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Neofidia Strother, a new name for *Fidia* Baly, 1863 and redescription of *Fidia kanaraensis* (Jacoby, 1895) with a new host record and notes on natural history (Coleoptera, Chrysomelidae, Eumolpinae)

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Abstract. *Neofidia* Strother nom. nov., is proposed as the replacement name for *Fidia* Baly, 1863, a junior homonym of *Fidia* Motschulsky, 1861 (not 1860, Griffin 1936). A list of the included species of *Neofidia* Strother nom. nov. and *Fidia* Motschulsky, 1861 is provided for clarity. *Fidia medvedevi* nom. nov. is the new replacement name proposed for *Lypesthes vietnamicus* Medvedev, 2015. *Fidia kanaraensis* (Jacoby, 1895) is redescribed and habitus, male and female genitalia are figured. Cashew (*Anacardium occidentale* L.) is reported as a new host of *F. kanaraensis* and partial information on the life history is provided. Eggs are laid singly on the surface of soil, and are covered with excreta and soil. Larvae tunnel into the tender roots. Adults are nocturnal and feed on tender leaves.

Keywords. India, leaf beetles, new combinations, endophallus, female genitalia.

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Introduction

The genus group name *Fidia,* coined by Dejean (1836), remained unavailable till Motschulsky (1861) described *Fidia atra* from the Old World, as Dejean (1836) had merely listed two New World species,

F. lurida Dejean, 1836 and *F. murina* Dejean, 1836, without a description, definition or indication. Motschulsky's species description, in combination with the generic name *Fidia*, unwittingly made this generic group name available. Baly (1863) described the Old World genera *Leprotes* (type species: *Adoxus gracilicornis* Baly, 1861 by original designation) as well as *Lypesthes* (type species: *Fidia atra* Motschulsky, 1861 by original designation), provided a description of *Fidia* Dejean, 1836 and listed the New World *Fidia lurida* Dejean, 1836 as its type species. Baly's description made both the names *Fidia* and *Fidia lurida* available, in effect making *Fidia* Baly, 1863, a junior homonym of *Fidia* Motschulsky, 1861. Chen (1935) treated *Leprotes* Baly, 1863 as a junior synonym of *Lypesthes* Baly, 1863. Following Baly (1863) and Chen (1935), the name *Lypesthes* has been applied consistently for the Old World genus based on the type species *Fidia atra* Motschulsky, 1861. Similarly, *Fidia* Baly, 1863 has been applied to the New World genus group established on the type species *Fidia lurida* Baly. Strother & Staines (2008) reviewed the New World *Fidia* Baly, 1863 and provided an account of the nomenclatural history of the generic name. Strother *et al.* (2007) applied to the ICZN for suppression of the name *Fidia* Motschulsky, 1861 (not 1860, Griffin 1936) and conservation of the usage of *Lypesthes* Baly, 1863. The Commission, however, rejected this proposal and upheld the priority of *Fidia* Motschulsky, 1861 (ICZN 2009). Löbl (2010) mentioned this issue, but did not make the nomenclatural changes. The Old World genus *Fidia* Motschulsky, 1861 is distinct from the New World *Fidia* Baly, 1863. Following the ruling of the Commission, reaffirming the priority of *Fidia* Motschulsky, 1861 the junior homonym *Fidia* Baly, 1863 is renamed here, as no available junior synonym exists for *Fidia* Baly, 1863.

Fidia Motschulsky comprises 34 species distributed in the Oriental and Palearctic Regions (Jacoby 1908; Pic 1923, 1924, 1928; Chen 1935; Eroshkina 1992; Medvedev & Zoia 1996; Moseyko & Sprecher-Uebersax 2010).

Information on the biology of *Fidia* Motschulsky is limited. Isono (1988) stated that the eggs are covered entirely with excrement in *Lypesthes*. Lee (2012) described the larva of *F. atra*. According to Jolivet *et al*. (2014), the coating of eggs or egg masses with glandular secretions and/or faeces is known in a number of genera including *Lypesthes*. A number of host plants is recorded for species of the genus (Table 1).

Fidia kanaraensis (Jacoby, 1895) comb. nov. was described originally by Jacoby (1895) in the genus *Leprotes*, based on the specimens from Mahe and the erstwhile Kanara in south India. Jacoby (1908) treated it under the *Fauna of British India* and extended its known range of distribution to the erstwhile southern Bombay and Bengal. No further information on its morphology, genitalia or natural history is known, except that it was listed as a pest of mango (*Mangifera indica* L.) by Rajendran & Singh (2016). The species is here redescribed with detailed information on its external morphology and genitalia. An attempt was made to elucidate its life cycle, that however, could not be completed successfully in the laboratory.

Material and methods

Specimens of *Fidia kanaraensis* were collected from Cardamom Research Station, Pampadumpara, Idukki (9º48′23.7″ N, 77º10.04′9″ E); College of Agriculture, Vellayani campus (8º25′47.5" N, 76º59′ 8.3″ E) and Kallar Reserve Forest (8º41′48.9″ N, 77º7′53.6″ E). All beetles were collected either from cashew or mango trees, except two specimens attracted to light.

Material from the following collections is examined:

BMNH = Natural History Museum, London, UK
KAU = Travancore Insect Collection, Kerala Agricultural University, Vellayani, India
MCZ = Museum of Comparative Zoology, Harvard University, Cambridge, MA, USA

NBAIR = National Bureau of Agricultural Insect Resources, Bengaluru, India
UASB = University of Agricultural Sciences, Bengaluru, India
USNM = National Museum of Natural History, Smithsonian Institution, Washington D.C., USA
ZIN = Zoological Institute, Russian Academy of Sciences, St Petersburg, Russia

Dissection

The specimens were relaxed by immersing in soap solution for about 20 minutes. The abdomen was cut off from the body by inserting a no. 3 sized insect pin between the metasternum and the abdomen and then severing the membranous connections and tissues in between. The severed abdomen was macerated in 10% KOH solution by keeping it overnight in a hot air oven, set at 50°C. Alternatively, for quick processing, the specimens were boiled in 10% KOH for about two minutes. The former method yielded better results as all the relevant structures, including ducts of the reproductive system, were intact, especially in females. The digested abdomen was thoroughly washed in water, followed by immersion in 2% acetic acid to remove excess alkali. One more round of washing with water was done to remove excess chemicals. The tergites and sternites were detached and the genitalia were completely pulled out of the muscles and tissues. The transparent membranous structures were stained with acid fuchsin and then transferred to glycerin for observation, photography and preservation.

Genitalia

The terminology for genitalia and associated structures follows Konstantinov (1998), Jolivet &Verma (2008) and Moseyko (2008). The endophallus was everted through the apical opening (ostium) as well as inflated through basal opening. Inflation of the endophallus follows Yamasako & Obhayashi (2011) with appropriate modification. A TSK STERiJECT hypodermic needle 0.2 × 9 mm (⅜") (The invisible needles™ Japan) was mounted on a syringe filled with K-Y® gel. The tip of the needle was inserted into the apical opening and affixed with the cyanoacrylate glue Fevikwik®. After allowing five minutes to dry, the aedeagus was kept in water for a minute, then immersed in K-Y® gel in a cavity slide and inflated by pushing the plunger flange slowly under controlled pressure. Eversion of endophallus was carried out using KK-3 type C fine nozzle. The endophallus was pushed towards the apical opening using the blunt end of a flexible fine needle through the basal opening. The tip of the fine nozzle, filled with K-Y® gel, was affixed at the base of the aedeagus proper with cyanoacrylate glue (Fevikwik®). The assembly was allowed to dry for five minutes and kept in water for one minute to relax the endophallic membrane. Then the aedeagus was immersed in K-Y® gel in a glass slide. The endophallus was then everted under controlled pressure of a syringe filled with K-Y® gel.

Measurements were taken using an ocular micrometer. Images were stacked using Zerene stacker ver. 1.04. Photographs and stacked images were edited with Adobe Photoshop CS4. A line diagram of female genitalia was drawn using Adobe Illustrator.

Biology

Attempts were made to study the biology of *F. kanaraensis.* Live beetles were collected from the field and pairs of beetles were released into transparent plastic jars with a layer of top soil and a twig of mango or cashew with new growth. The mouths of the jars were covered with cloth and fastened with rubber bands. Beetles were allowed to mate and oviposit. The leaves were changed at three-day intervals, and the layer of soil was kept moist by spraying water.

Table 1 (continued on the next page)**.** Host plants of *Fidia* Motschulsky, 1861.

No.	Species	Host family and species	Reference
1	*Fidia* sp.	Carpinaceae: *Carpinus* L. Fagaceae: *Castanea* Mill. *Quercus* L. Hamamelidaceae: *Corylopsis* Siebold & Zucc. Juglandaceae: *Juglans* L. *Pterocarya* Nutt. ex Moq. Lauraceae: *Cinnamomum* Schaeff. *Machilus* Desr. Rosaceae: *Malus* Mill. *Prunus* L. *Pyrus* L. Sapindaceae: *Aesculus* L Styracaceae: *Styrax* L. Taxodiaceae: *Cryptomeria* D.Don Ulmaceae: *Zelkova* Spach.	Jolivet & Hawkeswood 1995
2	*F. anger* (Chûjô, 1935) (= *L. fulvus* Baly, 1878)	Lauraceae: *Cinnamomum daphnoides* Sieb & Zucc	Chûjô 1958a
3	*F. itoi* (Chûjô, 1954)	Cupressaceae: *Cryptomeria japonica* D.Don	Chûjô 1954; Ohno 1958; Chûjô & Kimoto 1961; Kimoto 1964
4	*F. atra* (Motschulsky, 1861)	Betulaceae: *Carpinus tschonoskii* Maxim.	Ohno 1958; Chûjô & Kimoto 1961; Kimoto 1964
		Fagaceae: *Castanea crenata* Sieb & Zucc.	Chûjô & Kimoto 1961; Kimoto 1964; Lee 2012
		Quercus acutissima Carruthers	Ohno 1958; Chûjô & Kimoto 1961; Kimoto 1964
		Hamamelidaceae: *Corylopsis spicata* Sieb & Zucc	Chûjô 1954; Ohno 1958; Chûjô & Kimoto 1961; Kimoto 1964
		Hippocastanaceae: *Aesculus turbinata* Blume	Chûjô & Kimoto 1961; Kimoto 1964
		Juglandaceae: *Juglans mandshurica* Maxim.	Chûjô 1954; Ohno 1958
		Juglans ailanthifolia Carruthers	Chûjô & Kimoto 1961; Kimoto 1964
		Juglans sinensis Dode	Lee 2012
		Pterocarya rhoifolia Sieb & Zucc	Ohno 1958
		Rosaceae: *Malus pumila* (Willd.)	Chûjô 1954; Ohno 1958; Chûjô & Kimoto 1961; Kimoto 1964; Lee 2012
		Malus prunifolia (Willd)	Chûjô & Kimoto 1961; Kimoto 1964
		Pyrus pyrifolia (Burm.f.)	Lee 2012
		Pyrus asiatica (Nakai) M.F.Fay & Christenh.	Chen 1940; Lee 2012
		Prunus mume Sieb & Zucc	Ohno 1958; Chûjô & Kimoto 1961; Kimoto 1964; Lee 2012
		Styracaceae: *Styrax japonica* Sieb & Zucc	Ohno 1958; Chûjô & Kimoto 1961; Kimoto 1964
		Ulmaceae*: Zelkova serrata* (Thumb.)	Ohno 1958; Chûjô & Kimoto 1961; Kimoto 1964

Table 1 (continued)**.** Host plants of *Fidia* Motschulsky, 1861.

No.	Species	Host family and species	Reference
5	*F. fulva* (Baly, 1878)	Lauraceae: *Cinnamomum daphnoides* Sieb & Zucc	Chûjô & Kimoto 1961; Kimoto & Gressitt 1966
		Machilus thunbergii Sieb.& Zucc	Kimoto & Gressitt 1966
		Fagaceae: *Quercus salicina* Blume	Chûjô & Kimoto 1961; Kimoto & Gressitt 1966
6	*F. kanaraensis* (Jacoby, 1895)	Anacardiaceae: *Anacardium occidentale* L.	New record
		Mangifera indica L.	Rajendran & Singh 2016
7	*F. kiiensis* (Ohno, 1958)	Fagaceae: *Quercus* L.	Ohno 1958; Chûjô & Kimoto 1961; Kimoto 1964
8	*F. lewisii* (Baly, 1878)	Lauraceae: *Machilus thunbergii* Sieb & Zucc	Ohno 1958; Chûjô & Kimoto 1961; Kimoto 1964

Results

Genus ***Neofidia*** Strother nom. nov.

Fidia Dejean, 1836: 412 (catalog), nom. nud.
Atonia Gistel, 1848: 123 (*nec* Williston 1889, Diptera: Asilidae) (synonym of *Fidia* Dejean), nom. nud.
Fidia Baly, 1863: 153 (*nec* Motschulsky 1861: 22) (original description).
Fidea Glover, 1868: 71 (misspelling).

Fidia Dejean, 1836 – Dejean 1837: 436 (catalog). — Sturm 1843: 295 (catalog). — Crotch 1873: 33 (faunal treatment, species description). — Chapuis 1874: 275 (classification).
Atonia – Gistel 1851: 123.
Fidia Baly, 1863 – Gemminger & Harold 1874: 3376 (catalog). — Lefèvre 1877: 164 (species descriptions); 1885: 75 (catalog, species description). — Henshaw 1885: 108 (catalog). — Lefèvre 1885: 75 (catalog, species description). — Horn 1892: 198 (faunal treatment, species description). — Blatchley 1910: 1142 (faunal treatment). — Clavareau 1914: 76 (catalog). — Leng 1920: 293 (catalog). — Blackwelder 1946: 662 (checklist). — Bechyné 1950: 288 (taxonomic treatment); 1953: 249 (catalog). — Wilcox 1954: 402 (faunal treatment). — Arnett 1963: 928 (faunal treatment). — Balsbaugh & Hays 1972: 73 (faunal treatment). — Riley *et al*. 2003: 151 (catalog). — Ciegler 2007: 168 (faunal treatment). — Strother *et al*. 2007: 36 (nomenclature).
Fidia – Walsh, 1867: 87 (species description). — Wilcox 1975: 57 (checklist). — Seeno & Wilcox 1982: 62 (checklist). — Arnett 1985: 376 (faunal treatment). — LeSage 1991: 309 (faunal treatment). — Flowers 1996: 36 (checklist). — Riley *et al*. 2002: 671 (catalog).

Type species

Fidia lurida Baly, 1863: 153 (not *Fidia lurida* Dejean, 1836*,* nom. nud.)

Etymology

The name *Neofidia* alludes to the new name for *Fidia* Baly, 1863, as well as its Nearctic and Neotropical distribution. The gender is feminine.

Checklist of species

Neofidia albovittata (Lefèvre, 1877) comb. nov.
Fidia albovittata Lefèvre, 1877: 166
Fidia sallei Lefèvre, 1877: 166
Fidia sallaei Jacoby, 1882: 167 [unjustified emendation]
Fidia unistriata Jacoby, 1882: 168
Neofidia cana (Horn, 1892) comb. nov.
Fidia cana Horn, 1892: 199 (*Fidia*)
Neofidia clematis (Schaeffer, 1904) comb. nov.
Fidia clematis Schaeffer, 1904: 227
Neofidia comalensis (Strother *in* Strother & Staines, 2008) comb. nov.
Fidia comalensis Strother *in* Strother & Staines, 2008: 29
Neofidia confusa (Strother, 2003) comb. nov.
Fidia confusa Strother, 2003: 151
Fidia murina Crotch, 1873: 33 [not Glover, 1868: 71]
Neofidia convexicollis (Strother *in* Strother & Staines, 2008) comb. nov.
Fidia convexicollis Strother *in* Strother & Staines, 2008: 33
Neofidia costaricensis (Strother *in* Strother & Staines, 2008) comb. nov.
Fidia costaricensis Strother *in* Strother & Staines, 2008: 35
Neofidia delilahae (Strother *in* Strother & Staines, 2008) comb. nov.
Fidia delilahae Strother *in* Strother & Staines, 2008: 37
Neofidia dicelloposthe (Strother *in* Strother & Staines, 2008) comb. nov.
Fidia dicelloposthe Strother *in* Strother & Staines, 2008: 38
Neofidia dichroma (Strother *in* Strother & Staines, 2008) comb. nov.
Fidia dichroma Strother *in* Strother & Staines, 2008: 39
Neofidia guatemalensis (Jacoby, 1879) comb. nov.
Fidia guatemalensis Jacoby, 1879: 778
Neofidia humeralis (Lefèvre, 1877) comb. nov.
Fidia humeralis Lefèvre, 1877: 165
Fidia plagiata Lefèvre, 1877: 165
Neofidia longipes (Melsheimer, 1847) comb. nov.
Eumolpus longipes Melsheimer, 1847: 169
Pachnephorus viticolus Uhler, 1855: 418
Neofidia lurida (Baly, 1863) comb. nov.
Fidia lurida Baly, 1863: 153
Colaspis flavescens Sturm, 1826: 123 [nom. nud.]
Fidia lurida Dejean, 1836: 412 [nom. nud.]
Fidia viticida Walsh, 1867: 87
Neofidia marraverpa (Strother *in* Strother & Staines, 2008) comb. nov.
Fidia marraverpa Strother *in* Strother & Staines, 2008: 49
Neofidia papillata (Strother *in* Strother & Staines, 2008) comb. nov.
Fidia papillata Strother *in* Strother & Staines, 2008: 50
Neofidia pedestris (Lefèvre, 1877) comb. nov.
Fidia pedestris Lefèvre, 1877: 164
Neofidia pedinops (Strother *in* Strother & Staines, 2008) comb. nov.
Fidia pedinops Strother *in* Strother & Staines, 2008: 54
Fidia murina Dejean, 1836: 412 [nom. nud.]
Neofidia rileyorum (Strother *in* Strother & Staines, 2008) comb. nov.
Fidia rileyorum Strother *in* Strother & Staines, 2008: 56

Neofidia spuria (Lefèvre, 1877) comb. nov.
Fidia spuria Lefèvre, 1877: 165
Fidia atra Jacoby, 1882: 168 (not Motschulsky, 1861)
Neofidia texana (Schaeffer, 1933) comb. nov.
Fidia viticida var. *texana* Schaeffer, 1933: 472
Neofidia tibialis (Jacoby, 1890) comb. nov.
Fidia tibialis Jacoby, 1890: 232
Neofidia xanthonioides (Strother *in* Strother & Staines, 2008) comb. nov.
Fidia xanthonioides Strother *in* Strother & Staines, 2008: 94

Remarks

Strother & Staines (2008) provided a diagnosis and description of the genus. Both the genera, *Fidia* Motschulsky, 1861 and *Neofidia* Strother nom. nov., belong to the same tribe, Adoxini Baly, 1863 (*sensu* Moseyko & Kirejtshuk 2013). The Old World genus *Fidia* can be separated from the New World genus *Neofidia* Strother nom. nov. by the presence of a tooth on the ventral side of all femora (absent in *Neofidia* Strother nom. nov.). Another character mentioned by Strother & Staines (2008), the absence of paired apical spurs on the apex of fore tibia, cannot be used for separating these genera as spurs are present in some species of *Fidia*, at times being small and poorly visible. Among the Old World genera, *Neofidia* Strother nom. nov. is mostly close to *Aoria* Baly, 1863 and the similar genera *Aloria* Bryant, 1939 and *Bromius* Chevrolat *in* Dejean, 1836. It can be separated from *Aoria* by simple intercoxal mesothoracic process (bifurcated or with two spines in *Aoria*), from *Aloria* by 11-segmented antennae (9-segmented in *Aloria*) and from *Bromius* by the straight fore margin of lateral arms of pronotum ("propleura" of Jacoby 1908; convex in *Bromius*).

Distribution

North and Central America (Strother & Staines 2008)

Generic diagnosis

Body oblong, punctate-setose, frons and vertex hardly differentiated, antenna filiform, longer than ½ to ¾ of body length, second antennomere shorter than first, longer than half of it, shorter than next four or five. Compound eyes lateral, convex and entire, antennal calli triangular, pronotum as long as wide or gently wider than long, narrower than elytra, without lateral margins, fore margin of lateral arms of pronotum ('propleuron') straight, legs long and slender, tibia longitudinally carinate, all femora lack a ventral tooth, intermediate and posterior tibiae not emarginate preapically, apex of each tibia with a pair of small spurs, claws bifid.

Genus ***Fidia*** Motschulsky, 1861

Fidia Motschulsky, 1861: 22 (Strother *et al*. 2007 referred to International Commission on Zoological Nomenclature (ICZN) for suppression); ICZN (2009) rejected Strother *et al*. 2007 and reaffirmed priority.
Endoxus Baly, 1861: 285 (misspelling).
Lypesthes Baly, 1863: 152, type species *Fidia atra* Motschulsky, 1861.
Leprotes Baly, 1863: 158, type species *Adoxus gracilicornis* Baly, 1861 (synonymized with *Lypesthes* Baly, 1863).
Talmonus Fairmaire, 1889: 71, type species *Talmonus farinosus* Fairmaire, 1889 (*Fidia atra* Motschulsky, 1861) (synonymised with *Lypesthes* Baly, 1863).
Lypesthinia Pic, 1939: 32 (valid subgenus) [type species *Lypesthinia multidentata* Pic, 1939: 32].

Lypesthes – Chapuis 1874: 273. — Gemminger & Harold 1874: 3376 (catalog). — Lefèvre 1885: 74. — Jacoby 1908: 395, 412. — Clavareau 1914: 76 (catalog). — Chen 1935: 370–371; 1940: 491. — Chûjô 1938: 30; 1956: 88, 101. — Ohno 1958: 178. — Gressitt & Kimoto 1961: 198, 269. — Chûjô & Kimoto 1961: 145. — Kimoto 1964: 256; 2005: 34. — Kimoto & Gressitt 1982: 73. — Seeno & Wilcox 1982: 62 (checklist). — Moseyko & Sprecher-Uebersax 2010: 624.
Leprotes – Baly 1878: 250. — Chapuis 1874: 273. —Lefèvre 1885: 80. — Jacoby 1885: 203; 1908: 396, 425–426. — Chen 1935: 370–371.
Talmonus – Jacoby 1890: 115.
Lypesthinia – Seeno & Wilcox 1982: 62 (checklist).

Type species

Fidia atra Motschulsky, 1861: 22 (not *Fidia atra* Jacoby, 1882).

Checklist of species

Fidia albida (Pic, 1923) comb. nov.
Lypesthes albidus Pic, 1923: 16
Fidia atra Motschulsky, 1861: 22
Leprotes pulverulentus Jacoby, 1885: 203
Talmonus farinosus Fairmaire, 1889: 71
Leprotes testaceipes Pic, 1928: 26
Lypesthes ater fulvipes Chûjô, 1954: 106
Lypesthes ater ater f. *tibialis* Ohno, 1958: 174
Fidia basalis (Chen, 1940) comb. nov.
Leprotes atra Pic, 1936: 15
Leprotes basalis Chen, 1940: 517 [replacement name for *Leprotes atra* Pic, 1936: 15]
Fidia bicoloripes (Pic, 1936) comb. nov.
Leprotes bicoloripes Pic, 1936: 15
Fidia bisquamosa (Chen, 1935) comb. nov.
Lypesthes bisquamosus Chen, 1935: 374
Fidia brancuccii (Medvedev, 1993) comb. nov.
Hyperaxis brancuccii Medvedev, 1993: 362
Fidia carinata (Eroshkina, 1992) comb. nov.
Lypesthes carinatus Eroshkina, 1992: 86
Fidia fulva (Baly, 1878) comb. nov.
Leprotes fulvus Baly, 1878: 250
Lypesthes anger Chûjô, 1935: 204
Lypesthes taiwanus Chûjô, 1956: 105
Fidia gracilicornis (Baly, 1861) comb. nov.
Adoxus gracilicornis Baly, 1861: 285
Lypesthes sauteri Chûjô, 1938: 30
Fidia impressa (Pic, 1928) comb. nov.
Leprotes impressus Pic, 1928: 26
Fidia indica (Jacoby, 1908) comb. nov.
Lypesthes indica Jacoby, 1908: 412
Fidia irregularis (Eroshkina, 1992) comb. nov.
Lypesthes irregularis Eroshkina, 1992: 88
Fidia itoi (Chûjô, 1954) comb. nov.
Lypesthes itoi Chûjô, 1954: 103
Fidia japonica (Ohno, 1958) comb. nov.

Lypesthes japonicus Ohno, 1958: 179
Lypesthes babai Chûjô, 1958b: 4
Fidia kanaraensis (Jacoby, 1895) comb. nov.
Leprotes kanaraensis Jacoby, 1895: 270
Fidia kiiensis (Ohno, 1958) comb. nov.
Lypesthes kiiensis kiiensis Ohno, 1958: 177
Lypesthes kiiensis ab *immaculatus* Ohno, 1958: 179
Fidia laeta (Medvedev, 2007) comb. nov.
Lypesthes laetus Medvedev, 2007: 8
Fidia lewisi (Baly, 1878) comb. nov.
Leprotes lewisi Baly, 1878: 251
Fidia mausonica (Eroshkina, 1992) comb. nov.
Lypesthes mausonica Eroshkina, 1992: 87
Fidia medvedevi nom. nov.
Lypesthes vietnamicus Medvedev, 2015: 324 (*nec Lypesthes vietnamicus* Eroshkina, 1992: 89)
Fidia multidentata (Pic, 1939) comb. nov.
Lypesthinia multidentata Pic, 1939: 32
Fidia perelegans (Gressitt & Kimoto, 1961) comb. nov.
Lypesthes perelegans Gressitt & Kimoto, 1961: 271
Fidia phoebicola (Tan, 1983) comb. nov.
Hyperaxis phoebicola Tan, 1983: 130
Fidia picea (Gressitt & Kimoto, 1961) comb. nov.
Lypesthes piceus Gressitt & Kimoto, 1961: 271
Fidia regalis (Medvedev & Zoia, 1996) comb. nov.
Lypesthes regalis Medvedev & Zoia, 1996: 116
Fidia rufa (Pic, 1924) comb. nov.
Leprotes rufus Pic, 1924: 6
Fidia shirozui (Kimoto, 1969) comb. nov.
Lypesthes shirozui Kimoto, 1969: 17
Lypesthes farinosus Chûjô, 1938: 30 (*nec* Pic, 1923, *nec* Fairmaire, 1889)
Lypesthes gracilicornis Chûjô, 1956: 106 (*nec* Baly, 1861)
Fidia sinensis (Gressitt & Kimoto, 1961) comb. nov.
Lypesthes sinensis Gressitt & Kimoto, 1961: 272
Fidia striata (Eroshkina, 1992) comb. nov.
Lypesthes striatus Eroshkina, 1992: 84
Fidia submaculata (Pic, 1924) comb. nov.
Leprotes submaculatus Pic, 1924: 6
Fidia subregularis (Pic, 1923) comb. nov.
Leprotes subregularis Pic, 1923: 17
Leprotes farinosus Pic, 1923: 17
Fidia sulcatifrons (Gressitt & Kimoto, 1961) comb. nov.
Lypesthes sulcatifrons Gressitt & Kimoto, 1961: 273
Fidia vietnamica (Eroshkina, 1992) comb. nov.
Lypesthes vietnamicus Eroshkina, 1992: 89
Fidia vittata (Zhou & Tan, 1997) comb. nov.
Lypesthes vittatus Zhou & Tan, 1997: 189

Remarks

For comparison of *Fidia* with the genus *Neofidia* Strother nom. nov., see 'Remarks' under *Neofidia* Strother nom. nov. The Old World genus *Fidia* belongs to a comparatively large genus-group of the

tribe Adoxini, including the genera with bifid claws, straight fore margin of lateral arms of pronotum ('propleura'), simple intercoxal mesothoracic process and tooth on underside of each femur. It is poorly delimited from the genus *Hyperaxis* Gemminger & Harold, 1874, having a difference in longer pronotum, narrower hind femora with smaller tooth and smaller eyes.

Distribution

China, Indo-China, India, Japan, Korea, Laos, Myanmar, Nepal, Pakistan, Taiwan, Thailand, Vietnam.

Generic diagnosis

Body oblong, adorned with setae and or scales. Frons merges with vertex, hardly differentiated. Antenna filiform, longer than half of body length, longer than body length in some cases. Second antennomere usually shorter than first, longer than half of it, shorter than next three or four. Compound eyes lateral, hemispherical, feebly or not emarginate near antennal sockets. Antennal calli absent. Pronotum longer than wide or subquadrate, narrower than elytra, lateral margins incomplete, fore margin of lateral arms of pronotum ('propleuron') straight. Pygidium with or without elytral locking groove. Legs long, slender, all femora slightly thickened and toothed beneath, all tibiae longitudinally sulcate with rows of setae, mid- and hind tibiae not emarginate at apex, with short stout paired spines on apex. Claws bifid.

Fidia kanaraensis (Jacoby, 1895) comb. nov.
Figs 1–22, 24–25

Leprotes kanaraensis Jacoby, 1895: 270.

Leprotes kanaraensis – Jacoby 1908: 426. — Clavareau 1914: 76 (catalog).

Material examined

Type material

INDIA • 1 spec. (syntype of *Leprotes kanaraensis*, right antenna without five distal antennomeres; left antenna without three distal antennomeres; tibia and tarsi of right foreleg missing); Kanara; Jacoby leg; NHM 1909-28a (Fig. 18) • 1 spec. (syntype of *Leprotes kanaraensis,* labelled as "Cotype"); Kanara; H.E. Andrewes Bequest leg.; BMNH B.M. 1922–221 (Fig. 19) • 1 spec. (syntype of *Leprotes kanaraensis,* labelled as "Cotype"); Mahe, Malabar; MCZ Type 9764 (images available from: http://140.247.96.247/mcz/Species_record.php?id=9383).

Other material (44 specimens)

INDIA • 1 unsexed; India, Kerala, Vellayani; 08º 25′47.5″ N, 76º 59′8.3″ E; 18 m a.s.l.; 12 May 2017; Amritha Kumari leg.; cashew; KAU • 1 ♀; same collection data as for preceding; 12 Apr. 2017; KAU • 1 unsexed; same collection data as for preceding; 13 Jun. 2017; KAU • 3 unsexed; same collection data as for preceding; 15 Jun. 2017; KAU • 1 unsexed; same collection data as for preceding; 26 Jun. 2017; KAU • 1 unsexed; same collection data as for preceding; 24 Jun. 2017; H. Sangamesh leg.; at light; KAU • 1 unsexed; same collection data as for preceding; 15 May 2019; KAU • 1 ♂, 1 ♀, 1 unsexed; Kerala, Kallar; 8º41′48.9″ N, 77º7′53.6″ E; 25 Mar. 2018; S.R. Hiremath leg.; *Mangifera indica*; NBAIR • 2 ♂♂, 1 ♀, 13 unsexed; Kerala, CRS, Pampadumpara; 9º48′23.7″ N, 77º10.04′9″ E; 23 Apr. 2018; S. Amritha Kumari. leg.; mango; NBAIR • 1 unsexed; Karnataka, Bangalore; 916 m a.s.l.; 27 May 2006; K.J. David leg.; mango; UASB • 2 unsexed; Karnataka, Bangalore, GKVK; 8 Jun. 2006; K.S. Girish leg.; *Mangifera indica*; UASB • 1 unsexed; Karnataka, Bangalore, Hessarghatta; 12 Jul. 2009; H.M. Yeshwanth; UASB • 1 unsexed; Karnataka, Bangalore, Attur, 10 May 2012; mango; C.A. Viraktamath leg.; UASB • 1 unsexed; S Malabar, Walayar; 2000 ft. a.s.l.; 8 Aug. 1938; UASB • 1 unsexed; N Malabar, Taliparamba; 4 Aug. 1927; A.G.R. Coll leg.; pepper; UASB • 3 unsexed; Karnataka, Shanthigodu; Apr. 1988; cashew

sp. 17, CIE A20806, Pres. by Comm. Inst. Entomol. BM1990-1; identified by M.L. Cox as *Neculla* ?*pollinaria*; BMNH • 1 unsexed; Sindhudurg, Vengurla; 16 Apr. 1989; ?mango/cashew sp. 60, N. Khochare, CIE A20874, Pres. by Comm. Inst. Entomol. BM1990-1; identified by M.L. Cox as *Neculla* ?*pollinaria*; BMNH • 1 unsexed; Côte de Malabar; T. Deschamps leg.; 1900; F. Monros leg.; USNM • 2 unsexed; Chota-Nagpore, Barway, P. Cardon; Jun.–Aug. 1896; F. Monros leg.; USNM • 2 unsexed; Kerala, Chalakudy; 9 May 2008; J. Thomas leg.; cashew; ZIN • 1 unsexed; Kerala, Erattupettah, Wagamon Pass; 25 Apr. 2010; Prathapan leg.; ZIN.

Redescription

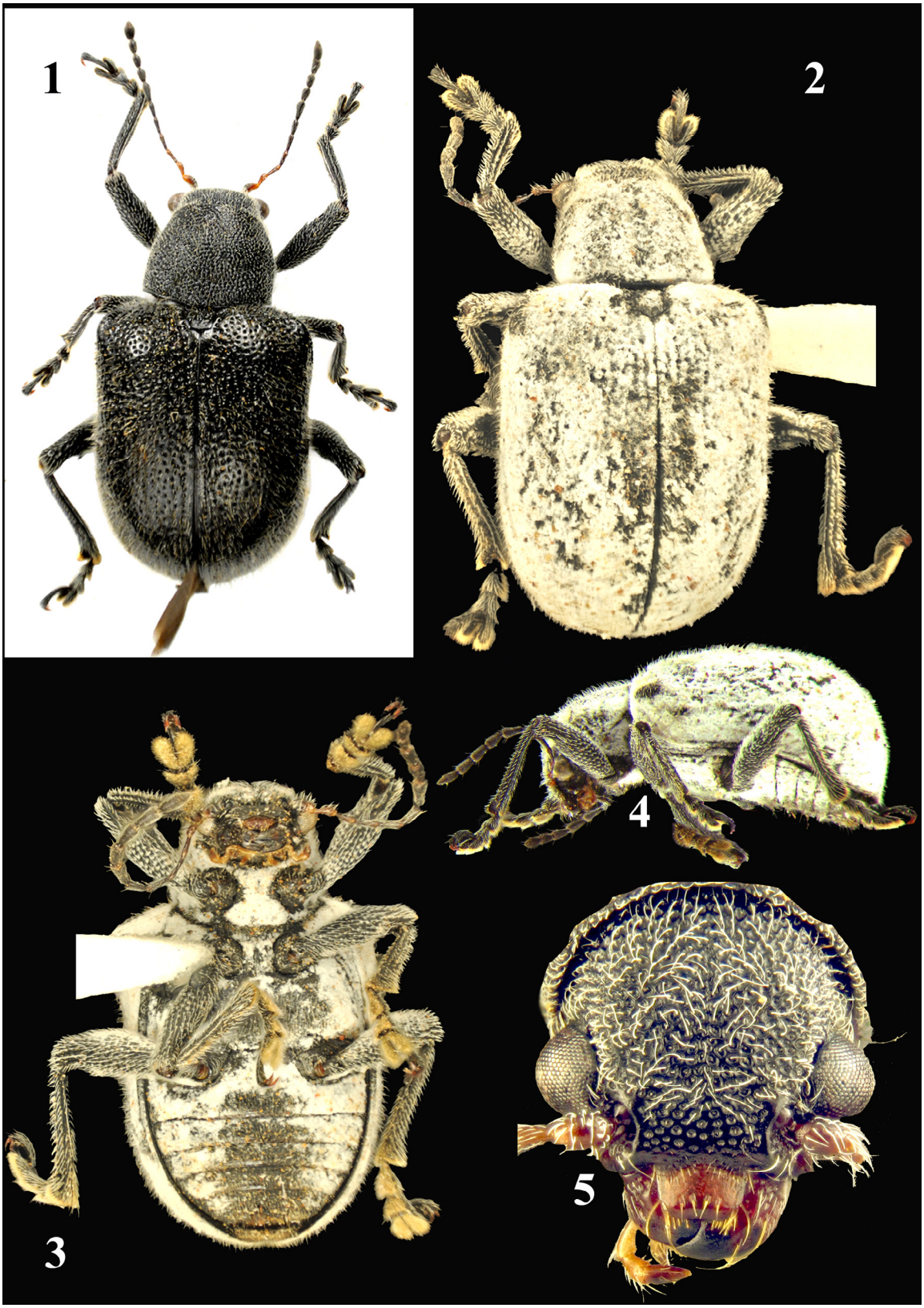
Body length. 4.6–5.0 mm (male); 6.4–7.2 mm (female). Width 2.6–2.8 mm (male); 3.3–3.9 mm (female). Body covered with white powdery encrustation (Figs 2–4, 25) absent on antennae, eyes, mouth parts and distal portion of legs. Integument entirely black except labrum, labium, maxilla, basal three or four antennomeres and claws dark chocolate brown. Entire dorsum covered with creamy white, dorsoventrally flattened, erect or curved pointed setae (Figs 1, 4).

Head. As densely setose as pronotum; punctures dense and coarse, distance between adjacent punctures less than half of diameter of a puncture (Fig. 5). Frons flat or gently depressed medially; anteriorly sparsely setose, sloping with smaller punctures, merges with narrow clypeus; anterolateral corners obtusely projecting. Antenna exceeds half of body length in male, shorter in female. First antennomere curved, thick, proximally black, distally brown; second antennomere thinner than first; 3–6 thin; 7–11 progressively broadened. Ratio of length of antennomeres 1–11 equals 1 : 0.64–0.9 : 0.7–0.8 : 0.7–0.87 : 0.87–0.93 : 0.78–0.87 : 1.04–1.16 : 0.87–0.96 : 0.9–1.01 : 0.87–0.99 : 1.16–1.19 (male); 1 : 0.68–0.78 : 0.78 : 0.85 : 0.9 : 0.78–0.83 : 0.93–1.1 : 0.78–0.85 : 0.73–0.88 : 0.75–0.85 : 1–1.15 (female). 8th and 9th antennomeres 1.8–2 times longer than broad. Transverse diameter of eye subequal to vertical, 3.7 to 4.8 times distance between antennal socket and eye. Interoccular space 1.75 to 2 times wider than interantennal space in males, 1.3–1.5 times wider in females. Transverse diameter of eye about 2.9 times diameter of antennal socket in male, 3.4–3.6 times in female. Interantennal space 1.3–1.8 times transverse diameter of one eye. Maximum width of head 1.5–1.7 times interocular space, 2.6–2.9 times interantennal space. Clypeus indistinct, narrow, with very short setae, anterior margin concave. Labrum broad apically; anterior margin thick, sloping, feebly emarginate; with a transverse row of four setose punctures, anterolateral corners each with a group of three longer setae, anterior margin of labrum with a row of short setae on either side, absent in middle. Maxillary palpi with apical palpomere longest, broadest; penultimate palpomere apparently shorter than one preceding it. Labial palpi with apical palpomere longer than preceding one. Mandibles stout, with long, bent setae laterally.

Pronotum. 1.3–1.5 times broader than long; posteriorly 1.2–1.4 times wider than anteriorly; lateral margin weakly formed in posterior half, absent anteriorly, weakly but regularly convex. Anterolateral callosity rounded with setae bearing pore placed laterally, not distinctly protruding laterally; posterolateral callosity rounded with seta bearing pore slightly protruding laterally. Punctures on pronotum subequal to those on vertex, distinctly smaller than elytral ones.

Scutellum. Longer than broad, apex weakly angulate presenting pentagonal appearance, with dense setae and punctures anteriorly, impunctate and shiny posteriorly.

Elytra. 1.28–1.38 times longer than broad. Elytra convex, sloping from apical third; lateral margins distinctly curved in middle; apex concave, obtusely angulate at sutural angle; humeral calli well developed with depression mesally and posteriorly; basal calli weakly but distinctly developed with weak depression posteriorly; punctures semiregular with a few countable rows in posterior half near sutural margin; interstices setose; setae flat, pointed.



Figs 1–5. *Fidia kanaraensis* (Jacoby, 1895) comb. nov. **1**. Dorsal view of habitus after removing powdery encrustation. **2**. Dorsal view of habitus with powdery encrustation. **3**. Ventral view of habitus. **4**. Lateral view of habitus. **5**. Head.

Figs 6–9. Male genitalia of *Fidia kanaraensis* (Jacoby, 1895) comb. nov. **6**. Aedeagus, dorsal view. **7**. Aedeagus, lateral view. **8**. Tergite VIII, sternite VIII & IX. **9**. Tegmen.

Thorax. Propleura with setose punctures. Thoracic sternites pubescent. Prosternum subquadrate with concave lateral margins, broadened posteriorly, densely punctate.

Abdomen. Ventrites setose; first ventrite longer than following two combined; first ventrite longest, ventrites 2–4 each shorter than preceding one, fifth longer than fourth, shorter than 3 and 4 combined.

Male genitalia. Tegmen (first spiculum of Jolivet & Verma 2008) membranous with 'Y'-shaped sclerotization, bifurcated distally, basal region narrow, encircles aedeagus (Fig. 9). Aedeagus in ventral view broadest proximally with lateral margin slightly concave medially, narrowed towards apex; apex triangular with tip truncated, ventral surface concave medially, more or less flat distally (Fig. 6). Spiculum gastrale (second spiculum of Jolivet & Verma 2008) Y-shaped with curved lateral arms, stem distinctly bent at tip. Tergite VIII semi-elliptical in shape with setose apical margin; spiculum relictum indistinct, Y-shaped (Fig. 8). Endophallus everted completely through apical opening, much longer than aedeagus proper with three distinct regions: basal phallomere (BP), median phallomere (MP) and apical phallomere (AP) (Fig. 10). Basal phallomere slightly shorter than median phallomere, narrowed in proximal half with a pair each of longitudinal sclerites dorsally and ventrally; distal half bulged with a large ventral bulb, covered with circular and triangular spicules. Median phallomere longest with a shorter proximal part and a longer distal part; proximal part with a small ventral bulb, membrane with a few circular spicules; distal part widest medially, membrane covered with small triangular spicules arranged serially. Apical phallomere globular, with three pairs of ventro-apical lobes (L1, L2 & L3) and a bifurcated apical sclerite (AS). Endophallus, when inflated through basal opening (Figs 11–12), only part of median phallomere and apical phallomere were visible; basal phallomere completely and proximal region of median phallomere being hidden.

Female genitalia (Fig. 13). With spermathecal capsule sickle shaped, weakly constricted proximally, apex subobtuse, inner margin almost V-shaped, outer margin strongly curved (Fig. 16). Length of spermathecal capsule 2.6–3.1 times its maximum width. Bursa copulatrix distinctly sclerotized, almost bean shaped (Fig. 14); spermathecal duct short, enters bursa copulatrix at its apex; spermathecal gland long, tubular, translucent, bifurcated in distal ⅔, arise close to spermathecal duct. Tergite VIII simple and crescent-shaped (Fig. 17), bears a number of long setae on its apical margin. Sternite VIII unrecognizable and tignum *sensu* Konstantinov 1998 (spiculum ventrale *sensu* Ślipiński & Escalona 2013) absent. Ovipositor very short, with partially reduced structures (Fig. 15). Proctiger is represented by a pair of baculi, connected basally with paraprocts. Paraprocts are small, connected with baculi of proctiger and valvifers. Valvifers are slightly elongate, coxites are with pointed apex and lack long setae on the apex. Styli are absent.

Distribution

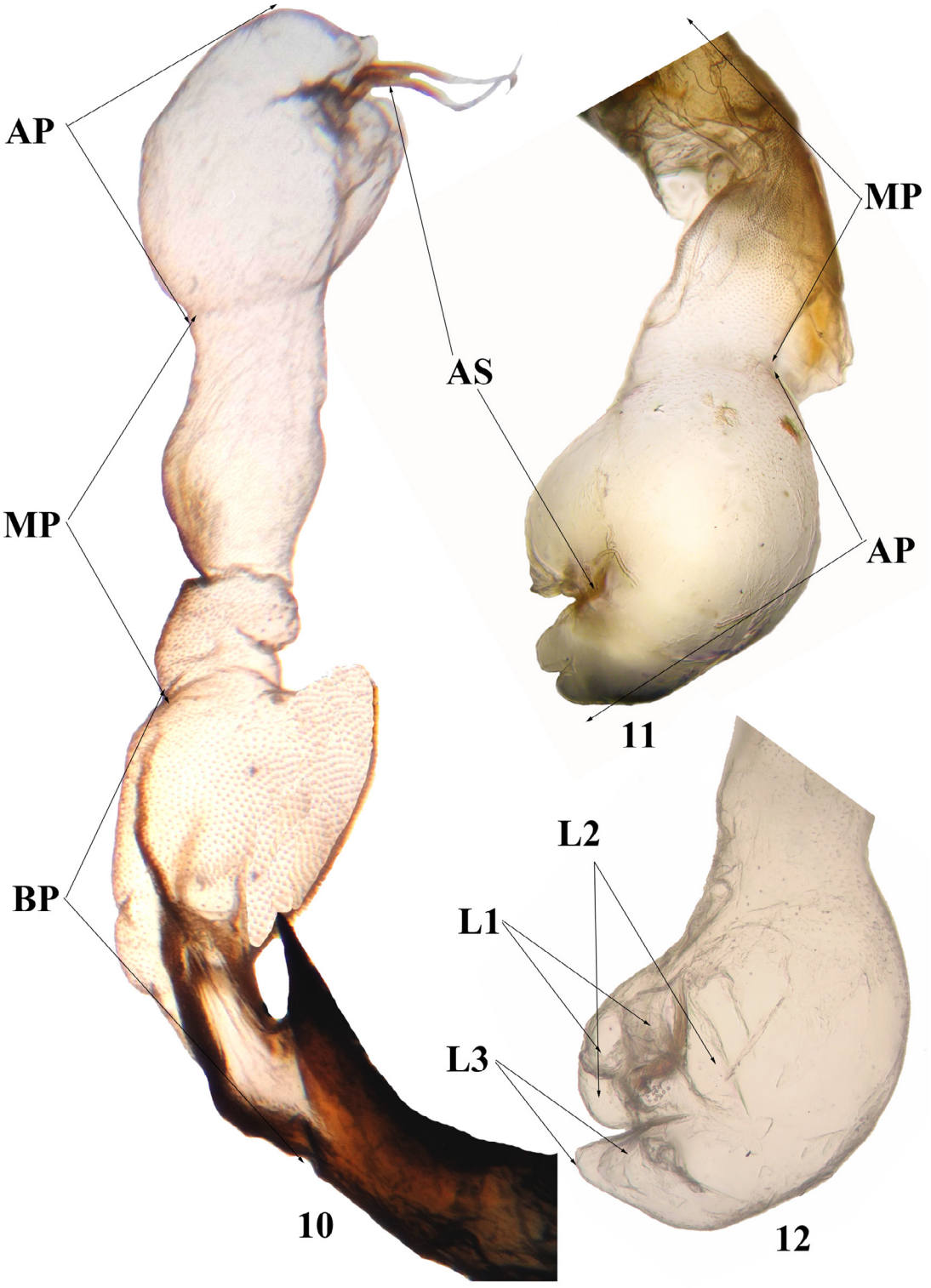
India (Bengal, 'southern Bombay', Karnataka, Kerala).

Host plants

Anacardium occidentale L. (**new record**) and *Mangifera indica* L. (Rajendran & Singh 2016) (both Anacardiaceae).

Biology

Fidia kanaraensis is a pest of cashew (*Anacardium occidentale*) and mango (*Mangifera indica*) in south India. Adults create moderate sized circular or irregular holes on the tender leaves (Fig. 26), mostly during the night and late evening hours, and hardly come out during the day. Infestation is apparently higher in cooler areas. Rajendran & Singh (2016) listed it as a pest of mango. No further information was available on its immature stages or biology. This is the first record of *F. kanaraensis* on cashew. Eggs were laid singly on the surface of soil and covered with a mixture of excreta and soil (Fig. 20).



Figs 10–12. Endophallus of *Fidia kanaraensis* (Jacoby, 1895) comb. nov., lateral view. **10**. Endophallus, everted through apical opening or ostium. **11**. Endophallus, everted through basal opening. **12**. Apical phallomere with three pairs of lobes. Abbreviations: AP = apical phallomere; AS = apical sclerite; BP = basal phallomere; L 1 = first pair of lobes; L 2 = second pair of lobes; L 3 = third pair of lobes; MP = median phallomere.

They are elliptical (0.58–0.73 mm × 0.40 mm) in shape and are cream or light yellow in color (Fig. 21). Eggs hatched after about 15 days. Grubs are scarabaeiform, C-shaped, dorsum covered with long setae and actively moved forward using the anal pseudopod (Figs 22, 24). Larvae bored into the roots. In the laboratory, they created a tunnel inside pieces of root and stem of seedlings of mango and cashew (Fig. 23). However, none of the larvae survived till the final instar in the laboratory.

Remarks

The genus in India is represented by two species. *Fidia indica* (Jacoby, 1908), the other Indian species, can be separated from *F. kanaraensis* by the more regularly arranged elytral punctures (rather confused, with countable rows in posterior half of elytra in *F. kanaraensis*) and finely transversely wrinkled elytral interstices in the basal area (interstices not wrinkled in *F. kanaraensis*). *Fidia shirozui* (Kimoto, 1969), from Taiwan, closely resembles *F. kanaraensis* and differences between these species require additional study.

Discussion

Fidia kanaraensis, though originally described from southern India, was also recorded in Bengal in eastern India (Jacoby 1908). Such a disjunct distribution is common for many peninsular Indian species

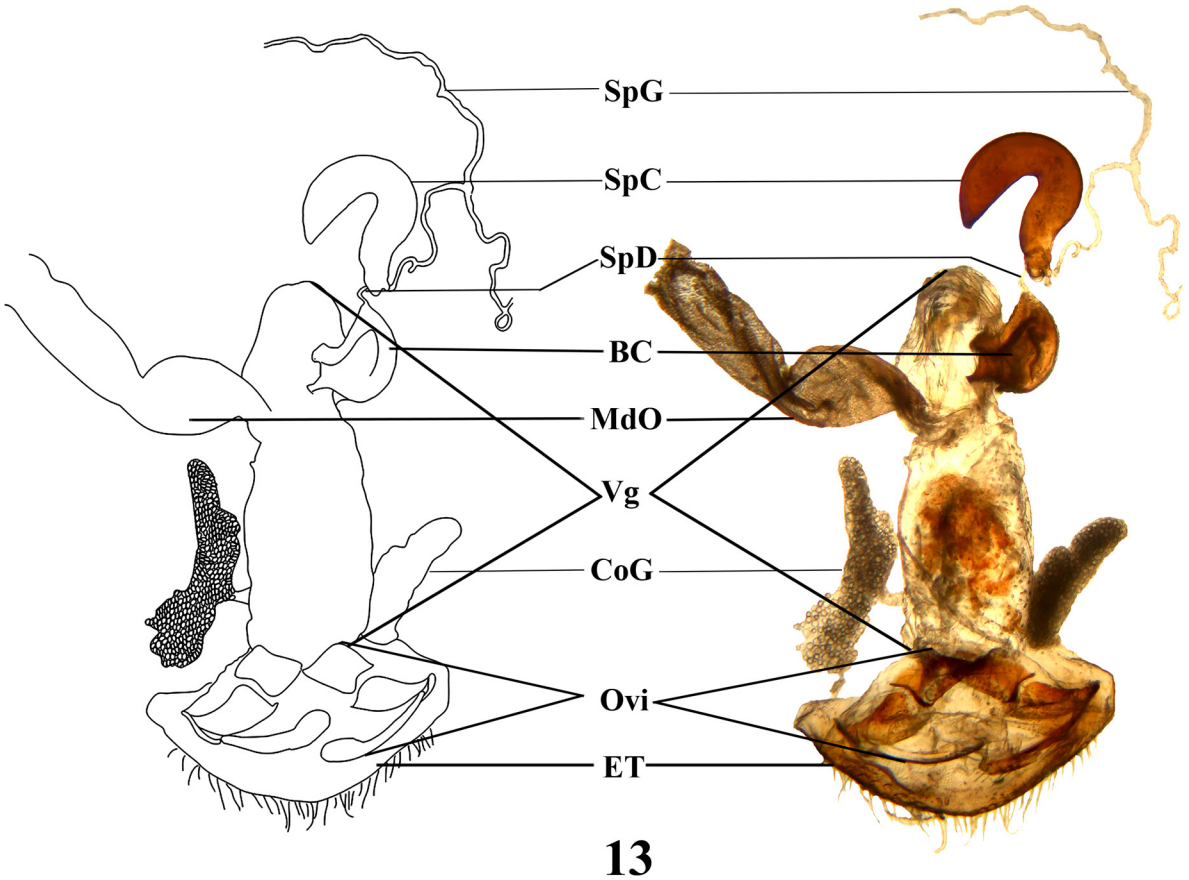
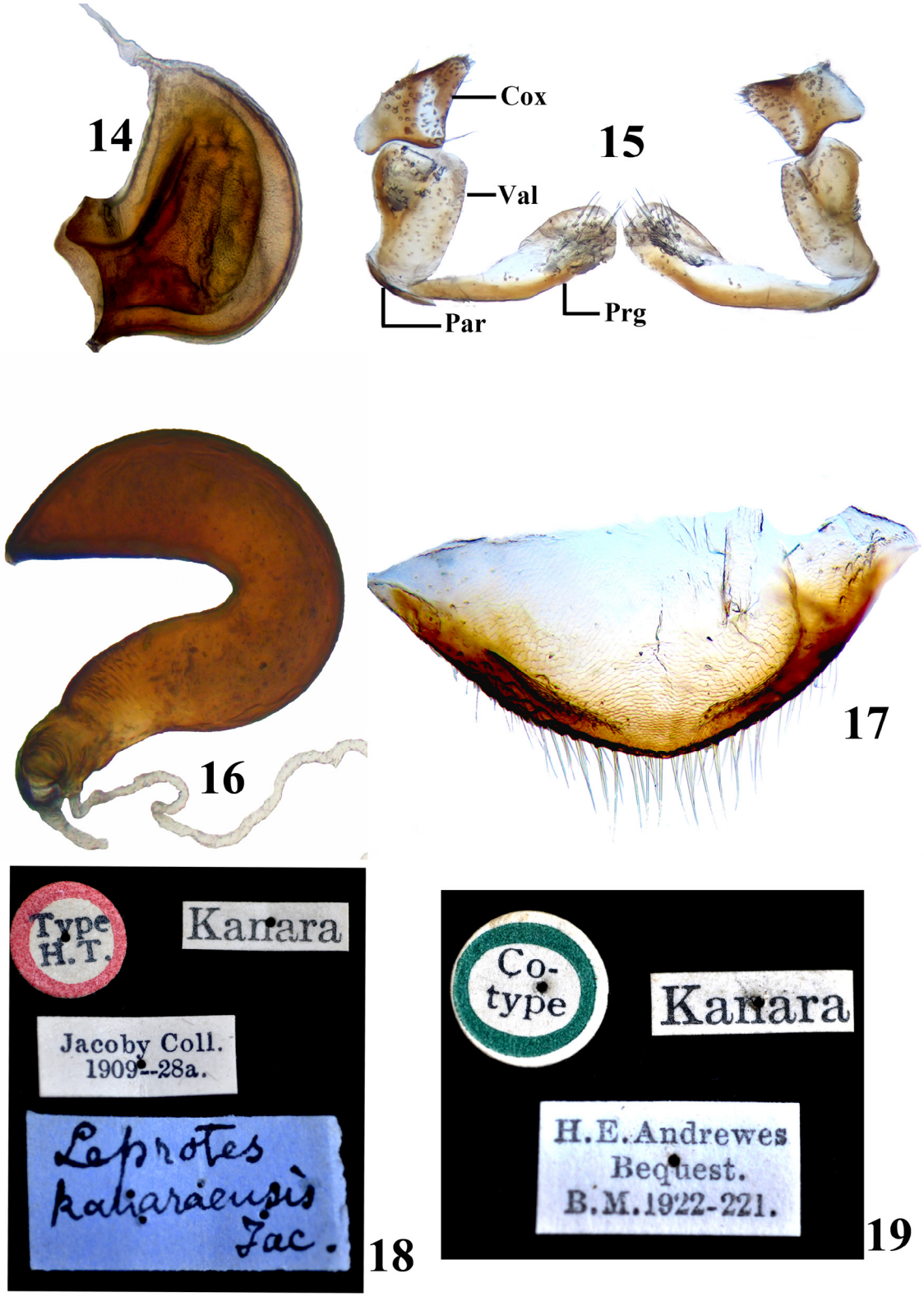
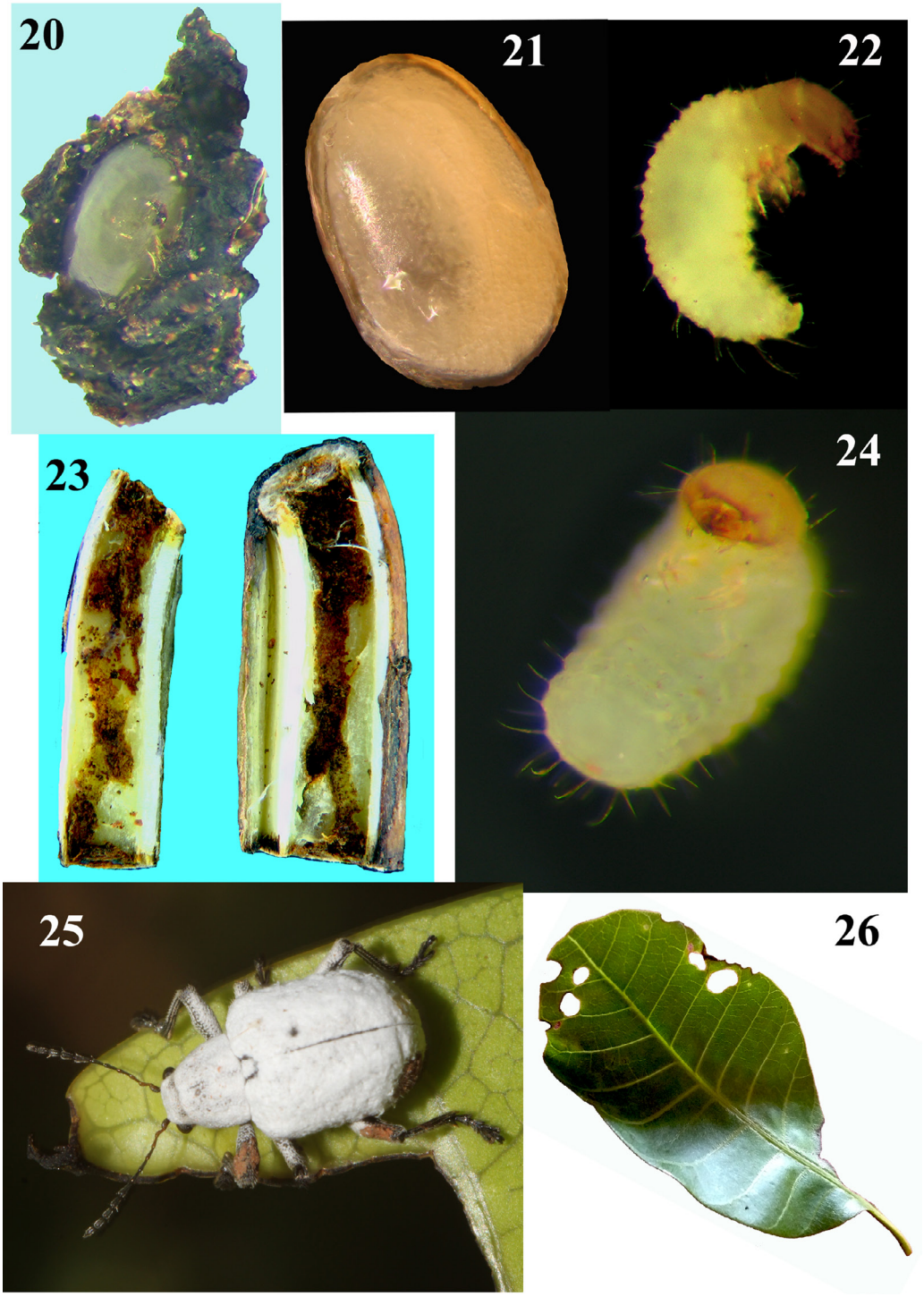


Fig 13. Female genitalia of *Fidia kanaraensis* (Jacoby, 1895) comb. nov. along with line diagram. Abbreviations: BC = bursa copulatrix; CoG = collateral gland; ET = eighth tergite; MdO = median oviduct; Ovi = ovipositor; SpC = spermathecal capsule; SpD = spermathecal duct; SpG = spermathecal gland; Vg = vagina.



Figs 14–19. Close up of parts of female genitalia of *Fidia kanaraensis* (Jacoby, 1895) comb. nov. **14**. Bursa copulatrix. **15**. Ovipositor. **16**. Spermatheca. **17**. Eighth tergite. **18**. Holotype labels. **19**. Paratype labels. Abbreviations: Cox = coxite; Par = paraproct; Prg = proctiger; Val = valvifer.

(Hora 1953). The body of *F. kanaraensis* is covered with a white, waxy secretion. This is also known in *F. atra*, the type species (Chûjô 1954), *F. japonicus* Ohno, 1958 (= *F. babai*) (Chûjô 1958b) and *F. shirozui* Kimoto, 1969. In the Oriental tortoise beetle, *Silana farinosa* (Boheman), the dorsum is



Figs 20–26. Biology and ecology of *Fidia kanaraensis* (Jacoby, 1895) comb. nov. **20**. Eggs covered with excreta. **21**. Naked eggs. **22**. First instar grub, lateral view. **24**. First instar grub, ventral view. **23**. Damage on mango root. **25**. Adult beetle on mango leaves. **26**. Damage on cashew leaves.

completely covered with a white coating (Maulik 1919). Similarly, in *Myrmeconycha* Konstantinov & Tishechkin 2017, a myrmecophilous flea beetle genus from the Neotropics, the head and pronotum are covered with white, waxy exudate. However, the actual origin, chemical nature or function of this white, waxy covering remains unknown.

Flowers (1999), using a different technique for teasing out the endophallus through the apical orifice, studied the endophallus in Eumolpinae and described the structures in the *Leprotites*. However, in our studies, we have everted the endophallus through the apical opening as well as inflated it (without eversion) through the basal opening. Due to the differing techniques used, comparison of structures with those shown by Flowers (1999) is difficult. A sclerotization on the vaginal wall near the base of the duct is present, as in some other eumolpines (Moseyko 2008; Zoia 2009). The short ovipositor as in *Fidia* is a progressive character in Chrysomelidae and an adaptation for open oviposition of groups of glued eggs or eggs with some coverage (Moseyko 2008). According to Li & Liang (2018), females with shorter ovipositors lay eggs on substrate surfaces or in shallow excavations. The female genitalia of *F. kanaraensis* are different from those of eumolpines such as *Platycorynus* Chevrolat, 1837 *Colasposoma* Laporte, 1833 and *Chrysochus* Chevrolat, 1836, but show a structural similarity to those of Synetinae (Li & Liang 2018). Treating Synetinae as a tribe within the subfamily Eumolpinae has already been implied by Crowson (1992). The presence of vaginal glands as in *Fidia* has been reported in *Syneta* by Reid (1995), who provides evidence strongly in favor of *Syneta* being a plesiomorphic eumolpine with many adult autapomorphies. However, Verma & Jolivet (2000) considered Synetinae as a separate subfamily. The pair of vaginal glands (CoG in Fig. 13), observed in *F. kanaraensis*, are either collateral glands or organs of symbiont transmission (Suzuki 1988). Covering the eggs with excreta and soil along with a glandular secretion (Jolivet *et al*. 2014) may be a means of transmission of symbionts. Trophic selections of the genus are distributed across plant families (Table 1). However, *F. kanaraensis* is the only species that feeds on Anacardiaceae. More information on the subterranean immatures of the species is necessary to formulate a management strategy in agro-ecosystems.

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