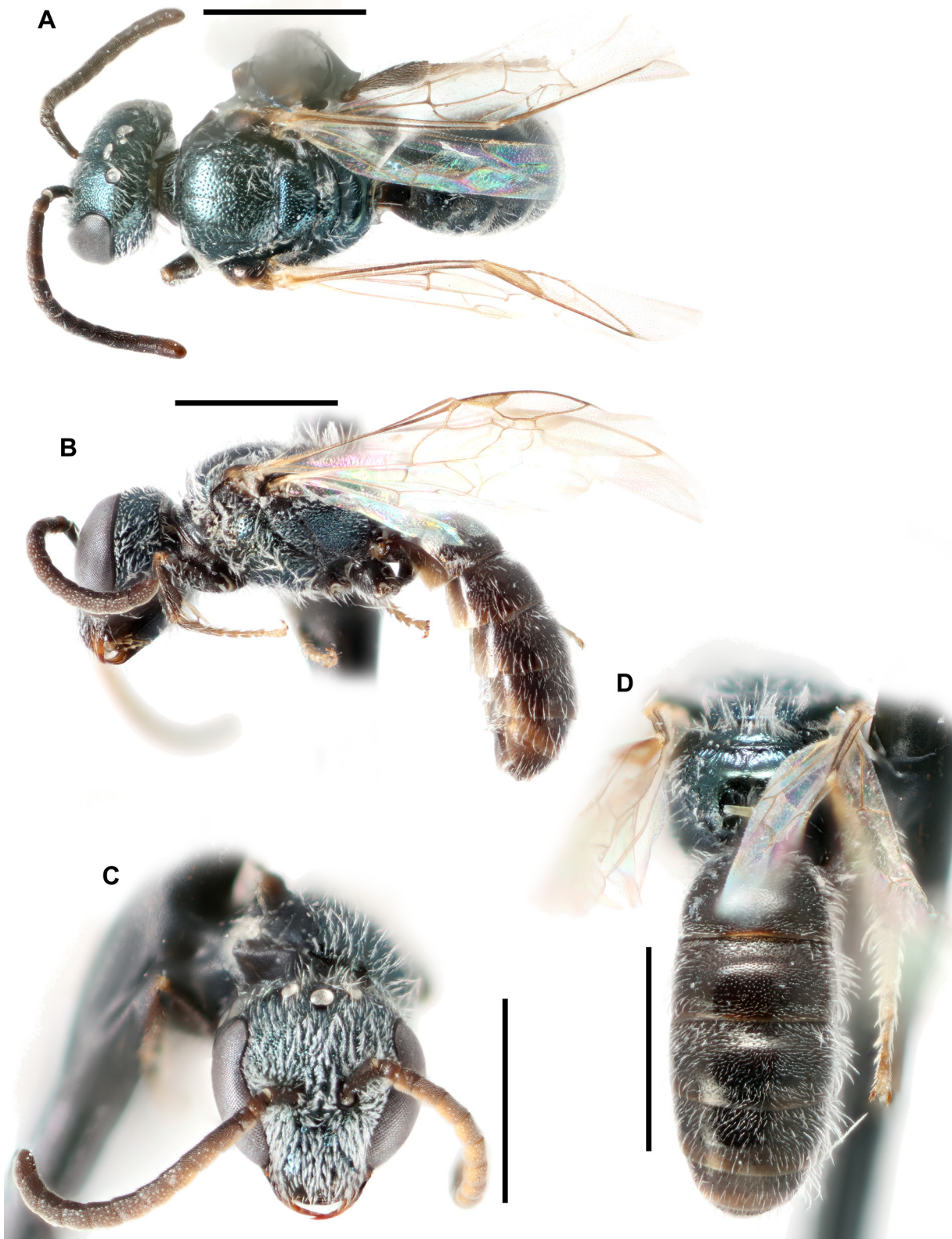
GUATEMALA – **Huehuetenango** • 1 ♂; La Democracia, Calauté; 15.571° N, 91.8496° W; elev. 915 m; 27 Apr. 2010; Philippe Sagot, Cafeta leg.; ECOAB.43127.

MEXICO – **Chiapas** • 1 ♀; 32 km E of La Trinitaria, Chinkultic ruins; 16.1333° N, 91.7833° W; elev. 1430 m; 15 Apr. 1993; C. Mendoza leg.; SEMC SM0341356 • 1 ♀; Soyalo; 16.91° N, 92.94° W; elev. 1356 m; 15 Jun. 2016; Philippe Sagot leg.; ECOAB ECOAB.66657. – **Guerrero** • 1 ♂; 20 mi. S of Chilpancingo; [17.25° N, 99.48° W]; elev. 1128 m; 6 Aug. 1954; SEMC • 1 ♀; 6 mi. NE of Tixtla; [17.63° N, 99.33° W]; 16 Jul. 1984; J.B. Woolley leg.; TAMU-ENTO X1362205. – **Hidalgo** • 1 ♀; 38 mi. NE of Jacala; [21.4° N, 98.8° W]; elev. 945 m; 10 Jul. 1961; ex *Bidens* sp.; SEMC. – **Jalisco** •



**Fig. 33.** *Lasioglossum (D.) holzenthali* sp. nov., ♀, holotype (WRME). A. Lateral habitus. B. Dorsal habitus. C. Face. D. Metasoma and propodeum. Scale bars = 1 mm.





**Fig. 34.** *Lasioglossum (D.) holzenthali* sp. nov., ♂ (CAVE40602). **A.** Dorsal habitus. **B.** Lateral habitus. **C.** Face. **D.** Metasoma and propodeum. Scale bars = 1 mm.



1 ♀; Chamela Estación Biología; [19.5° N, 105.04° W]; 11 Mar. 2000; F.D. Parker leg.; BBSL397009. – **Michoacán** • 2 ♀♀; Dr. Miguel Silva, 9 km S of Ario de Rosales; 19.116° N, 101.7357° W; elev. 1450 m; 29 Oct. 1987; T.L. Griswold leg.; BBSL1100948, BBSL1100949 • 1 ♀; Huetamo, Highway 15; 18.631° N, 100.8995° W; 7 Mar. 1972; F.D. Parker, D. Miller leg.; BBSL1100941 • 2 ♂♂; Los Sabinos, 28 km S of Ario de Rosales; 18.9556° N, 101.7447° W; elev. 1190 m; 29 Oct. 1987; T.L. Griswold leg.; BBSL1100938, BBSL1100939. – **Morelos** • 2 ♀♀; 4.7 mi. S of Yauhtepec; [18.82° N, 99.06° W]; elev. 983 m; 15 Aug. 1962; University of Kansas Mexico Expedition leg.; SEMC • 1 ♀; 7.3 mi. S of Yauhtepec; [18.78° N, 99.06° W]; elev. 914 m; 16 Aug. 1962; Ordway and Naumann leg.; SEMC • 1 ♀; Cuernavaca; [18.92° N, 99.22° W]; Feb. 1945; N.L.H. Krauss leg.; USNM. – **Nayarit** • 1 ♀; San Blas area; 22.8667° N, 105.1° W; 16–21 Mar. 1983; W.J. Hanson leg.; BBSL1101035 • 1 ♂; San Blas, La Bajada; 21.5166° N, 105.2195° W; 20–21 Mar. 1983; W.J. Hanson leg.; BBSL1101024. – **Puebla** • 1 ♀; 3 mi. NW of Petlalcingo; [18.1° N, 97.97° W]; 3 Apr. 1962; F.D. Parker leg.; UCDC. – **San Luis Potosí** • 1 ♀; 17 mi. E of Ciudad del Maíz; [22.38° N, 99.36° W]; elev. 975 m; 23 Jul. 1962; University of Kansas Mexico Expedition leg.; SEMC • 1 ♀; 5 mi. E of Ciudad del Maíz; [22.4° N, 99.53° W]; elev. 1433 m; 22 Aug. 1954; University of Kansas Mexico Expedition leg.; SEMC • 2 ♀♀; *ibid.*; 22 Aug. 1954; SEMC • 2 ♀♀; *ibid.*; 22–23 Aug. 1954; SEMC • 1 ♀; Xilitla; [21.38° N, 98.99° W]; elev. 442 m; 23 Jul. 1954; SEMC. – **Sinaloa** • 3 ♂♂; Sierra “Surutata” [Surutato], Cañon de “Tarahumares” [Tarahumaras], El Alamo; [25.82° N, 107.75° W]; 4 Mar. 1971; D.E. Breedlove leg.; ex *Lopezia ciliatula*; CAS CASENT 8416781, CASENT 8416782, CASENT 8416783. – **Sonora** • 1 ♂; 18 km E of Alamos, Rancho E. Guyabo, Barranca de Caja; 27.0127° N, 108.7752° W; elev. 370 m; 1–4 Apr. 2008; M.E. Irwin, F.D. Parker leg.; BBSL FDP747628 • 1 ♀; 30 km east of Agua Prieta; 31.33168° N, 109.25817° W; 5 May 2001; R.L. Minckley leg.; RLM SBV011946 • 2 ♀♀; Alamos; [27.03° N, 108.94° W]; 3 Sep. 1991; T. Griswold leg.; BBSL849293, BBSL849295 • 3 ♀♀; El Chalate, 3.7 km ENE of Rancho Los Llanos, 47 km ENE of Alamos; 27.0817° N, 108.7567° W; elev. 700 m; 1–10 Oct. 2006; M.E. Irwin leg.; BBSL FDP88440, FDP88445, FDP88469 • 1 ♂; *ibid.*; 1–10 Oct. 2006; M.E. Irwin leg.; BBSL FDP88505 • 4 ♀♀; Rancho El Cajón, 40 km E of Alamos; 27.05° N, 108.7318° W; elev. 420 m; 1–11 Oct. 2006; M.E. Irwin leg.; BBSL FDP746162, FDP746355, FDP746397, FDP746558 • 5 ♂♂; *ibid.*; 1–11 Oct. 2006; M.E. Irwin leg.; BBSL FDP745913, FDP746263, FDP746588, FDP746589, FDP746669 • 1 ♀; Rancho La Lajas, 44 km E of Alamos; 27.0572° N, 108.7133° W; elev. 555 m; 26 Sep.–11 Oct. 2006; M.E. Irwin leg.; BBSL FDP755132 • 1 ♀; Rancho Los Encinitas, 42 km ENE of Alamos; 27.06216° N, 108.74083° W; elev. 480 m; 1–10 Oct. 2006; M.E. Irwin leg.; BBSL FDP749879 • 1 ♀; Rancho Los Encinitas, 42 km ENE of Alamos; 27.0622° N, 108.7408° W; elev. 480 m; 1–9 Oct. 2006; M.E. Irwin leg.; BBSL FDP746840 • 1 ♀; Rancho Palo Injerto, 40 km E of Alamos; 27.042° N, 108.7337° W; elev. 425 m; 30 Sep. 2006; M.E. Irwin leg.; BBSL FDP748502 • 1 ♀; Rancho Santa Bárbara, 30 km NE of Alamos; 27.12° N, 108.72166° W; elev. 1334 m; 2 Apr. 2008; M.E. Irwin, F.D. Parker leg.; BBSL FDP749614 • 1 ♀; Rancho Santa Bárbara, 57 km NE of Alamos; 27.1095° N, 108.7418° W; elev. 1410 m; 2–6 Oct. 2006; M.E. Irwin leg.; BBSL FDP747268 • 1 ♂; Rancho Santa Bárbara, 57 km NE of Alamos; 27.1127° N, 108.7388° W; elev. 1380 m; 5 Oct. 2006; M.E. Irwin leg.; BBSL FDP86569 • 2 ♀♀; Rancho Santa Bárbara, 57 km NE of Alamos; 27.1095° N, 108.7418° W; elev. 1410 m; 6–9 Oct. 2006; M.E. Irwin leg.; BBSL FDP747222, FDP747241 • 1 ♀; Rancho Santa Bárbara, 59 km NE of Alamos; 27.1195° N, 108.7223° W; elev. 1355 m; 3 Oct. 2006; M.E. Irwin leg.; BBSL FDP746995. – **Tamaulipas** • 1 ♀; “Lleva” [Llera], Rio Guayalejo; [23.32° N, 99.03° W]; 27 Mar. 2001; M.J. Sharkey leg.; PCYU • 1 ♀; 6.6 mi. W of Antiguo Morelos; [22.55° N, 99.19° W]; elev. 427 m; 3 Sep. 1962; Ordway and Naumann leg.; SEMC • 1 ♀; 8 mi. NW of Nuevo Morelos; [22.62° N, 99.31° W]; 22 Jul. 1962; ex *Kallstroemia*; SEMC • 1 ♂; Altas Cumbres, 12 mi. SW of Ciudad Victoria; [23.6° N, 99.2° W]; 4 Jul. 1986; Schaffner, Kovarik leg.; TAMU-ENTO X1416868 • 1 ♂; west of Gómez Farias; [23.03° N, 99.16° W]; 15 Nov. 1985; Kovarik, Jones, Haack leg.; TAMU-ENTO X1421045. – **Veracruz** • 1 ♀; Orizaba; [18.85° N, 97.1° W]; Crawford leg.; USNM. – **Unknown** • 1 ♀; Jalapa [exact location unknown]; Crawford leg.; USNM.

UNITED STATES – **Arizona** • 1 ♀; Cochise Co., 3 mi. SW of Portal along Cave Creek; 31.8869° N, 109.1736° W; elev. 1550 m; 25–30 Jun. 1987; SEMC1590744 • 1 ♂; *ibid.*; 25–30 Jun. 1987; SEMC1590739 • 2 ♀♀; *ibid.*; 30 Jun.–15 Jul. 1987; SEMC1590807, SEMC1590820 • 1 ♀; *ibid.*; 15–19 Jul. 1987; SEMC1590885 • 1 ♂; Cochise Co., 3.2 km SW of Portal; [31.89° N, 109.17° W]; 12 Jul. 1987; Bryan N. Danforth leg.; ex *Asclepias*; SEMC • 1 ♀; Cochise Co., Bisbee, 1429 Franklin Street; 31.4066° N, 109.9327° W; elev. 1585 m; 22 Aug.–1 Sep. 2013; A.S. Menke leg.; BBSL FDP152690 • 1 ♀; Cochise Co., Rosewood; 31.36732° N, 109.1432° W; 20 Mar. 2014; W. Radke leg.; RLM SBV086684 • 1 ♀; Cochise Co., Southwestern Research Station, 5 mi. W of Portal; 31.8839° N, 109.206° W; 2 Sep. 2005; A. Kawakita leg.; AMNH • 1 ♀; Gila Co., 21 km S of Globe; 33.2353° N, 110.782° W; elev. 1480 m; 20–25 May 2013; M.E. Irwin leg.; BBSL FDP152196 • 1 ♀; Graham Co., Coronado National Forest, 20–30 mi. SW of Safford, Mount Graham Road; 32.6222° N, 109.8242° W; elev. 2592 m; 17 Aug. 2001; R.W. Brooks leg.; ex *Geranium caespitosum*; SEMC SM0273670 • 1 ♀; Pima Co., Catalina Mountains, junction of Oracle and Catalina Highway; [32.45° N, 110.77° W]; elev. 2600 m; 28 Aug. 1997; Robert L. Minckley leg.; SEMC SM0475669 • 1 ♂; Pima Co., Mount Lemmon Trail, Coronado National Forest; 32.4406° N, 110.7856° W; elev. 2135–2500 m; 15 Aug. 2001; R.W. Brooks leg.; ex *Erigeron oreophilus*; SEMC SM0274290 • 1 ♀; Pima Co., Oracle Ridge Trail, Coronado National Forest, 26–30 mi. N of Tucson; 32.4536° N, 110.7672° W; elev. 2348 m; 16 Aug. 2001; R.W. Brooks leg.; ex *Scrophularia parviflora*; SEMC SM0273644 • 1 ♀; Pima Co., Red Ridge Trail, Coronado National Forest, 26–30 mi. N of Tucson; 32.4533° N, 110.7672° W; elev. 2372–2378 m; 16 Aug. 2001; R.W. Brooks leg.; ex *Erigeron oreophilus*; SEMC SM0273457 • 1 ♀; Pima Co., Santa Catalina Mountains, “Summertown” [Summerhaven]; [32.44° N, 110.76° W]; elev. 2438 m; 1 Aug. 1992; L. Packer leg.; PCYU • 1 ♀; Santa Cruz Co., Mount Washington at Route 61; 31.4195° N, 110.7117° W; elev. 1609 m; 2–7 May 2004; F.D. Parker, M.E. Irwin leg.; BBSL584956 • 1 ♂; *ibid.*; 2–7 May 2004; F.D. Parker, M.E. Irwin leg.; BBSL584955 • 1 ♀; Santa Cruz Co., Santa Rita Mountains, Super Trail from Madera Canyon; 31.7053° N, 110.8633° W; elev. 1800 m; 30 Aug. 2000; R.W. Brooks leg.; SEMC SM0196629 • 1 ♂; 38 mi. NE of Globe; [33.78° N, 110.32° W]; 16 Jun. 1950; L.D. Beamer leg.; SEMC • 1 ♂; 4 mi. S of Jerome; [34.69° N, 112.12° W]; 7 Jul. 1952; R.H. Beamer, L.D. Beamer, Cheng Liang, W.E. LaBerge leg.; SEMC • 1 ♂; Chiricahua Mountains; [31.8° N, 109.3° W]; 4 Jul. 1940; R.H. Beamer leg.; SEMC • 1 ♂; Graham Mountains; [32.7° N, 109.9° W]; elev. 1829–2134 m; 8 Jul. 1955; Butler, Werner leg.; ex *Ceanothus*; UAIC • 1 ♀; *ibid.*; 9 Aug. 1955; Butler leg.; ex *Salvia?*; UAIC • 1 ♀; Granite Dells; [34.61° N, 112.41° W]; 5 Jul. 1950; Jerome G. Rozen leg.; ex *Nolina microcarpa*; SEMC • 1 ♂; Green Spring, Mount Lemmon; [32.451° N, 110.747° W]; elev. 2195 m; 13 Aug. 1978; F. Werner, M. Hetz leg.; UAIC • 1 ♀; Huachuca; [31.5° N, 110.4° W]; 1937; W. Benedict leg.; SEMC • 1 ♀; Madera Canyon, Santa Rita Mountains; [31.74° N, 110.89° W]; 23 Sep. 1956; F.G. Werner leg.; ex “*Aplopappus gracilis*” and *Eriogonum* sp.; UAIC • 1 ♀; Montezuma Canyon, Huachuca Mountains; [31.34° N, 110.24° W]; elev. 1524 m; 16 May 1961; R.H. and E.M. Painter leg.; UAIC • 1 ♂; Oak Creek Canyon; [34.91° N, 111.73° W]; 6 Jul. 1952; R.H. Beamer, L.D. Beamer, Cheng Liang, W.E. LaBerge leg.; SEMC • 1 ♀; *ibid.*; 6 Jul. 1952; R.H. Beamer, L.D. Beamer, W.E. LaBerge, A. Wolf, Cheng Liang, C. Weiner leg.; SEMC • 1 ♂; *ibid.*; 31 Jul. 1952; R.H. Beamer leg.; SEMC • 1 ♀; Salt River Canyon; [33.7° N, 110.8° W]; 16 Jun. 1950; R.H. Beamer leg.; SEMC • 8 ♂♂; *ibid.*; 16 Jun. 1950; R.H. Beamer leg.; SEMC • 1 ♂; Santa Catalina Mountains; [32.4° N, 110.7° W]; 15 Jul. 1950; L.D. Beamer leg.; SEMC • 1 ♂; *ibid.*; 16 Jul. 1950; L.D. Beamer leg.; SEMC • 1 ♂; Wet Canyon, Graham Mountains; [32.65° N, 109.81° W]; 8 Jul. 1955; Butler, Werner leg.; UAIC • 1 ♂; White Mountains; [33.9° N, 109.6° W]; 19 Jun. 1950; L.D. Beamer leg.; SEMC • 1 ♂; *ibid.*; 19 Jun. 1950; L.D. Beamer leg.; ex *Penstemon superbus*; SEMC • 1 ♀; *ibid.*; 19 Jun. 1950; R.H. Beamer leg.; ex *Amorpha fruticosa*; SEMC • 2 ♂♂; *ibid.*; 19 Jun. 1950; R.H. Beamer leg.; ex *Amorpha fruticosa*; SEMC • 1 ♂; Whiteriver; [33.84° N, 109.96° W]; 19 Jun. 1950; L.D. Beamer leg.; SEMC. – **New Mexico** • 2 ♀♀; Catron Co., Mogollon Mountains; [33.5° N, 108.6° W]; 29 Aug. 1951; E.L. Kessel leg.; CAS CASENT 8416797, CASENT 8416798 • 1 ♂; *ibid.*; 29 Aug. 1951; E.L. Kessel leg.; CAS CASENT 8416768 • 1 ♀; Catron Co., Pueblo Camping Area, W. Highway 180; 33.5942° N, 108.9611° W; elev. 1951 m; 25 May 2000; D.E. Baumgardner leg.; TAMU-ENTO X1497788 • 1 ♀; Chaves Co., 6 mi. SE of Piñon;

[32.56° N, 105.47° W]; 12 Aug. 1982; J.C. Schaffner leg.; TAMU-ENTO X1396223 • 4 ♀♀; Cibola Co., 18 mi. S of Grants, El Malpais National Conservation Area; [34.89° N, 107.88° W]; elev. 2164 m; 8 Aug. 1997; J.C. Schaffner leg.; TAMU-ENTO X1315312, X1316378, X1409486, X1422789 • 1 ♀; Grant Co., 0.5 km NE of McMillan Campground; 32.9274° N, 108.2111° W; 2 Sep. 2010; T.L. Griswold leg.; BBSL843365 • 1 ♂; 0.3 km S of Oak Spring; 32.1771° N, 104.4483° W; elev. 1359 m; 9 Jun. 2011; J.D. Herndon leg.; BBSL CAVE40602. – **Texas** • 1 ♂; Culberson Co., McKittrick Canyon; [31.984° N, 104.76° W]; elev. 1539 m; 14 May 1989; T. Griswold leg.; BBSL239906.

## Description

### Female

**COLOURATION.** Head and mesosoma blue-green to olive green; clypeus apex black; labrum black; mandible dark red with black basal spot and apex; flagellum black. Pronotal lobe black; legs black with tarsi dark reddish brown; tegula black to brown; wing membrane hyaline, veins with subcosta dark brown, otherwise lighter brown. Metasoma black with rims of terga and sterna narrowly translucent brown.

**PUBESCENCE.** Body pile colour white to pale yellow. Tomentum dense on pronotal collar and lobe and space between pronotal lobe and tegula; sparse on metepisternum, T2–T3 basolaterally, and T4 throughout. Mesoscutum pubescence thin to moderately plumose. Wing setae dark, short and dense. Acarinarial fan complete, sparse. T2 fringes sparse, T3 fringes sparse.

**SURFACE SCULPTURE.** Clypeus shiny, with punctures dense in basal half ( $IS \leq 1$  PD), large and irregularly sparse apically ( $IS < 2$  PD); supraclypeal area imbricate, with punctures dense marginally ( $IS \leq 1$  PD), sparser medially ( $IS = 1–2$  PD); paraocular area imbricate, with punctures dense ( $IS < 1$  PD), sparser around antenna socket ( $IS \leq 1$  PD); frons reticulate, with punctures crowded ( $IS = 0$  PD); vertex shiny, with punctures dense laterally ( $IS < 1$  PD), fine and moderately sparse medially ( $IS = 1–2$  PD); gena shiny, becoming lineolate posteriorly, with punctures absent; postgena shiny, becoming imbricate posteriorly. Tegula punctures fine, sparse ( $IS = 1–4$  PD); mesoscutum tessellate, with punctures dense ( $IS < 1$  PD), becoming sparse anteromedially ( $IS = 1–3$  PD); scutellum tessellate, becoming shiny submedially, with punctures dense marginally ( $IS < 1$  PD), moderately sparse submedially ( $IS = 1–2$  PD); metapostnotum shiny, becoming weakly tessellate posteriorly, with rugae strong, subparallel, reaching posterior margin; preepisternum imbricate with crowded punctures ( $IS = 0$  PD), becoming sparser and obscure ventrally ( $IS = 1–2$  PD); hypoepimeron imbricate, with punctures dense ( $IS < 1$  PD); mesepisternum imbricate, with punctures dense ( $IS < 1$  PD), becoming moderately dense marginally ( $IS = 1–2$  PD); metepisternum weakly rugulose; propodeum lateral surface weakly tessellate, posterior surface shiny. T1 anterior slope shiny, disc shiny, with punctures moderately dense ( $IS = 1–2$  PD), absent in large subapicolateral boss; T2 disc shiny, with punctures moderately dense ( $IS = 1–2$  PD), apical rim weakly coriarius, with punctures moderately sparse ( $IS = 1–3$  PD).

**STRUCTURE.** Face length/width ratio 0.81 ( $\pm 0.01$  SD); clypeus apicolateral denticles low rounded knobs; gena/eye width ratio 0.91 ( $\pm 0.09$  SD). Pronotal angle slightly obtuse, nearly right-angled; intertegular span 0.97 ( $\pm 0.07$  SD) mm; mesoscutum length/width ratio 0.87 ( $\pm 0.04$  SD); mesoscutum/scutellum length ratio 2.89 ( $\pm 0.18$  SD); scutellum/metanotum length ratio 1.8 ( $\pm 0.13$  SD); metanotum/metapostnotum length ratio 0.71 ( $\pm 0.04$  SD); forewing with 3 submarginal cells; tegula slightly enlarged, nearly reaching posterior margin of mesoscutum; inner margin straight; tegula length 0.4 ( $\pm 0.01$  SD) mm, width 0.23 ( $\pm 0.01$  SD) mm; propodeum lateral carinae not reaching dorsal margin; oblique carina weak, straight. T2 depressed apical rim less than 50% of tergum. ( $n = 10$ )

**VARIATION.** The tegula punctures can vary from very sparse ( $IS = 1–4$  PD) to dense ( $IS \leq 1$  PD), the mesepisternum punctures can vary from moderately sparse ( $IS = 1–2$  PD) to dense ( $IS < 1$  PD), and the T1–T3 apical rims can rarely be indistinctly punctate.



**Male**

**COLOURATION.** Head and mesosoma blue-green; clypeus apex black; labrum black; mandible orange with black base and red apex; flagellum black dorsally, brown ventrally. Pronotal lobe black; legs black to dark reddish brown; tegula dark brown; wing membrane lightly infuscated, veins with subcosta black, otherwise dark brown. Metasoma black with apical rims of terga narrowly translucent brown, apical rims of sterna and downcurved lateral areas of terga more broadly translucent brown.

**PUBESCENCE.** Body pile colour white. Tomentum dense on lower paraocular area, pronotal angle and lobe, and space between pronotal lobe and tegula; sparse on clypeus, supraclypeal area, and gena. Mesoscutum pubescence simple to moderately plumose. Wing setae dark, short and dense. Sterna pubescence short (0.5–1.5 OD), densely plumose, sparse on S2–3, dense on S4–5.

**SURFACE SCULPTURE.** Clypeus shiny, with punctures dense ( $IS \leq 1$  PD); supraclypeal area imbricate, with punctures dense ( $IS \leq 1$  PD); paraocular area shiny, with punctures dense ( $IS < 1$  PD); frons reticulate, with punctures crowded ( $IS = 0$  PD); vertex shiny, with punctures dense ( $IS < 1$  PD); gena shiny, with punctures dense ( $IS \leq 1$  PD); postgena shiny to lineate. Tegula punctures dense ( $IS < 1$  PD), becoming moderately dense medially ( $IS = 1-2$  PD); mesoscutum shiny, becoming tessellate anteromedially, with punctures moderately sparse ( $IS = 1-2$  PD), becoming dense on lateral and posterior margins ( $IS < 1$  PD); scutellum shiny to weakly tessellate, with punctures sparse ( $IS = 1-3$  PD), diversopunctate, becoming dense marginally and on median line; metanotum weakly rugulose; metapostnotum shiny, with rugae strong, subparallel, nearly reaching posterior margin; preëpisternum areolate; hypoepimeron shiny, with punctures dense ( $IS < 1$  PD); mesepisternum shiny, with punctures dense ( $IS < 1$  PD); metepisternum areolate, becoming smooth dorsally; propodeum lateral surface tessellate, with punctures crowded ( $IS = 0$  PD), posterior surface shiny and densely punctate ( $IS < 1$  PD). T1 anterior slope shiny, disc shiny, with punctures dense ( $IS \leq 1$  PD), becoming sparse in large subapicolateral boss ( $IS = 2-4$  PD); T2 disc shiny, with punctures dense ( $IS \leq 1$  PD), apical rim shiny, with punctures dense ( $IS \leq 1$  PD).

**STRUCTURE.** Face length/width ratio 0.86 ( $\pm 0.02$  SD); gena/eye width ratio 0.74 ( $\pm 0.08$  SD). Pronotal angle obtuse; intertegular span 0.86 ( $\pm 0.09$  SD) mm; mesoscutum length/width ratio 0.87 ( $\pm 0.02$  SD); mesoscutum/scutellum length ratio 2.75 ( $\pm 0.15$  SD); scutellum/metanotum length ratio 1.83 ( $\pm 0.19$  SD); metanotum/metapostnotum length ratio 0.73 ( $\pm 0.07$  SD); forewing with 3 submarginal cells; tegula enlarged, nearly reaching posterior margin of mesoscutum in dorsal view; inner posterior margin weakly concave; tegula length 0.37 ( $\pm 0.04$  SD) mm, width 0.2 ( $\pm 0.02$  SD) mm; propodeum lateral carinae not reaching dorsal margin; oblique carina absent. (n = 10)

**GENITALIA.** As in Fig. 76H. Gonocoxite about 2 times as broad as gonostylus. Gonostylus very long, about 2 times as long as broad, and strongly concave on outer margin, with sparse long setae dorsally and on apical half of inner margin and short setae apically. Penis valves parallel, with sparse short setae laterally. Retrorse lobe rounded, about 2.7 times as long as broad, with sparse short setae in apical half.

**VARIATION.** The tegula punctures can vary from dense ( $IS \leq 1$  PD) and distinct to virtually impunctate, the mesoscutum can vary from mostly shiny to entirely tessellate, the scutellum punctures can vary from dense ( $IS < 1$  PD) to sparse ( $IS = 1-3$  PD), the metapostnotal rugae can vary from strong and nearly reaching the posterior margin to shallow and barely reaching halfway, and the apical rims of T1–T3 can be partially impunctate (but always with some punctures near the premarginal line). Most of this atypical variation was seen in a single, unusually small individual.

**Range**

Mountains of Texas, New Mexico, Arizona, and throughout Mexico (Fig. 35).

### Floral hosts

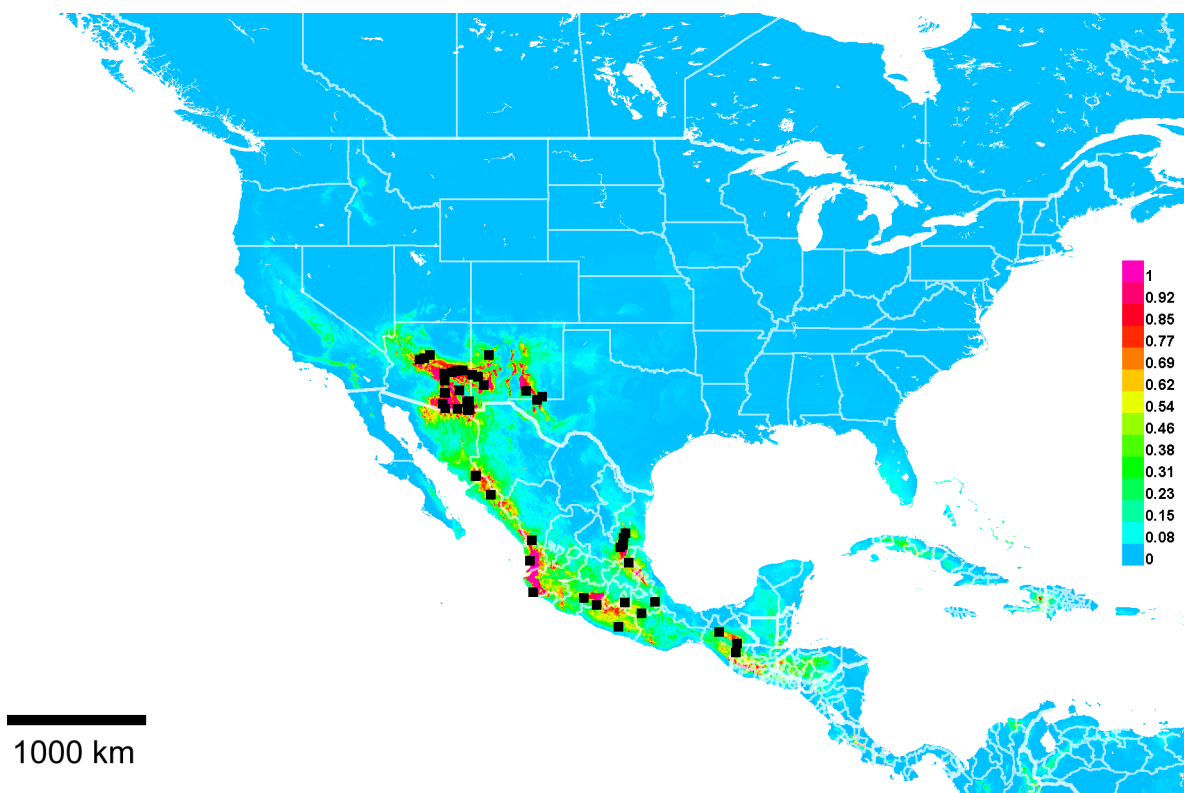
APOCYNACEAE: *Asclepias* • ASPARAGACEAE: *Nolina* Michx.: *N. microcarpa* S.Watson • ASTERACEAE: *Bidens* L. • *Erigeron*: *E. oreophilus* Greenm. • FABACEAE: *Amorpha* L.: *A. fruticosa* L. • GERANIACEAE Juss.: *Geranium* L.: *G. caespitosum* E.James • ONAGRACEAE Juss.: *Lopezia* Cav.: *L. ciliatula* Plitmann, P.H.Raven & Breedlove [ambiguous] • PLANTAGINACEAE: *Penstemon*: *P. superbus* A.Nelson • RHAMNACEAE Juss.: *Ceanothus* L. • SCROPHULARIACEAE: *Scrophularia* L.: *S. parviflora* Wooton & Standl. • ZYGOPHYLLACEAE: *Kallstroemia* Scop.

### DNA barcodes

Four confirmed sequences available (BOLD process IDs: BBLEG165-17, DLII1145-08, DLIII126-18, DLIII207-20). There is a moderate amount of divergence within these sequences (1.07% maximum intraspecific p-distance). They are closest in terms of p-distance to *L. deludens* sp. nov. (2.01% minimum interspecific p-distance). No fixed nucleotide substitutions distinguish *L. holzenthali* sp. nov. from all other species of the *L. gemmatum* complex, but four fixed nucleotide substitutions distinguish it from the closely related *L. perparvum* and all known related, undescribed Neotropical species: 120(C), 315(A), 477(T), and 499(C) (Supp. file 2).

### Comments

Uncommon. *Lasioglossum holzenthali* sp. nov. is regularly collected at high elevations in Mexico and the southern United States, but rarely in large numbers.



**Fig. 35.** Georeferenced collection records of *Lasioglossum(D.) holzenthali* sp. nov. (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence.

*Lasioglossum (Dialictus) indagator* sp. nov.

urn:lsid:zoobank.org:act:D5070EC1-B6A9-49D4-9C68-7D03A6BE5BCD

Figs 36–38, 76I, 84B, 105B

### Diagnosis

Females of *L. indagator* sp. nov. have the tegula relatively small (reaching but not exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin weakly concave, with a gentle S-shaped curve and blunt posterior angle, and moderately sparsely punctate laterally at midlength (IS = 1–3 PD); mesoscutum lateral and posterior margins, metanotum, and pleura with abundant tomentum; mesoscutum, scutellum, and mesepisternum shiny and densely punctate (IS ≤ 1 PD) (mesoscutum becoming tessellate and more sparsely punctate anteromedially (IS = 1–2 PD)); metapostnotum with subparallel rugae not reaching posterior margin; T1 anterior slope coriarius; gena subequal to or slightly wider than eye in lateral view; and tegula and metasoma red-orange.

Females of *L. indagator* sp. nov. are most similar to those of *L. diabolicum* sp. nov., *L. ellisiae*, *L. gaudiale*, and *L. gloriosum* sp. nov., all of which (except *L. gloriosum*) have the mesoscutum, metanotum, and pleura with tomentum sparse or absent, and all except *L. gaudiale* have the metapostnotum rugae reaching the posterior margin. In addition, females of *L. gaudiale* have the T1 anterior slope shiny and scutellum often sparsely punctate (IS = 1–2 PD). Females of *L. gloriosum* have the tegula larger (exceeding posterior margin of mesoscutum in dorsal view) and densely punctate (IS ≤ 1 PD). Females of *L. diabolicum* have the gena slightly narrower than the eye in lateral view.

Males of *L. indagator* sp. nov. have the tegula relatively small (at most slightly exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin weakly concave and a blunt posterior angle, and usually moderately sparsely punctate in part (IS = 1–2 PD); face broad (length/width ratio ≤ 0.83) and covered with very dense tomentum up to the median ocellus; mesoscutum usually moderately densely punctate (IS = 1–2 PD) and fringed with tomentum; pleura with extensive tomentum; metapostnotum shiny with strong, short rugae not reaching the posterior margin; T2–T3 with extensive basolateral tomentum; and head and mesosoma usually blue to blue-green. They are most similar to those of *L. gaudiale* and *L. gloriosum* sp. nov. See the diagnosis for *L. gaudiale* for a comparative diagnosis between these three species.

### Etymology

The specific epithet ‘*indagator*’ is a noun derived from the Latin verb ‘*indago*’ (to hunt, chase) and the suffix ‘-ator’ (implying action or agency). It means ‘hunter’ and refers to the fact that most specimens were identified as *L. hunteri* in the past.

### Material examined

#### Holotype

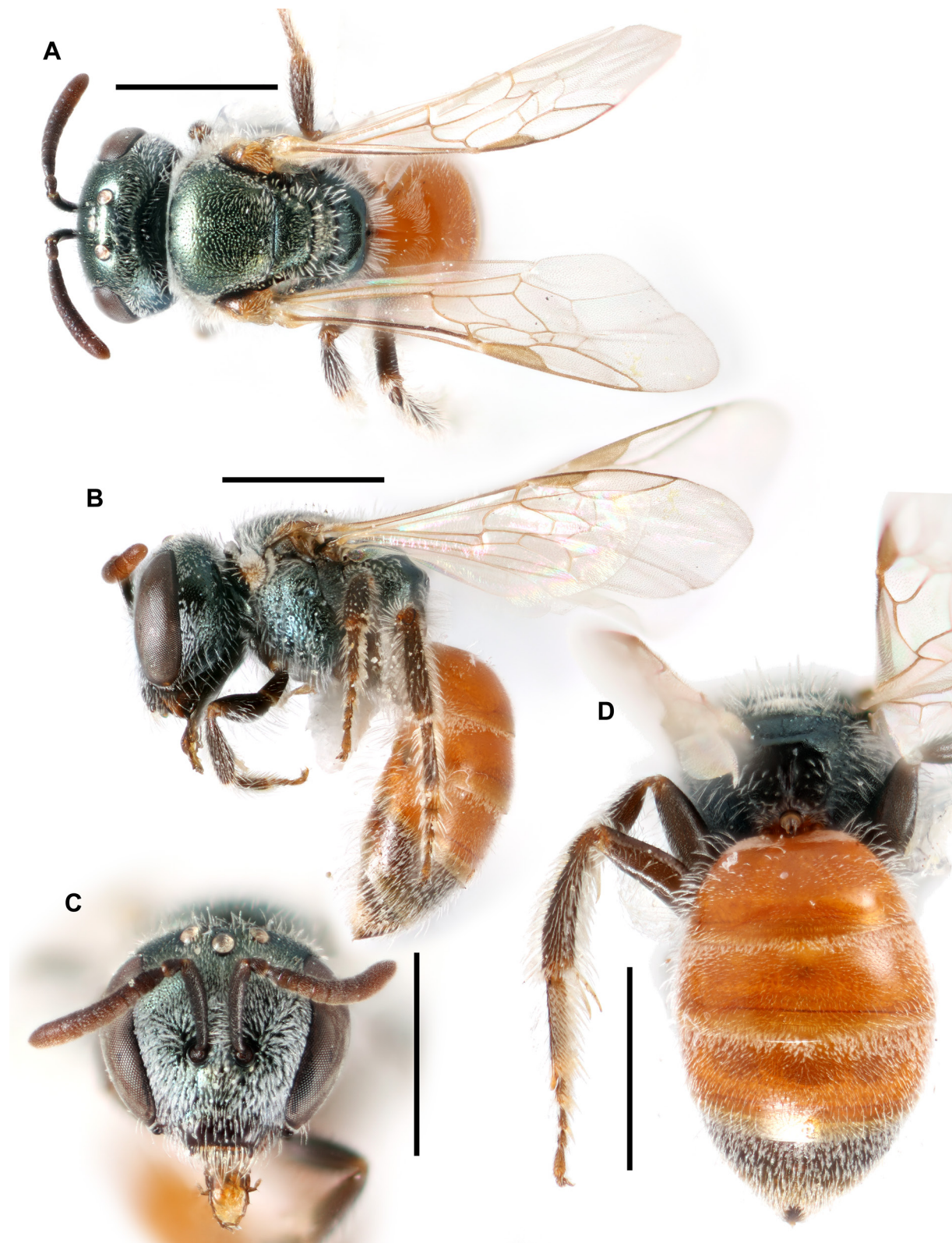
UNITED STATES – Arizona • ♀; Cochise Co., St. David Cienega; 31.8465° N, 110.2275° W; 4 Apr. 2016; C.M. Delphia & J.B. Runyon leg.; MTEC (to be placed on permanent loan to CAS).

[Verbatim label: ARIZONA: Cochise Co. / St. David Cienega / N31°50.79' W110°13.65' / 04 April 2016 / CMDelphia&JBRunyon // BOLD / DLIII123-18 / gard0059-AZ // CMDC // HOLOTYPE / *Lasioglossum (Dialictus) indagator* Gardner and Gibbs]

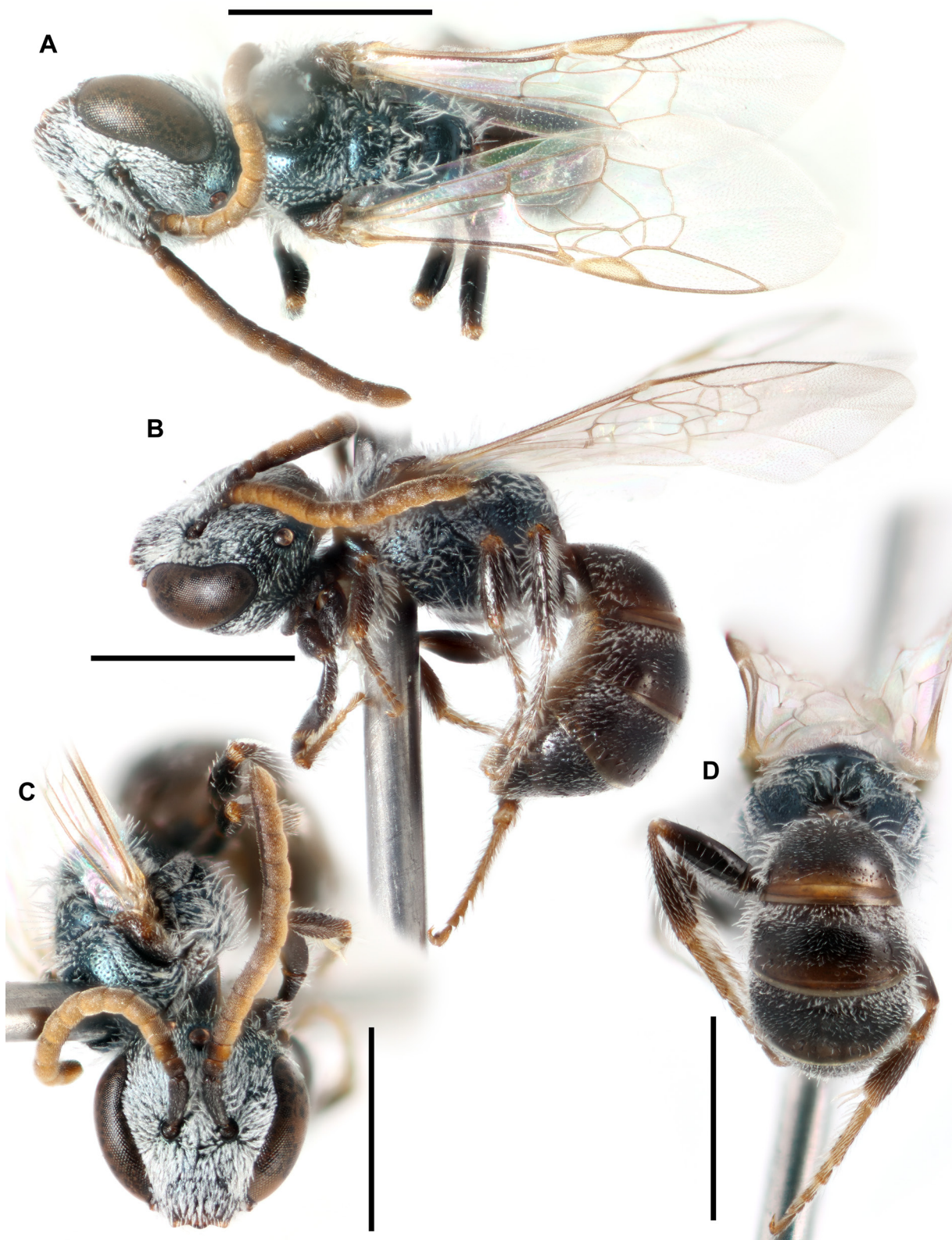
#### Paratypes

MEXICO – Sonora • 1 ♀; 30 km E of Agua Prieta, Quarry, roadside E; 31.31996° N, 109.26848° W; 18 Aug. 2003; A. Nelson leg.; RLM SBV035655 • 1 ♀; Rancho San Bernardino; 31.3183° N, 109.2689° W; 31 Aug. 2001; R. Minckley leg.; RLM SBV138341.





**Fig. 36.** *Lasioglossum (D.) indagator* sp. nov., ♀, holotype (MTEC). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma and propodeum. Scale bars = 1 mm.



**Fig. 37.** *Lasioglossum (D.) indagator* sp. nov., ♂ (WRME 518968). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma and propodeum. Scale bars = 1 mm.



UNITED STATES – **Arizona** • 4 ♀♀; Cochise Co., 3.45 mi. S by E of Willcox; 32.2262° N, 109.7822° W; elev. 1273 m; 1 Sep. 2009; Terry L. Griswold leg.; BBSL985340, BBSL985382, BBSL985406, BBSL985439 • 3 ♀♀; *ibid.*; 1 Sep. 2009; Terry L. Griswold leg.; WRME BBSL985389, BBSL985437, BBSL985440 • 2 ♀♀; Cochise Co., 4 mi. E of Willcox; [32.25° N, 109.76° W]; 11–18 Aug. 1987; K.V. Krombein leg.; USNM • 1 ♀; *ibid.*; 27 Aug. 2007; PCYU • 1 ♀; Cochise Co., 6.4 km SE of Willcox on Blue Sky Road; 32.2275° N, 109.7814° W; elev. 1250 m; 25 Aug. 2001; R.W. Brooks leg.; SEMC SM0270737 • 3 ♀♀; Cochise Co., Dry Lake, 4 mi. SE of Willcox, sand dunes; 32.2271° N, 109.7812° W; 27 Aug. 2013; Terry L. Griswold leg.; BBSL878989, BBSL881054, BBSL881055 • 1 ♂; Cochise Co., roadside outside of Willcox; 32.2392° N, 109.7716° W; 10 May 2017; T. McMahon leg.; WRME 518968 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3386° N, 109.2719° W; 8 Aug. 2003; A. Romero leg.; RLM SBV033848 • 1 ♀; La Paz Co., Bouse, along Bouse Avenue, Bouse Wash; 33.9318° N, 114.0131° W; 10 May 2012; Z.M. Portman leg.; ex *Prosopis* sp.; BBSL813796 • 1 ♂; Maricopa Co., Phoenix; [33.4° N, 112.1° W]; 10 May 1934; R.H. Crandall leg.; UAIC • 1 ♀; Pima Co., Greaterville Road; 31.7864° N, 110.8231° W; elev. 1320 m; 8 Jul. 2010; Douglas Yanega leg.; ex *Condalia*; UCRC ENT 275913 • 1 ♀; Pima Co., Sabino Canyon, Santa Catalina Mountains; [32.33° N, 110.8° W]; 26 Mar. 1962; M.L. Noller leg.; ex *Phacelia*; UAIC • 1 ♀; Pima Co., Santa Rita Range Reserve; [31.83° N, 110.85° W]; 27 May 1958; G.D. Butler, F.G. Werner leg.; ex mesquite; UAIC • 1 ♀; *ibid.*; 2 Jun. 1958; G.D. Butler leg.; ex mesquite; UAIC • 2 ♂♂; Pima Co., Silver Bell Bajada, Int. BioL. Program; [32.4° N, 111.5° W]; J.L. Neff leg.; CUIC • 1 ♀; Pima Co., Tucson; [32.2° N, 110.9° W]; 4 Mar. 1934; Bryant leg.; CAS CASENT 8416762 • 1 ♀; *ibid.*; 16 May 1954; G.D. Butler leg.; UAIC • 1 ♀; *ibid.*; 9 Apr. 1955; G.D. Butler leg.; UAIC • 1 ♂; *ibid.*; 6 Jul. 1962; G.D. Butler leg.; ex cotton; UAIC • 1 ♀; *ibid.*; 23 Jun. 1963; F.D. Parker leg.; UCDC • 2 ♀♀; 10 mi. E of Nogales; [31.34° N, 110.77° W]; 26 Mar. 1955; G.D. Butler, F.G. Werner leg.; UAIC • 1 ♀; 21 mi. N of Pearce; [32.25° N, 109.84° W]; 8 Jul. 1955; G.D. Butler, F.G. Werner leg.; UAIC • 1 ♀; Arivaca; [31.58° N, 111.33° W]; 13 Jul. 1950; Jerome G. Rozen leg.; SEMC • 1 ♀; *ibid.*; 13 Jul. 1950; R.H. Beamer leg.; SEMC • 1 ♂; Avra Valley; [32.44° N, 111.32° W]; 6 Jul. 1955; G.D. Butler, F.G. Werner leg.; ex *Solanum elaeagnifolium*; CUIC • 1 ♂; *ibid.*; 6 Jul. 1955; G.D. Butler, F.G. Werner leg.; ex alfalfa; UAIC • 1 ♀; *ibid.*; 5 Jul. 1957; G.D. Butler leg.; ex cotton; UAIC • 1 ♀; Catalina Mountains; [32.4° N, 110.8° W]; 8 Apr. 1955; G.D. Butler leg.; UAIC • 1 ♀; Continental; [31.85° N, 110.97° W]; 14 Jun. 1955; G.D. Butler leg.; ex mesquite; UAIC • 1 ♂; Maricopa Mountains; [33° N, 112.5° W]; 13 Apr. 1947; H. Townes, M. Townes leg.; SEMC • 1 ♀; Randolph; [32.92° N, 111.51° W]; 18 Jul. 1956; C. Williams leg.; ex alfalfa; UAIC • 2 ♀♀; Sahuarita; [31.96° N, 110.96° W]; 11 Apr. 1947; H. Townes, M. Townes leg.; SEMC • 1 ♀; *ibid.*; 9 Jul. 1952; R.H. Beamer, L.D. Beamer, W.E. LaBerge, Cheng Liang leg.; SEMC • 1 ♂; *ibid.*; 5 Jul. 1956; G.D. Butler leg.; UAIC • 1 ♀; Santa Rita Mountains; [31.8° N, 110.8° W]; 10 Jul. 1950; R.H. Beamer leg.; ex *Sphaeralcea laxa*; SEMC • 1 ♀; Superior, Boyce Thompson Arboretum; [33.28° N, 111.16° W]; 23 Jul. 1955; G.D. Butler leg.; UAIC. – **California** • 1 ♀; San Bernardino Co., Ontario, near I-15; 34.0478° N, 117.5456° W; elev. 280 m; 31 Aug. 1999; Douglas Yanega leg.; ex *Eriogonum fasciculatum*; UCRC ENT 00030189. – **New Mexico** • 1 ♀; Chaves Co., Mescalero Sands; [32.94° N, 103.95° W]; 3 Jun. 1974; H.E. Evans leg.; CSUC • 1 ♀; Doña Ana Co., Las Cruces; [32.32° N, 106.76° W]; 25 Apr. 1954; L.D. Beamer leg.; ex *Salix*; SEMC • 1 ♀; *ibid.*; 25 Apr. 1954; R.H. Beamer leg.; ex *Salix*; SEMC • 1 ♀; Hidalgo Co., Rodeo vicinity; [31.84° N, 109.03° W]; 11–12 Jun. 1987; Bryan N. Danforth leg.; ex *Berlandiera*; SEMC • 16 ♀♀; *ibid.*; 11 Jun. 1987; Bryan N. Danforth leg.; ex *Euphorbia*; SEMC • 1 ♀; 10 mi. W of Roswell; [33.39° N, 104.7° W]; 22 Jul. 1952; Cheng Liang, W.E. LaBerge, R.H. Beamer, L.D. Beamer leg.; SEMC • 1 ♀; Rest Stop, garden; 32.2268° N, 108.087° W; elev. 1353 m; 15 Aug. 2011; Biobus 2011 leg.; DEBU. – **Texas** • 3 ♀♀; Brewster Co., Big Bend National Park, Castolon; [29.133° N, 103.514° W]; 19 Jun. 1999; Sam W. Droege leg.; BBSL430411, BBSL430430, BBSL430454 • 2 ♀♀; Brewster Co., Elephant Mountain WMA, Calamity Creek; 30.0371° N, 103.5653° W; 22–23 Apr. 2011; E.G. Riley leg.; TAMU-ENTO X0611953, X0612279 • 1 ♀; Brewster Co., Elephant Mountain WMA, campground & vicinity; 30.0482° N, 103.5698° W; 22–23 Apr. 2011; E.G. Riley leg.; TAMU-ENTO X0611835 • 1 ♂; Hockley Co., 2 mi. S of Anton; [33.78° N, 102.16° W]; 9 Sep. 1982; D.A. Dean leg.; ex cotton; TAMU-ENTO



X1417025 • 1 ♀, 1 ♂; Hudspeth Co., McNary; [31.25° N, 105.8° W]; 31 May 1974; H.E. Evans leg.; ex *Chilopsis*; CSUC • 1 ♀; Big Bend National Park, Santa Elena Canyon; [29.165° N, 103.612° W]; 26 Aug. 1967; R.C. Gardner, C.R. Kovacic leg.; UCDC • 1 ♀; *ibid.*; 20 Mar. 1968; D.S. Horning Jr. leg.; UCDC.

## Description

### Female

**COLOURATION.** Head and mesosoma blue-green to olive green; clypeus apex black; labrum black; mandible orange with black base and red apex; flagellum black dorsally, reddish brown ventrally. Pronotal lobe orange; legs brown; tegula orange; wing membrane hyaline, veins with subcosta dark brown, otherwise light brown to pale amber. Metasoma orange with dark spiracular spots on T2–T4 (small on T2) and rims of terga and sterna broadly translucent yellow.

**PUBESCENCE.** Body pile colour white. Tomentum dense on paraocular area, gena, pronotal collar and lobe, space between pronotal lobe and tegula, metanotum medially, metepisternum, and T2–T3 basolaterally; sparse on mesoscutum lateral and posterior margins, preepisternum, and T4. Mesoscutum pubescence moderately to densely plumose. Wing setae dark with light intermixed basally, short and dense. Acarinarial fan complete, dense. T2 fringes sparse, T3 fringes sparse.

**SURFACE SCULPTURE.** Clypeus shiny, with punctures dense in basal third ( $IS \leq 1$  PD), large and irregularly spaced apically ( $IS < 2$  PD); supraclypeal area shiny, with punctures dense marginally ( $IS \leq 1$  PD), moderately dense medially ( $IS = 1-2$  PD); paraocular area shiny, with punctures crowded ( $IS = 0$  PD); frons shiny, with punctures crowded ( $IS = 0$  PD); vertex shiny, with punctures dense laterally ( $IS < 1$  PD), sparse medially ( $IS = 1-3$  PD); gena shiny, with punctures fine, moderately dense ( $IS = 1-2$  PD); postgena imbricate. Tegula punctures dense ( $IS < 1$  PD), becoming sparse mediolaterally ( $IS = 1-3$  PD); mesoscutum shiny, becoming tessellate anteromedially, with punctures dense ( $IS < 1$  PD), becoming sparse anteromedially ( $IS = 1-3$  PD); scutellum shiny, with punctures dense ( $IS < 1$  PD); metapostnotum finely reticulate, with rugae weak, subparallel, not reaching posterior margin; preepisternum ruguloso-punctate; hypopimeron shiny, with punctures crowded ( $IS = 0$  PD); mesepisternum shiny, with punctures dense ( $IS < 1$  PD); metepisternum lineolate; propodeum lateral surface tessellate, posterior surface weakly tessellate. T1 anterior slope coriarius, disc weakly coriarius, with punctures minute, moderately sparse ( $IS = 1-3$  PD), absent on rim and in large subapicolateral boss; T2 disc weakly coriarius, with punctures minute, moderately dense ( $IS = 1-3$  PD), apical rim weakly coriarius, with punctures minute, very sparse ( $IS = 2-6$  PD), obscure.

**STRUCTURE.** Face length/width ratio 0.78 ( $\pm 0.02$  SD); clypeus apicolateral denticles rounded obtuse points; gena/eye width ratio 0.9 ( $\pm 0.13$  SD). Pronotal angle obtuse; intertegular span 0.77 ( $\pm 0.04$  SD) mm; mesoscutum length/width ratio 0.9 ( $\pm 0.03$  SD); mesoscutum/scutellum length ratio 2.85 ( $\pm 0.18$  SD); scutellum/metanotum length ratio 1.74 ( $\pm 0.14$  SD); metanotum/metapostnotum length ratio 0.84 ( $\pm 0.12$  SD); forewing with 3 submarginal cells; tegula enlarged, reaching posterior margin of mesoscutum in dorsal view; inner posterior margin weakly concave; tegula length 0.41 ( $\pm 0.02$  SD) mm, width 0.21 ( $\pm 0.01$  SD) mm; propodeum lateral carinae not reaching dorsal margin; oblique carina very weak, straight. T2 depressed apical rim less than 50% of tergum. ( $n = 10$ )

**VARIATION.** The clypeus apical margin, labrum, and flagellum ventral surface can vary from black to orange, the mesoscutum and mesepisternum can vary from shiny to weakly tessellate or imbricate, and the metapostnotum microsculpture can vary from shiny to finely reticulate.

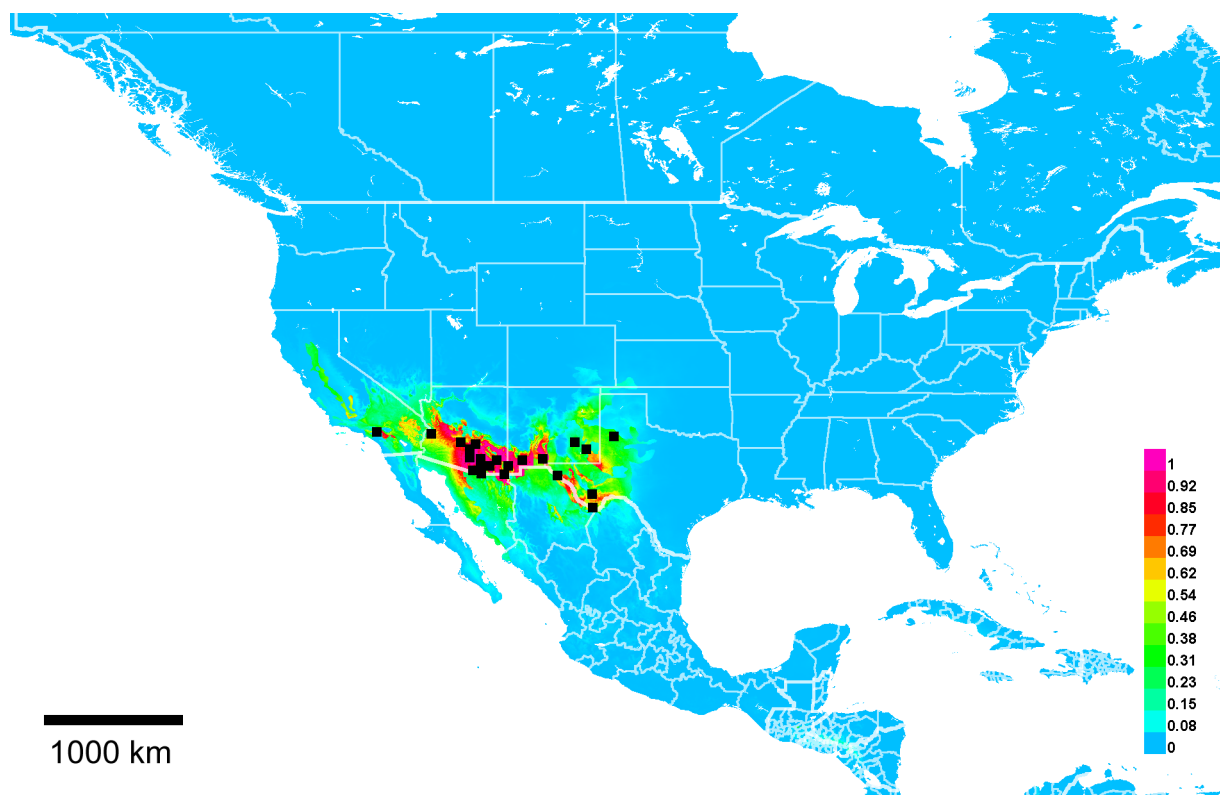
### Male

**COLOURATION.** Head and mesosoma blue to blue-green; clypeus apex reddish brown; labrum orange; mandible orange with black basal spot and red apex; flagellum reddish brown dorsally, orange-brown

ventrally. Pronotal lobe orange-brown; legs reddish brown; tegula orange-brown; wing membrane hyaline, veins with subcosta brown, otherwise light brown. Metasoma black with depressed apical rims of terga and sterna translucent brown, downcurved lateral areas of terga becoming translucent yellow.

**PUBESCENCE.** Body pile colour white. Tomentum dense on face below lateral ocelli, gena, pronotal angle and lobe, space between pronotal lobe and tegula, metepisternum, and T2–T3 basally; sparse on scutum, preëpisternum, mesepisternum, and T4 basally. Mesoscutum pubescence mostly densely plumose with sparse simple setae medially. Wing setae light with dark intermixed apically, short and sparse. Sterna pubescence short (0.5–1 OD), simple to moderately plumose, sparse.

**SURFACE SCULPTURE.** Clypeus shiny, with punctures dense (IS < 1 PD); supraclypeal area shiny, with punctures dense (IS ≤ 1 PD); paraocular area shiny, with punctures fine, dense (IS < 1 PD); frons shiny, with punctures fine, crowded (IS = 0 PD); vertex shiny, with punctures dense laterally (IS < 1 PD), moderately dense medially (IS = 1–2 PD); gena shiny, with punctures dense (IS ≤ 1 PD); postgena shiny to lineate. Tegula punctures dense (IS < 1 PD), becoming moderately dense laterally (IS = 1–2 PD); mesoscutum shiny, with punctures moderately dense (IS = 1–2 PD); scutellum shiny, with punctures dense (IS < 1 PD); metanotum shiny and finely, densely punctate (IS < 1 PD) to rugulose; metapostnotum shiny to weakly tessellate, with rugae strong, subparallel, not reaching posterior margin; preëpisternum areolate; hypoepimeron shiny, with punctures crowded (IS = 0 PD); mesepisternum shiny, with punctures dense (IS < 1 PD); metepisternum finely areolate, becoming smooth dorsally; propodeum lateral surface shiny to weakly tessellate, with punctures dense (IS < 1 PD), posterior surface shiny and densely punctate (IS < 1 PD). T1 anterior slope shiny, disc shiny, with punctures dense (IS ≤ 1 PD), becoming moderately



**Fig. 38.** Georeferenced collection records of *Lasioglossum (D.) indagator* sp. nov. (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence.

sparse laterally and on apical rim (IS = 1–2 PD), very sparse and fine in small subapicolateral boss (IS = 2–4 PD); T2 disc shiny, with punctures dense (IS ≤ 1 PD), apical rim shiny, with punctures absent.

STRUCTURE. Face length/width ratio 0.81 (±0.43 SD); gena/eye width ratio 0.76 (±0.4 SD). Pronotal angle obtuse; intertegular span 0.67 (±0.04 SD) mm; mesoscutum length/width ratio 0.9 (±0.47 SD); mesoscutum/scutellum length ratio 2.69 (±1.42 SD); scutellum/metanotum length ratio 1.71 (±0.17 SD); metanotum/metapostnotum length ratio 0.75 (±0.4 SD); forewing with 3 submarginal cells; tegula enlarged, reaching posterior margin of mesoscutum in dorsal view; inner posterior margin weakly concave; tegula length 0.36 (±0.03 SD) mm, width 0.2 (±0.01 SD) mm; propodeum lateral carinae not reaching dorsal margin; oblique carina absent. (n = 9)

GENITALIA. As in Fig. 76I. Gonocoxite about 1.8 times as broad as gonostylus. Gonostylus rounded on outer margin with no concavities, with sparse long setae dorsally and in middle of inner margin, and short setae apically and along inner margin. Penis valves parallel, with sparse short setae laterally. Retrorse lobe rounded, nearly 3 times as long as broad, with sparse short setae in apical half.

VARIATION. The metapostnotal rugae can occasionally reach the posterior margin, the terga punctures can vary from dense (IS ≤ 1 PD) to moderately dense (IS = 1–2 PD), and the tegula and pronotal lobe colour can vary from orange-brown to very dark brown.

### Range

California and Sonoran and Chihuahuan Deserts (Fig. 38).

### Floral hosts

ASTERACEAE: *Berlandiera* • BIGNONIACEAE: *Chilopsis* • BORAGINACEAE: *Phacelia* • EUPHORBIACEAE: *Euphorbia* • FABACEAE: *Medicago*: *M. sativa* • *Prosopis* • MALVACEAE: *Gossypium* • *Sphaeralcea*: *S. laxa* Wooton & Standl. • POLYGONACEAE: *Eriogonum*: *E. fasciculatum* • RHAMNACEAE: *Condalia* Cav. • SALICACEAE: *Salix* • SOLANACEAE: *Solanum*: *S. elaeagnifolium*.

### DNA barcodes

Three confirmed sequences available (BOLD process IDs: BBHYA1505-12, DLII1076-07, DLIII123-18). There is a small amount of divergence within these sequences (0.15% maximum intraspecific p-distance). They are closest in terms of p-distance to *L. helianthi* (1.4% minimum interspecific p-distance). One fixed nucleotide substitution distinguishes *L. indagator* sp. nov. from all other Nearctic *L. gemmatum* complex species: 315(G) ([Supp. file 2](#)).

### *Lasioglossum (Dialictus) lepidii* (Graenicher, 1927)

Figs 39–41, 96B, 119A

*Halictus (Chloralictus) lepidii* Graenicher, 1927: 204 (holotype, ♀, deposited in USNM, examined).

*Lasioglossum (Chloralictus) lepidii* – Michener 1951: 1114 (catalogue).

*Dialictus tegularis* – Mitchell 1960: 423 (in part, synonymy, redescription). — Hurd 1979: 1972 (in part, catalogue). — Moure & Hurd 1987: 134 (in part, catalogue).

*Lasioglossum (Dialictus) tegulare* – Krombein 1967: 466 (in part, catalogue).

*Lasioglossum (Dialictus) lepidii* – Gibbs 2009a: 22 (resurrection from synonymy, redescription). — Gibbs 2011: 25, 32 (key to species), 130 (review).



## Diagnosis

Females of *L. lepidii* have the tegula relatively small (reaching but not exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin straight and a blunt posterior angle, and sparsely punctate medially (IS = 1–3 PD); mesoscutum very dull, tessellate, and moderately densely punctate (IS = 1–2 PD) becoming dense on lateral and posterior margins (IS < 1 PD); metapostnotum with very strong, coarse rugae reaching posterior margin and covering propodeum dorsolateral slope; mesepisternum with weak microsculpture and dense, distinct punctures (IS < 1 PD); frons very finely punctate with very narrow, but distinct shiny interspaces between punctures; and T1–T3 very finely, minutely, obscurely punctate.

Females of *L. lepidii* are most similar to those of *L. ellisiae*, *L. holzenthali* sp. nov., *L. puteulanum*, and *L. tegulare*. Females of *L. ellisiae* have the tegula inner posterior margin sinuous and pointed posteriorly, and mesoscutum often shiny posteriorly. Females of *L. holzenthali* have the propodeum dorsolateral slope smooth, without rugae, and T1–T3 deeply and distinctly punctate. Females of *L. puteulanum* and *L. tegulare* have the mesepisternum very dull with crowded, indistinct punctures, and T1–T2 discs deeply and distinctly punctate.

Males of *L. lepidii* have the tegula relatively small (as in the female); metapostnotum shiny with strong anastomosing rugae; pleura finely and densely punctate (IS ≤ 1 PD), the preepisternum and hypoepimeral area more so than mesepisternum; discs of T1–T2 minutely and moderately sparsely punctate (IS = 1–2 PD) and apical rims impunctate; face with very dense appressed tomentum below eye emargination obscuring most of surface; and mesothoracic spiracle deeply impressed.

Males of *L. lepidii* are most similar to those of *L. diabolicum* sp. nov., *L. ellisiae*, *L. holzenthali* sp. nov., *L. puteulanum*, and *L. tegulare*. All of these species have the preepisternum, hypoepimeral area, and mesepisternum more coarsely and uniformly punctate, mesothoracic spiracle no more deeply impressed than surrounding punctures, and facial tomentum either less dense or less tightly appressed, appearing shaggier. Males of *L. holzenthali*, *L. puteulanum*, *L. tegulare*, and sometimes *L. ellisiae* have the disc of T2 more deeply and densely punctate (IS ≤ 1 PD). Males of *L. holzenthali* also have the apical rims of T1–T3 deeply and densely punctate (IS ≤ 1 PD).

Many specimens from tropical regions of Mexico, from Veracruz to Yucatán to Jalisco, are very similar to those of *L. lepidii* both morphologically and in DNA barcodes. These specimens appear to have the mesoscutum more sparsely punctate laterally (IS = 1–2 PD) and metapostnotum with finer, shallow rugae.

## Etymology

Graenicher (1927) named this species after the plant *Lepidium virginicum* L., one of its hosts.

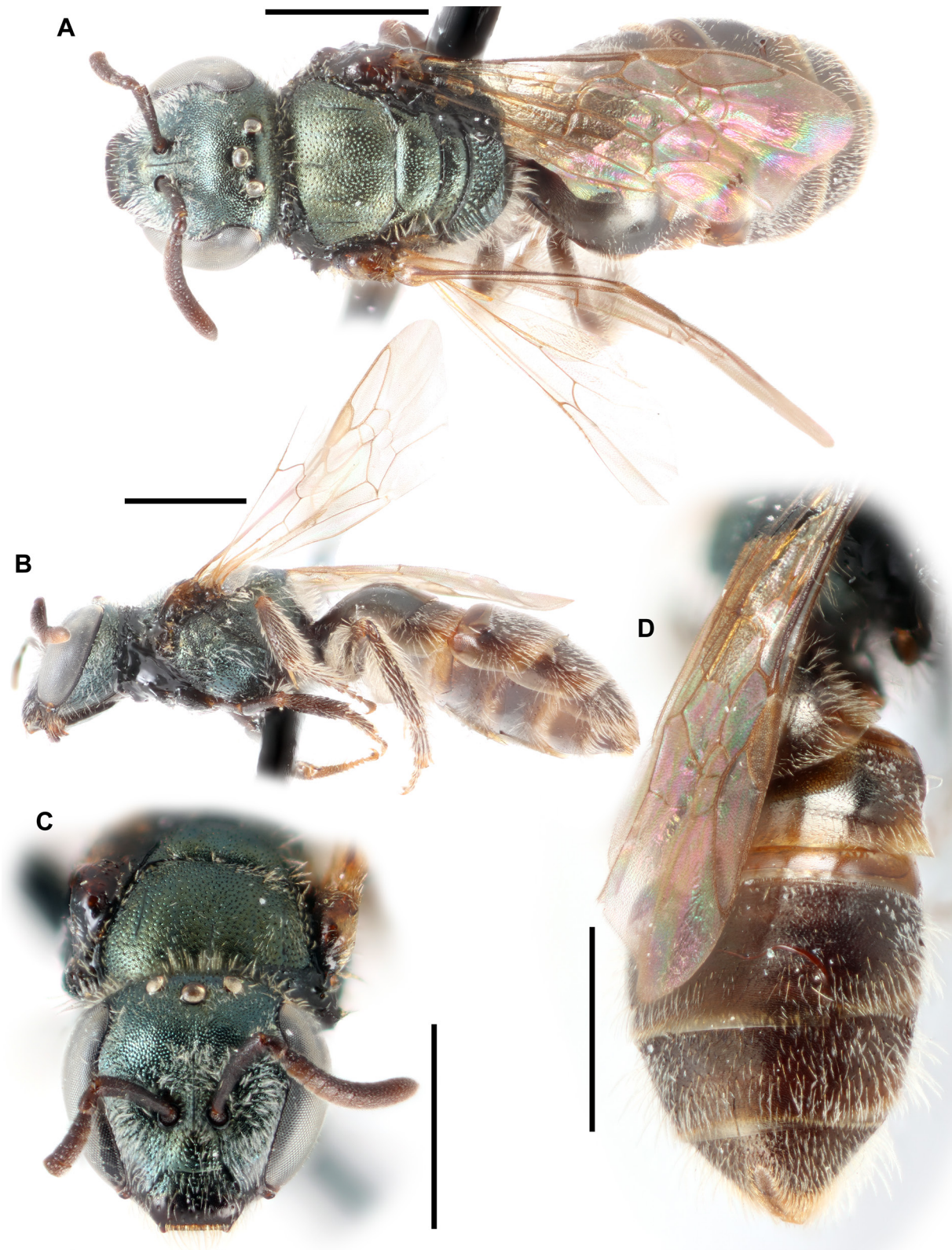
## Material examined

### Holotype

UNITED STATES – **Florida** • ♀; South Miami; [25.71° N, 80.29° W]; 20 Apr. 1927; USNM 41800.

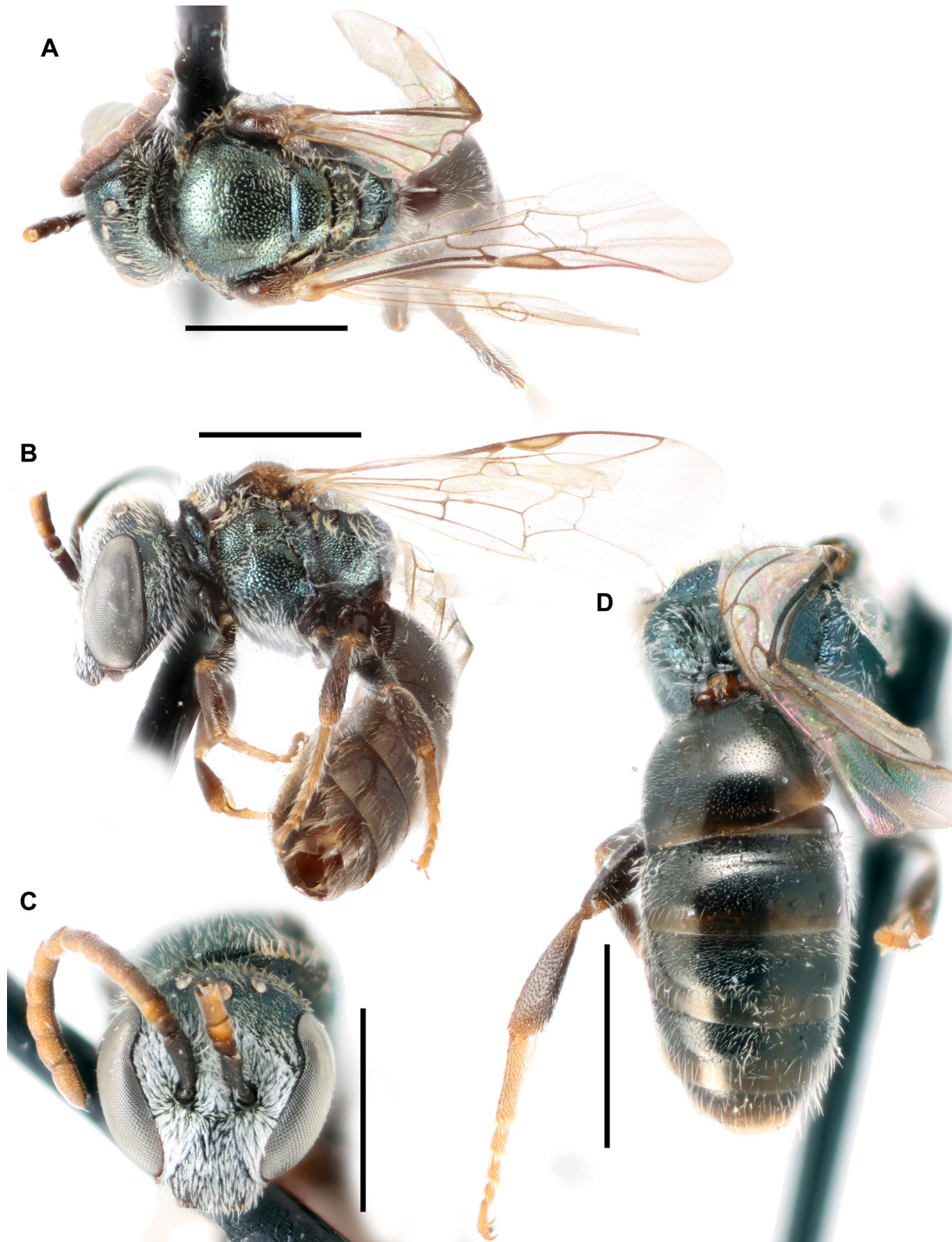
### Other material

UNITED STATES – **Florida** • 2 ♀♀; Broward Co., Hallandale Beach; [25.98° N, 80.15° W]; 10 Dec. 1985; G.C. Eickwort leg.; CUIC • 2 ♀♀, 1 ♂; Collier Co., Collier-Seminole State Park; [25.98° N, 81.6° W]; 25–26 May 1978; N.F. and J.B. Johnson leg.; CUIC • 1 ♂; Dade Co., Redlands; [25.53° N, 80.49° W]; 21 Mar. 1987; Eickwort and Spielholz leg.; CUIC • 1 ♀; Highlands Co., Archbold Biological Station, Lake Placid; [27.18° N, 81.35° W]; 2 Apr. 1984; B. Alexander leg.; CUIC • 1 ♀; Highlands Co., Highlands Hammock State Park; [27.47° N, 81.55° W]; 13 Apr. 1964; G.C. Eickwort leg.; SEMC • 1 ♀; Leon Co., Tall Timbers Research Station, 3 mi. W of Iamonia; [30.66° N, 84.21° W]; 30 Mar. 1986;



**Fig. 39.** *Lasioglossum (D.) lepidii* (Graenicher, 1927), ♀ (PCYU). **A.** Dorsal habitus. **B.** Lateral habitus. **C.** Face. **D.** Metasoma. Scale bars = 1 mm.





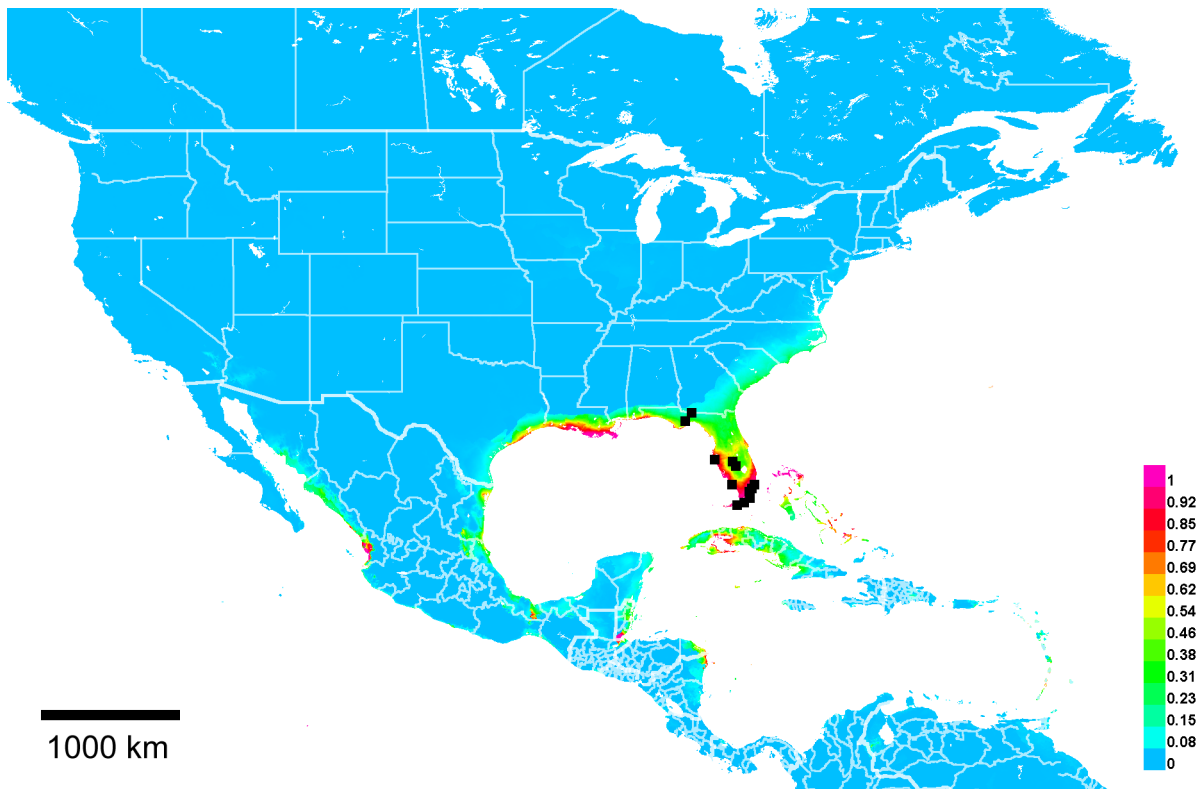
**Fig. 40.** *Lasioglossum (D.) lepidii* (Graenicher, 1927), ♂ (PCYU). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma. Scale bars = 1 mm.



B. Alexander leg.; CUIC • 3 ♀♀, 4 ♂♂; Monroe Co., Bahia Honda Key, Bahia Honda State Recreation Area; [24.662° N, 81.267° W]; 25 Mar. 1987; Eickwort and Spielholz leg.; CUIC • 2 ♀♀, 3 ♂♂; Monroe Co., Key Largo (city); [25.09° N, 80.44° W]; 22 Mar. 1987; Eickwort and Spielholz leg.; CUIC • 1 ♂; Monroe Co., Key Largo (east end); [25.27° N, 80.3° W]; 22 Mar. 1987; Eickwort and Spielholz leg.; CUIC • 3 ♀♀, 1 ♂; Monroe Co., Key Largo, Pennekamp State Park; [25.125° N, 80.406° W]; 22 Mar. 1987; Eickwort and Spielholz leg.; CUIC • 4 ♀♀, 2 ♂♂; Monroe Co., Long Key, Long Key State Recreation Area; [24.82° N, 80.81° W]; 23 Mar. 1987; Eickwort and Spielholz leg.; CUIC • 1 ♀; Pinellas Co., Fort Desoto County Park; [27.62° N, 82.72° W]; 1 Jun. 1978; N.F. and J.B. Johnson leg.; CUIC • 3 ♀♀; Wakulla Co., 2 mi. N of Mack's Landing, Apalachicola National Forest; [30.12° N, 84.64° W]; 21 May 1981; G.C. Eickwort *et al.* leg.; CUIC • 2 ♀♀; Wakulla Co., Ochlockonee River State Park; [30° N, 84.48° W]; 21 May 1981; G.C. Eickwort *et al.* leg.; CUIC • 1 ♂; Wakulla Co., Sopchoppy; [30.06° N, 84.49° W]; 1 Apr. 1981; L.L. Pechuman leg.; CUIC • 1 ♀; Islamorada; [24.92° N, 80.63° W]; 12 Apr. 1966; G. Eickwort leg.; SEMC • 1 ♂; Miami; [25.8° N, 80.2° W]; 4 May 1927; S. Graenicher leg.; SEMC • 1 ♀; *ibid.*; 22 Jun. 1927; S. Graenicher leg.; SEMC • 1 ♀, 1 ♂; Westchester Miami; [25.75° N, 80.33° W]; 31 Aug. 2006; J.A. Genaro leg.; PCYU.

### Range

Florida (Fig. 41).



**Fig. 41.** Georeferenced collection records of *Lasioglossum (D.) lepidii* (Graenicher, 1927) (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence. Because many coastal records lacked soil data, the model was generated without soil type as an environmental variable.

### Floral hosts (from Graenicher 1927)

AMARANTHACEAE: *Telanthera* R.Br.: *T. floridana* Chapm. [ambiguous] • ASTERACEAE: *Pityopsis* Nutt.: *P. graminifolia* (Michx.) Nutt.: *P. g.* var. *tracyi* (Small) Semple • BRASSICACEAE: *Lepidium*: *L. virginicum* L. • *Warea* Nutt.: *W. carteri* Small • MALVACEAE: *Sida* L.

### DNA barcodes

Three confirmed sequences available (BOLD process IDs: DIAL863-06, DIAL865-06, DIAL867-06). There is a moderate amount of divergence within these sequences (0.61% maximum intraspecific p-distance). They are closest in terms of p-distance to *L. pseudotegulare* in the Nearctic (2.06% minimum interspecific p-distance) and an undescribed species in the Neotropics (1.23% minimum interspecific p-distance). Two fixed nucleotide substitutions distinguish *L. lepidii* from all other Nearctic species of the *L. gemmatum* complex: 372(A) and 552(G) ([Supp. file 2](#)).

### Comments

It is possible that additional work will determine some or all of the Neotropical specimens to be *L. lepidii*, but at present the great geographic distance between the two populations is taken as sufficient justification for keeping them separate. If *L. lepidii* occurs in Mexico, then it would also be expected to occur either in Cuba or the Gulf of Mexico coast between Florida and Veracruz, but no specimens resembling *L. lepidii* have been seen from these areas.

A record on BOLD from Hidden Valley Ranch RV Park, New Mexico, also has a very similar DNA barcode to *L. lepidii*, but the voucher specimen has not been examined. This location is very arid desert habitat, in stark contrast to the wet tropical or subtropical habitats of other specimens, and it would be very unusual for *L. lepidii* to regularly occur here.

### *Lasioglossum (Dialictus) magnitegula* sp. nov.

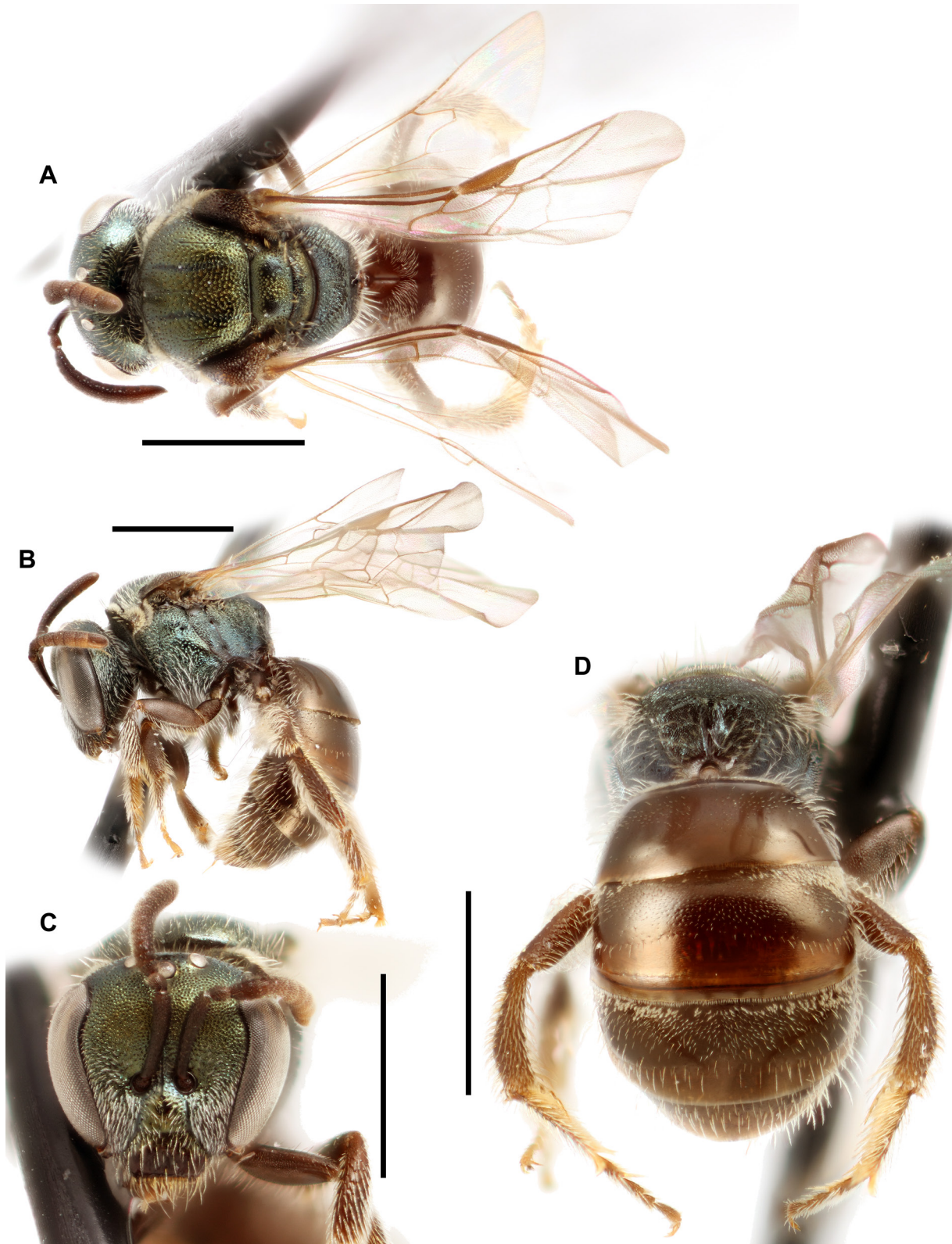
[urn:lsid:zoobank.org:act:7F2257A4-B961-4C86-AFEC-ED2B2ECE27A5](https://zoobank.org/urn:lsid:zoobank.org:act:7F2257A4-B961-4C86-AFEC-ED2B2ECE27A5)

Figs 42–44, 76J, 78B, 79B, 80B, 113A

### Diagnosis

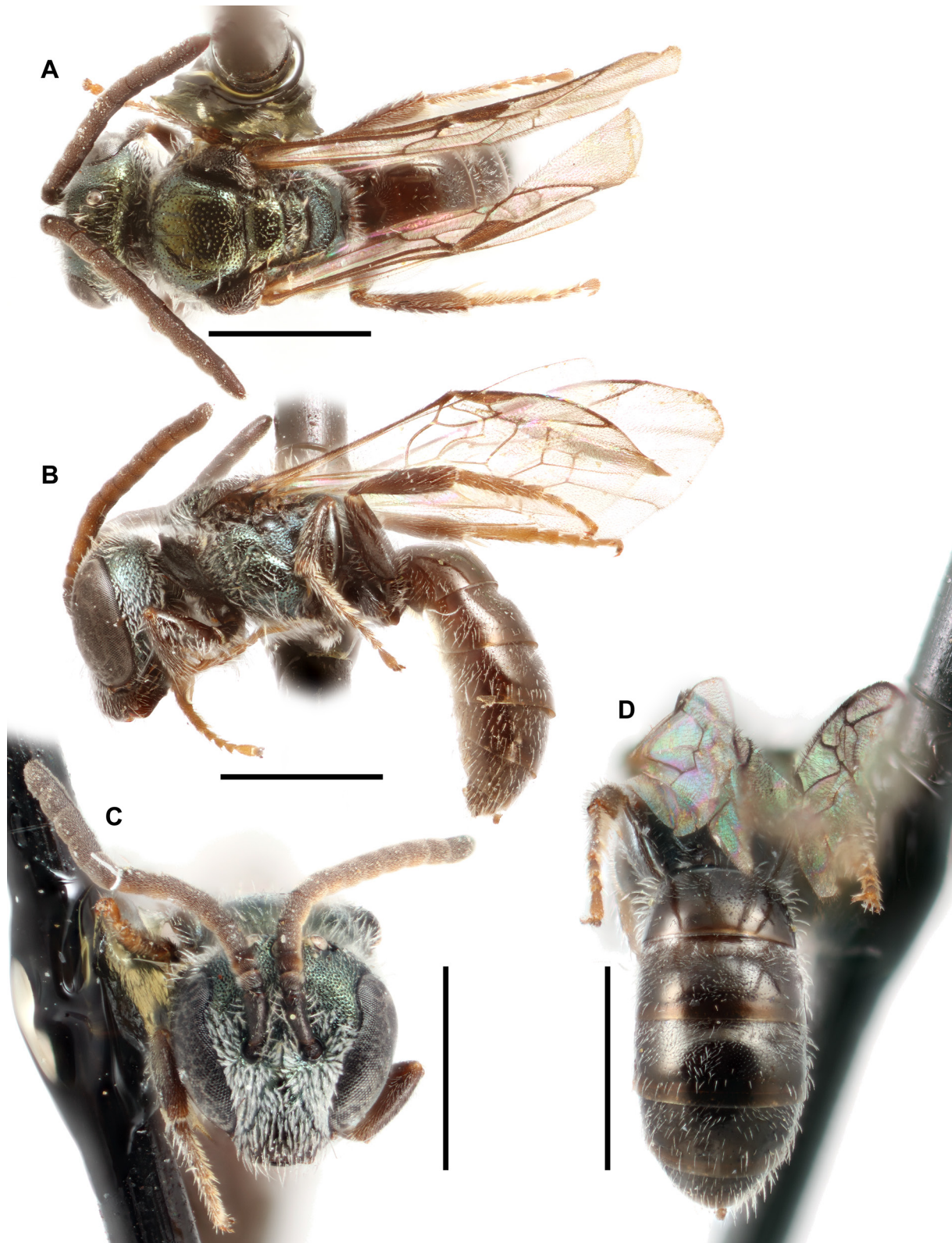
Females of *L. magnitegula* sp. nov. have the tegula extremely large (maximum length  $\geq 60\%$  ITS and clearly exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin strongly concave and a rounded posterior projection about 1 lateral OD in size, and very densely punctate (IS < 1 PD); metapostnotum very dull, finely reticulate, with fine subparallel rugae; metasomal terga apical rims shiny, glabrous, and impunctate; tomentum entirely absent on T4 disc and limited to small basolateral patches on T2–T3; mesoscutum with sparse erect pubescence less than 1 OD long (each seta about its length from the one nearest it) and very short intervening setae no more than stubble; and mesoscutum greenish, golden, or coppery, contrasting with bluer propodeum.

Females of *L. magnitegula* sp. nov. are most similar to those of *L. angelicum* sp. nov., *L. perparvum*, and *L. pseudotegulare*, all of which have the T4 disc with at least some sparse tomentum and metasomal terga apical rims with at least some minute punctures and/or short simple setae. All except *L. perparvum* have the mesoscutum with dense erect pubescence about 1 OD long (each seta less than its length from the one nearest it) and short intervening setae with a distinct length 0.25 OD or more. In addition, females of *L. angelicum* have the metapostnotum with coarse anastomosing rugae and basal half usually shiny, and *L. perparvum* have the tegula small (not exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin straight, and sparsely punctate (IS = 1–4 PD).



**Fig. 42.** *Lasioglossum (D.) magnitegula* sp. nov., ♀, holotype (BBSL FDP746586). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma and propodeum. Scale bars = 1 mm.





**Fig. 43.** *Lasioglossum (D.) magnitegula* sp. nov., ♂ (BBSL1101077). **A.** Dorsal habitus. **B.** Lateral habitus. **C.** Face. **D.** Metasoma. Scale bars = 1 mm.

Males of *L. magnitegula* sp. nov. have the tegula extremely large (as in the female); mesoscutum usually shiny and coarsely, moderately sparsely punctate (IS = 1–2 PD), with sparse erect pubescence (some gaps 0.5 OD or wider visible in lateral view) appearing simple at 40 × magnification, and more greenish or golden, contrasting with bluer propodeum; metapostnotum tessellate to reticulate with fine subparallel rugae; T1–T2 apical rims and discs apicolaterally impunctate or very minutely, sparsely punctate; and face relatively long (length/width ratio usually >0.86).

Males of *L. magnitegula* sp. nov. are most similar to those of *L. angelicum* sp. nov., *L. perparvum*, and *L. pseudotegulare*. Males of *L. angelicum* and *L. pseudotegulare* have the T1–T2 apical rims punctate, mesoscutum with dense erect, plumose pubescence (no gaps wider than 0.5 OD visible in lateral view), and mesoscutum concolourous with the rest of the mesosoma. In addition, males of *L. angelicum* have the face slightly shorter (length/width ratio ≤0.86). Males of *L. perparvum* have the tegula much smaller (not exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin weakly concave, and sparsely punctate laterally (IS = 1–3 PD); and mesoscutum usually tessellate and finely, densely punctate laterally (IS < 1 PD).

### Etymology

The specific epithet ‘*magnitegula*’ is a noun derived from the Latin adjective ‘*magnus*’ (large, great) and the noun ‘*tegula*’ (roof tile, literally ‘covering instrument’, now applied to the sclerite covering the wing base). It refers to the extraordinarily enlarged tegula of this species relative to its small body size. An appropriate translation would be the big-tegula sweat bee.

### Material examined

#### Holotype

MEXICO – **Sonora** • ♀; Rancho El Cajón, 40 km E of Alamos; 27.05° N, 108.7318° W; elev. 420 m; 1–11 Oct. 2006; M.E. Erwin leg.; BBSL FDP746586.

[Verbatim label: Mexico: Sonora: Rancho El Cajón, 40 km E Alamos / 27°03.00'N 108°43.91'W / 420m 1–11 Oct 2006 / M.E.Irwin Malaise trap / FDP746586 / ALM 7.0\_2006 // HOLOTYPE / *Lasioglossum (Dialictus) magnitegula* Gardner and Gibbs]

#### Paratypes

MEXICO – **Baja California Sur** • 1 ♂; El Pedrito beach, 3 mi. S of Todos Santos; 23.394094° N, 110.2124° W; 24 Sep. 2016; Paul A. Rude leg.; EMEC 1181137. – **Guerrero** • 1 ♀; 42 mi. N of Acapulco; [17.3° N, 99.7° W]; elev. 472 m; 9 Aug. 1962; University of Kansas Mexico Expedition leg.; SEMC. – **Jalisco** • 1 ♀; 12 km ENE of El Tuito; 20.3604° N, 105.2607° W; 6 Nov. 1987; T.L. Griswold leg.; BBSL1100811 • 1 ♂; *ibid.*; 6 Nov. 1987; T.L. Griswold leg.; BBSL1100810 • 1 ♀; 20 km S of Purificación; [19.54° N, 104.61° W]; 16 Jul. 1989; Charles D. Michener leg.; ex *Phyla nodiflora*; SEMC • 1 ♂; 22 km SE of Puerto Vallarta; [20.51° N, 105.08° W]; 29 Sep. 1985; R.J. McGinley leg.; USNM • 2 ♀♀; 8.8 km N of El Tuito; 20.3897° N, 105.3109° W; 18 Apr. 1986; F.D. Parker leg.; BBSL1100802, BBSL1100803 • 5 ♀♀; Careyes; 19.4289° N, 105.0274° W; 12 Feb.–19 Mar. 1997; F.D. Parker leg.; BBSL1100765, BBSL1100766, BBSL1100773, BBSL1100774, BBSL1100775 • 5 ♀♀; *ibid.*; 12 Feb.–19 Mar. 1997; F.D. Parker leg.; WRME BBSL1100742, BBSL1100744, BBSL1100745, BBSL1100755, BBSL1100759 • 1 ♀; Chamela; [19.5° N, 105.04° W]; 31 Mar. 1985; Ricardo Ayala Barajas leg.; SEMC • 1 ♀; Chamela; 19.4986° N, 105.0435° W; 1–8 Oct. 1985; T.L. Griswold, F.D. Parker leg.; BBSL1100731 • 1 ♂; Cuiztmala Playa, 8 km S of Careyes; 19.4269° N, 105.0134° W; 4 Oct. 1985; T.L. Griswold, F.D. Parker leg.; BBSL1100729 • 1 ♀; Guadalajara; [20.65° N, 103.35° W]; Crawford leg.; USNM • 1 ♀; km 157 Carretera Barra de Navidad-Puerto Vallarta; [20.225° N, 105.33° W]; 18 Apr. 1986; F.D. Parker leg.; BBSL1100812 • 2 ♀♀; Puerto Vallarta; 20.6214° N, 105.226° W; 25 Jan. 1984; G.E. Bohart leg.; BBSL1100819, BBSL1100833 • 3 ♂♂; *ibid.*; 25 Jan. 1984; G.E. Bohart leg.;

BBSL1100814, BBSL1100839, BBSL1100841 • 3 ♂♂; *ibid.*; 25 Jan. 1984; George E. Bohart leg.; WRME BBSL1100813, BBSL1100835, BBSL1100838 • 1 ♀; *ibid.*; 7 Dec. 1986; G.E. Bohart leg.; BBSL1100789 • 3 ♀♀; Quimixto; [20.5° N, 105.37° W]; 16 Dec. 1987; G.E. Bohart leg.; BBSL1100806, BBSL1100808, BBSL1100809 • 2 ♂♂; *ibid.*; 16 Dec. 1987; G.E. Bohart leg.; BBSL1100805, BBSL1100807 • 2 ♀♀; Rio Chamela, Chamela; [19.527° N, 105.071° W]; elev. 10 m; 5 Apr. 1994; Ricardo Ayala Barajas leg.; ex *Bacopa*; SEMC SM0327594, SM0327595. – **Michoacán** • 1 ♀; Arroya Cupuan, S of Nueva Italia; [18.9942° N, 102.0587° W]; elev. 250 m; 1 Nov. 1987; T. Griswold leg.; BBSL1100946. – **Morelos** • 1 ♀, 1 ♂; 6 mi. south of Temixco; [18.77° N, 99.24° W]; 5 May 1962; L.A. Stange leg.; UCDC • 1 ♀; 7.3 mi. S of Yauatepec; [18.78° N, 99.06° W]; elev. 914 m; 15 Aug. 1962; Marston, Naumann leg.; SEMC • 3 ♀♀, 1 ♂; *ibid.*; 16 Aug. 1962; Ellen Ordway, Naumann leg.; SEMC • 1 ♀; 8 mi. S of Yauatepec; [18.76° N, 99.06° W]; 16 Aug. 1962; Roberts, Marston leg.; SEMC • 1 ♂; Cuernavaca; 18.9348° N, 99.2308° W; 27–29 Nov. 1987; F.D. Parker leg.; BBSL1101077 • 1 ♀; Sierra de Huatla, CEAMISH 2.5 km N and 4 km W of Huatla; 18.45° N, 99.033° W; elev. 1050 m; 5 Sep. 1996; R.W. Brooks leg.; ex flying around mud along a stream; SEMC SM0254429. – **Nayarit** • 1 ♂; San Blas area; 22.8667° N, 105.1° W; 16–21 Mar. 1983; W.J. Hanson leg.; BBSL1101031 • 2 ♀♀; San Blas La Bajada; 21.5166° N, 105.2195° W; 20–21 Mar. 1983; W.J. Hanson leg.; BBSL1101027, BBSL1101028. – **Oaxaca** • 1 ♀; Pochutla, San Agustín Playa; 15.6654° N, 96.5452° W; elev. 10 m; 28 Jan. 2012; Philippe Sagot leg.; ECOAB 44118. – **Puebla** • 2 ♀♀; 7 mi. N of Izúcar de Matamoros; [18.7° N, 98.47° W]; elev. 1356 m; 19 Aug. 1962; University of Kansas Mexico Expedition leg.; SEMC. – **Sinaloa** • 3 ♀♀; 5 mi. E of Concordia; 23.2799° N, 105.9987° W; 12 Sep. 1970; G.E. Bohart, R.M. Bohart leg.; BBSL1101014, BBSL1101015, BBSL1101016 • 2 ♀♀; San Lorenzo; [24.43° N, 107.12° W]; 11 Sep. 1970; G.E. and R.M. Bohart leg.; BBSL1100992, BBSL1100997 • 2 ♂♂; *ibid.*; 11 Sep. 1970; G.E. and R.M. Bohart leg.; BBSL1100993, BBSL1100994. – **Sonora** • 1 ♀; 30 km east of Agua Prieta; 31.31782° N, 109.2357° W; 14 Oct. 2002; R.L. Minckley leg.; RLM SBV045458 • 1 ♂; 30 km east of Agua Prieta; 31.31397° N, 109.25527° W; 10 Jun. 2004; N. de la Torre leg.; RLM SBV025693 • 1 ♂; 36 km E of Tecoripa; [28.62° N, 109.58° W]; 16 Aug. 1991; T. Griswold leg.; BBSL849287 • 1 ♂; Alamos; 27.0185° N, 108.9348° W; 7 Sep. 1970; G.E. Bohart, R.M. Bohart leg.; BBSL1100959 • 2 ♀♀; Alamos; [27.03° N, 108.94° W]; 3 Sep. 1991; T. Griswold leg.; BBSL849300, BBSL849301 • 3 ♀♀; same collection data as for holotype; BBSL FDP746163, FDP746316, FDP746386 • 2 ♀♀; same collection data as for holotype; WRME FDP746126, FDP746776 • 1 ♀; Rancho Palo Injerto, 40 km E of Alamos; 27.042° N, 108.7337° W; elev. 425 m; 30 Sep. 2006; M.E. Erwin leg.; BBSL FDP748603 • 1 ♂; Rancho San Bernardino; 31.314° N, 109.2553° W; 10 Jun. 2004; N. de la Torre leg.; RLM SBV025693 • 1 ♀; Rancho San Bernardino; 31.3178° N, 109.2357° W; 14 Oct. 2002; Robert L. Minckley leg.; RLM SBV045458 • 1 ♀; Rancho San Bernardino; 31.3186° N, 109.2508° W; 5 Sep. 2001; R.L. Minckley leg.; RLM SBV139281 • 1 ♀; Rancho San Bernardino, 28 km E of Agua Prieta; 31.33333° N, 109.25972° W; 10 Jul. 2000; K. Toal *et al.* leg.; RLM SBV002330. – **Veracruz** • 1 ♀; Estación Biología Los Tuxtlas, vic. Laguna Escondida; [18.59° N, 95.09° W]; 16 Sep. 1987; L. Carroll leg.; TAMU-ENTO X1418845.

## Description

### Female

**COLOURATION.** Head and mesosoma blue-green to golden-green; clypeus apex black; labrum brown; mandible brown with black base and red apex; flagellum dark brown dorsally, lighter brown ventrally. Pronotal lobe black; legs black to dark brown; tegula dark brown; wing membrane lightly infuscated, veins dark brown. Metasoma black with rims of terga and sterna broadly brown.

**PUBESCENCE.** Body pile colour white to pale yellow. Tomentum dense on pronotal collar and lobe, space between pronotal lobe and tegula, and T2–T3 basal margins; sparse on lower paraocular area and gena. Mesoscutum pubescence thin, weakly plumose. Wing setae dark, short and dense. Acarinarial fan complete, dense. T2 fringes absent, T3 fringes absent.



**SURFACE SCULPTURE.** Clypeus shiny, with punctures dense ( $IS \leq 1$  PD); supraclypeal area shiny, with punctures dense ( $IS \leq 1$  PD); paraocular area imbricate around antenna socket, otherwise shiny, with punctures crowded ( $IS = 0$  PD); frons reticulate, with punctures crowded ( $IS = 0$  PD); vertex shiny, with punctures crowded laterally ( $IS = 0$  PD), sparse medially ( $IS = 1-2$  PD); gena lineolate, with punctures minute, dense ( $IS \leq 1$  PD), obscure; postgena lineolate. Tegula punctures crowded ( $IS = 0$  PD); mesoscutum tessellate, with punctures dense ( $IS < 1$  PD), becoming moderately sparse anteromedially ( $IS = 1-2$  PD); scutellum tessellate, with punctures dense marginally and on median line ( $IS < 1$  PD), absent submedially; metapostnotum finely reticulate, with rugae weak, subparallel, reaching posterior margin; preëpisternum rugose; hypoepimeron imbricate, with punctures crowded ( $IS = 0$  PD); mesepisternum imbricate, with punctures dense ( $IS \leq 1$  PD); metepisternum lineate dorsally, imbricate ventrally; propodeum lateral surface tessellate, posterior surface tessellate. T1 anterior slope weakly coriarius, disc weakly coriarius, with punctures fine, sparse ( $IS = 1-4$  PD), absent in large subapicolateral boss and on rim; T2 disc weakly coriarius, with punctures fine, moderately sparse ( $IS = 1-3$  PD), apical rim weakly coriarius, with punctures absent.

**STRUCTURE.** Face length/width ratio 0.83 ( $\pm 0.01$  SD); clypeus apicolateral denticles low rounded knobs; gena/eye width ratio 0.84 ( $\pm 0.09$  SD). Pronotal angle obtuse; intertegular span 0.73 ( $\pm 0.04$  SD) mm; mesoscutum length/width ratio 0.95 ( $\pm 0.04$  SD); mesoscutum/scutellum length ratio 2.8 ( $\pm 0.16$  SD); scutellum/metanotum length ratio 1.87 ( $\pm 0.19$  SD); metanotum/metapostnotum length ratio 0.75 ( $\pm 0.08$  SD); forewing with 3 submarginal cells; tegula enlarged, exceeding posterior margin of mesoscutum in dorsal view; inner posterior margin strongly concave, with broadly rounded projection angled toward axilla posteriorly; tegula length 0.46 ( $\pm 0.03$  SD) mm, width 0.22 ( $\pm 0.02$  SD) mm; propodeum lateral carinae nearly reaching dorsal margin; oblique carina strong, straight. T2 depressed apical rim less than 50% of tergum. ( $n = 10$ )

**VARIATION.** The mesoscutum and mesepisternum can vary from shiny to dull and densely punctate ( $IS < 1$  PD) to moderately sparsely punctate ( $IS = 1-2$  PD); the metasomal terga discs can vary from distinctly punctate to nearly impunctate; and T2–T3 sometimes lack any tomentum, even basolaterally.

### Male

**COLOURATION.** Head and mesosoma blue-green to golden green; clypeus apex black; labrum black; mandible orange with black base and red apex; flagellum black dorsally, brown ventrally. Pronotal lobe black; legs dark brown; tegula black to dark reddish brown; wing membrane infuscated, veins with subcosta black, otherwise dark brown. Metasoma black with depressed apical rims of terga and sterna and downcurved lateral areas of terga translucent brown.

**PUBESCENCE.** Body pile colour white. Tomentum dense on lower paraocular area, pronotal angle and lobe, and space between pronotal lobe and tegula; sparse on clypeus, supraclypeal area, and gena. Mesoscutum pubescence simple. Wing setae dark, long and dense. Sterna pubescence short (0.5–1.5 OD), moderately plumose, sparse.

**SURFACE SCULPTURE.** Clypeus shiny, with punctures dense ( $IS \leq 1$  PD); supraclypeal area shiny to weakly imbricate, with punctures dense ( $IS \leq 1$  PD); paraocular area shiny, with punctures dense ( $IS < 1$  PD); frons reticulate, with punctures crowded ( $IS = 0$  PD); vertex shiny, with punctures dense laterally ( $IS < 1$  PD), slightly sparser medially ( $IS \leq 1.5$  PD); gena shiny anteriorly, lineate posteriorly, with punctures fine, moderately dense ( $IS = 1-2$  PD), obscure; postgena shiny to lineate. Tegula punctures crowded ( $IS = 0$  PD); mesoscutum shiny, with punctures moderately sparse ( $IS = 1-2$  PD), becoming dense on lateral and posterior margins ( $IS < 1$  PD); scutellum shiny, with punctures moderately sparse ( $IS = 1-2$  PD); metanotum shiny with fine crowded punctures ( $IS = 0$  PD); metapostnotum tessellate to finely reticulate, with rugae shallow, subparallel, nearly reaching posterior margin; preëpisternum areolate; hypoepimeron shiny, with punctures crowded ( $IS = 0$  PD); mesepisternum shiny, with punctures dense ( $IS < 1$  PD);

metepisternum finely rugulose, becoming smooth dorsally; propodeum lateral surface shiny to imbricate, with punctures dense ( $IS \leq 1$  PD), shallow and obscure, posterior surface shiny and obscurely, densely punctate ( $IS \leq 1$  PD). T1 anterior slope shiny, disc shiny, with punctures fine, sparse ( $IS = 1-3$  PD), absent in large subapicolateral boss and on rim; T2 disc shiny, with punctures fine, sparse ( $IS = 1-3$  PD), apical rim shiny, with punctures absent.

STRUCTURE. Face length/width ratio  $0.87 (\pm 0.01$  SD); gena/eye width ratio  $0.7 (\pm 0.07$  SD). Pronotal angle obtuse; intertegular span  $0.62 (\pm 0.05$  SD) mm; mesoscutum length/width ratio  $0.99 (\pm 0.05$  SD); mesoscutum/scutellum length ratio  $2.62 (\pm 0.22$  SD); scutellum/metanotum length ratio  $1.95 (\pm 0.31$  SD); metanotum/metapostnotum length ratio  $0.73 (\pm 0.08$  SD); forewing with 3 submarginal cells; tegula enlarged, exceeding posterior margin of mesoscutum in dorsal view; inner posterior margin strongly concave, with broadly rounded projection angled toward axilla posteriorly; tegula length  $0.45 (\pm 0.03$  SD) mm, width  $0.21 (\pm 0.02$  SD) mm; propodeum lateral carinae not reaching dorsal margin; oblique carina absent. ( $n = 10$ )

GENITALIA. As in Fig. 76J. Gonocoxite about 2 times as broad as gonostylus. Gonostylus short, slightly longer than broad, and slightly concave on outer margin, without long setae. Penis valves parallel, with sparse short setae laterally. Retrorse lobe rounded, about 2.8 times as long as broad, with sparse short setae in median band.

VARIATION. The mesoscutum and scutellum punctures can vary from dense ( $IS < 1$  PD) to sparse ( $IS = 1-3$  PD), the mesoscutum can sometimes be tessellate anteromedially, the mesepisternum punctures can vary from dense ( $IS < 1$  PD) to moderately dense ( $IS = 1-2$  PD), and the terga punctures can vary from deep and distinct to so minute that they are hardly visible.



**Fig. 44.** Georeferenced collection records of *Lasioglossum* (*D.*) *magnitegula* sp. nov. (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence.

### Range

Western Mexico from Sonora to Chiapas, crossing into Veracruz at the Isthmus of Tehuantepec (Fig. 44).

### Floral hosts

PLANTAGINACEAE: *Bacopa* Aubl. • VERBENACEAE: *Phyla* Lour.: *P. nodiflora* (L.) Greene.

### DNA barcodes

None available.

### Comments

Common in Mexico. *Lasioglossum magnitegula* sp. nov. probably occurs rarely in the United States. Four specimens were collected from Rancho San Bernardino, Sonora, less than 2 km from the US border.

### *Lasioglossum (Dialictus) paululum* (Sandhouse, 1924)

*Halictus (Chloralictus) paululum* Sandhouse, 1924: 23 (holotype, ♂, deposited in USNM, type no. 26419, USNMMENT01570300, examined).

*Lasioglossum (Chloralictus) paululum* – Michener 1951: 1116 (catalogue).

*Dialictus paululum* – Hurd 1979: 1969 (catalogue). — Moure & Hurd 1987: 120 (catalogue).

*Lasioglossum (Dialictus) paululum* – Scott *et al.* 2011: 30 (checklist).

### Diagnosis

See the diagnosis for the *L. stictaspis* species complex. *Lasioglossum paululum* is a member of this group and reliable, unique diagnostic characters are not yet known. Female specimens determined as *L. stictaspis* from Colorado, which may correspond to *L. paululum*, frequently have the mesoscutum and mesepisternum shiny, T3 with very dense and complete subapical band of tomentum, ocellocular area shiny with distinctly separated punctures ( $IS \leq 1 PD$ ), and all pubescence bright white, in contrast with specimens from New Mexico which usually have the mesoscutum and mesepisternum dull, T3 with subapical band of tomentum slightly sparser and narrowly interrupted medially, ocellocular area dull with crowded punctures ( $IS = 0 PD$ ), and pubescence yellowish dorsally. However, the dull New Mexico forms can occur as far north as Alberta, and the shiny Colorado forms can occur west to Arizona, with any combination of these characters possible in between. The males are even more difficult to separate, but male *L. paululum* may have a slightly longer face. Sandhouse (1924) described the face as relatively long, although the holotype length/width ratio is only 0.84.

### Comments

*Lasioglossum paululum* may be a junior synonym of *L. stictaspis*, but a more detailed revision of the *L. stictaspis* species complex is needed. If *L. paululum* proves to be distinct, then at least some of the *L. stictaspis* specimens recorded from Canada in Gardner & Gibbs (2022) are probably this species.

### *Lasioglossum (Dialictus) perparvum* (Ellis, 1914)

Figs 45–47, 76K, 78A, 79A, 80A, 115B, 116B

*Halictus perparvus* Ellis, 1914: 102 (holotype, ♀, deposited in USNM, examined).

*Halictus pseudotegularis* non auct. – Cockerell 1898: 237 (comparison to *tegulare*).

*Halictus perparvus* – Cockerell 1916: 77 (comparative notes to *helianthi*).



*Halictus (Chloralictus) perparvus* – Sandhouse 1924: 2 (key to species), 12 (comparison to *ellisiae*).  
*Lasioglossum (Chloralictus) perparvum* – Michener 1951: 1116 (catalogue).  
*Dialictus perparvus* – Hurd 1979: 1970 (catalogue). — Moure & Hurd 1987: 121 (catalogue).

### Diagnosis

Females of *L. perparvum* have the tegula relatively small (reaching but not exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin straight and a blunt posterior angle, and finely, sparsely punctate laterally (IS = 1–4 PD); mesoscutum densely punctate (IS < 1 PD, becoming sparser (IS = 1–2 PD) anteromedially); metapostnotum very dull, finely reticulate, with fine subparallel rugae; T2 apical rim with scattered minute punctures bearing short simple setae; T4 disc with sparse tomentum; mesoscutum with sparse erect pubescence (each seta separated by about its length from the one nearest it and some gaps more than 0.5 OD visible in lateral view) and very short intervening setae no more than stubble; and mesoscutum greenish or golden, contrasting with bluer propodeum.

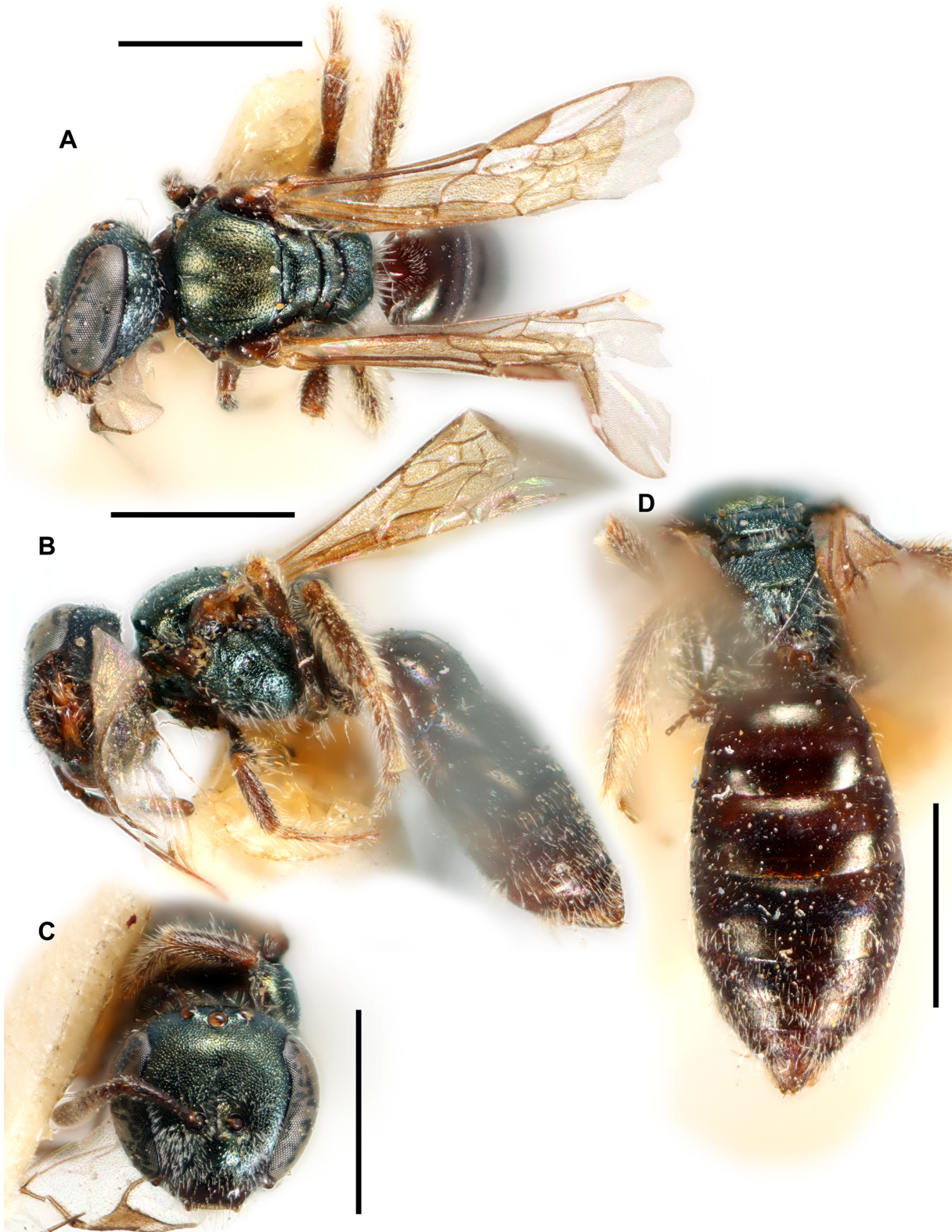
Females of *L. perparvum* are most similar to those of *L. holzenthali* sp. nov., *L. lepidii*, *L. magnitegula* sp. nov., and *L. profundum* sp. nov., all of which (except *L. magnitegula*) have the mesoscutum with denser erect pubescence (each seta separated by less than its length from the one nearest it and no gaps more than 0.5 OD visible in lateral view) with short intervening setae 0.25 OD long or more, mesoscutum concolourous with propodeum, and metapostnotum shiny with weak microsculpture and strong, coarse rugae. In addition, females of *L. holzenthali* have the T1–T3 apical rims usually deeply and distinctly punctate and *L. profundum* have the tegula entirely impunctate except on anterior margin. Females of *L. magnitegula* have the tegula much larger (clearly exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin strongly concave, and densely punctate (IS < 1 PD), T2 apical rim glabrous and impunctate, and T4 disc lacking tomentum.

Males of *L. perparvum* have the tegula relatively small (as in the female); mesoscutum tessellate anteriorly and densely punctate laterally (IS < 1 PD), with sparse erect pubescence (some gaps 0.5 OD or more visible in lateral view); metapostnotum tessellate to finely reticulate with fine subparallel rugae; discs of T1–T2 deeply and moderately densely punctate (IS = 1–2 PD); and mesoscutum more greenish or golden, contrasting with bluer propodeum.

Males of *L. perparvum* are most similar to those of *L. diabolicum* sp. nov., *L. ellisiae*, and *L. magnitegula* sp. nov. Males of *L. diabolicum* and *L. ellisiae* have the mesoscutum usually shiny, concolourous with the rest of the mesosoma, and with dense erect pubescence (no gaps more than 0.5 OD visible in lateral view). Males of *L. magnitegula* have the tegula much larger (exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin strongly concave, and densely punctate (IS < 1 PD); and mesoscutum usually shiny and more coarsely punctate laterally (IS ≤ 1 PD).

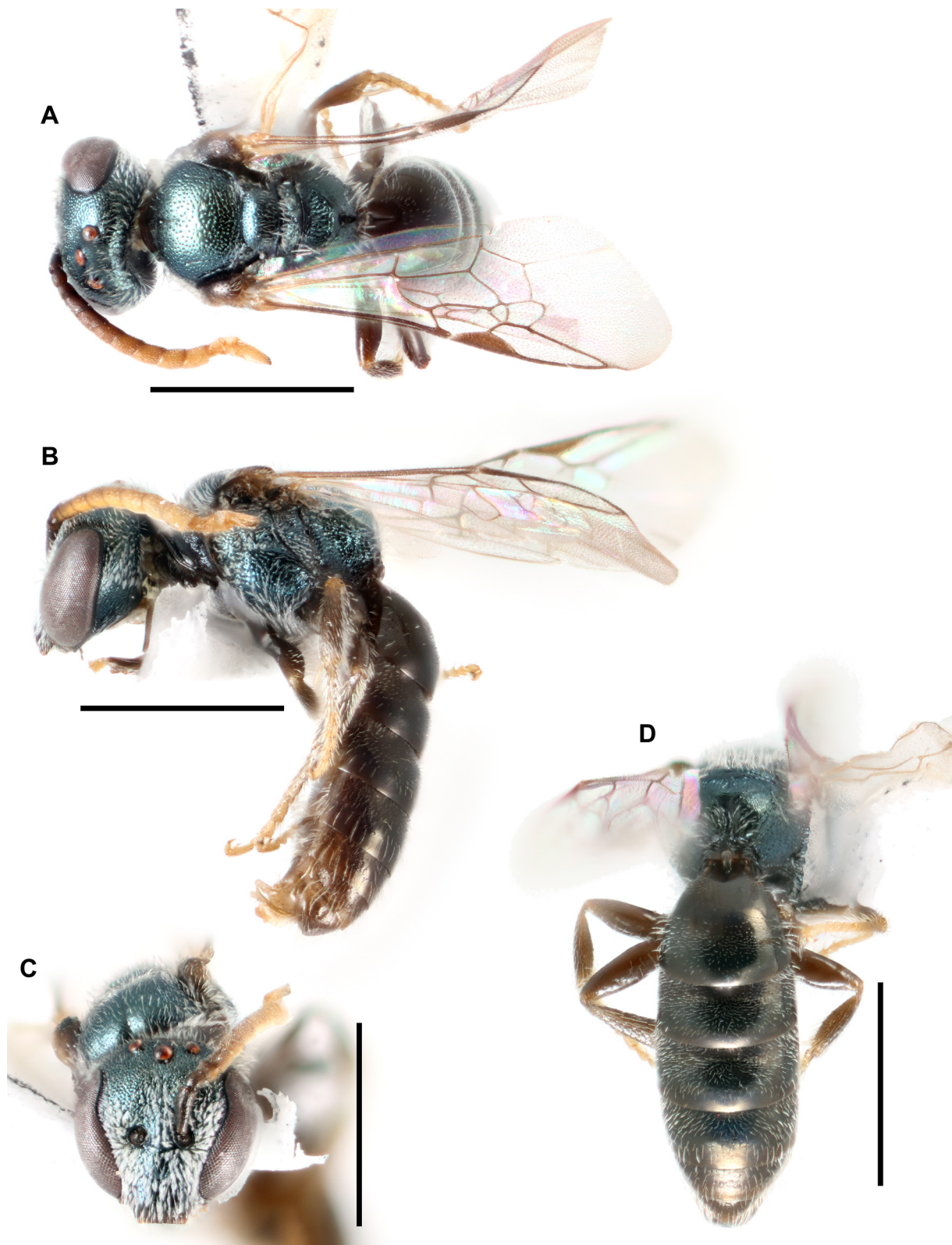
In the Neotropics there are at least two (but possibly more) very similar, undescribed species. One of these has the tegula more coarsely and densely punctate laterally (IS < 1 PD); the other has the mesoscutum with sparser punctures laterad of the parapsidal line (IS ≥ 1 PD) and T2 apical rim impunctate and glabrous in the female.

*Lasioglossum deludens* sp. nov. is not especially similar to those of *L. perparvum*, but has been very often misidentified as *L. perparvum* and it is worth diagnosing the two specifically. Both sexes of *L. deludens* have the tegula translucent yellow-orange and impunctate (except on anterior margin) (opaque brown and punctate in *L. perparvum*), mesoscutum with dense erect pubescence (sparse in *L. perparvum*) and concolourous with propodeum (propodeum distinctly bluer in *L. perparvum*), and metapostnotum shiny with strong, coarse rugae (dull with fine rugae in *L. perparvum*). Females have the mesoscutum usually



**Fig. 45.** *Lasioglossum (D.) perparvum* (Ellis, 1914), ♀, holotype (USNM). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma and propodeum. Scale bars = 1 mm.





**Fig. 46.** *Lasioglossum (D.) perparvum* (Ellis, 1914), ♂ (ASUHIC). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma and propodeum. Scale bars = 1 mm.



shiny (dull and tessellate in *L. perparvum*). Males have the face covered in dense tomentum up to upper ocular tangent (dense tomentum limited to paraocular area in *L. perparvum*).

### Etymology

Ellis (1914) formed the specific epithet '*perparvus*' from the Latin prefix '*per-*' (very) and the adjective '*parvus*' (little).

### Material examined

#### Holotype

UNITED STATES – **Arizona** • ♀; Phoenix; [33.4° N, 112.1° W]; Kunzé leg.; USNM.

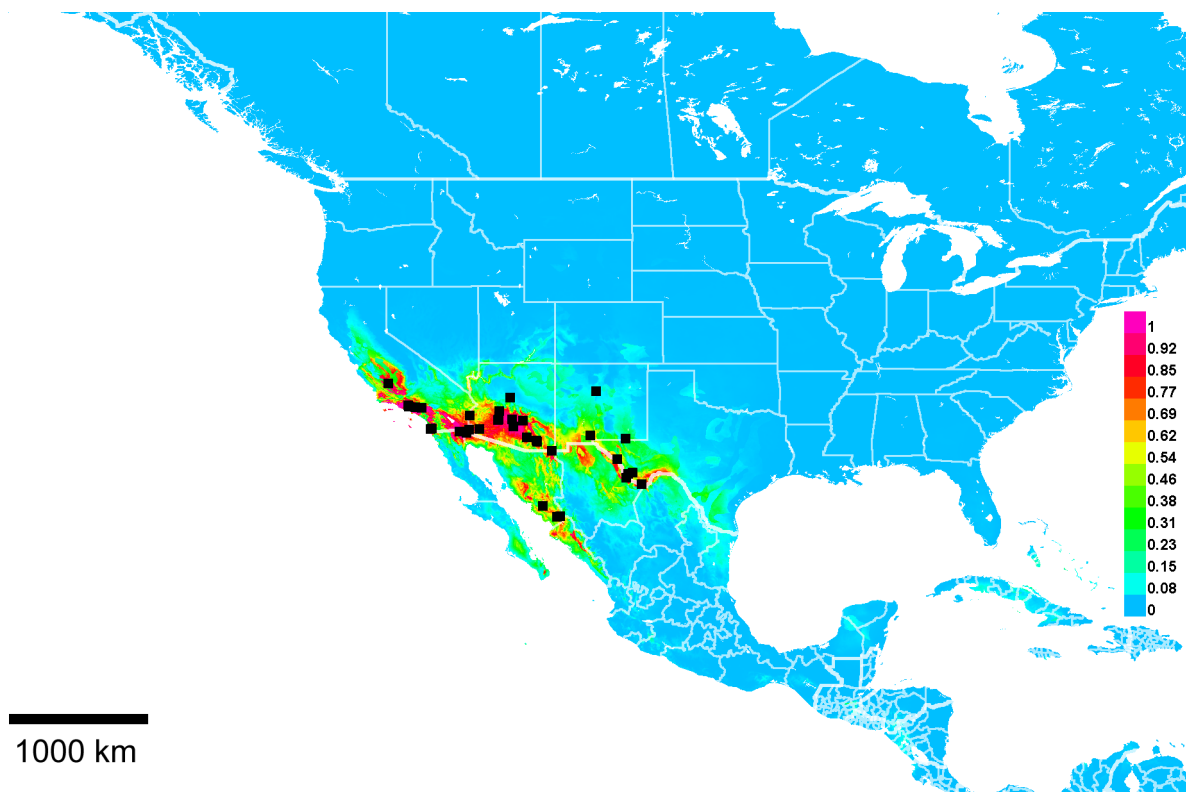
#### Other material

MEXICO – **Baja California** • 1 ♀; 9 km W of Pólvora; [32.55° N, 115.29° W]; 13 Jul. 1953; R.R. Snelling leg.; ex *Tamarix*; LACM. – **Chihuahua** • 1 ♂; Rio Conchos, 2 km W of Ojinaga; [29.56° N, 104.45° W]; 19 Jun. 1968; J.E. Hafernik leg.; TAMU-ENTO X1361793. – **Sonora** • 2 ♂♂; 10 mi. S of Guaymas; 27.9102° N, 110.7259° W; 8 Oct. 1968; George E. Bohart leg.; ex *Antigonon* sp.; BBSL1100987, BBSL1100988 • 1 ♂; 5.5 km ENE of Hornos, km 23, highway 116; 27.7285° N, 109.8448° W; elev. 40 m; 23–26 Jul. 2008; M.E. Irwin leg.; BBSL FDP149246 • 1 ♂; Alamos; [27.02° N, 108.93° W]; 3 Sep. 1991; Terry L. Griswold leg.; BBSL849279 • 1 ♀; Arrollo El Limón, Rancho Las Lajas, 26 km E of Alamos; 27.0672° N, 108.7245° W; elev. 427 m; 20–22 Jun. 2008; M.E. Irwin leg.; BBSL FDP754255 • 1 ♂; *ibid.*; 20–22 Jun. 2008; M.E. Irwin leg.; BBSL FDP754257 • 1 ♂; Rancho El Cajón, 40 km E of Alamos; 27.05° N, 108.7318° W; elev. 420 m; 1–11 Oct. 2006; M.E. Irwin leg.; BBSL FDP746038 • 1 ♂; Rancho Palo Injerto, 40 km E of Alamos; 27.042° N, 108.7337° W; elev. 425 m; 1–7 Oct. 2006; M.E. Irwin leg.; BBSL FDP754482 • 1 ♀; Rancho San Bernardino; 31.3002° N, 109.2625° W; 3 May 2002; N. de la Torre leg.; RLM SBV066649 • 2 ♀♀; *ibid.*; 4 Jul. 2002; Robert L. Minckley leg.; RLM SBV063726, SBV063988 • 1 ♀; *ibid.*; 14 Aug. 2002; Robert L. Minckley leg.; ex *Rorippa nasturtium-aquaticum*; RLM SBV044363 • 2 ♂♂; *ibid.*; 14 Aug. 2002; Robert L. Minckley leg.; ex *Rorippa nasturtium-aquaticum*; RLM SBV044364, SBV044367 • 2 ♀♀; *ibid.*; 14 Aug. 2002; Robert L. Minckley leg.; RLM SBV044228, SBV044246 • 2 ♀♀; *ibid.*; 14 Oct. 2002; Robert L. Minckley leg.; RLM SBV045355, SBV045365 • 1 ♂; *ibid.*; 14 Oct. 2002; Robert L. Minckley leg.; RLM SBV045358 • 1 ♂; Rancho San Bernardino; 31.3002° N, 109.2626° W; 14 Oct. 2002; Robert L. Minckley leg.; RLM SBV062871 • 1 ♂; Rancho San Bernardino; 31.3072° N, 109.2568° W; 29 May 2004; N. de la Torre leg.; ex *Tamarix ramosissima*; RLM SBV025073 • 1 ♂; Rancho San Bernardino; 31.3075° N, 109.2572° W; 16 Jun. 2004; A. Romero leg.; ex *Tamarix ramosissima*; RLM SBV054986 • 1 ♂; Rancho San Bernardino; 31.314° N, 109.2553° W; 15 Jun. 2004; A. Romero leg.; RLM SBV054833 • 1 ♂; Rancho San Bernardino; 31.3144° N, 109.2556° W; 6 Jun. 2004; R. Gyuro leg.; ex *Tamarix ramosissima*; RLM SBV062835 • 1 ♀; Rancho San Bernardino; 31.3242° N, 109.2666° W; 24 Jul. 2005; N.M. Williams leg.; ex *Convolvulus arvensis*; RLM SBV052037 • 1 ♀; Rancho San Bernardino; 31.3256° N, 109.2667° W; 9 Sep. 2007; A. Romero leg.; ex *Physalis acutifolia*; RLM SBV077987 • 2 ♀♀; Rancho San Bernardino; 31.3259° N, 109.288° W; 2 Apr. 2006; Robert L. Minckley *et al.* leg.; ex *Physaria gordonii*; RLM SBV056198, SBV056205 • 1 ♀; Rancho San Bernardino; 31.3291° N, 109.2655° W; 13 Jul. 2000; Robert L. Minckley leg.; ex *Convolvulus arvensis*; RLM SBV079131.

UNITED STATES – **Arizona** • 1 ♂; Cochise Co., Benson; [31.97° N, 110.29° W]; elev. 1091 m; 14–15 Sep. 1974; E.G. Linsley, J.M. Linsley leg.; ex *Helianthus annuus*; CUIC • 2 ♀♀; Maricopa Co., 1100 W Mission Drive, Chandler; 33.346° N, 111.8599° W; elev. 367 m; 27 Mar. 2017; S.J. Hall *et al.* leg.; ASUHIC 0112721, 0113164 • 5 ♀♀; Maricopa Co., 115 E Country Gables Drive, Phoenix; 33.6223° N, 112.0718° W; elev. 412 m; 18 May 2017; S.J. Hall *et al.* leg.; ASUHIC 0113090, 0113098, 0113099, 0113102, 0113104 • 1 ♀; Maricopa Co., 1414 E Libra Drive, Tempe; 33.3656° N, 111.9163° W; elev. 365 m; 3 May 2017; S.J. Hall *et al.* leg.; ASUHIC 112726 • 4 ♀♀; Maricopa Co., 1738 E Palmcroft Drive,

Tempe; 33.4044° N, 111.9099° W; elev. 361 m; 16 May 2017; S.J. Hall *et al.* leg.; ASUHC 0113361, 0113362, 0113368, 0113370 • 7 ♂♂; *ibid.*; 16 May 2017; S.J. Hall *et al.* leg.; ASUHC 0113380, 0113385, 0113387, 0113388, 0113393, 0113396, 0113398 • 1 ♀; Maricopa Co., 1926 E Calle De Caballos, Tempe; 33.3401° N, 111.9069° W; elev. 362 m; 10 May 2017; S.J. Hall *et al.* leg.; ASUHC 113144 • 1 ♂; *ibid.*; 10 May 2017; S.J. Hall *et al.* leg.; ASUHC 113193 • 2 ♀♀; Maricopa Co., 2031 S Sierra Vista Drive, Tempe; 33.406° N, 111.9308° W; elev. 357 m; 3 May 2017; S.J. Hall *et al.* leg.; ASUHC 0112746, 0112748 • 1 ♀; Maricopa Co., 302 E Fairmont Drive, Tempe; 33.3964° N, 111.9346° W; elev. 358 m; 30 Mar. 2017; S.J. Hall *et al.* leg.; ASUHC 113448 • 3 ♀♀; *ibid.*; 27 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 0113467, 0113487, 0113493 • 1 ♂; Maricopa Co., 7 km SE of Wickenburg, Hassayampa River Preserve; 33.9097° N, 112.6752° W; elev. 550 m; 11–13 Sep. 2013; M.E. Irwin leg.; BBSL FDP152452 • 1 ♂; Maricopa Co., 8201 E Windsor Avenue, Scottsdale; 33.4783° N, 111.9038° W; elev. 373 m; 11 May 2017; S.J. Hall *et al.* leg.; ASUHC 112605 • 2 ♀♀; Maricopa Co., McDowell Sonoran Preserve; 33.644° N, 111.8567° W; elev. 516 m; 16 May 2017; S.J. Hall *et al.* leg.; ASUHC 0113004, 0113088 • 1 ♀; Maricopa Co., Papago Park; 33.4571° N, 111.9424° W; elev. 391 m; 3 May 2017; S.J. Hall *et al.* leg.; ASUHC 113247 • 3 ♂♂; Maricopa Co., Phoenix; [33.4° N, 112.1° W]; 7 Aug. 1994; Jerome G. Rozen, K. C. Rozen leg.; AMNH • 1 ♀; Maricopa Co., Phoenix, vicinity of 1300 North Washington Street; [33.4° N, 112.1° W]; 5 Oct. 2009; K.C. Rozen leg.; ex *Euphorbia*; AMNH • 1 ♀; Pima Co., Tucson; [32.2° N, 110.9° W]; 31 Jul. 1954; G.D. Butler leg.; ex alfalfa; UAIC • 1 ♂; *ibid.*; 29 Aug. 1954; G.D. Butler leg.; ex alfalfa; UAIC • 1 ♀; *ibid.*; 13 Mar. 1955; F.G. Werner leg.; ex honeydew on arborvitae; UAIC • 1 ♂; *ibid.*; 15 May 1960; G.D. Butler leg.; UAIC • 1 ♂; Pima Co., Tucson, Tumamoc Hills; [32.21° N, 111° W]; 30 Apr. 1992; W.T. Wcislo leg.; ex *Parkinsonia*; SEMC • 1 ♀, 1 ♂; 3 mi. NE of Cottonwood; [34.77° N, 111.97° W]; 7 Jul. 1952; R.H. Beamer, L.D. Beamer, Cheng Liang, W.E. LaBerge leg.; SEMC • 5 ♀♀, 2 ♂♂; Arlington; [33.33° N, 112.76° W]; 2 Aug. 1954; G.D. Butler leg.; ex alfalfa; UAIC • 1 ♂; Canoa; [31.8° N, 111.02° W]; 21 Jun. 1960; G.D. Butler leg.; ex cotton; CUIC • 1 ♂; Casa Grande; [32.91° N, 111.77° W]; 26 May 1955; G.D. Butler leg.; UAIC • 1 ♂; *ibid.*; 1 Nov. 1955; G.D. Butler leg.; ex alfalfa; UAIC • 2 ♀♀; *ibid.*; 28 Feb. 1956; G.D. Butler leg.; ex alfalfa; UAIC • 1 ♀; *ibid.*; 18 Jul. 1956; C. Williams leg.; ex alfalfa; UAIC • 1 ♀; Continental; [31.85° N, 110.97° W]; 14 Jun. 1955; G.D. Butler leg.; ex alfalfa; UAIC • 2 ♂♂; *ibid.*; 27 Jul. 1956; C. Williams leg.; ex alfalfa; UAIC • 1 ♀; Hassayampa; [33.35° N, 112.73° W]; 2 Aug. 1954; G.D. Butler leg.; ex alfalfa; UAIC • 1 ♀; Litchfield Park; [33.49° N, 112.36° W]; 11 Jun. 1954; G.D. Butler leg.; ex alfalfa; UAIC • 1 ♂; Maricopa; [33.06° N, 112.05° W]; 30 Jul. 1956; C. Williams leg.; ex cotton; UAIC • 8 ♀♀, 7 ♂♂; Marinette; [33.6° N, 112.27° W]; 6 Jul. 1950; R.H. Beamer leg.; SEMC • 1 ♂; Roll; [32.75° N, 113.99° W]; 19 Jul. 1954; G.D. Butler leg.; ex alfalfa; UAIC • 1 ♀; St. David; [31.9° N, 110.21° W]; 2 May 1956; F.G. Werner, G.D. Butler leg.; ex alfalfa; UAIC • 1 ♀, 1 ♂; Superior, Boyce Thompson Arboretum; [33.28° N, 111.16° W]; 23 Jul. 1955; G.D. Butler leg.; ex *Condalea*; UAIC • 3 ♀♀, 3 ♂♂; *ibid.*; 23 Jul. 1955; G.D. Butler leg.; ex *Melaleuca*; UAIC • 1 ♂; Yuma; [32.69° N, 114.63° W]; 7 Jun. 1951; G.D. Butler leg.; CUIC • 2 ♀♀; *ibid.*; 7 Jun. 1951; G.D. Butler leg.; UAIC • 8 ♀♀, 12 ♂♂; *ibid.*; 11 Jun. 1951; G.D. Butler leg.; UAIC • 1 ♂; *ibid.*; 4 Jun. 1955; G.D. Butler leg.; ex Heliotrope; UAIC • 5 ♀♀; Yuma V.; [32.5° N, 114.8° W]; 3 Aug. 1954; J. Durkin leg.; ex alfalfa; UAIC • 1 ♀; *ibid.*; 6 Aug. 1954; J. Durkin leg.; ex alfalfa; UAIC • 2 ♀♀, 1 ♂; *ibid.*; 12 Aug. 1954; J. Durkin leg.; ex alfalfa; UAIC • 1 ♀; *ibid.*; 17 Aug. 1954; J. Durkin leg.; ex alfalfa; UAIC. – **California** • 1 ♀; Kern Co., Lost Hills; 35.6847° N, 119.9038° W; 17 Mar. 2015; A. Haack leg.; ex *Phacelia ciliata*; UCDC FORB201570296 • 1 ♀; *ibid.*; 29 Apr. 2016; M. Epperly leg.; ex *Polygonum aviculare*; UCDC FORB201670582 • 2 ♀♀; Los Angeles Co., 19619 Enadia Way; 34.2004° N, 118.5607° W; elev. 231 m; 29 Mar. 2018; S.B. Lerman leg.; ASUHC LA-XS-2-BB-1 956, LA-XS-2-BB-1 963 • 1 ♀; *ibid.*; 19 Apr. 2018; S.B. Lerman leg.; ASUHC LA-XS-2-BB-2 967 • 1 ♀; Los Angeles Co., 5035 Gloria Avenue; 34.1607° N, 118.4796° W; elev. 215 m; 3 Apr. 2018; S.B. Lerman leg.; ASUHC LA-LL-3-BB-1 988 • 2 ♀♀; *ibid.*; 26 Apr. 2018; S.B. Lerman leg.; ASUHC LA-LL-3-BB-2 980, LA-LL-3-BB-2 981 • 14 ♀♀, 5 ♂♂; Los Angeles Co., Chatsworth; 34.26° N, 118.601° W; 1–8 Jul. 2017; LACM • 1 ♀; Los Angeles Co., Claremont; 34.0894° N, 117.7111° W; 1–8 Aug. 2016; LACM • 1 ♀, 1 ♂; Los Angeles Co., Gardena; 33.876° N, 118.288° W;

2–9 Oct. 2018; LACM • 6 ♀♀; Los Angeles Co., Pasadena, Arroyo Park; [34.15° N, 118.165° W]; 7 Mar. 2001; John S. Ascher leg.; AMNH • 6 ♀♀, 1 ♂; Los Angeles Co., Torrance; 33.8712° N, 118.331° W; 13–23 Jul. 2017; LACM • 3 ♀♀; Los Angeles Co., Valley Village; 34.171° N, 118.398° W; 1–8 Jul. 2017; LACM • 1 ♀; Riverside Co., Blythe; [33.62° N, 114.59° W]; 31 May 2001; R.S. Beal leg.; ex *Pluchea sericea*; CSUC • 21 ♀♀, 7 ♂♂; Riverside Co., Norco; 33.912° N, 117.5702° W; 1–8 Jun. 2016; LACM • 4 ♀♀, 2 ♂♂; San Bernardino Co., Grand Terrace; 34.0234° N, 117.3152° W; 1–8 Jul. 2016; LACM • 1 ♀; San Diego Co., Lake Murray Park; 32.7892° N, 117.0514° W; 29 Mar. 2011; K.J. Hung leg.; WRME 518947 • 1 ♀; La Mesa; [32.77° N, 117.02° W]; 11 May 2011; K.J. Hung leg.; WRME 518946 • 1 ♀; San Diego; [32.71° N, 117.16° W]; 15 Apr. 2015; K.J. Hung, Cen leg.; WRME 518948. – **New Mexico** • 1 ♂; Doña Ana Co., Las Cruces; [32.32° N, 106.76° W]; 12 Jun. 1962; S.R. Race leg.; ex clover; NMSU • 1 ♀; Doña Ana Co., New Mexico State University campus; [32.28° N, 106.75° W]; elev. 1189 m; 11 Jun. 1979; G.S. Forbes leg.; NMSU • 2 ♀♀; 5 mi. N of Radium [Springs]; [32.56° N, 106.91° W]; 18 Jul. 1952; R.H. Beamer, L.D. Beamer, C. Weiner, A. Wolf, Cheng Liang, W.E. LaBerge leg.; SEMC • 5 ♀♀; Radium Springs; [32.49° N, 106.91° W]; 16 Jul. 1952; R.H. Beamer, L.D. Beamer, W.E. LaBerge, Cheng Liang leg.; SEMC • 1 ♂; Rattlesnake Springs; 32.1095° N, 104.4716° W; elev. 1115 m; 18 Jul. 2011; J.D. Herndon leg.; ex *Mentha spicata*; BBSL CAVE47174 • 1 ♂; *ibid.*; 19 Jul. 2011; N. Klass leg.; ex *Mentha spicata*; BBSL CAVE44906 • 1 ♂; Sandia Mountains; [35.2° N, 106.4° W]; 17 Jul. 1952; SEMC. – **Texas** • 1 ♂; Brewster Co., Big Bend National Park, Trap Spring; [29.163° N, 103.42° W]; elev. 870 m; 15 Apr. 1986; Terry L. Griswold leg.; BBSL700809 • 1 ♀; Hudspeth Co., Indio Mountains Research Station, vicinity of Indio Ranch House; 30.7769° N, 105.0161° W; elev. 1231 m; 12–13 Apr. 2002; M.J. Yoder leg.; TAMU-ENTO X1417407 • 1 ♀; Presidio Co., Plata; [29.88° N, 104.02° W]; 24 Aug. 1969; Veryl V. Board, Hafernik leg.; TAMU-ENTO X1398988 • 1 ♂; Presidio Co., Shafter; [29.82° N, 104.31° W]; 20 Jun. 1968; J.E. Hafernik leg.; TAMU-ENTO X1362321.



**Fig. 47.** Georeferenced collection records of *Lasioglossum (D.) perparvum* (Ellis, 1914) (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence.



## Range

California and Sonoran and Chihuahuan Deserts (Fig. 47).

## Floral hosts

ASTERACEAE: *Helianthus*: *H. annuus* • *Pluchea*: *P. sericea* (Nutt.) Coville • BORAGINACEAE: *Heliotropium* • BRASSICACEAE: *Nasturtium* W.T.Aiton: *N. officinale* R.Br. • *Physaria*: *P. gordonii* • CONVOLVULACEAE: *Convolvulus* L.: *C. arvensis* L. • EUPHORBIACEAE: *Euphorbia* • FABACEAE: *Medicago*: *M. sativa* • *Parkinsonia* • LAMIACEAE: *Mentha*: *M. spicata* • MALVACEAE: *Gossypium* • MYRTACEAE Juss.: *Melaleuca* L. • POLYGONACEAE: *Antigonon* Endl. • RHAMNACEAE: *Condalia* • SOLANACEAE: *Physalis*: *P. acutifolia* • TAMARICACEAE: *Tamarix*: *T. ramosissima*.

Some additional floral hosts were reported in Moure & Hurd (1987), but many of these are likely attributable to *L. deludens* sp. nov.

## DNA barcodes

Nine confirmed sequences available (BOLD process IDs: NCBEE350-21, NCBEE361-21, NCBEE367-21, NCBEE370-21, NCBEE371-21, NCBEE373-21, NCBEE374-21, NCBEE375-21, NCBEE464-21). These sequences are identical (0% maximum intraspecific p-distance). They are closest in terms of p-distance to *L. holzenthali* sp. nov. in the Nearctic (2.91% minimum interspecific p-distance) and an undescribed species in the Neotropics (1.65% minimum interspecific p-distance). Five fixed nucleotide substitutions distinguish *L. perparvum* from all other Nearctic species of the *L. gemmatum* complex: 132(A), 249(C), 334(G), 358(A), and 360(T) (Supp. file 2).

## Comments

Uncommon. Most specimens determined as *L. perparvum* in various collections prior to this work were the much more common *L. deludens* sp. nov. Morphological examination and DNA barcodes suggest that *L. perparvum* may belong to a large and difficult species complex with most of its diversity in the Neotropics.

### *Lasioglossum (Dialictus) profundum* sp. nov.

[urn:lsid:zoobank.org:act:733EE382-5F27-440B-A179-DE2D0A166E65](https://zoobank.org/act:733EE382-5F27-440B-A179-DE2D0A166E65)

Figs 48–50, 76L, 81A, 82A

## Diagnosis

Females of *L. profundum* sp. nov. have the tegula very small (maximum length <45% ITS and barely reaching posterior margin of mesoscutum in dorsal view if at all), dark brown, with inner posterior margin straight, and impunctate except on far anterior margin; mesoscutum coarsely punctate (punctures as large as on mesepisternum, but sparser medially (IS = 1–2 PD)); mesoscutum and mesepisternum usually dull, tessellate to imbricate (mesoscutum sometimes shiny posteriorly); metapostnotum shiny with strong, coarse rugae; T1–T3 apical rims finely punctate; T2–T3 with tomentum covering half or more length of segment laterally; and mesoscutum with dense erect pubescence (each seta less than its length from the one nearest it and no gaps more than 0.5 OD wide visible in lateral view) and short intervening setae 0.25 OD long or more.

Females of *L. profundum* sp. nov. are most similar to those of *L. deludens* sp. nov. and *L. rufodeludens* sp. nov. See the diagnosis for *L. deludens* for a comparative diagnosis between these three species. They are also somewhat similar to those of *L. holzenthali* sp. nov. and *L. perparvum*, both of which have the tegula with at least some fine punctures medially and T2–T3 with tomentum covering less than half length

of segment laterally. In addition, females of *L. holzenthali* have the T1–T3 apical rims with larger and deeper punctures. Females of *L. perparvum* have the mesoscutum with sparse erect pubescence (each seta about its length from the one nearest it and some gaps more than 0.5 OD wide visible in lateral view) and very short intervening setae no more than stubble, mesoscutum more finely punctate, and metapostnotum dull with fine rugae.

Males of *L. profundum* sp. nov. have the tegula relatively small (maximum length less than half ITS and not reaching posterior margin of mesoscutum in dorsal view), dark brown, with inner posterior margin weakly concave and a blunt posterior angle, and impunctate except on far anterior margin and sometimes a few punctures on posterior margin; mesoscutum shiny and usually coarsely, moderately densely punctate (IS = 1–2 PD); metapostnotum usually shiny with strong subparallel rugae; face with dense tomentum up to eye emargination and slightly above; mesoscutum with dense erect pubescence (no gaps more than 0.5 OD visible in lateral view); and head and mesosoma usually deep blue.

Males of *L. profundum* sp. nov. are most similar to those of *L. deludens* sp. nov. and *L. rufodeludens* sp. nov. See the diagnosis for *L. deludens* for a comparative diagnosis between these three species. They are also somewhat similar to those of *L. holzenthali* sp. nov. and *L. perparvum*, both of which have the face with dense tomentum limited to paraocular area and tegula usually punctate medially (rarely may be impunctate in *L. holzenthali*). In addition, males of *L. holzenthali* have the T1–T3 apical rims deeply and distinctly punctate. Males of *L. perparvum* have the mesoscutum with sparse erect pubescence (some gaps more than 0.5 OD visible in lateral view) and metapostnotum dull with fine rugae.

### Etymology

The specific epithet ‘*profundum*’ is a Latin adjective meaning ‘deep’ or ‘profound’. It is a reference to this species’ deep blue and brown colouration, deep punctures, and its abundance near the deep caves at Carlsbad Caverns National Park. An appropriate translation would be the deep sweat bee.

### Material examined

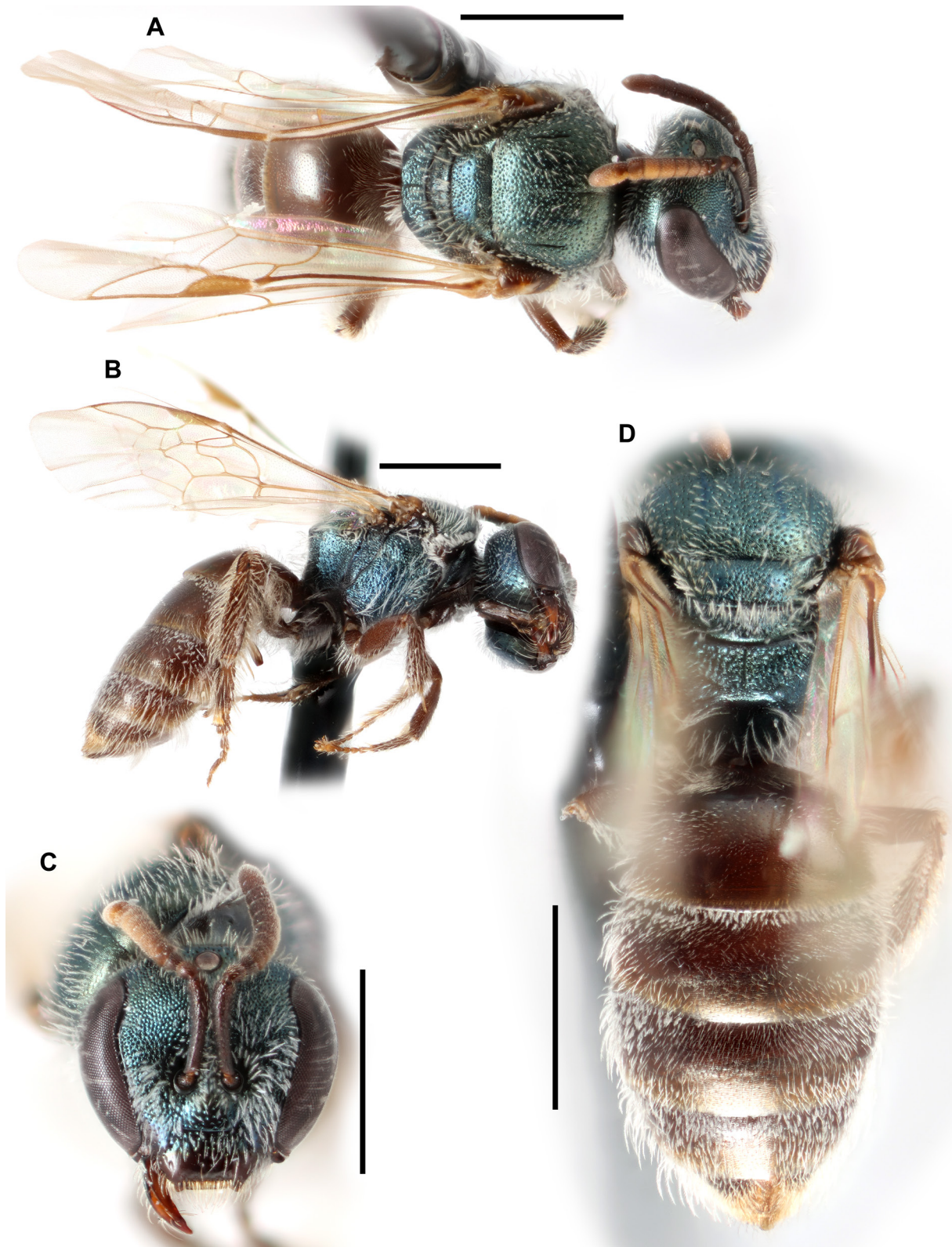
#### Holotype

UNITED STATES – Texas • ♀; Brewster Co.; 29.1532° N, 103.1095° W; 30 Apr.; H.W. Ikerd leg.; BBSL USGS-DRO 009757.

[Verbatim label: USGS / DRO / 009757 / USA Texas / Brewster Co. / 29.1532N 103.1095 / 30 Apr- / HW Ikerd 837 // DIAL1409E02 // HOLOTYPE / *Lasioglossum (Dialictus) profundum* Gardner and Gibbs]

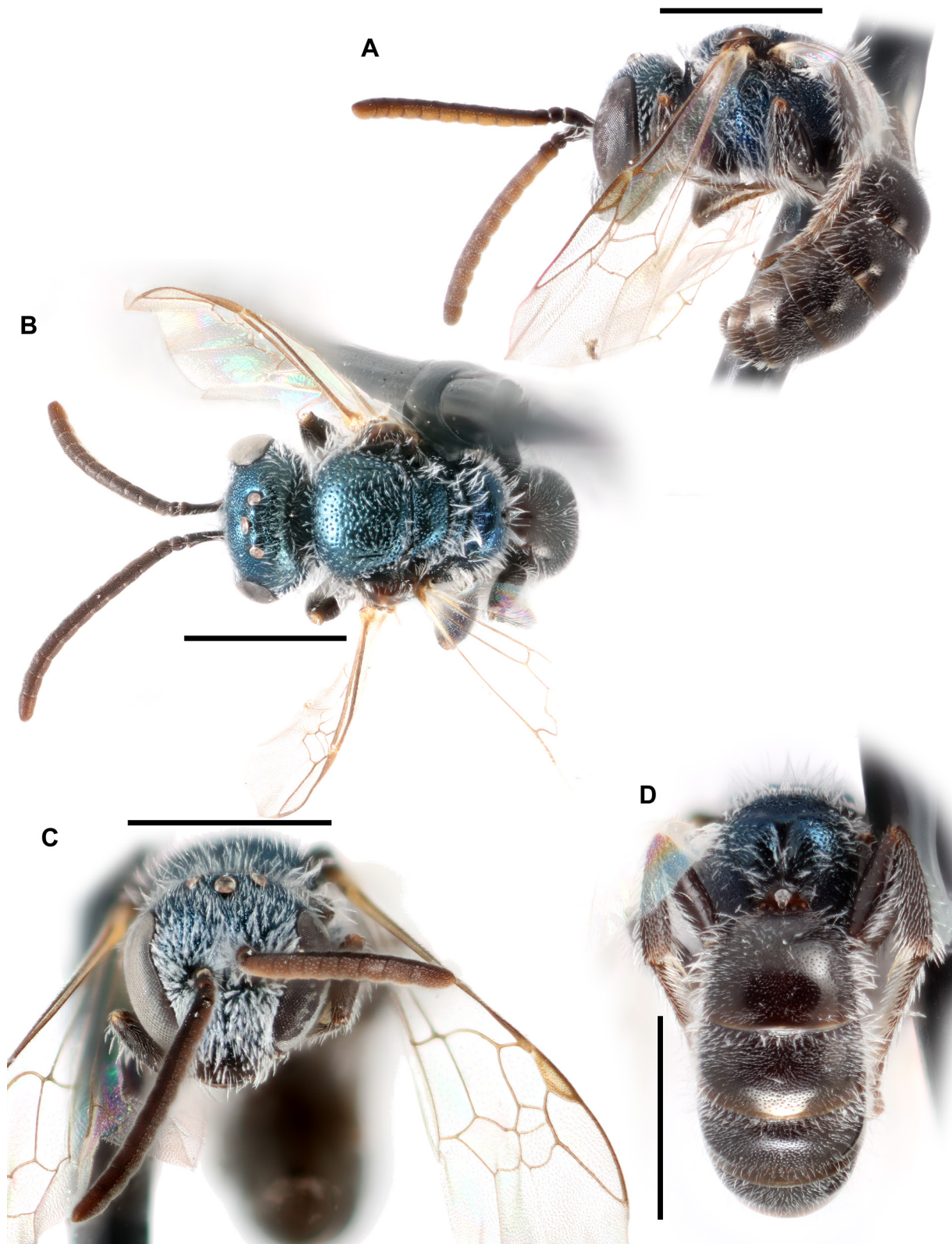
#### Paratypes

MEXICO – **Chihuahua** • 1 ♀; 44 km E of Parral; [26.93° N, 105.22° W]; 21 Aug. 1991; N. Pember leg.; SEMC SM0343012 • 1 ♀; 83 km N of Chihuahua; [29.38° N, 106.07° W]; 29 Aug. 1991; Jerome G. Rozen leg.; SEMC SM0313020. – **Coahuila** • 1 ♀; 18 km S of Cuatrociénegas; 26.867° N, 102.133° W; elev. 920 m; 27 Mar. 1992; Douglas Yanega leg.; ex *Chamaesaracha crenata*; SEMC SM0313029 • 1 ♀; 55 km E of Parras de la Fuente; 25.3167° N, 101.7333° W; elev. 1960 m; 31 Mar. 1992; B. Alexander leg.; ex *Lesquerella argyraea*; SEMC SM0342995 • 1 ♀; *ibid.*; 1 Apr. 1992; R.W. Brooks leg.; ex *Dalea radicans*; SEMC SM0342998 • 1 ♀; Muralla Pass; [26.33° N, 101.37° W]; 10 Jul. 1965; W.F. Chamberlain leg.; TAMU-ENTO X1396192. – **Nuevo León** • 1 ♀; 4.2 km S of Iturbide; [24.7° N, 99.92° W]; 23 Mar. 1991; R.W. Brooks, R. Leschen leg.; ex yellow poppy; SEMC • 1 ♀; Galeana, El Potosí; [24.89° N, 100.23° W]; elev. 3055 m; 22 Jun. 2013; Liliana Ramírez Freire, CVM leg.; LRF UANL-APO-145 • 1 ♀; Los Llanos, Galeana; 24.8089° N, 100.7119° W; elev. 1865 m; 28 Sep. 2013; Liliana Ramírez Freire, CVM leg.; LRF UANL-APO-781 • 2 ♀♀; Pablillo, Galeana; 24.6119° N, 100.0014° W; elev. 2085 m; 24 Aug. 2014; Liliana Ramírez Freire, CVM leg.; LRF. – **Querétaro** • 1 ♂; 10 mi. E of San Juan del Rio; [20.39° N, 99.85° W]; elev. 1981 m; SEMC.



**Fig. 48.** *Lasioglossum (D.) profundum* sp. nov., ♀, holotype (BBSL USGS-DRO 009757). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma and propodeum. Scale bars = 1 mm.





**Fig. 49.** *Lasioglossum (D.) profundum* sp. nov., ♂ (CAVE19682). A. Lateral habitus. B. Dorsal habitus. C. Face. D. Metasoma and propodeum. Scale bars = 1 mm.

UNITED STATES – **New Mexico** • 1 ♀; Chaves Co., Bitter Lake NWR, trailer north of HQ; 33.4636° N, 104.4066° W; 20 Jul. 2004; D. Richman leg.; NMSU • 2 ♀♀; Eddy Co., 0.7 km E of Longview Spring; 32.1007° N, 104.6137° W; elev. 1551 m; 19 Aug. 2010; R. Krauss, Terry L. Griswold leg.; BBSL CAVE22065, CAVE22081 • 2 ♂♂; Eddy Co., 1.1 km SW by W of Oak Spring; 32.1743° N, 104.458° W; elev. 1314–1374 m; 25 Aug. 2010; R. Krauss, J.D. Herndon leg.; BBSL CAVE22281, CAVE22298 • 8 ♀♀; Eddy Co., 1.5 km SSW of Main Cave Entrance; 32.1638° N, 104.4443° W; elev. 1152 m; 31 Aug. 2010; J.D. Herndon, R. Krauss leg.; BBSL CAVE21899, CAVE21902, CAVE21904, CAVE21905, CAVE21941, CAVE21946, CAVE21961, CAVE22712 • 4 ♂♂; *ibid.*; 31 Aug. 2010; J.D. Herndon, R. Krauss leg.; BBSL CAVE21911, CAVE21916, CAVE21932, CAVE21938 • 2 ♀♀; Eddy Co., 1.7 km E by S of Chimney Cave; 32.1638° N, 104.4443° W; elev. 1152 m; 12 May 2010; Terry L. Griswold, J.D. Herndon leg.; BBSL CAVE9369, CAVE9683 • 2 ♀♀; Eddy Co., 1.9 km SSW of Main Cave Entrance; 32.1615° N, 104.4494° W; elev. 1161 m; 17 Aug. 2010; J.D. Herndon leg.; BBSL CAVE21816, CAVE21821 • 1 ♀; *ibid.*; 31 Aug. 2010; R. Krauss, J.D. Herndon leg.; BBSL CAVE21471 • 1 ♀; Eddy Co., 2.2 km E of Chimney Cave; 32.1669° N, 104.4392° W; elev. 1159 m; 21 Jun. 2010; J.D. Herndon, A. Druk leg.; BBSL CAVE3175 • 25 ♂♂; Eddy Co., 22 mi. SW of Carlsbad; [32.2° N, 104.5° W]; 21 May 1969; D.J. Brothers, Krueger, Charles D. Michener leg.; ex *Lepidium integrifolium*; SEMC • 2 ♂♂; *ibid.*; 21 May 1969; D.J. Brothers, Krueger, Charles D. Michener leg.; ex *Sphaeralcea*; SEMC • 1 ♂; Eddy Co., 3 mi. S of Artesia; [32.8° N, 104.4° W]; 20 May 1969; D.J. Brothers, Krueger, Charles D. Michener leg.; ex *Chamaesaracha coniooides*; SEMC • 2 ♀♀, 4 ♂♂; Eddy Co., Carlsbad; [34.42° N, 104.23° W]; 20 May 1969; D.J. Brothers, Krueger, Charles D. Michener leg.; ex *Lepidium integrifolium*; SEMC • 5 ♀♀; Eddy Co., Lowe Ranch; 32.1744° N, 104.4989° W; elev. 1382 m; 1 Jun. 2010; J.D. Herndon, A. Druk leg.; BBSL CAVE10540, CAVE10567, CAVE10592, CAVE10600, CAVE10604 • 1 ♂; *ibid.*; 1 Jun. 2010; J.D. Herndon, A. Druk leg.; BBSL CAVE10526 • 1 ♀; *ibid.*; 7 Jul. 2010; A. Druk, J.D. Herndon leg.; BBSL CAVE7929 • 2 ♀♀; *ibid.*; 23 Aug. 2010; J.D. Herndon leg.; BBSL CAVE22640, CAVE22651 • 5 ♀♀; Eddy Co., Rattlesnake Springs; 32.1095° N, 104.4716° W; elev. 1115 m; 19 May 2010; J.D. Herndon, A. Druk leg.; BBSL CAVE10756, CAVE10773, CAVE10802, CAVE10860, CAVE10863 • 1 ♀; *ibid.*; 18 Jun. 2010; J.D. Herndon leg.; BBSL CAVE6420 • 1 ♂; Eddy Co., Slaughter Canyon, 0.4 km NE by N of Slaughter Cave; 32.1152° N, 104.5681° W; elev. 1324 m; 13 Aug. 2010; J.D. Herndon leg.; BBSL CAVE19682 • 1 ♀; Eddy Co., Slaughter Canyon, 0.7 km WSW of Rainbow Cave; 32.1152° N, 104.5681° W; elev. 1324 m; 17 May 2010; Terry L. Griswold, J.D. Herndon, A. Druk leg.; BBSL CAVE9579 • 3 ♀♀; Eddy Co., Slaughter Canyon, parking lot; 32.1104° N, 104.5624° W; elev. 1324 m; 2 Jun. 2010; J.D. Herndon, A. Druk leg.; BBSL CAVE10632, CAVE10649, CAVE10666 • 1 ♂; Eddy Co., Slaughter Canyon, parking lot, 0.4 km N along trail; 32.1131° N, 104.5643° W; elev. 1290 m; 5 May 2010; J.D. Herndon leg.; ex *Fallugia paradoxa*; BBSL CAVE26004 • 2 ♀♀; Eddy Co., Walnut Canyon, Whites City; 32.1781° N, 104.3819° W; elev. 1211 m; 28 Jul. 2010; J.D. Herndon leg.; BBSL CAVE22666, CAVE22668 • 1 ♂; *ibid.*; 28 Jul. 2010; J.D. Herndon leg.; BBSL CAVE22670 • 1 ♀; Eddy Co., Yucca Canyon, Yucca Trail Head; 32.0982° N, 104.5871° W; elev. 1395 m; 28 Apr. 2010; J.D. Herndon, A. Druk leg.; BBSL CAVE9712 • 3 ♀♀; *ibid.*; 19 Aug. 2010; R. Krauss, Terry L. Griswold leg.; BBSL CAVE21859, CAVE21882, CAVE21886 • 1 ♂; Hidalgo Co., 20.3 mi. S of Animas; 31.6619° N, 108.8378° W; elev. 1479 m; 20 Sep. 1999; Charles D. Michener leg.; ex *Heterotheca psammophila*; SEMC SM0149449 • 1 ♀; Socorro Co., Sevilleta National Wildlife Refuge; [34.3° N, 106.8° W]; 15–29 Jul. 2003; Karen Wetherill leg.; TAMU • 1 ♀; Socorro Co., Sevilleta National Wildlife Refuge; 34.3325° N, 106.6328° W; 17 Jun.–1 Jul. 2010; Karen Wetherill leg.; TAMU • 1 ♀; Socorro Co., Sevilleta National Wildlife Refuge; 34.335° N, 106.7219° W; 15–29 Jul. 2010; Karen Wetherill leg.; TAMU • 6 ♀♀; *ibid.*; 10–24 Jul. 2014; Karen W. Wright leg.; TAMU • 1 ♀; Socorro Co., Sevilleta National Wildlife Refuge; 34.3431° N, 106.7417° W; 12–26 Jun. 2014; Karen W. Wright leg.; TAMU • 1 ♀; *ibid.*; 13–27 Jun. 2015; Karen W. Wright leg.; TAMU. – **Texas** • 1 ♀; Bandera Co., Lost Maples State Park; [29.82° N, 99.58° W]; 27 Apr. 1986; P.W. Kovarik, K. Haack leg.; TAMU-ENTO X1416734 • 7 ♂♂; *ibid.*; 27 Apr. 1986; P.W. Kovarik, K. Haack leg.; TAMU-ENTO X1314010, X1316280, X1362315, X1385981, X1387307, X1418242, X1422921 • 1 ♀; Brewster Co., Big Bend National Park; [29.3° N, 103.2° W]; 11 Jul. 1937;



Rollin H. Baker leg.; TAMU-ENTO X1388812 • 1 ♀, 2 ♂♂; Brewster Co., Big Bend National Park, Government Spring; [29.34° N, 103.256° W]; elev. 1200 m; 13 Apr. 1986; Terry L. Griswold leg.; BBSL • 1 ♀; Brewster Co., Big Bend National Park, Government Spring; [29.34° N, 103.256° W]; 5 Jul. 1986; Heraty leg.; ex scrub cottonwood; TAMU-ENTO X1414321 • 4 ♀♀, 2 ♂♂; Brewster Co., Big Bend National Park, Mule Ears Overlook; [29.166° N, 103.436° W]; elev. 860 m; 15 Apr. 1986; Terry L. Griswold leg.; BBSL • 2 ♀♀; Brewster Co., Big Bend National Park, North Rosillos Mountains; 29.5661° N, 103.2567° W; 17–21 Mar. 1992; R.A. Wharton, J.B. Woolley leg.; TAMU-ENTO X1315317, X1408760 • 1 ♂; Brewster Co., Big Bend National Park, North Rosillos Mountains, Alamo Springs; [29.6° N, 103.3° W]; 10–21 Jul. 1991; R. Vogtsberger leg.; TAMU-ENTO X1417434 • 1 ♀; Brewster Co., Big Bend National Park, North Rosillos Mountains, Buttrill Spring & Lodge; [29.56° N, 103.29° W]; 14–17 Jun. 1991; R.A. Wharton leg.; TAMU-ENTO X1388434 • 1 ♂; Brewster Co., Big Bend National Park, North Rosillos Mountains, nr. Buttrill Spring; [29.56° N, 103.29° W]; 23–25 Apr. 1991; G. Zolnerowich leg.; TAMU-ENTO X1361553 • 1 ♀; Brewster Co., Big Bend National Park, Oak Canyon; [29.275° N, 103.32° W]; elev. 1400–1520 m; 11 Apr. 1986; R.T. Griswold leg.; BBSL • 1 ♂; Brewster Co., Big Bend National Park, Wasp Spring; [29.3° N, 103.4° W]; elev. 925 m; 15 Apr. 1986; Terry L. Griswold leg.; ex *Acacia greggii*; BBSL • 1 ♀; Brewster Co., Calamity Creek Road, 25 km S of Alpine; [30.14° N, 103.63° W]; 29 Apr. 2003; Laurence Packer, Fraser leg.; BBSL • 1 ♀; Brewster Co., The Post, 6 mi. SW of Marathon; [30.16° N, 103.3° W]; 10 Aug. 1969; Veryl V. Board, Hafernik leg.; TAMU-ENTO X1393532 • 35 ♀♀; Brewster Co.; 29.1532° N, 103.1095° W; 30 Apr.; H.W. Ikerd leg.; BBSL USGS-DRO 009535, USGS-DRO 009536, USGS-DRO 009538, USGS-DRO 009542, USGS-DRO 009553, USGS-DRO 009555, USGS-DRO 009556, USGS-DRO 009558, USGS-DRO 009560, USGS-DRO 009621, USGS-DRO 009623, USGS-DRO 009624, USGS-DRO 009625, USGS-DRO 009640, USGS-DRO 009648, USGS-DRO 009650, USGS-DRO 009653, USGS-DRO 009661, USGS-DRO 009665, USGS-DRO 009666, USGS-DRO 009667, USGS-DRO 009669, USGS-DRO 009670, USGS-DRO 009681, USGS-DRO 009703, USGS-DRO 009706, USGS-DRO 009737, USGS-DRO 009808, USGS-DRO 009811, USGS-DRO 009812, USGS-DRO 009816, USGS-DRO 009817, USGS-DRO 009821, USGS-DRO 009923, USGS-DRO 009947 • 1 ♀; Brewster Co.; 29.3072° N, 103.4782° W; 29 Apr.; H.W. Ikerd leg.; BBSL USGS-DRO 004267 • 1 ♀; Brewster Co.; 29.3469° N, 103.3081° W; 29 Apr.; H.W. Ikerd leg.; BBSL USGS-DRO 004256 • 1 ♂; Burnet Co., Inks Lake State Park; [30.73° N, 98.36° W]; 2 May 1987; J.B. Woolley leg.; TAMU-ENTO X1395402 • 1 ♀; Culberson Co., Choza Spring, Guadalupe Mountains National Park; [31.906° N, 104.786° W]; elev. 1610 m; 8 Apr. 1986; R.T. Griswold leg.; BBSL240379 • 1 ♂; Edwards Co., 10 mi. NE of Rocksprings; [30.12° N, 100.09° W]; 6 Aug. 1982; J.C. Schaffner leg.; TAMU-ENTO X1391743 • 14 ♀♀; Edwards Co., 23 mi. W of Rocksprings; [30.02° N, 100.59° W]; 6 Aug. 1982; J.C. Schaffner leg.; ex *Rhus* sp.; TAMU-ENTO X1361854, X1392434, X1393384, X1393451, X1395218, X1395826, X1396020, X1396202, X1396226, X1397400, X1397419, X1397449, X1397457, X1397581 • 10 ♂♂; *ibid.*; 6 Aug. 1982; J.C. Schaffner leg.; ex *Rhus* sp.; TAMU-ENTO X1361856, X1393279, X1393538, X1395794, X1395820, X1396242, X1397410, X1397490, X1397493, X1397577 • 1 ♀; El Paso Co., Franklin Mountains State Park, McKelligon Canyon Park; [31.84° N, 106.485° W]; 15–30 Jul. 2005; N. Brown leg.; TAMU-ENTO X1362588 • 1 ♀; Jeff Davis Co., 11.3 mi. W of SR 17 on SR 166, Davis Mountains Scenic Loop; [30.541° N, 104.1° W]; 21 Aug. 1974; H. Greenbaum leg.; TAMU-ENTO X1399812 • 2 ♀♀; Jeff Davis Co., 18 mi. S of Kent; [30.81° N, 104.22° W]; 30 May 1999; Laurence Packer leg.; PCYU • 1 ♀; Jeff Davis Co., 20 km S of Kent; [30.89° N, 104.22° W]; 30 Apr. 2003; Laurence Packer, Fraser leg.; ex *Nama*; PCYU • 2 ♀♀; *ibid.*; 30 Apr. 2003; Laurence Packer, Fraser leg.; PCYU • 1 ♀; Jeff Davis Co., 20 mi. S of Kent; [30.89° N, 104.22° W]; 15 Aug. 1965; J.C. Schaffner leg.; TAMU-ENTO X1393259 • 1 ♂; Jeff Davis Co., 9 mi. SE of Fort Davis; [30.5° N, 103.79° W]; 23 Aug. 1967; R.C. Gardner, C.R. Kovacic leg.; UCDC • 1 ♂; Jeff Davis Co., Chihuahuan Desert Research Institute; [30.54° N, 103.84° W]; 29 Apr. 2003; Laurence Packer, Fraser leg.; PCYU • 1 ♀; Jeff Davis Co., H.O. Canyon, Davis Mountains; [30.592° N, 104.373° W]; elev. 1890 m; 5 Jul. 1968; J.E. Hafernik leg.; TAMU-ENTO X1392413 • 2 ♀♀; Jeff Davis Co., Madera Canyon, Texas Highway 118; 30.7061° N, 104.1042° W; 17–19 Oct. 2014; B. Hays leg.; TAMU-ENTO X1361891,



X1364140 • 1 ♂; Potter Co., Bushland; [35.19° N, 102.06° W]; 17–24 Jul. 1983; T.J. Kring leg.; TAMU-ENTO X1397481 • 1 ♂; Presidio Co., 10 mi. S of Marfa; [30.16° N, 104.02° W]; 9 Aug. 1982; J.C. Schaffner leg.; TAMU-ENTO X1370498 • 1 ♂; Presidio Co., Big Bend Ranch SNA, 2.5 mi. W of La Saucedá; [29.47° N, 104° W]; 7–9 Aug. 1991; J.B. Woolley, G. Zolnerowich leg.; TAMU-ENTO X1315431 • 8 ♀♀; Presidio Co., Big Bend State Natural Area, Agua Adentro; [29.48° N, 104.04° W]; 18–23 Jun. 1990; D. Judd leg.; TAMU-ENTO X1370725, X1370868, X1415373, X1416792, X1417898, X1418101, X1418960, X1422251 • 2 ♀♀; Reeves Co., TAMU Research Station at Pecos; [31.37° N, 103.62° W]; 17 Aug. 1976; S.J. Merritt leg.; ex *Solanum* sp.; TAMU-ENTO X1365251, X1400265 • 1 ♀; Starr Co., Falcon State Park; [26.58° N, 99.14° W]; 19 Jun. 1969; Veryl V. Board leg.; TAMU-ENTO X1393343 • 1 ♀; Val Verde Co., 8 miles west of Carta Valley; [29.79° N, 100.81° W]; 5 May 1997; W.F. Chamberlain leg.; TAMU-ENTO X1395825 • 1 ♂; 10 miles NE of Marathon; [30.31° N, 103.13° W]; 28 Jul. 1986; W.F. Chamberlain leg.; TAMU-ENTO X1409646 • 1 ♀; 10 miles south of Marathon; [30.06° N, 103.25° W]; 28 Jul. 1986; W.F. Chamberlain leg.; TAMU-ENTO X1410909 • 1 ♂; 16 miles east of Sonora; [30.57° N, 100.38° W]; 28 Jul. 1986; W.F. Chamberlain leg.; TAMU-ENTO X1388594 • 2 ♂♂; 20 miles south of Fort Stockton; [30.6° N, 102.88° W]; 28 Jul. 1986; W.F. Chamberlain leg.; TAMU-ENTO X1388593, X1408050.

## Description

### Female

COLOURATION. Head and mesosoma blue to blue-green; clypeus apex black; labrum black; mandible orange with black base and red apex; flagellum dark reddish brown dorsally, light brown ventrally. Pronotal lobe black; legs reddish brown; tegula dark brown; wing membrane hyaline, veins with subcosta dark brown, otherwise brown to light brown. Metasoma black with rims of terga and sterna narrowly translucent yellow.

PUBESCENCE. Body pile colour white. Tomentum dense on paraocular area, gena anteriorly, pronotal collar and lobe, space between pronotal lobe and tegula, and T2–T3 basolaterally; sparse on T4 throughout. Mesoscutum pubescence thin to moderately plumose. Wing setae dark, short and dense. Acarinarial fan complete, dense. T2 fringes sparse, T3 fringes sparse.

SURFACE SCULPTURE. Clypeus shiny, with punctures dense in basal third ( $IS < 1 PD$ ), large and irregularly spaced apically ( $IS < 2 PD$ ); supraclypeal area shiny, with punctures dense ( $IS \leq 1 PD$ ); paraocular area imbricate around antenna socket, otherwise shiny, with punctures crowded ( $IS = 0 PD$ ), slightly sparser around antenna socket ( $IS \leq 1 PD$ ); frons shiny, with punctures crowded ( $IS = 0 PD$ ); vertex shiny, with punctures dense laterally ( $IS < 1 PD$ ), sparse medially ( $IS = 1–3 PD$ ); gena shiny, with punctures dense ( $IS < 1.5 PD$ ); postgena shiny, becoming imbricate posteriorly. Tegula punctures absent; mesoscutum tessellate, with punctures dense ( $IS < 1 PD$ ), becoming moderately sparse submedially and anteromedially ( $IS = 1–2 PD$ ); scutellum tessellate, with punctures dense marginally and on median line ( $IS < 1 PD$ ), moderately sparse submedially ( $IS = 1–2 PD$ ); metapostnotum weakly imbricate, becoming tessellate posteriorly, with rugae strong, anastomosing, reaching posterior margin; preepisternum imbricate with crowded punctures ( $IS = 0 PD$ ); hypoepimeron imbricate, with punctures dense ( $IS < 1 PD$ ); mesepisternum imbricate, with punctures dense ( $IS \leq 1 PD$ ), becoming crowded medially ( $IS = 0 PD$ ); metepisternum finely ruguloso-lineate dorsally, ruguloso-punctate ventrally; propodeum lateral surface tessellate, posterior surface tessellate. T1 anterior slope coriarius, disc weakly coriarius, with punctures moderately dense ( $IS = 1–2 PD$ ), minute and sparse on rim laterally ( $IS = 1–4 PD$ ), absent in large subapicolateral boss and on rim medially; T2 disc shiny, with punctures moderately dense ( $IS = 1–2 PD$ ), apical rim weakly coriarius, with punctures minute, sparse ( $IS = 1–4 PD$ ).

STRUCTURE. Face length/width ratio 0.82 ( $\pm 0.01 SD$ ); clypeus apicolateral denticles low rounded knobs; gena/eye width ratio 0.86 ( $\pm 0.13 SD$ ). Pronotal angle slightly obtuse, nearly right-angled; intertegular span

0.91 ( $\pm 0.05$  SD) mm; mesoscutum length/width ratio 0.85 ( $\pm 0.03$  SD); mesoscutum/scutellum length ratio 2.82 ( $\pm 0.11$  SD); scutellum/metanotum length ratio 1.68 ( $\pm 0.15$  SD); metanotum/metapostnotum length ratio 0.8 ( $\pm 0.06$  SD); forewing with 3 submarginal cells; tegula enlarged, nearly reaching posterior margin of mesoscutum; inner margin straight; tegula length 0.36 ( $\pm 0.02$  SD) mm, width 0.21 ( $\pm 0.01$  SD) mm; propodeum lateral carinae not reaching dorsal margin; oblique carina strong, straight. T2 depressed apical rim less than 50% of tergum. (n = 10)

VARIATION. The labrum and flagellum ventral surface can vary from black to orange, the mesoscutum posterior half can vary from strongly tessellate to shiny, and the T1 anterior slope can vary from coriarius to shiny.

### Male

COLOURATION. Head and mesosoma blue to blue-green; clypeus apex black; labrum black; mandible orange with black base and red apex; flagellum dark reddish brown dorsally, orange ventrally. Pronotal lobe black; legs black to dark reddish brown; tegula dark brown; wing membrane hyaline, veins with subcosta dark brown, otherwise brown to light brown. Metasoma black with depressed apical rims of terga and sterna and downcurved lateral areas of terga broadly translucent reddish brown.

PUBESCENCE. Body pile colour white. Tomentum moderately dense on face below eye emargination, gena, pronotal angle and lobe, and space between pronotal lobe and tegula; sparse on preëpisternum and metepisternum. Mesoscutum pubescence simple to moderately plumose. Wing setae dark and light intermixed, short and dense. Sterna pubescence short (0.5–1.5 OD), moderately plumose, sparse.

SURFACE SCULPTURE. Clypeus shiny, with punctures dense (IS < 1 PD); supraclypeal area shiny, with punctures dense (IS  $\leq$  1 PD); paraocular area shiny, with punctures crowded (IS = 0 PD); frons reticulate, with punctures crowded (IS = 0 PD); vertex shiny, with punctures dense laterally (IS < 1 PD), moderately dense medially (IS = 1–2 PD); gena shiny, with punctures fine, dense (IS  $\leq$  1 PD), obscure; postgena shiny to weakly imbricate-lineate. Tegula punctures absent; mesoscutum shiny, becoming weakly tessellate anteromedially, with punctures moderately dense (IS = 1–2 PD), becoming dense on lateral and posterior margins (IS < 1 PD); scutellum shiny, with punctures dense (IS < 1 PD); metanotum shiny and densely punctate (IS < 1 PD); metapostnotum shiny to tessellate, with rugae strong, subparallel, nearly reaching posterior margin; preëpisternum areolate; hypoepimeron areolate, with punctures crowded (IS = 0 PD); mesepisternum shiny, with punctures crowded (IS = 0 PD); metepisternum areolate, becoming smooth dorsally; propodeum lateral surface shiny, with punctures crowded (IS = 0 PD), posterior surface shiny and moderately densely punctate (IS = 1–2 PD), becoming crowded laterally (IS = 0 PD). T1 anterior slope shiny, disc shiny, with punctures dense (IS  $\leq$  1.5 PD), becoming sparse in small subapicolateral boss (IS = 1–4 PD) and absent on rim medially; T2 disc shiny, with punctures dense (IS  $\leq$  1 PD), apical rim shiny, with punctures absent.

STRUCTURE. Face length/width ratio 0.86 ( $\pm 0.01$  SD); gena/eye width ratio 0.74 ( $\pm 0.07$  SD). Pronotal angle obtuse; intertegular span 0.8 ( $\pm 0.11$  SD) mm; mesoscutum length/width ratio 0.89 ( $\pm 0.03$  SD); mesoscutum/scutellum length ratio 2.82 ( $\pm 0.08$  SD); scutellum/metanotum length ratio 1.85 ( $\pm 0.15$  SD); metanotum/metapostnotum length ratio 0.73 ( $\pm 0.08$  SD); forewing with 3 submarginal cells; tegula enlarged, nearly reaching posterior margin of mesoscutum in dorsal view; inner posterior margin weakly concave; tegula length 0.36 ( $\pm 0.05$  SD) mm, width 0.2 ( $\pm 0.03$  SD) mm; propodeum lateral carinae not reaching dorsal margin; oblique carina absent. (n = 10)

GENITALIA. As in Fig. 76L. Gonocoxite about 1.8 times as broad as gonostylus. Gonostylus boot-shaped, strongly concave on outer margin and sharply angled at inner basal margin, with sparse long setae dorsally and short setae apically and along inner margin. Penis valves convergent apically, widely separated basally, with sparse short setae laterally. Retrorse lobe truncate apically, about 2.5 times as long as broad.

VARIATION. The mesoscutum punctures can vary from large and dense (IS < 1 PD) to fine and sparse (IS = 1–3 PD), the metapostnotal rugae can vary from parallel to anastomosing, the propodeum lateral face can vary from distinctly punctate to almost rugulose, and the apical rims of T1–T3 can be entirely impunctate or with a few moderately sparse punctures near the premarginal line (IS = 1–2 PD).

### Range

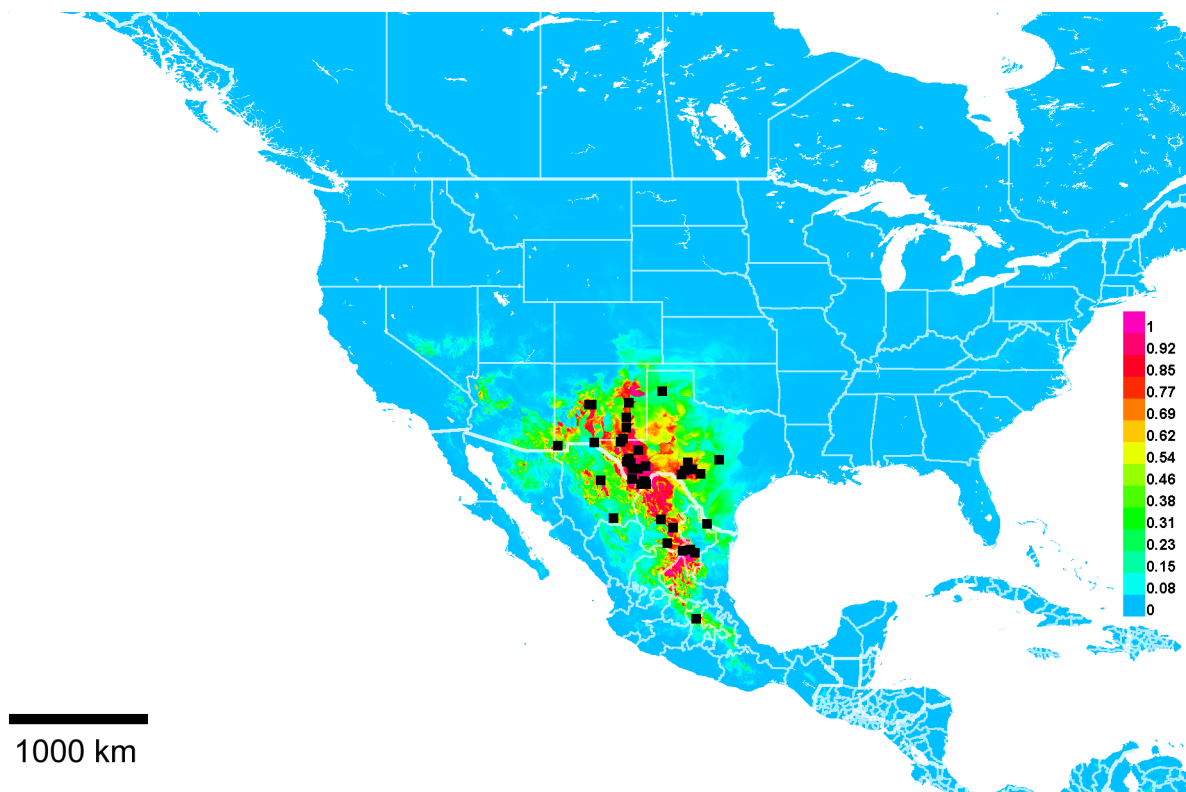
Chihuahuan Desert (Fig. 50).

### Floral hosts

ANACARDIACEAE: *Rhus* • BORAGINACEAE: *Nama* • BRASSICACEAE: *Lepidium*: *L. integrifolium* • *Physaria*: *P. argyraea* (A.Gray) O’Kane & Al-Shehbaz • FABACEAE: *Acacia*: *A. greggii* • *Dalea* L.: *D. radicans* S.Watson • ROSACEAE: *Fallugia* Endl.: *F. paradoxa* (D.Don) Endl. ex Torr. • SOLANACEAE: *Chamaesaracha*: *C. crenata* Rydb. • *Solanum*.

### DNA barcodes

Five confirmed sequences available (BOLD process IDs: DLII048-06, DLII1120-07, DLII1699-09, DLIII115-18, LASNA048-08). There is a small amount of divergence within these sequences (0.16% maximum intraspecific p-distance). They are closest in terms of p-distance to *L. tegulare* (0.76% minimum interspecific p-distance). No fixed nucleotide substitutions distinguish *L. profundum* sp. nov. from all other species of the *L. gemmatum* complex, but one fixed nucleotide substitution distinguishes it from the closely related *L. puteulanum* and *L. tegulare*: 390(T) (Supp. file 2).



**Fig. 50.** Georeferenced collection records of *Lasioglossum (D.) profundum* sp. nov. (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence.



*Lasioglossum (Dialictus) pseudotegulare* (Cockerell, 1896)

Figs 51–53, 76M, 88A, 89A, 108B, 111A, 112A

*Halictus pseudotegularis* Cockerell, 1896: 294 (holotype, ♀, deposited in USNM, examined).

*Halictus pseudotegularis* – Cockerell 1899: 5 (catalogue).

*Halictus (Chloralictus) pseudotegularis* – Sandhouse 1924: 2, 8 (key to species), 11 (comparison to *ellisiae*). — Ellis 1914: 101 (comparison to *jamaicae* = *gemmatum*).

*Lasioglossum (Chloralictus) pseudotegulare* – Michener 1951: 1117 (catalogue).

*Dialictus pseudotegularis* – Hurd 1979: 1970 (catalogue). — Moure & Hurd 1987: 125 (catalogue).

### Diagnosis

Females of *L. pseudotegulare* have the face relatively long (length/width ratio usually  $\geq 0.83$ ); tegula large (maximum length usually more than half ITS and reaching or exceeding posterior margin of mesoscutum in dorsal view), densely punctate ( $IS < 1 PD$ ), and with inner posterior margin strongly concave and a rounded posterior projection 0.5–1 OD in size; metapostnotum finely reticulate with shallow subparallel rugae; mesepisternum shiny with at most weak microsculpture; mesoscutum with dense erect pubescence (each seta less than its length from the one nearest it and no gaps more than 0.5 OD visible in lateral view) and short intervening setae 0.25 OD long or more; disc of T4 with sparse tomentum; mesoscutum concolourous with propodeum; apical rims of T1–T2 sometimes distinctly punctate (especially in Sonoran Desert specimens), and gena narrower than eye in lateral view.

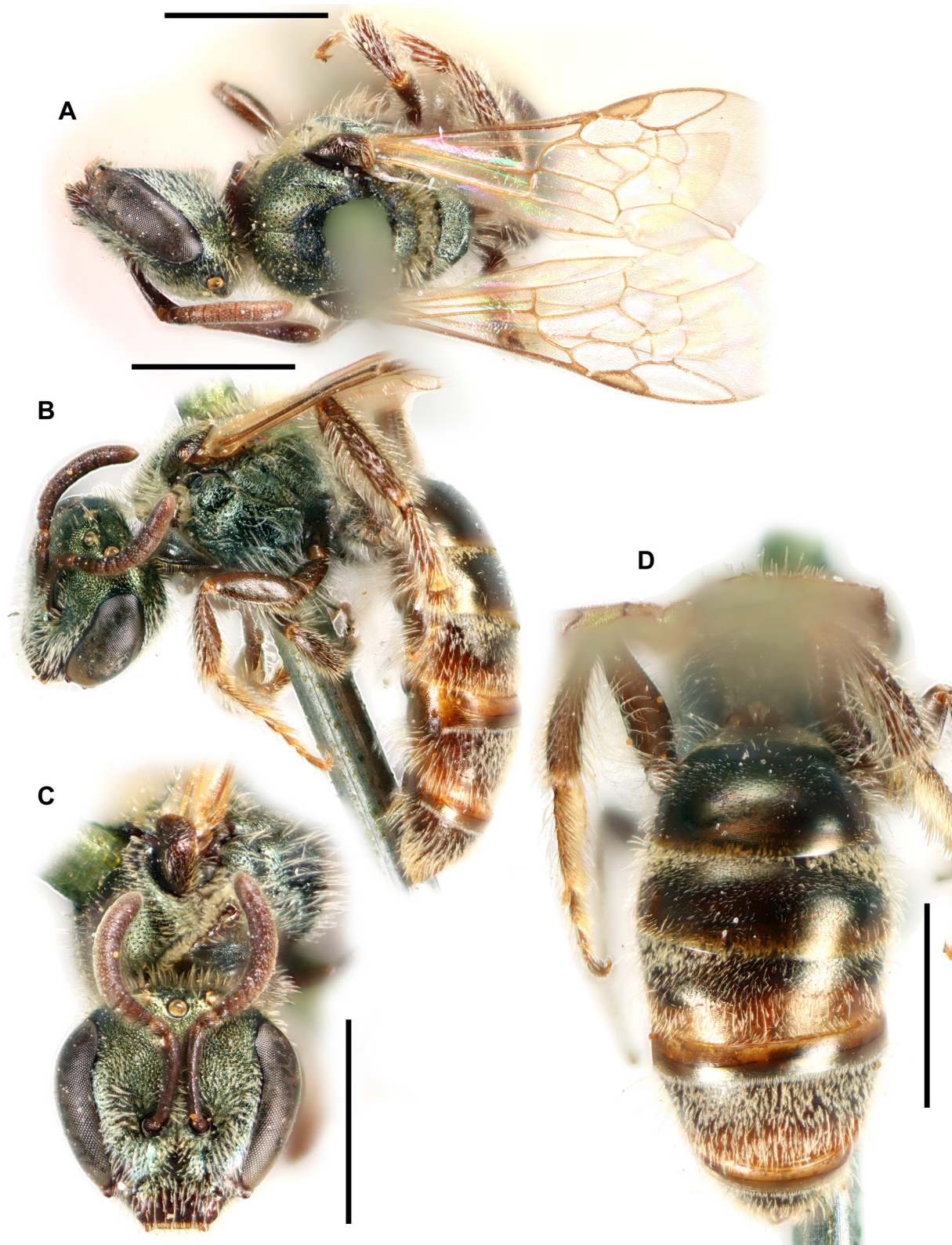
Females of *L. pseudotegulare* are most similar to those of *L. angelicum* sp. nov., *L. gaudiale*, and *L. magnitegula* sp. nov. Females of *L. angelicum* have the metapostnotum shiny with strong anastomosing rugae and face slightly shorter (length/width ratio  $\leq 0.83$ ). Females of *L. gaudiale* have the gena about as wide as eye in lateral view, metapostnotum usually shiny, and tegula with a posterior point narrower than 0.5 OD. Females of *L. magnitegula* have the mesoscutum with sparse erect pubescence (each seta about its length from the one nearest it) and very short intervening setae no more than stubble, T4 without tomentum, mesoscutum more greenish, golden, or reddish, contrasting with bluer propodeum, and apical rims of T1–T2 impunctate.

Males of *L. pseudotegulare* have the face relatively long (length/width ratio usually  $> 0.86$ ); tegula large (as in the female); mesepisternum densely punctate ( $IS < 1 PD$ ); metapostnotum tessellate to finely reticulate with shallow subparallel rugae; discs of T1–T2 deeply, distinctly, and densely punctate ( $IS \leq 1 PD$ ); T1–T2 apical rims with numerous deep, dense punctures basolaterally ( $IS \leq 1 PD$ ); and head and mesosoma uniformly coloured.

Males of *L. pseudotegulare* are most similar to those of *L. angelicum* sp. nov. and *L. magnitegula* sp. nov. Males of *L. angelicum* have the face shorter (length/width ratio  $\leq 0.86$ ) and discs of T1–T3 more sparsely punctate ( $IS = 1–2 PD$ ). Males of *L. magnitegula* have the T1–T2 apical rims impunctate and mesoscutum with a more greenish or golden tint, contrasting with the bluer propodeum. In direct comparison, the mesosoma punctures are somewhat larger and coarser in *L. magnitegula* than in *L. pseudotegulare*.

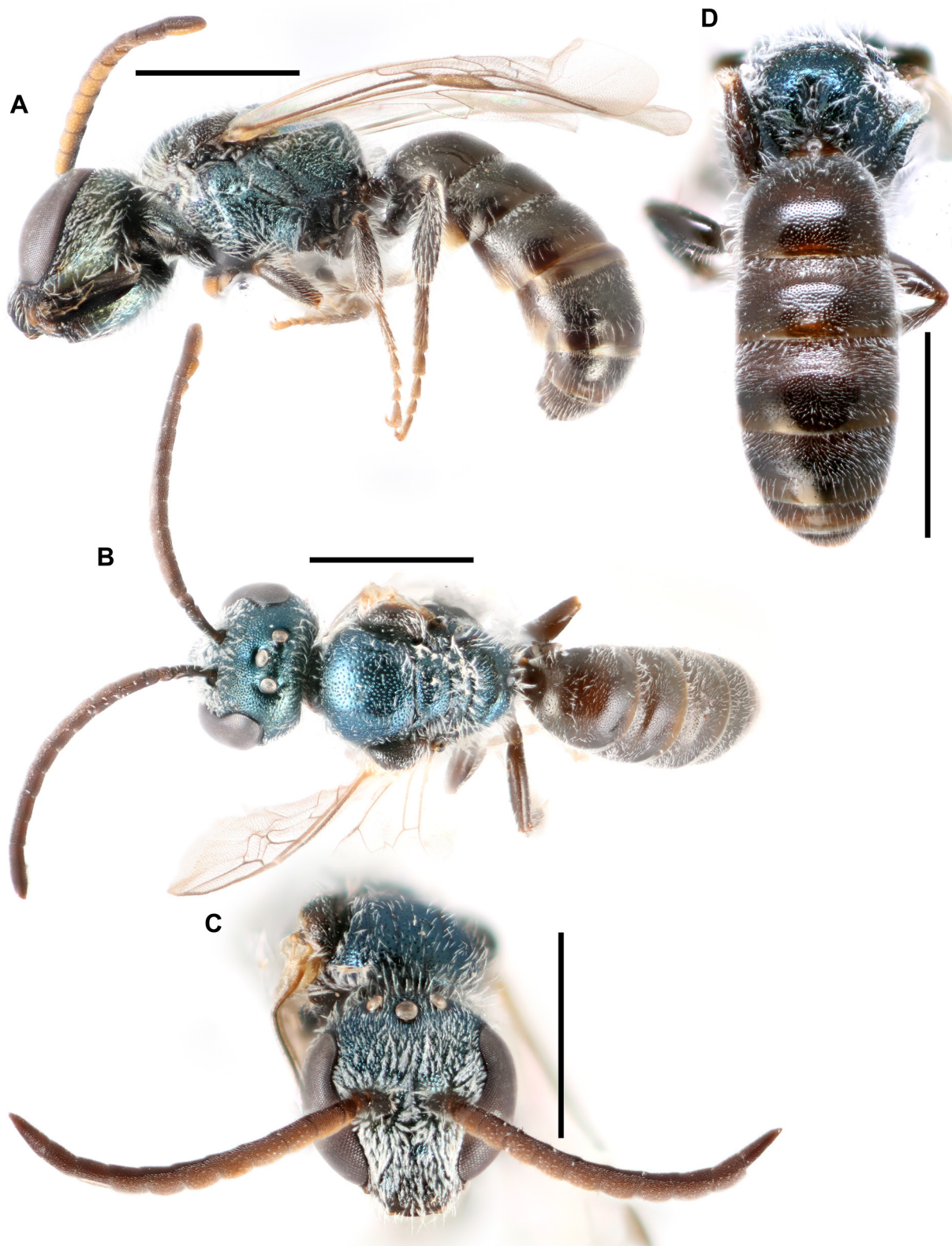
A similar, undescribed species only known from Veracruz may be confused with *L. pseudotegulare*, but can be separated in both sexes by the metapostnotum shiny with strong rugae and tegula usually orange (dark brown in *L. pseudotegulare*).

Some other species in the *L. stictaspis* species complex can also be very similar in both sexes. Most have the mesepisternum dull or more sparsely punctate ( $IS = 1–2 PD$ ), metapostnotum with strong anastomosing rugae, or T1–T2 less distinctly punctate, but a few can only be distinguished by a shorter face.



**Fig. 51.** *Lasioglossum (D.) pseudotegulare* (Cockerell, 1896), ♀, holotype (USNM 12065). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma. Scale bars = 1 mm.





**Fig. 52.** *Lasioglossum (D.) pseudotegulare* (Cockerell, 1896), ♂ (A =ASUHC0112600; B–C = ASUHC0113605; D = ASUHC0112865). **A.** Lateral habitus. **B.** Dorsal habitus. **C.** Face. **D.** Metasoma and propodeum. Scale bars = 1 mm.



## Etymology

Cockerell (1896) formed the specific epithet '*pseudotegularis*' from the Greek noun '*pseudos*' (lie), the Latin noun '*tégula*' (roof tile, literally 'covering instrument', now applied to the sclerite covering the wing base), and the Latin adjectival suffix '*-aris*' (of or pertaining to).

## Material examined

### Holotype

MEXICO – **Veracruz** • ♀; Paso de Telaya; [20.19° N, 96.87° W]; 29 Mar.; C.H.T. Townsend leg.; ex *Argemone mexicana*; USNM 12065.

### Other material

MEXICO – **Chiapas** • 1 ♀; Puerto “Madera” [Madero]; [14.73° N, 92.42° W]; Oct. 1954; N.L.H. Krauss leg.; SEMC • 1 ♀; Suchiate, Ignacio López Rayón; 14.6252° N, 92.1866° W; elev. 18 m; 17 Dec. 1986; I. Zarazua leg.; ECOAB.44006 • 1 ♀; Tapachula; 14.74° N, 92.31° W; elev. 28 m; 6 Mar. 2015; Jovani Ruiz *et al.* leg.; ECOAB.77418 • 1 ♀; Tuxtla Chico, Rosario Izapa; 14.9733° N, 92.1546° W; elev. 445 m; 3 Mar. 2001; F. Camposeco, Miguel Guzmán, M. Rincón leg.; ECOAB.52762. – **Colima** • 1 ♀; Manzanillo; [19.11° N, 104.34° W]; 14 Jul. 1965; W.F. Chamberlain leg.; TAMU-ENTO X1388664. – **Guerrero** • 1 ♀; 20 mi. W of Acapulco; [16.98° N, 100.17° W]; 10 Aug. 1962; SEMC. – **Jalisco** • 1 ♀; La Huerta; [19.48° N, 104.64° W]; 15 Jul. 1989; R.J. McGinley leg.; USNM. – **Morelos** • 2 ♀♀; 7.3 mi. S of Yautepec; [18.78° N, 99.06° W]; elev. 914 m; 16 Aug. 1962; Ellen Ordway, Naumann leg.; SEMC. – **Oaxaca** • 1 ♀; El Camarón; [15.88° N, 97° W]; 24 Apr. 1962; F.D. Parker leg.; UCDC. – **Puebla** • 1 ♀; Tecuantepec; 20.1447° N, 97.4973° W; elev. 120 m; 4 Jul. 2011; Jason J. Gibbs leg.; WRME 518957. – **San Luis Potosí** • 36 ♀♀, 13 ♂♂; 3.4 mi. NE of El Naranjo; [22.56° N, 99.3° W]; elev. 244 m; 5 Sep. 1962; University of Kansas Mexico Expedition leg.; SEMC • 1 ♀; El Naranjo El Salto; [22.59° N, 99.38° W]; 29 Jun. 1965; Paul J. Spangler leg.; USNM • 1 ♀; El Salto; [22.59° N, 99.38° W]; elev. 549 m; 8 Jun. 1961; University of Kansas Mexico Expedition leg.; ex *Kallstroemia hirsutissima*; SEMC • 2 ♀♀, 2 ♂♂; *ibid.*; 8 Jun. 1961; University of Kansas Mexico Expedition leg.; SEMC • 1 ♀; *ibid.*; 3 Sep. 1962; SEMC • 2 ♀♀; El Salto Falls; [22.59° N, 99.38° W]; elev. 400 m; 3–5 Jul. 1990; Robert L. Minckley leg.; ex *Lippia*; SEMC • 3 ♀♀; El Salto Falls, 12 km NW of El Naranjo; [22.59° N, 99.38° W]; elev. 400 m; 4 Jul. 1990; D. Conlon leg.; SEMC • 1 ♀; Tamazunchale; [21.26° N, 98.79° W]; 30 Mar. 1951; J. Latham leg.; SEMC • 2 ♀♀, 3 ♂♂; *ibid.*; 31 Mar. 1951; N. Walker leg.; SEMC • 4 ♀♀, 1 ♂; *ibid.*; 31 Mar. 1951; SEMC • 1 ♀; *ibid.*; 22 Jun. 1952; SEMC. – **Sonora** • 1 ♀; 5 mi. west of Santa Ana; [30.56° N, 111.2° W]; 10 Jun. 1961; F.D. Parker leg.; UCDC • 1 ♂; Magdalena; 30.6271° N, 110.9623° W; 2 Sep. 1970; George E. Bohart, R.M. Bohart leg.; BBSL1100990 • 1 ♀; Rancho Puerta Blanca; 31.3119° N, 109.1133° W; 25 May 2008; Robert L. Minckley leg.; RLM SBV083948 • 1 ♀; Rancho San Bernardino; 31.3002° N, 109.2625° W; 4 Jul. 2002; Robert L. Minckley leg.; RLM SBV063736 • 1 ♀; Rancho San Bernardino; 31.3002° N, 109.2626° W; 14 Aug. 2002; A. Romero leg.; RLM SBV044128 • 1 ♀; Rancho San Bernardino; 31.3109° N, 108.9932° W; 8 Apr. 2006; Robert L. Minckley *et al.* leg.; RLM SBV057769 • 2 ♀♀; Rancho San Bernardino; 31.3297° N, 109.2559° W; 3 Apr. 2002; A. Romero leg.; RLM SBV016123, SBV016519 • 1 ♀; Rancho San Bernardino; 31.3321° N, 109.2702° W; 12 Oct. 2002; A. Romero leg.; RLM SBV045025 • 1 ♀; Rancho San Bernardino; 31.333° N, 109.265° W; 6 May 2001; Robert L. Minckley leg.; RLM SBV012468 • 1 ♀; Rancho San Bernardino; 31.3335° N, 109.2601° W; 24 Jul. 2001; Robert L. Minckley leg.; RLM SBV134655. – **Tamaulipas** • 6 ♀♀; 8 mi. NW of Nuevo Morelos; [22.62° N, 99.31° W]; 22 Jul. 1962; University of Kansas Mexico Expedition leg.; ex *Kallstroemia* sp.; SEMC • 1 ♀, 1 ♂; El Limón; [22.82° N, 99.01° W]; 17 Jun. 1953; PBL leg.; SEMC • 1 ♀; Tampico; [22.23° N, 97.86° W]; 26 Mar. 1951; SEMC.

UNITED STATES – **Arizona** • 1 ♀; Cochise Co., Rancho San Bernardino; 31.3378° N, 109.2622° W; 5 Sep. 2001; Robert L. Minckley leg.; RLM SBV139207 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3345° N, 109.2524° W; 11 Jul. 2001; Robert L. Minckley leg.; RLM SBV133322 •

1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3357° N, 109.2737° W; 6 Apr. 2006; Robert L. Minckley *et al.* leg.; RLM SBV056611 • 1 ♀; *ibid.*; 22 Apr. 2007; Robert L. Minckley leg.; RLM SBV072889 • 1 ♀; Cochise Co., San Bernardino National Wildlife Refuge; 31.3369° N, 109.2436° W; 31 Jul. 2004; A. Romero leg.; RLM SBV055730 • 7 ♀♀; Maricopa Co., 1100 W Mission Drive, Chandler; 33.346° N, 111.8599° W; elev. 367 m; 27 Mar. 2017; S.J. Hall *et al.* leg.; ASUHIC 0112711, 0112715, 0112716, 0112719, 0112722, 0112723, 0113166 • 1 ♂; *ibid.*; 27 Mar. 2017; S.J. Hall *et al.* leg.; ASUHIC 112724 • 2 ♀♀; Maricopa Co., 115 E Country Gables Drive, Phoenix; 33.6223° N, 112.0718° W; elev. 412 m; 12 Apr. 2017; S.J. Hall *et al.* leg.; ASUHIC 0113542, 0113543 • 2 ♀♀; *ibid.*; 18 May 2017; S.J. Hall *et al.* leg.; ASUHIC 0113105, 0113107 • 6 ♀♀; Maricopa Co., 1414 E Libra Drive, Tempe; 33.3656° N, 111.9163° W; elev. 365 m; 3 May 2017; S.J. Hall *et al.* leg.; ASUHIC 0112609, 0112610, 0112612, 0112614, 0112616, 0112729 • 5 ♂♂; *ibid.*; 3 May 2017; S.J. Hall *et al.* leg.; ASUHIC 0112453, 0112454, 0112617, 0112618, 0112730 • 1 ♂; *ibid.*; 6 Jun. 2017; S.J. Hall *et al.* leg.; ASUHIC 113271 • 1 ♀; Maricopa Co., 1535 N Home Unit 58, Mesa; 33.444° N, 111.8116° W; elev. 382 m; 29 Mar. 2017; S.J. Hall *et al.* leg.; ASUHIC 113112 • 3 ♀♀; Maricopa Co., 1615 E Fremont Drive, Tempe; 33.3823° N, 111.9128° W; elev. 361 m; 4 May 2017; S.J. Hall *et al.* leg.; ASUHIC 0114780, 0114783, 0114784 • 3 ♀♀; Maricopa Co., 1738 E Palmcroft Drive, Tempe; 33.4044° N, 111.9099° W; elev. 361 m; 26 Apr. 2017; S.J. Hall *et al.* leg.; ASUHIC 0113357, 0113358, 0113359 • 10 ♀♀; *ibid.*; 16 May 2017; S.J. Hall *et al.* leg.; ASUHIC 0113365, 0113367, 0113369, 0113371, 0113372, 0113373, 0113374, 0113375, 0113376, 0113378 • 10 ♂♂; *ibid.*; 16 May 2017; S.J. Hall *et al.* leg.; ASUHIC 0113381, 0113382, 0113383, 0113386, 0113389, 0113391, 0113394, 0113395, 0113397, 0113399 • 8 ♀♀; Maricopa Co., 1863 E Geneva Drive, Tempe; 33.3945° N, 111.9058° W; elev. 362 m; 3 Apr. 2017; S.J. Hall *et al.* leg.; ASUHIC 0112653, 0112654, 0112655, 0112657, 0112659, 0112660, 0112661, 0112662 • 10 ♀♀; *ibid.*; 26 Apr. 2017; S.J. Hall *et al.* leg.; ASUHIC 0112665, 0112666, 0112667, 0112668, 0112669, 0112672, 0112674, 0112677, 0112678, 0113111 • 6 ♂♂; *ibid.*; 26 Apr. 2017; S.J. Hall *et al.* leg.; ASUHIC 0112679, 0112680, 0112681, 0112682, 0112683, 0112685 • 3 ♀♀; Maricopa Co., 1926 E Calle De Caballos, Tempe; 33.3401° N, 111.9069° W; elev. 362 m; 4 Apr. 2017; S.J. Hall *et al.* leg.; ASUHIC 0113109, 0113158, 0113160 • 3 ♀♀; *ibid.*; 10 May 2017; S.J. Hall *et al.* leg.; ASUHIC 0113143, 0113147, 0113149 • 13 ♂♂; *ibid.*; 10 May 2017; S.J. Hall *et al.* leg.; ASUHIC 0112920, 0113183, 0113185, 0113186, 0113188, 0113189, 0113190, 0113191, 0113192, 0113194, 0113195, 0113198, 0113199 • 13 ♀♀; Maricopa Co., 2031 S Sierra Vista Drive, Tempe; 33.406° N, 111.9308° W; elev. 357 m; 3 May 2017; S.J. Hall *et al.* leg.; ASUHIC 0112459, 0112460, 0112734, 0112735, 0112736, 0112737, 0112738, 0112739, 0112740, 0112743, 0112744, 0112745, 0112747 • 2 ♀♀; Maricopa Co., 2302 E Earll Drive, Phoenix; 33.4837° N, 112.0322° W; elev. 347 m; 4 May 2017; S.J. Hall *et al.* leg.; ASUHIC 0113554, 0113556 • 2 ♂♂; *ibid.*; 4 May 2017; S.J. Hall *et al.* leg.; ASUHIC 0113604, 0113605 • 1 ♀; Maricopa Co., 2721 E Downing Circle, Mesa; 33.4287° N, 111.7723° W; elev. 390 m; 19 Apr. 2017; S.J. Hall *et al.* leg.; ASUHIC 113168 • 5 ♂♂; *ibid.*; 19 Apr. 2017; S.J. Hall *et al.* leg.; ASUHIC 0112586, 0112753, 0113260, 0113592, 0113593 • 2 ♀♀; *ibid.*; 22 May 2017; S.J. Hall *et al.* leg.; ASUHIC 0113573, 0113575 • 1 ♂; *ibid.*; 22 May 2017; S.J. Hall *et al.* leg.; ASUHIC 113594 • 24 ♀♀; Maricopa Co., 2814 N 11<sup>th</sup> Avenue, Phoenix; 33.4801° N, 112.0868° W; elev. 335 m; 4 May 2017; S.J. Hall *et al.* leg.; ASUHIC 0113503, 0113505, 0113507, 0113508, 0113510, 0113511, 0113512, 0113513, 0113515, 0113516, 0113517, 0113518, 0113519, 0113520, 0113521, 0113523, 0113524, 0113526, 0113528, 0113529, 0113531, 0113532, 0113536, 0113540 • 11 ♂♂; *ibid.*; 4 May 2017; S.J. Hall *et al.* leg.; ASUHIC 0113579, 0113580, 0113581, 0113582, 0113583, 0113584, 0113585, 0113586, 0113587, 0113590, 0113591 • 28 ♀♀; *ibid.*; 22 May 2017; S.J. Hall *et al.* leg.; ASUHIC 0112823, 0112826, 0112827, 0112828, 0112829, 0112830, 0112831, 0112832, 0112833, 0112835, 0112836, 0112840, 0112844, 0112845, 0112846, 0112847, 0112848, 0112849, 0112850, 0112851, 0112852, 0112855, 0112856, 0112857, 0112858, 0112873, 0113577, 0113825 • 22 ♂♂; *ibid.*; 22 May 2017; S.J. Hall *et al.* leg.; ASUHIC 0112447, 0112461, 0112574, 0112575, 0112576, 0112577, 0112579, 0112583, 0112862, 0112863, 0112864, 0112865, 0112866, 0112868, 0112869, 0112870, 0112871, 0112872, 0112993, 0113596, 0113597, 0113598 • 2 ♀♀; Maricopa Co., 302 E Fairmont Drive, Tempe; 33.3964° N, 111.9346° W; elev. 358 m; 30 Mar. 2017; S.J. Hall *et al.*

leg.; ASUHC 0113446, 0113450 • 5 ♀♀; *ibid.*; 27 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 0113478, 0113481, 0113486, 0113489, 0113492 • 1 ♂; *ibid.*; 27 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 113607 • 6 ♀♀; Maricopa Co., 3346 E Downing Street, Mesa; 33.4293° N, 111.7585° W; elev. 395 m; 3 May 2017; S.J. Hall *et al.* leg.; ASUHC 0112590, 0112591, 0112593, 0112594, 0112704, 0112705 • 1 ♂; *ibid.*; 3 May 2017; S.J. Hall *et al.* leg.; ASUHC 112596 • 1 ♀; *ibid.*; 22 May 2017; S.J. Hall *et al.* leg.; ASUHC 112597 • 3 ♀♀; Maricopa Co., 7 W Erie Drive, Tempe; 33.3968° N, 111.9402° W; elev. 357 m; 18 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 0112703, 0113496, 0113497 • 3 ♀♀; *ibid.*; 11 May 2017; S.J. Hall *et al.* leg.; ASUHC 0112448, 0113173, 0113174 • 1 ♀; *ibid.*; 16 May 2017; S.J. Hall *et al.* leg.; ASUHC 112702 • 1 ♂; *ibid.*; 16 May 2017; S.J. Hall *et al.* leg.; ASUHC 113498 • 7 ♀♀; Maricopa Co., 8201 E Windsor Avenue, Scottsdale; 33.4783° N, 111.9038° W; elev. 373 m; 19 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 0113558, 0113559, 0113560, 0113561, 0113565, 0113566, 0113569 • 3 ♂♂; *ibid.*; 19 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 0113600, 0113601, 0113602 • 24 ♀♀; *ibid.*; 11 May 2017; S.J. Hall *et al.* leg.; ASUHC 0112446, 0112598, 0112601, 0112602, 0112603, 0113115, 0113117, 0113118, 0113119, 0113121, 0113122, 0113123, 0113124, 0113125, 0113127, 0113128, 0113129, 0113131, 0113132, 0113134, 0113135, 0113136, 0113139, 0113576 • 12 ♂♂; *ibid.*; 11 May 2017; S.J. Hall *et al.* leg.; ASUHC 0112600, 0112606, 0113133, 0113175, 0113176, 0113177, 0113178, 0113179, 0113180, 0113181, 0113182, 0113606 • 3 ♀♀; Maricopa Co., 8433 E Palm Lane, Scottsdale; 33.4686° N, 111.899° W; elev. 369 m; 19 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 0113544, 0113550, 0113552 • 14 ♀♀; *ibid.*; 16 May 2017; S.J. Hall *et al.* leg.; ASUHC 0112622, 0112625, 0112626, 0112628, 0112630, 0112632, 0112638, 0112639, 0112642, 0112644, 0112645, 0112649, 0112650, 0112651 • 11 ♀♀; Maricopa Co., 862 E 9<sup>th</sup> Place, Mesa; 33.4321° N, 111.812° W; elev. 381 m; 11 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 0112687, 0112688, 0112689, 0112690, 0112691, 0112693, 0112694, 0112695, 0112696, 0112697, 0112698 • 1 ♂; *ibid.*; 11 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 112699 • 1 ♀; Maricopa Co., Marquahala; [33.8° N, 113.3° W]; 15 Sep. 1979; J. Haworth, G.D. Butler leg.; UAIC • 1 ♀; Maricopa Co., Mountain View Park; 33.5787° N, 112.0799° W; elev. 401 m; 7 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 112898 • 1 ♀; *ibid.*; 18 May 2017; S.J. Hall *et al.* leg.; ASUHC 112932 • 1 ♀; Maricopa Co., Papago Park; 33.4571° N, 111.9424° W; elev. 391 m; 30 Mar. 2017; S.J. Hall *et al.* leg.; ASUHC 113239 • 2 ♀♀; *ibid.*; 3 May 2017; S.J. Hall *et al.* leg.; ASUHC 0112473, 0112475 • 1 ♂; Maricopa Co., Phoenix; [33.4° N, 112.1° W]; May–Jun. 2014; T.M. Onuferko leg.; WRME 518958 • 4 ♀♀, 4 ♂♂; Maricopa Co., Phoenix, Cotton Research Center; [33.404° N, 111.988° W]; 20–21 Sep. 1979; G.D. Butler leg.; ex cotton; UAIC • 1 ♀; Maricopa Co., South Mountain Park; 33.3565° N, 111.9891° W; elev. 406 m; 12 Apr. 2017; S.J. Hall *et al.* leg.; ASUHC 112773 • 1 ♂; Pima Co., Tucson; [32.2° N, 110.9° W]; 27 Jun. 1954; G.D. Butler leg.; ex alfalfa; UAIC • 1 ♀; *ibid.*; 19 Mar. 1955; G.D. Butler leg.; ex *Lesquerella gordonii*; UAIC • 1 ♂; *ibid.*; 22–25 Apr. 1962; G.D. Butler leg.; UAIC • 1 ♂; *ibid.*; 6 Jul. 1962; G.D. Butler leg.; ex cotton; UAIC • 2 ♂♂; Santa Cruz Co., Patagonia; [31.54° N, 110.76° W]; 10 Aug. 1958; F.G. Werner leg.; UAIC • 1 ♀; Casa Grande; [32.88° N, 111.76° W]; 18 Jul. 1956; C. Williams leg.; ex alfalfa; UAIC • 1 ♀; Coolidge; [32.98° N, 111.52° W]; 23 Feb. 1956; G.D. Butler leg.; UAIC • 1 ♂; Glendale; [33.54° N, 112.19° W]; 21 Aug. 1956; C. Williams leg.; ex cotton; UAIC. – **California** • 1 ♀, 3 ♂♂; Imperial Co., Algodones Dunes, 1 km SW of Wash Road at 11.3 km SE of Highway 78; 32.9235° N, 114.9904° W; elev. 111 m; 18–22 Oct. 2012; T.J. Zavortink leg.; UCDC • 1 ♀; Imperial Co., Algodones Dunes, 1 km SW of Wash Road at 11.3 km SE of Highway 78; 32.9236° N, 114.9904° W; elev. 113 m; 8–12 Sep. 2014; Z. Khouri, T.J. Zavortink leg.; UCDC • 1 ♂; *ibid.*; 9–18 Oct. 2014; T.J. Zavortink leg.; UCDC • 1 ♀; Riverside Co., Deep Canyon alluvial outwash; 33.6783° N, 116.3717° W; elev. 200 m; 4 Jun. 2002; M.E. Irwin leg.; BBSL FDP151772 • 1 ♂; Riverside Co., Palm Springs; 33.6796° N, 116.548° W; 14–18 Apr. 2014; F.D. Parker, T.D. McIntyre leg.; BBSL FDP145682. – **Texas** • 1 ♂; Presidio Co., Marfa; [30.31° N, 104.02° W]; elev. 1463 m; 29 Jul. 2001; W.D. Edmonds leg.; TAMU-ENTO X1297276.

## Range

Tropics of eastern and western Mexico, north to southern Arizona (Fig. 53).



**Floral hosts**

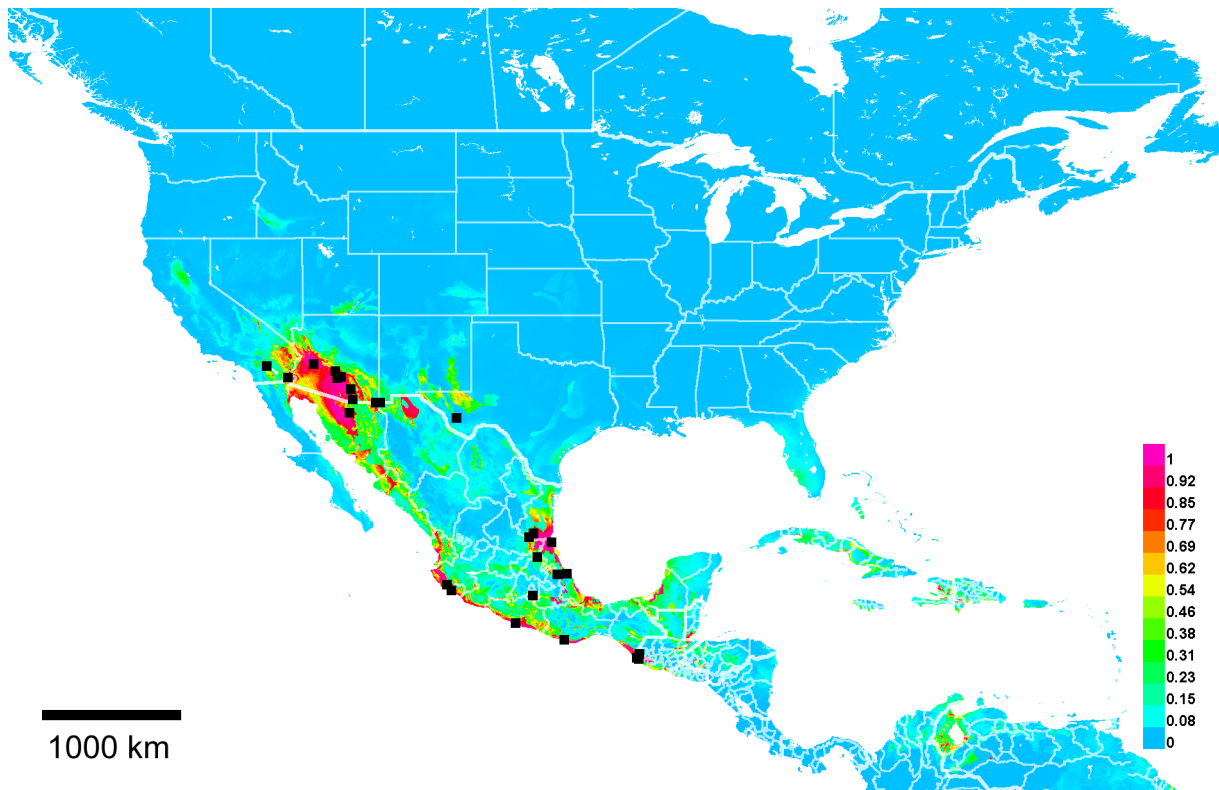
BRASSICACEAE: *Physaria*: *P. gordonii* • FABACEAE: *Medicago*: *M. sativa* • MALVACEAE: *Gossypium* • PAPAVERACEAE: *Argemone*: *A. mexicana* L.

**DNA barcodes**

Twenty-three confirmed sequences available (BOLD process IDs: BBLEG172-17, DLIII133-19, NCBEE340-21, NCBEE344-21, NCBEE345-21, NCBEE346-21, NCBEE351-21, NCBEE353-21, NCBEE354-21, NCBEE355-21, NCBEE356-21, NCBEE358-21, NCBEE359-21, NCBEE360-21, NCBEE362-21, NCBEE372-21, NCBEE376-21, NCBEE377-21, NCBEE378-21, NCBEE379-21, NCBEE380-21, NCBEE381-21, NCBEE382-21). There is a moderate amount of divergence within these sequences (0.79% maximum intraspecific p-distance). They are closest in terms of p-distance to *L. carlinvillense* (1.07% minimum interspecific p-distance). One fixed nucleotide substitution distinguishes *L. pseudotegulare* from all other Nearctic species of the *L. gemmatum* complex: 255(T) (Supp. file 2).

**Comments**

Specimens from the Sonoran Desert usually have the apical rims of T1–T2 as distinctly punctate as the discs (except in the middle of the rim of T1), while Neotropical specimens usually have the apical rims of T1–T2 indistinctly punctate or impunctate. It is conceivable that the Sonoran and Neotropical populations are two different species. However, DNA barcodes do not distinguish specimens from Arizona, Jalisco, Puebla, or Chiapas, a few Sonoran specimens lack punctures on the rims of T1–T2 (and vice versa), and no other morphological differences between populations can be found. Currently, there is insufficient evidence to support a two-species hypothesis.



**Fig. 53.** Georeferenced collection records of *Lasioglossum (D.) pseudotegulare* (Cockerell, 1896) (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence.

The record of *L. pseudotegulare* in De Luca *et al.* (2019) was misidentified by J. Gardner and is in fact a *L. gaudiale*.

***Lasioglossum (Dialictus) puteulanum* Gibbs, 2009**

Figs 54–56, 92A, 101A, 118A

*Lasioglossum (Dialictus) puteulanum* Gibbs, 2009a: 25 (holotype, ♀, deposited in PCYU, examined).

*Lasioglossum (Dialictus) puteulanum* – Gibbs 2011: 25, 32 (key to species), 159 (review).

**Diagnosis**

Females of *L. puteulanum* have the tegula relatively small (reaching but not exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin weakly concave, and sparsely punctate (IS = 1–2 PD); face relatively long (length/width ratio usually >0.83); frons reticulate-punctate, without even narrow shiny interspaces between punctures; metapostnotum with coarse, anastomosing rugae, shiny in basal half; mesepisternum strongly imbricate to rugulose with crowded, indistinct punctures (IS = 0 PD); T3 with tomentum limited to basolateral patches; and head and mesosoma usually blue-green to deep blue.

Females of *L. puteulanum* are most similar to those of *L. helianthi*, *L. lepidii*, and *L. tegulare*, all of which have the face shorter (length/width ratio usually ≤0.83) and head and mesosoma usually blue-green to olive green. In addition, females of *L. helianthi* have the T3 disc with sparse tomentum throughout, *L. lepidii* have the frons and mesepisternum with very dense (IS <0.5 PD) but distinctly separated punctures, the frons appearing smooth and shiny, and *L. tegulare* have the tegula more densely punctate (IS ≤1 PD).

Males of *L. puteulanum* have the tegula relatively small (as in the female); mesoscutum relatively coarsely and moderately densely punctate (IS = 1–2 PD); metapostnotum shiny with strong subparallel rugae; disc of T2 uniformly densely punctate (IS ≤1 PD) including premarginal line; face with uniformly sparse tomentum below eye emargination; and head and mesosoma usually blue to blue-green.

Males of *L. puteulanum* are most similar to those of *L. ellisiae*, *L. helianthi*, *L. lepidii*, and *L. tegulare*. Males of *L. ellisiae* and *L. helianthi* have the mesoscutum usually more finely and densely punctate (IS ≤1 PD). Males of *L. ellisiae* and *L. lepidii* have the disc of T2 more finely and sparsely punctate in apical half (IS = 1–2 PD), not strongly contrasting with apical rims across the premarginal line. Males of *L. tegulare* have the tegula more densely punctate (IS ≤1 PD), face with sparser tomentum more limited to paraocular area, and head and mesosoma usually greener.

**Etymology**

The specific epithet '*puteulanum*' is a medieval Latin adjective meaning 'blue'.

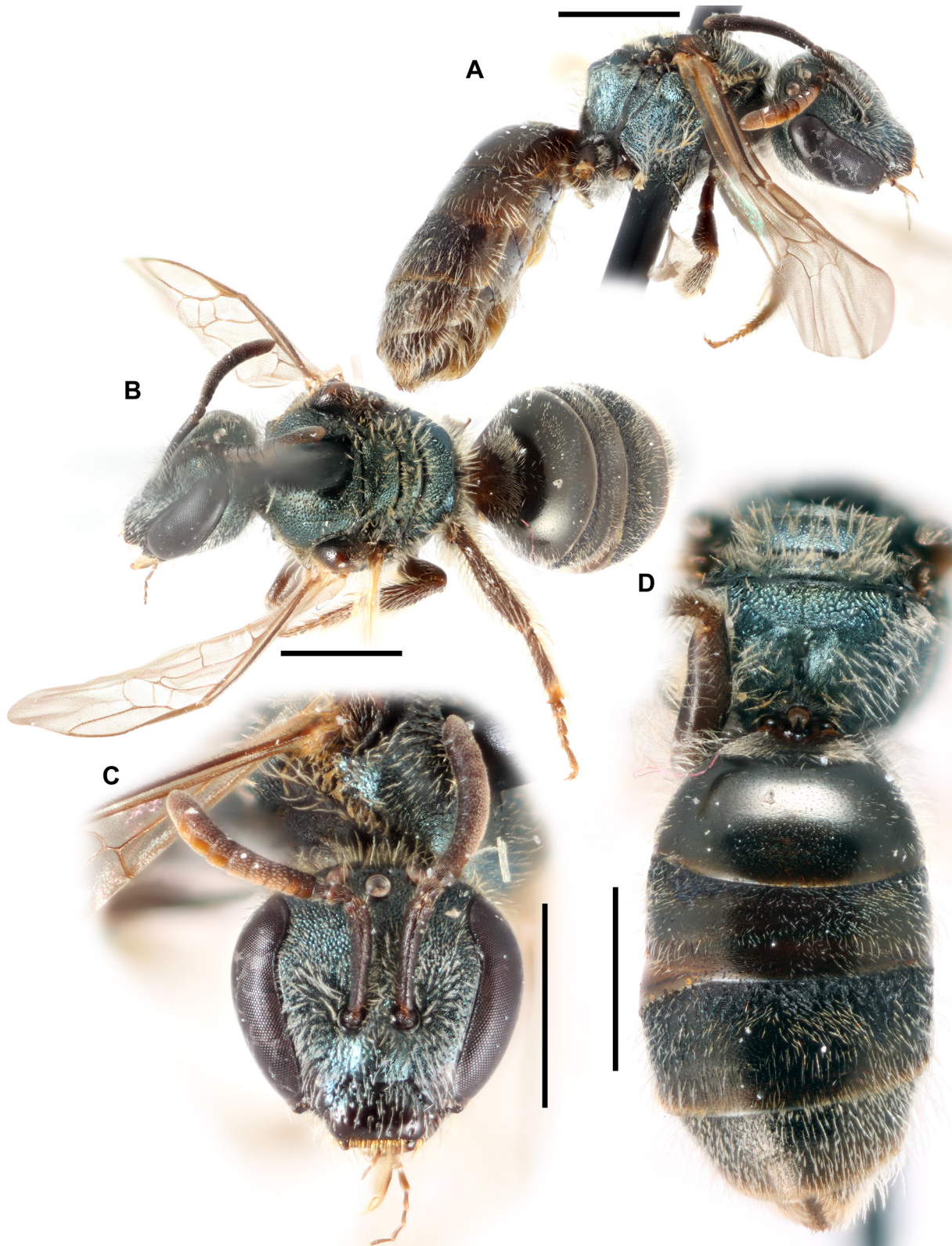
**Material examined**

**Holotype**

UNITED STATES – **Florida** • ♀; Palm Beach Co.; 26.34889° N, 80.2756° W; 25 Jan. 2005; S.W. Droege leg.; PCYU.

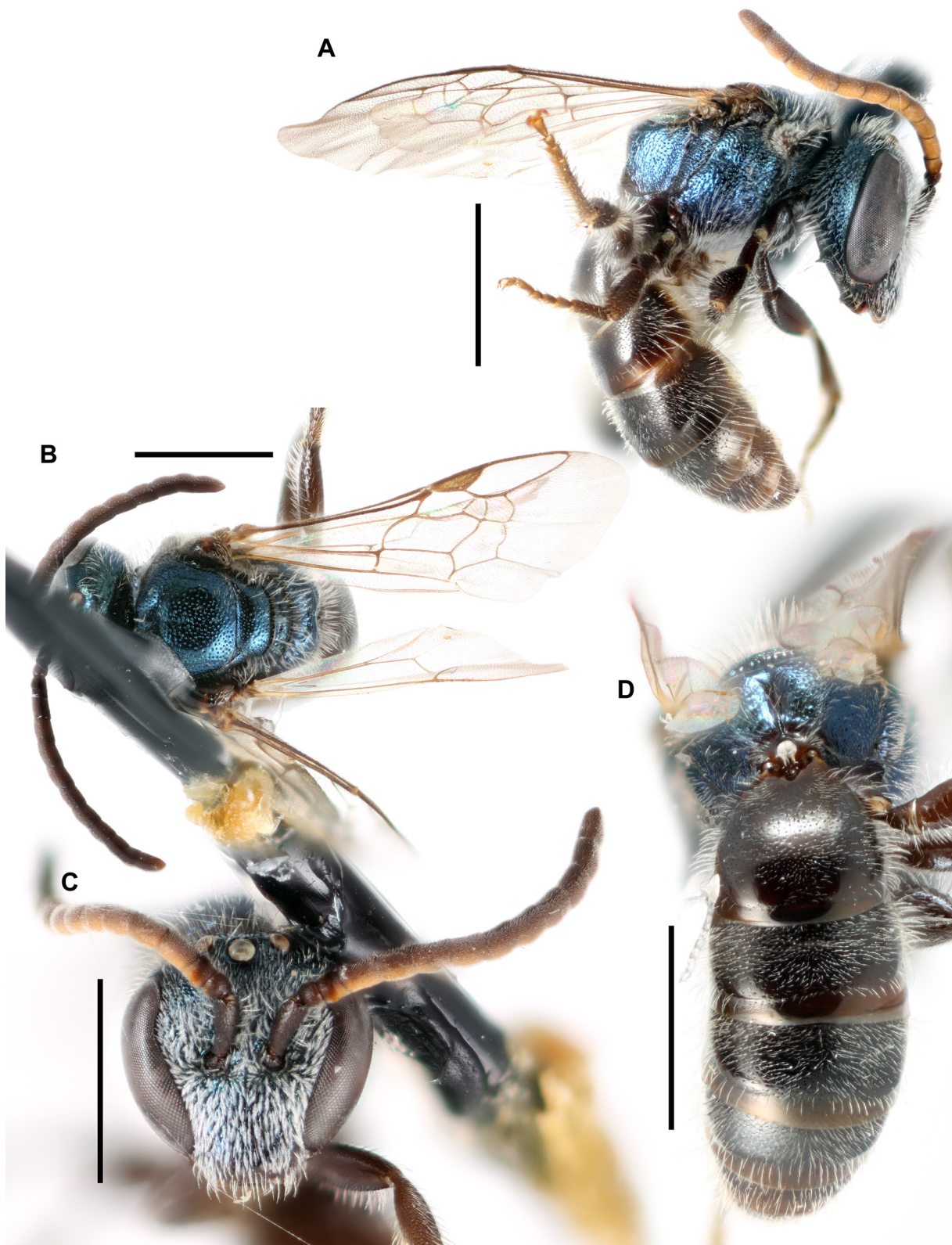
**Other material**

UNITED STATES – **Alabama** • 1 ♀; Dale Co., Fort Rucker Mil. Res.; [31.3° N, 85.7° W]; 20 Apr. 1983; R. Turnbow leg.; TAMU-ENTO X1313238. – **Florida** • 1 ♀; Alachua Co.; [29.7° N, 82.4° W]; 15 Apr. 1956; R.A. Morse leg.; BBSL700637 • 4 ♀♀, 1 ♂; Broward Co., Broward Beach State Park, Fort Lauderdale; [26.08° N, 80.11° W]; 9 Dec. 1985; G.C. Eickwort leg.; CUIC • 1 ♂; Broward Co., Fort



**Fig. 54.** *Lasioglossum (D.) puteulanum* Gibbs, 2009, ♀, holotype (PCYU). A. Lateral habitus. B. Dorsal habitus. C. Face. D. Metasoma and propodeum. Scale bars = 1 mm.





**Fig. 55.** *Lasioglossum (D.) puteulanum* Gibbs, 2009, ♂. A. Lateral habitus. B. Dorsal habitus. C. Face. D. Metasoma and propodeum. Scale bars = 1 mm.

Lauderdale; [26.12° N, 80.14° W]; 6 Mar. 1979; P.W. Kovarik leg.; TAMU-ENTO X1393296 • 15 ♀♀; Broward Co., Hallandale Beach; [25.98° N, 80.15° W]; 10 Dec. 1985; G.C. Eickwort leg.; CUIC • 7 ♀♀; Broward Co., Hollywood; [26.01° N, 80.15° W]; 13 Dec. 1985; C.D. Michener leg.; SEMC • 3 ♀♀; Broward Co.; 26.1071° N, 80.2637° W; 27 Jan. 2005; S.W. Droege leg.; PCYU USGS-DRO 032175, 032210, 032211 • 2 ♂♂; *ibid.*; 27 Jan. 2005; S.W. Droege leg.; PCYU USGS-DRO 031971, 032048 • 7 ♀♀; Citrus Co., Lecanto; [28.85° N, 82.49° W]; 10 Apr. 1969; G.E. Bohart leg.; BBSL700695, BBSL700699, BBSL700700, BBSL700701, BBSL700702, BBSL700703, BBSL700704 • 1 ♀, 1 ♂; Collier Co., Collier-Seminole State Park; [25.98° N, 81.6° W]; 25–26 May 1978; N.F. and J.B. Johnson leg.; CUIC • 1 ♂; *ibid.*; 13 Apr. 1986; G.C. Eickwort leg.; SEMC • 1 ♀; Dade Co., Matheson Hammock County Park; [25.67° N, 80.27° W]; 20–21 Mar. 1987; Eickwort and Spielholz leg.; CUIC • 1 ♀; Dade Co., Upper Matecumbe Key; [24.92° N, 80.63° W]; 28 Jun. 1970; W.F. Chamberlain leg.; TAMU-ENTO X1403133 • 2 ♀♀; Franklin Co., coast 10 mi. S of Panacea; [29.92° N, 84.51° W]; 7 Apr. 1964; G.C. Eickwort leg.; SEMC • 1 ♀; Hendry Co.; 26.3121° N, 81.2354° W; 27 Jan. 2005; S.W. Droege leg.; PCYU USGS-DRO 031791 • 1 ♀; Highlands Co., Archbold Biological Station, Lake Placid; [27.18° N, 81.35° W]; 2 Apr. 1984; B. Alexander leg.; CUIC • 1 ♀, 3 ♂♂; Highlands Co., Highlands Hammock State Park; [27.47° N, 81.55° W]; 14 Apr. 1964; G.C. Eickwort leg.; SEMC • 2 ♀♀; Lee Co.; 26.2879° N, 81.8309° W; 7–8 Nov. 2016; A. Abbate leg.; WRME 0377287, 0377288 • 1 ♀; Leon Co., Tall Timbers Research Station, 3 mi. W of Iamonia; [30.66° N, 84.21° W]; 30 Mar. 1986; B. Alexander leg.; CUIC • 3 ♀♀; Levy Co., Chiefland; [29.47° N, 82.86° W]; 12 Apr. 1969; G.E. Bohart leg.; BBSL700694, BBSL700696, BBSL700705 • 1 ♀; Liberty Co., Torreya State Park; [30.57° N, 84.95° W]; 6 Apr. 1964; G.C. Eickwort leg.; SEMC • 13 ♀♀; Martin Co.; 27.083° N, 80.1442° W; 4 Jun. 2007; S.W. Droege leg.; PCYU • 8 ♀♀; Martin Co.; 27.1008° N, 80.152° W; 4 Jun. 2007; S.W. Droege leg.; PCYU • 2 ♂♂; Martin Co.; 27.081° N, 80.1416° W; 4 Jun. 2007; S.W. Droege leg.; PCYU • 1 ♂; Monroe Co., Big Pine Key; [24.69° N, 81.37° W]; 10 Apr. 1966; F.W. Mead leg.; *ex* tidal flat; BBSL700634 • 1 ♂; Monroe Co., Big Pine Key, Key Deer National Wildlife Refuge; [24.73° N, 81.39° W]; 25 Mar. 1987; Eickwort and Spielholz leg.; CUIC • 3 ♂♂; Monroe Co., Key Largo (city); [25.09° N, 80.44° W]; 22 Mar. 1987; Eickwort and Spielholz leg.; CUIC • 1 ♀; Monroe Co., Key Largo, Pennekamp State Park; [25.125° N, 80.406° W]; 22 Mar. 1987; Eickwort and Spielholz leg.; CUIC • 1 ♀; Monroe Co., Middle Cape Sable, Everglades National Park; [25.27° N, 81.12° W]; 7 Apr. 1966; H.V. Weems Jr. leg.; *ex* *Bidens pilosa*; BBSL700636 • 1 ♂; Orange Co., UCF, Orlando; [28.6° N, 81.2° W]; 10 Jun. 1993; S.M. Fullerton leg.; UCFC 0 294 659 • 1 ♂; *ibid.*; 29 Jun. 1993; S.M. Fullerton leg.; UCFC 0 294 690 • 1 ♀; *ibid.*; 27 Oct. 1995; S.M. Fullerton leg.; UCFC 0 292 299 • 1 ♀; same collection data as for holotype; PCYU USGS-DRO 032341 • 4 ♂♂; Wakulla Co., 2 mi. N of Mack's Landing, Apalachicola National Forest; [30.12° N, 84.64° W]; 21 May 1981; G.C. Eickwort *et al.* leg.; CUIC • 1 ♀; Wakulla Co., Ochlockonee River State Park; [30° N, 84.48° W]; 21 May 1981; G.C. Eickwort *et al.* leg.; CUIC • 2 ♀♀; Big Coppet Key; [24.6° N, 81.66° W]; 21 Mar. 1959; G.R. Ferguson leg.; BBSL700697, BBSL700698 • 1 ♂; Big Pine Key; [24.69° N, 81.37° W]; 9 Jun. 1960; R.E. Woodruff leg.; BBSL700635 • 1 ♂; Brighton; [27.23° N, 81.1° W]; 19 Apr. 1937; J.C. Bradley leg.; CUIC • 1 ♂; Crescent City; [29.43° N, 81.51° W]; 1–3 May 1955; H.E. and M.A. Evans leg.; CUIC • 3 ♂♂; Gainesville; [29.65° N, 82.32° W]; 6 May 1955; H.E. and M.A. Evans leg.; CUIC • 1 ♀; Inverness; [28.84° N, 82.33° W]; C. Robertson leg.; INHS • 1 ♀; Orlando; [28.54° N, 81.38° W]; Mar. 1944; R. Bohart and G. Bohart leg.; BBSL700638 • 1 ♀; South Miami; [25.71° N, 80.29° W]; 8 Jan. 1927; S. Graenicher leg.; UCMC • 1 ♀; Westchester Miami; [25.75° N, 80.33° W]; 31 Aug. 2006; J.A. Genaro leg.; PCYU. – **Georgia** • 1 ♀; Chatham Co.; 32.1392° N, 81.1395° W; 23 Oct. 2009; W. Carver leg.; PCYU USGS-DRO 138903 • 1 ♀; Colquitt Co., Murphy; [31.07° N, 83.82° W]; 5 Apr. 1981; L.L. Pechuman leg.; CUIC • 2 ♀♀; Colquitt Co., Reed Bingham State Park; [31.17° N, 83.54° W]; 22 May 1981; G.C. Eickwort *et al.* leg.; CUIC • 1 ♀; *ibid.*; 23 May 1981; G.C. Eickwort *et al.* leg.; CUIC • 1 ♂; Bainbridge; [30.9° N, 84.58° W]; Jul. 1909; CUIC. – **Hawaii** • 3 ♀♀; Oahu Co., Hawaii Kai; 21.2839° N, 157.7152° W; 3–4 Mar. 2012; S.W. Droege leg.; WRME USGS-DRO 297263, 297265, 297267 • 1 ♀; Oahu Co., Hawaii Kai; 21.2927° N, 157.7162° W; 3–4 Mar. 2012; S.W. Droege leg.; WRME USGS-DRO 297340 • 2 ♀♀; Oahu Co., Pearl City; 21.3945° N, 157.9866° W; 2 Mar. 2012;



S.W. Droege leg.; WRME USGS-DRO 297050, 297051 • 1 ♀; Oahu Co., Waipio; 21.3734° N, 158.0008° W; 2 Mar. 2012; S.W. Droege leg.; WRME USGS-DRO 297210 • 4 ♀♀; Oahu Co.; 21.3416° N, 157.9013° W; 1 Mar. 2012; S.W. Droege leg.; WRME USGS-DRO 296832, 296836, 296840, 296844 • 3 ♀♀; Oahu Co.; 21.3375° N, 157.9016° W; 1 Mar. 2012; S.W. Droege leg.; WRME USGS-DRO 296778, 296790, 296793 • 1 ♂; *ibid.*; 1 Mar. 2012; S.W. Droege leg.; WRME USGS-DRO 296771 • 5 ♀♀; Oahu Co.; 21.3179° N, 157.8912° W; 1–2 Mar. 2012; S.W. Droege leg.; WRME USGS-DRO 297397, 297406, 297429, 297430, 297432 • 3 ♀♀; Oahu Co.; 21.3152° N, 157.89° W; 1–2 Mar. 2012; S.W. Droege leg.; WRME USGS-DRO 297496, 297500, 297501 • 5 ♀♀; Oahu Co.; 21.3119° N, 157.8879° W; 1–2 Mar. 2012; S.W. Droege leg.; WRME USGS-DRO 296887, 296888, 296890, 296891, 296892 • 4 ♀♀; Oahu Co.; 21.3034° N, 157.8785° W; 1–2 Mar. 2012; S.W. Droege leg.; WRME USGS-DRO 296930, 296963, 296971, 296972 • 1 ♀; Oahu Co.; 21.3213° N, 157.886° W; 1–2 Mar. 2012; S.W. Droege leg.; WRME USGS-DRO 297321 • 1 ♀; Oahu Co.; 21.2945° N, 157.6615° W; 3–4 Mar. 2012; S.W. Droege leg.; WRME USGS-DRO 297242 • 4 ♀♀; Oahu Co.; 21.2786° N, 157.7753° W; 3–4 Mar. 2012; S.W. Droege leg.; WRME USGS-DRO 297324, 297326, 297327, 297329 • 1 ♂; Oahu Co.; 21.6254° N, 157.9215° W; 7–8 Mar. 2012; S.W. Droege leg.; WRME USGS-DRO 297047. – **Mississippi** • 2 ♀♀; Jackson Co.; 30.3657° N, 88.7325° W; 4–5 Jun. 2005; S.W. Droege leg.; PCYU USGS-DRO 043857, 043858 • 2 ♀♀; Jackson Co.; 30.5297° N, 88.6942° W; 4–5 Jun. 2005; S.W. Droege leg.; PCYU USGS-DRO 044024, 044025 • 1 ♀; Jackson Co.; 30.4563° N, 88.7824° W; 4–5 Jun. 2005; S.W. Droege leg.; PCYU USGS-DRO 043950. – **North Carolina** • 1 ♀; Moore Co.; 35.2844° N, 79.314° W; 19 May 2006; S.W. Droege leg.; PCYU USGS-DRO 056825 • 1 ♂; Wake Co.; [35.8° N, 78.6° W]; 10 Jul. 1949; M.W. Wing leg.; CUIC • 1 ♂; Raleigh; [35.78° N, 78.64° W]; 16 Jul. 1948; M.W. Wing leg.; CUIC. – **South Carolina** • 1 ♀; Aiken Co., Savannah River Site; 4–5 May 2018; J. Ledvina leg.; WRME • 1 ♀; Aiken Co.; 33.3537° N, 81.6138° W; 27 Jun. 2013; WRME 0377355 • 1 ♀; Aiken Co.; 33.39° N, 81.5461° W; 16 Jul. 2013; WRME • 1 ♀; Aiken Co.; 33.3865° N, 81.6399° W; 3 Aug. 2013; WRME 0377294 • 1 ♀; Aiken Co.; 33.3869° N, 81.6368° W; 3 Aug. 2013; WRME • 1 ♀; Barnwell Co., Savannah River Site; 15–16 May 2016; S. Breland leg.; WRME • 2 ♀♀; Barnwell Co.; 33.1979° N, 81.5873° W; 4 Jul. 2013; WRME 0377353, 0377354 • 1 ♀; Charleston Co., James Island; [32.74° N, 79.96° W]; 28 Jun. 1950; W.F. Chamberlain leg.; TAMU-ENTO X1399629 • 1 ♂; *ibid.*; 28 Jun. 1950; W.F. Chamberlain leg.; TAMU-ENTO X1399590 • 1 ♂; Charleston Co., Sullivan’s Island; [32.76° N, 79.84° W]; 7 Jul. 1950; W.F. Chamberlain leg.; TAMU-ENTO X1360666 • 1 ♀; Chesterfield Co.; 34.6232° N, 80.18993° W; 18–19 May 2006; S.W. Droege leg.; PCYU USGS-DRO 057409 • 2 ♀♀; *ibid.*; 18–19 May 2006; S.W. Droege leg.; PCYU USGS-DRO 057409, 057415 • 1 ♀; Chesterfield Co.; 34.5036° N, 80.22485° W; 18–19 May 2006; S.W. Droege leg.; PCYU USGS-DRO 057184, 058098 • 1 ♂; Carolina Sandhills National Wildlife Refuge; 34.5597° N, 80.2561° W; 6 Sep. 2006; S.W. Droege leg.; PCYU USGS-DRO 062591 • 1 ♀; Carolina Sandhills National Wildlife Refuge; 34.547° N, 80.1766° W; 6–7 Sep. 2006; S.W. Droege leg.; PCYU USGS-DRO 066336. – **Tennessee** • 1 ♂; 4 Jun. 1918; CUIC.

### Range

Southeastern United States and Hawaii (Fig. 56).

### Floral hosts

ASTERACEAE: *Bidens*: *B. pilosa* L.

### DNA barcodes

Twenty confirmed sequences available (BOLD process IDs: BWTWO856-10, DIAL027-06, DIAL028-06, DIAL029-06, DIAL487-06, DIAL496-06, DIAL498-06, DIAL501-06, DIAL513-06, DIAL514-06, DIAL866-06, DLII393-07, DLII396-07, DLII398-07, DLII411-07, DLII435-07, DLII465-07, DLII472-07, DLII474-07, DLIII113-18). There is a moderate amount of divergence within these sequences (0.94% maximum intraspecific p-distance). They are closest in terms of p-distance to *L. tegulare* (0.31% minimum

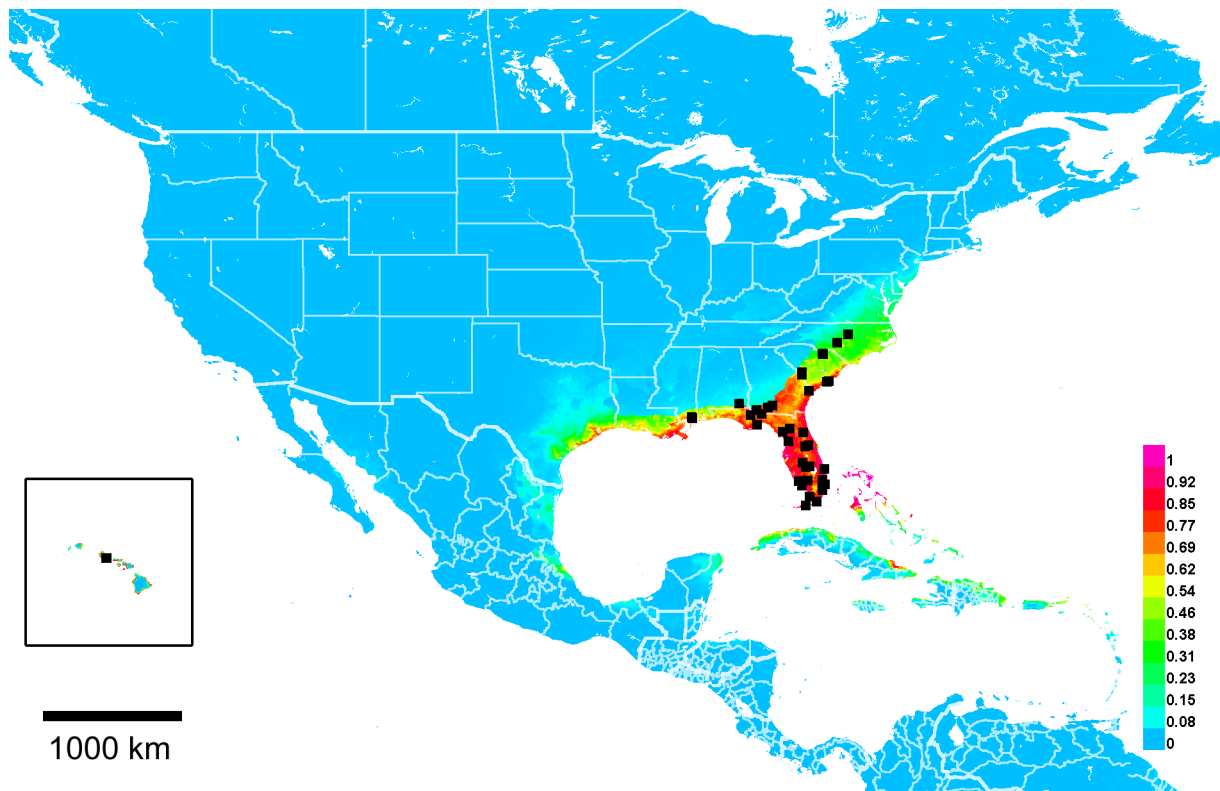


interspecific p-distance). No fixed nucleotide substitutions distinguish *L. puteulanum* from all other species of the *L. gemmatum* complex, but two fixed nucleotide substitutions distinguish it from the closely related *L. profundum* sp. nov. and *L. tegulare*: 339(C) and 609(T) (Supp. file 2).

### Comments

*Lasioglossum puteulanum* was previously only known from the southeastern United States. It was first reported from Hawaii by Tabor & Koch (2021), but has evidently existed there and gone undetected for some time previously. The specimens of *L. helianthi* from Magnacca *et al.* (2013) were examined and found to be a mixed series including some *L. puteulanum*, and a successful DNA barcode from one of these specimens confirmed the identification. How *L. puteulanum* could have been moved from the southeastern United States to Hawaii is not known. It seems to be a unique case, as the three other species of *L. (Dialictus)* introduced to Hawaii are all native to California.

The Alabama specimen recorded here is unusual in that it has only two branches on the metatibial spur, which is normally diagnostic for *L. carlinvillense*. Its identification was based on other characters and is somewhat tenuous.



**Fig. 56.** Georeferenced collection records of *Lasioglossum (D.) puteulanum* Gibbs, 2009 (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence. Because many coastal records lacked soil data, the model was generated without soil type as an environmental variable.

*Lasioglossum (Dialictus) rufodeludens* sp. nov.

urn:lsid:zoobank.org:act:D04BB5BC-FD13-4140-8449-9CA4A9A6C241

Figs 57–59, 76N

### Diagnosis

Females of *L. rufodeludens* sp. nov. have the tegula relatively small (maximum length half or less ITS and barely reaching posterior margin of mesoscutum in dorsal view if at all), yellow-orange, impunctate, and with inner posterior margin straight; mesoscutum and mesepisternum completely dull, tessellate to imbricate; postgena smooth, shiny or lineolate; T1 anterior slope shiny (sometimes weakly coriarius but not appearing dull), and metasoma red-orange.

Females of *L. rufodeludens* sp. nov. are most similar to those of *L. deludens* sp. nov., *L. ellisiae*, and *L. profundum* sp. nov. Females of *L. ellisiae* have the tegula at least sparsely punctate and the inner posterior margin sinuous, mesoscutum and mesepisternum posterior half often shiny, postgena lineate, and T1 anterior slope dull and coriarius. See the diagnosis for *L. deludens* for a comparative diagnosis between the other similar species.

Males of *L. rufodeludens* sp. nov. have the tegula relatively small (as in the female); mesoscutum tessellate and moderately densely punctate (IS = 1–2 PD); and face with dense tomentum up to eye emargination. They are most similar to those of *L. deludens* sp. nov. and *L. profundum* sp. nov. See the diagnosis for *L. deludens* for a comparative diagnosis between these three species.

Both sexes are also somewhat similar to those of *L. gemmatum* and *L. surianae*, which have the tegula at least obscurely punctate and are restricted to the Caribbean islands and Florida keys. Females of these species also have the mesepisternum shiny, and males have the face with tomentum limited to lower paraocular area.

### Etymology

The specific epithet ‘*rufodeludens*’ is a participle derived from the Latin adjective ‘*rufo*’ (red) plus the present participle ‘*deludens*’ (deceiving). It refers to this species’ red metasoma and its close similarity to *L. deludens* sp. nov. An appropriate translation would be the red deceiving sweat bee.

### Material examined

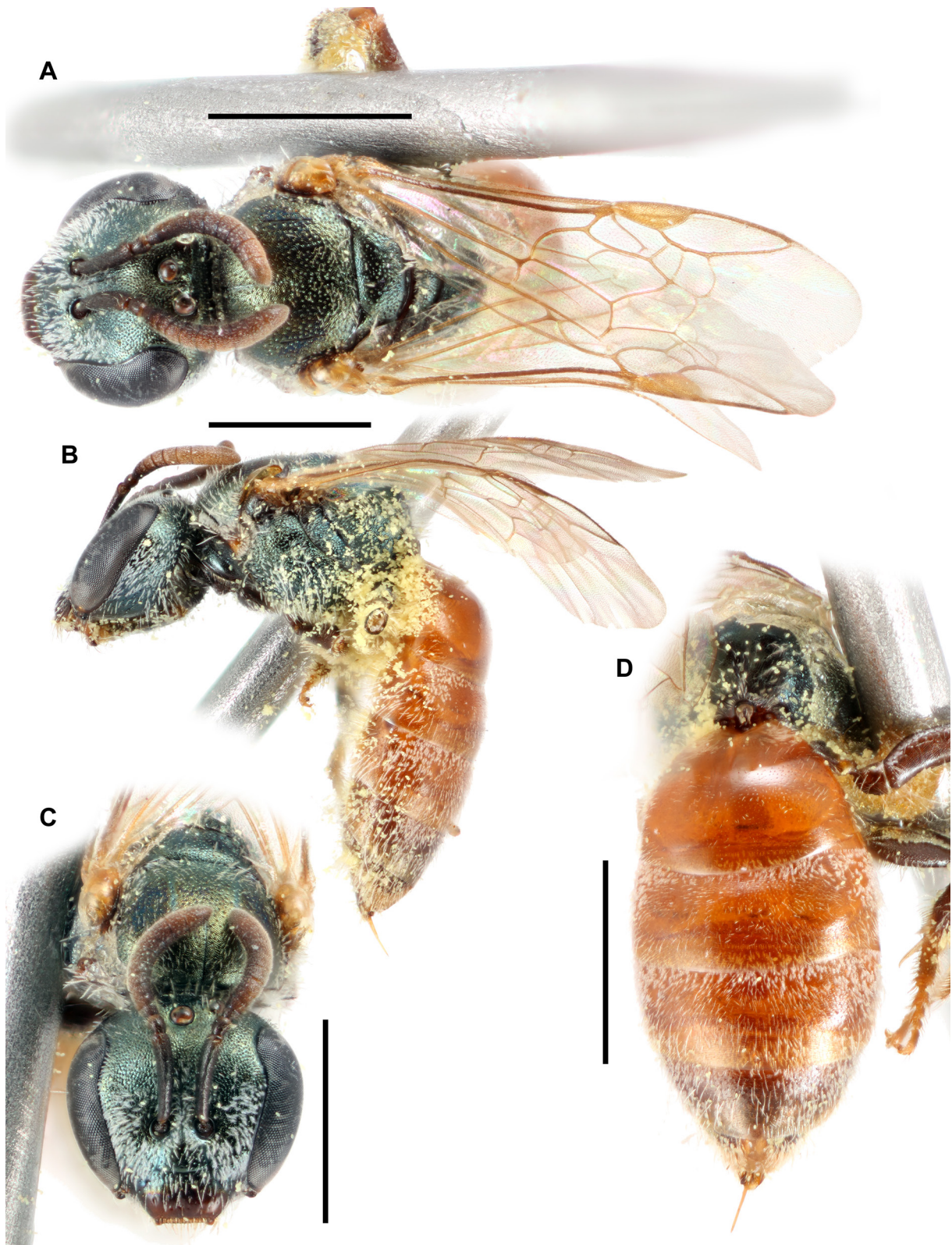
#### Holotype

UNITED STATES – Texas • ♀; Hidalgo Co., Bentsen Rio Grande State Park; 26.186° N, 98.374° W; 16 Mar. 2007; J.L. Neff leg.; ex *Salix nigra*; PCYU.

[Verbatim label: 32047 // TEXAS: Hidalgo Co. / Bentsen Rio Grande SP / 26.186° N 98.374° W / 16-iii-2007 J.L. Neff // on flowers of *Salix nigra* // CCDB-01566 H2 // *Lasioglossum (Dialictus) hunteri* det J.L. Neff 2008 // HOLOTYPE / *Lasioglossum (Dialictus) rufodeludens* Gardner and Gibbs]

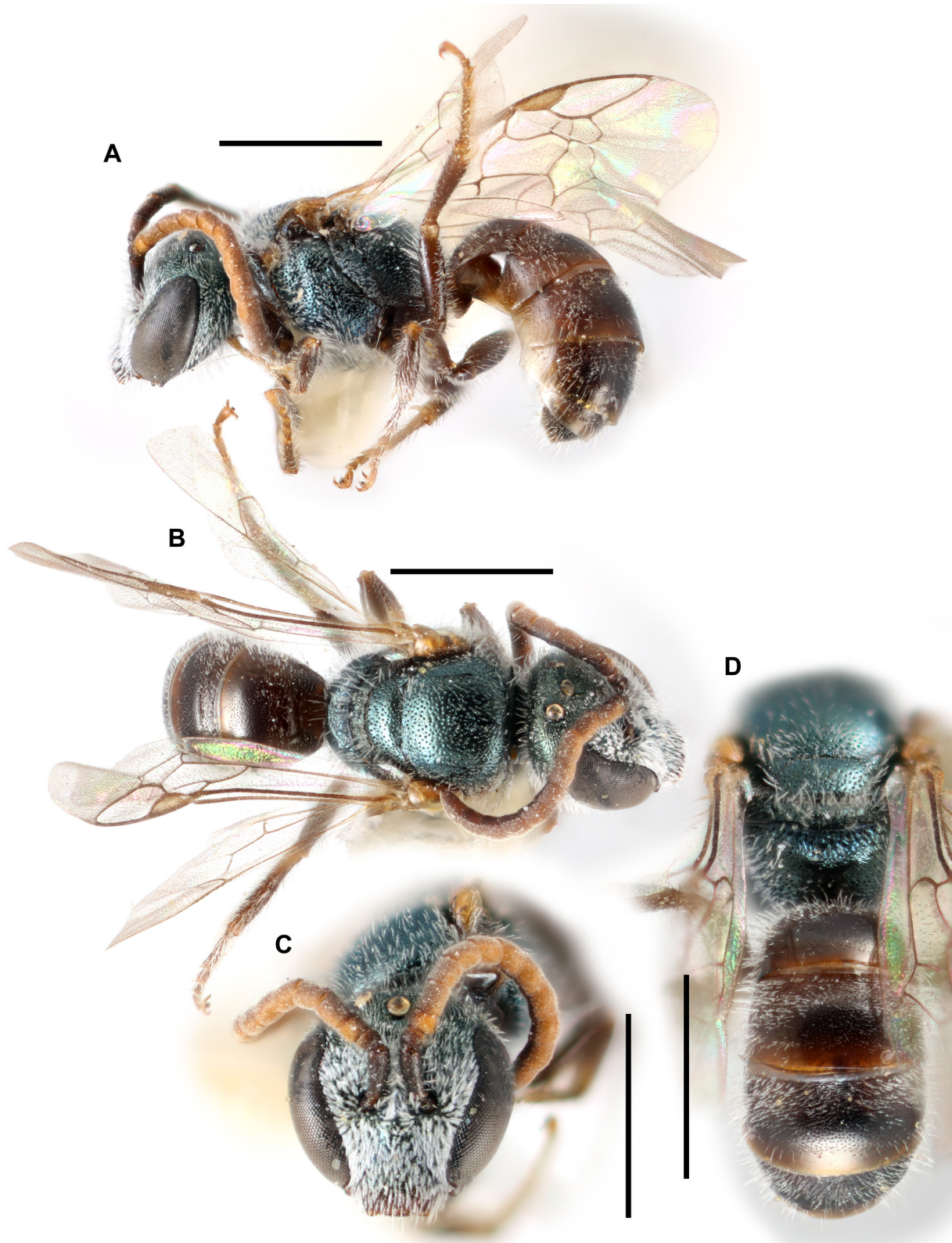
#### Paratypes

MEXICO – Nuevo Leon • 1 ♀, 4 ♂♂; 4 km S of Linares; [24.81° N, 99.55° W]; elev. 400 m; 22 Mar. 1991; R. Brooks, R. Leschen leg.; ex *Prosopis laevigata*; SEMC. – Tamaulipas • 1 ♂; 22 mi. S of Jiménez; [23.9° N, 98.48° W]; 15 Jun. 1953; University of Kansas Mexico Expedition leg.; ex *Lippia*; SEMC • 1 ♀; 8 mi. NE of San Fernando; [24.93° N, 98.06° W]; 27 Aug. 1954; SEMC • 1 ♀, 1 ♂; 8 mi. S of Jiménez; [24.1° N, 98.49° W]; 15 Jun. 1953; SEMC • 1 ♀; Jaumave, “El Chihue”; [23.4° N, 99.37° W]; 19 Oct. 1995; Larisa Loya leg.; BBSL1101050 • 1 ♀, 1 ♂; Jiménez; [24.22° N, 98.49° W]; 19 Jul. 1962; University of Kansas Mexico Expedition leg.; SEMC.



**Fig. 57.** *Lasioglossum (D.) rufodeludens* sp. nov., ♀, holotype (PCYU). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma. Scale bars = 1 mm.





**Fig. 58.** *Lasioglossum (D.) rufodeludens* sp. nov., ♂ (SEMC). A. Lateral habitus. B. Dorsal habitus. C. Face. D. Metasoma and propodeum. Scale bars = 1 mm.

UNITED STATES – Texas • 1 ♀; Eagle Pass; [28.71° N, 100.5° W]; 13 Nov. 1965; W.F. Chamberlain leg.; TAMU-ENTO X1389895.

## Description

### Female

COLOURATION. Head and mesosoma blue to olive green; clypeus apex black; labrum reddish brown; mandible orange with black base and red apex; flagellum black dorsally, brown ventrally. Pronotal lobe reddish brown; legs reddish brown with femur-tibia joints and tarsi orange; tegula orange; wing membrane lightly infuscated, veins with subcosta dark brown, otherwise brown. Metasoma orange with dark spiracular spots on T3–T4 and rims of terga and sterna broadly translucent.

PUBESCENCE. Body pile colour white. Tomentum dense on gena, pronotal collar and lobe, and space between pronotal lobe and tegula; sparse on paraocular area, T2–T3 basolaterally, and T4 throughout. Mesoscutum pubescence thin to moderately plumose. Wing setae dark, short and dense. Acarinarial fan complete, dense. T2 fringes sparse, T3 fringes sparse.

SURFACE SCULPTURE. Clypeus shiny, with punctures dense in basal third ( $IS \leq 1$  PD), large and irregularly sparse apically ( $IS < 2$  PD); supraclypeal area shiny, with punctures moderately dense ( $IS = 1-2$  PD); paraocular area imbricate around antenna socket, otherwise shiny, with punctures dense ( $IS < 1$  PD), sparser around antenna socket ( $IS \leq 1$  PD); frons shiny, with punctures fine, dense ( $IS < 1$  PD); vertex shiny, with punctures dense laterally ( $IS \leq 1$  PD), minute and sparse medially ( $IS = 2-4$  PD); gena shiny, with punctures absent; postgena lineolate, becoming shiny anteriorly. Tegula punctures absent; mesoscutum tessellate, with punctures dense ( $IS \leq 1$  PD), becoming sparser anteromedially ( $IS = 1-2$  PD); scutellum tessellate, becoming shiny submedially, with punctures dense marginally ( $IS < 1$  PD), moderately sparse submedially ( $IS = 1-2$  PD); metapostnotum shiny, with rugae strong, anastomosing, reaching posterior margin; preëpisternum areolate-rugulose; hypoepimeron weakly imbricate, with punctures dense ( $IS < 1$  PD); mesepisternum imbricate, with punctures dense ( $IS < 1$  PD); metepisternum weakly rugulose; propodeum lateral surface rugulose anteriorly, tessellate posteriorly, posterior surface tessellate. T1 anterior slope shiny, disc shiny, with punctures moderately sparse ( $IS = 1-2$  PD), absent in large subapicolateral boss and on rim medially; T2 disc shiny, with punctures moderately dense ( $IS = 1-2$  PD), apical rim weakly coriarius, with punctures minute, sparse ( $IS = 2-4$  PD).

STRUCTURE. Face length/width ratio 0.81 ( $\pm 0.01$  SD); clypeus apicolateral denticles low rounded knobs; gena/eye width ratio 0.89 ( $\pm 0.07$  SD). Pronotal angle slightly obtuse, nearly right-angled; intertegular span 0.77 ( $\pm 0.05$  SD) mm; mesoscutum length/width ratio 0.86 ( $\pm 0.03$  SD); mesoscutum/scutellum length ratio 2.78 ( $\pm 0.25$  SD); scutellum/metanotum length ratio 1.71 ( $\pm 0.18$  SD); metanotum/metapostnotum length ratio 0.74 ( $\pm 0.08$  SD); forewing with 3 submarginal cells; tegula enlarged, reaching posterior margin of mesoscutum; inner margin straight; tegula length 0.35 ( $\pm 0.02$  SD) mm, width 0.2 ( $\pm 0.01$  SD) mm; propodeum lateral carinae not reaching dorsal margin; oblique carina strong, straight. T2 depressed apical rim less than 50% of tergum. ( $n = 7$ )

VARIATION. The mesoscutum punctures can vary from moderately sparse ( $IS = 1-2$  PD) to dense ( $IS \leq 1$  PD) and the clypeus apical half, labrum, and pronotal lobe can vary from dark reddish brown to orange.

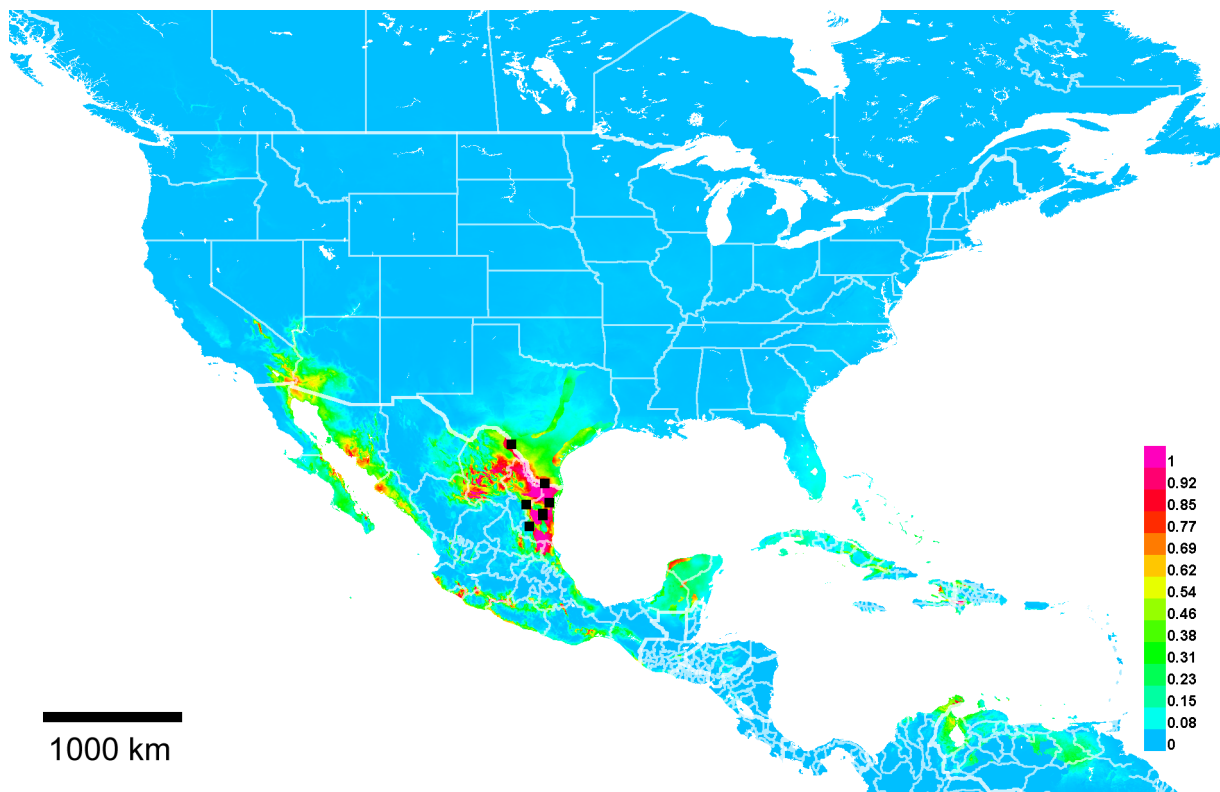
### Male

COLOURATION. Head and mesosoma blue-green to olive green; clypeus apex black; labrum orange; mandible orange with black basal spot and red apex; flagellum reddish brown dorsally, orange ventrally. Pronotal lobe orange; legs reddish brown; tegula orange; wing membrane lightly infuscated, veins dark brown. Metasoma black with depressed apical rims and downcurved lateral areas of terga broadly translucent reddish brown.

**PUBESCENCE.** Body pile colour white. Tomentum dense on face below eye emargination, gena, pronotal angle and lobe, and space between pronotal lobe and tegula; sparse on metepisternum. Mesoscutum pubescence simple to moderately plumose. Wing setae dark, short and dense. Sterna pubescence short (<1 OD), moderately plumose, sparse.

**SURFACE SCULPTURE.** Clypeus shiny, with punctures dense (IS <1 PD); supraclypeal area shiny, with punctures dense (IS ≤1 PD); paraocular area shiny, with punctures fine, crowded (IS = 0 PD); frons shiny, with punctures fine, crowded (IS = 0 PD); vertex shiny, with punctures dense (IS <1 PD); gena shiny, with punctures fine, dense (IS ≤1 PD); postgena imbricate-lineate. Tegula punctures absent; mesoscutum tessellate, becoming shiny posterolaterally, with punctures dense (IS ≤1 PD), becoming slightly sparser submedially (IS = 1–2 PD); scutellum shiny, with punctures dense (IS ≤1 PD); metanotum finely rugulose; metapostnotum shiny to imbricate, with rugae shallow, subparallel, nearly reaching posterior margin; preëpisternum shiny with crowded punctures (IS = 0 PD); hypoepimeron shiny, with punctures crowded (IS = 0 PD); mesepisternum shiny, with punctures crowded (IS = 0 PD); metepisternum areolate, becoming smooth dorsally; propodeum lateral surface shiny to imbricate, with punctures dense (IS ≤1 PD), posterior surface shiny and densely punctate (IS ≤1 PD). T1 anterior slope shiny, disc shiny, with punctures fine, moderately dense (IS = 1–2 PD), becoming sparse in small subapicolateral boss (IS = 1–4 PD) and absent on rim; T2 disc shiny, with punctures moderately dense (IS = 1–2 PD), apical rim shiny, with punctures absent.

**STRUCTURE.** Face length/width ratio 0.86 (±0.02 SD); gena/eye width ratio 0.66 (±0.09 SD). Pronotal angle obtuse; intertegular span 0.7 (±0.03 SD) mm; mesoscutum length/width ratio 0.91 (±0.02 SD); mesoscutum/scutellum length ratio 2.84 (±0.19 SD); scutellum/metanotum length ratio 1.84 (±0.17 SD);



**Fig. 59.** Georeferenced collection records of *Lasioglossum* (*D.*) *rufodeludens* sp. nov. (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence.



metanotum/metapostnotum length ratio 0.68 ( $\pm 0.1$  SD); forewing with 3 submarginal cells; tegula enlarged, nearly reaching posterior margin of mesoscutum in dorsal view; inner posterior margin straight; tegula length 0.34 ( $\pm 0.01$  SD) mm, width 0.19 ( $\pm 0$  SD) mm; propodeum lateral carinae not reaching dorsal margin; oblique carina absent. (n = 5)

GENITALIA. As in Fig. 76N. Gonocoxite about 1.7 times as broad as gonostylus. Gonostylus rounded on outer margin with no concavities, sinuous on inner margin, with sparse long setae in middle of inner margin and short setae apically. Penis valves divergent apically. Retrorse lobe rounded, about 2.5 times as long as broad, evenly covered in short sparse setae.

VARIATION. The mesoscutum can vary from entirely tessellate to partially shiny posterolaterally and the metapostnotum can vary from mostly shiny to mostly imbricate.

### Range

Tamaulipas, Nuevo Leon, and southern Texas (Fig. 59).

### Floral hosts

FABACEAE: *Prosopis*: *P. laevigata* (Willd.) M.C.Johnst. • SALICACEAE: *Salix*: *S. nigra* • VERBENACEAE: *Lippia* L.

### DNA barcodes

One confirmed sequence available (BOLD process ID: BOWGF941-09). It is most similar in terms of p-distance to *L. deludens* sp. nov. (1.59% minimum interspecific p-distance). Four fixed nucleotide substitutions distinguish *L. rufodeludens* sp. nov. from all other Nearctic species of the *L. gemmatum* complex: 102(C), 196(C), 537(G), and 630(T) (Supp. file 2).

There are five very similar sequences from Estación Biología de Chamela, Jalisco, which are not believed to be conspecific. In addition to the extreme geographic separation, one of the Jalisco specimens was photographed and it has a dark brown, punctate tegula.

### Comments

Rare. The scarcity of specimens may be due in part to a lack of collecting effort in far southern Texas and northeastern Mexico, where *L. rufodeludens* sp. nov. is evidently restricted.

*Lasioglossum (Dialictus) stictaspis* (Sandhouse, 1923)  
Figs 60–66, 76O, 81C, 89B, 91A, 100B, 111B, 112B, 114B

*Dialictus stictaspis* Sandhouse, 1923: 195 (holotype, ♂, deposited in USNM, examined).

*Halictus (Chloralictus) albuquerquensis* Michener, 1937: 316 (holotype, ♀, deposited in CAS, examined).

*Lasioglossum (Dialictus) stictaspis* – Michener 1951: 1119 (catalogue).

*Lasioglossum (Chloralictus) albuquerquense* – Michener 1951: 1112 (catalogue).

*Dialictus stictaspis* – Hurd 1979: 1971 (catalogue). — Moure & Hurd 1987: 131 (catalogue).

*Dialictus albuquerquensis* – Hurd 1979: 1964 (catalogue). — Moure & Hurd 1987: 89 (catalogue).

### Diagnosis

See the diagnosis for the *L. stictaspis* species complex and the diagnosis for *L. paululum*. Females of *L. stictaspis* s. str., described from New Mexico, have the tegula relatively large (reaching and sometimes slightly exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin weakly

concave, and densely punctate ( $IS \leq 1$  PD); metapostnotum dull, tessellate to finely reticulate, and usually with fine subparallel rugae; mesepisternum shiny (sometimes with weak microsculpture) and densely punctate ( $IS < 1$  PD); mesoscutum dull and coarsely punctate (2–3 punctures between posterior end of parapsidal line and/or lateral edge of mesoscutum and some  $IS = 1–2$  PD between parapsidal lines); T1–T2 discs finely and moderately sparsely punctate ( $IS = 1–3$  PD) and apical rims impunctate; T3 with dense subapical band of tomentum (often medially interrupted); face short (length/width ratio  $\leq 0.83$ ) and gena narrower than eye in lateral view.

Females of *L. stictaspis* s. str. are most similar to those of *L. angelicum* sp. nov., *L. diabolicum* sp. nov., *L. ellisiae*, *L. gaudiale*, and *L. pseudotegulare*. Females of *L. angelicum* and *L. pseudotegulare* have the T1–T2 discs more deeply and densely punctate ( $IS = 1–2$  PD) with some punctures often extending onto apical rims. In addition, females of *L. angelicum* have the metapostnotum shiny with strong anastomosing rugae, and females of *L. pseudotegulare* have the face slightly longer (length/width ratio usually  $> 0.83$ ). Females of *L. ellisiae* have the tegula slightly smaller (not exceeding posterior margin of mesoscutum in dorsal view) and usually more sparsely punctate (up to  $IS = 1–3$  PD), metapostnotum with strong, coarse rugae and basal half shiny, and T3 usually without subapical tomentum (rarely with a sparse, broadly interrupted band). Females of *L. gaudiale* have the metapostnotum with strong, coarse rugae and basal half shiny, gena about as wide as eye in lateral view, and T3 without subapical tomentum.

Males of *L. stictaspis* s. str. have the tegula densely punctate ( $IS \leq 1$  PD), relatively large (slightly exceeding posterior margin of mesoscutum in dorsal view), and inner posterior margin concave, with a small rounded posterior projection about 0.5 lateral OD in size; metapostnotum tessellate to finely reticulate with shallow subparallel rugae; mesepisternum densely punctate ( $IS < 1$  PD); mesoscutum coarsely and moderately densely punctate ( $IS = 1–2$  PD); disc of T2 with punctures deep, distinct, and usually dense ( $IS \leq 1$  PD); and T1–T2 apical rims impunctate.

Males of *L. stictaspis* s. str. are most similar to those of *L. angelicum* sp. nov., *L. diabolicum* sp. nov., *L. ellisiae*, and *L. pseudotegulare*. Males of *L. angelicum* and *L. pseudotegulare* have the T1–T2 apical rims punctate; in addition, males of *L. pseudotegulare* have the T2 disc even more densely punctate medially ( $IS < 1$  PD). Males of *L. diabolicum* and *L. ellisiae* have the tegula slightly smaller (not exceeding posterior margin of mesoscutum in dorsal view) with inner posterior margin straight or sinuous and a blunt posterior angle or point narrower than 0.5 lateral OD, and usually more sparsely punctate in part ( $IS \geq 1$  PD); in addition, males of *L. ellisiae* have the mesoscutum more uniformly and densely punctate ( $IS \leq 1$  PD).

*Lasioglossum stictaspis* s. lat. is highly variable and a large number of specimens, especially those from south or west of New Mexico, may lack one or more of the above diagnostic characters, making them very difficult to separate from similar species.

### Etymology

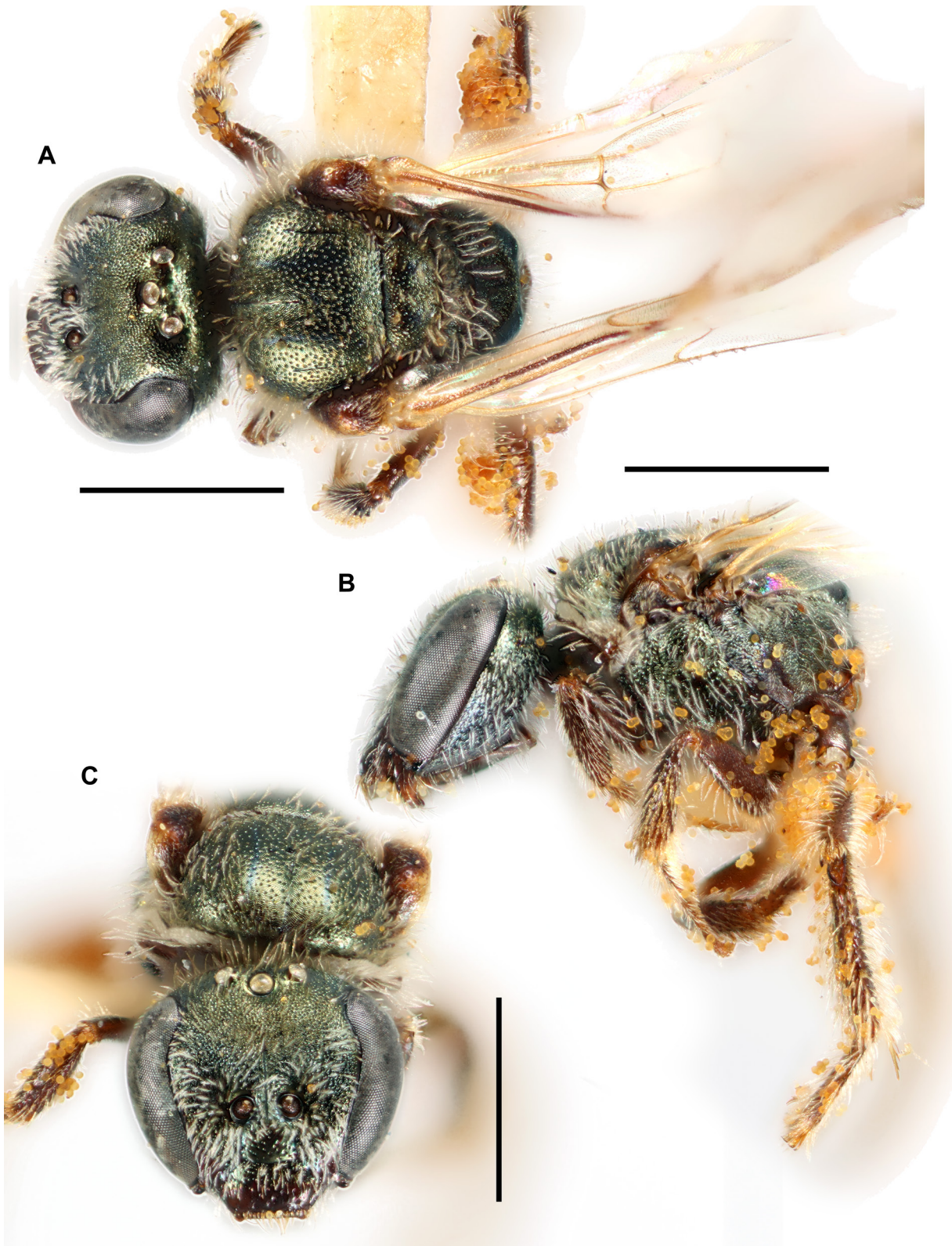
Sandhouse (1923) formed the specific epithet ‘*stictaspis*’ from the Greek adjective ‘*stiktos*’ (punctured, spotted) and the noun ‘*aspis*’ (shield). It likely refers to the punctured tegula of this species.

### Range

Western Great Plains and Rio Grande River valley (*L. stictaspis* s. str.) and west to California, south throughout Mexico (*L. stictaspis* s. lat.).

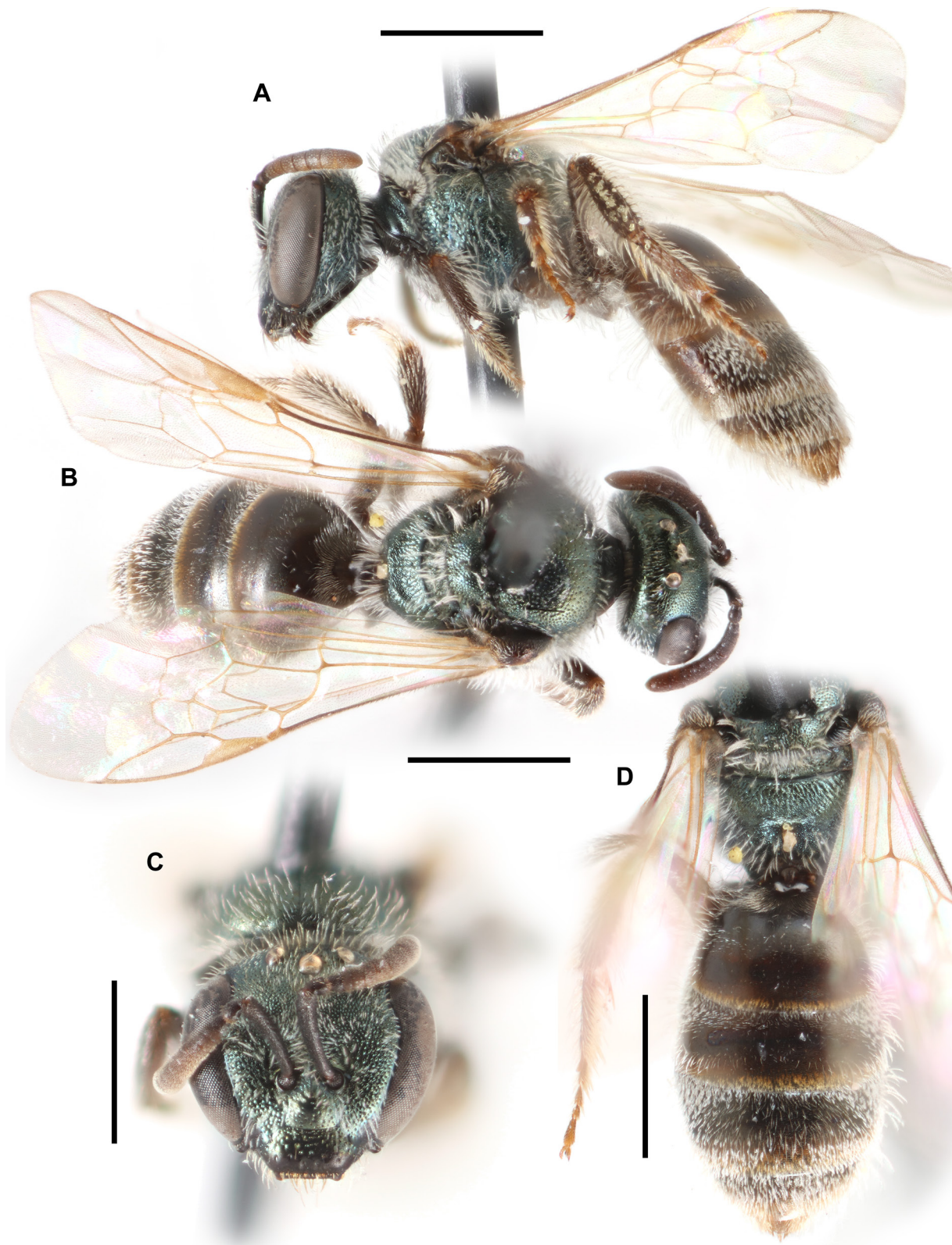
### DNA barcodes

Twenty-four confirmed sequences available, three haplotypes (BOLD process IDs: DLIII224-20, DLIII225-20, DLIII227-20 (haplotype 1); DLIII231-20, NCBEE336-21, NCBEE339-21, NCBEE343-21,



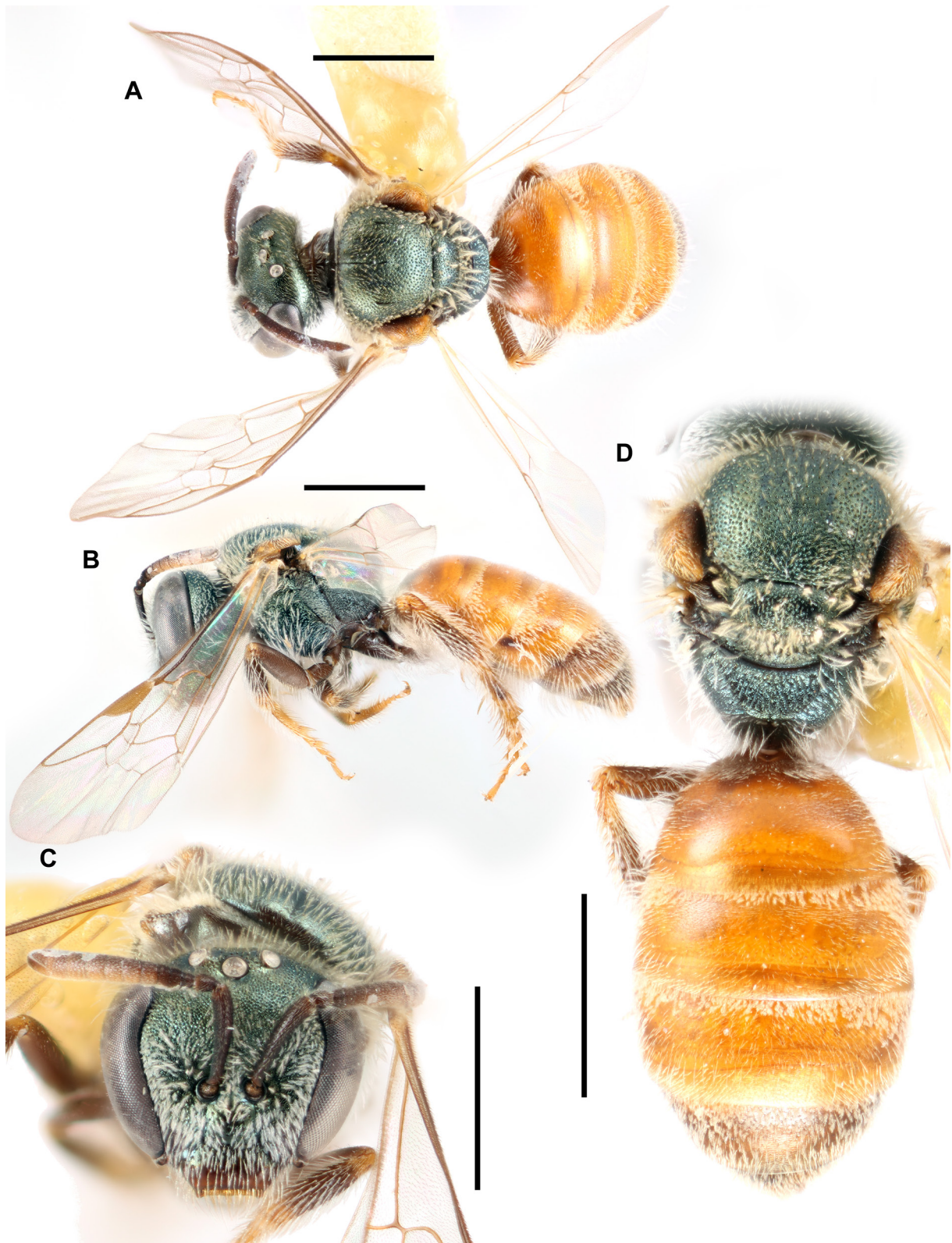
**Fig. 60.** *Lasioglossum (D.) stictaspis* (Sandhouse, 1923), ♀, holotype of *L. (D.) albuquerqueense* Michener, 1937 (CAS). **A.** Dorsal habitus. **B.** Lateral habitus. **C.** Face. Scale bars = 1 mm.





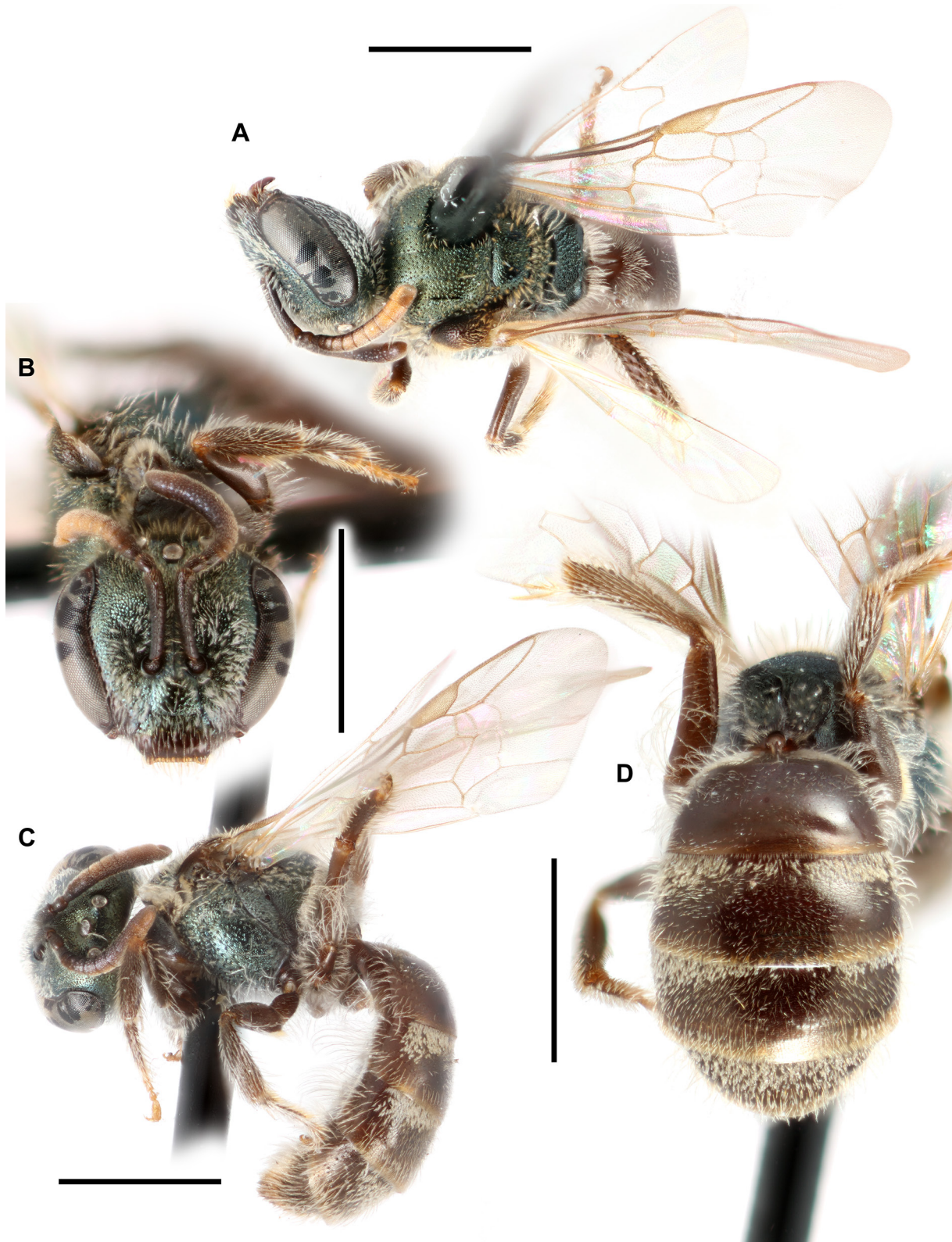
**Fig. 61.** *Lasioglossum (D.) stictaspis* (Sandhouse, 1923), ♀, Colorado morph (reproduced from Gardner & Gibbs 2022) (UCMC). **A.** Lateral habitus. **B.** Dorsal habitus. **C.** Face. **D.** Metasoma and propodeum. Scale bars = 1 mm.





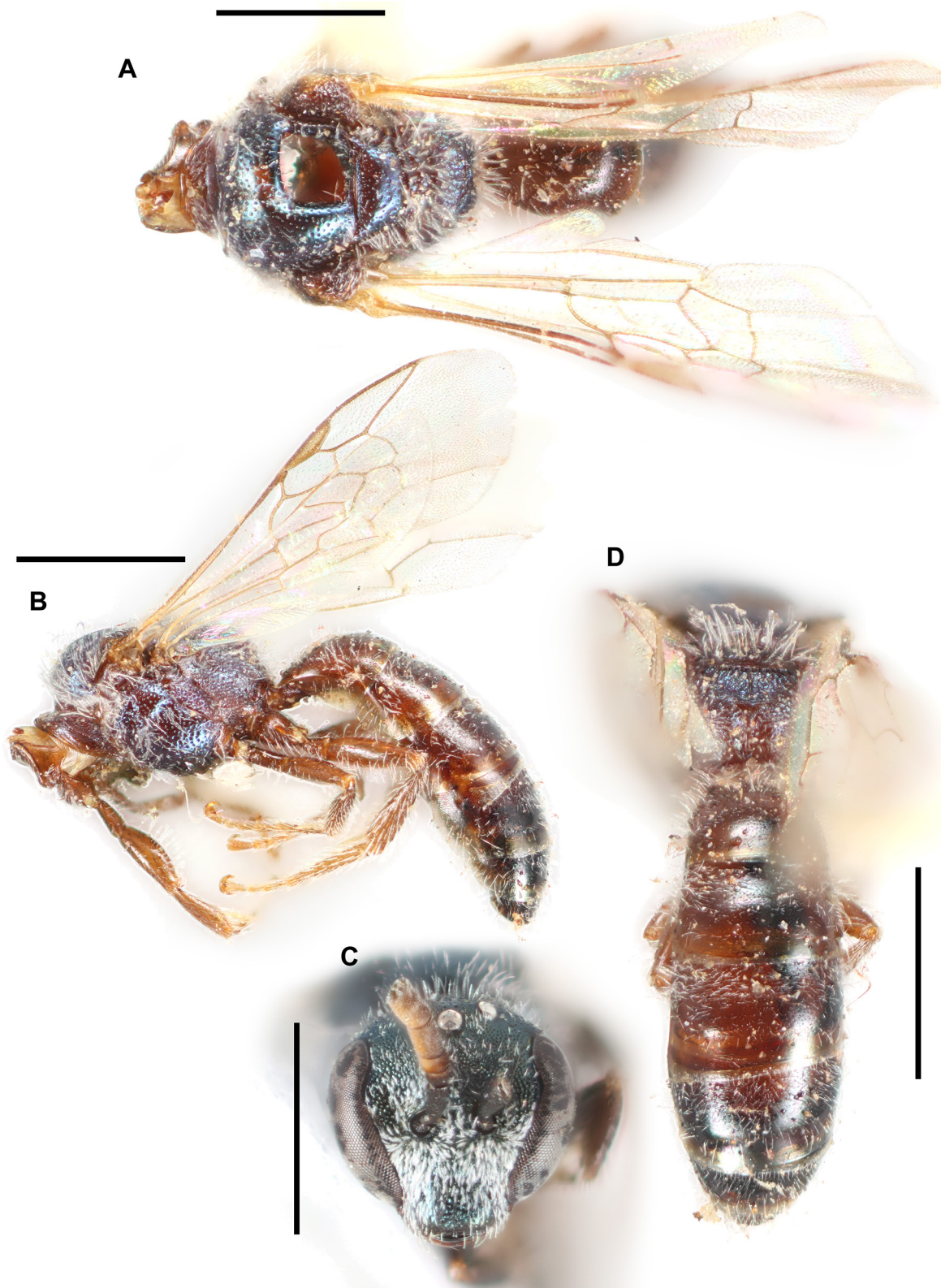
**Fig. 62.** *Lasioglossum (D.) stictaspis* (Sandhouse, 1923), ♀, red-tailed morph. A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma and propodeum. Scale bars = 1 mm.



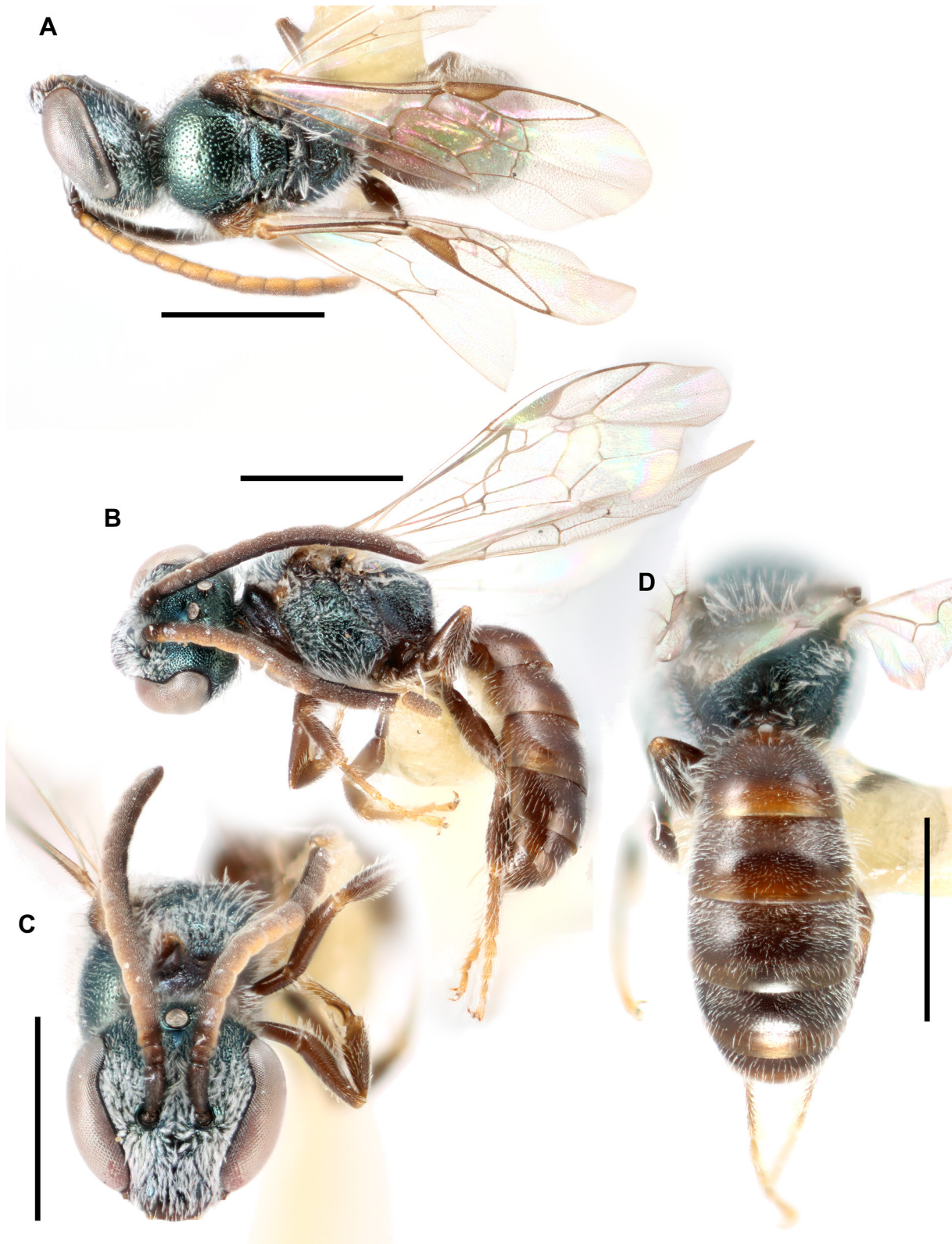


**Fig. 63.** *Lasioglossum (D.) stictaspis* (Sandhouse, 1923), ♀, Mexico morph (WRME). A. Dorsal habitus. B. Face. C. Lateral habitus. D. Metasoma. Scale bars = 1 mm.





**Fig. 64.** *Lasioglossum (D.) stictaspis* (Sandhouse, 1923), ♂, holotype (USNM) (except C, which is a Colorado specimen) (reproduced from Gardner & Gibbs 2022). **A.** Dorsal habitus. **B.** Lateral habitus. **C.** Face. **D.** Metasoma and propodeum. Scale bars = 1 mm.



**Fig. 65.** *Lasioglossum* (*D.*) *stictaspis* (Sandhouse, 1923), ♂, red-tailed morph. **A.** Dorsal habitus. **B.** Lateral habitus. **C.** Face. **D.** Metasoma. Scale bars = 1 mm.





**Fig. 66.** *Lasioglossum (D.) stictaspis* (Sandhouse, 1923), ♂, Mexico morph (WRME). **A.** Lateral habitus. **B.** Dorsal habitus. **C.** Face. **D.** Metasoma and propodeum. Scale bars = 1 mm.



NCBEE347-21, NCBEE349-21, NCBEE357-21, NCBEE369-21, NCBEE404-21, NCBEE407-21, NCBEE412-21 (haplotype 2); DLIII124-18, DLIII128-19, DLIII129-19, DLIII130-19, DLIII131-19, DLIII132-19, DLIII135-19, DLIII136-19, NCBEE403-21, SMTTP733-15 (haplotype 3)). Haplotypes 2 and 3 are shared with *L. diabolicum* sp. nov. Haplotype 3 has some relatively deep divergence and may be possible to split into additional haplotypes. No fixed nucleotide substitutions distinguish all *L. stictaspis* from all other Nearctic species of the *L. gemmatum* complex, but one fixed substitution distinguishes haplotype 2: 402(G) ([Supp. file 2](#)).

### Comments

The species treated by Gardner & Gibbs (2022) as *L. stictaspis* may include two species, the other one being *L. paululum*, described from Colorado. See that work for specimen records and range map. Specimens with a duller mesoscutum and ocellular area, yellowish pubescence, and a slightly weaker T3 subapical band of tomentum match the holotype of *L. albuquerqueense* and are here considered *L. stictaspis* s. str. *Lasioglossum stictaspis* s. lat. ranges south throughout Mexico and west to California. It can have almost any combination of punctation and surface sculpture in any location.

It is likely that *L. stictaspis* s. lat. comprises multiple species, but correlates between morphological, genetic, and geographic variation cannot be found to support a species hypothesis. One of these may be *L. paululum*, but additional species from Mexico, Arizona, or California are likely undescribed. More data is needed to clarify limits and relationships between these species.

### *Lasioglossum (Dialictus) surianae* (Mitchell 1960)

Figs 67–69

*Dialictus surianae* Mitchell, 1960: 420 (holotype, ♀, deposited in FSCA, examined).

*Lasioglossum (Dialictus) surianae* – Krombein 1967: 466 (catalogue). — Gibbs 2011: 26, 32 (key to species), 185 (redescription).

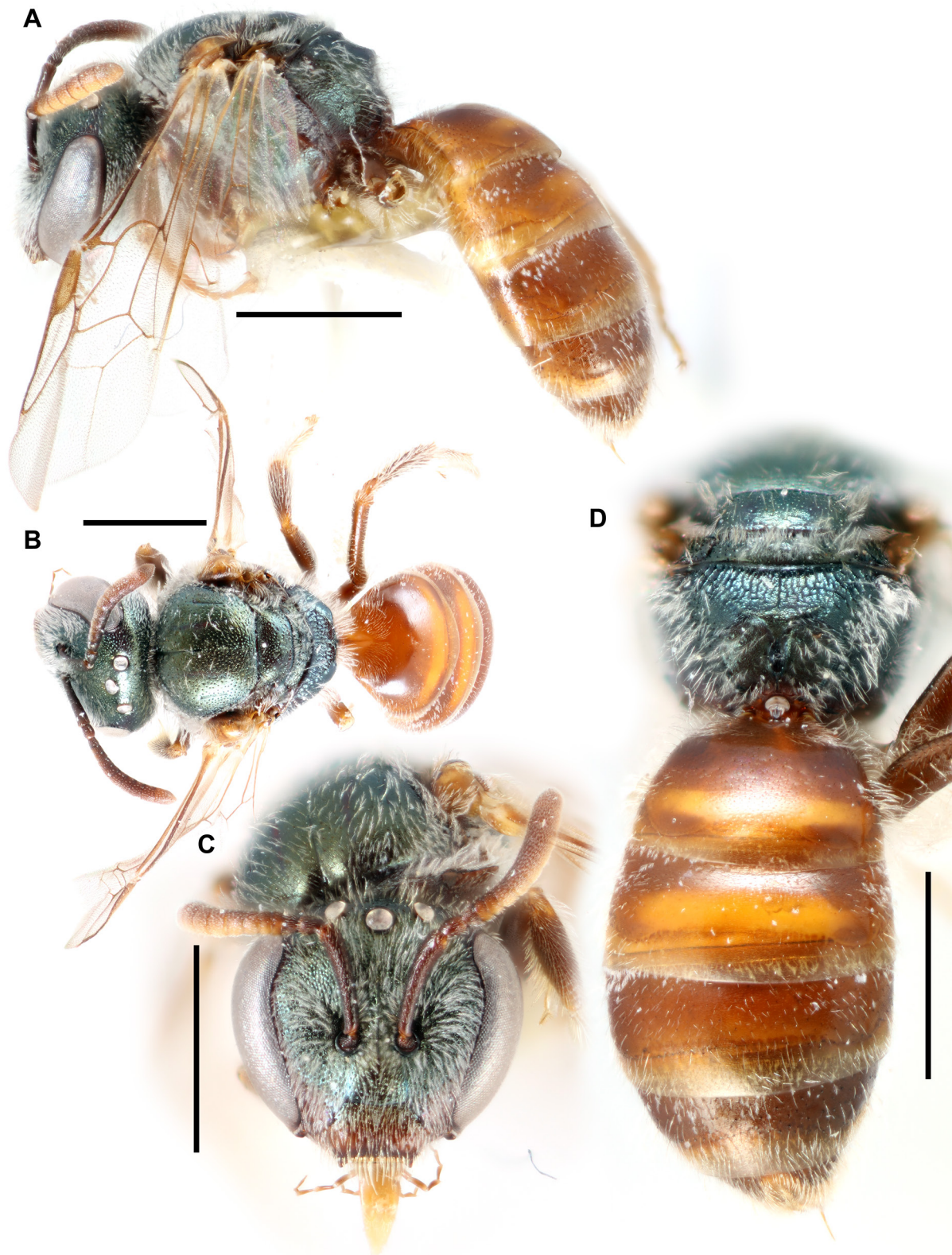
*Dialictus surianae* – Hurd 1979: 1972 (catalogue). — Moure & Hurd 1987: 132 (catalogue).

### Diagnosis

Females of *L. surianae* have the tegula very small (maximum length less than half ITS and not reaching posterior margin of mesoscutum in dorsal view) with inner posterior margin straight, translucent yellow, and very finely, sparsely punctate (IS = 2–6 PD); mesepisternum shiny and densely punctate (IS < 1 PD); postgena dull with lineolate microsculpture; frons shiny with distinct (but still very narrow) interspaces between punctures; and metasoma red-orange with terga reddish brown at base. The tegula punctures are so fine that at low magnification or at certain angles, they may not be visible and the tegula will appear impunctate.

Females of *L. surianae* are most similar to those of *L. deludens* sp. nov., *L. diabolicum* sp. nov., and *L. rufodeludens* sp. nov. Females of *L. deludens* and *L. rufodeludens* have the tegula impunctate except on extreme anterior margin and postgena smooth and shiny. In addition, females of *L. deludens* have the metasoma black to brown (sometimes slightly reddish on apical rims), and females of *L. rufodeludens* have the mesepisternum dull. Females of *L. diabolicum* have the frons dull and reticulate with no distinct interspaces between punctures.

Males of *L. surianae* have the tegula small (as in the female), face with tomentum limited to lower paraocular area, and mesepisternum shiny and densely punctate (IS ≤ 1 PD). The only male specimen available for study was missing the metasoma, so additional diagnostic characters on the metasoma may exist.



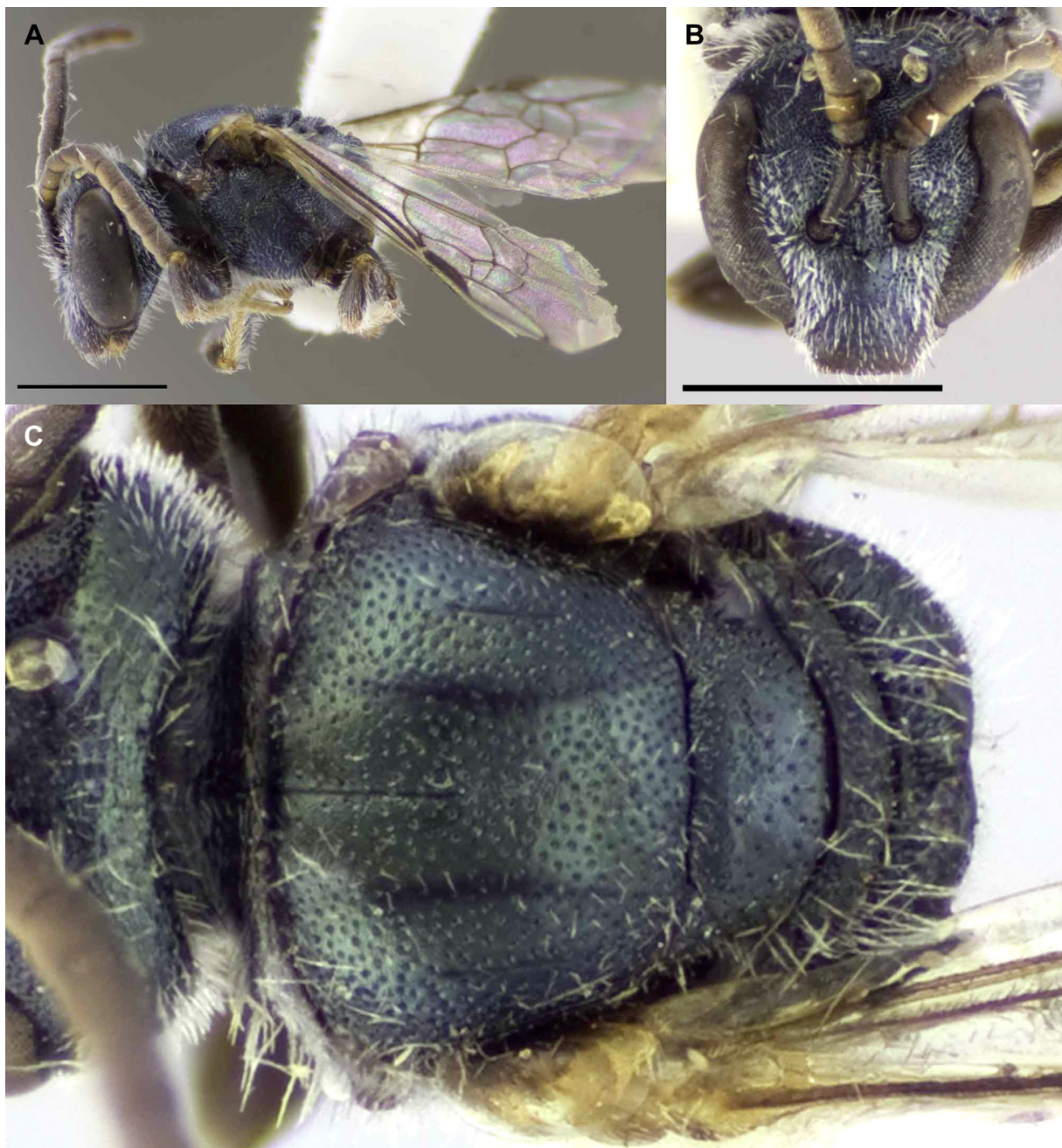
**Fig. 67.** *Lasioglossum (D.) surianae* (Mitchell, 1960), ♀ (PCYU). A. Lateral habitus. B. Dorsal habitus. C. Face. D. Metasoma and propodeum. Scale bars = 1 mm.



Males of *L. surianae* are most similar to those of *L. deludens* sp. nov., *L. diabolicum* sp. nov., *L. rufodeludens* sp. nov., and *L. perparvum*, all of which (except *L. perparvum*) have the face entirely covered with dense tomentum below the eye emargination. In addition, males of *L. deludens* and *L. rufodeludens* have the tegula impunctate except on extreme anterior margin. Males of *L. perparvum* have the clypeus with some sparse tomentum and tegula usually dark brown.

### Etymology

Mitchell (1960) named this species after the plant *Suriana maritima* L., one of its hosts.



**Fig. 68.** *Lasioglossum* (*D.*) *surianae* (Mitchell, 1960), ♂ (reproduced from Gibbs 2011) (UCFC). A. Lateral habitus. B. Face. C. Mesonotum. Scale bars = 1 mm.



**Material examined**

**Holotype**

UNITED STATES – **Florida** • ♀; Plantation Key; [24.985° N, 80.546° W]; 27 Nov. 1955; H.V. Weems Jr. leg.; FCSA.

**Other material**

BAHAMAS • 2 ♀♀; Great Exuma, Georgetown N., Island #26; 23.5° N, 75.75° W; 8 Aug. 2004; M.F. Keller leg.; PCYU • 1 ♂; Gorda Cay; 26.0833° N, 77.5333° W; 26 Jun.–7 Jul. 1998; T. Peak leg.; UCFC • 1 ♀; *ibid.*; 7–16 Jul. 1998; T. Peak leg.; UCFC.

UNITED STATES – **Florida** • 1 ♀; Key Vaca; [24.76° N, 80.96° W]; 28 Dec. 1955; H.V. Weems Jr. leg.; CUIC • 1 ♀; Monroe Co., Stock Island; [24.57° N, 81.74° W]; 15 Oct. 1963; H.V. Weems Jr. leg.; CUIC • 1 ♀; Monroe Co., Big Pine Key; [24.69° N, 81.37° W]; 23 Jun. 1971; W.H. Pierce leg.; CUIC • 1 ♂; *ibid.*; 19 May 1971; W.H. Pierce leg.; CUIC.

**Range**

Florida and Bahamas (Fig. 69).

**Floral hosts** (from Mitchell 1960 and Gibbs 2011)

ASTERACEAE: *Bidens*: *B. pilosa* • CONVOLVULACEAE: *Jacquemontia* Choisy • SURIANACEAE Arn.: *Suriana* L.: *S. maritima* L.



**Fig. 69.** Georeferenced collection records of *Lasioglossum (D.) surianae* (Mitchell, 1960) (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence. Because many coastal records lacked soil data, the model was generated without soil type as an environmental variable.

## DNA barcodes

One confirmed sequence available (BOLD process ID: BEECB173-07). It is closest in terms of p-distance to *L. pseudotegulare* (4.29% minimum interspecific p-distance). Nine fixed nucleotide substitutions distinguish *L. suriana* from all other Nearctic species of the *L. gemmatum* complex: 15(A), 105(C), 123(C), 276(C), 288(G), 358(C), 399(C), 420(T), and 564(T) ([Supp. file 2](#)).

### *Lasioglossum (Dialictus) tegulare* (Robertson, 1890)

Figs 70–72, 83B, 85B, 98B, 101B, 118B, 117A

*Halictus tegularis* Robertson, 1890: 318 (lectotype designated in Cresson (1928), ♀, deposited in ANSP, type no. 4254, examined).

*Halictus tegularis* – Dalla Torre 1896: 58 (catalogue). — Cockerell 1896: 294 (comparison to *pseudotegularis*); 1899: 5 (catalogue). — Cresson 1928: 65 (lectotype designation).

*Chloralictus tegularis* – Robertson 1902: 248, 249 (key).

*Halictus (Chloralictus) tegularis* – Viereck 1916: 702, 703 (key to species), 706 (checklist). — Ellis 1914: 101 (comparison to *jamaicae* = *gemmatum* and *coactus*), 103 (comparison to *perparvum*). — Sandhouse 1924: 2 (key to species), 11 (comparison to *ellisiae*).

*Lasioglossum (Chloralictus) tegulare* – Michener 1951: 1118 (catalogue).

*Dialictus tegularis* – Mitchell 1960: 423 (key, redescription). — Hurd 1979: 1972 (catalogue). — Moure & Hurd 1987: 134 (catalogue).

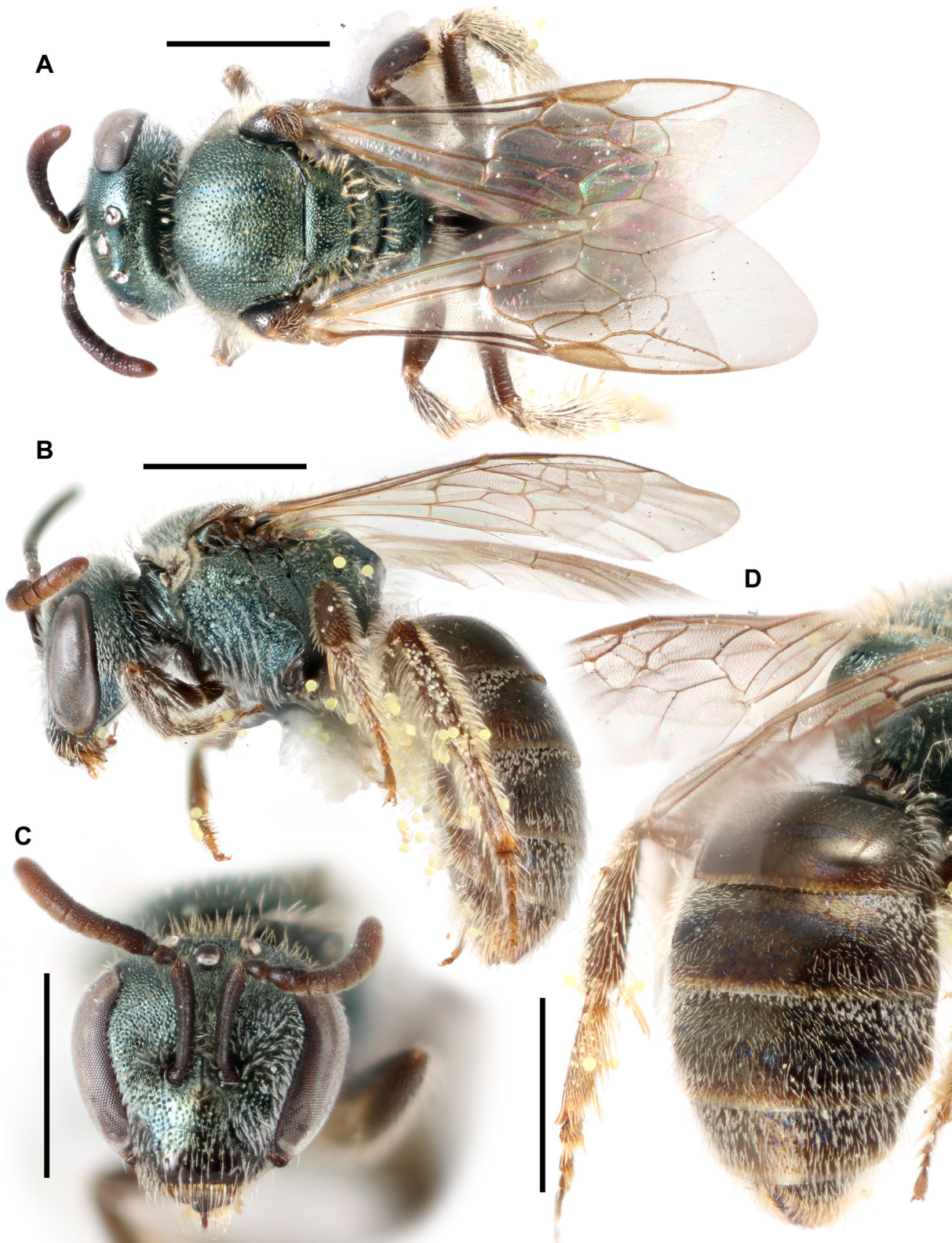
*Lasioglossum (Dialictus) tegulare* – Krombein 1967: 466 (catalogue). — Gibbs 2009a: 13 (key, redescription); 2010: 37, 45 (key), 323 (redescription); 2011: 25, 32 (key to species), 195 (review). — Wolf & Ascher 2009: 143 (checklist). — Gibbs *et al.* 2013: 87 (checklist). — Kilpatrick *et al.* 2020: 84 (checklist).

## Diagnosis

Females of *L. tegulare* have the tegula relatively small (reaching but not exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin weakly concave and a narrowly rounded posterior projection smaller than 0.5 OD, and densely (IS < 1 PD) to moderately densely punctate (IS = 1–2 PD); mesoscutum and mesepisternum very dull, strongly tessellate, imbricate, or rugulose; mesepisternum punctures crowded (IS = 0 PD) and indistinct; metapostnotum with strong, coarse rugae reaching posterior margin and covering propodeum dorsolateral slope, shiny in basal half; face short (length/width ratio usually  $\leq 0.83$ ); T2–T4 flat in lateral view; T3 without subapical tomentum; and head and mesosoma usually olive green.

Females of *L. tegulare* are most similar to those of *L. coactus*, *L. ellisiae*, *L. holzenthali* sp. nov., and *L. puteulanum*. Females of *L. coactus* have T2–T4 convex in lateral view and T3 with dense and complete subapical band of tomentum. Females of *L. ellisiae* have the mesepisternum punctures distinctly separated and round, and the mesoscutum posterior half and mesepisternum often shiny. Females of *L. holzenthali* have the mesepisternum punctures distinctly separated (up to 1 PD) and metapostnotum rugae not extending onto propodeum dorsolateral slope. Females of *L. puteulanum* have the face longer (length/width ratio usually  $> 0.83$ ), tegula more sparsely punctate (IS = 1–2 PD, closer to 2 PD), and head and mesosoma usually blue (rarely olive green).

Males of *L. tegulare* have the tegula relatively small (as in the female); mesoscutum relatively coarsely and moderately densely punctate (IS = 1–2 PD); metapostnotum shiny with strong subparallel rugae; discs of T1–T2 and premarginal line uniformly densely punctate (IS  $\leq 1$  PD); face with sparse tomentum below eye emargination, more concentrated in paraocular area; and head and mesosoma usually olive green.



**Fig. 70.** *Lasioglossum (D.) tegulare* (Robertson, 1890), ♀. **A.** Dorsal habitus. **B.** Lateral habitus. **C.** Face. **D.** Metasoma. Scale bars = 1 mm.





**Fig. 71.** *Lasioglossum (D.) tegulare* (Robertson, 1890), ♂ (TAMU). A. Dorsal habitus. B. Lateral habitus. C. Face. D. Metasoma. Scale bars = 1 mm.

Males of *L. tegulare* are most similar to those of *L. coactus*, *L. ellisiae*, and *L. puteulanum*. Males of *L. coactus* have the discs of T1–T3 even more densely punctate (IS < 1 PD) and strongly convex, and apical rims abruptly and deeply depressed. Males of *L. ellisiae* have the mesoscutum usually more finely and densely punctate laterally (IS < 1 PD) and disc of T2 becoming more sparsely punctate near and on premarginal line (IS = 1–2 PD). Males of *L. puteulanum* have the face below eye emargination evenly covered in tomentum, tegula more sparsely punctate (IS = 1–3 PD), and the head and mesosoma usually blue to blue-green.

### Etymology

Robertson (1890) formed the specific epithet ‘*tegularis*’ from the Latin noun ‘*tegula*’ (roof tile, literally ‘covering instrument’, now applied to the sclerite covering the wing base), and the adjectival suffix ‘*-aris*’ (of or pertaining to).

### Material examined

#### Holotype

UNITED STATES – **Connecticut** • ♀; New Haven; [41.31° N, 72.93° W]; 6 Jun. 1878; W.H. Patton leg.; ANSP 4254.

#### Other material

CANADA – **Ontario** • 1 ♀; Haldimand Norfolk Co., Nixon West; [42.85° N, 80.4° W]; 22 Jul. 1995; L. Packer leg.; PCYU-LAS:875 • 1 ♂; Caledon, Gschwendtner property; 43.8148° N, 79.9768° W; 18 Sep. 2003; J. Grixti leg.; PCYU • 1 ♀; Dunrobin; 45.4124° N, 76.0398° W; 9 Jul. 2009; J. Phillips leg.; WRME 0414013 • 1 ♀; Kinburn; 45.3775° N, 76.1277° W; 16 Jun. 2009; J. Phillips leg.; WRME 0414015 • 5 ♀♀; Norfolk; 42.6493° N, 80.5687° W; 11 Jun. 2007; PCYU • 1 ♂; Norfolk; 42.6497° N, 80.5729° W; 11 Aug. 2007; A. Taylor leg.; PCYU • 1 ♀; Toronto, Albany avenue parquette; 43.66585° N, 79.41071° W; 11 Jul. 2010; J. Gibbs leg.; PCYU-KCC-10096. – **Quebec** • 1 ♀, 1 ♂; CMN (Natural Heritage Campus), Gatineau; 45.4462° N, 75.8131° W; elev. 113 m; 17 Jul. 2018; T.M. Onuferko leg.; CMNC.

UNITED STATES – **Arkansas** • 1 ♀; Garland Co., Lake Ouachita State Park; [34.617° N, 93.18° W]; May 1972; G. Heinrich leg.; SEMC • 4 ♀♀; Polk Co., Rich Mountain Fire Tower, 12.5 (air) km NW of Mena; 34.6743° N, 94.3292° W; 10 Apr. 2015; E. Riley, YPT leg.; TAMU-ENTO X1234686, X1239110, X1248045, X1289439 • 2 ♀♀; Magazine Mountain; [35.17° N, 93.64° W]; elev. 762 m; 11 Jun. 1994; W.F. Chamberlain leg.; TAMU-ENTO X1316102, X1419611. – **Connecticut** • 1 ♀; New London Co.; 41.547° N, 72.069° W; 1 Jun. 2002; S.W. Droege leg.; PCYU USGS-DRO 005683. – **District of Columbia** • 2 ♀♀; Fairfax Co.; 38.9309° N, 77.116° W; 24 Jun. 2006; Pascarella leg.; PCYU USGS-DRO 058092, 058098 • 1 ♂; Washington; 38.9463° N, 77.0344° W; 16 Jun. 2004; S.W. Droege leg.; PCYU • 1 ♂; Washington; 38.879° N, 77.0333° W; 13–14 Jul. 2004; C. Osborn leg.; PCYU • 1 ♂; Washington; 38.891° N, 77.0308° W; 15–16 Jul. 2004; C. Osborn leg.; PCYU • 1 ♂; Washington; 38.8694° N, 77.0261° W; 4–5 Oct. 2004; E. Keto leg.; PCYU • 1 ♂; Washington; 38.885° N, 77.034° W; 18–19 Oct. 2004; E. Keto leg.; PCYU • 1 ♀; Washington; 38.8871° N, 77.0128° W; 1 Sep. 2005; N.B. Staff leg.; PCYU • 1 ♀; Washington; 38.8912° N, 77.0242° W; 16 Aug. 2006; S.W. Droege leg.; PCYU. – **Georgia** • 1 ♂; Cobb Co., Lost Mountain; [33.94° N, 84.7° W]; 13 Jul. 1913; PCYU • 1 ♀; Floyd Co., Rome; [34.26° N, 85.16° W]; 10–16 Aug. 1988; A.L. Wharton leg.; TAMU-ENTO X1388293 • 1 ♀; Athens; [33.95° N, 83.36° W]; 16 Apr. 1977; C.W. Fisher leg.; TAMU-ENTO X1399194 • 1 ♂; Rabun Bald; [34.97° N, 83.3° W]; elev. 1219–1463 m; 21 Aug. 1913; PCYU. – **Iowa** • 1 ♀; Clay Co., IA Chicago and Eastern RR, 0.8 km E of Everly; 43.1603° N, 95.3086° W; elev. 410 m; 7 Aug. 2003; C. Hemsley leg.; PCYU. – **Kentucky** • 1 ♀; Laurel Co.; 37.1528° N, 84.1167° W; 27 Jul. 2007; S.W. Droege leg.; PCYU • 1 ♀; Wayne Co.; 36.924° N, 84.8715° W; 27 Jul. 2007; S.W. Droege leg.; PCYU USGS-DRO 081955. – **Maryland** • 1 ♂; Anne Arundel Co.; 38.7839° N, 76.7014° W; B. Hollister leg.; PCYU • 4 ♀♀; *ibid.*; B. Hollister leg.; SEMC • 1 ♀; Calvert Co.; 38.5361° N, 76.5175° W; 1–14 Jul. 2006; M. Gates leg.;



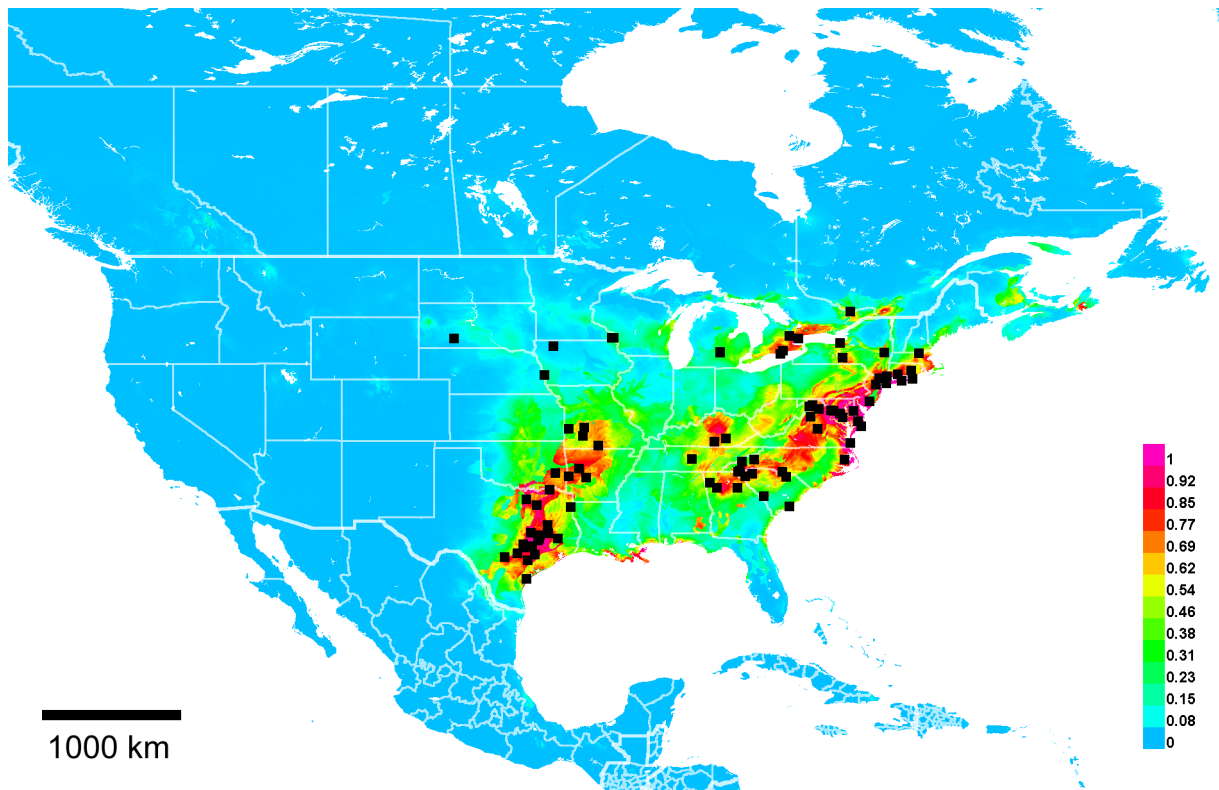
PCYU USGS-DRO 067768 • 1 ♀; Caroline Co.; 39.1098° N, 75.7724° W; 7 Apr. 2005; S.W. Droege leg.; PCYU • 1 ♀; Caroline Co.; 38.9194° N, 75.8279° W; 13 May 2007; M. Price leg.; PCYU • 6 ♀♀; Prince George's Co., Temple Hills; [38.81° N, 76.95° W]; 22 Aug. 1976; G.C. Eickwort leg.; CUIC • 1 ♀; Prince George's Co.; 39.0815° N, 76.7887° W; 19–20 May 2003; R. Jackowski leg.; BBSL USGS-DRO 018675 • 1 ♀; Prince George's Co.; 39.08454° N, 76.8055° W; 19–20 May 2003; R. Jackowski leg.; BBSL USGS-DRO 018765 • 1 ♀; Prince George's Co.; 38.9123° N, 76.755° W; 12–13 Aug. 2003; Haramis and Arch leg.; BBSL USGS-DRO 013084 • 1 ♀; Prince George's Co.; 38.9977° N, 76.7573° W; 19 Jul. 2004; S. Kolski leg.; BBSL USGS-DRO 026947 • 1 ♀; Prince George's Co.; 39.0002° N, 76.7505° W; 19 Jul. 2004; S. Kolski leg.; BBSL USGS-DRO 026986 • 1 ♀; Prince George's Co.; 38.9764° N, 76.7491° W; 20 Jul. 2004; S. Kolski leg.; BBSL USGS-DRO 027244 • 1 ♀; Prince George's Co.; 39.0352° N, 76.8739° W; 21 Jul. 2004; S. Kolski leg.; BBSL USGS-DRO 027444 • 1 ♀; Prince George's Co.; 38.9903° N, 76.7515° W; 20 Aug. 2004; S. Kolski leg.; BBSL USGS-DRO 027914 • 1 ♀; Prince George's Co.; 38.9344° N, 76.7373° W; 17 Aug. 2002; E.J. Jackson leg.; PCYU USGS-DRO 008304 • 1 ♂; Prince George's Co.; 38.9123° N, 76.755° W; 12–13 Aug. 2003; Haramis and Arch leg.; PCYU USGS-DRO 013026 • 1 ♀; Prince George's Co.; 38.9959° N, 76.7886° W; 2 Sep. 2004; S. Na leg.; PCYU USGS-DRO 031553 • 1 ♀; Prince George's Co.; 38.9949° N, 77.2527° W; 24 Jun. 2006; H. Katki leg.; PCYU USGS-DRO 058176 • 1 ♀; Talbot Co.; 38.8° N, 76.283° W; 7–8 May 2005; W. Steiner leg.; PCYU • 1 ♂; Wicomico Co.; 38.2909° N, 75.5364° W; 12 Jun. 2004; S.W. Droege leg.; PCYU • 1 ♀; Cabin John; [38.98° N, 77.16° W]; 16 Apr. 1915; J. C. Crawford leg.; SEMC. – **Massachusetts** • 1 ♀; Middlesex Co., Dunstable, sandpit 0.1 mi. E of airport; [42.694° N, 71.547° W]; 29 Apr. 2006; M.F. Veit leg.; PCYU • 1 ♀; Middlesex Co., Harvard: Oxbow National Wildlife Refuge, Wallace Road; [42.5° N, 71.62° W]; 28 May 2006; M.F. Veit leg.; PCYU. – **Michigan** • 1 ♀; Ingham Co., East Lansing, MSU arboretum; 42.72° N, 84.475° W; 30 Jun. 2013; J. Gibbs leg.; WRME 0414022 • 1 ♀; Ingham Co., East Lansing, Whitehills Park; 42.753° N, 84.48° W; 4 Jul. 2013; J. Gibbs leg.; WRME • 1 ♂; Ingham Co., Lansing River Trail; 42.707° N, 84.528° W; 3 Aug. 2013; J. Gibbs leg.; WRME. – **Minnesota** • 1 ♀; Houston Co.; [43.7° N, 91.5° W]; 26 May 1940; C.E. Pederson leg.; UMSP\_BEE 110267. – **Missouri** • 1 ♀; Greene Co., Rocky Barrens Conservation Area, 1.5 mi. NE of Willard, T30N R22W Sec. 19 (N1/2); [37.32° N, 93.4° W]; 14 Apr. 2006; Arduser leg.; ex *Lesquerella filiformis*; PCYU • 3 ♀♀; Hickory Co., Pomme de Terre State Park; [37.87° N, 93.3° W]; 27 Jul. 1979; W. D. Forester leg.; ex “False Orange” [*Citrus* sp.?]; TAMU-ENTO X1596629, X1596657, X1599936 • 1 ♀; Ozark Co., Caney Mountain Conservation Area, along service road (N trail), T23N R13W Sec. 9; [36.69° N, 92.394° W]; 16 Jul. 2006; R.P. Jean leg.; PCYU • 1 ♂; Milo; [37.76° N, 94.31° W]; 29 Jun. 1964; J.C. Schaffner leg.; TAMU-ENTO X1393314. – **Nebraska** • 1 ♀; Douglas Co.; 41.2796° N, 95.9073° W; 10 May 2007; S.W. Droege leg.; PCYU USGS-DRO 075887. – **New Jersey** • 1 ♀; Atlantic Co.; 39.5833° N, 74.7667° W; 21 Jul. 2003; B. Ahlstrom leg.; PCYU • 1 ♂; Ramsey; [41.06° N, 74.14° W]; 10 Jul. 1913; CUIC • 1 ♂; Westfield; [40.66° N, 74.35° W]; 15 Aug. 1956; G.R. Ferguson leg.; BBSL700632 • 1 ♂; Weymouth; [39.52° N, 74.78° W]; 26 Jul. 1923; CUIC. – **New York** • 1 ♂; Albany Co., Colonie; [42.72° N, 73.83° W]; 20 Aug. 1969; G. and K. Eickwort leg.; CUIC • 1 ♀; Albany Co., Partridge Run State Game Area, 5 mi. N of Rensselaerville; [42.58° N, 74.15° W]; 6 Jun. 1970; G. and K. Eickwort leg.; CUIC • 1 ♀; Albany Co., Rensselaerville; [42.52° N, 74.14° W]; 28 Jul. 1970; G. and K. Eickwort leg.; CUIC • 1 ♀; Albany Co., Rensselaerville, Huyck Reserve; [42.515° N, 74.14° W]; 12 Jun. 1969; G. and K. Eickwort leg.; CUIC • 1 ♀; Cayuga Co., Fair Haven Beach State Park; [43.34° N, 76.68° W]; 8 Jun. 1968; G. and K. Eickwort leg.; CUIC • 1 ♂; Nassau Co., Floral Park; [40.72° N, 73.7° W]; 4 Jul. 1982; D. Yanega leg.; CUIC • 7 ♂♂; Nassau Co., Hempstead Lake State Park; [40.69° N, 73.64° W]; 4–6 Jul. 1974; G.C. Eickwort leg.; CUIC • 3 ♀♀, 1 ♂; Nassau Co., Jones Beach State Park; [40.595° N, 73.5° W]; 31 Jul. 1974; G.C. Eickwort leg.; CUIC • 1 ♀, 1 ♂; *ibid.*; 26 Jun. 1976; G. Eickwort leg.; CUIC • 2 ♀♀; Nassau Co., Kennedy Wildlife Sanctuary, Tobay Beach; [40.611° N, 73.432° W]; 18 Jun. 1989; G.C. Eickwort leg.; CUIC • 1 ♀; Nassau Co., Tobay Beach; [40.611° N, 73.432° W]; 24–26 Jun. 1976; G.C. Eickwort leg.; CUIC • 1 ♂; Queens Co., Floral Park, Long Island; [40.72° N, 73.7° W]; 6 Aug. 1983; D. Yanega leg.; SEMC • 1 ♀; Suffolk Co.; [40.9° N, 72.7° W]; 6 Sep. 2005; S.W. Droege leg.; PCYU USGS-DRO 046015



• 1 ♀; *ibid.*; 6 Sep. 2005; S.W. Droege leg.; WRME • 3 ♂♂; Tompkins Co., Buttermilk Falls State Park, Ithaca; [42.41° N, 76.51° W]; 7 Oct. 1967; G. and K. Eickwort leg.; CUIC • 1 ♂; Tompkins Co., Michigan Hollow gravel pit, 5 mi. S of Danby; [42.28° N, 76.5° W]; 7 Sep. 1968; G. and K. Eickwort leg.; CUIC • 1 ♀; Tompkins Co., Six Mile Creek, SE of Ithaca Reservoir; [42.41° N, 76.45° W]; 25 May 1968; G. and K. Eickwort leg.; CUIC • 3 ♀♀; Westchester Co., Bedford; [41.2° N, 73.64° W]; 6 Jul. 1957; G.R. Ferguson leg.; BBSL700691, BBSL700692, BBSL700693 • 1 ♀; Ludlowville; [42.55° N, 76.54° W]; 6 Jun. 1968; L.L. Pechuman leg.; CUIC • 1 ♀; Montauk; [41.03° N, 71.96° W]; 4 May 1947; R. Latham leg.; CUIC • 1 ♀; Three Mile Harbor; [41° N, 72.18° W]; 6 Jun. 1941; R. Latham leg.; CUIC • 1 ♂; Van Cortland Park; [40.9° N, 73.89° W]; 20 Jul. 1913; CUIC. – **North Carolina** • 1 ♀; Union Co.; 34.984° N, 80.449° W; Sep.–Oct. 2003; R. Jackowski leg.; PCYU USGS-DRO 023920 • 1 ♀, 6 ♂♂; Black Mountains; [35.79° N, 82.26° W]; Aug. 1912; Beutenmüller leg.; PCYU • 1 ♀; Great Smoky Mountains National Park, Cataloochee overlook; 35.6399° N, 83.06017° W; 6 Aug. 2006; J. Gibbs leg.; GSNP • 1 ♂; Highlands; [35.05° N, 83.2° W]; 22 Jul. 1958; T.B. Mitchell leg.; PCYU • 1 ♀; Pettigrew State Park; [35.79° N, 76.41° W]; 27 May 1959; T.B. Mitchell leg.; PCYU. – **Oklahoma** • 1 ♀; Latimer Co.; [34.9° N, 95.2° W]; Jun. 2002; K. Stephan leg.; TAMU-ENTO X1419622. – **Rhode Island** • 2 ♀♀; Newport Co.; 41.4969° N, 71.3678° W; 22 Jul. 2005; P. Ostenton leg.; PCYU. – **South Carolina** • 1 ♀; Aiken Co.; 33.3878° N, 81.6402° W; 3 Aug. 2013; WRME • 1 ♀; Charleston Co., James Island; [32.74° N, 79.96° W]; 28 Jun. 1950; W.F. Chamberlain leg.; TAMU-ENTO X1399604 • 1 ♀; *ibid.*; 19 Aug. 1950; W.F. Chamberlain leg.; TAMU-ENTO X1403433 • 1 ♀; Chesterfield Co.; 34.6367° N, 80.17584° W; 18–19 May 2006; S.W. Droege leg.; PCYU USGS-DRO 056978 • 1 ♀; Greenville Co., Greenville; [34.85° N, 82.39° W]; 28 May 1977; R.S. Peigler leg.; ex Chestnut; TAMU-ENTO X1365240 • 1 ♀, 1 ♂; Okanee Co., near Walhalla; 34.81283° N, 83.13679° W; 9 Aug. 2006; J. Gibbs leg.; PCYU • 1 ♀; Clemson; [34.68° N, 82.84° W]; 16 Apr. 1950; G.M. Chamberlain leg.; TAMU-ENTO X1316445 • 1 ♀; *ibid.*; 1 Jul. 1952; W.F. Chamberlain leg.; TAMU-ENTO X1361346 • 2 ♀♀; Greenville; [34.85° N, 82.39° W]; 16–31 Aug. 1981; Richard S. Peigler leg.; TAMU-ENTO X1396429, X1396695 • 1 ♀; *ibid.*; 1–15 Sep. 1981; Richard S. Peigler leg.; TAMU-ENTO X1396286 • 1 ♂; *ibid.*; 1–15 Sep. 1981; Richard S. Peigler leg.; TAMU-ENTO X1397289. – **South Dakota** • 2 ♀♀; Jackson Co.; 43.6617° N, 101.7683° W; 22–23 Aug. 2011; J. Devalez leg.; PWRC USGS-DRO 266789, 266800. – **Tennessee** • 1 ♀; Rutherford Co.; 35.8275° N, 86.2912° W; 20 Jul. 2007; D. Green leg.; PCYU • 1 ♀; Rutherford Co.; 35.8197° N, 86.3159° W; 20 Jul. 2007; D. Green leg.; PCYU. – **Texas** • 10 ♀♀; Anderson Co., 10 mi. SW of Elkhart; [31.52° N, 95.7° W]; 5–6 Jun. 1976; H.R. Burke leg.; TAMU-ENTO X1364860, X1365137, X1365337, X1365468, X1365770, X1366096, X1398653, X1398690, X1399047, X1400893 • 4 ♂♂; *ibid.*; 5–6 Jun. 1976; H.R. Burke leg.; TAMU-ENTO X1365421, X1365995, X1398573, X1399232 • 2 ♀♀; Anderson Co., Salmon; [31.57° N, 95.5° W]; 1–15 May 1974; H.R. Burke leg.; TAMU-ENTO X1393291, X1393469 • 2 ♀♀; *ibid.*; 28 Apr.–16 May 1975; H.R. Burke leg.; TAMU-ENTO X1400746, X1400818 • 5 ♀♀; *ibid.*; 17 May–6 Jun. 1975; H.R. Burke leg.; TAMU-ENTO X1365182, X1398531, X1399216, X1399529, X1401121 • 1 ♀; Bastrop Co., Buescher State Park; [30.06° N, 97.17° W]; 22 Apr. 1973; J.C. Schaffner leg.; TAMU-ENTO X1391914 • 1 ♀; Bastrop Co., Camp Swift Nat. Gd. 8.6 km N of Bastrop; 30.278° N, 97.275° W; 31 Jan.–17 Feb. 2003; J.C. Abbott leg.; CTMI • 1 ♀; Brazos Co., 0.4 mi. W of Navasota R. on S. R. 21; [30.865° N, 96.197° W]; 14 Jul. 1974; H. Greenbaum leg.; TAMU-ENTO X1311831 • 1 ♀; Brazos Co., 6.2 mi. N of Millican, FM Road 2154; [30.509° N, 96.295° W]; 19 Apr. 1975; S.J. Merritt leg.; TAMU-ENTO X1398950 • 3 ♀♀; Brazos Co., 9 km SSE of College Station, 15889 Woodlake Drive; 30.53145° N, 96.2817° W; elev. 79 m; 22 Aug. 2013; J.D. Oswald leg.; TAMU-ENTO X1058927, X1060436, X1064907 • 1 ♀; *ibid.*; 23 Aug. 2013; J.D. Oswald leg.; TAMU-ENTO X1064394 • 2 ♀♀; Brazos Co., Bryan; [30.67° N, 96.37° W]; 1–2 May 1976; H.R. Burke leg.; TAMU-ENTO X1312321, X1387324 • 2 ♂♂; *ibid.*; 1–2 May 1976; H.R. Burke leg.; TAMU-ENTO X1389946, X1395461 • 66 ♀♀; *ibid.*; 29–30 May 1976; H.R. Burke leg.; TAMU-ENTO X1364579, X1364727, X1364862, X1364898, X1365086, X1365091, X1365145, X1365146, X1365185, X1365186, X1365226, X1365234, X1365260, X1365264, X1365275, X1365316, X1365328, X1365333, X1365336, X1365346, X1365357, X1365381, X1365396, X1365409, X1365428, X1365445, X1365447, X1365454, X1365479, X1365497, X1365522, X1365526,

X1365550, X1365557, X1365590, X1365622, X1365726, X1365732, X1365975, X1366118, X1398550, X1398582, X1398686, X1398695, X1398710, X1398784, X1398828, X1398842, X1398854, X1398897, X1398964, X1398997, X1399032, X1399039, X1399055, X1399079, X1399095, X1399098, X1399112, X1399231, X1399266, X1399280, X1399393, X1399466, X1399490, X1399538 • 1 ♂; *ibid.*; 29–30 May 1976; H.R. Burke leg.; TAMU-ENTO X1365280 • 1 ♀; Brazos Co., College Station; [30.63° N, 96.33° W]; 25 Mar. 1975; P.H. Thompson leg.; TAMU-ENTO X1400761 • 1 ♀; *ibid.*; 15–22 May 1977; S.J. Merritt leg.; TAMU-ENTO X1401248 • 1 ♂; *ibid.*; 15–22 May 1977; S.J. Merritt leg.; TAMU-ENTO X1365943 • 1 ♀; *ibid.*; 25 Apr. 1979; C.W. Agnew leg.; TAMU-ENTO X1361837 • 3 ♀♀; *ibid.*; 27 May 1983; S.J. Merritt leg.; ex *Ptilimnium* sp.; TAMU-ENTO X1392345, X1392380, X1397537 • 1 ♂; *ibid.*; 27 May 1983; S.J. Merritt leg.; ex *Ptilimnium* sp.; TAMU-ENTO X1397304 • 2 ♀♀; Brazos Co., College Station, 1.25 mi. Highway 30 and Texas Aus.; [30.63° N, 96.33° W]; 21 May 1981; W.P. Forrester leg.; TAMU-ENTO X1675348, X1675426 • 1 ♀; Brazos Co., College Station, Riley Estate; 30.58849° N, 96.25366° W; 21–26 Mar. 2011; E. Riley, M. T. leg.; TAMU-ENTO X1428048 • 1 ♀; *ibid.*; 21–25 Mar. 2011; E. Riley, M. T. leg.; TAMU-ENTO X1426033 • 6 ♀♀; *ibid.*; 1–3 Apr. 2011; E. Riley, M. T. leg.; TAMU-ENTO X1424633, X1427050, X1427409, X1428015, X1428227, X1428233 • 1 ♂; Brazos Co., near College Station, TAMU Range Sci. Area; [30.58° N, 96.37° W]; 15 Aug. 1981; S.J. Merritt leg.; ex *Eupatorium*; TAMU-ENTO X1387829 • 2 ♀♀; Brazos Co., on Highway 30 8.3 miles east of Highway 6 junction; [30.63° N, 96.213° W]; 7 May 1981; S.J. Merritt leg.; ex *Bifora*; TAMU-ENTO X1398894, X1399300 • 1 ♂; Brazos Co., on Highway 30 9 miles east of Highway 6 junction; [30.623° N, 96.205° W]; 7 May 1981; S.J. Merritt leg.; ex *Rudbeckia* sp.; TAMU-ENTO X1399155 • 1 ♀; Brazos Co., TAMU-Riverside Campus; 30.64282° N, 96.49347° W; elev. 80 m; 28 Sep. 2013; K. Fryer leg.; TAMU-ENTO X1006852 • 1 ♂; *ibid.*; 28 Oct. 2013; K. Fryer leg.; TAMU-ENTO X0707268 • 1 ♀; Brazos Co., Turk Ranch Road 0.9 mi. SE of Duck Pond Road junction; [30.598° N, 96.218° W]; 18 Sep. 1976; S.J. Merritt leg.; ex misc. plants; TAMU-ENTO X1365368 • 1 ♂; Brazos Co.; [30.6° N, 96.3° W]; 24 Jul. 1937; J.E. Gillaspay leg.; ex cotton; TAMU-ENTO X1388245 • 1 ♀; *ibid.*; 16 Oct. 1954; A.H. Alex leg.; ex *Aster*; TAMU-ENTO X1389426 • 1 ♀; *ibid.*; 26 Oct. 1954; A.H. Alex leg.; ex *Aster*; TAMU-ENTO X1389257 • 1 ♀; *ibid.*; 30 May 1962; A.H. Alex leg.; ex *Rudbeckia bicolor*; TAMU-ENTO X1388492 • 2 ♂♂; Brazos Co.; 30.59215° N, 96.27266° W; elev. 88 m; 16–23 Apr. 2017; K.W. Wright leg.; TAMU-ENTO X1533790, X1534943 • 2 ♂♂; *ibid.*; 30 Apr.–13 May 2017; K.W. Wright leg.; TAMU-ENTO X1533817, X1534968 • 2 ♀♀; Burleson Co., FM 50 4.4 mi. N of Clay; [30.443° N, 96.375° W]; 5 May 1984; S.J. Merritt leg.; ex *Rudbeckia* sp.; TAMU-ENTO X1395879, X1397568 • 1 ♂; Burleson Co., Highway 21 6.4 mi. NE of Caldwell; [30.595° N, 96.612° W]; 30 May 1975; S.J. Merritt leg.; TAMU-ENTO X1398605 • 1 ♀; Burleson Co., Highway 50 1.8 mi. N of Highway 60 junction; [30.557° N, 96.47° W]; 30 May 1975; S.J. Merritt leg.; TAMU-ENTO X1400901 • 1 ♀; Caldwell Co., Luling; [29.68° N, 97.65° W]; 27 Sep. 1965; G.E. Bohart leg.; BBSL700707 • 1 ♀; Colorado Co.; [29.6° N, 96.5° W]; 30 Mar. 1922; Mrs. Grace Wiley leg.; SEMC • 1 ♀; Denton Co.; 33.2043° N, 97.0816° W; 27 Apr. 2002; H.W. Ikerd leg.; PCYU USGS-DRO 012240 • 1 ♀; *ibid.*; 27 Apr.; H.W. Ikerd leg.; PCYU USGS-DRO 004904 • 1 ♀; *ibid.*; 27 Apr.; H.W. Ikerd leg.; PCYU USGS-DRO 004921 • 1 ♀; Fayette Co., Carmine; [30.15° N, 96.69° W]; 27 May 2015; P. Rude leg.; EMEC • 1 ♀; Harrison Co., Karnack; [32.67° N, 94.17° W]; 31 May 1998; W.F. Chamberlain leg.; TAMU-ENTO X1395791 • 1 ♀; Houston Co., Eastham Prison Unit; [30.98° N, 95.63° W]; 21 May 1971; DEVAC Crew leg.; ex cotton; TAMU-ENTO X1388349 • 1 ♀; Kaufman Co., 10.4 km NE of Forney; 32.7934° N, 96.3765° W; 12 Oct.–30 Nov. 2014; Brandon Hays leg.; TAMU-ENTO X1445683 • 1 ♀; Lamar Co., Camp Maxey malaise in Equisetum bog; [33.8° N, 95.56° W]; 21 May–Jun. 2004; Godwin leg.; CTMI • 1 ♀; Lavaca Co., 15 mi. S of Hallettsville; [29.22° N, 96.97° W]; 28 Sep. 1965; G.E. Bohart leg.; ex *Croton*; BBSL700710 • 1 ♀; Robertson Co., 12.1 mi. NE of junction of Highway 6 and OSR; [30.87° N, 96.31° W]; 15 Jun. 1975; S.J. Merritt leg.; TAMU-ENTO X1400889 • 1 ♂; Robertson Co., 12.1 miles east of Highways 6 and OSR junction; [30.75° N, 96.25° W]; 4 Jun. 1977; S.J. Merritt leg.; ex *Rudbeckia* sp.; TAMU-ENTO X1396753 • 1 ♀; Robertson Co., 13.9 miles east of junction of Highways 6 and OSR; [30.75° N, 96.22° W]; 11 Jun. 1977; S.J. Merritt leg.; ex *Monarda*; TAMU-ENTO X1395660 • 1 ♀; Robertson Co., 20.8 mi. NW of junction of Highways OSR and FM 46;

[31.1° N, 96.62° W]; 14 Jun. 1975; S.J. Merritt leg.; TAMU-ENTO X1365588 • 1 ♀; Robertson Co., 4.4 mi. NE of junction of Highways 6 and OSR; [30.79° N, 96.4° W]; 14 Jun. 1975; S.J. Merritt leg.; TAMU-ENTO X1365512 • 1 ♀; Robertson Co., on FM 46 2.2 miles south of Franklin; [31.005° N, 96.46° W]; 18 Jul. 1981; S.J. Merritt leg.; ex *Cassia* sp.; TAMU-ENTO X1397350 • 3 ♂♂; Robertson Co., Salter Research Farms; 31.0333° N, 96.7725° W; elev. 88 m; 21 Apr. 2017; K. Wright leg.; ex *Lupinus texensis*; TAMU-ENTO X1533735, X1533737, X1533741 • 2 ♀♀; Walker Co., Ellis Prison; [30.88° N, 95.46° W]; 18 Jul. 1977; W.L. Sterling leg.; TAMU-ENTO X1365443, X1399148 • 1 ♀; *ibid.*; 27 Jul. 1977; W.L. Sterling leg.; TAMU-ENTO X1395612 • 1 ♀; *ibid.*; 29 Jul. 1977; W.L. Sterling leg.; TAMU-ENTO X1366174 • 1 ♀; *ibid.*; 19–23 Sep. 1977; W.L. Sterling leg.; TAMU-ENTO X1402078 • 1 ♀; *ibid.*; 26 Oct. 1977; W.L. Sterling leg.; TAMU-ENTO X1405812 • 1 ♀; College Station; [30.63° N, 96.33° W]; 14 Mar. 1920; TAMU-ENTO X1387651 • 1 ♀; *ibid.*; 5 Jun. 1955; A.H. Alex leg.; ex *Leucophyllum frutescens*; TAMU-ENTO X1389501 • 2 ♂♂; *ibid.*; 24 Jun. 1962; A.H. Alex leg.; ex *Mentha* sp.; TAMU-ENTO X1311772, X1386336 • 2 ♂♂; *ibid.*; 15 Jun. 1963; A.H. Alex leg.; ex *Melilotus alba*; TAMU-ENTO X1399872, X1399904 • 2 ♂♂; *ibid.*; 16 Jun. 1963; A.H. Alex leg.; ex *Melilotus alba*; TAMU-ENTO X1312790, X1399955 • 1 ♀; Livingston Lake State Park; 30.66° N, 95° W; 28 May 2015; P. Rude leg.; EMEC • 1 ♀; Rockport; [28.02° N, 97.06° W]; 23 Mar. 1981; W.F. Chamberlain leg.; TAMU-ENTO X1405250 • 1 ♀; San Antonio; [29.42° N, 98.49° W]; 29 Aug. 1964; A.H. Alex leg.; ex *Helianthus annuus*; TAMU-ENTO X1400773 • 1 ♂; Taylor; [30.57° N, 97.41° W]; 3 Jun. 1935; J.E. Gillaspay leg.; TAMU-ENTO X1388917. – **Virginia** • 1 ♀; Accomack Co.; 37.9377° N, 75.3177° W; 30 Jun.–1 Jul. 2006; S.W. Droege leg.; PCYU USGS-DRO 059595 • 2 ♀♀; Clarke Co., Blandy Experimental Farm S of Boyce; [39.06° N, 78.06° W]; 12–14 Jun. 1986; J.K. Liebherr leg.; CUIC • 1 ♀; Fluvanna Co.; 37.753° N, 78.162° W; 2 Oct. 2004; S.W. Droege leg.; PCYU • 1 ♀; Assateague Island;



**Fig. 72.** Georeferenced collection records of *Lasioglossum (D.) tegulare* (Robertson, 1890) (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence.



37.9576° N, 75.3147° W; 30 Jun.–1 Jul. 2006; S.W. Droege leg.; PCYU USGS-DRO 059936 • 3 ♀♀; Assateague Island; 37.9625° N, 75.3108° W; 30 Jun.–1 Jul. 2006; S.W. Droege leg.; PCYU USGS-DRO 059443, 059450, 059454 • 1 ♀; Highway 340 10 km N of Shenandoah; 38.564° N, 78.606° W; 7 Jun. 2005; A. Zayed leg.; PCYU • 1 ♀; Virginia Beach; [36.85° N, 76° W]; 16–17 Jun. 2007; W. Steiner leg.; PCYU. – **West Virginia** • 2 ♀♀; Hampshire Co.; 39.3314° N, 78.46° W; 24 May 2003; S.W. Droege leg.; BBSL USGS-DRO 018461, 018469 • 1 ♂; Hampshire Co.; 39.4183° N, 78.5799° W; 7 Jul. 2002; S.W. Droege leg.; PCYU USGS-DRO 007348 • 1 ♂; Hampshire Co.; 39.2334° N, 78.6843° W; 11 Jul. 2002; S.W. Droege leg.; PCYU USGS-DRO 003053 • 2 ♀♀; Hampshire Co.; 39.34575° N, 78.4026° W; 29–30 May 2004; S.W. Droege leg.; PCYU USGS-DRO 032806, 032813 • 1 ♀; Hampshire Co.; 39.35096° N, 78.5087° W; 29–30 May 2004; S.W. Droege leg.; PCYU USGS-DRO 032567.

### Range

Eastern United States and Canada (Fig. 72).

### Floral hosts

APIACEAE: *Bifora* Hoffm. • *Ptilimnium* Raf. • ASTERACEAE: *Aster* • *Eupatorium* L. • *Helianthus*: *H. annuus* • *Rudbeckia*: *R. bicolor* Nutt. • BRASSICACEAE: *Physaria*: *P. filiformis* (Rollins) O’Kane & Al-Shehbaz • EUPHORBIACEAE: *Croton* • FABACEAE: *Cassia* • *Lupinus*: *L. texensis* • *Melilotus*: *M. officinalis*: *M. o.* subsp. *alba* • FAGACEAE Dumort.: *Castanea* Mill. • LAMIACEAE: *Mentha* • *Monarda* • MALVACEAE: *Gossypium* • SCROPHULARIACEAE: *Leucophyllum*: *L. frutescens*.

### DNA barcodes

Twenty-three confirmed sequences available (BOLD process IDs: DIAL091-06, DIAL485-06, DIAL490-06, DIAL491-06, DIAL493-06, DIAL495-06, DIAL518-06, DIAL683-06, DIAL684-06, DIAL742-06, DIAL743-06, DIAL744-06, DIAL745-06, DIAL824-06, DIAL1050-06, DIAL1051-06, DLII061-06, DLII468-07, DLII1300-08, DLII1331-08, DLII1356-08, DLII1545-09, LASNA006-08). There is a large amount of divergence within these sequences (1.58% maximum intraspecific p-distance). They are closest in terms of p-distance to *L. puteulanum* (0.31% minimum interspecific p-distance). No fixed nucleotide substitutions distinguish *L. tegulare* from all other species of the *L. gemmatum* complex or closely related species.

### Comments

Robertson (1890) included Montana, California, and Mexico specimens in the type series. These must constitute other species in the *L. gemmatum* complex, but were not examined in this study. Cresson (1928) subsequently designated a Connecticut specimen from the type series as the name-bearing type.

### *Lasioglossum (Dialictus) tegulariforme* (Crawford, 1907)

Figs 73–75, 76P, 88B, 90A, 93A, 108A, 109A

*Halictus (Chloralictus) tegulariformis* Crawford, 1907: 194 (holotype, ♀, deposited in USNM, examined).

*Halictus tegulariformis* – Cockerell 1916: 77 (comparative notes to *helianthi*).

*Halictus (Chloralictus) tegulariformis* – Ellis 1914: 101 (comparison to *jamaicae* = *gemmatum*). — Sandhouse 1924: 2, 7 (key to species), 11 (comparison to *ellisiae*).

*Lasioglossum (Chloralictus) tegulariforme* – Michener 1951: 1118 (catalogue).

*Dialictus tegulariformis* – Hurd 1979: 1972 (catalogue). — Moure & Hurd 1987: 133 (catalogue).

**Diagnosis**

Females of *L. tegulariforme* have the tegula very large (maximum length more than half ITS and clearly exceeding posterior margin of mesoscutum in dorsal view), with inner posterior margin strongly concave, and densely punctate ( $IS < 1 PD$ ); T1 disc with an impunctate median line about 1 OD wide; paraocular area punctures similar in size and density to frons punctures; mesoscutum completely dull, tessellate, and finely and densely punctate ( $IS \leq 1 PD$  with 4–5 punctures between posterior end of parapsidal line and lateral edge of mesoscutum); T1 anterior slope usually somewhat shiny with weak microsculpture; and T3 usually with a dense and complete subapical band of tomentum.

Females of *L. tegulariforme* are most similar to those of *L. angelicum* sp. nov., *L. gaudiale*, and *L. helianthi*, all of which have the T1 disc uniformly punctate, paraocular punctures distinctly larger and sparser than frons punctures, and T3 lacking a complete subapical band of tomentum. Females of *L. gaudiale* (and most *L. angelicum*) also have the mesoscutum more sparsely punctate ( $IS = 1–2 PD$  and 2–3 punctures between posterior end of parapsidal line and lateral edge of mesoscutum) and often shiny. Females of *L. helianthi* have the tegula smaller (maximum length half or less ITS and not exceeding posterior margin of mesoscutum in dorsal view).

Males of *L. tegulariforme* have the tegula large (as in the female); mesoscutum tessellate and densely punctate ( $IS \leq 1 PD$ ); metapostnotum shiny with strong rugae; disc of T1 finely, sparsely punctate medially ( $IS = 1–3 PD$ ), contrasting with the more densely punctate disc of T2 ( $IS = 1–2 PD$ ); and T1–T2 apical rims impunctate.

Males of *L. tegulariforme* are most similar to those of *L. angelicum* sp. nov. and *L. helianthi*, both of which have the T1–T2 discs uniformly moderately densely to sparsely punctate ( $IS = 1–2 PD$ ) with some punctures extending onto apical rims. In addition, males of *L. angelicum* have the mesoscutum usually more sparsely punctate ( $IS = 1–2 PD$ ), and males of *L. helianthi* have the tegula smaller (not exceeding posterior margin of mesoscutum in dorsal view).

**Etymology**

Crawford (1907) formed the specific epithet ‘*tegulariformis*’ from the specific epithet ‘*tegularis*’ plus the Latin noun ‘*forma*’ (shape, figure) and the adjectival suffix ‘*-is*’ (pertaining to, having the nature of). It refers to the similarity of this species to *L. tegulare*.

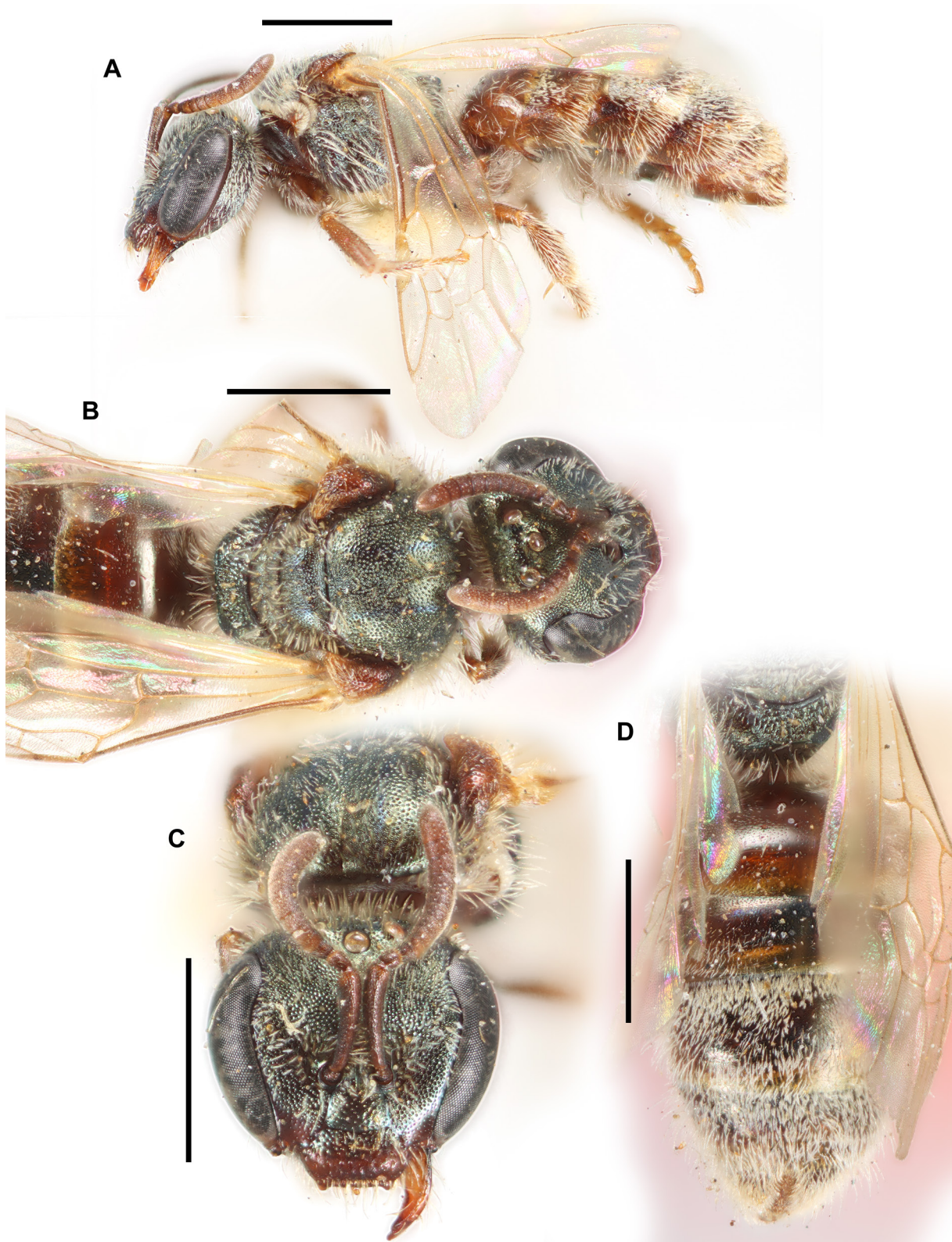
**Material examined****Holotype**

UNITED STATES – **Nevada** • ♀; Ormsby Co.; [39.2° N, 119.8° W]; 6 Jul.; Baker leg.; USNM.

**Other material**

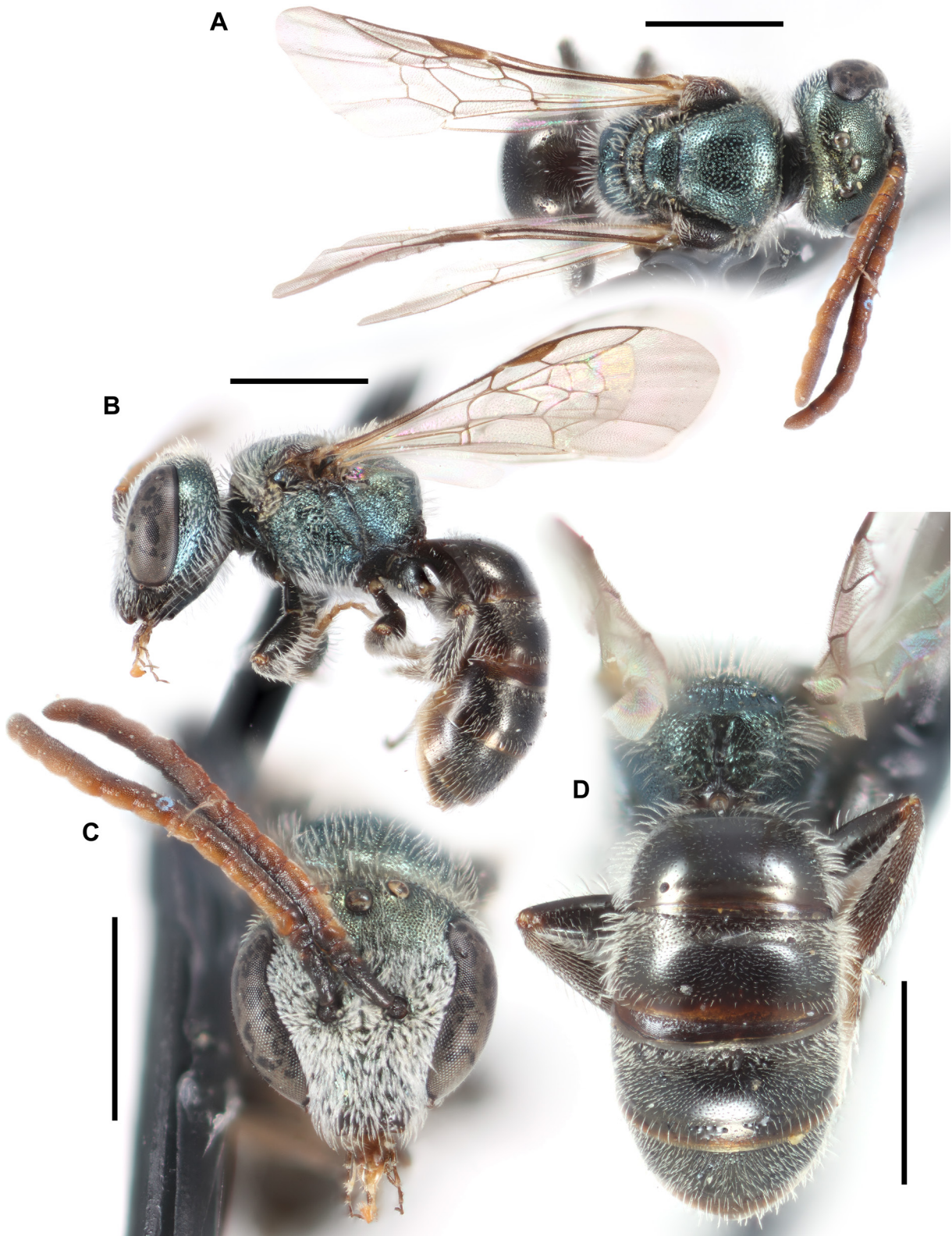
CANADA – **British Columbia** • 1 ♀; Okanagan-Similkameen Reg. Dist., Osoyoos, Rd. 22, Okanagan R.; 49.0895° N, 119.5358° W; elev. 280 m; 22 Apr. 2009; L.R. Best leg.; PCYU.

UNITED STATES – **California** • 1 ♀; Contra Costa Co., San Pablo; [37.96° N, 122.35° W]; 6 Jun. 1931; E.P. Van Duzee leg.; CAS • 1 ♀; Los Angeles Co., Chatsworth; 34.26° N, 118.601° W; 1–8 Jul. 2017; LACM • 1 ♀; Merced Co., Dos Palos; [36.99° N, 120.63° W]; 6 Sep. 1949; J.E. Gillaspay leg.; TAMU-ENTO X1389007 • 1 ♀; San Mateo Co., Redwood City; [37.48° N, 122.23° W]; 13 Sep. 1952; P.H. Arnaud leg.; ex *Foeniculum vulgare*; CAS • 1 ♂; Yolo Co., CLBL; 38.52395° N, 121.91851° W; elev. 28.35 m; “Summer 2006”; T. Shih, M. VanDyke leg.; ex *Origanum* sp. “Marjoram”; WRME • 1 ♀; Yolo Co., Hermle 3; 38.765384° N, 121.796119° W; 6 Jul. 2016; A. Buderer leg.; ex *Polygonum aviculare*; UCDC FORB201662412 • 1 ♀; Yolo Co., Hermle SR3; 38.7457° N, 121.7657° W; 7 Jul. 2016; O. Lundin leg.; UCDC FORB201686092 • 1 ♀; Yolo Co., Johnston A; 38.782453° N, 121.790404° W;



**Fig. 73.** *Lasioglossum (D.) tegulariforme* (Crawford, 1907), ♀, holotype (USNM) (reproduced from Gardner & Gibbs 2022). **A.** Lateral habitus. **B.** Dorsal habitus. **C.** Face. **D.** Metasoma and propodeum. Scale bars = 1 mm.





**Fig. 74.** *Lasioglossum (D.) tegulariforme* (Crawford, 1907), ♂ (reproduced from Gardner & Gibbs 2022) (WRME). **A.** Dorsal habitus. **B.** Lateral habitus. **C.** Face. **D.** Metasoma and propodeum. Scale bars = 1 mm.

23 May 2016; A. Buderer leg.; ex *Anthemis cotula*; UCDC FORB201661310 • 3 ♀♀; *ibid.*; 5 Jul. 2016; A. Buderer leg.; ex *Hirschfeldia incana*; UCDC FORB201662280, FORB201662279, FORB201662221 • 2 ♀♀; *ibid.*; 29 Jul. 2016; R. Deleray leg.; ex *Hirschfeldia incana*; UCDC FORB201662630, FORB201662626 • 1 ♀; Yolo Co., Russell Ranch A; 38.542148° N, 121.869337° W; 30 Jun. 2016; R. Deleray leg.; ex *Convolvulus arvensis*; UCDC FORB201662118 • 6 ♀♀; Yolo Co., Russell Ranch SR3; 38.5423° N, 121.8855° W; 26 Jul. 2016; O. Lundin leg.; UCDC FORB201685695, FORB201685690, FORB201685751, FORB201685793, FORB201685700, FORB201685689 • 1 ♂; Yolo Co., Student Farm 1A; 38.5399° N, 121.766° W; 16 Aug. 2011; N.S.L. Pope leg.; ex *Phacelia californica*; WRME FORB201103273 • 1 ♀; Yolo Co., Turk 10W/S; 38.574631° N, 121.952068° W; 6 Jun. 2016; A. Buderer leg.; ex *Eschscholzia californica*; UCDC FORB201661556 • 1 ♀; Yolo Co., Turk 10W/S; 38.576708° N, 121.946151° W; 29 Jun. 2016; R. Deleray leg.; ex *Convolvulus arvensis*; UCDC FORB201662039 • 1 ♀; Yolo Co., Turk 10W/S; 38.574631° N, 121.952068° W; 29 Jun. 2016; R. Deleray leg.; ex *Malva nicaeensis*; UCDC FORB201662066 • 1 ♀; Yolo Co., Turk 10W/S; 38.576708° N, 121.946151° W; 29 Jun. 2016; R. Deleray leg.; ex *Polygonum aviculare*; UCDC FORB201662051 • 1 ♀; *ibid.*; 25 Aug. 2016; S. Cibotti leg.; ex “*Physalis lancifolia*”; UCDC FORB201663575 • 1 ♀; Yolo Co., Turk 54 SR2; 38.6131° N, 121.9665° W; 12 Jul. 2016; O. Lundin leg.; UCDC FORB201685452 • 1 ♀; Yolo Co., Turk 6S; 38.576639° N, 121.937155° W; 18 Mar. 2016; R. Deleray leg.; ex *Phacelia ciliata*; UCDC FORB201660028 • 2 ♀♀; Yolo Co., Turk 6S; 38.5795° N, 121.9389° W; 20 Jul. 2016; A. Buderer leg.; ex *Solanum americanum*; UCDC FORB201663367, FORB201663366 • 1 ♀; *ibid.*; 24 Aug. 2016; S. Cibotti leg.; ex “*Physalis lancifolia*”; UCDC FORB201664451 • 1 ♀; Yolo Co.; 38.5775° N, 121.8297° W; 19 Jun. 2008; K. Ullmann leg.; ex *Lepidium latifolium*; WRME M2008SR2Barger\_016 • 1 ♀; Holt; [37.93° N, 121.43° W]; 7 Aug. 1948; W.F. Chamberlain leg.; TAMU-ENTO X1388805. – **Idaho** • 1 ♀; Boundary Co., Kootenai National Wildlife Refuge; 48.7347° N, 116.3965° W; 8 Jul. 2010; Jan Rose leg.; FWSE • 1 ♀; *ibid.*; 9 Aug. 2010; Jan Rose leg.; FWSE • 2 ♀♀; Canyon Co., Deer Flat National Wildlife Refuge; 43.55281° N, 116.64137° W; 4 Oct. 2012; Addison Mohler leg.; FWSE • 2 ♀♀; Canyon Co., Deer Flat National Wildlife Refuge, DFS; 43.55281° N, 116.64137° W; 5–6 Jul. 2012; Sabrina Seidel leg.; FWSE • 3 ♀♀; Gooding Co., Wood R. 1 mi. NE Gooding; [42.95° N, 114.7° W]; 6–7 Jul. 1980; M.S. and K.M. Wasbauer leg.; CUIC. – **Nevada** • 1 ♂; Fallon; [39.47° N, 118.78° W]; 12 Aug. 1940; L.C. Kuitert leg.; SEMC. – **Oregon** • 9 ♀♀; Harney Co., Malheur National Wildlife Refuge; 42.8277° N, 118.8874° W; 14 Jul. 2010; Linda Beck leg.; FWSE • 1 ♀; Harney Co., Malheur National Wildlife Refuge; 43.2635° N, 118.8421° W; 20 May 2011; Tami Coe leg.; FWSE • 4 ♀♀; Harney Co., Malheur NWR; 43.2652° N, 118.8433° W; 8 Jul. 2010; Linda Beck leg.; FWSE • 5 ♀♀; Multnomah Co., Government Island Habitat Restoration Project; 45.58233° N, 122.53719° W; 11 May 2016; M. Blackburn, R. Hatfield leg.; FWSE • 1 ♀; *ibid.*; 21 Jul. 2016; M. Blackburn, K. Hietala-Henschell leg.; FWSE • 1 ♀; *ibid.*; 25 May 2017; M. Blackburn, R. Hatfield leg.; FWSE • 1 ♀; *ibid.*; 22 Jun. 2017; M. Blackburn, K. Hietala-Henschell leg.; FWSE • 1 ♀; *ibid.*; 26 Jul. 2017; M. Blackburn, K. Hietala-Henschell leg.; FWSE. – **Washington** • 4 ♀♀; Stevens Co., Little Pend Oreille National Wildlife Refuge; 48.4654° N, 117.7358° W; 23–24 Aug. 2011; Mike Munts leg.; FWSE.

### Range

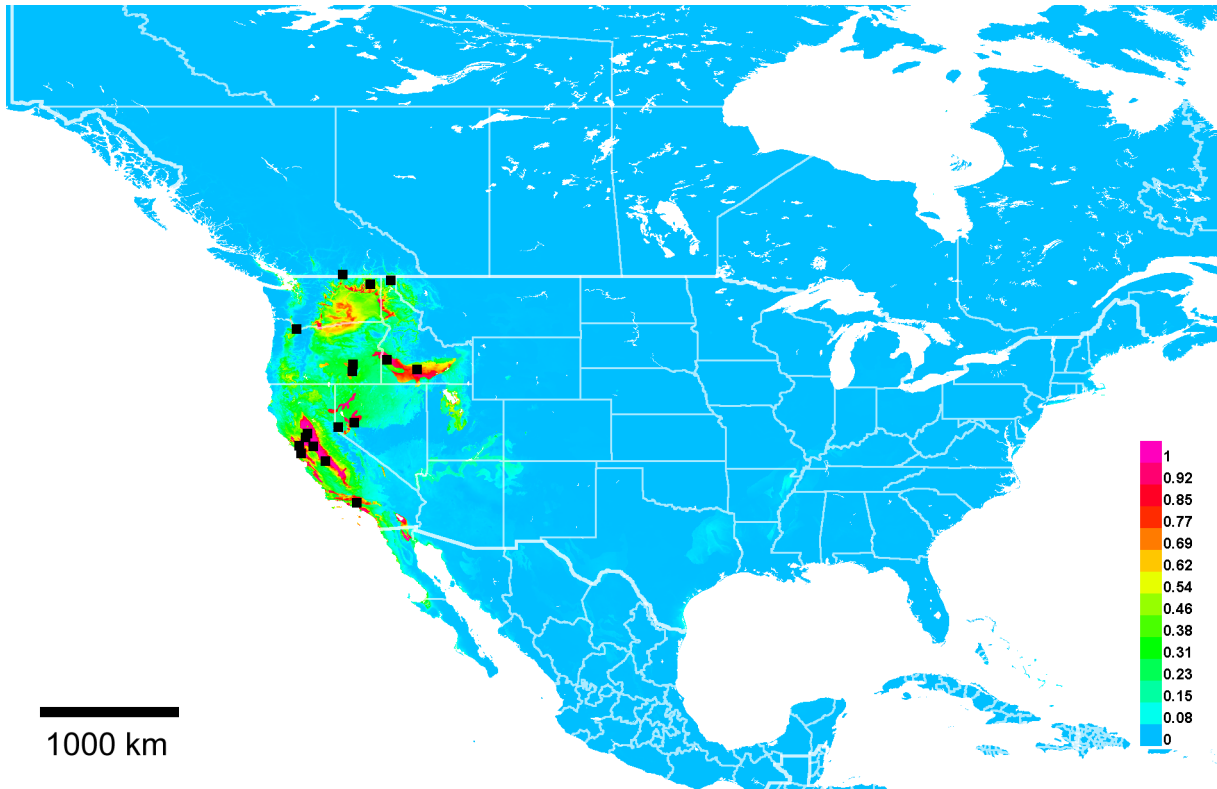
Cascadia bioregion, northern Great Basin, and California (Fig. 75).

### Floral hosts

APIACEAE: *Foeniculum*: *F. vulgare* • ASTERACEAE: *Anthemis*: *A. cotula* L. • BORAGINACEAE: *Phacelia*: *P. californica* Cham. • *P. ciliata* • BRASSICACEAE: *Hirschfeldia*: *H. incana* (L.) Lagr.-Foss. • *Lepidium*: *L. latifolium* L. • CONVOLVULACEAE: *Convolvulus* L.: *C. arvensis* L. • LAMIACEAE: *Origanum* L. • MALVACEAE: *Malva* L.: *M. nicaeensis* All. • PAPAVERACEAE: *Eschscholzia*: *E. californica* • POLYGONACEAE: *Polygonum*: *P. aviculare* L. • SOLANACEAE: *Physalis* • *Solanum*: *S. americanum* Mill.

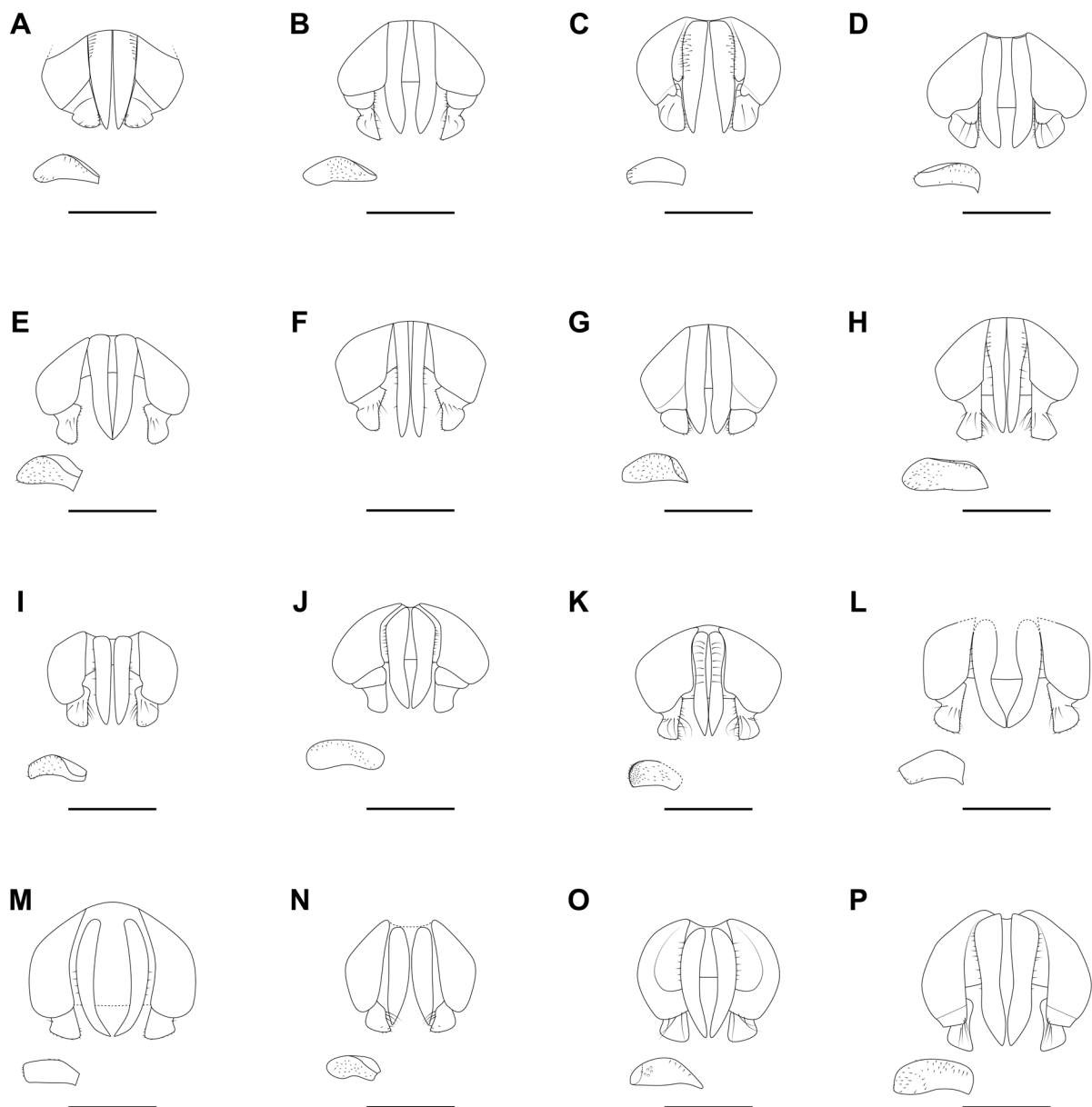
**DNA barcodes**

Three confirmed sequences available (BOLD process IDs: BCLRB752-10, DLIII111-18, DLIII112-18). There is a small amount of divergence within these sequences (0.31% maximum intraspecific p-distance). They are closest in terms of p-distance to *L. deludens* sp. nov. (2.17% minimum interspecific p-distance). Two fixed nucleotide substitutions distinguish *L. tegulariforme* from all other Nearctic species of the *L. gemmatum* complex: 183(T) and 570(C) (Supp. file 2).

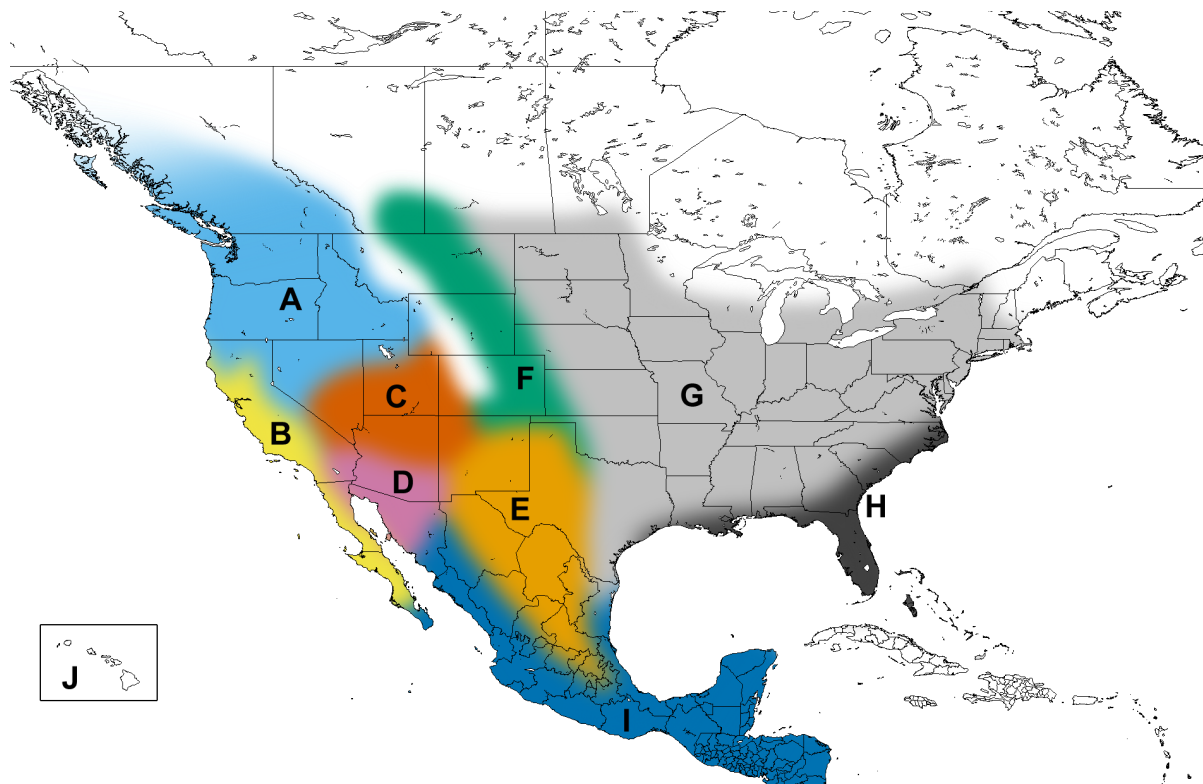


**Fig. 75.** Georeferenced collection records of *Lasioglossum (D.) tegulariforme* (Crawford, 1907) (black squares) and predicted distribution by maximum entropy ecological niche modelling in Maxent (colour shading). Warmer colours indicate higher cloglog probability of occurrence.





**Fig. 76.** Male genitalia illustrated in dorsal view and positioned such that the gonostylus is parallel to the plane of vision. Retorse lobes are also illustrated separately to the bottom left of each figure in lateral view, positioned parallel to the plane of vision. **A.** *Lasioglossum (D.) angelicum* sp. nov. **B.** *L. (D.) coactus* (Cresson, 1872). **C.** *L. (D.) deludens* sp. nov. **D.** *L. (D.) diabolicum* sp. nov. **E.** *L. (D.) gaudiale* (Sandhouse, 1924). **F.** *L. (D.) gloriosum* sp. nov. (the retorse lobe was not visible for illustration). **G.** *L. (D.) helianthi* (Cockerell, 1916). **H.** *L. (D.) holzenthali* sp. nov. **I.** *L. (D.) indagator* sp. nov. **J.** *L. (D.) magnitegula* sp. nov. **K.** *L. (D.) perparvum* (Ellis, 1914). **L.** *L. (D.) profoundum* sp. nov. **M.** *L. (D.) pseudotegulare* (Cockerell, 1896). **N.** *L. (D.) rufodeludens* sp. nov. This genital capsule was damaged during dissection and some details may be slightly distorted. **O.** *L. (D.) stictaspis* (Sandhouse, 1923) (holotype) (reproduced from Gardner & Gibbs 2022). **P.** *L. (D.) tegulariforme* (Crawford, 1907) (reproduced from Gardner & Gibbs 2022). Scale bars = 0.25 mm.



**Fig. 77.** Major geographic regions with distinct *Lasioglossum gemmatum* species complex fauna. Borders are intentionally blurred because the limits of these regions are approximate and spillover near transition zones is well-known. **A.** Cascadia (also including northern Great Basin). **B.** California. **C.** High desert (including southern Great Basin, Mojave Desert, and Colorado Plateau). **D.** Western low desert (including Sonoran Desert and western Chihuahuan Desert). **E.** Eastern low desert (including most of Chihuahuan Desert). **F.** Western Great Plains. **G.** Eastern. **H.** Southeastern. **I.** Neotropical. **J.** Hawaii.

**Table 2.** List of species of *L. gemmatum* complex associated with major geographic regions defined in Fig. 77. These lists should not be considered absolutely inclusive but should be reliable near the centre of each region and become slightly less inclusive nearer to transition zones. Species marked with an asterisk occur primarily at high elevations or sky islands within the given regions.

Region	Associated species
Cascadia	<i>L. helianthi</i> , <i>L. tegulariforme</i>
California	<i>L. angelicum</i> sp. nov., <i>L. deludens</i> sp. nov., <i>L. gaudiale</i> , <i>L. helianthi</i> , <i>L. perparvum</i> , <i>L. tegulariforme</i>
High desert	<i>L. deludens</i> sp. nov., <i>L. diabolicum</i> sp. nov., <i>L. eremum</i> sp. nov. *, <i>L. gaudiale</i> , <i>L. gloriosum</i> sp. nov.
Western low desert	<i>L. deludens</i> sp. nov., <i>L. diabolicum</i> sp. nov., <i>L. gaudiale</i> , <i>L. indagator</i> sp. nov., <i>L.</i> <i>holzenthali</i> sp. nov. *, <i>L. perparvum</i> , <i>L. pseudotegulare</i> , <i>L. stictaspis</i>
Eastern low desert	<i>L. coactus</i> , <i>L. deludens</i> sp. nov., <i>L. ellisiae</i> , <i>L. eremum</i> sp. nov. *, <i>L. gaudiale</i> , <i>L.</i> <i>indagator</i> sp. nov., <i>L. holzenthali</i> sp. nov. *, <i>L. perparvum</i> , <i>L. profundum</i> sp. nov., <i>L. stictaspis</i>
Western Great Plains	<i>L. coactus</i> , <i>L. ellisiae</i> , <i>L. eremum</i> sp. nov. *, <i>L. gaudiale</i> , <i>L. stictaspis</i>
Eastern	<i>L. carlinvillense</i> , <i>L. coactus</i> , <i>L. ellisiae</i> , <i>L. rufodeludens</i> sp. nov., <i>L. tegulare</i>
Southeastern	<i>L. lepidii</i> , <i>L. puteulanum</i> , <i>L. surianae</i>
Neotropical	<i>L. holzenthali</i> sp. nov. *, <i>L. magnitegula</i> sp. nov., <i>L. pseudotegulare</i> , <i>L. rufode-</i> <i>ludens</i> sp. nov., <i>L. stictaspis</i> , numerous undescribed species
Hawaii	<i>L. helianthi</i> , <i>L. puteulanum</i>

### Keys

This is a challenging complex, so efforts should be made to ensure the specimen is well-prepared. It is helpful to examine long series of specimens (if available) to mitigate difficulties caused by rare, unusual variation. Geographical data are useful for helping discriminate species (see Fig. 77 and Table 2), but readers should refer back to species diagnoses and descriptions to verify their identifications.

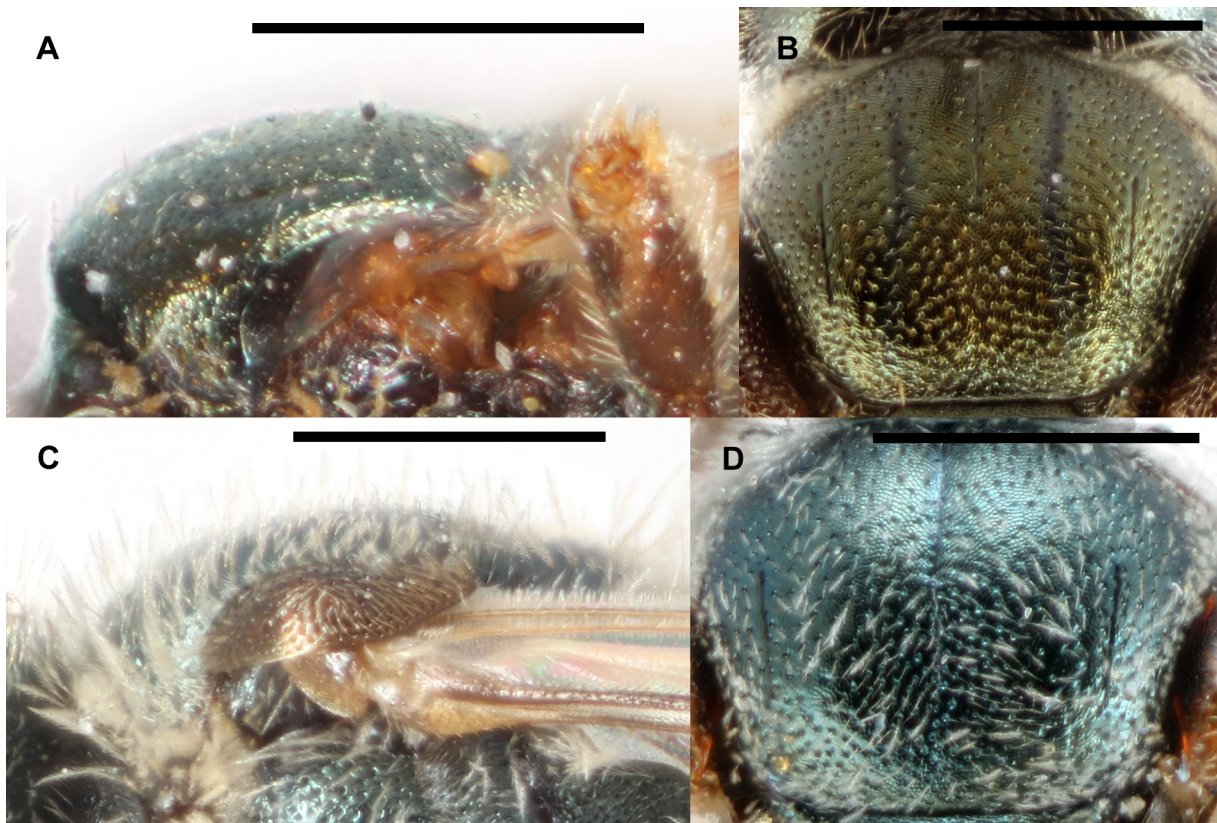
### Key to Nearctic *Lasioglossum* groups with enlarged tegula

1. Head and mesosoma black to brown ..... 2
  - Head and mesosoma metallic golden, green, or blue ..... 3
2. Mesepisternum rugose ..... *L. (Hemihalictus) kincaidii* (Cockerell, 1898)
  - Mesepisternum imbricate ..... *L. (Hemihalictus) glabriventre* (Crawford, 1907)
3. Metasoma with no appressed tomentum in either sex (but with abundant simple setae); S2–S4 with long (2–4 OD), dense, scopa-like pubescence in males .....
  - ..... *L. (Dialictus) knereri* Gibbs, 2010 (atypical forms only known from California)
  - Metasoma with some appressed tomentum at least on T2–T3 basolateral areas in females; S2–S4 with shorter (1–2 OD) and sparser pubescence in males, not scopa-like ..... 4
4. T1 with lateral tomentum (except in some males); clypeus projecting more than 50% below suborbital tangent; propodeum oblique carina absent in both sexes .....
  - ..... *L. (Dialictus) perdifficile* species complex
  - T1 without lateral tomentum in either sex; clypeus projecting about 50% below suborbital tangent; propodeum oblique carina present in females (but may be fine and difficult to distinguish from background surface sculpture) ..... *L. (Dialictus) gemmatum* species complex



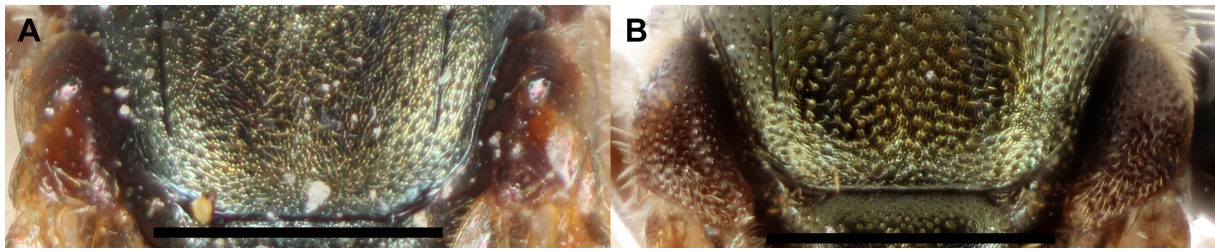
**Key to females**

1. Mesoscutum with appressed, fine, stubble-like setae less than 0.25 OD long, appearing shaved, and erect plumose setae about 1 OD long or less, these setae very sparse (each seta separated by about its length from the one nearest it, with some gaps about a seta's length wide visible in lateral view) (Fig. 78A–B); mesoscutum golden-green to coppery, contrasting with blue to blue-green propodeum; size very small (ITS 0.67–0.77 mm); metasoma black ..... 2
  - Mesoscutum with appressed, fine setae 0.25–0.5 OD long and erect plumose setae about 1 OD long, these setae dense (each seta within its length from the one nearest it, with no gaps wider than half a seta's length visible in lateral view) (Fig. 78C–D); mesoscutum usually concolourous with propodeum; size larger (ITS normally >0.77 mm, except in *L. gloriosum* sp. nov., *L. indagator* sp. nov., and *L. rufodeludens* sp. nov., in which the metasoma is red-orange) ..... 3
2. Tegula sparsely punctate (IS = 1–4 PD) at least laterally, not exceeding posterior margin of mesoscutum in dorsal view, with inner posterior margin straight, coming to a blunt angle posteriorly (Fig. 79A); apical rims of T1–T3 minutely punctate (Fig. 80A) (deserts of southern United States and northern Mexico) ..... *L. perparvum* (Ellis, 1914)
  - Tegula densely punctate (IS < 1 PD), exceeding posterior margin of mesoscutum in dorsal view by almost 1 OD, with inner posterior margin concave and a rounded projection reaching axilla posteriorly (Fig. 79B); apical rims of T1–T3 impunctate (Fig. 80B) (Neotropical Mexico, rarely occurring north to United States border) ..... *L. magnitegula* sp. nov.

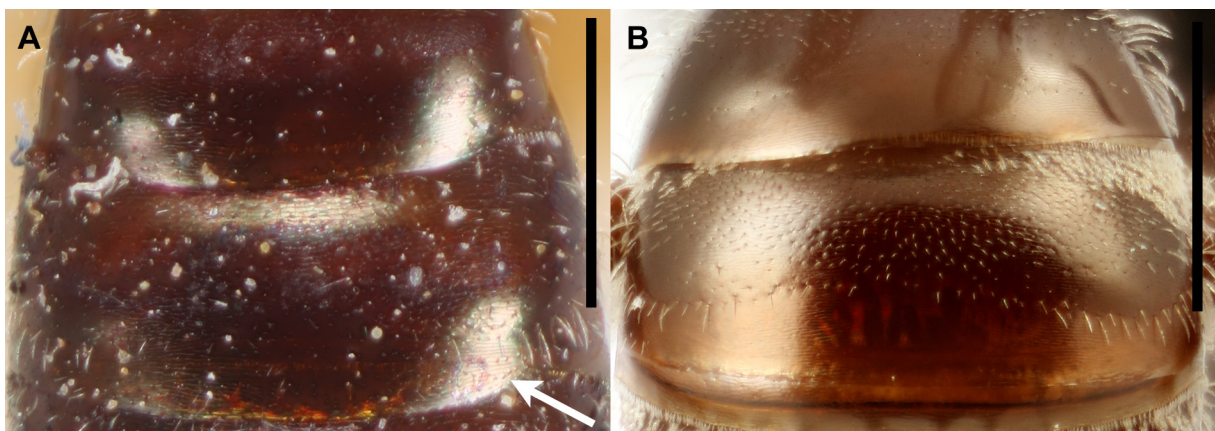


**Fig. 78.** Mesoscutum pubescence. **A.** *Lasioglossum perparvum* (Ellis, 1914), ♀, lateral view, with pubescence very short and sparse. **B.** *L. magnitegula* sp. nov., ♀, dorsal view, with pubescence very short and sparse. **C.** *L. angelicum* sp. nov., ♀, lateral view, with pubescence long and dense. **D.** *L. deludens* sp. nov., ♀, dorsal view, with pubescence long and dense. Scale bars = 0.5 mm.

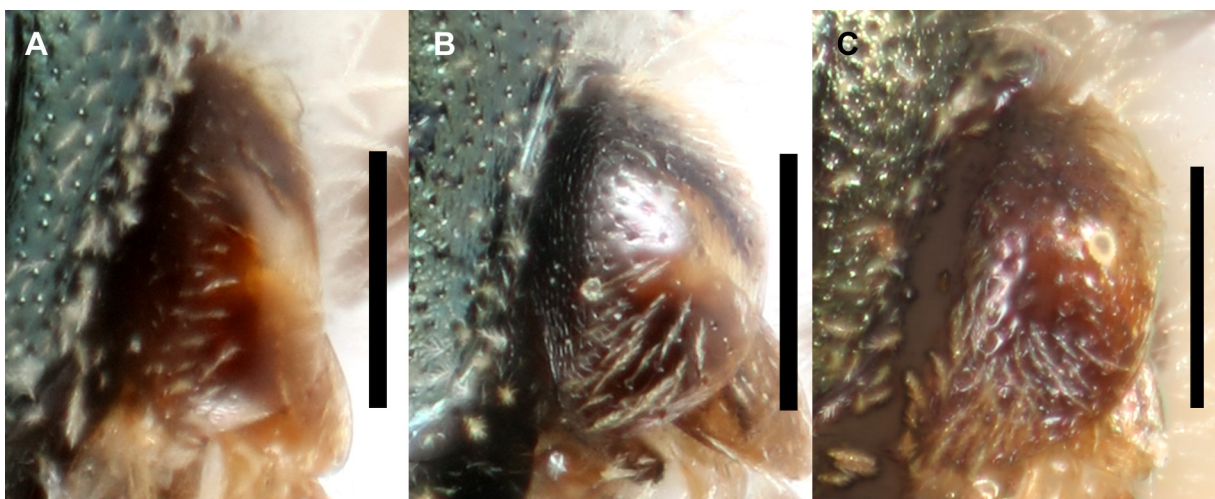




**Fig. 79.** Tegulae. **A.** *Lasioglossum perparvum* (Ellis, 1914), ♀, sparsely punctate, not exceeding posterior margin of mesoscutum, and inner posterior margin straight. **B.** *L. magnitegula* sp. nov., ♀, densely punctate, exceeding posterior margin of mesoscutum, and inner posterior margin concave. Scale bars = 0.5 mm.



**Fig. 80.** T1–T2 apical rims. **A.** *Lasioglossum perparvum* (Ellis, 1914), ♀, apical rims with some fine punctures and short setae (arrow). **B.** *L. magnitegula* sp. nov., ♀, apical rims impunctate and glabrous. Scale bars = 0.5 mm.



**Fig. 81.** Tegula. **A.** *Lasioglossum profundum* sp. nov., ♀, impunctate. **B.** *L. holzenthali* sp. nov., ♀, sparsely punctate. **C.** *L. stictaspis* (Sandhouse, 1923), ♀, densely punctate. Scale bars = 0.25 mm.

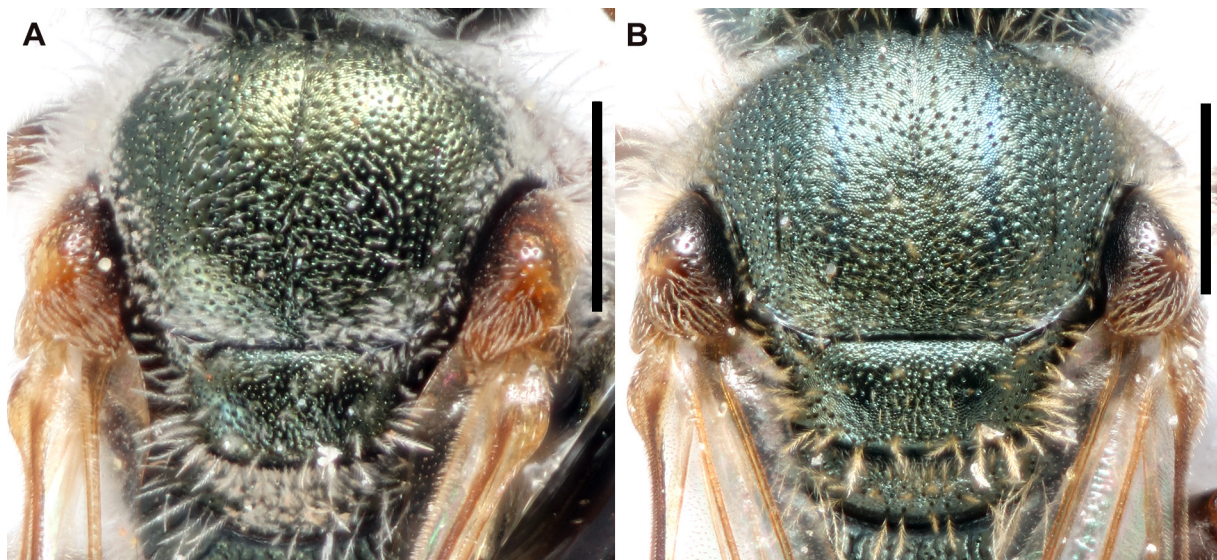
3. Tegula impunctate except on extreme anterior margin (Fig. 81A) ..... 4  
 – Tegula with at least a few distinct punctures medially, usually many (Fig. 81B–C) ..... 7
4. Tegula dark brown; mesoscutum coarsely punctate (punctuation similar to mesepisternum) .....  
 ..... *L. profundum* sp. nov.  
 – Tegula yellow-orange; mesoscutum more finely punctate (punctures smaller than those of mesepisternum) ..... 5
5. Mesoscutum and mesepisternum completely dull, tessellate to imbricate; metasoma entirely red-orange (eastern Texas, Nuevo Leon, and Tamaulipas) ..... *L. rufodeludens* sp. nov.  
 – Mesoscutum lateral and posterior margins and/or mesepisternum shiny with at most weak microsculpture (rarely both dull); at least basal half of discs of metasomal terga reddish brown to black (apical areas may be red-orange or black) ..... 6
6. Postgena smooth and shiny (as in Fig. 82A) (Chihuahuan and Sonoran Deserts) .....  
 ..... *L. deludens* sp. nov.  
 – Postgena dull, lineolate (as in Fig. 82B) (Florida Keys and Bahamas) .....  
 ..... *L. surianae* (Mitchell, 1960) [in part]
7. Mesoscutum, preepisternum, mesepisternum, and hypopimeron margins fringed with appressed tomentum (Fig. 83A); metepisternum covered in dense tomentum obscuring the surface; metanotum median third covered in dense pubescence obscuring the surface (Fig. 83A); tegula and metasoma bright red-orange ..... 8  
 – Mesoscutum and pleura without appressed tomentum (except sometimes mesoscutum anterolateral margins or metepisternum with sparse tomentum not obscuring the surface) (Fig. 83B); metanotum with dense pubescence limited to anterior margin (Fig. 83B); tegula and metasoma usually black to brown (if red-orange, then lacking the other characters) ..... 9



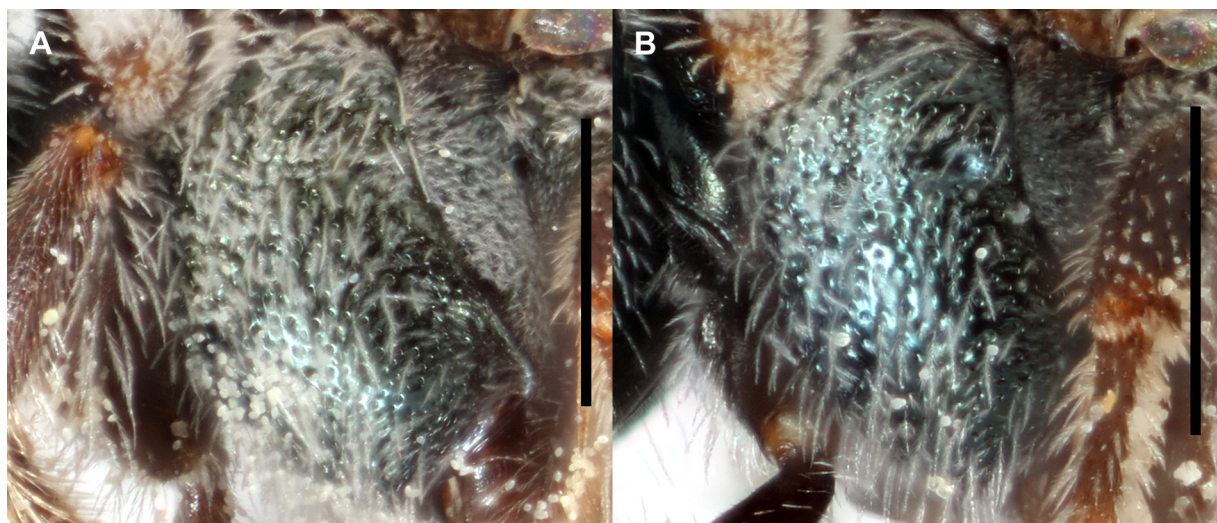
**Fig. 82.** Ventral surface of head showing postgena. **A.** *Lasioglossum profundum* sp. nov., ♀, smooth and shiny. **B.** *L. coactus* (Cresson, 1872), ♀, dull and lineolate. Scale bars = 0.5 mm.



8. Mesepisternum with most punctures separated by half a puncture diameter or less ( $IS < 0.5 PD$ ) (Fig. 84A); tegula outer margin densely punctate ( $IS \leq 1 PD$ ) (Nevada, Utah, and northern New Mexico) ..... *L. gloriosum* sp. nov.
- Mesepisternum with most punctures separated by up to one puncture diameter or slightly more ( $IS \leq 1 PD$ ) (Fig. 84B); tegula outer margin sparsely punctate ( $IS = 1–3 PD$ ) (southern Arizona, New Mexico, and Texas) ..... *L. indagator* sp. nov.



**Fig. 83.** Mesonotum. **A.** *Lasioglossum gloriosum* sp. nov., ♀, with dense tomentum on metanotum and margins of mesoscutum. **B.** *L. tegulare* (Robertson, 1890), ♀, with sparse tomentum. Scale bars = 0.5 mm.



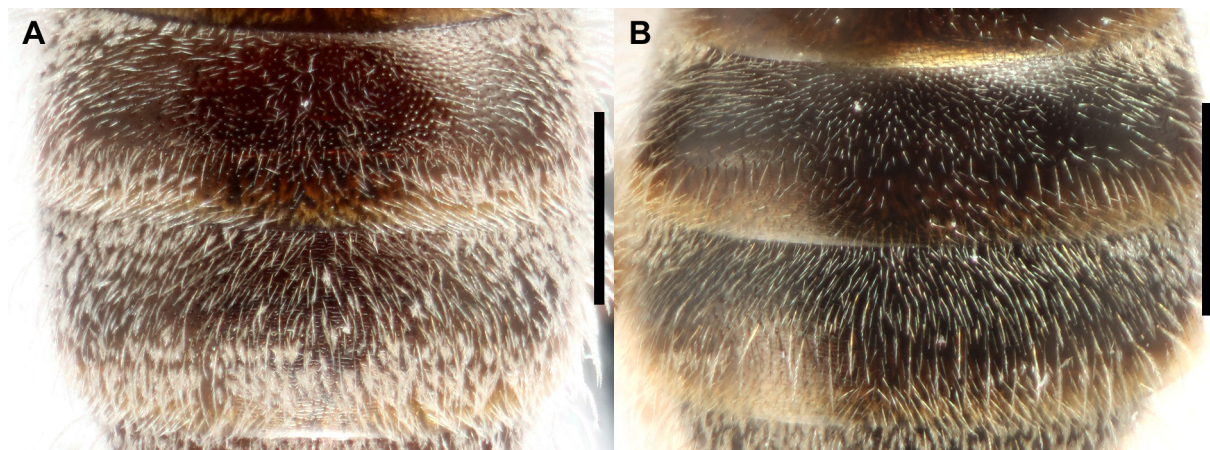
**Fig. 84.** Mesepisternum. **A.** *Lasioglossum gloriosum* sp. nov., ♀, with punctures very dense ( $IS \leq 0.5 PD$ ). **B.** *L. indagator* sp. nov., ♀, with punctures sparser ( $IS \leq 1 PD$ ). Scale bars = 0.5 mm.



9. T2–T3 usually each slightly convex with apical rim distinctly downcurved in lateral view (Fig. 85A); T3 usually with dense and complete subapical band of tomentum (Fig. 86A); disc of T2 with deep and dense punctures (IS  $\leq$  1 PD) reaching premarginal line and contrasting with largely impunctate apical rim (Fig. 86A) (Colorado to Veracruz) ..... *L. coactus* (Cresson, 1872)
- T2–T3 each flat in lateral view and apical rim continuous with contour of disc (Fig. 85B); T3 without subapical band of tomentum or this band sparse and broadly interrupted medially (except in *L. stictaspis* and *L. tegulariforme*, in which the disc of T2 has finer and sparser punctures (IS = 1–3 PD) either becoming inconspicuous near premarginal line or extending onto apical rim) (Fig. 86B) ..... 10



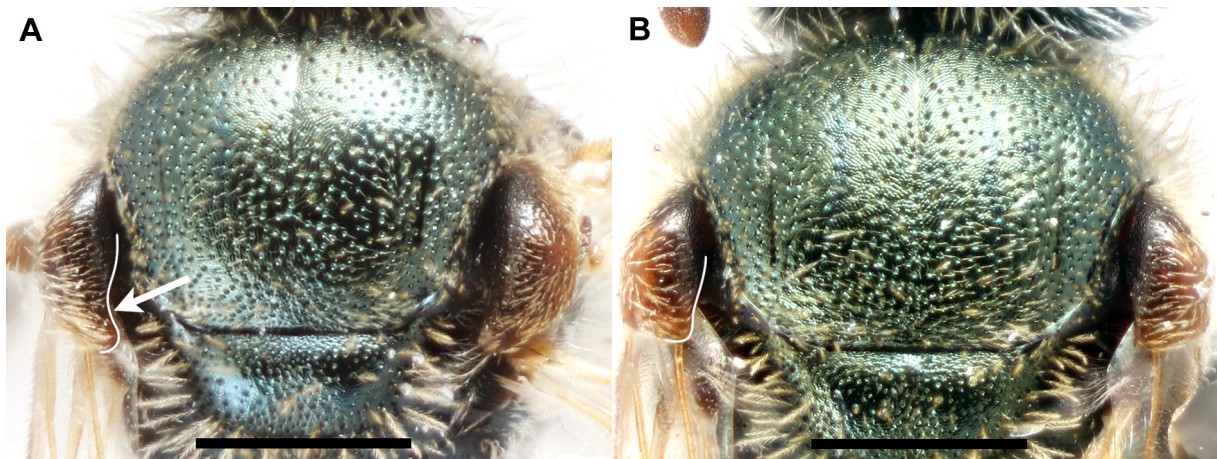
**Fig. 85.** Metasomal terga. **A.** *Lasioglossum coactus* (Cresson, 1872), ♀, with T2–T3 each slightly convex and apical rim downcurved in lateral view. **B.** *L. tegulare* (Robertson, 1890), ♀, with T2–T3 each flat and apical rim continuous with contour of disc in lateral view. Scale bars = 0.5 mm.



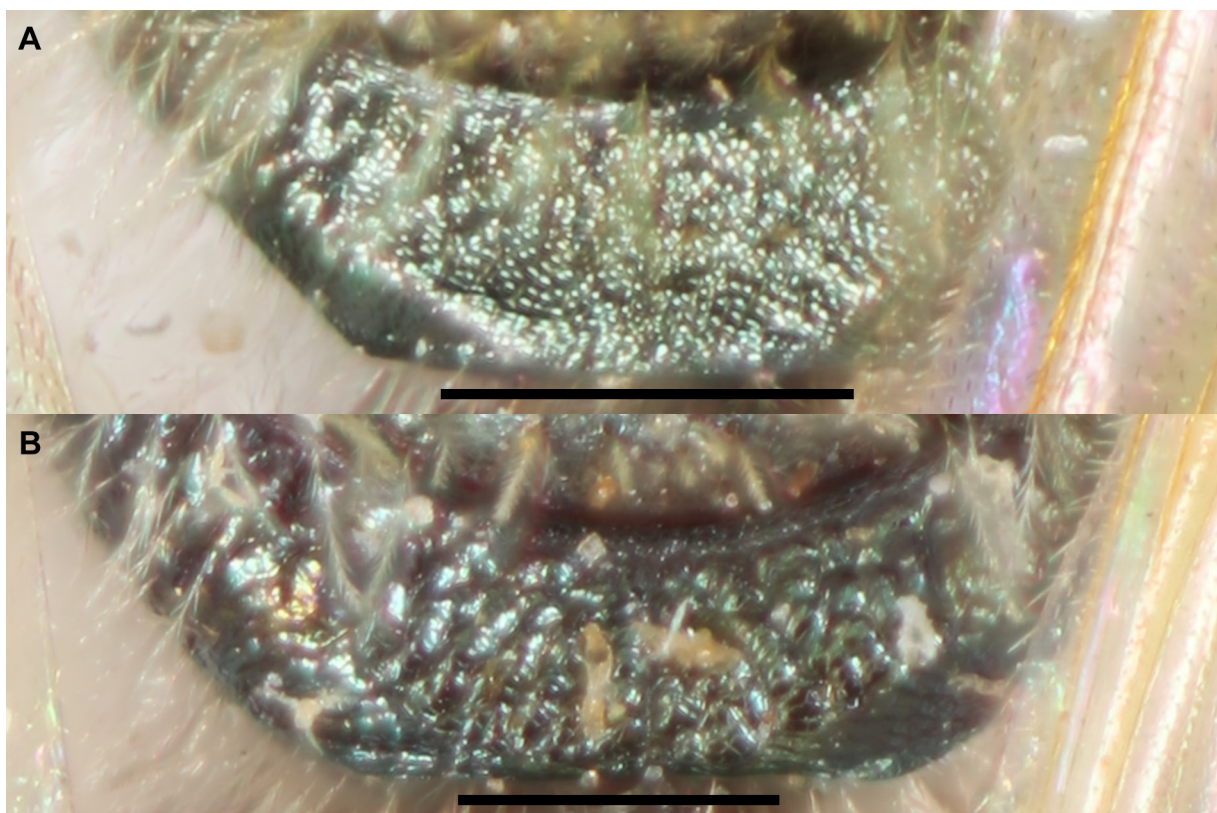
**Fig. 86.** T2–T3. **A.** *Lasioglossum coactus* (Cresson, 1872), ♀, with complete subapical band of tomentum on T3 and deep and dense punctures on disc of T2 contrasting with sparsely punctate apical rim. **B.** *L. angelicum* sp. nov., ♀, T3 without complete subapical band of tomentum and fine T2 punctures not contrasting across premarginal line. Scale bars = 0.5 mm.



10. Tegula relatively large (maximum length more than half ITS and reaching or exceeding posterior margin of mesoscutum in dorsal view), densely punctate throughout (IS < 1 PD), and usually with inner posterior margin deeply concave, forming a broadly rounded posterior projection about the size of 0.5–1 lateral OD (Fig. 87A) (United States west of ~99° and Mexico) ..... 11



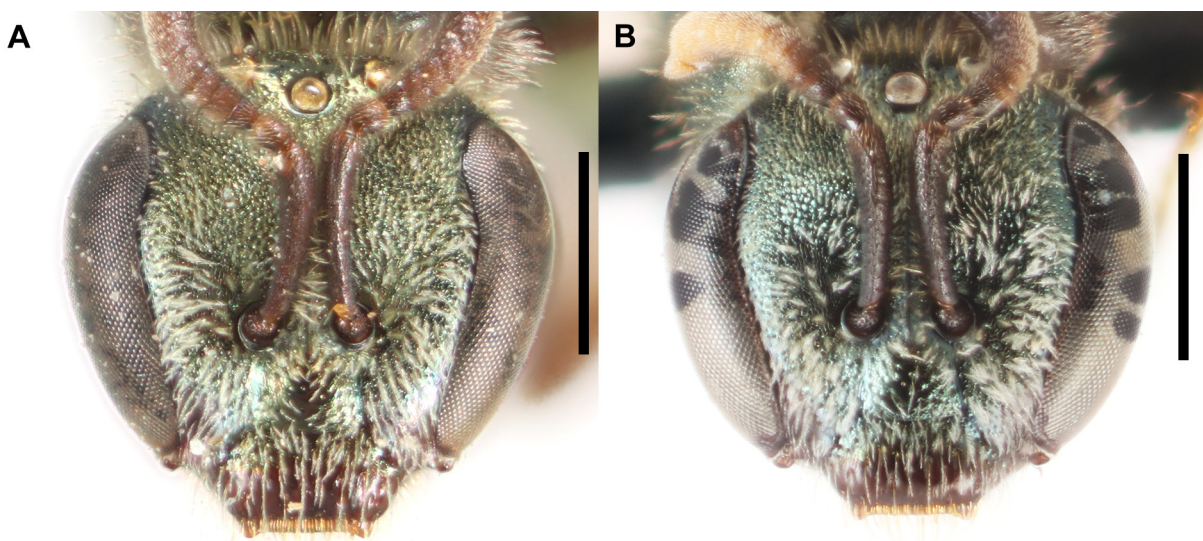
**Fig. 87.** Tegulae. **A.** *Lasioglossum angelicum* sp. nov., ♀, large with inner posterior margin concave and distinct posterior projection (outline and arrow). **B.** *L. diabolicum* sp. nov., ♀, small with inner posterior margin nearly straight and no posterior projection (outline). Scale bars = 0.5 mm.



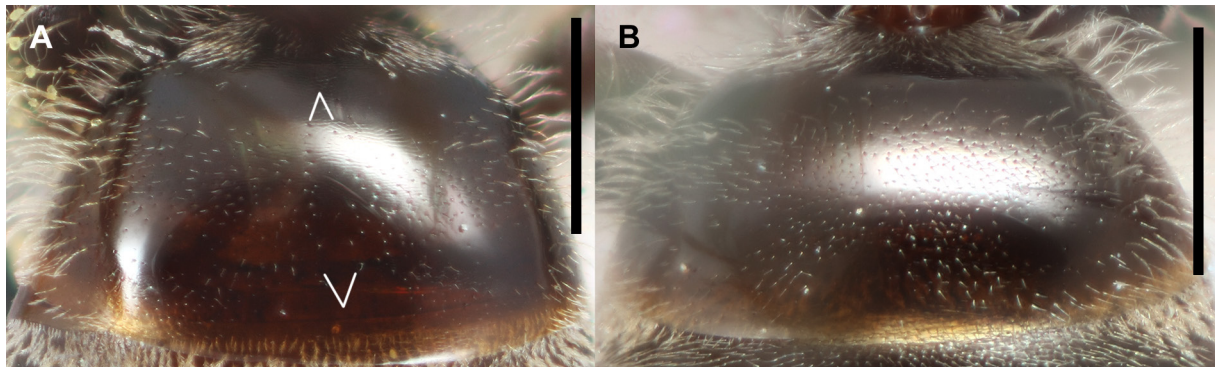
**Fig. 88.** Metapostnotum. **A.** *Lasioglossum pseudotegulare* (Cockerell, 1896), ♀, completely dull with fine rugae obscured by microsculpture. **B.** *L. regulariforme* (Crawford, 1907), ♀, shiny with strong rugae. Scale bars = 0.25 mm.



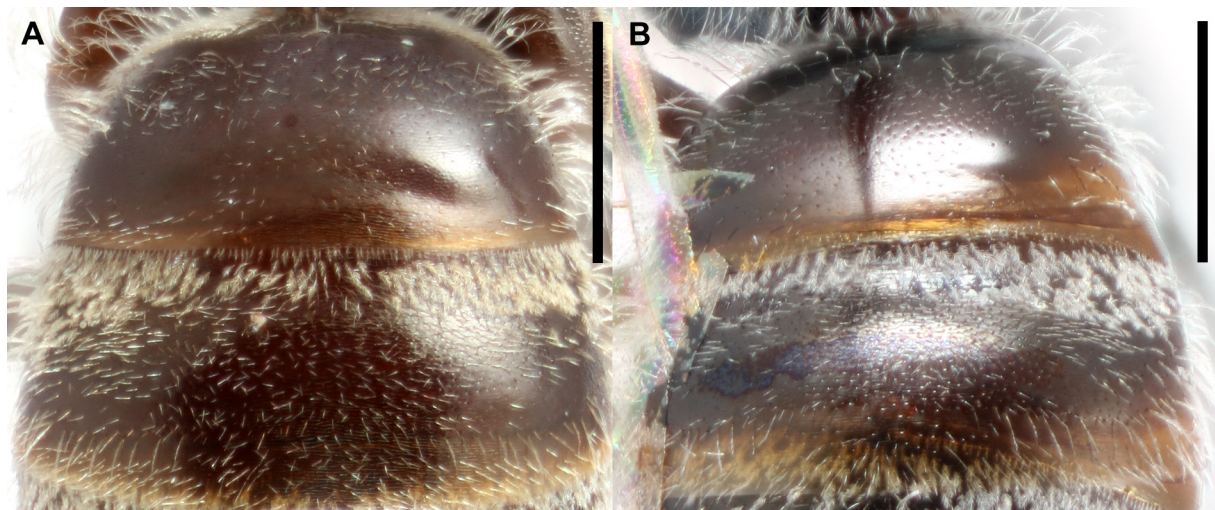
- Tegula relatively small (maximum length about half ITS or less and at most reaching posterior margin of mesoscutum in dorsal view), more sparsely punctate medially ( $IS \geq 1$  PD), and with inner posterior margin straight or weakly concave, forming a sharp posterior angle or point smaller than 0.5 lateral OD (Fig. 87B) (if tegula larger or more densely punctate, then occurring in United States east of  $\sim 99^\circ$ ) ..... 17
- 11. Metapostnotum smooth with fine, subparallel rugae and completely dull due to fine reticulate microsculpture (Fig. 88A) ..... 12
  - Metapostnotum roughened with strong, usually anastomosing rugae (except usually subparallel in *L. gaudiale*) and shiny basally between rugae due to weak microsculpture (Fig. 88B) ..... 13
- 12. Face slightly longer on average (length/width ratio 0.8–0.85) (Fig. 89A); mesepisternum densely punctate ( $IS < 1$  PD) and usually shiny; mesoscutum uniformly dull due to strong tessellate microsculpture; in Nearctic region, T1–T2 apical rims distinctly punctate with no change in sculpture across premarginal line (impunctate in Neotropics) ..... *L. pseudotegulare* (Cockerell, 1896)
  - Face slightly shorter on average (length/width ratio 0.77–0.84) (Fig. 89B); mesepisternum usually dull or more sparsely punctate (with some  $IS \geq 1$  PD) and/or mesoscutum shiny at least on lateral and posterior margins; T1–T2 apical rims impunctate or punctures much sparser and finer than on discs ..... *L. stictaspis* species complex [in part]
- 13. T1 disc with impunctate median line 1 OD wide or slightly less (Fig. 90A) .....
  - ..... *L. tegulariforme* (Crawford, 1907)
  - T1 disc evenly punctate throughout (Fig. 90B) ..... 14
- 14. T1 disc punctures very fine and sparse ( $IS = 1-4$  PD), much sparser than punctures in T2 basal half, or if similar, then all punctures very fine (no wider than fine setae arising from them) and somewhat obscured by coriarius microsculpture on T1–T2 discs (Fig. 91A) ..... *L. stictaspis* species complex [in part]
  - T1 disc punctures distinct and moderately dense ( $IS = 1-2$  PD), similar to punctures in T2 basal half; T1–T2 shiny except sometimes coriarius on T1 anterior slope or T2 apical rim (Fig. 91B) ..... 15



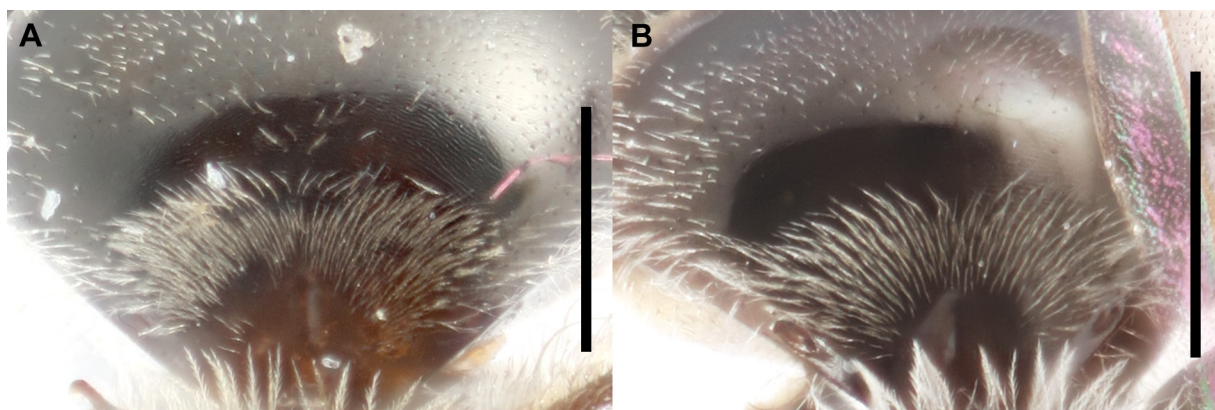
**Fig. 89.** Face. **A.** *Lasioglossum pseudotegulare* (Cockerell, 1896), ♀, slightly longer. **B.** *L. stictaspis* (Sandhouse, 1923), ♀, slightly shorter. Scale bars = 0.5 mm.



**Fig. 90.** T1 disc. **A.** *Lasioglossum tegulariforme* (Crawford, 1907), ♀, with median impunctate line about 1 OD wide (brackets). **B.** *L. angelicum* sp. nov., ♀, uniformly punctate. Scale bars = 0.5 mm.



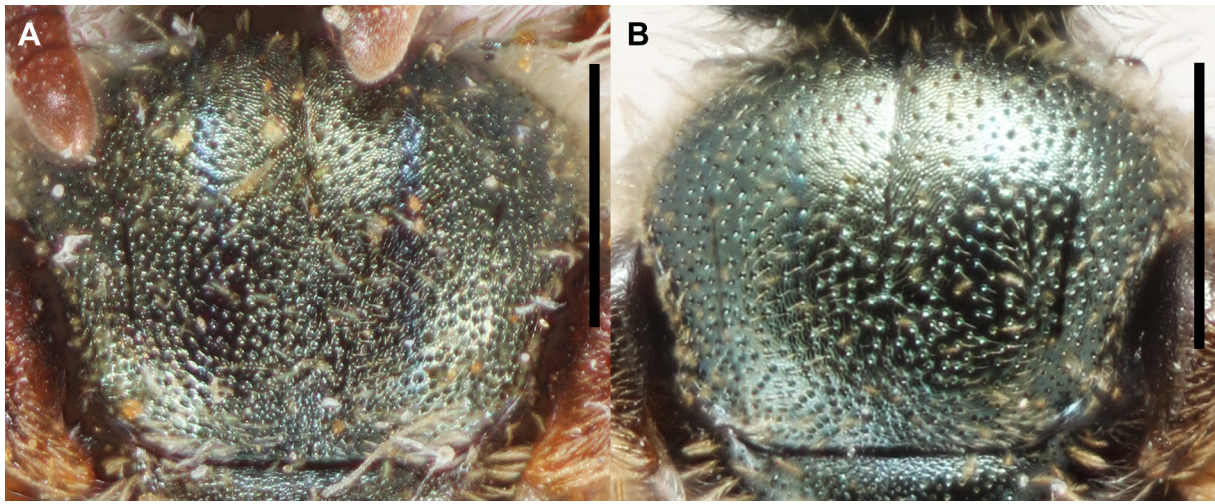
**Fig. 91.** T1–T2. **A.** *Lasioglossum stictaspis* (Sandhouse, 1923), ♀, dull and finely, somewhat obscurely punctate. **B.** *L. gaudiale* (Sandhouse, 1924), ♀, shiny and deeply, distinctly punctate. Scale bars = 0.5 mm.



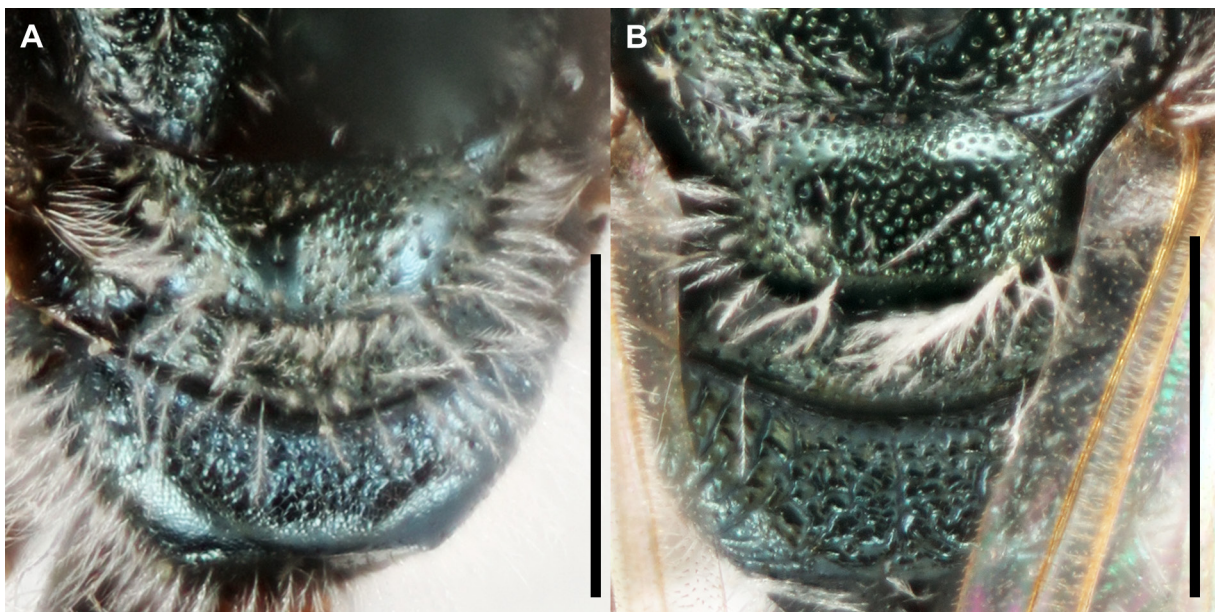
**Fig. 92.** T1 anterior slope. **A.** *Lasioglossum puteulanum* Gibbs, 2009, ♀, coriarious. **B.** *L. angelicum* sp. nov., ♀, smooth and shiny. Scale bars = 0.5 mm.



15. T1 anterior slope usually dulled by strong coriarius microsculpture (as in Fig. 92A); mesoscutum very densely and finely punctate (posterior half with no IS > 1 PD and 4–5 punctures present between posterior end of parapsidal line and lateral edge of mesoscutum) (as in Fig. 93A); T3 usually with sparse tomentum throughout disc ..... *L. helianthi* (Cockerell, 1916) [in part]
- T1 anterior slope shiny, mirror-smooth, with at most weak microsculpture not dulling surface (Fig. 92B); mesoscutum more sparsely or coarsely punctate (posterior half with IS = 1–3 PD in centre or only 2–3 punctures present between posterior end of parapsidal line and lateral edge of mesoscutum, except sometimes in *L. angelicum* sp. nov.) (Fig. 93B); T3 with tomentum limited to basal band and, at most, a thin, sparse subapical band which is broadly interrupted medially ..... 16



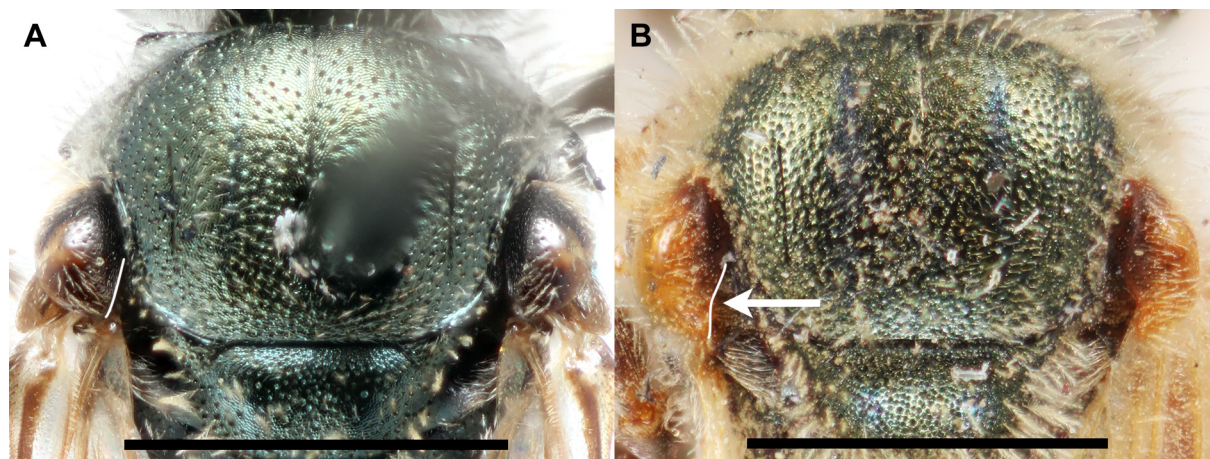
**Fig. 93.** Mesoscutum. **A.** *Lasioglossum tegulariforme* (Crawford, 1907), ♀, finely and very densely punctate. **B.** *L. angelicum* sp. nov., ♀, coarsely and moderately sparsely punctate. Scale bars = 0.5 mm.



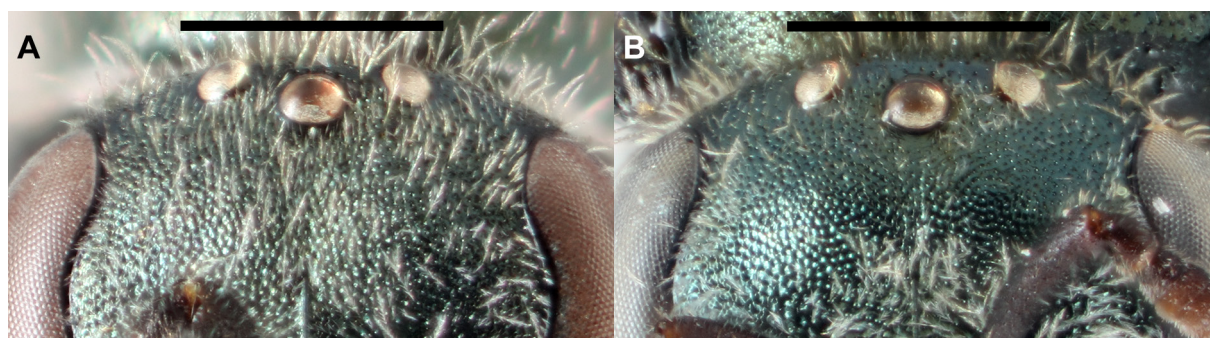
**Fig. 94.** Scutellum and metapostnotum. **A.** *Lasioglossum gaudiale* (Sandhouse, 1924), ♀, scutellum coarsely punctate and metapostnotum rugae not reaching posterior margin. **B.** *L. eremum* sp. nov., ♀, scutellum finely punctate and metapostnotum rugae reaching posterior margin. Scale bars = 0.5 mm.



16. Gena about as wide as eye in lateral view; metapostnotum rugae usually subparallel and not reaching posterior margin (Fig. 94A); scutellum often very coarsely and sparsely punctate in comparison to mesoscutum posterior margin (IS = 1–2 PD) (Fig. 94A) ....*L. gaudiale* (Sandhouse, 1924) [in part]  
 – Gena narrower than eye in lateral view; metapostnotum rugae usually anastomosing and reaching posterior margin (as in Fig. 94B); scutellum finely and densely punctate (IS < 1 PD except sometimes submedially), similar to mesoscutum posterior margin (as in Fig. 94B) ..... *L. angelicum* sp. nov.
17. Tegula inner posterior margin straight or nearly so and clearly not reaching posterior margin of mesoscutum in dorsal view (Fig. 95A) ..... 18  
 – Tegula inner posterior margin concave or sinuous and reaching posterior margin of mesoscutum in dorsal view (Fig. 95B) ..... 21
18. Frons above frontal carina dull, reticulate, with no distinct interspaces between punctures (Fig. 96A) (United States west of Rocky Mountains and Mexico) ..... 19  
 – Frons above frontal carina shiny due to narrow interspaces between punctures (Fig. 96B) (Florida and Bahamas) ..... 20



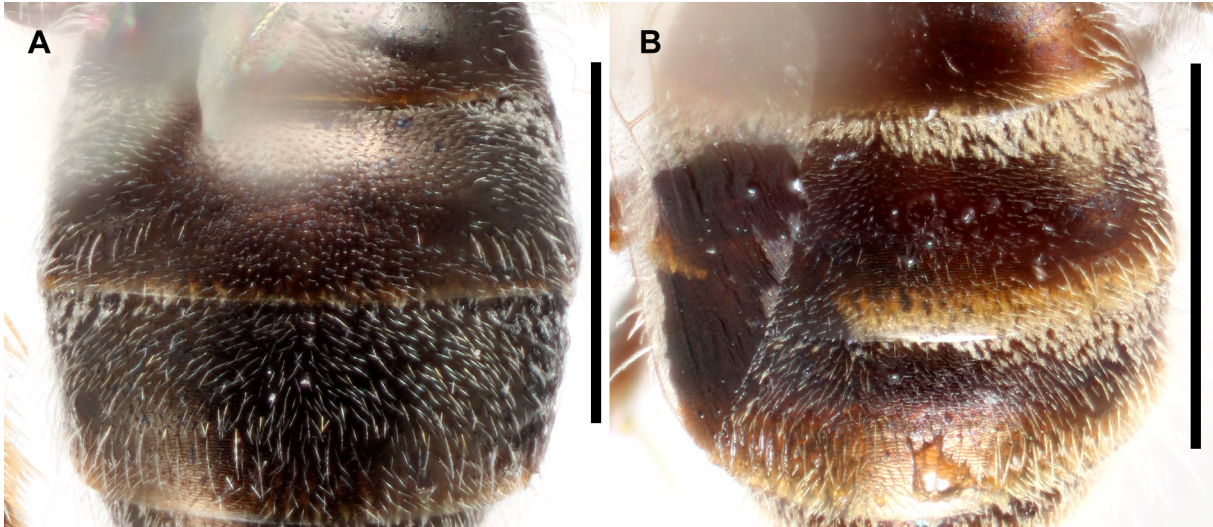
**Fig. 95.** Tegulae. **A.** *Lasioglossum holzenthali* sp. nov., ♀, not reaching posterior margin of mesoscutum and inner posterior margin straight (outline on left). **B.** *L. ellisiae* (Sandhouse, 1924), ♀, reaching posterior margin of mesoscutum and inner posterior margin concave (arrow and outline on left). Scale bars = 1 mm.



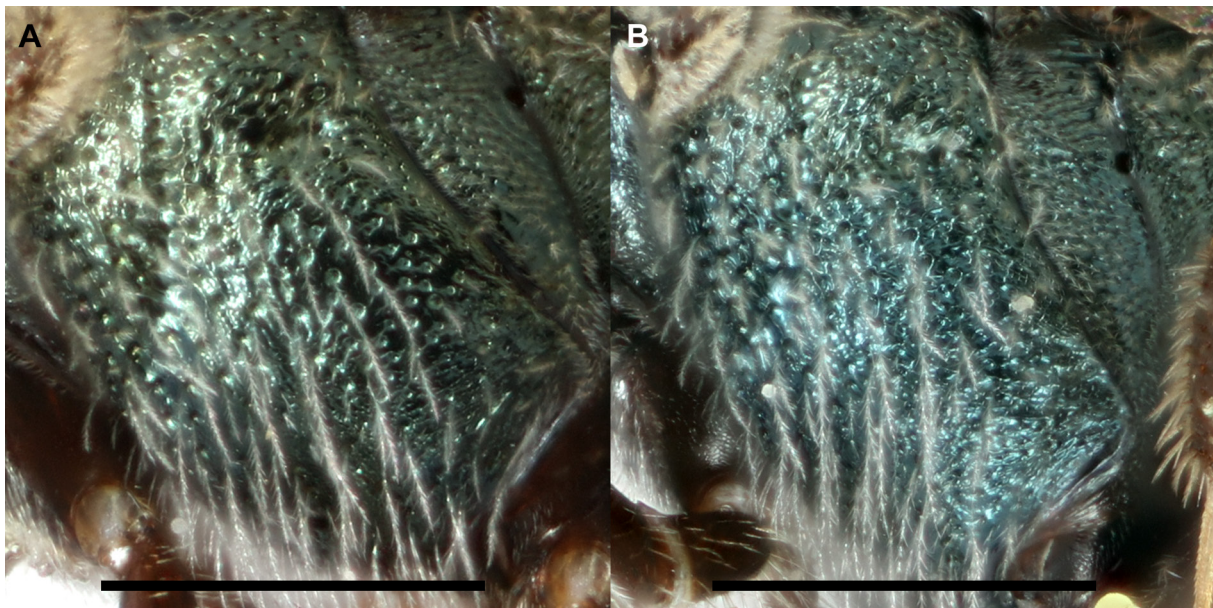
**Fig. 96.** Frons. **A.** *Lasioglossum holzenthali* sp. nov., ♀, roughened and dulled by crowded punctures without distinct interspaces. **B.** *L. lepidii* (Graenicher, 1927), ♀, smooth and shiny between punctures. Scale bars = 0.5 mm.



19. T1–T3 apical rims usually deeply and distinctly punctate, similar to discs (Fig. 97A); postgena anterior half smooth, shiny or imbricate (as in Fig. 82A); T2–3 with sparse basal bands of tomentum not obscuring the surface underneath and much narrower medially than laterally (Fig. 97A) ..... *L. holzenthali* sp. nov.
- T1–T3 apical rims impunctate (Fig. 97B); postgena anterior half lineate (as in Fig. 82B); T2–3 with dense basal bands of tomentum obscuring the surface underneath and about as wide medially as laterally (Fig. 97B) ..... *L. diabolicum* sp. nov. [in part]



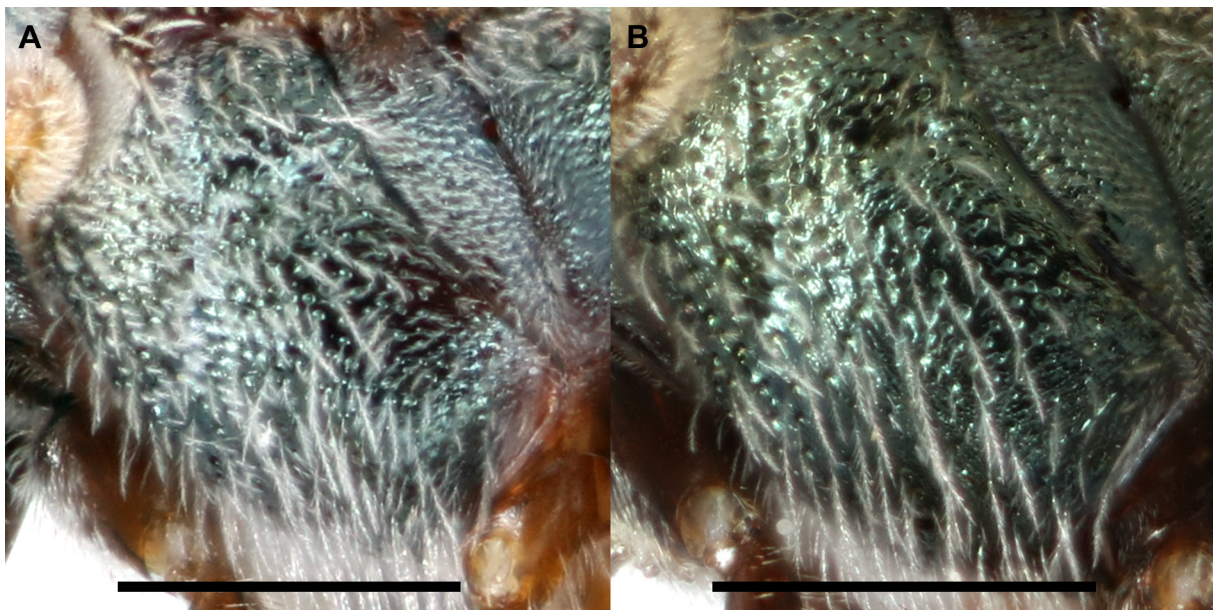
**Fig. 97.** T1–T3. **A.** *Lasioglossum holzenthali* sp. nov., ♀, with thin, sparse basal bands of tomentum and apical rims deeply and distinctly punctate. **B.** *L. diabolicum* sp. nov., ♀, with thick, dense basal bands of tomentum and apical rims impunctate. Scale bars = 1 mm.



**Fig. 98.** Mesepisternum. **A.** *Lasioglossum diabolicum* sp. nov., ♀, shiny with distinct round punctures. **B.** *L. tegulare* (Robertson, 1890), ♀, dull and rugulose. Scale bars = 0.5 mm.



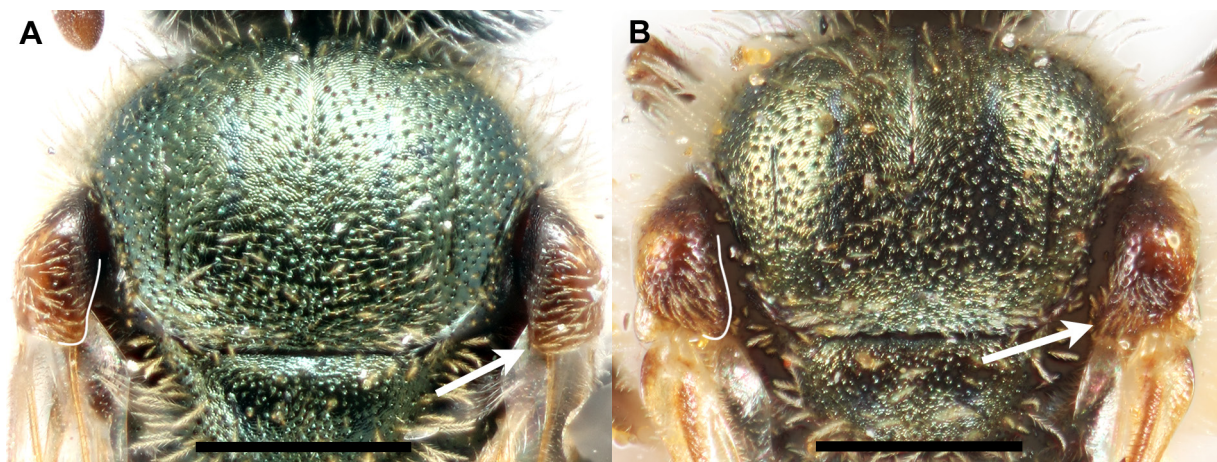
20. Tegula and metasoma dark brown to black ..... *L. lepidii* (Graenicher, 1927)  
 – Tegula and metasoma reddish brown to orange ..... *L. surianae* (Mitchell, 1960) [in part]
21. Mesepisternum with distinct round punctures; surface often shiny (Fig. 98A) ..... 22  
 – Mesepisternum punctures either indistinct or so crowded (IS = 0 PD) that most are polygonal, not round; surface dull, imbricate or rugulose (Fig. 98B) ..... 27
22. T1 disc punctures very fine and sparse (IS = 1–4 PD), much sparser than punctures in T2 basal half, or if similar, then all punctures very fine (no wider than fine setae arising from them) and somewhat obscured by coriarius microsculpture on T1–T2 discs (Fig. 91A) ..... 23  
 – T1 disc punctures distinct and moderately dense (IS = 1–2 PD), similar to punctures in T2 basal half; T1–T2 discs shiny or with microsculpture not obscuring the punctures (Fig. 91B) ..... 25
23. Mesepisternum punctures similar in size and density to those of hypopimeron (Fig. 99A); tegula sparsely punctate medially (IS = 1–3 PD); metapostnotum roughened with strong rugae and shiny basally between rugae due to weak microsculpture (as in Fig. 88B) (east of Rocky Mountains) ..... *L. ellisiae* (Sandhouse, 1924) [in part]  
 – Mesepisternum punctures slightly larger and sparser than those of hypopimeron (Fig. 99B), or if similar, then occurring west of Rocky Mountains; tegula often densely punctate medially (IS ≤ 1 PD); metapostnotum often smooth with fine rugae and completely dull due to fine reticulate microsculpture (as in Fig. 88A) ..... 24
24. Tegula with a blunt angle posteriorly (outline and arrow, Fig. 100A) and usually sparsely punctate medially (IS = 1–3 PD) ..... *L. diabolicum* sp. nov. [in part]  
 – Tegula with at least a small rounded posterior projection (outline and arrow, Fig. 100B) and usually densely punctate medially (IS ≤ 1 PD) ..... *L. stictaspis* species complex [in part]



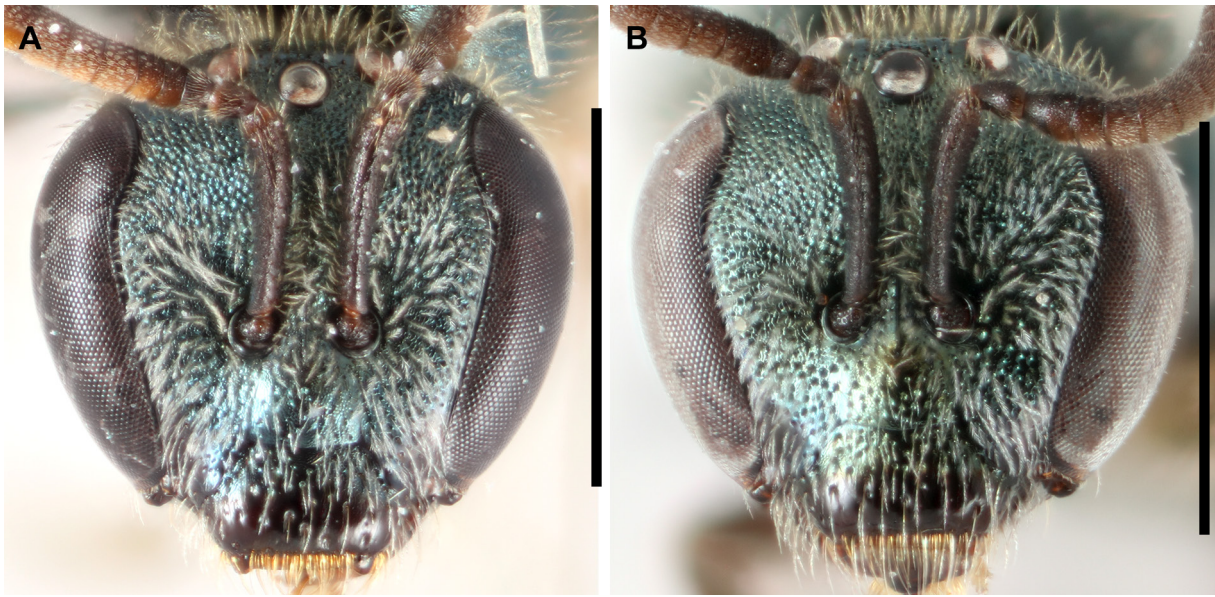
**Fig. 99.** Mesepisternum. **A.** *Lasioglossum ellisiae* (Sandhouse, 1924), ♀, punctures similar to hypopimeron. **B.** *L. diabolicum* sp. nov., ♀, punctures slightly larger and coarser than on hypopimeron. Scale bars = 0.5 mm.



25. Mesoscutum finely and densely punctate (4–5 punctures present between posterior end of parapsidal line and lateral edge of mesoscutum, separated by <math><0.5\text{ PD}</math>) (as in Fig. 93A); T3 usually with sparse tomentum throughout disc ..... *L. helianthi* (Cockerell, 1916) [in part]  
 – Mesoscutum coarsely punctate (2–3 punctures present between posterior end of parapsidal line and lateral edge of mesoscutum, which *may* be separated by up to 1 PD) (as in Fig. 93B); T3 with tomentum limited to basal band and, at most, a thin, sparse subapical band which is broadly interrupted medially ..... 26
26. T1 anterior slope shiny, mirror-smooth, with at most weak microsculpture not dulling surface (as in Fig. 92B); scutellum often sparsely punctate in comparison to mesoscutum posterior margin (IS = 1–2 PD) (Fig. 94A); metapostnotum rugae usually not reaching posterior margin or extending onto propodeum dorsolateral slope except at extreme base (Fig. 94A) ..... *L. gaudiale* (Sandhouse, 1924) [in part]  
 – T1 anterior slope dulled by coriarius microsculpture (as in Fig. 92A); scutellum densely punctate (IS <math><1\text{ PD}</math>), similar to mesoscutum posterior margin (Fig. 94B); metapostnotum rugae reaching posterior margin and extending onto most of propodeum dorsolateral slope (Fig. 94B) ..... *L. eremum* sp. nov.
27. T2–3 with dense basal bands of tomentum obscuring the surface underneath and about as wide medially as laterally (Fig. 97B) (west of Rocky Mountains, except Hawaii) ..... *L. diabolicum* sp. nov. [in part]  
 – T2–3 with sparse basal bands of tomentum not obscuring the surface underneath and much narrower medially than laterally (as in Fig. 97A) (east of Rocky Mountains and Hawaii) ..... 28
28. Face slightly longer on average (length/width ratio 0.81–0.87) (Fig. 101A); tegula slightly more sparsely punctate medially (IS = 1–2 PD); head and mesosoma usually blue to blue-green (southeastern United States and Hawaii) ..... *L. puteulanum* Gibbs, 2009  
 – Face slightly shorter on average (length/width ratio 0.8–0.85) (Fig. 101B); tegula slightly more densely punctate medially (IS  $\leq 1\text{ PD}$ ); head and mesosoma usually olive green (eastern United States) ..... 29
29. Inner hind tibial spur with 3 or 4 subapical teeth ..... *L. tegulare* (Robertson, 1890)  
 – Inner hind tibial spur with 2 subapical teeth ..... *L. carlinvillense* Gibbs, 2009



**Fig. 100.** Tegulae. **A.** *Lasioglossum diabolicum* sp. nov., ♀, with blunt posterior angle (white outline and arrow). **B.** *L. stictaspis* (Sandhouse, 1923), ♀, with rounded posterior projection (white outline and arrow). Scale bars = 0.5 mm.

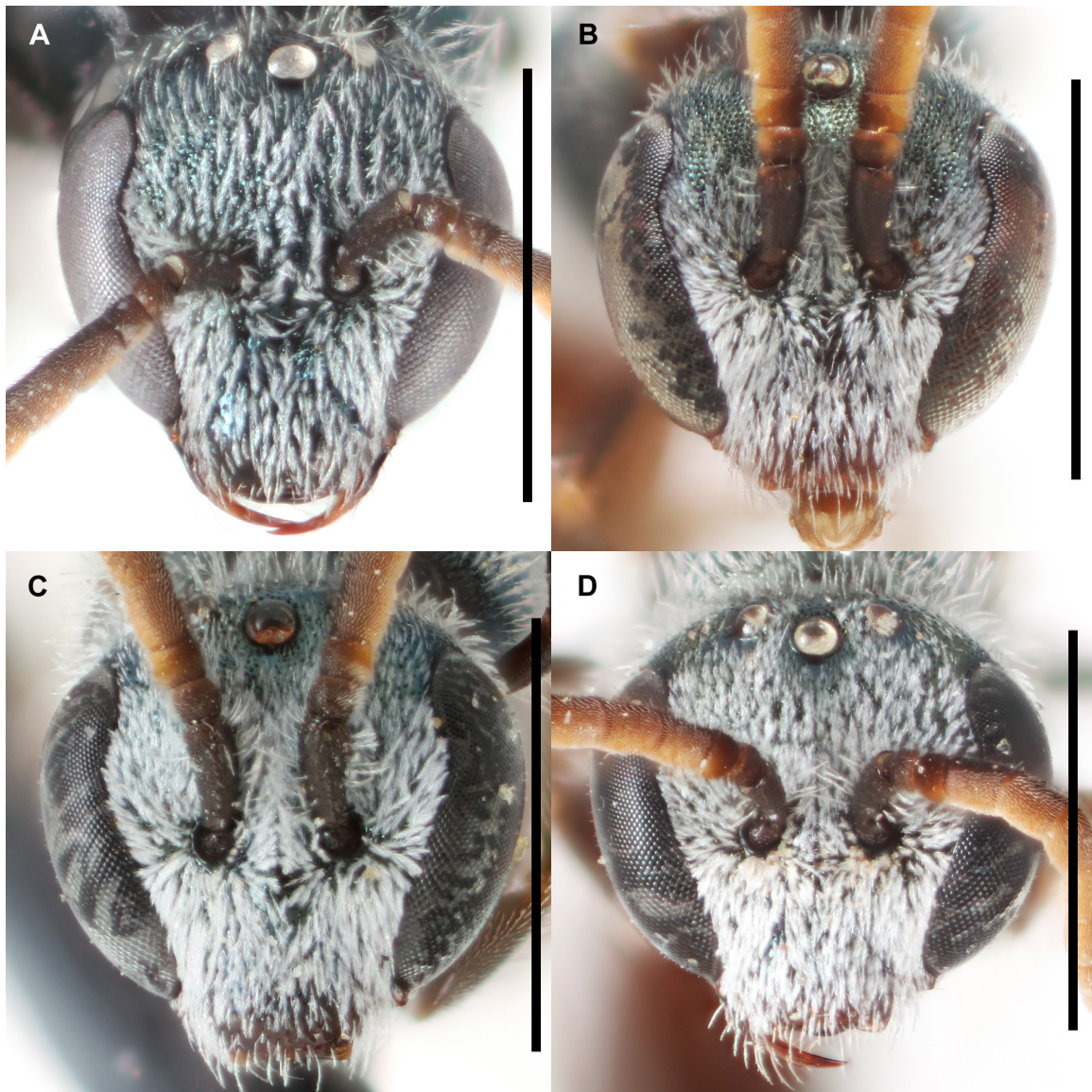


**Fig. 101.** Face. **A.** *Lasioglossum puteulanum* Gibbs, 2009, ♀, slightly longer. **B.** *L. tegulare* (Robertson, 1890), ♀, slightly shorter. Scale bars = 1 mm.



**Key to males**

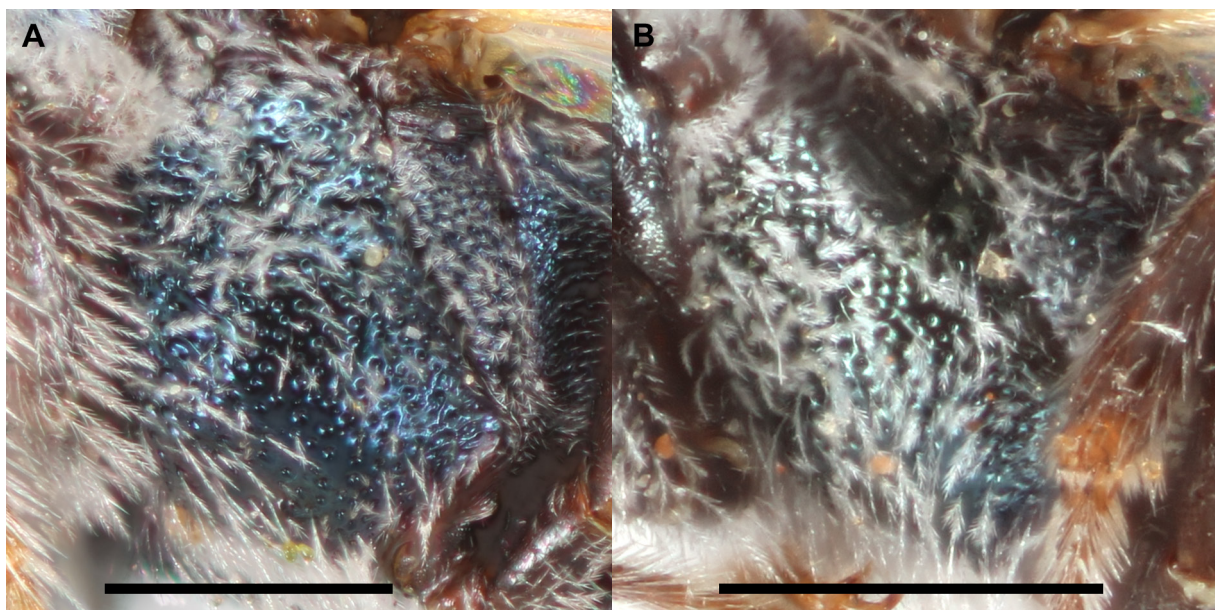
1. Tegula impunctate except on extreme anterior margin (as in Fig. 81A); face uniformly covered in dense tomentum at least below eye emargination (Fig. 102B–D) ..... 2
  - Tegula with at least a few distinct punctures medially, usually many (as in Fig. 81B–C), or (rarely) if impunctate, then face with dense tomentum limited to paraocular area (Fig. 102A) ..... 4
2. Mesoscutum tessellate anteriorly and often posteriorly; face with dense appressed tomentum at level of eye emargination and below (as in Fig. 102B) (eastern Texas, Nuevo Leon, and Tamaulipas) ..... *L. rufodeludens* sp. nov.
  - Mesoscutum shiny, at most weakly tessellate anteromedially; face with dense appressed tomentum slightly above level of eye emargination (Fig. 102C) (Chihuahuan and Sonoran deserts) ..... 3



**Fig. 102.** Face. **A.** *Lasioglossum holzenthali* sp. nov., ♂, with dense tomentum on lower paraocular areas and sparser tomentum between. **B.** *L. ellisiae* (Sandhouse, 1924), ♂, with dense tomentum below eye emargination. **C.** *L. deludens* sp. nov., ♂, with dense tomentum slightly above eye emargination. **D.** *L. gloriosum* sp. nov., ♂, with dense tomentum below ocelli. Scale bars = 1 mm.

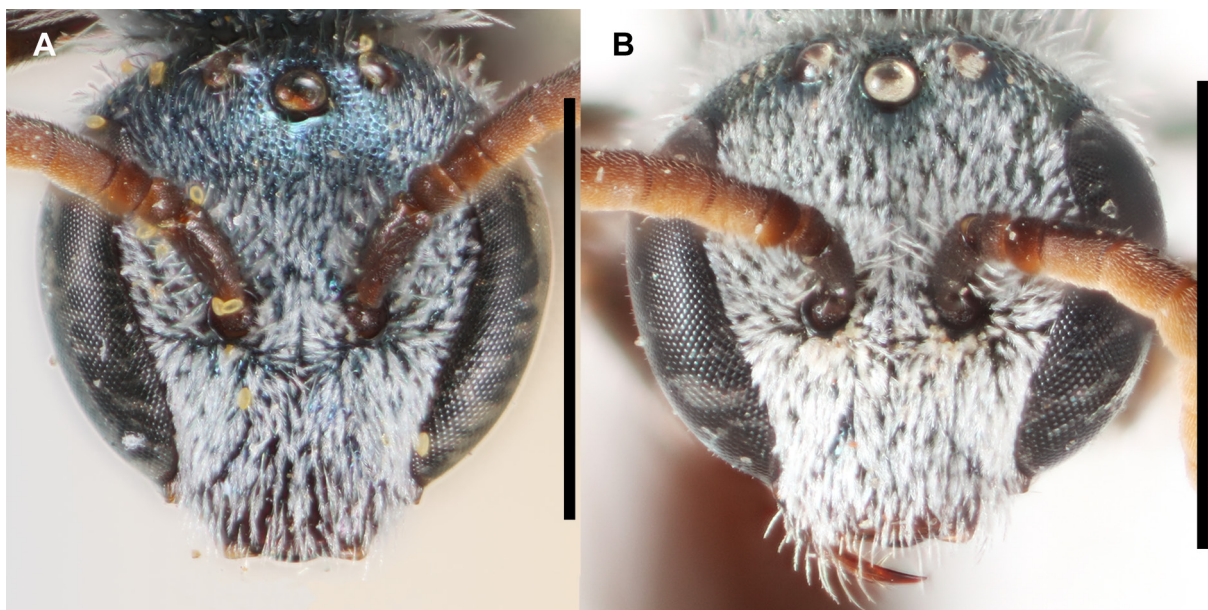


3. Tegula yellow-orange (Chihuahuan and Sonoran deserts) ..... *L. deludens* sp. nov.  
 – Tegula dark brown (Chihuahuan desert) ..... *L. profundum* sp. nov.
4. Face covered in dense appressed tomentum up to median ocellus or nearly so (Fig. 102D); mesoscutum often fringed with tomentum (as in Fig. 83A) ..... 5  
 – Face covered in dense appressed tomentum only up to eye emargination (Fig. 102B) or tomentum restricted to lower paraocular area (Fig. 102A); mesoscutum without tomentum (as in Fig. 83B) ...  
 ..... 7
5. Preëpisternum and metepisternum with sparse tomentum not obscuring the surface underneath (Fig. 103A); face usually narrower (length/width ratio >0.83) (Fig. 104A) ..... *L. gaudiale* (Sandhouse, 1924)  
 – Preëpisternum and metepisternum with dense tomentum largely obscuring the surface underneath (Fig. 103B); face broad (length/width ratio ≤0.83) (Fig. 104B) ..... 6
6. Mesoscutum mostly densely punctate (IS < 1 PD); tegula inner posterior margin strongly concave and rugulose; metapostnotum rugae usually reaching posterior margin; head and mesosoma integument mostly olive green (north of ~34°) (Fig. 105A) ..... *L. gloriosum* sp. nov.  
 – Mesoscutum mostly moderately sparsely punctate (IS = 1–2 PD); tegula inner posterior margin weakly concave and distinctly punctate; metapostnotum rugae usually not reaching posterior margin; head and mesosoma integument mostly blue (south of ~34°) (Fig. 105B) ..... *L. indagator* sp. nov.
7. T1–T4 each strongly convex in lateral view (Fig. 106A); apical rim abruptly depressed and impunctate, contrasting with densely punctate discs along premarginal line (IS < 1 PD) (Fig. 107A) .....  
 ..... *L. coactus* (Cresson, 1872)  
 – T1–T4 each mostly flat in lateral view (Fig. 106B); apical rim slightly depressed, with more gradual change or no change in sculpture across premarginal line (Fig. 107B) ..... 8

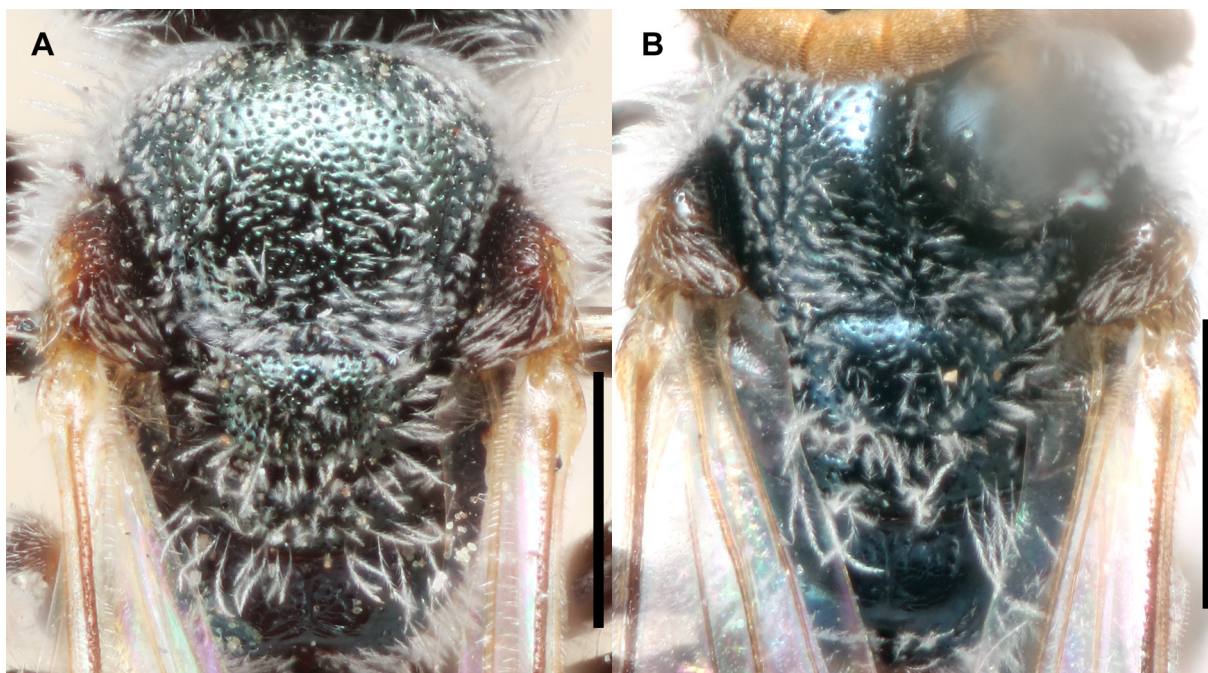


**Fig. 103.** Pleura. **A.** *Lasioglossum gaudiale* (Sandhouse, 1924), ♂, with sparse tomentum not obscuring the surface. **B.** *L. gloriosum* sp. nov., ♂, with dense tomentum obscuring the surface on preëpisternum and metepisternum. Scale bars = 0.5 mm.





**Fig. 104.** Face. **A.** *Lasioglossum gaudiale* (Sandhouse, 1924), ♂, slightly narrower. **B.** *L. gloriosum* sp. nov., ♂, broad. Scale bars = 1 mm.



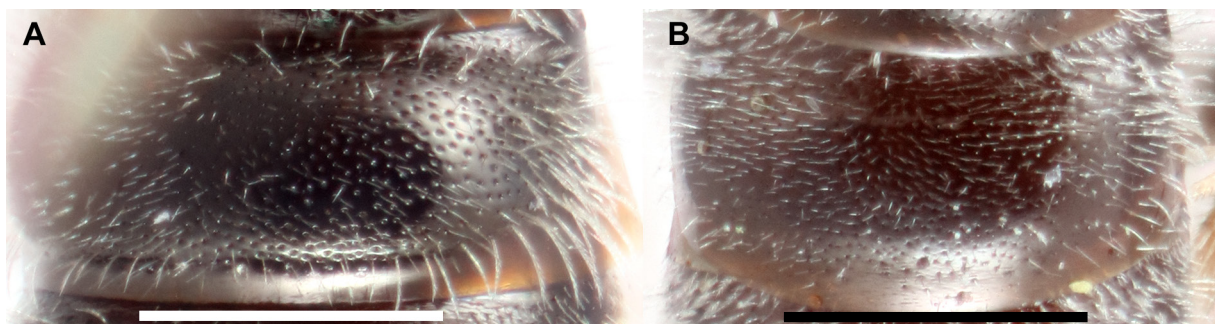
**Fig. 105.** Mesonotum. **A.** *Lasioglossum gloriosum* sp. nov., ♂, with mesoscutum densely punctate, tegula inner posterior margin strongly concave with crowded punctures, and metapostnotum rugae reaching posterior margin. **B.** *L. indagator* sp. nov., ♂, with mesoscutum sparsely punctate, tegula inner posterior margin weakly concave and more sparsely punctate, and metapostnotum rugae not reaching posterior margin. Scale bars = 0.5 mm.



8. Tegula inner posterior margin deeply concave, with a broadly rounded posterior projection about the size of 0.5–1 lateral OD directed toward axilla and sometimes partially covering it; tegula relatively large (reaching or exceeding posterior margin of mesoscutum in dorsal view) and densely punctate throughout (IS < 1 PD) (as in Fig. 87A) ..... 9
- Tegula inner posterior margin weakly concave or straight, with a blunt posterior angle or point narrower than 0.5 lateral OD and not reaching axilla; tegula relatively small (at most reaching posterior margin of mesoscutum in dorsal view) and often more sparsely punctate medially (IS ≥ 1 PD) (as in Fig. 87B) ..... 17



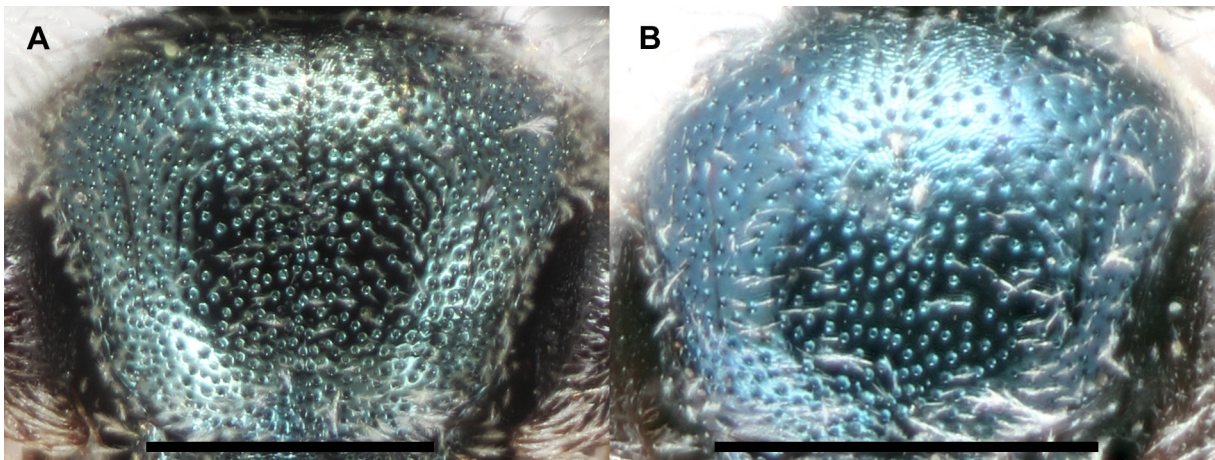
**Fig. 106.** Metasomal terga. **A.** *Lasioglossum coactus* (Cresson, 1872), ♂, T1–T3 each strongly convex with abruptly depressed apical rim. **B.** *L. helianthi* (Cockerell, 1916), ♂, T1–T3 each weakly convex with apical rim weakly depressed. Scale bars = 1 mm.



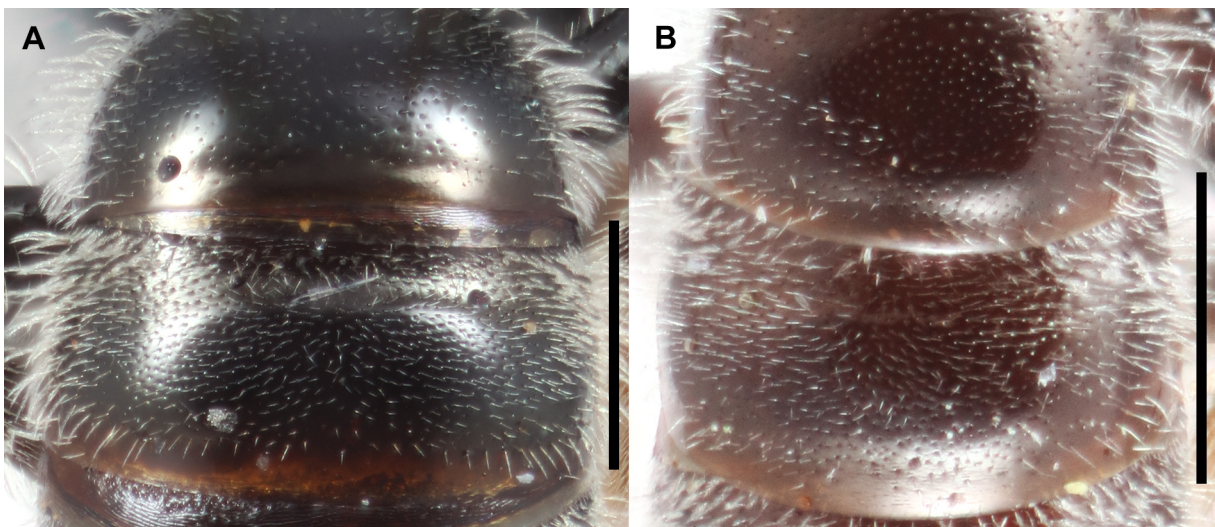
**Fig. 107.** T2. **A.** *Lasioglossum coactus* Cresson, 1872), ♂, apical rim deeply depressed and impunctate, contrasting with very densely punctate disc. **B.** *L. helianthi* (Cockerell, 1916), ♂, apical rim flat with gradual change in punctation across premarginal line. Scale bars = 0.5 mm.



9. Mesoscutum entirely densely punctate (IS < 1 PD; sometimes with a few scattered IS = 1 PD submedially) (Fig. 108A) (Cascadia bioregion, California, and Hawaii) ..... 10  
 – Mesoscutum more sparsely punctate (most IS ≥ 1 PD) (Fig. 108B) (not occurring in Cascadia bioregion or Hawaii) ..... 12
10. T1 disc punctures slightly but distinctly sparser medially (IS = 1–3 PD) than those of T2 (IS = 1–2 PD); T1–T2 apical rims impunctate except for a few scattered punctures below T1 subapicolateral boss (Fig. 109A) ..... *L. tegulariforme* (Crawford, 1907)  
 – T1–T2 discs nearly identically, moderately densely punctate (IS = 1–2 PD) and with distinct punctures extending across premarginal line onto basal margin of apical rims (Fig. 109B) ..... 11



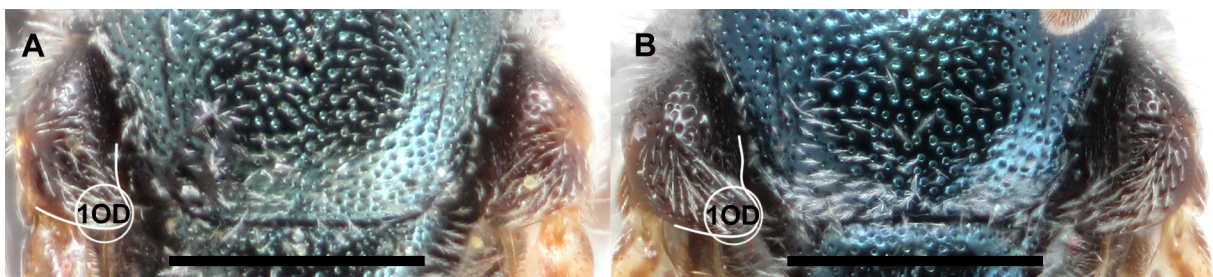
**Fig. 108.** Mesoscutum. **A.** *Lasioglossum tegulariforme* (Crawford, 1907), ♂, densely punctate. **B.** *L. pseudotegulare* (Cockerell, 1896), ♂, moderately sparsely punctate. Scale bars = 0.5 mm.



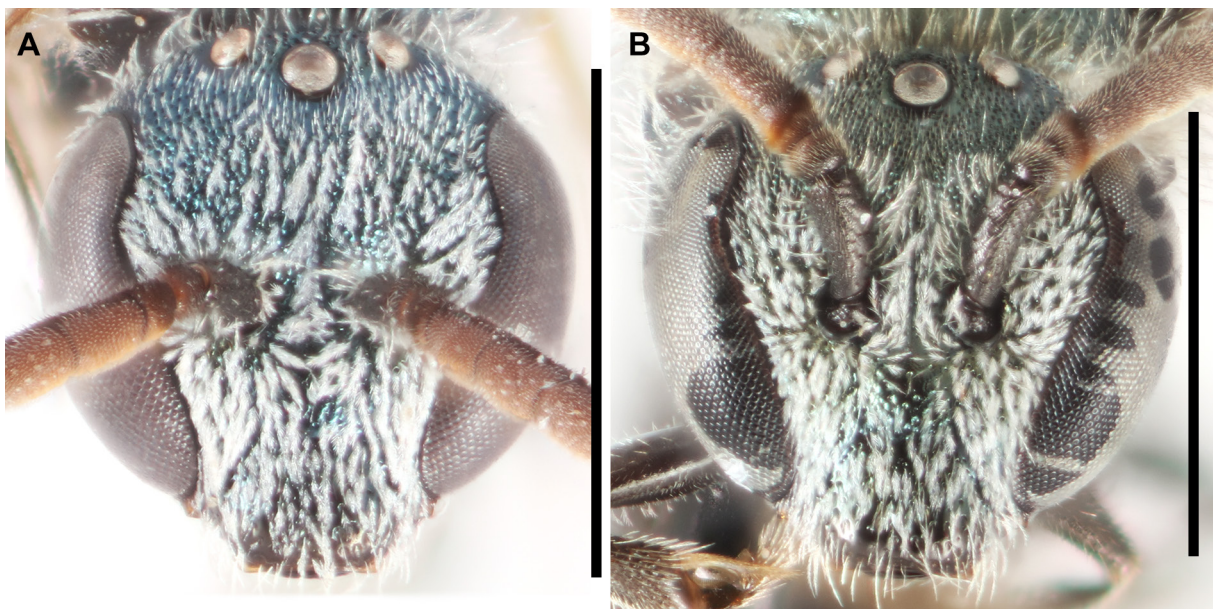
**Fig. 109.** T1–T2. **A.** *Lasioglossum tegulariforme* (Crawford, 1907), ♂, T1 more sparsely punctate than T2 and apical rims impunctate. **B.** *L. helianthi* (Cockerell, 1916), ♂, T1 and T2 uniformly punctate with some punctures on apical rims. Scale bars = 0.5 mm.



11. Tegula slightly smaller (maximum length usually  $\leq 55\%$  ITS and reaching but not clearly exceeding mesoscutum posterior margin in dorsal view) and with narrower posterior projection closer to the size of 0.5 lateral OD (Fig. 110A) ..... *L. helianthi* (Cockerell, 1916) [in part]  
 – Tegula slightly larger (maximum length  $> 55\%$  ITS and exceeding mesoscutum posterior margin in dorsal view) and with larger posterior projection closer to the size of 1 lateral OD (Fig. 110B) .....  
 ..... *L. angelicum* sp. nov. [in part]
12. T1–T2 apical rims with distinct punctures extending across premarginal line onto basal margin of apical rims (Fig. 109B) ..... 13  
 – T1–T2 apical rims impunctate (except sometimes with a few scattered, minute punctures below T1 subapicolateral boss) (as in Fig. 109A) ..... 15

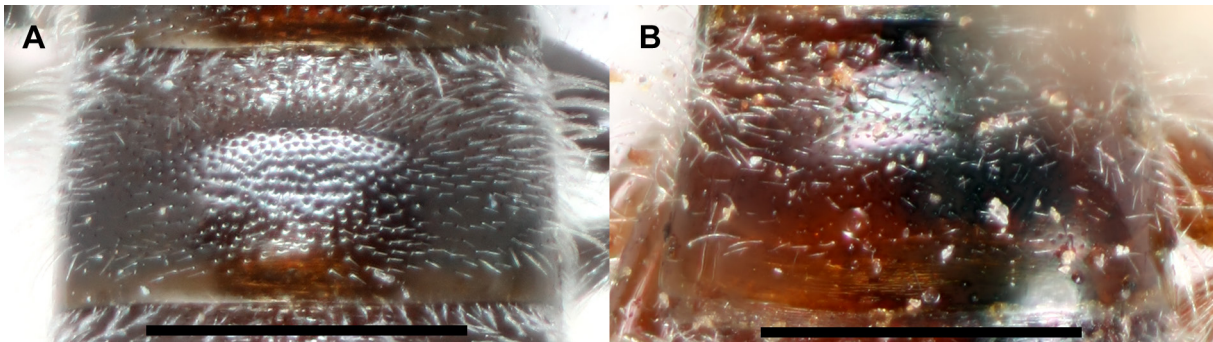


**Fig. 110.** Tegulae. **A.** *Lasioglossum helianthi* (Cockerell, 1916), ♂, with smaller posterior projection (outline on left) barely exceeding mesoscutum posterior margin. **B.** *L. angelicum* sp. nov., ♂, with larger posterior projection (outline on left) clearly exceeding mesoscutum posterior margin. The white circle corresponds to 1 lateral OD. Scale bars = 0.5 mm.

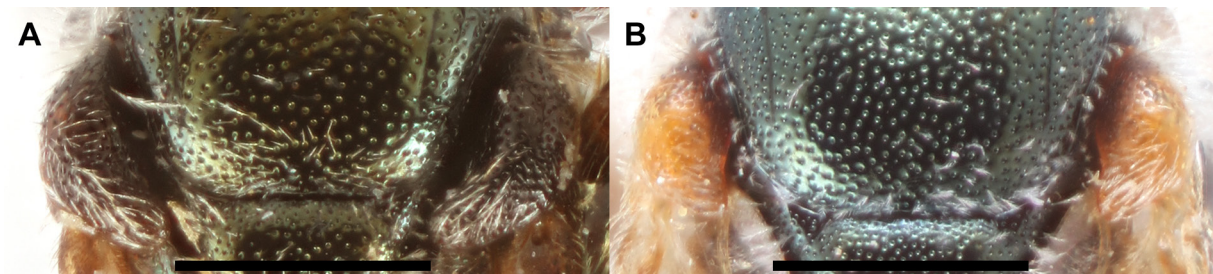


**Fig. 111.** Face. **A.** *Lasioglossum pseudotegulare* (Cockerell, 1896), ♂, slightly longer. **B.** *L. stictaspis* (Sandhouse, 1923), ♂, slightly shorter. Scale bars = 1 mm.

13. Face slightly longer (length/width ratio usually  $>0.86$ ) (Fig. 111A); discs of T2–T3 and usually T1 with punctures very dense medially (IS  $<1$  PD), often nearly touching (Fig. 112A) .....  
 ..... *L. pseudotegulare* (Cockerell, 1896)
- Face slightly shorter (length/width ratio  $\leq 0.86$ ) (Fig. 111B); discs of T1–T3 with punctures sparser medially (IS  $\geq 1$  PD), not close to touching (Fig. 112B) ..... 14
14. Mesepisternum ventral half densely punctate (IS  $<1$  PD); T1 shiny; tarsi and femur-tibia joints dark brown (southern California coast and Los Angeles basin) ..... *L. angelicum* sp. nov. [in part]
- Mesepisternum ventral half more sparsely punctate (IS  $\geq 1$  PD), T1 coriarius at base, tarsi and femur-tibia joints orange, or occurring in Sonoran Desert and eastward (some specimens are morphologically indistinguishable and can only be separated by geography) .....  
 ..... *L. stictaspis* species complex [in part]
15. Tegula extremely large (maximum length  $>67\%$  ITS and exceeding mesoscutum posterior margin by nearly 1 OD) (Fig. 113A); face slightly longer (length/width ratio usually  $>0.86$ ) (as in Fig. 111A) (Neotropical Mexico, rarely occurring north to United States border) ..... *L. magnitegula* sp. nov.
- Tegula smaller (maximum length  $\leq 67\%$  ITS and exceeding mesoscutum posterior margin by less than 1 OD if at all) (Fig. 113B); face slightly shorter (length/width ratio usually  $<0.86$ ) (Fig. 111B) ..... 16



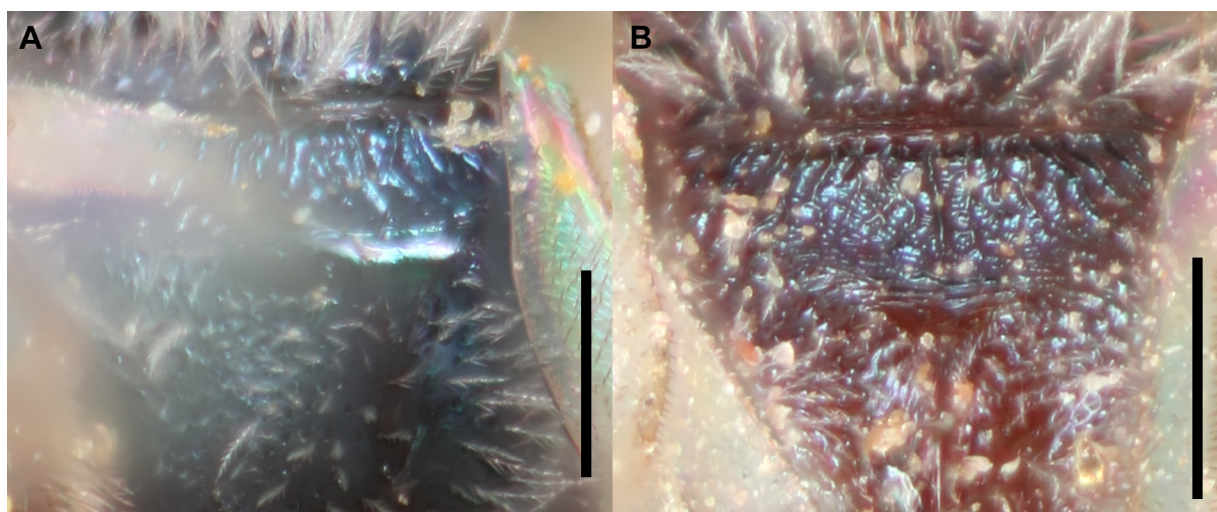
**Fig. 112.** T2. **A.** *Lasioglossum pseudotegulare* (Cockerell, 1896), ♂, punctures nearly touching in centre. **B.** *L. stictaspis* (Sandhouse, 1923), ♂, punctures not close to touching. Scale bars = 0.5 mm.



**Fig. 113.** Tegulae. **A.** *Lasioglossum magnitegula* sp. nov., ♂, very large and exceeding mesoscutum posterior margin by almost 1 OD. **B.** *L. ellisiae* (Sandhouse, 1924), ♂, smaller and not exceeding mesoscutum posterior margin. Scale bars = 0.5 mm.

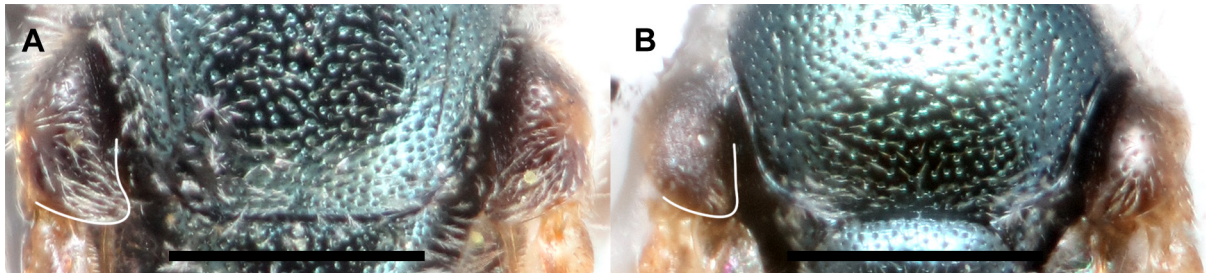


16. Metapostnotum shiny with strong subparallel rugae (as in Fig. 114A) (east of Rocky Mountains to Atlantic coast) ..... *L. ellisiae* (Sandhouse, 1924) [in part]  
 – Metapostnotum dull by strong microsculpture or, if shiny, then rugae anastomosing (Fig. 114B) (west of Rocky Mountains and east to ~102°) ..... *L. stictaspis* species complex [in part]
17. Face with tomentum limited to lower paraocular area and clypeus without tomentum ..... 18  
 – Face with uniformly dense tomentum below eye emargination, or if denser in lower paraocular area, then clypeus with some sparse tomentum ..... 19
18. Tegula dark brown with deep, crowded punctures (IS = 0 PD) (high elevations of southwestern United States) ..... *L. eremum* sp. nov.  
 – Tegula yellow-orange and very finely and sparsely punctate medially (IS = 2–6 PD) (Florida and Bahamas) ..... *L. suriana*e (Mitchell, 1960)
19. T1–T3 apical rims with distinct punctures extending across premarginal line, at least onto basal margin of T1–T2 apical rims (Fig. 109B) ..... 20  
 – T1–T3 apical rims impunctate (except sometimes with a few scattered, minute punctures below T1 subapicolateral boss) (as in Fig. 109A) ..... 22
20. Tegula inner posterior margin concave, with a distinct posterior projection longer than 1 mesoscutum PD, and usually densely punctate medially (IS ≤ 1 PD) (Fig. 115A); clypeus usually with tomentum about as dense as on lower paraocular area (as in Fig. 102B) (Cascadia bioregion, Hawaii, and California) ..... *L. helianthi* (Cockerell, 1916) [in part]  
 – Tegula inner posterior margin straight or weakly concave, with at most a small posterior bump about 1 mesoscutum PD long, and usually sparsely punctate medially (IS > 1 PD) (Fig. 115B); clypeus usually with tomentum sparser than on lower paraocular area (Fig. 102A) (not occurring in Cascadia bioregion or Hawaii) ..... 21
21. T1–T2 apical rims punctate except T1 apicomedia and far sides of T2 (Fig. 116A); T3 apical rim with at least some punctures; metapostnotum shiny (including posterior margin) .....  
 ..... *L. holzenthali* sp. nov.

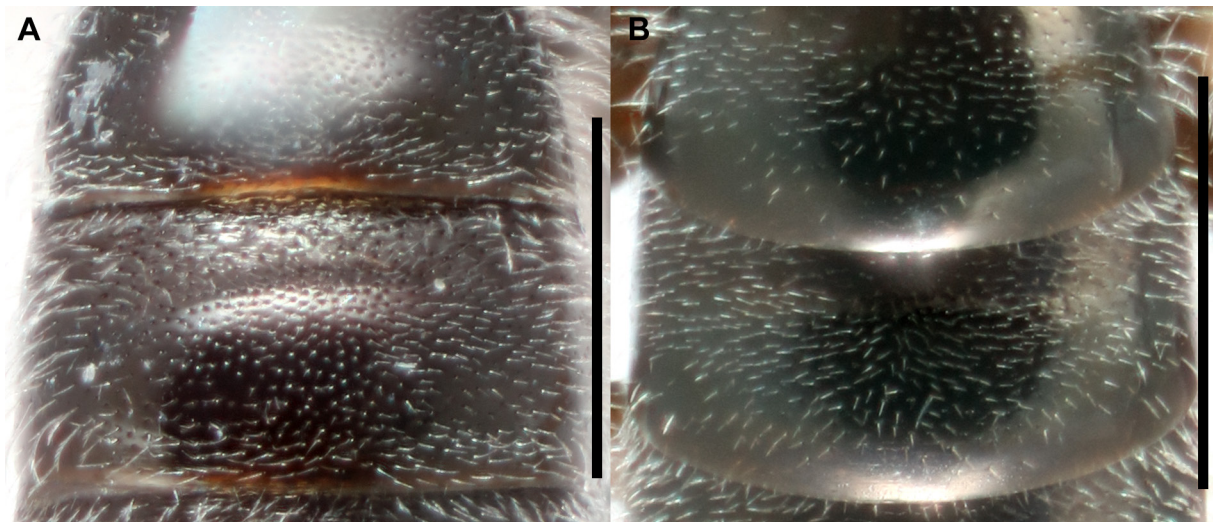


**Fig. 114.** Metapostnotum. **A.** *Lasioglossum gaudiale* (Sandhouse, 1924), ♂, shiny with subparallel rugae. **B.** *L. stictaspis* (Sandhouse, 1923), ♂, dull with anastomosing rugae. Scale bars = 0.25 mm.

- T1–T2 apical rims punctate only on basal margins (Fig. 116B); T3 apical rim impunctate; metapostnotum dulled by strong imbricate microsculpture (most noticeable on posterior margin) ..  
..... *L. perparvum* (Ellis, 1914) [in part]
- 22. Mesoscutum with sparse erect setae up to 1 OD long, with several gaps half a seta's length wide or wider in lateral view, these setae appearing thin and simple at 40 × magnification (as in Fig. 78A–B) ..... *L. perparvum* (Ellis, 1914) [in part]
- Mesoscutum with dense erect setae 1 OD long or slightly longer, with no gaps half a seta's length wide in lateral view, these setae distinctly plumose at 40 × magnification (as in Fig. 78C–D) .....  
..... 23
- 23. Discs of T2–T3 uniformly punctate, with dense punctures along premarginal line ( $IS \leq 1 PD$ ), sharply contrasting with impunctate apical rims (Fig. 117A) ..... 24
- Discs of T2–T3 becoming slightly more sparsely punctate near and on premarginal line, without a sharp contrast between discs and apical rims (Fig. 117B) ..... 25



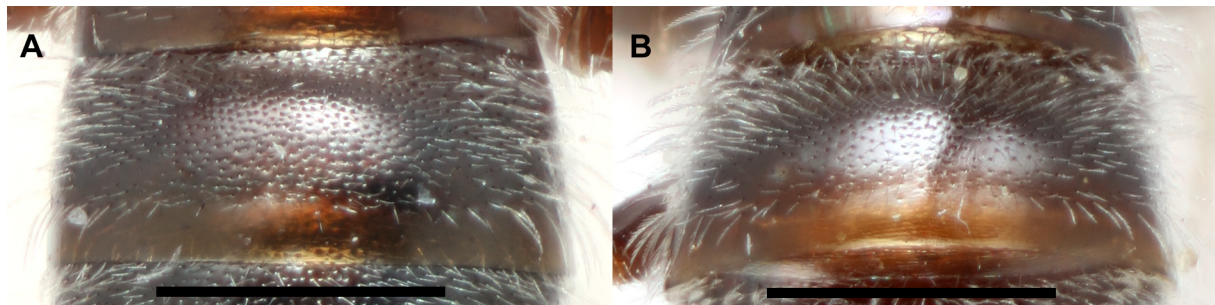
**Fig. 115.** Tegulae. **A.** *Lasioglossum helianthi* (Cockerell, 1916), ♂, inner posterior margin concave with distinct posterior projection (outline on left). **B.** *L. perparvum* (Ellis, 1914), ♂, inner posterior margin nearly straight without posterior projection (outline on left). Scale bars = 0.5 mm.



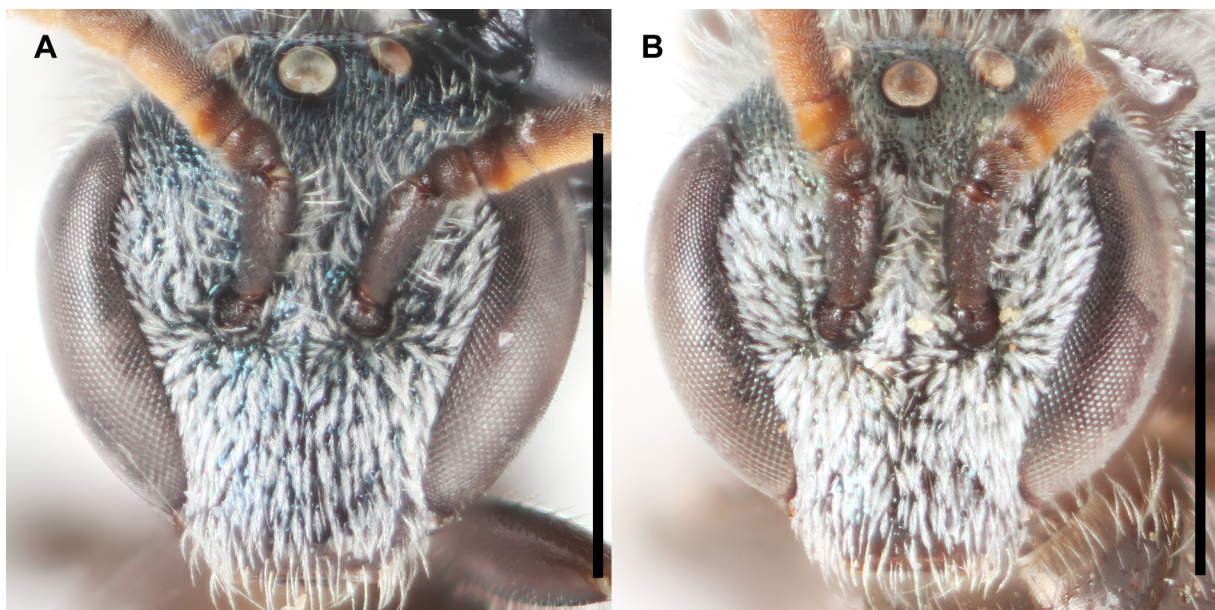
**Fig. 116.** T1–T2. **A.** *Lasioglossum holzenthali* sp. nov., ♂, with apical rims mostly punctate. **B.** *L. perparvum* (Ellis, 1914), ♂, with apical rims punctate only on basal margin. Scale bars = 0.5 mm.



24. Face slightly longer (length/width ratio  $\geq 0.86$ ) (Fig. 118A); tegula slightly more sparsely punctate medially (IS = 1–2 PD); head and mesosoma blue (Hawaii and southeastern United States) ..... *L. puteulanum* Gibbs, 2009
- Face slightly shorter (length/width ratio usually  $< 0.86$ ) (Fig. 118B); tegula relatively densely punctate medially (IS  $\leq 1$  PD); head and mesosoma green to bluish (widespread across eastern Canada and United States, excluding Florida) ..... *L. tegulare* (Robertson, 1890)  
 [*L. carlinvillense* (Gibbs, 2009) may also key here, but male diagnostic characters are not currently known. Small specimens from Illinois to Alabama should be identified with caution, ideally with associated females.]
25. Preepisternum and hypoepimeral area very finely punctate to areolate with punctures smaller than on mesepisternum (Fig. 119A) (Florida) ..... *L. lepidii* (Graenicher, 1927)
- Preepisternum and hypoepimeral area more coarsely punctate to areolate with punctures about the same size as on mesepisternum (Fig. 119B) (not occurring in Florida) ..... 26



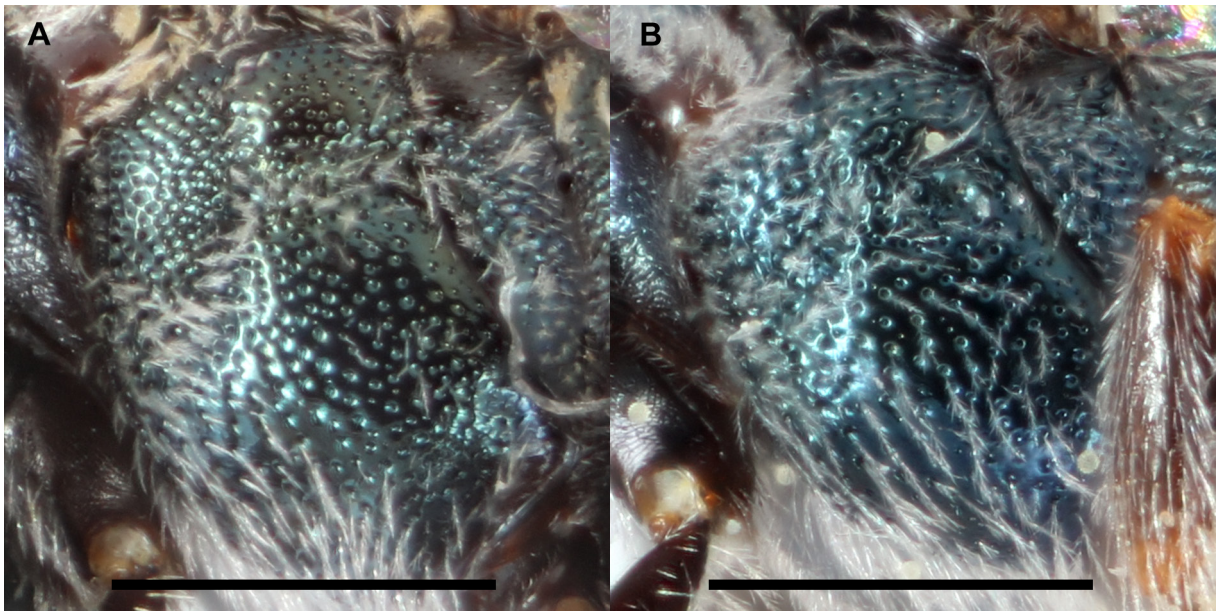
**Fig. 117.** T2. **A.** *Lasioglossum egulare* (Robertson, 1890), ♂, with dense punctures up to premarginal line sharply contrasting with impunctate apical rim. **B.** *L. diabolicum* sp. nov., ♂, with punctures becoming more sparsely punctate near and on premarginal line and not sharply contrasting with apical rim. Scale bars = 0.5 mm.



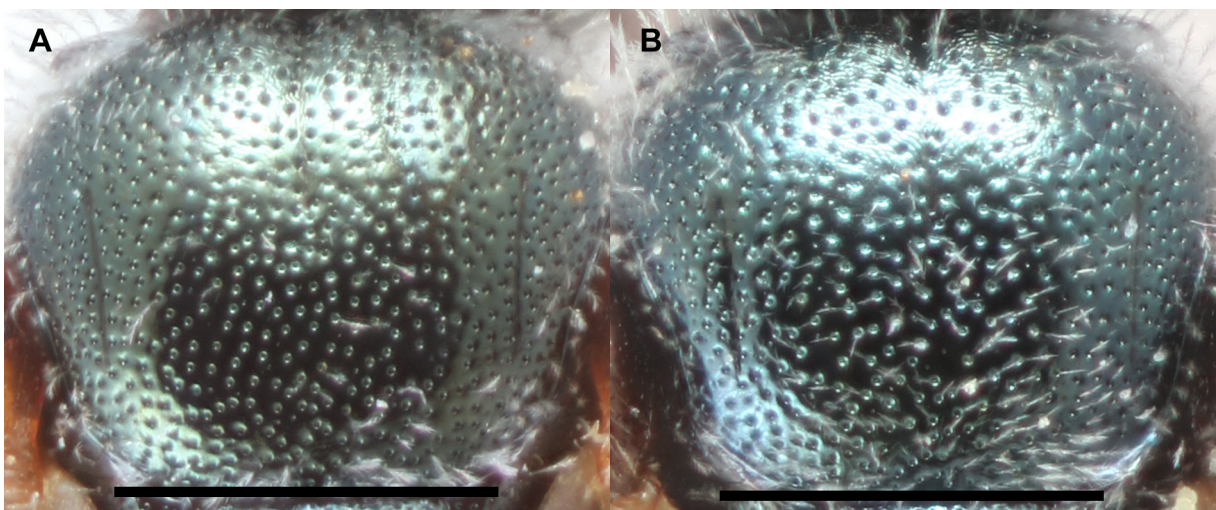
**Fig. 118.** Face. **A.** *Lasioglossum puteulanum* Gibbs, 2009, ♂, slightly longer. **B.** *L. tegulare* (Robertson, 1890), ♂, slightly shorter. Scale bars = 1 mm.



26. Mesoscutum punctures between parapsidal lines all separated by 1 PD or slightly more or less (Fig. 120A); metapostnotum usually shiny (east of Rocky Mountains) ..... *L. ellisiae* (Sandhouse, 1924) [in part]  
 – Mesoscutum between parapsidal lines more irregularly and sparsely punctate, with some IS < 1 PD and some IS  $\geq$  2 PD (Fig. 120B); metapostnotum usually dulled by strong imbricate microsculpture (west of Rocky Mountains and east to  $\sim 102^\circ$ ) ..... 27
27. Tegula relatively small, usually not reaching mesoscutum posterior margin in dorsal view, and inner posterior margin straight or weakly concave, with at most a small posterior bump about 1 mesoscutum PD long (as in Fig. 100A) ..... *L. diabolicum* sp. nov.



**Fig. 119.** Pleura. **A.** *Lasioglossum lepidii* (Graenicher, 1927), ♂, preepisternum and hypoepimeron more finely punctate than mesepisternum. **B.** *L. diabolicum* sp. nov., ♂, preepisternum and hypoepimeron as coarsely punctate as mesepisternum. Scale bars = 0.5 mm.



**Fig. 120.** Mesoscutum. **A.** *Lasioglossum ellisiae* (Sandhouse, 1924), ♂, evenly punctate with most IS = 1 PD. **B.** *L. diabolicum* sp. nov., ♂, more coarsely and unevenly punctate. Scale bars = 0.5 mm.

- Tegula relatively large, usually reaching mesoscutum posterior margin in dorsal view, and inner posterior margin concave, with a distinct posterior projection longer than 1 mesoscutum PD (as in Fig. 100B) ..... *L. stictaspis* species complex [in part]

## Discussion

Our revision of the *L. gemmatum* species complex in the western Nearctic region uncovered many new species and redefined the previously over-applied names *L. tegulariforme* and *L. hunteri* in a much more restricted sense. The true *L. tegulariforme* is a relatively uncommon species restricted to California and the Cascadia bioregion, while *L. hunteri* is considered a red-tailed form of *L. ellisiae*. While the identification of western *L. gemmatum* complex species is, unfortunately, much more difficult with the recognition of so many species, application of the new taxon concepts and use of the new identification keys will result in a better understanding of regional bee biodiversity and improve the accuracy and reliability of results from future studies.

The previously under-applied name *L. stictaspis*, conversely, may now be over-applied and require further revision. Prior to 2021, *L. stictaspis* was restricted to a small number of specimens with two submarginal cells in the forewing instead of the usual three (Sandhouse 1923). Gardner & Gibbs (2022) expanded *L. stictaspis* to include specimens with three submarginal cells, associated the female with *L. albuquerqueense*, and recognised its range from Alberta and Saskatchewan to New Mexico and Texas. In the present work, we attempted to distinguish additional specimens from California, Arizona, and Mexico from *L. stictaspis* s. str., but were unable to find diagnostic characters that could be tested with other data and corroborate a species hypothesis. Some geographic trends in variation exist: for instance, no red-tailed *L. stictaspis* are known from east of the Rocky Mountains, while a majority of specimens from west of the Rocky Mountains and north of Mexico are red-tailed. Most specimens north of Mexico have a subapical band of tomentum on T3 and dense mesepisternum punctures, while most Mexican specimens lack subapical tomentum on T3 and have sparser mesepisternum punctures. Most specimens east of the Rocky Mountains have a smooth and dull metapostnotum, while coarse and shiny metapostnota become more common further west. However, the boundaries of this variation are extremely diffuse, such that any attempt to split *L. stictaspis* morphologically results in species that occur sympatrically throughout almost their entire range, and splitting by geography results in undiagnosable species. The multiple haplotypes within available COI barcodes also contain the full range of morphological variation. Given the presence of multiple overlapping COI haplotypes within morphologically similar specimens, including within the closely related *L. diabolicum* sp. nov., it is possible that COI barcode-based identification is confounded by incomplete lineage sorting or introgression (Gibbs 2018a; Patten *et al.* 2015). Additional, more robust genetic data may help resolve species limits within *L. stictaspis* s. lat.

Outside of *L. stictaspis*, there are several cases of allopatry within the *L. gemmatum* species complex, such that a known locality can drastically reduce the number of possible species identifications for an unknown specimen. The keys provided in this work are designed to work on specimens from anywhere in the Nearctic, and geographic differences are used to separate species where appropriate, but in some cases, geography can be a useful shortcut to identification. As an aid to geography-based identification, the major regions with distinct *L. gemmatum* species complex fauna are summarized in Fig. 77, and the species associated with each region are listed in Table 2. Notable patterns of allopatry include *L. angelicum* sp. nov. and *L. stictaspis* (allopatric in California and western low desert, respectively), *L. gloriosum* sp. nov. and *L. indagator* sp. nov. (allopatric in high and low deserts, respectively), *L. diabolicum* sp. nov. and *L. stictaspis* (partially allopatric; unique to high desert and eastern low desert + western Great Plains, respectively, but co-occurring in western low desert), and *L. helianthi* and *L. tegulariforme* (the only two species known from Cascadia, but co-occurring with several other species in California).



While some primarily Neotropical species were included in this work due to their occasional presence in the Nearctic, it is clear from examination of additional specimens that much work remains to be done in the Neotropics before the *L. gemmatum* species complex can be fully defined. Preliminary morphological sorting and DNA barcoding indicates the probable existence of at least 16 additional undescribed species in the Neotropics; it is even possible that the *L. gemmatum* species complex has a Neotropical centre of diversity. Many of these undescribed species are morphologically similar to *L. perparvum* (and *L. magnitegula* sp. nov. to a lesser extent) or belong to the *L. stictaspis* species complex. Future studies of the Neotropical *L. gemmatum* species complex should be prepared to deal with the *L. stictaspis* species complex and a likely *L. perparvum* species complex.

Future studies of the Nearctic *L. gemmatum* species complex should focus on the *L. stictaspis* species complex and testing for cryptic diversity within other species with multiple and/or shared COI haplotypes, such as *L. coactus* and *L. gaudiale*. *Lasioglossum ellisiae* may also harbour cryptic diversity, with some morphologically unusual females from southern Texas with a smooth propodeum, and a few unusual males from the eastern United States without facial tomentum. Studies of biological and behavioural aspects, such as nesting, foraging, social organization, bionomics, and dispersal would also be highly informative, given the relative dearth of such information for the *L. gemmatum* complex compared to other *Lasioglossum*. These studies could shed light on the function of the enlarged tegula and why its evolution appears to have led to such rapid diversification and dispersal throughout the New World.

## Acknowledgments

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## Supplementary files

**Supp. file 1.** Morphological character matrix used in conjunction with DNA barcodes to generate the phylogeny. Pink-shaded characters were recorded from female specimens and blue-shaded characters were from males. Variable characters are enclosed in curly brackets with all possible states. Unknown characters are marked with ?.

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**Supp. file 2.** Available 654-bp DNA barcodes of Nearctic *L. gemmatum* complex species. All sequences for each species or haplotype were merged into a single sequence with variable sites treated as ambiguities. Nucleotides diagnostic across all species are shaded black; nucleotides diagnostic within particular subsets are outlined.

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