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Three new *Eustala* (Araneae, Araneidae) species from the Galápagos Islands (Ecuador)

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Abstract. Three new *Eustala* species are described from the Galápagos archipelago: *Eustala occidentalis* sp. nov. with a western distribution, *Eustala orientalis* sp. nov. with an eastern distribution and *Eustala meridionalis* sp. nov. with a distribution restricted to the southern island Floreana.

Key words. new species, colour variation, island fauna

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Introduction

Because they construct conspicuous orbwebs, Araneidae are among the most prominent group of spiders. With 169 genera and more than 3000 described species, it is also one of the largest spider families (Jocqué *et al.* 2013; Platnick 2014). On the Galápagos Islands, the family is represented by nine genera: *Cyclosa* Menge, 1866, *Galaporella* Levi, 2009*, Gasteracantha* Sundevall, 1833, *Mastophora* Holmberg, 1876*, Metazygia* F.O.Pickard-Cambridge, 1904*, Metepeira* F.O.Pickard-Cambridge, 1903 and *Neoscona* Simon, 1864 are represented by one species each, and *Argiope* Audouin, 1826 by two species (Baert *et al.* 2008; Baert 2013). In this paper, I report on the ninth genus, *Eustala* Simon, 1895, which is the most speciose araneid genus of the archipelago with three species, here described as new.

The American continent harbours 82 species of the genus *Eustala*, of which half are found in South America. Most of these (35 species) occur in the eastern and southern part (Guyana, Brazil, Uruguay and Argentina) of the South American mainland. Only six species are cited from the western part, more precisely from Peru, but none from Ecuador (Platnick 2014).

The *Eustala* specimens found on the Galápagos have so far been assigned to one species: *Eustala vegeta* (Keyserling, 1865) (Baert *et al.* 2008; Garrett *et al*. 2008). However, a more detailed analysis of the male palp and the female scapus shows that they belong to a complex of three different species, each with a well defined, segregated distribution over the islands of the archipelago. The males can easily be distinguished by the structure of their terminal apophyses, the females by the shape of their scapus.

Material and methods

The material studied consists of samples taken by the following sampling teams (field numbers in brackets): L. Baert & J.-P. Maelfait (82/LB,JPM), L. Baert, J.-P. Maelfait & K. Desender (86/LB,JPM,KD; 88/LB,JPM,KD; 91/LB,JPM,KD; 00/LB,JPM,KD), J. Herathy (91/JH), S. Peck (89/SP; 92/SP; 96/SP), W.G. Reeder (75/WGR; 77/WGR; 78/WGR; 79/WGR; 80/WGR), S. Riechert (70/SR) and L. Roque (99/LR).

The type material of the three species is deposited in the collections of the Royal Belgian Institute of Natural Sciences, Brussels (Belgium).

Specimens were examined and measured with a Wild M5 stereo-microscope, and illustrated using a Wild M10 stereomicroscope. The electron microscope photographs were made with an ESEM FEI QUANTA 200 microscope. The colour photographs were made with a Nikon D7000 with an AF Micro Nikkor 60 mm objective. All measurements are in mm.

The left male palps are depicted, except the right one for *E. orientalis*. The female genitalia were cleared in a methylsalicylate solution.

Abbreviations

AME	=	Anterior Median Eyes
Cl	=	Clypeus length
CDRS	=	Charles Darwin Research Station
DAME	=	Diameter of Anterior Median Eye
Fe	=	Femur
j(s)	=	juvenile(s)
L/D	=	length of scapus/diameter of scapus
MOQ	=	Median Ocular Quadrat
Mt	=	Metatarsus
Pa	=	Patella
PLE	=	Posterior Lateral Eye
PME	=	Posterior Median Eye
SA	=	Subadult
Ta	=	Tarsus
Ti	=	Tibia
(♂)	=	subadult male
(♀)	=	subadult female

Results

Taxonomy

Class Arachnida Cuvier, 1812
Order Araneae Clerck, 1757
Family Araneidae Clerck, 1757

Genus ***Eustala*** Simon, 1895

Diagnosis of the genus

The carapace has a deep longitudinal cleft in the thoracic region. The abdomen has a triangular shape with a dorsal folium pattern and a ventral white patch. The posterior median eyes are usually slightly smaller than the anterior median eyes. The males are smaller than the females. The distal margin of the

male first coxa has a distinct hook, which fits into a groove on the second femur. The palpal patella has one very long macroseta. The bulb has a huge, variably-shaped conductor and a conspicuous white, cone-shaped median apophysis produced downward on the ventral side of the large bulb. Females are characterized by the scapus of the epigyne projecting forward.

The males of the three species described here differ from all known *Eustala* species by the structure of the terminal apophysis, the subterminal apophysis and the embolus, the females by the shape of the anteriorly projecting scapus.

The males of these three Galápagos species differ from each other by the structure of their terminal apophysis (Fig. 6) while the females are recognized by the shape of their scapus (Figs 1C, 3C, 4C).

Eustala occidentalis sp. nov.
urn:lsid:zoobank.org:act:95A5F993-4A60-4567-ABAD-9D8489A5EDD3
Figs 1 A–E, 2 A–F, 5 A, 6 A, 7

Epeira prompta Hentz, 1847. – Banks 1902: 61; 1924: 97. — Snodgrass 1902: 76. — Roth & Craig 1970: 120 (misidentification).
Eustala sp. – Roth & Craig 1970: 116. — Baert 2013: 176, 178
Eustala vegeta (Keyserling, 1865). – Baert, Maelfait, Hendrickx & Desender 2008: p. 47, Map 15 — Garrett, Conner & Roque-Albelo 2008: 2–4, f. 1 (misidentification).

Diagnosis

Male: Terminal apophysis needle-like, short and slightly curved, its apical and caudal ridges equal in length and structure.

Etymology

The species name refers to its distribution in the western part of the archipelago.

Type material

Holotype
♂, ISLA SANTA CRUZ, Bahía Tortuga, arid zone, 14 Mar. 1986, leg. Baert, Maelfait & Desender.

Allotype
♀, ISLA SANTA CRUZ, Along the road connecting the Charles Darwin Research Station to Puerto Ayora, Arid zone, 15 Apr. 1982, leg. Baert & Maelfait.

Paratypes
ISLA SANTA CRUZ: 1 ♂,1 ♀, CDRS, 1 Mar. 1986 (B.86/046); 1 ♂, CDRS, 2 Mar. 1986 (B.86/047); 1 ♀, 1 j ♀, CDRS, 11 Mar. 1986 (B.86/083); 1 ♂, CDRS, 16 Mar. 1986 (B.86/0124); 2 ♂♂, CDRS, dormitorio, Mar. 1986 (leg. Baert, Maelfait & Desender 1986). 1 ♂, 2 j, CDRS, dormitorio, 17 Feb. 1988 (B.88/317) (leg. Baert, Maelfait & Desender 1988); 1 ♂, 3 km South of Bellavista, alt. 115 m, 1–29 Feb. 1989 (P.89/81); 1 ♂, CDRS, dormitorio, Apr. 1991 (B.91/757) (leg. Baert, Maelfait & Desender, 1991); 1 ♀, 2.7 km of Los Gemelos, alt. 500 m, 23 Mar. 1996 (B.96/6); 1 ♀, Media Luna, alt. 600m, 11 Mar. 1998 (B.98/015) (leg. Baert, Maelfait & Desender, 1998); 1 ♀, 1 (♀), 1 (♂), 2 j(s), Cerro Colourado, alt. 10 m, 10 Mar. 1975 (leg. W.G. Reeder); 1 ♀, Horneman farm, Bellavista, alt. 225 m, cultivated zone, 14 Oct. 1975 (leg. W.G. Reeder); 1 ♀, 1 j, nesting zone 3 area, 1 Aug. 1970 (leg. Riechert); 1 ♀, northern base of Media Luna, alt. 610-620 m, open shrub savanna of *Miconia* surrounded by ferns and grasses, 3 May 1980 (leg. W.G. Reeder); 2 ♀♀, 1 (♂), 1 (♀), 3 j(s), CDRS, Academy Bay, altitude 5–15 m, from *Scutia*, *Croton*, *Castela* and *Cryptocarpus* plants, 16 Aug. 1977 (leg. W.G. Reeder); 1 ♀, 6 j(s), CDRS, Academy Bay, alt. 10 m, from *Scutia*, *Cryptocarpus* and *Scalesia* plants, 18 Oct. 1975 (leg. W.G. Reeder).

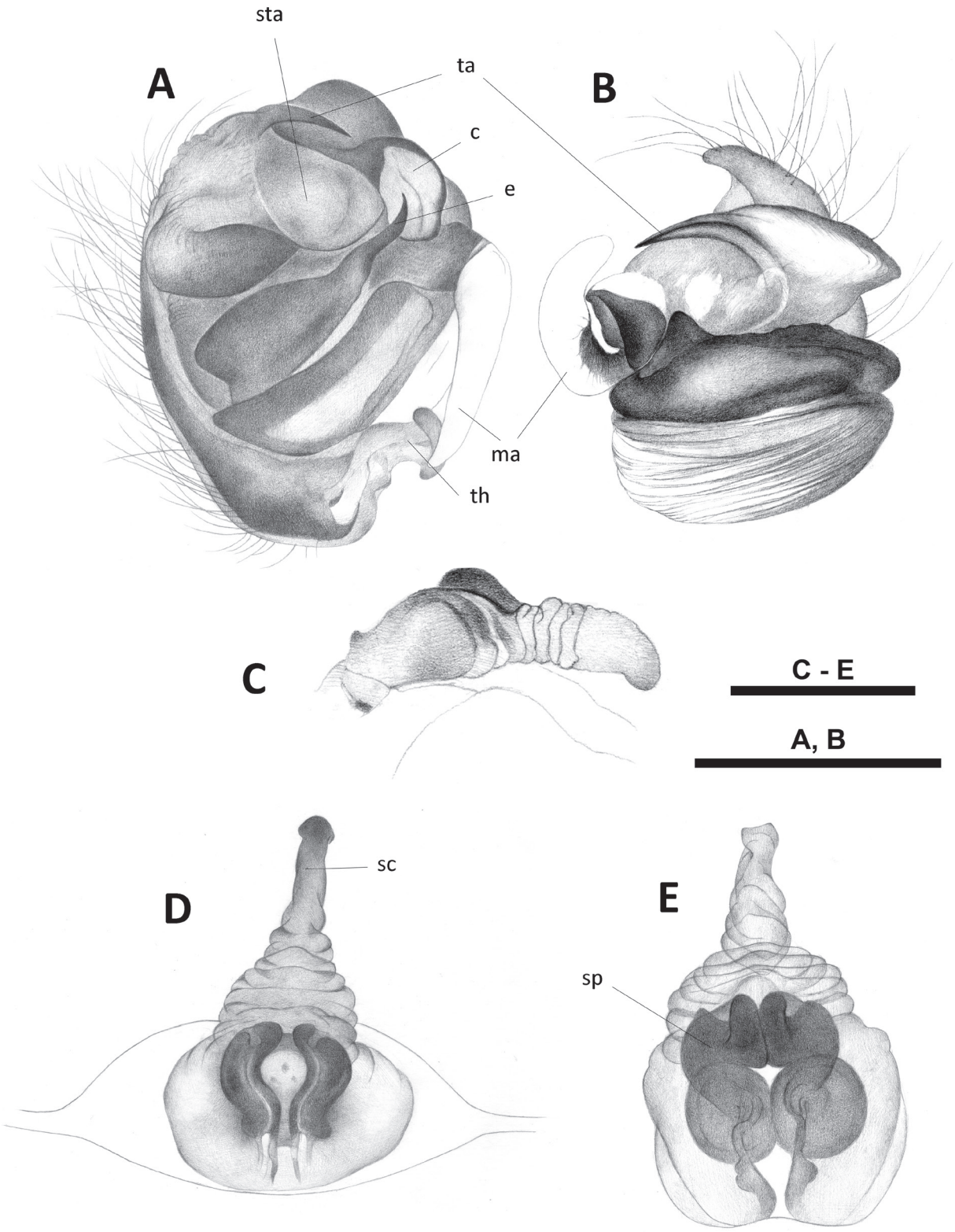

Fig. 1. *Eustala occidentalis* sp. nov. **A**. ♂ left palp, ventral view. **B**. ♂ left palp, apical view. **C**. ♀ scapus, lateral view. **D**. ♀ epigyne scapus, ventral view. **E**. ♀, spermathecae. c = conductor, e = embolus, ma = median apophysis, sc = scapus, sp = spermathecae, sta = subterminal apophysis, ta : terminal apophysis, th = tarsal hook. Scale lines = 0.5 mm.

RBINS inventory number of all type material is I.G. 32722.

Other material examined originating from the islands Fernandina, Isabela (Volcán Sierra Negra, Volcán Alcedo, Volcán Darwin), Marchena, Pinta and Santiago (see Table 1).

Description

Male (holotype)

LENGTH. Total length 5.80; carapace length 3.14, width 2.63, height 0.75; abdomen length 3.65, width 2.63.

CARAPACE. Colour (in alcohol) yellowish with clypeus and eye region black, dorsal cephalic part black with central yellow V; two short, diverging combs of long, thin, white hairs starting from PME and PLE. Chelicerae black with few yellow stains. Labium black with white apical edge. Endites black with white apical and inner edges. Sternum white with irregular blackish suffused border. Pedipalps with striped yellow-black appearance. Legs yellow with variable black annulations.

ABDOMEN. Dorsum white with distinct dorsal dark folium pattern (colour pattern A), with six sclerotized apodemes; venter black with central white patch; spinnerets dark.

EYES. MOQ: PME = 0.72 AME. Cl = 0.5 DAME.

LEGS. Measurements:
I (15.23): Fe 4.63, Pa 1.65, Ti 3.73, Mt 3.73, Ta 1.49
II (11.48): Fe 3.57, Pa 1.25, Ti 2.43, Mt 2.94, Ta 1.29
III (6.81): Fe 2.43, Pa 0.86, Ti 1.33, Mt 1.37, Ta 0.82
IV (10.35): Fe 3.57, Pa 1.25, Ti 2.20, Mt 2.39, Ta 0.94

SPINATION. All legs with numerous spines.

PEDIPALP (Figs 1A–B, 5A). One very long patellar seta, slightly longer than bulbus. Cymbium with conspicious T-shaped tarsal hook, its transverse bar slightly curved and with rounded extremities. Terminal apophysis (Fig. 6 A) needle-like, slightly bent, short, apical and caudal ridges equal in shape and length; embolus short, sharp tip, slightly curved at tip, lying in excavation of small, whitish conductor.

Female (allotype)

LENGTH. Total length 10.72; carapace length 4.20, width 3.53, height 1.18; abdomen length 7.35, width 6.78.

CARAPACE. Colour: orange brown; chelicerae creamy orange; labium, endites and sternum orange brown. Legs orange brown.

ABDOMEN. Creamy white, faintly speckled with cream spots, four apodemes; grey patches extend laterally of the proximal dots; three branched, dirty-grey lines run backwards in distal half of dorsum; venter cream with central white patch; spinnerets orange brown.

EYES. MOQ: PME = 0.79 AME. Cl = 0.9 DAME.

LEGS. Measurements:
I (18.21): Fe 5.47, Pa 2.27, Ti 4.31, Mt 4.47, Ta 1.69
II (15.41): Fe 4.59, Pa 2.12, Ti 3.45, Mt 3.80, Ta 1.45
III (9.29): Fe 3.14, Pa 1.37, Ti 1.88, Mt 1.92, Ta 0.98
IV (14.28): Fe 4.98, Pa 1.96, Ti 3.06, Mt 3.18, Ta 1.10

Table 1. Other material examined of *Eustala occidentalis* sp. nov. Abbreviations: BAL: Baltra, EDE: Eden, FER: Fernandina, IBC: Isabela, Beagle Crater, ISN: Isabela, Sierra Negra, IVA: Isabela, Volcán Alcedo, IVD: Isabela, Volcán Darwin, MAR: Marchena, PIN: Pinta, PIZ: Pinzón, RAB: Rábida, SAN: Santiago, SEY: Seymour Norte, SPL: South Plaza; ♂: male, (♂): subadult male, ♀: female, (♀): subadult female, j(s): juvenile(s), #: several.

Island	Locality	Altitude	Date	Sex	Lit. / Leg.
BAL					Roth & Craig, 1970
EDE				j	99/LR
FER	500 m S of Cabo Hammond	10 m	1 May 1975	1♀	75/WGR
FER	West vegetation strip, camp area	20 m	10 Aug. 1977	1♀ 1(♂) 7j(s)	77/WGR
FER	Between Cabo Hammond & *Bursera* Hills	70 m	26 Apr. 1975	3 ♂♂ 2(♂) 1♀ 1(♀) 10j(s)	75/WGR
FER	Cerro Verde	170 m	9 May 1991	2♂♂ 2♀♀ 2j(s)	91/LB,JPM,KD
FER	W slope, 500m S of camp crater	380 m	16 Aug. 1977	1♀	77/WGR
FER	W slope of camp crater	450 m	16 Aug. 1977	3 ♂♂ 4♀♀ 2(♂) 4(♀♀) #j(s)	77/WGR
FER	Along encañada	600 m	7 May 1991	1j♀	91/LB,JPM,KD
IBC	Camp		22 May 1980	7♂ 3(♂) 13♀♀ 3(♀) #j(s)	80/WGR
IBC	Outside crater wall	40-50 m	22 May 1980	1♂ 2j(s)	80/WGR
ISN	Lagoons of Villamil		14 Jul. 1970	1♀	70/SR
ISN	Near Villamil (road to highlands, 1 km from sea)	10-15 m	11 Jul. 1978	2♂♂ 2♀♀	78/WGR
ISN	Camp above Alemania	540 m	24 Jan. 1975	5♂♂ 1(♂) 8♀♀ 1(♀) #j(s)	75/WGR
ISN	Camp above Alemania	540 m	23 Jan. 1978	1♂ 5♀♀	78/WGR
ISN	Crater rim	925 m	19 Feb. 1986	1♂	86/LB,JPM,KD
IVA	E slope	340 m	18 May 1980	1♂	80/WGR
IVA	West of lava flow (W slope)	370-380 m	25 May 1980	2♂♂ 8♀♀ #j(s)	80/WGR
IVA	Pega Pega camp	380 m	23 May 1980	1♂ 2(♂) 4(♀) 6j(s)	80/WGR
IVA	E slope	380 m	25 May 1980	1♂	80/WGR
IVA	W slope	620-1260 m	21–23 May 1980	1♀♀	80/WGR
IVA	Pega Pega camp	780 m	13 May 1980	1♂ 7♀♀ #j(s)	80/WGR
IVA	West of lava flow (W slope)		23 May 1980	1♀ 1(♀) 2j(s)	80/WGR
IVA	East of lava flow		24 May 1980	1♀ 6j(s)	80/WGR
IVA	East rim	1045 m	16 May 1980	1♀	80/WGR
IVA	East rim	1045 m	17 May 1980	1♂ 7♀♀ #j(s)	80/WGR
IVD	Tagus Cove	20 m	13–22 May 1992	1♂	92/SP
IVD	Flat between IBC & IVD	40-50 m	22 May 1980	3♂♂ 4(♂) 11♀♀ 6(♀) #j(s)	80/WGR
MAR	Playa Negra		10 Mar. 1988	#j(s)	88/LB,JPM,KD
MAR	Punto Mejio		11 Mar. 1988	1j♀	88/LB,JPM,KD
MAR	Playa Negra		29 Mar. 2000	2♂♂ 1♀	00/LB,JPM,KD
MAR	SW slope of beach camp area	5 m	24 Jan. 1977	1♂ 4♀♀ 3(♀) 7j(s)	77/WGR
MAR	Above beach at Beach camp (S slope)	5-10 m	26 Jan. 1977	2♂♂ 2(♂) 9♀♀ 3(♀) 12j(s)	77/WGR
MAR	S Playa camp, new lava flow	16-20 m	31 Jan. 1977	1♂ 1(♂) 2j(s)	77/WGR
MAR	SW Playa, *Bursera* forest	30 m	12–24 Mar. 1992	1♂	92/SP
MAR		50 m	10 Mar. 1988	1j♀	88/LB,JPM,KD
MAR	Fumarole at Barranco	160-190 m	29 Jan. 1977	2♂♂ 2♀♀ 3(♀) 5j(s)	77/WGR
PIN	Cabo Ibbetson		31 Mar. 2000	1♂	00/LB,JPM,KD

Island	Locality	Altitude	Date	Sex	Leg.
PIN	S slope, camp area	250 m	19 Jul. 1975	1m 3♀♀ 1(m) #j(s)	75/WGR
PIN	S slope, camp area	250 m	20 Jan. 1977	2♀	77/WGR
PIN	E slope	300 m	20 Mar. 1986	1♀	86/LB,JPM,KD
PIN	W slope	300 m	21 Mar. 1986	1♂	86/LB,JPM,KD
PIN	E slope	360 m	19 Mar. 1986	1♂	86/LB,JPM,KD
PIN	W slope	400 m	30 Mar. 2000	1♀	00/LB,JPM,KD
PIN	Below summit	630 m	22 Jul. 1977	1♀	77/WGR
PIZ	Old crater camp	300-320 m	5 Feb. 1979	2(♂) #j(s)	79/WGR
PIZ	Crater camp ridge summit	320 m	6 Feb. 1979	1♀ (1♀) #j(s)	79/WGR
RAB	Margins of lagoon	3-10 m	28 Sep. 1975	1♂ 3j(s) ♀	75/WGR
SAN	7 km SE of Playa Espumila		9 Jun. 1991	1j♀	91/JH
SAN	Bahía Bucanero (behind beach)		14 Apr. 1975	1♀ 5j(s)	75/WGR
SAN	Bahía Bucanero	3 m	18 Sep. 1975	2♀♀ 1(♀)	75/WGR
SAN	Bahía Bucanero	5-10 m	10 Sep. 1975	1♀	75/WGR
SAN	Bahía Bucanero	10-15 m	12 Sep. 1975	1♀	75/WGR
SAN	Bahía Bucanero	15 m	17 Apr. 1975	1j♀ 2j(s)	75/WGR
SAN	Mina de sal	50 m	8 Mar. 1986	1♀	86/LB,JPM,KD
SAN	Transect from Bahía Bucanero to summit	75m	11 Sep. 1975	1♀	75/WGR
SAN	Cerro Cowan	260 m	7 Apr. 1982	1♀	82/LB,JPM
SAN	N slope	400 m	4 Mar. 1986	1(♀)	86/LB,JPM,KD
SAN	SW slope	400 m	7 Mar. 1986	1♀	86/LB,JPM,KD
SAN	SW facing slope of crater area	810-830 m	1 Sep. 1975	6(♂) 1♀ 16(♀) 2j(s) ♀♀	75/WGR
SAN	1.5 km S of summit (tree fern valley)	875 m	21 Sep. 1975	4j(s)	75/WGR
SEY		10 m	26 Oct. 1975	1♀	75/WGR
SPL		10-15 m	19 Mar. 1975	3♂♂ 1♀ 2j(s)	75/WGR

Epigyne (Fig. 1C–E). Length of scapus 0.91, diameter (lateral view) 0.19, L/D = 2.95. Spermathecae touching each other medially; scapus evenly broad (ventral view), broadest in the middle, tip slightly curved (lateral view).

Variation

The males in our samples vary in length between 4.9 and 7.4 mm, the females between 5.7 and 10.6 mm.

A great diversity in abdominal colouration, independent of island origin, can be observed (Figure 2). The abdominal colour can vary from uniform light cream (Pattern A: for example ♂ of sample B.88/317: Santa Cruz, surroundings of CDRS, 17 Feb. 1988; Allotype ♀ from Santa Cruz and ♀ from Marchena, 26/I/1977, leg. Reeder), to very dark (Pattern B: for example ♀ specimen from Santa Cruz, Media Luna, 620 m alt., 3 May 1980, leg. Reeder), with all possible variations in between. The colour may be uniform or with a faint or a very conspicuous folium (patterns on Fig. 2A, 2D–F), showing two sinuous lines converging backwards. Some specimens, male and females, have a black abdomen with two large white shoulder spots (pattern, Fig. 2C: for example ♂ specimen from sample P.92/179: Tagus cove, Volcán Darwin, 22 May 1992, but also some specimens from Santa Cruz, Volcán Sierra Negra, Pinta and Santiago), a few with a dorsal longitudinal white band (Fig. 2D, F) and some with a white abdomen with median black folium (Fig. 2E). Cephalothorax also variable, with or without marked black stains.

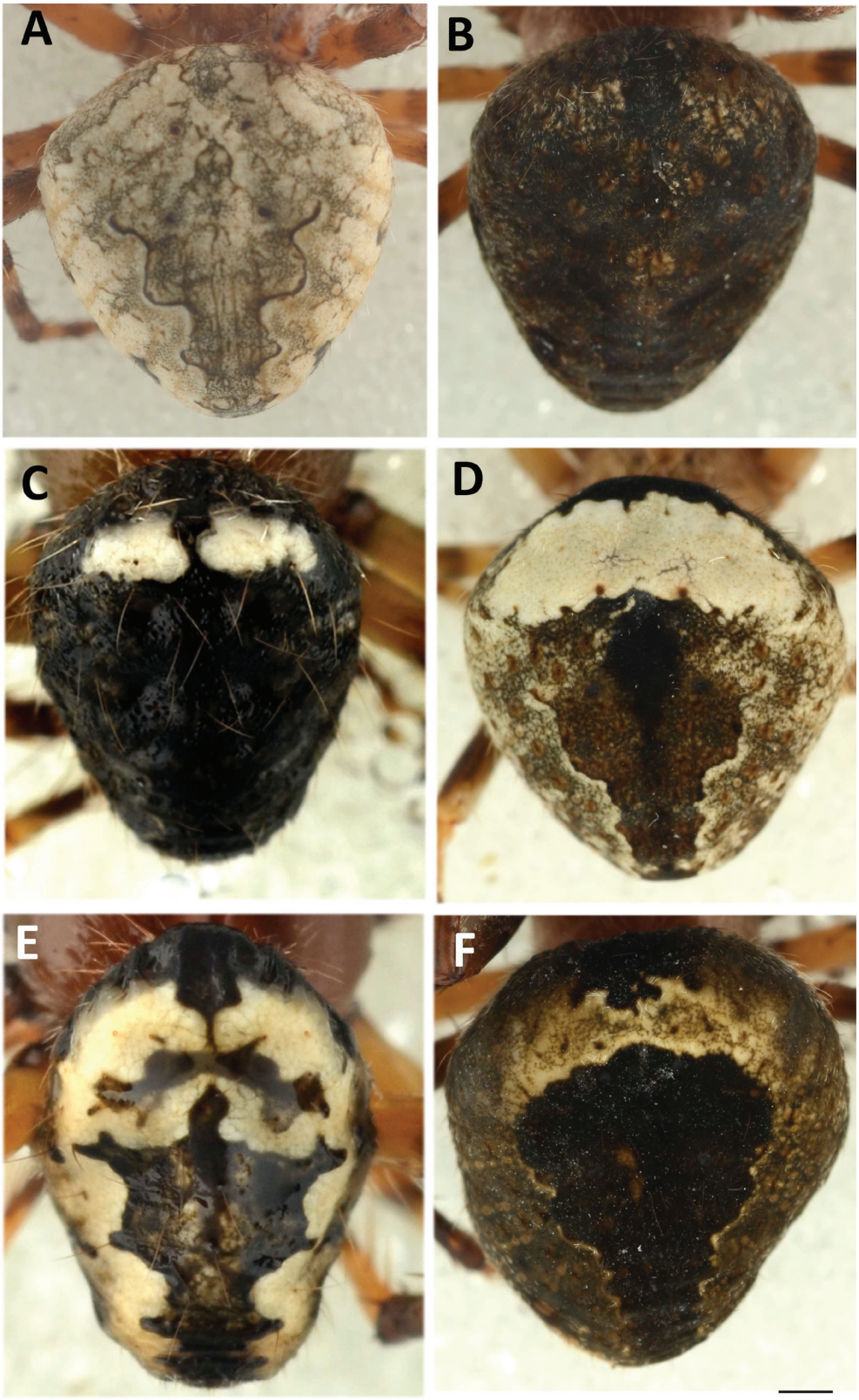

Fig. 2. *Eustala occidentalis* sp. nov., examples of abdominal patterns. **A**. ♀ from Isla Rábida. **B**. ♀ from Isla Santa Cruz. **C**. ♂ from Isla Isabela, Tagus Cove. **D**. ♀ from Isla Pinta. **E**. ♂ from Isla Santa Cruz. **F**. ♀ from Isla Santiago. Scale lines = 1 mm. Photographs: Alain Pauly.

Distribution

E. occidentalis sp. nov. has a western distribution within the archipelago (Fig. 7): Fernandina (up to 600 m alt.); the Isabela volcanoes Volcán Sierra Negra (arid zone and above 900 m alt.), Volcán Alcedo (above 300 m alt.), Volcán Darwin and Beagle Crater (coastal arid zone); Marchena; Pinta (from coast to summit); Pinzon (above 300 m alt.); Rábida; Santiago (from coast to summit); Seymour Norte; South Plaza and Santa Cruz (from coast up to 600 m alt.). There is apparently no preferred vegetation zone. It also occurs along the walls of buildings (cf. CDRS buildings of the dormitorio).

Eustala orientalis sp. nov.
urn:lsid:zoobank.org:act:AF420B6B-A770-4731-908B-4ECF219861A9
Figs 3 A–E, 5 C, 6 C, 7

Eustala vegeta (Keyserling, 1865). – Baert, Maelfait, Hendrickx & Desender 2008: 47, map 15 (misidentification).
Eustala sp. – Baert 2013: 176, 178.

Diagnosis

Males differ from *E. occidentalis* sp. nov. by the structure of the terminal apophysis: flat and broadening towards the tip, its caudal ridge being longer than the apical ridge. Females differ from *E. occidentalis* sp. nov. by the shape of the scapus.

Etymology

The species name refers to its distribution in the eastern part of the archipelago.

Type material

Holotype
♂, ISLA ESPAÑOLA, 1 km W of Punta Cevalos beach, vegetation of beach berm: *Valessia*, *Grabowskia*, *Prosopis*, *Cordia*, 7 Feb. 1977, leg. W.G. Reeder.

Allotype
♀, ISLA ESPAÑOLA, 1 km W of Punta Cevalos beach, vegetation of beach berm: *Valessia*, *Grabowskia*, *Prosopis*, *Cordia*, 7 Feb. 1977, leg. W.G. Reeder.

Paratypes
ISLA ESPAÑOLA: 1 ♂, Bahía Gardner, Playa blanca, 27 Apr. 1991 (B.91/0742) (leg. Baert, Maelfait & Desender, 1991); 1 ♀, 2 (♀♀), Caleta at Bahía Manzanilla, 21 Mar. 2009 (B.09/014-15); 2 ♂♂, 6 ♀♀, 3 (♂♂), # j(s), 1 km W of Punta Cevalos beach, vegetation of upper beach: *Valessia*, *Grabowskia*, *Prosopis*, *Cordia*, 7 Feb. 1977 (leg. W.G. Reeder); 1 ♂, Punta Suarez, albatros colony, 28 Feb. 1977 (leg. W.G. Reeder).

ISLOTE GARDNER near ESPAÑOLA: 2 ♀♀, alt. 10–30 m, through *Bursera*, *Croton*, *Alternanthera*, and ferns, 12 Feb. 1977 (leg. W.G. Reeder); 1 ♀, alt. 30 m, from Croton in *Bursera-Opuntia-Cordia-Croton* community, 12 Feb. 1977 (leg. W.G. Reeder).

RBINS inventory number of all type material is I.G. 32724.

Other material examined from the islands of Genovesa, San Cristóbal and Santa Fé (see Table 2).

Table 2. Other material examined of *Eustala orientalis* sp. nov. Abbreviations: GEN: Genovesa, SCB: San Cristóbal, SFE: Santa Fé; ♂: male, (♂): subadult male,♀: female, (♀): subadult female, j(s): juvenile(s).

Island	Locality	Altitude	Date	Sex	Leg.
GEN	500 m W of Playa Bahía Darwin	10–15 m	23 Oct. 1975	3♀♀ 1(♂) 4(♀) 4j(s)	75/WGR
GEN	500 m SE of crater rim	50 m	25 Oct. 1975	1j♀	75/WGR
GEN	Lago Arcturus	60 m	13 Mar. 1988	1♂	88/LB,JPM,KD
SCB	Wreck Bay area, upper beach vegetation	5 m	9 Feb. 1975	1♂ 1♀	75/WGR
SCB	Cerro Mundo	550 m	13–23 Feb. 1989	1♂	89/SP
SCB	El Junco (near Cabo Guido Rosillo)	600 m	18 Feb. 1978	3♂ 1♀ 2j(s)	78/WGR
SFE	Camp area	5–10 m	24 Jan. 1979	2♂	79/WGR
SFE		50–100 m	1–2 Apr. 1982	1♀	82/LB,JPM
SFE	1 km SSW of camp beach, second arranco	100 m	24 Jan. 1979	1j	79/WGR

Description

Male (holotype)

LENGTH. Total length 5.06; carapace length 2.67, width 2.16, height 0.90; abdomen length 3.41, width 2.27, height 1.96.

CARAPACE. Colour (in alcohol) yellow brown with clypeus and eye region black, dorsal cephalic part yellow brown with central, faintly suffused, blackish V; two short combs of long white hairs diverge from between PME and PLE. Chelicerae yellow with central, faintly suffused, blackish stain. Labium and endites pale yellow with white margin. Sternum yellow with faintly suffused, blackish stains in front of coxae. Pedipalps yellow-brown with some black stain. Legs pale yellow with black annulations, variable between specimens; coxae and proximal part of femora whitish.

ABDOMEN. Dorsum creamy white with small, black median triangle in front, two small, white central stains and distinct dark sepia folium with dark brown margins and ten brown apodemes arranged as 4-2-2-2, becoming smaller caudally and towards the sides; venter whitish, slightly suffused with black; colulus and spinnerets dark.

EYES. MOQ: PME = 0.8 AME. Cl = 0.5 DAME.

LEGS. Measurements:
I (13.09): Fe 4.12, Pa 1.37, Ti 3.25, Mt 3.10, Ta 1.25
II (9.97): Fe 3.06, Pa 1.14, Ti 2.12, Mt 2.55, Ta 1.10
III (5.89): Fe 2.12, Pa 0.78, Ti 1.14, Mt 1.14, Ta 0.71
IV (8.94): Fe 3.10, Pa 1.10, Ti 1.88, Mt 2.04, Ta 0.82

SPINATION. All legs with numerous spines.

PEDIPALP (Figs 3A–B, 5C). One very long patellar seta, slightly longer than bulbus. Cymbium with conspicuous, rounded, T-shaped tarsal hook. Terminal apophysis (Fig. 6C) short, caudal ridge being longer than apical ridge, flat and broadening towards tip.

Female (allotype)

LENGTH. Total length 7.10; carapace length 3.10, width 2.67, height 1.06; abdomen length 4.47, width 4.16, height 3.14.

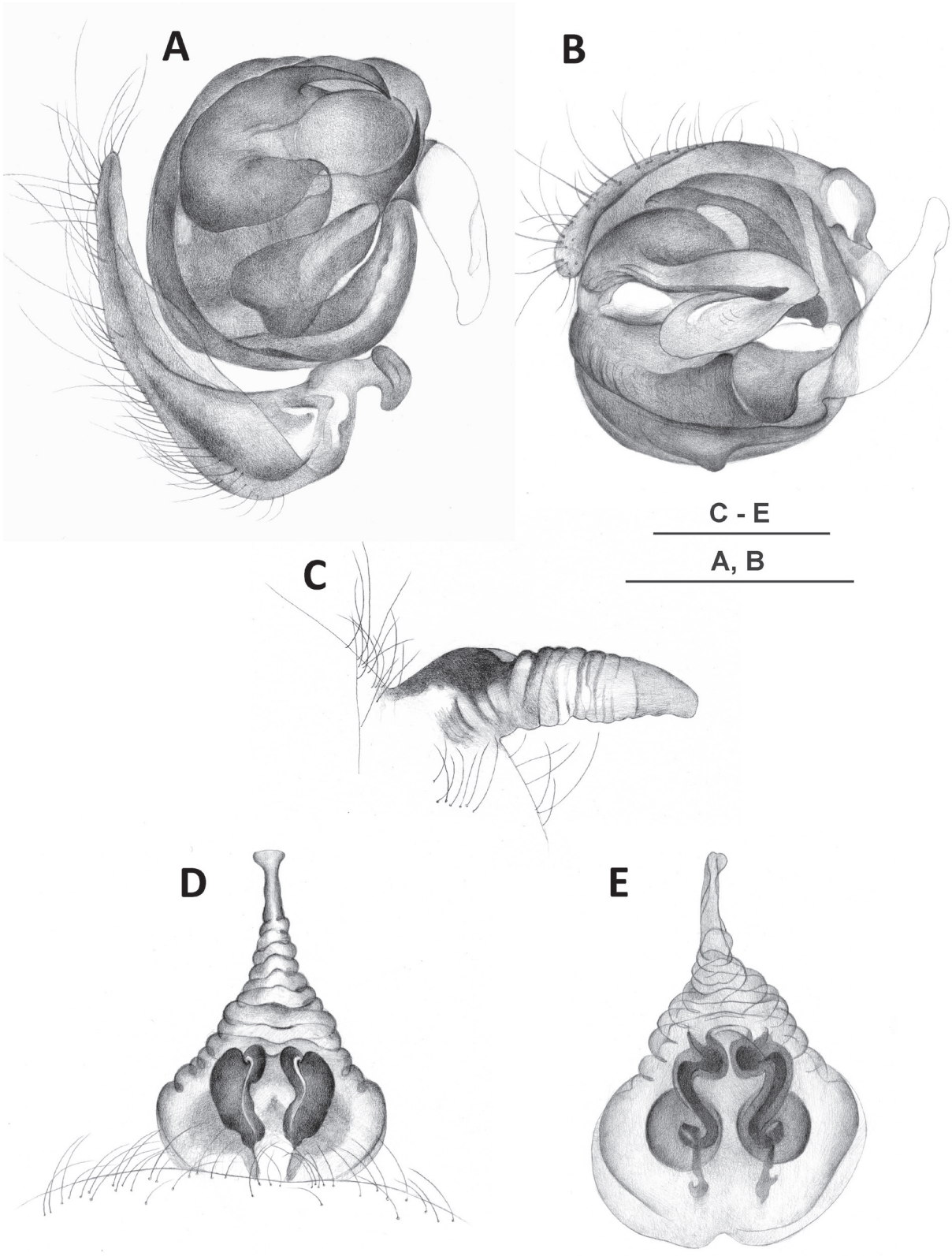

Fig. 3. *Eustala orientalis* sp. nov. **A**. ♂ left palp, ventral view. **B**. ♂ left palp, apical view. **C**. ♀ scapus, lateral view. **D**. ♀ epigyne scapus, ventral view. **E**. ♀, spermathecae. Scale lines = 0.5 mm.

Carapace. As in male, but with more pronounced orange tinge.

Abdomen. As in male, but more uniform grey; shoulders white; venter sepia with white stains; spinnerets orange brown.

Eyes. MOQ: PME = 0.88 AME. Cl = 0.77 DAME.

Legs. Measurements:
I (13.26): Fe 4.12, Pa 1.57, Ti 3.18, Mt 3.06, Ta 1.33
II (11.18): Fe 3.25, Pa 1.45, Ti 2.55, Mt 2.20, Ta 1.73
III (6.81): Fe 2.31, Pa 1.02, Ti 1.29, Mt 1.33, Ta 0.86
IV (10.32): Fe 5.57, Pa 1.37, Ti 2.16, Mt 2.24, Ta 1.98

Epigyne (Fig. 3C–E). Length of scapus 0.47, diameter (lateral view) 0.16, L/D = 4.8. Spermathecae separated; scapus broader at tip (in ventral view), straight, evenly broad (in lateral view).

Variation

The males in our samples vary in length between 4.6 and 6.9 mm, the females between 5.1 and 8 mm.

The colour variation of the abdomen is comparable to that of the previous species.

Distribution

E. orientalis sp. nov. has an eastern distribution within the archipelago (Fig. 7): Española (arid zone), Islote Gardner near Española, Genovesa (arid zone), San Cristóbal (coastal arid zone and above 500 m alt.) and Santa Fé. We cannot detect a preference for a certain kind of vegetation zone, as most islands are low in altitude.

Eustala meridionalis sp. nov.
urn:lsid:zoobank.org:act:AAB212B1-16FA-4110-8133-7BB2EEE7FB52
Figs 4 A-C, 5 B, 6 B, 7

Eustala vegeta (Keyserling, 1865) – Baert, Maelfait, Hendrickx & Desender 2008: 47, map 15 (misidentification).
Eustala sp. – Baert 2013: 176, 178.

Diagnosis

Male: Differing from *E. occidentalis* and *E. orientalis* in the structure of the terminal apophysis, which is flat and broadening towards tip, apical ridge being slightly longer than caudal ridge. The female differs from both species by having a shorter and thicker scapus.

Etymology

The species name refers to its distribution in the southern part of the archipelago.

Type material

Holotype
♂, ISLA FLOREANA, Cerro Pajas at the edge of *Scalesia* forest, alt. 335 m, 18 Apr. 1996 (P.96/55), leg. S. Peck.

Allotype

♀, ISLA FLOREANA, SE slope of Cerro Pajas, *Scalesia pedunculata* with undergrowth of *Tournefortia rufo-sericea* and *Croton scouleri*, alt. 360 m, 20 Feb. 1977, leg. W.G. Reeder.

Paratypes

ISLA FLOREANA : 3 ♂♂, 1 (♀), SE slope of Cerro Pajas, alt. 360 m, 20 Feb. 1977 (leg. W.G. Reeder); 1 ♂, Base of Cerro Pajas, *Scalesia* forest, alt. 300 m, 16 Apr. 1996 (P.96/62) (leg. S. Peck); 1 j♀, along road towards top of the island, transition to *Scalesia* woodland, vegetation mainly consisting of *Tournefortia rufo-sericea* and *Scalesia pedunculata*, thin shrub undergrowth, alt. 300 m, 22 Feb. 1988 (B.88/332) (leg. Baert, Maelfait & Desender).

RBINS inventory number of all type material is I.G. 32723.

Description

Male (holotype)

LENGTH. Total length 5.02; carapace length 2.71, width 2.55, height 0.75; abdomen length 3.14, width 2.39, height 1.96.

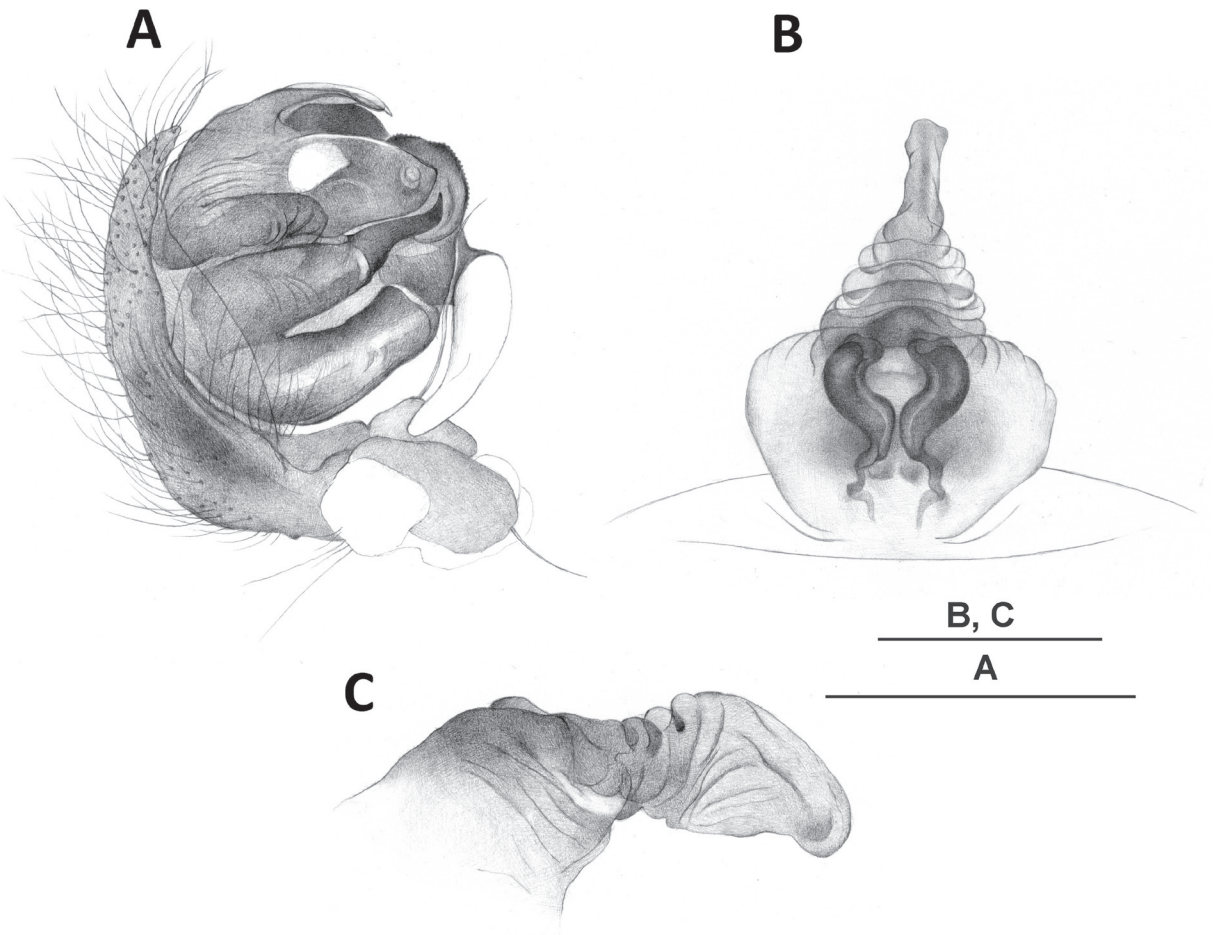

Fig. 4. *Eustala meridionalis* sp. nov. **A**. ♂ left palp, ventral view. **B**. ♀ epigyne scapus, ventral view. **C**. ♀ scapus, lateral view. Scale lines = 0.5 mm.

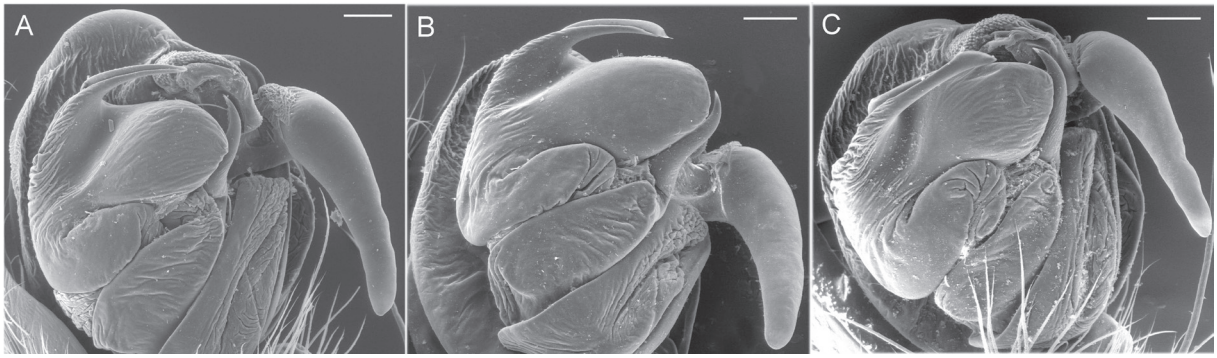

Fig. 5. Electron microscopic photographs of ♂ left palp. **A**. *Eustala occidentalis* sp. nov. **B**. *Eustala meridionalis* sp. nov. **C**. *Eustala orientalis* sp. nov. Scale lines = 0.1 mm.

Carapace. Colour (in alcohol) yellowish with black suffused striae and marked yellow V in cephalic region; two short combs of long, white hairs diverge from between PME and PLE. Chelicerae black with yellowish inner sides. Labium black with white apical edge. Endites black with white apical and inner margins. Sternum light yellow with broad, blackish suffused border. Pedipalps dark. Legs pale yellow with black annulations, variable among specimens; coxae and proximal part of femora whitish.

Abdomen. Dorsum greyish, speckled with cream spots; area between the converging waved brown lines darker grey. Venter light yellow, suffused with grey. Colulus and spinnerets black.

Eyes. MOQ: PME = 0.73 AME. Cl = 0.63 DAME.

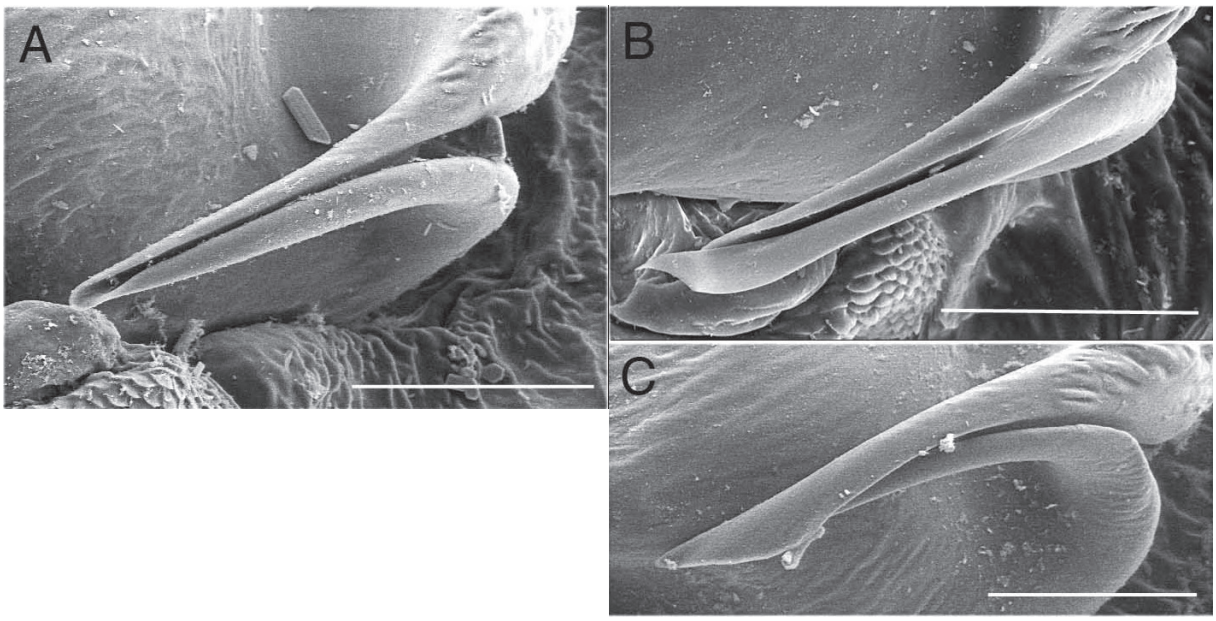

Fig. 6. Electron microscopic photographs of terminal apophysis of ♂ left palp. **A**. *Eustala occidentalis* sp. nov. **B**. *Eustala meridionalis* sp. nov. **C**. *Eustala orientalis* sp. nov. Scale lines = 0.1 mm.

Legs. Measurements:
I (13.25): Fe 4.04, Pa 1.37, Ti 3.33, Mt 3.22, Ta 1.29
II (10.29): Fe 3.14, Pa 1.18, Ti 2.24, Mt 2.63, Ta 1.10
III (6.05): Fe 2.16, Pa 0.82, Ti 1.18, Mt 1.22, Ta 0.67
IV (9.22): Fe 3.14, Pa 1.14, Ti 1.96, Mt 2.16, Ta 0.82

Spination. All legs with numerous spines.

Pedipalp (Figs 4A, 5B). One very long patellar seta, a bit shorter than bulbus. Cymbium with conspicious, rounded, T-like tarsal hook. Terminal apophysis (Fig. 6B) flat and broadening towards tip, apical ridge of terminal apophysis being slightly longer than caudal ridge.

Female (allotype)
length. Total length 8.49; carapace length 3.53, width 2.86, height 1.37; abdomen length 5.18, width 4.90, height 3.76.

Carapace. Cream with some faint brown stains in cephalic area; eyes with black rings. Chelicerae cream. Labium yellow brown with white apical edge. Endites yellow brown with white apical and inner

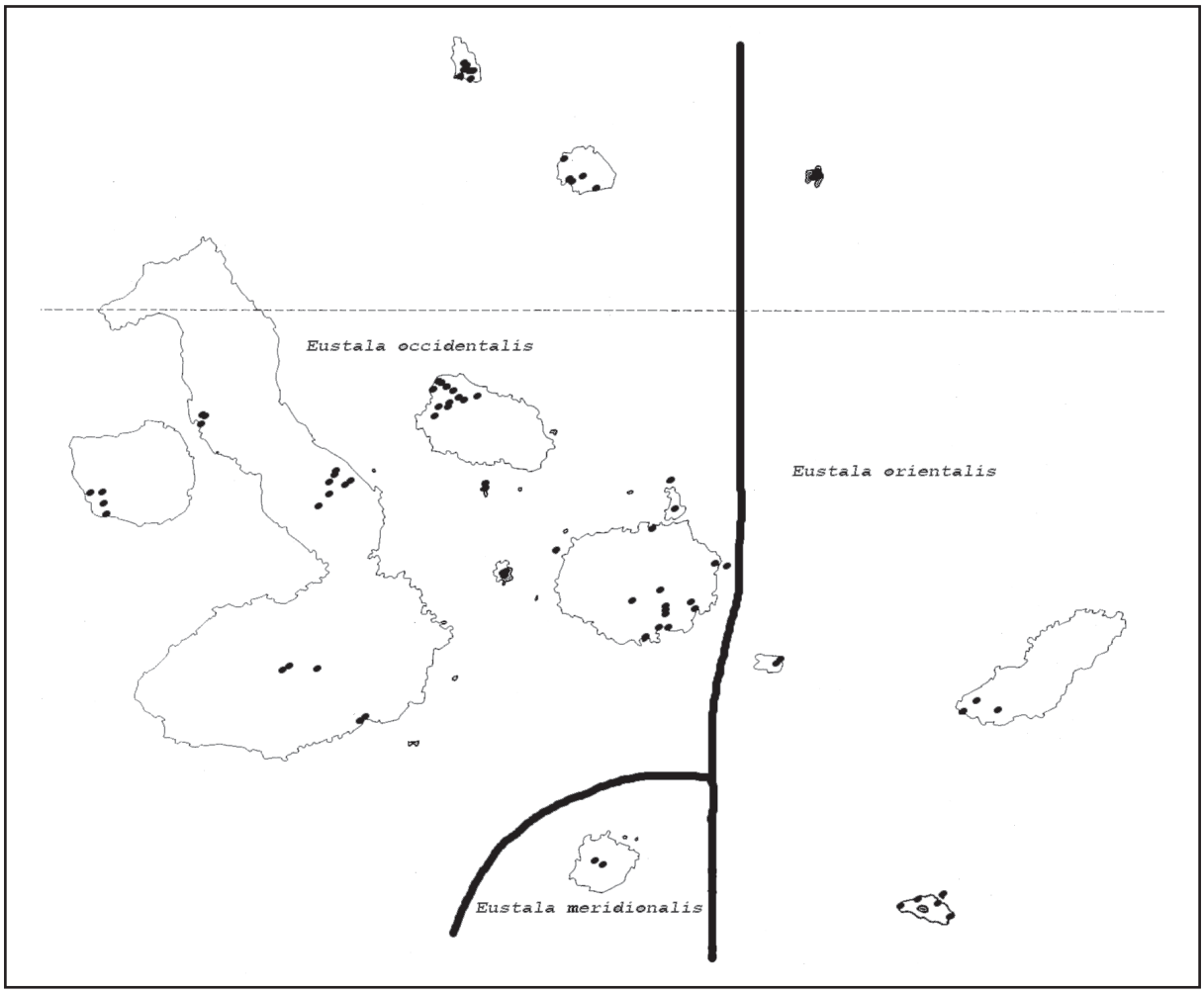

Fig. 7. Distribution map of *Eustala occidentalis* sp. nov., *Eustala occidentalis* sp. nov. and *Eustala meridionalis* sp. nov.

edges. Sternum whitish with broad, yellowish brown border. Legs yellowish brown with annulations fainter than in male.

Abdomen. Dorsum lighter than in male; venter cream with three white stains. Colulus and spinnerets black with orange tinge.

Eyes. MOQ: PME = 0.92 AME. Cl = 0.80 DAME.

Legs. Measurements:
I (14.66): Fe 4.43, Pa 1.76, Ti 3.45, Mt 3.57, Ta 1.45
II (12.32): Fe 3.65, Pa 1.65, Ti 2.75, Mt 2.94, Ta 1.33
III (7.84): Fe 2.51, Pa 1.49, Ti 1.53, Mt 1.49, Ta 0.82
IV (10.98): Fe 3.69, Pa 1.53, Ti 2.35, Mt 2.43, Ta 0.98

Epigyne (Fig. 4 B–C). Scapus 0.35 mm long, 0.21 mm thick, L/D = 1.67. Spermathecae separated; scapus broader at tip (in ventral view), straight and very broad in the middle (in lateral view).

Variation

The few males in our samples vary between 4.70 and 5.90 mm in length. The male caught at the base of Cerro Pajas (P.96/62) shows the same two broad white spots as some *E. occidentalis* sp. nov. specimens (see colour pattern C of *E. occidentalis* sp. nov., Fig. 2C). The other males all have a much lighter appearance. Their abdomen has more white and their cephalothorax is as light as that of the female allotype.

Distribution

E. meridionalis sp. nov. has only been found above 300 m alt. in the *Scalesia* zone of Cerro Pajas and its vicinity on the centrally located southern island Floreana (Fig. 7).

Discussion

The three *Eustala* species described here differ consistently from all mainland species: the males by the shape of the palpal terminal apophysis, the females by the shape of the epigyne scapus and the configuration of the spermathecae.

Chickering (1955) previously wrote that the colour pattern of the Central American *Eustala* species is highly variable. He therefore did not attribute much importance to this character in his species descriptions. This observation was later corroborated by Levi (1977: 96) in his generic diagnosis of *Eustala*: "Most species are variable in colouration with dark and light individuals, but most have a folium pattern on the dorsum, exceptions being some specimens of *E. anastera* that are contrastingly coloured with black patches on white in alcohol (figs. 219, 222)". The colour patterns as given here by Levi coincide strikingly with the patterns observed in *Eustala* species from Galápagos (Fig. 2, patterns A–B and E).

The three species show a very distinctive segregated distribution over the archipelago. *E. occidentalis* sp. nov. has the broadest range over the central (Santa Cruz), the western (Santiago, Isabela and Fernadina) and two of the northern islands (Pinta and Marchena). This part of the archipelago is younger than 2.3 my (Geist *et al*. 2013). *E. meridionalis* sp. nov. lives on the isolated southern island of Floreana which has an age between 1.5 and 2.3 my (Geist *et al*. 2013). *E. orientalis* sp. nov. shows a peculiar distribution which I cannot explain. Its presence on the eastern islands San Cristóbal and Española may be logical and understandable, these islands being the oldest ones (between 2.4 and 4.0 My, Geist *et al*. 2013). But its presence on the "eastern" islands Santa Fé and Genovesa is less explicable, since

the distance separating Santa Fé and Santa Cruz, where *E. occidentalis* sp. nov. lives, hardly exceeds 17.5 km. Moreover, Genovesa belongs to the very young northern islands (age between 0.3 and 0.8 my according to Geist *et al*. 2013), lying on a straight line north of Santa Fé along the 90° W longitude, at a distance of approximately 125 km, but only some 50 km east of the central northern island Marchena. *Odo desenderi* Baert, 2009 has a similar distribution. It occurs on Santa Fé and Genovesa but in an inexplicable way also on Marchena.

Eustala species are, like most araneids, probably good ballooners, which can easily be transported by wind. One should expect *E. orientalis* sp. nov. to be able to bridge the short northwest distance between Santa Fé and Santa Cruz, and to be found on that central island. This has apparently not happened, although the prevailing winds come from the southeast.

The distribution of *E. orientalis* sp. nov. on the older southeastern islands and *E. occidentalis* sp. nov. on the younger central and northwestern islands fits the line of the progression rule pattern, paralleling the geological formation of the islands (Wagner & Funk 1995; Parent *et al*. 2008).

Natural History

Eustala species are apparently nocturnal (Levi 1977: 97) and remove their web during daytime. They seem to have no retreat, but rest on a branch of the vegetation in which they live (Levi 1977: 97).

They were mostly caught by sweeping in daytime and were sometimes caught at night.

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