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Longidorus carniolensis sp. n. (Nematoda, Longidoridae) from vineyard soil in Slovenia

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Abstract

A new needle nematode, *Longidorus carniolensis* **sp. n.**, recovered from the soil around the roots of grapevine *Vitis vinifera* L. from Slovenia, is described and illustrated. *Longidorus carniolensis* is an amphimictic species**,** characterised by females with a moderately long (L=5.6–8.2 mm) and plump (a=51–72.4, ave. 66.3) body, assuming a spiral to C-shape when heat relaxed. Head region continuous, anteriorly almost flat, lip region 23–25 µm wide; guiding ring situated posteriorly (42–47 µm, 43–50 µm in males), odontostyle long (ave. 146.6 (136–157) µm); pharyngeal glands with normal location, their nuclei of approximately equal size; tail bluntly conoidal to almost hemispherical. Males abundant, spicules slender and long (122–145 µm), ventromedian supplements 13–17, irregularly spaced, preceded by an adanal pair. Four juvenile stages present, the first stage juvenile with bluntly conoidal tail. Codes for identifying the new species when using the key by Chen et al. (1997) are: A 56, B 4, C 4, D 1, E 4, F 35, G 1, H 1, I 2. The new species is morphologically the most similar to *L. poessneckensis* Altherr, 1974, *L. macrosoma* Hooper, 1961, *L. caespiticola* Hooper, 1961, *L. helveticus* Lamberti et al., 2001, *L. macroteromucronatus* Altherr, 1974, *L. pius* Barsi & Lamberti, 2001, *L. raskii* Lamberti & Agostinelli, 1993, *L. kheirii* Pedram et al., 2008, *L. silvae* Roca, 1993, *L. iuglandis* Roca et al., 1985, *L. vinearum* Bravo & Roca, 1995 and *L. major* Roca & d'Erico, 1987, but differs from these species either by the body and odontostyle length, position of guide ring, head region and tail shape or the shape of the first stage juvenile tail. Sequence data from the D2-D3 region of the 28S rDNA distinguishes this new species from other species of the genus *Longidorus* with known sequences. Relationships of *L. carniolensis* **sp. n.** with other *Longidorus* species based on analysis of this DNA fragment and morphology are discussed.

Keywords

grapevine, morphology, taxonomy, 28S rDNA

Introduction

The nematodes of the genus *Longidorus* Micoletzky, 1922 cause damage to many economically important crops by direct feeding on their roots. Additionally, they can cause indirect damage to the host plants by transmitting plant viruses. To date, six *Longidorus* species have been reported from Slovenia (Širca and Urek 2009): *L. elongatus* (de Man, 1876) Micoletzky, 1922, *L. caespiticola* Hooper, 1961, *L. juvenilis* Dalmasso, 1969, *L. helveticus* Lamberti, Kunz, Grunder, Molinari, De Luca, Agostinelli & Radicci, 2001, *L. leptocephalus* Hooper, 1961, *L. moesicus* Lamberti, Choleva & Agostinelli, 1983. The study of relationships between longidorids and Nepoviruses in Slovenia and Bulgaria in the frame of a bilateral project, revealed the presence of a new species described herein as *L. carniolensis* sp. n. The description of the new species is based both on morphological and molecular data, in particular the sequence of D2D3 expansion regions of the large subunit rDNA nuclear gene which proved to be useful in molecular phylogenetic analyses of Longidoridae (Rubtsova et al. 2001, Ye et al. 2004, He et al. 2005). Additionally, sequences of these domains allow species differentiation (Širca and Urek 2009).

Materials and methods

Soil samples were collected in July 2008 and October 2009 from the rhizosphere of *Vitis vinifera* L. in Drašiči and Krmačina localities in the southern part of Slovenia. The sampling was performed by digging holes beneath grapevine plants and carefully collecting soil around the roots at 40–50 cm depth. Approximately 500 cm^3 of a collected soil sample was gently mixed and two 200 cm^3 sub-samples were processed. Nematodes were extracted from the soil using a decanting method followed by the Baermann funnel technique. Longidorid nematodes for morphological study were hand-picked, fixed in TAF (7 ml 40% formalin, 2 ml tri- ethanolamine, and 91 ml distilled water), processed to glycerol (Seinhorst 1959) and mounted on glass microscope slides in anhydrous glycerol.

Drawings and photographs were taken using an Olympus BX51 compound microscope powered with differential interference contrast (DIC). Images were taken with a ColorView IIIu camera and cell^P software (Olympus Soft Imaging Solutions Gmbh). Measurements were made using an Olympus BX 41 light microscope, a digitising tablet (CalComp Drawing Board III, GTCO CalCom Peripherals, Scottsdale, AZ, USA), and Digitrak 1.0f programme (Philip Smith, Scottish Crop Research Institute, Dundee, UK).

Total DNA extraction and amplification

Extracted female nematodes for molecular study were transferred into 1.5 ml tube in a 1 µl drop of sterile water. DNA was extracted from a single female nematode from type-locality Drašiči and from Krmačina locality; 10 µl 1M EDTA pH 8 and 50 µl nucleic lysis solution (Promega Wizard DNA purification kit) mixture was added to each tube and homogenised with micropestle. Isolation of DNA was continued according to manufacturer's instructions. Isolated DNA was re-suspended in 10 µl of distilled water of which 2 µl was used in each PCR reaction. A fragment of the D2 and D3 expansion region of the 28S rDNA gene was amplified using the primers D2A (5'-ACA AGT ACC GTG AGG GAA AGT TG-3') and D3B (5'-TCG GAA GGA ACC AGC TAC TA-3') (Rubtsova et al. 2001) in a PCR cycler and conditions as described earlier (Širca et al. 2007).

Analyses of rDNA sequence

Obtained PCR products were purified using the JetQuick PCR purification spin kit (Genomed) and sequenced on an ABI PRISM 310 DNA Sequencer using BigDye Terminator Cycle Sequencing Ready Reaction Kit (Applied Biosystems), the sequences obtained were submitted to the GenBank. Cluster analyses were performed using sequences of several *Longidorus* species from the NCBI GenBank (http://www.ncbi.nlm.nih.gov/) obtained from different phylogenetic studies (Rubtsova et al. 2001, Handoo et al. 2005, He et al. 2005, Lišková 2007, Kumari et al. 2009, Širca and Urek 2009) (Table 1). *Xiphinema index* (AY601628) (He et al. 2005) was used as an out-group. For cluster analyses and tree construction a Neighbour-Joining method was applied using MEGA5 software (Tamura et al. 2011).

Taxonomy

***Longidorus carniolensis* sp. n.**
urn:lsid:zoobank.org:act:546D321E-CF14-46C1-A623-73A1F76839BD
http://species-id.net/wiki/Longidorus_carniolensis
Figs 1–12

Measurements. See Table 2.

Description. *Female*. Body moderately long (L=5.6–8.2 mm) and plump (a=51–72.4), assuming a spiral to C shape when heat relaxed. Cuticle consisting of several layers under light microscope: 11–14 µm thick at guiding ring level; 7–8 µm along the

Table 1. Species of fam. Longidoridae used in phylogenetic reconstructions.

GenBank accession number	Nematode species	Origin	Reference
AY601583	*Longidorus africanus* Merny, 1966	California, USA	He et al. 2005
AY494715	*L. americanum* Handoo, Carta & Skantar, 2005	Georgia, USA	Handoo et al. 2005
AY601571	*L. apulus* Lamberti et Bleve-Zacheo, 1977	Mola di Bari, Italy	He et al. 2005
AY601570	*L. arthensis* Brown, Grunder, Hooper, Klingler & Kunz, 1974	Suter, Switzerland	He et al. 2005
AY601574	*L. athesinus* Lamberti, Coiro & Agostinelli, 1991	Italy	He et al. 2005
AY601572	*L. attenuatus* Hooper, 1961	Germany	He et al. 2005
AY601576	*L. breviannulatus* Norton & Hoffmann, 1975	Nebraska, USA	He et al. 2005
HM447030	*L. caespiticola*	Brdo, Slovenia	Širca and Urek 2009
AY601585	*L. camelliae* Zheng, Peneva & Brown, 2000	Hangzhou, China	He et al. 2005
JN631811	*L. carniolensis* sp. n.	Krmačina, Slovenia	This study
JN631812	*L. carniolensis* sp. n.	Drašiči, Slovenia	This study
AF480072	*L. carpathicus* Lišková, Robbins & Brown, 1997	Germany	Rubtsova 2001
EF654539	*L. distinctus* Lamberti, Choleva & Agostinelli, 1983	Kráľovský Chlmec, Slovakia	Lišková 2007
AY593057	*L. dunensis* Brinkman, Loof & Barbez, 1987		Holterman et al. Unpublished
AY601575	*L. edmundsi* Hunt & Siddiqi	Caribbean sea beach, Cuba	He et al. 2005
HM447032	*L. elongatus*	Maribor, Slovenia	Širca and Urek 2009
AY601573	*L. euonymus* Mali & Hooper, 1973	Zabagr, Hungary	He et al. 2005
AY601581	*L. goodeyi* Hooper, 1961	Peebles, Scotland, UK	He et al. 2005
HM447031	*L. helveticus*	Trška gora, Slovenia	Širca and Urek 2009
AF480074	*L. intermedius* Kozlowska & Seinhorst, 1979	Germany	Rubtsova et al. 2001
DQ364599	*L. juvenilis*	Svetinje, Slovenia	Širca et al. 2007
AY601568	*L. latocephalus* Lamberti, Choleva & Agostinelli, 1983	Greece	He et al. 2005
DQ364600	*L. leptocephalus*	Juršinci, Slovenia	Širca et al. 2007
AY601565	*L. macrosoma* Hooper, 1961	Switzerland	He et al. 2005
HM447029	*L. moesicus*	Vrhpolje, Slovenia	Širca and Urek 2009
AY601577	*L. piceicola* Lišková, Robbins & Brown, 1997	Branisko, Slovakia	He et al. 2005
EF538750	*L. poessneckensis* Altherr, 1974	Cerne Voderady, Czech Republic	Kumari et al. 2009
AF480073	*L. profundorum* Hooper, 1965	Germany	Rubtsova et al. 2001
AF480071	*L. sturhani* Rubtsova, Subbotin, Brown & Moens, 2001	Belgium	Rubtsova et al. 2001
EF538754	*L. uroshis* Krnjaic, Lamberti, Krnjaic, Agostinelli & Radicci, 2002	Velke Pole, Slovakia	Kumari et al. 2009
AY601628	*Xiphinema index* Thorne & Allen	Argentina	He et al. 2005

Table 2. Measurements of females, males and juvenile stages of *Longidorus carniolensis* sp. n., from Slovenia (mean ± standard deviation, with range). All measurements in micrometers.

Character	Holotype	Females	Males	J1	J2	J3	J4
n	n=1	n=13	n=14	n=15	n=6	n=11	n=9
L	7089	7447.5±679.0 5653-8226	7917.7±753.9 6702-9525	1349.9±53.8 1283-1449	2584.2±228.0 2329-2872	3692.2±238.0 3305-4149	5441.2±700.7 4677-6647
a	65.2	66.3±6.1 51.0-72.4	72.5±6.4 59.6-81.2	44.0±2.3 39.3-46.2	46.5±4.3 39.8-50.6	50.5±4.7 42.8-57.4	60.6±3.7 53.2-65.6
b	14.2	12.7±0.9 11.6-14.3	12.8±0.8 11.8-14.9	4.9±0.4 4.3-5.6	6.3±0.3 5.8-6.6	7.9±0.7 7.0-9.0	9.7±1.7 8.4-13.9
c	165.7	177.9±35.5 108.1-224.5	173.7±27.5 127.6-241.8	41.2±2.7 36.8-45.9	71.9±4.8 66.4-79.4	94.2±9.2 82.5-113.6	132.6±17.6 98.2-155.1
c’	0.6	0.6±0.1 0.5-1.0	0.8±0.1 0.6-1.1	1.4±0.1 1.2-1.5	0.8±0.04 0.7-0.9	0.7±0.1 0.6-0.8	0.7±0.04 0.6-0.8
V (%)	49.7	49.4±1.4 47.1-51.5					
G1 (%)	11.9	13.4±2.6 10.6-17.4					
G2 (%)	11.8	13.3±2.6 9.9-17.3					
d	2.0	1.8±0.1 1.7-2.0	2.1±1.1 1.0-5.8	2.0±0.1 1.8-2.2	1.9±0.1 1.8-2.1	1.9±0.1 1.7-2.1	1.7±0.6 0.3-2.0
d’	2.0	2.0±0.2 1.8-2.3	1.9±0.1 1.8-2.1	1.7±0.1 1.6-1.9	1.8±0.2 1.7-2.1	1.9±0.1 1.7-2.2	1.9±0.4 0.8-2.2
Anterior end to guiding ring	45.4	44.6±1.6 42-47	46.5±2.3 43-50	21±0.7 20–22	28.7±1.6 26.5-30.5	33.9±1.0 32-35	39.8±1.2 38-42
Anterior end to nerve ring	267.5	258.6±15.4 220-275	270.7±9.5 249-289	129.6±8.9 114-145	182.1±31.0 153-228	207.5±24.1 176-273	231.1±15.9 213-252
Hemizonid	237.5	253.7±18.9 204-270	10.4±0.5 10-11			205.9±7.4 195-216, n=7	234.6±19.2 210-216, n=4

Character	**Holotype**	**Females**	**Males**	**J1**	**J2**	**J3**	**J4**
n	n=1	n=13	n=14	n=15	n=6	n=11	n=9
Odontostyle	144	147.5±4.7 136-157	149.1±6.6 132-159	81.9±3.5 76-88	88.2±5.0 79-94	107.7±4.4 98-114	125.9±3.6 120-131
Replacement odontostyle				87.6±2.5 85-93	104.9±2.4 101-108	123.7±3.2 119-130	146.0±3.9 142-152
Odontophore	92	91.4±4.1 85-97	90.2±6.4 75-99	49.6±3.9 43-56	62.4±2.3 59-66	72.9±4.2 64-78	85.1±3.4 81-91
Neck length	500	590.5±59.9 462-674	618.6±56.6 510-703	274.1±20.8 237-317	408.3±33.4 370-448	472.5±48.7 409-524	553.6±47.5 478-628
Pharyngeal bulb length	139	142.7±6.0 133-152	141.1±6.9 129-157	72.6±2.3 67-75	89.6±3.1 84-93	106.8±6.1 96-114	123.6±5.6 118-135
Pharyngeal bulb width	39	40.2±2.8 36-44	37.9±2.1 32-41	15.6±0.9 14-17	22.7±1.4 21-24	28.1±1.6 26-31	33.3±1.9 31-37
DO*	11.4	11.6±0.3 11.2-11.9	11.0±0.8 9.8-11.8	14.0±2.4 11.3-18.1	10.9±1.3 9.1-12.0	11.3±0.7 10.3-11.9	11.7±1.6 9.9-14.8
DN	37.1	38.1±2.6 32.8-40.2	37.9±3.0 33.2-42.9	38.6±1.9 36.7-42.7	37.2±1.7 35.5-40.3	37.0±1.0 35.6-38.4	36.8±3.7 30.0-42.6
LS1N	53.7	56.1±2.6 52.3-61.0	55.0±3.0 49.6-62.3	52.0±2.6 47.9-57.3	50.6±1.7 48.6-52.7	52.9±2.1 48.1-55.3	54.3±2.2 52.2-57.7
RS1N	53.7	54.6±2.5 51.5-58.6	55.5±2.6 52.4-61.2	51.5±2.7 46.3-55.3	50.9±1.4 48.9-52.7	53.3±2.3 48.1-56.3	53.5±2.5 50.7-57.4
S2O	83.4	84.9±1.6 82.3-87.1	86.3±5.7 81.9-102.5	84.2±1.0 82.7-85.8	84.8±2.7 83.1-90.2	85.0±1.6 81.6-87.1	82.8±0.9 81.6-84.1
Prerectum	347.5	419.0±85.9 280-550	576.8±182.2 248-832	141.7±60.7 81-290	183.8±30.1 150-224	289.1±50.0 175-363	363.6±91.7 275-538
Rectum	51.5	50.3±3.0 47-57	-	14.3±1.9 12-19	22.8±0.8 22-24	32.6±2.6 30-38	45.3±2.4 42- 49
Tail	42.8	43.3±9.2 34-69	46.4 ± 6.8 32-61	32.9±1.4 31-35	35.9±1.6 34-38	39.4±2.9 35.5-45	41.2±3.2 38-48

Character	**Holotype**	**Females**	**Males**	**J1**	**J2**	**J3**	**J4**
n	n=1	n=13	n=14	n=15	n=6	n=11	n=9
Length of hyaline part	20.2	17.8±0.7 17-19	16.9±1.2 14-19	7.9±0.9 6-9	10.4±0.7 9-11	13.1±0.9 11-15	14.9±0.8 13-16
Body diameter at: - lip region	22.9	24.2±0.8 23-25	24.8±1.3 22-26.5	10.6±0.4 10-11	15.0±0.5 15-16	18.4±1.1 17-20	20.9±0.5 20-21
- guiding ring	46.6	48.5±3.3 44-55	48.0±2.3 45-52	18.3±0.5 18-19	26.8±2.2 25-31	35.7±2.7 31-41	43.0± 3.9 38.7-51
- base of pharynx	95.4	93.4±4.5 89-101	93.8±4.8 84-103	30.2±1.2 29-33	50.5±3.4 46-55	63.9±3.8 59-73	76.4±5.6 69.5-84
- mid-body/at vulva	108.7	112.9±9.5 97-127	109.3±5.4 98-117	30.7±1.2 29-33	55.8±4.0 49-60	73.5±5.6 66-85	89.8±10.0 79-105
- anus	68.5	68.2±4.3 60-75	61.2±3.2 55-66	24.3±1.0 22-26	44.4±1.7 42-46	55.2±3.6 51.3-60.5	63.1±3.6 59-70
- hyaline part	49.5	49.0±1.7 47-52	39.5±2.2 37-43	16.0±0.9 15-17	26.8±2.7 24-32	37.6±2.5 32-41	42.9±2.7 39-47
Spicules			126.9±5.8 122-145				

* Following Loof and Coomans 1972

body; 13–15 µm on tail posterior to anus. Lateral pores number 10–14 in pharyngeal region: a single pore in front of guide ring, rarely two or none; 3–5 in odontostyle and 1–3 in odontophore regions; 3–4 dorsal pores and 7–10 ventral pores; numerous lateral body pores. Usually the fifth ventral pore (sometimes the fourth) differs in size (Figs 1A, 4F and 6H) compared to the other ventral pores. Lip region continuous, anteriorly almost flat, 7–9 µm high. Labial papillae prominent. Amphid aperture assumed to be a minute pore, difficult to be observed under light microscope. Pouch-like amphidial fovea with convoluted fine dendritic branches (receptors), extending to 1/2 - 2/3 the distance between anterior end and guiding ring, fovea slightly longer (15–18 µm, n=5) than wide (14–16 µm, n=4) with no distinct margins. Fusus (sensillium pouch) at 57±1.9 (55–60) µm from anterior end. Guiding ring 7–9 µm wide. Odontostyle long and very slender, 2 µm wide at the base. Odontophore with weakly developed flanges. In all females a small (2–3 µm long) rudimentary odontostyle tip (vestigium) present, directed forward, and observed in the slender pharynx at 300.5±40.3 (224–350) µm from anterior end; in two specimens the vestigium located in odontophore area. Slender pharynx often coiled in its posterior part. In this region 5–7 glandular bodies are observed in all females. Nerve ring surrounding odontophore base, rarely surrounding mid-odontophore, or just behind it, second nerve ring at a distance of 85.2±6.6 (78–98) µm behind the first one. Hemizonid flat, 10–11 µm long. Pharyngeal bulb about 1/4 of the neck length. Normal arrangement of pharyngeal glands, the nuclei of dorsal and ventrosublateral glands approximately the same size, their diameters 3.4±0.4 (3–4) µm, n=7 and 3.9±0.2 (3.5–4) µm, n=11, respectively. Cardia small, broadly rounded, wider than long, variable in size: 20.1±1.8 (10–23) × 10.1±1.8 (7–12) µm . Reproductive system amphidelphic, varying in dimensions due to the stage of maturity of female. Vagina extending about half body width. *Pars distalis vaginae* with characteristic shape (Fig. 2F, G), 26–28 µm and *pars proximalis vaginae* 32–38 µm long, respectively; muscular walls of the latter almost parallel. Uteri very long, anterior uterus 494.6±52 (430–563) µm long, posterior uterus 510.0±88.7 (357–643) µm long, differentiated, filled with sperm cells in all females examined; well developed sphincter between uterus and *pars dilatata oviductus* also containing numerous sperm cells. Anterior and posterior oviduct of similar size, measured in four specimens: 275–348 µm, and 283–330 µm. Anterior ovarium 263.4±51.8 (210–347) µm long, n=7, posterior ovarium 234.3±35.8 (183–309) µm long, n=5; in older mature specimens the length is about 3 times greater (1055–1060 µm for anterior and 1020 µm for posterior ovary). One egg in anterior *pars dilatata oviductus* measuring 227 × 87.5 µm and one uterine egg measuring 225 × 77.5 µm. A weakly developed ovijector present, 112.0±12 (95–125) µm long. In one female a rudimentary adanal pair of supplementary papillae was observed (Fig. 9E). Prerectum variable in length; rectum 0.7±0.1 (0.6–0.8) body width at anus. A short post-intestinal sac present. Tail bluntly conoidal, rounded to almost hemispherical; ventral side straight or slightly convex, the dorsal curvature greater. Two pairs of lateral pores.

Male. Body C shaped when heat relaxed, posterior part more strongly coiled ventrally. Similar to females in general morphology except for genital system. Lateral pores

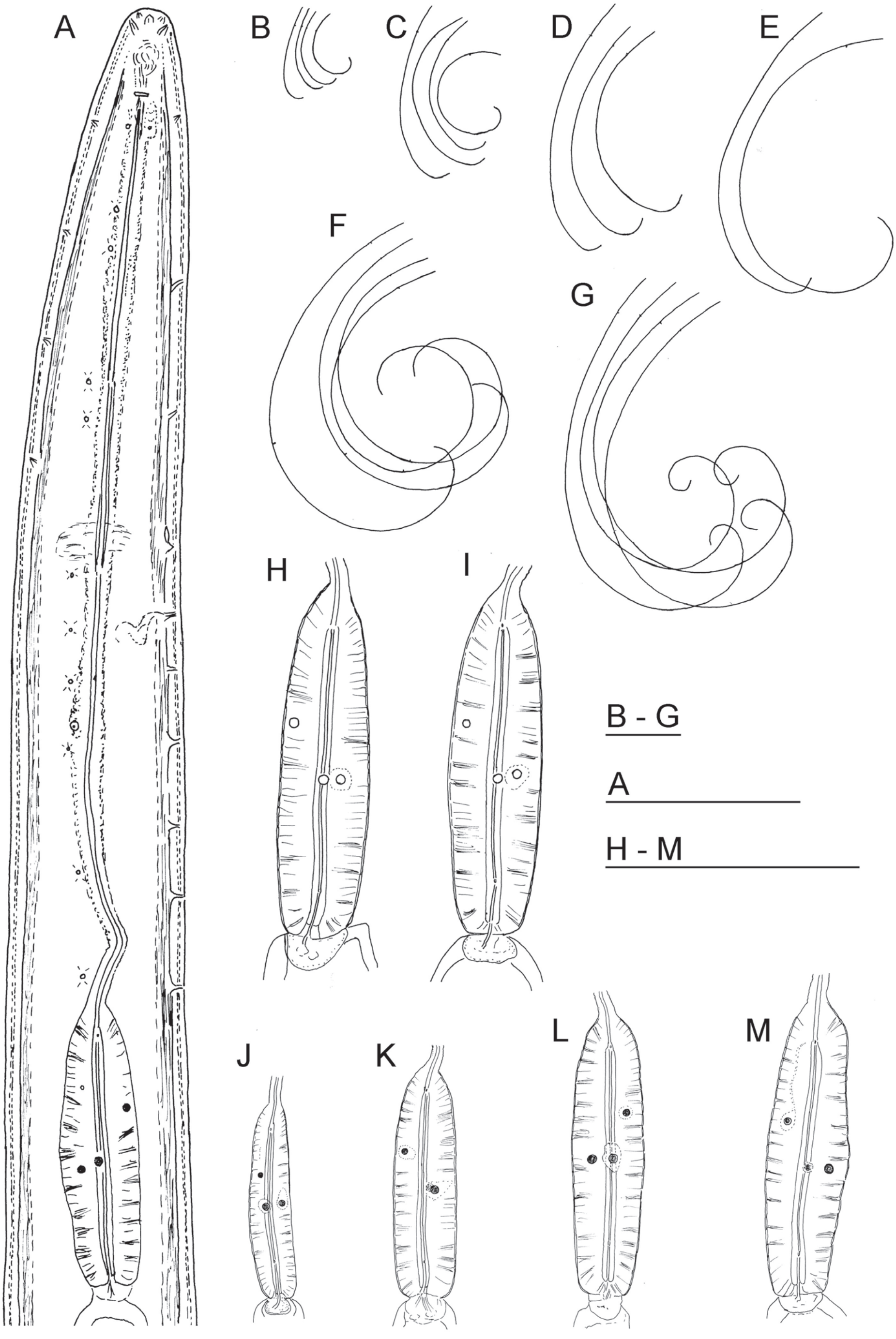

Figure 1. *Longidorus carniolensis* sp. n. *Female*: **A** Neck region **F** Habitus **H** Pharyngeal bulb *Male*: **G** Habitus **I** Pharyngeal bulb; *Juveniles*: **B–E** Habitus of first, second, third and forth juvenile stages **J–M** Pharyngeal bulb of first, second, third and forth juvenile stages. Scale bars: **B–G** 1 mm; **A, H–M** 100 μm.

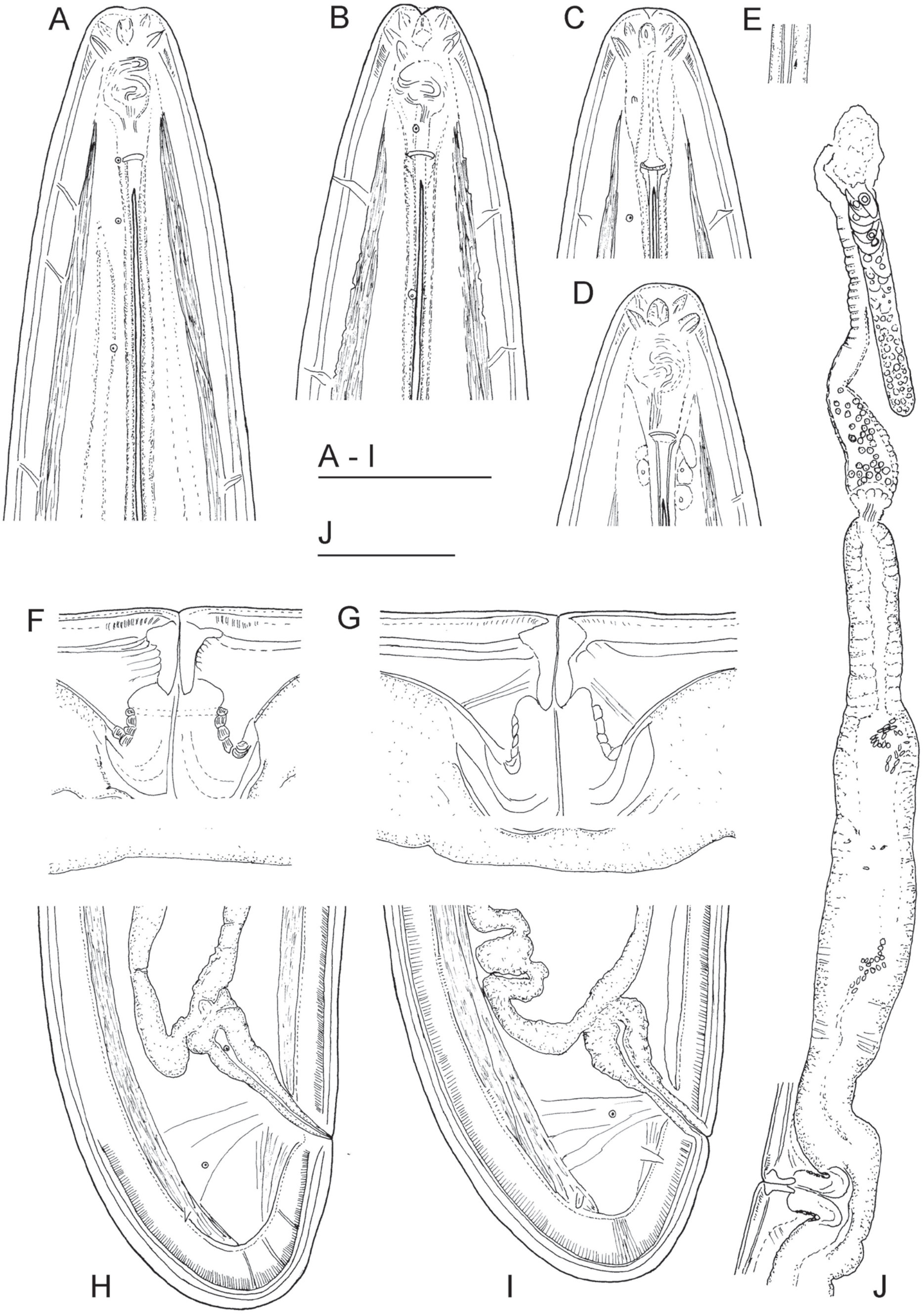

Figure 2. *Longidorus carniolensis* sp. n. *Female*: **A–D** Anterior ends **E** Vestigium in the walls of the slender part of pharynx **F, G** Vulval region **G** Anterior genital branch. *Scale bars*: **A–I** 50 µm, **J** 100 µm.

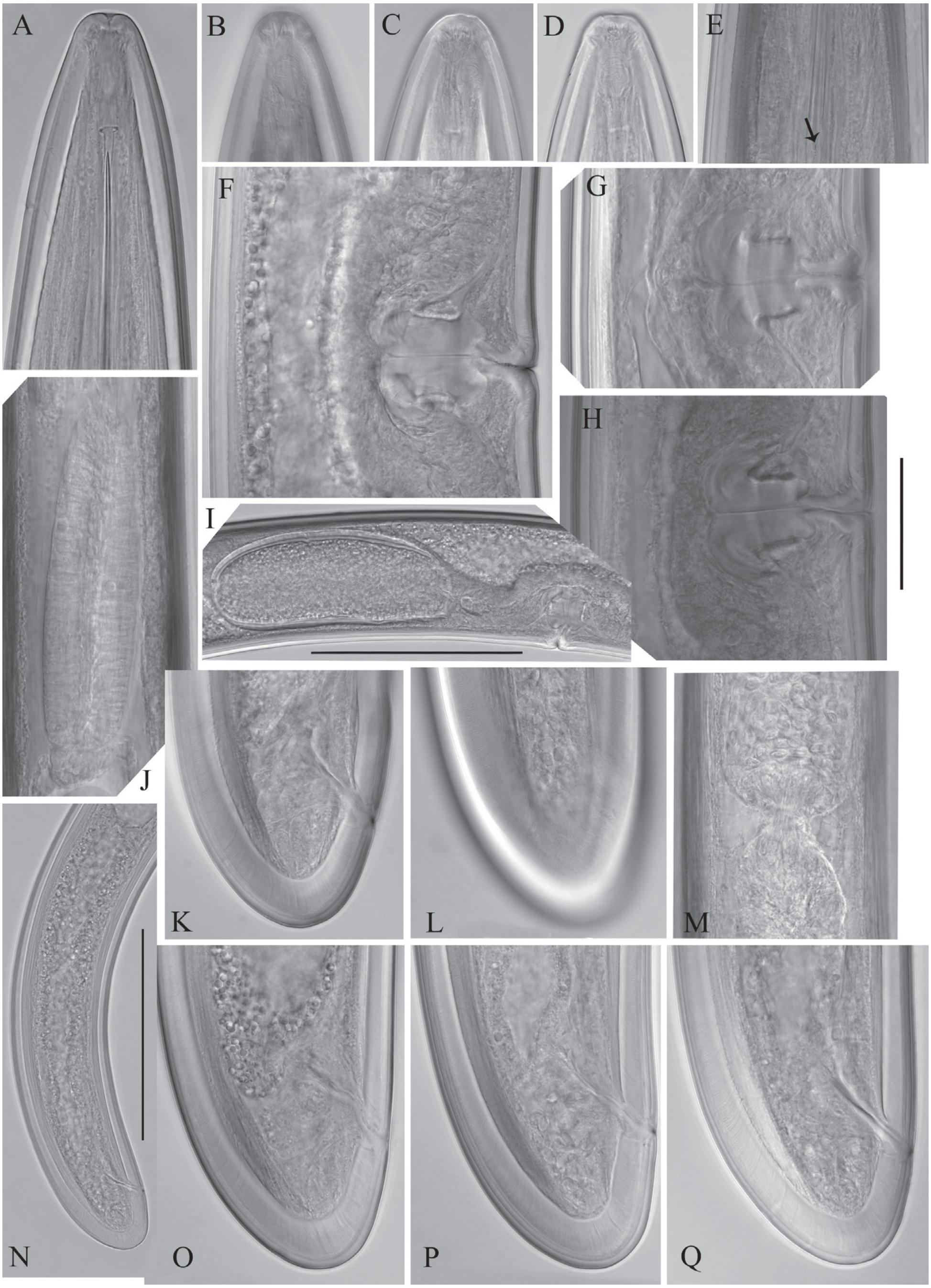

Figure 3. *Longidorus carniolensis* sp. n. *Female:* **A** Anterior region **B–D** Amphidial fovea **E** Vestigium **F–H** Vulval region **I** Vulval region, uterus and egg **J** Pharyngeal bulb, dorsal and subventral glands **K, L** Tail – different optical sections **M** Sphincter **N** Prerectum **O–Q** Variation in tail shape. Scale bars: **I, N** 200 μm; **A–G, H–M, O–Q** 50 μm.

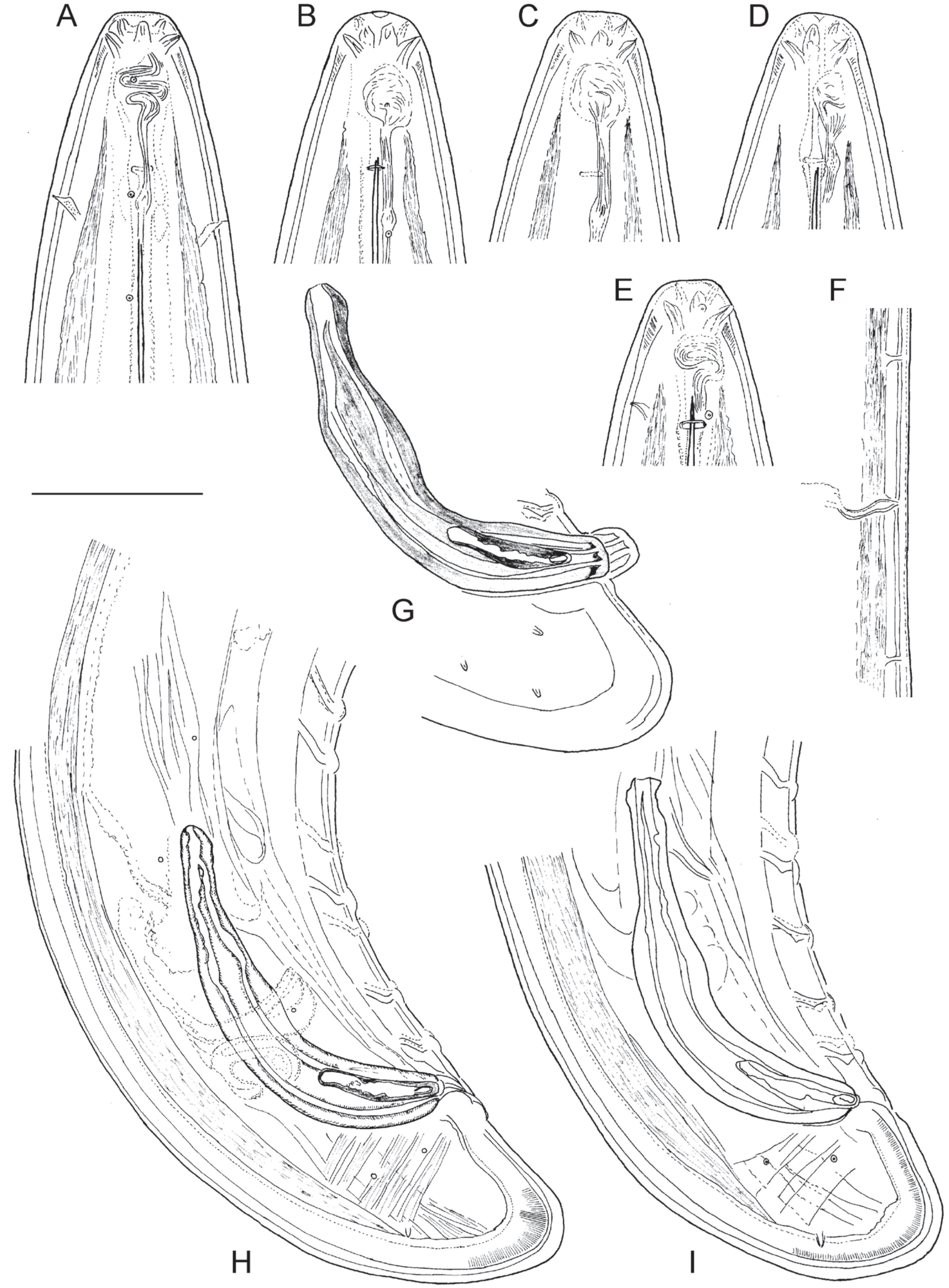

Figure 4. *Longidorus carniolensis* sp. n. *Male:* **A–E** Anterior end **B, D, E** in sublateral view **F** Excretory pore and ventral pores **G** Partly protracted spicules **H–I** Tail end. *Scale bar*: 50 µm.

number 10–15 in pharyngeal region: a single pore in front of guide ring, 3–5 in odontostyle and 1–2 in odontophore regions; 2–5 dorsal pores, mostly 3–4, and 7–10 ventral pores. Cuticle in post-labial region at the guiding ring level 10.5–13.5 µm thick, 6.5–9 µm along body, 9–10 µm in post-cloacal area. Second nerve ring at 80.7±14 (50–100) µm behind the first one (n=14). In all males a small vestigium (2–3 µm, in one specimen 6 µm long), directed forward (in two specimens directed rearward), is observed in the slender pharynx at 300.5±40.3 (224–350) µm from anterior end; in two specimens the vestigium detected in odontophore area. Two to eleven glandular bodies observed in all males in posterior part of the slender pharynx and pharyngeal bulb. In two specimens lens-like hemizonion at a distance of 242 and 271 µm from anterior end observed. Pharyngeal bulb slightly less than 1/4 of neck length (22.9±1.6 (20.9–26.7%). Ventromedian supplements composed of one adanal pair and a row of 13–17 irregularly spaced single ones, the first three appear as double in some specimens. Spicules comparatively slender, of almost equal width along the length, curved to almost at right angle. Lateral guiding piece not bifid, with uneven internal walls. Post-cloacal papilla well developed. Tail short, bluntly conoidal, ventral side almost straight, dorsal side convex. Two or three pairs of lateral caudal pores.

Juveniles. Four developmental stages clearly present (Fig. 11) as determined from the position of the replacement odontostyle and the principal morphometric characters of body, odontostyle and replacement odontostyle lengths, and developing gonad (genital primordium) size. The *habitus* of juveniles not changing considerably during successive stages, assuming J or C shape. In first stage juvenile, lip region somewhat different from the next stages, it is rounded with a very weak depression after the second circle of labial papillae, the latter slightly protruding and changing the lip region outline. Amphidial fovea in first two stages has no clearly visible receptors, only small refractive elements discernable. Both the tail and body width at anus is increasing in length and **c'** ratio is decreasing. Tail shape in J1 is conoidal, ventrally almost straight or slightly concave, dorsally convex, which gives asymmetrical appearance, in successive stages it gradually becomes rounded but always with the dorsal curvature more strongly expressed.

Differential diagnosis and relationships. *Longidorus carniolensis* is an amphimictic species**,** characterized by females with a moderately long (L=5.6–8.2 mm) and plump (**a**=51–72) body, assuming a spiral to C-shape when heat relaxed; head region continuous, anteriorly almost flat, lip region 23–25 µm wide, guiding ring situated posteriorly (42–47 µm, 43–50 µm in males), long odontostyle (146.6 (136–157) µm), distribution of pharyngeal glands normal, nuclei of approximately equal size, tail bluntly conoid to hemispherical. Males abundant, spicules slender and long (122–145 µm), ventromedian supplements 13–17, irregularly spaced and preceded by an adanal pair. Postembrional development through four juvenile stages.

The codes for identifying the new species when using the polytomous key by Chen et al. (1997) are: A 56, B 4, C 4, D 1, E 4, F 35, G 1, H 1, I 2. The species belongs to the group of species with long odontostyle – over 100 µm and bluntly conoid to hemispherical tail: *L. poessneckensis*, *L. macrosoma*, *L. caespiticola*, *L. helveticus*, *L.*

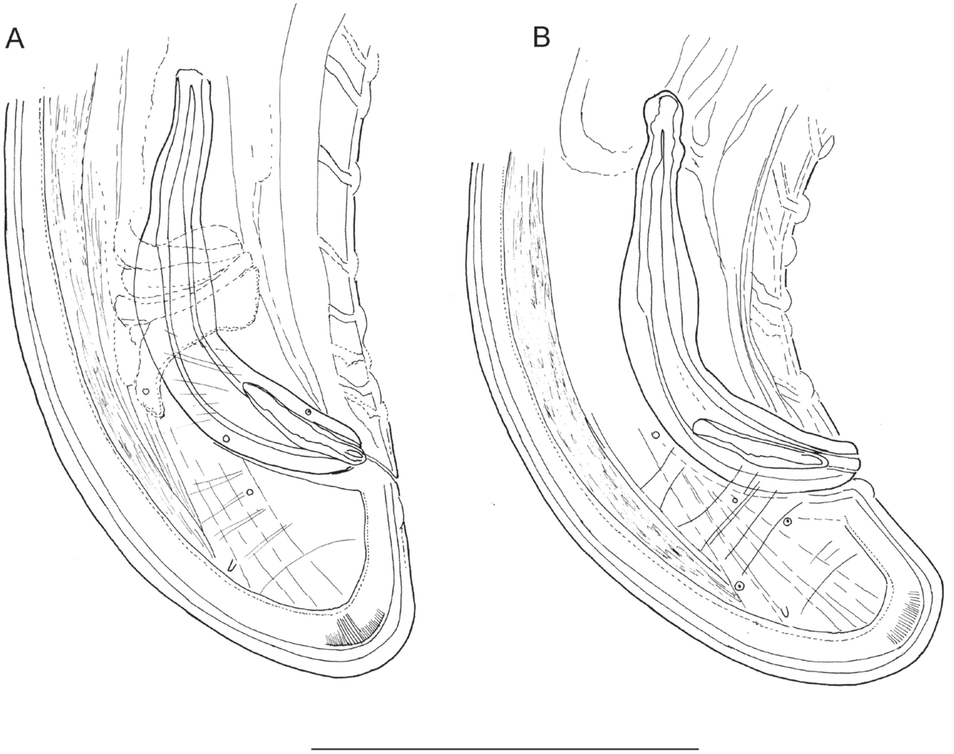

Figure 5. *Longidorus carniolensis* sp. n. Male: **A, B** Variation in tail shape. Scale bar: 50 µm.

macroteromucronatus Altherr, 1974, *L. raskii* Lamberti & Agostinelli, 1993, *L. kheirii* Pedram, Niknam, Robbins, Ye & Karegar, 2008, *L. pius* Barsi & Lamberti, 2001, *L. nevesi* Macara, 1986, *L. major* Roca & d'Erico, 1987, *L. carpathicus*, *L. piceicola*, *L. vinearum* Bravo & Roca, 1995, *L. pauli* Lamberti, Molinari, De Luca, Agostinelli & Di Vito, 1999, *L. arthensis*, *L. iuglandis* Roca, Lamberti & Agostinelli, 1985, *L. picenus* Roca, Lamberti & Agostinelli, 1985, *Longidorus silvae* Roca, 1993, *L. uroshis*, *L. saginus* Khan, Seshardi, Weischer & Mathen, 1971, *L. orongorongensis* Yeates & Van Etteger, 1992, *L. cretensis* Tzortzakakis, Peneva, Terzakis, Neilson & Brown, 2001, *L. cylindricaudatus* Krnjaić, Roca, Krnjaic & Agostinelli, 2005, *L. fasciatus* Roca & Lamberti, 1981 and *L. litchii*. *Longidorus carniolensis* sp. n. can be differentiated from all these species either by morphometrics or/and quantitative characters. It differs from:

L. poessneckensis – by its somewhat longer odontostyle (ave. 147.5 (136–157) *vs* ave. 133 (122–142), ave. 126 (122–130) and ave. 140.2 (132–148) µm); more posteriorly sitated guiding ring (ave. 44.6 (42–47) *vs* ave. 40 (36–43) and 39 ave. (37–40) µm); tail short conoidal *vs* elongate conoid in J1 (c'=1.2–1.5 *vs* 1.8–2.2 and 1.8–2.5); males abundant *vs* males very rare (Sturhan and Loof 2001, Lišková and Kumari 2010, Kornobis and Peneva 2011);

L. macrosoma – by its shorter (5.6–8.2 *vs* 8.4–11.9 mm) and more plump (a=51–72.4 *vs* 77–113 and 105–126) body; differently shaped lip region (later-

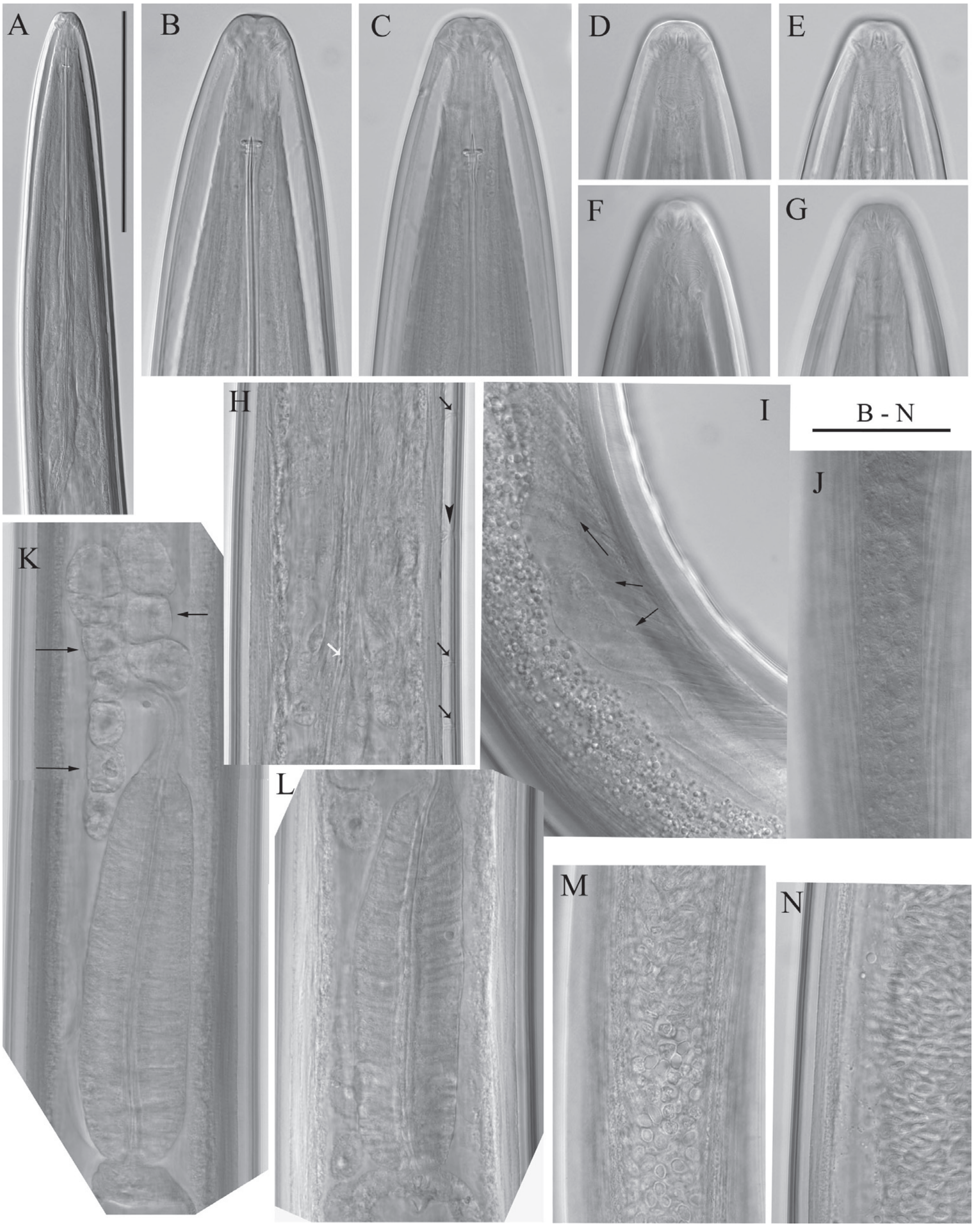

Figure 6. *Longidorus carniolensis* sp. n. *Male:* **A** Anterior region **B, C** Head region **D–G** Amphidial fovea **H** Vestigium (white arrow), excretory pore (thick arrow) and ventral pores (slender arrows) **I** Ejaculatory glands (marked by arrows) **J** Lateral field **K, L** Pharyngeal bulb with glandular bodies (marked by arrows) **M, N** Sperm cells at different stage of development. Scale bars: **A** 200 µm; **B–N** 50 µm.

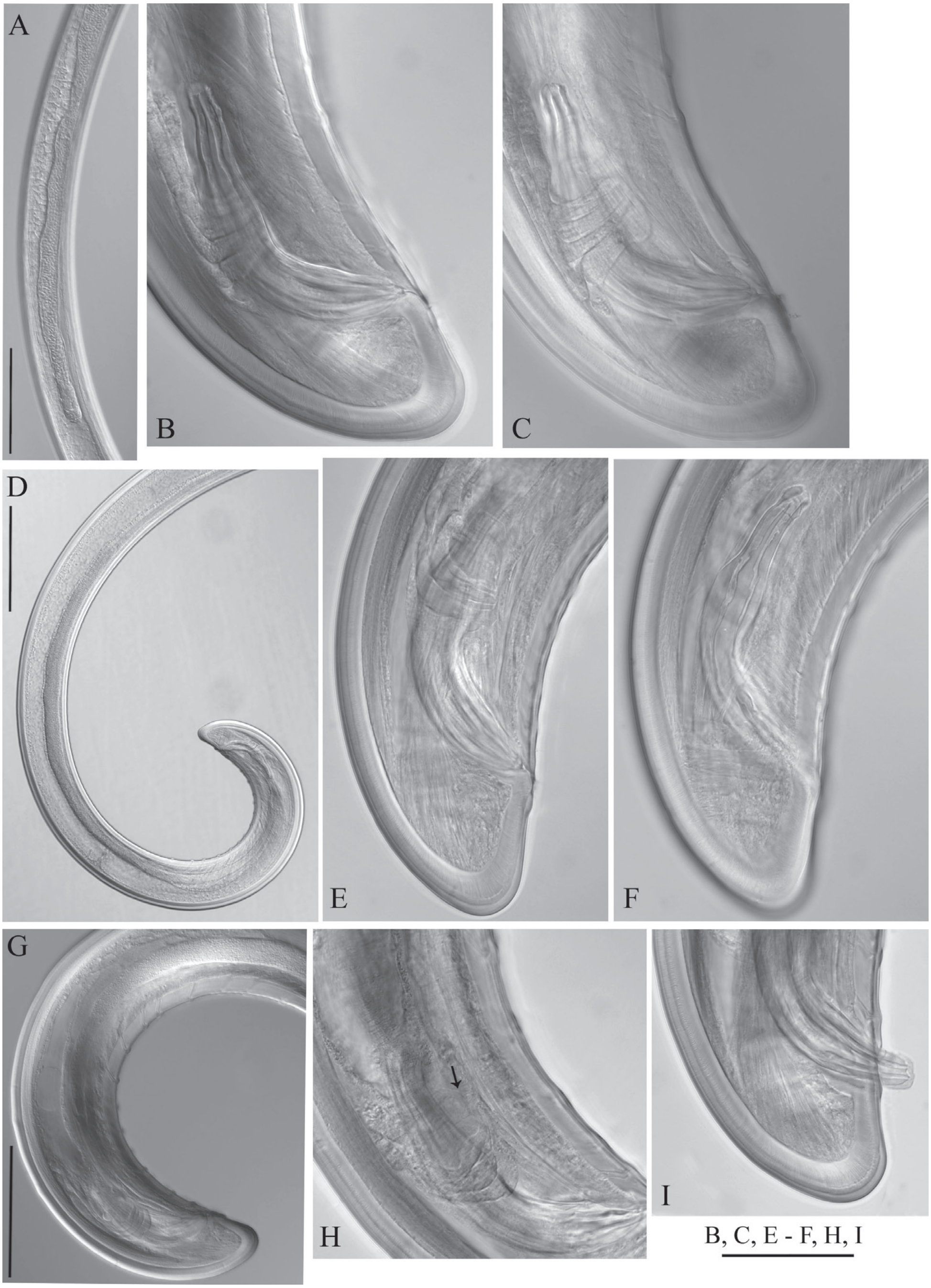

Figure 7. *Longidorus carniolensis* sp. n. *Male:* **A** Posterior genital branch **B, C, E, F** Tail and copulatory apparatus – different optical sections **D, G** Posterior end **H** Rectum (marked by arrow), spicules and lateral piece **I** Partly protracted spicules. Scale bars: **A, D, G** – 200 µm; **B, C, E–F, H, I** – 50 µm.

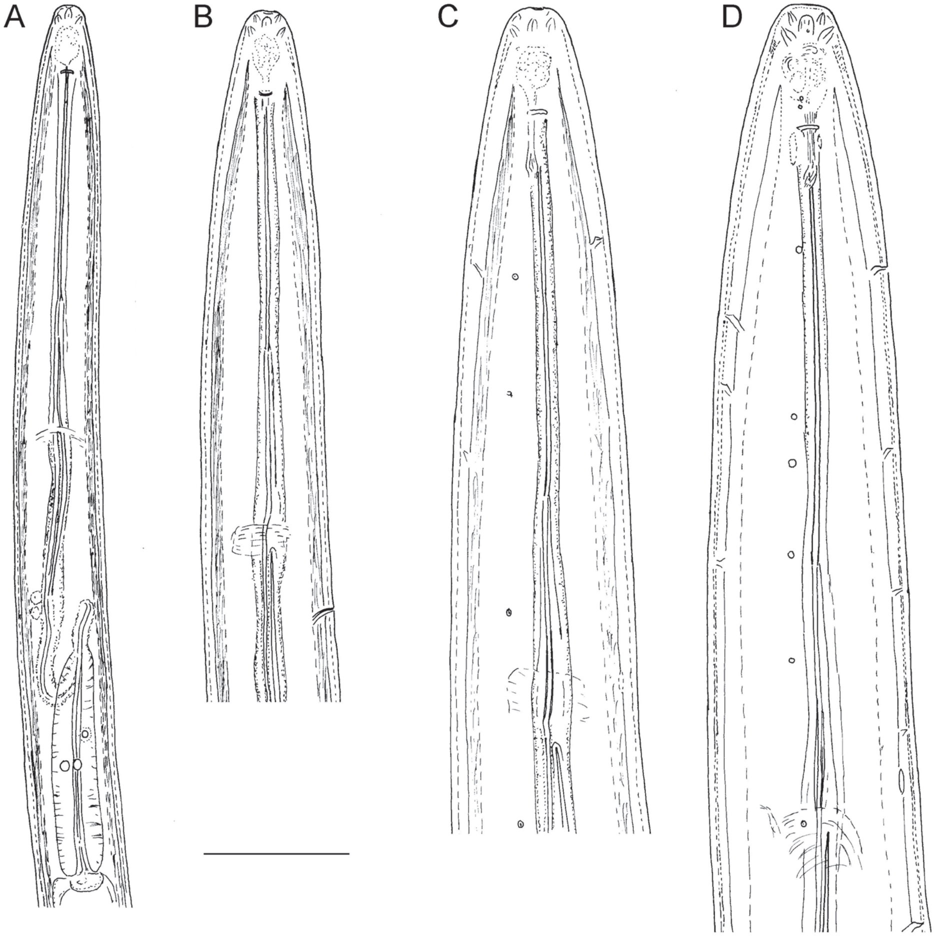

Figure 8. *Longidorus carniolensis* sp. n. *Juveniles*: **A** Neck region of first stage **B–D** Spear region of second, third and fourth stage. *Scale bar*: 50 µm.

ally rounded *vs* truncated, flattened); somewhat longer odontostyle (136–157 *vs* 113–148 µm); different tail shape in J1, bluntly conoidal *vs* mucronate; longer spicules in males 122–145 *vs* 105 µm and ave. 116.2 (112–121) µm (Hooper 1961, Lamberti et al. 2001);

L. caespiticola – by its longer odontostyle (136–157 *vs* 100–120, 96–109 µm); different numbers of dorsal (2–5 *vs* a single pore) and ventral (7–10 *vs* 5–6) pores; more posteriorly sitated guiding ring (42–47 *vs* 30–41, 37, 42.5 µm); longer spicules in males (122–145 *vs* 90, 80–95 µm), smaller **c'** value in J1 (1.2–1.5 *vs* almost 2) (Hooper 1961, Širca and Urek 2009);

L. helveticus – by different tail shape of J1 being bluntly conoid *vs* mucronated; longer (122–145 *vs* 104–118 µm) and differently shaped spicules (Lamberti et al. 2001);

L. macroteromucronatus – by having more posteriorly situated guide ring (42–47 vs 38 µm); thicker cuticle along the body (6–7 *vs* 4 µm) and on tail region (9–10.5 v*s* 13–15 µm); longer odontostyle (136–157 *vs* 133 µm) (Altherr 1974);

L. raskii – by its wider lip region (23–25 *vs* 15–19 and 14–16 µm); more posteriorly situated guiding ring (42–47 *vs* 33–38 and 33–43 µm); longer odontostyle (136–157 *vs* 90–103 and 98–100 µm); longer spicules (122–145 *vs* 82–103 and 79–90 µm) (Lamberti and Agostinelli 1993, Lamberti et al. 2001, Krnjaić et al. 2002);

L. kheirii – by its longer odontostyle (136–157 *vs* 111–130 µm); different tail shape in J1 (bluntly conoidal *vs* mucronated); males abundant *vs* males rare; longer spicules (122–145 *vs* 80 µm) (Pedram et al. 2008);

L. pius – by its more posterior position of the guiding ring (42–47 *vs* 35–42 and 37–42.5 µm); different tail shape in J1 (bluntly conoidal *vs* mucronated); males abundant *vs* males absent (Barsi and Lamberti 2001a, Barsi and De Luca 2008)

L. nevesi – by having wider lip region (23–25 *vs* 16–22 µm), different amphidial fovea shape (pouch like, not bilobed *vs* bilobed); differently shaped and longer spicules in males (122–145 *vs* 87–100 µm) (Macara 1986);

L. major – by having shorter body (L=5.6–8.2 *vs* 8.5–12 mm); somewhat narrower lip region (23–25 *vs* 22–27 µm); different tail shape in J1 (bluntly conoidal *vs* mucronate) and amphidial fovea (pouch like, not bilobed *vs* bilobed), males abundant *vs* males absent (Roca and d'Erico 1987);

L. carpathicus – by its longer body (L=5.6–8.2 mm *vs* 6.2–6.5 mm); wider (23–25 *vs* 16–18 µm) and differently shaped lip region; lower **c'** value (**c'**= ave. 0.6 (0.5–1.0) *vs* **c'**= 0.8); different shape in J1 (bluntly conoidal *vs* mucronated with a rather long mucro); males abundant *vs* males absent (Lišková et al. 1997);

L. piceicola – by having longer body (L=5.6–8.2 *vs* 4.2–6.5, 4.4–8.0 and 5.2–7.9 mm); wider (23–25 *vs* 14–17 µm) and differently shaped lip region (continious, almost flat *vs* broadly rounded); lower **c'** value (**c'**=ave. 0.6 (0.5–1.0) *vs* **c'**=0.9–1.3); differently shaped tail in J1 (bluntly conoidal *vs* elongate conoid) (Lišková et al. 1997, Barsi and Lamberti 2001b);

L. vinearum – by having different lip region shape (abruptly *vs* gradually tapering), different shape of amphidial fovea (pouch like not bilobed *vs* irregularly bilobed); longer odontostyle (136–157 *vs* 105.5–132.5 µm); different tail shape in J1 (bluntly conoidal *vs* conical, c'=1.2–1.5 *vs* 1.9–2.8) (Bravo and Roca 1995);

L. pauli – by having different (continious *vs* slightly offset) and wider (23–25 *vs* 14–17 µm) lip region, amphidial fovea pouch like, not bilobed *vs* bilobed; longer odontostyle (136–157 *vs* 102–118 µm); lower **a** and **c'** values (**a**=51.0–72.4 *vs* **a**=120.3–143.5; **c'**= ave. 0.6 (0.5–1.0) *vs* **c'**=0.9 (0.8–1.0), respectively); more posteriorly situated guiding ring (42–47 *vs* 27–36 µm); longer spicules (122–145 *vs* 61–69 µm); different tail shape in J1 (bluntly conoidal *vs* subdigitate) (Lamberti et al. 1999);

L. arthensis – by its wider (23–25 *vs* 14–17 µm) lip region, amphidial fovea pouch like not bilobed *vs* bilobed; longer odontostyle (136–157 *vs* 102–111 µm); lower **c'** values (**c'**=av 0.6 (0.5–0.1) *vs* **c'**=av 0.9 (0.8–1.1); more posteriorly sitated guiding ring

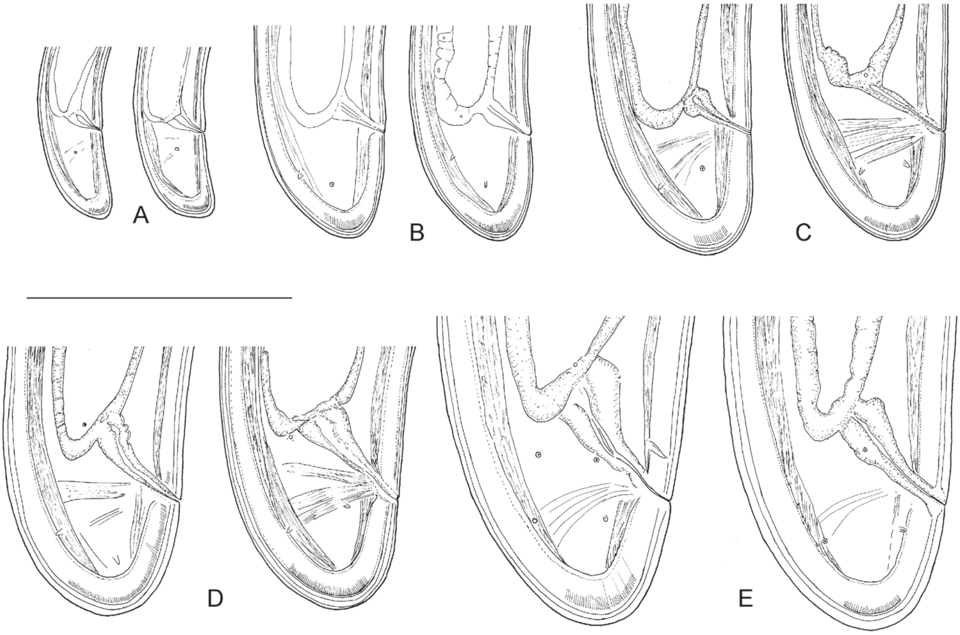

Figure 9. *Longidorus carniolensis* sp. n. Evolution of the tail. **A–D** Tail of first–fourth juvenile stage **E** Tail of female. Scale bar: 100 µm.

(42–47 *vs* 30–38 µm); longer spicules (122–145 *vs* 60–66 µm); different tail shape in J1 (bluntly conoidal *vs* mucronated) (Brown et al. 1994);

L. iuglandis – by its wider lip region (23–25 *vs* 14–16 µm); amphidial pouches not bilobed *vs* bilobed; longer odonostyle (136–157 *vs* 112–128 µm); more posterior position of the guiding ring (42–47 *vs* 31–41 µm); longer tail (34–69 *vs* 33–41 µm); longer spicules (122–145 *vs* 93–99 µm); different tail shape in J1 (bluntly conoidal *vs* mucronated) (Roca et al. 1985);

L. picenus - by its wider lip region (23–25 *vs* 19–22 µm); amphidial fovea not bilobed *vs* bilobed; more posterior position of the guiding ring (42–47 *vs* 31–41 µm); longer spicules (122–145 *vs* 103–112 µm); different tail shape in J1 (bluntly conoidal *vs* mucronated) (Roca et al. 1985);

L. silvae - by its more plump body (**a**=51.0–72.4 *vs* **a**=87.5–137.5 in Italian population and **a**=87.4–116 in Serbian populations), wider lip region (23–25 *vs* 14–17 µm); amphidial fovea not bilobed *vs* bilobed; longer odontostyle (136–157 *vs* 113.5–133 µm (Italian population) and 108–136 µm (Serbian populations)); different tail shape in J1 (bluntly conoidal *vs* mucronated); males abundant *vs* males rare; longer spicules (122–145 *vs* 77–78 µm) (Roca 1993, Barsi and Lamberti 2004, Barsi et al. 2007);

L. uroshis – by having wider (23–25 *vs* 15–20.5 µm) lip region; lower **a** values (**a**=51.0–72.4 *vs* a=96.9–108.9); different tail shape in J1 (bluntly conoidal *vs* mucronated); longer spicules (122–145 *vs* 59–72 µm) (Krnjaić et al. 2000);

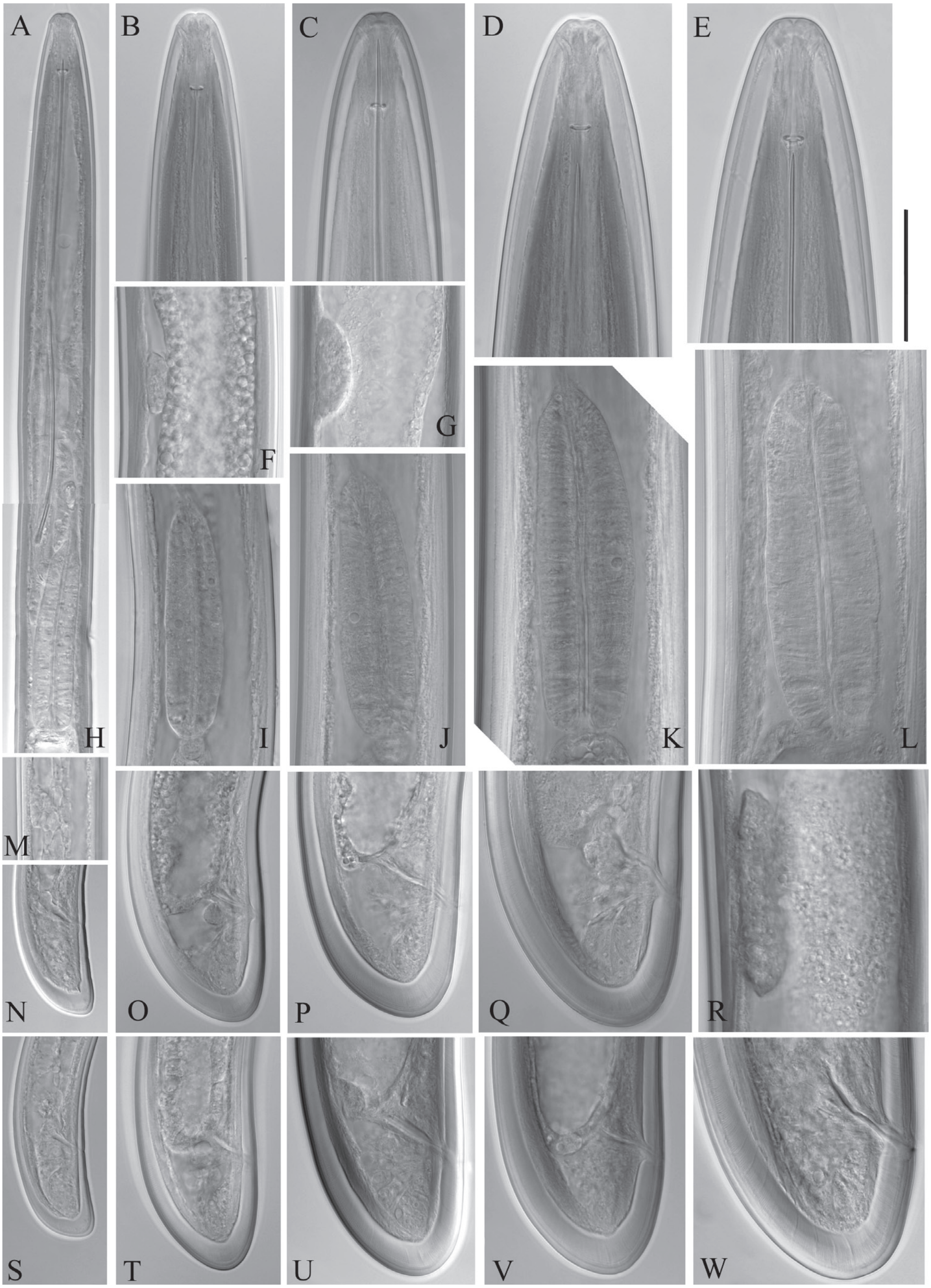

Figure 10. *Longidorus carniolensis* sp. n. *Juvenile*: **A–D** Anterior region of first, second, third and forth stages **H–K** Pharyngeal bulb of first, second, third and forth juvenile stages **M, F, G, R** genital primordium of first, second, third and forth stages **N, S** Tail shape of first stage **O, T** Tail shape of second stage **P, U** Tail shape of third stage **Q, V** Tail shape of forth stage *Female*: **E** Anterior region **L** Pharyngeal bulb **W** Tail shape. *Scale bar:* 50 µm.

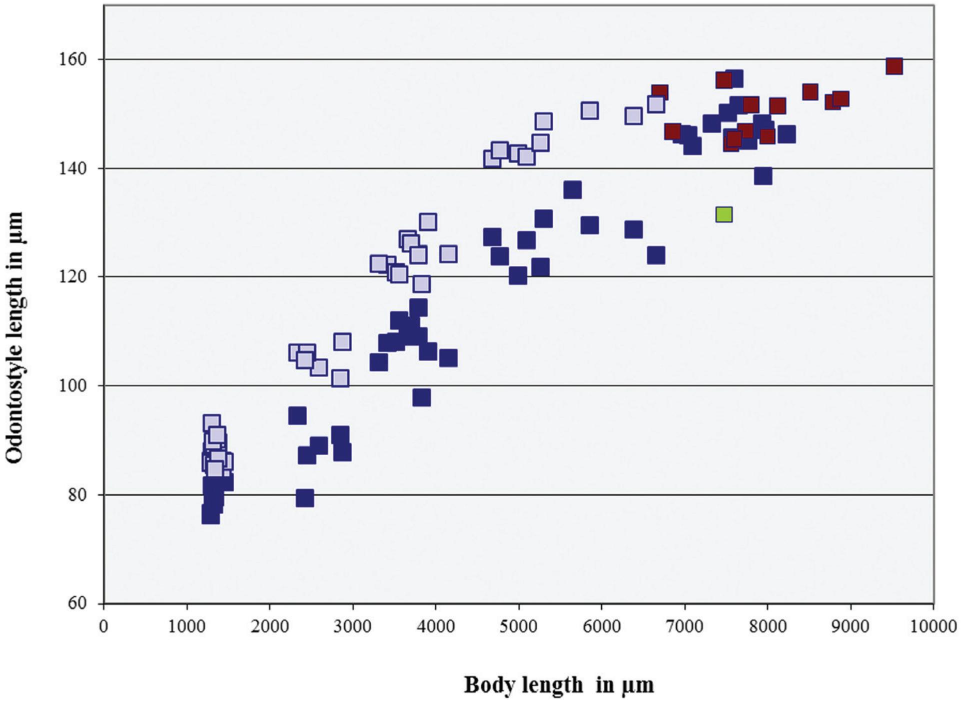

Figure 11. *Longidorus carniolensis* sp. n. Scatter plot of the functional (■) and replacement odontostyle (□) in relation to the body length of the juvenile stages and adults: females (🟦) and males (🟥), female with very short odontostyle (🟩).

L. saginus – by having longer body (L=5.6–9.5 *vs* 4.8–6.4 mm); amphidial fovea pouch shaped not bilobed *vs* asymetrically bilobed; longer tail (34–69 *vs* 21–33 µm) (Khan et al. 1971);

L. orongorongensis – by its more anterior position of the guiding ring (42 -47 *vs* 63–73 µm); shorter odontostyle (136–157 *vs* 152–166 µm); longer spicules (122–145 *vs* 84–87 µm) (Yeates et al. 1992);

L. cretensis – by having normal *vs* abnormal location of pharyngeal glands; wider lip region (23–25 *vs* 17–21 µm); longer spicules (122–145 *vs* 71–91 µm); different tail shape in J1 (bluntly conoidal *vs* conoid pointed) (Tzortzakakis et al. 2001);

L. cylindricaudatus – by having lip region abruptly *vs* gradually tapering; amphidial fovea not bilobed *vs* bilobed; shorter odontostyle (136–157 *vs* 164–178 µm); lower **a** values (**a**=51–72.4 *vs* **a**=94.4–113.4); males abundant *vs* males absent (Krnjaić et al. 2005);

L. fasciatus – by its wider lip region (23–25 *vs* 12–14 µm); different amphidial poches (not bilobed *vs* asymmetrically bilobed); longer odontostyle (136–157 *vs* 102–119 µm; male abundant *vs* males absent (Roca and Lamberti 1981);

L. litchii – by its somewhat shorter odontostyle (136–157 *vs* 138–171 mm); different amphidial poches (not bilobed *vs* bilobed); more anterior postion of the guiding

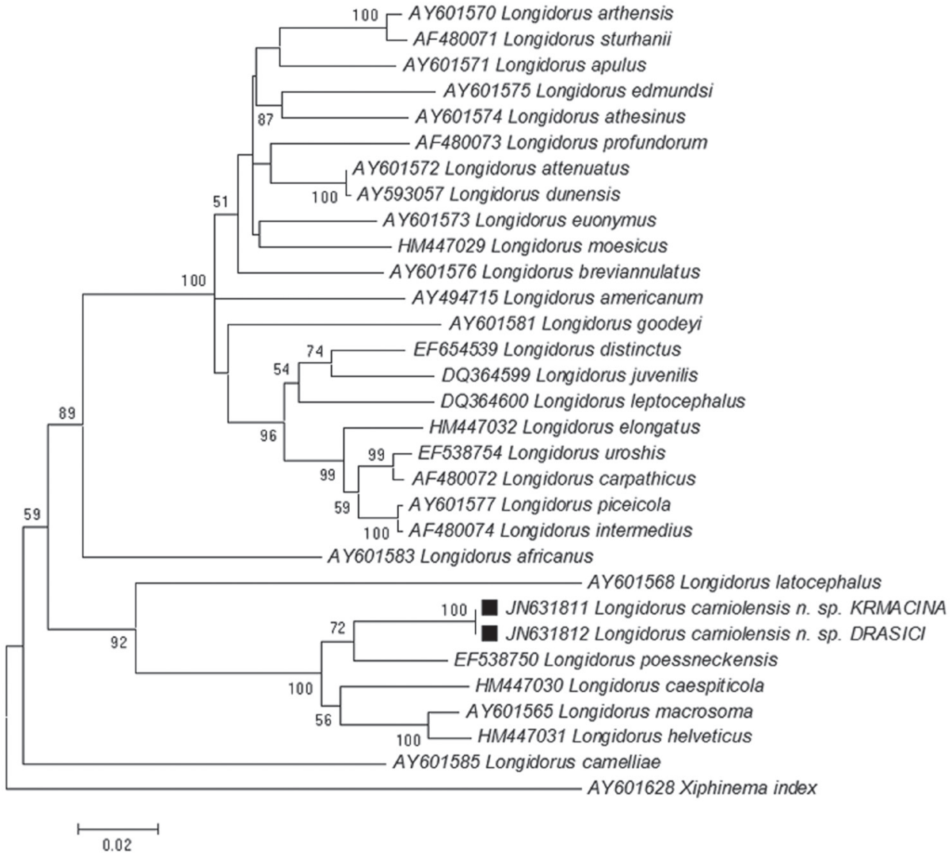

Figure 12. Phylogenetic tree of rDNA D2/D3 expansion region sequences of *Longidorus carniolensis* sp. n. from Slovenia (square mark) and sequences of closely related *Longidorus* species (NCBI GenBank). Sequences were analysed using Neighbour Joining Method. Bootstrap support values higher than 50% are presented.

ring (42–47 *vs* 82.5–96.5 µm); different tail shape in J1 (bluntly conoidal *vs* elongate conoid with long digitate tip, **c'**=1.2–1.5 *vs* **c'**=2.7–3.4); longer spicules (122–145 vs 68.5–71 µm) (Xu and Cheng 1992).

Type-locality and plant association. An old vineyard with roots of several *V. vinifera* varieties close to Drašiči village in southern part of Slovenia (45°39'N; 15°23'E), 229 m above sea-level.

Other-locality: a vineyard close to Krmačina village in southern part of Slovenia.

Distribution notes. *Longidorus carniolensis* n. sp were detected in 6 out of 10 soil samples from locations of Drašiči and Krmačina. Population density was 4–15 specimens of all developmental stages per 200 cm^3 of soil sample.

Type-material. Holotype female and 2 female, 5 male and 8 juvenile (3 J1, 1 J2, 2 J3, 2 J4) paratypes deposited in the Nematode Collection of Agricultural Institute of Slovenia, Ljubljana, Slovenia; two female, two male and 10 juvenile (3 J1, 2 J2, 2 J3, 2 J4) paratypes - in the Wageningen Nematode Collection (WaNeCo), Wageningen, the Netherlands; one female, one male and 6 juvenile (3 J1, 1 J2, 1 J3, 1 J4) paratypes - in the Nematode Collection of The Food and Environment Research Agency, Sand Hutton, UK (former Rothamsted Nematode Collection); one female, three male and 6 juvenile (3 J1, 2 J3, 1 J4) paratypes - in the Nematode Collection of the Zoology Museum, Ghent University, Belgium; one female, three male and two juvenile (1 J3, 1 J4) paratypes - in the Nematode Collection of the Institute of Plant Protection, Bari, Italy; two female, one male and 6 juvenile (3 J1, 1 J2, 1 J3, 1 J4) paratypes - in the Nematode Collection of the University of California at Riverside, USA; one female, one male and two juvenile (1 J3, 1 J4) paratypes - in the USDA Nematode Collection, Beltsville, Maryland, USA; 4 female, 5 male and 8 juvenile (3 J1, 1 J2, 2 J3, 2 J4) paratypes - in the Nematode Collection of the Institute of Biodiversity and Ecosystem Research, BAS, Sofia.

Etymology. The species epithet *carniolensis* was derived from Carniola which is the Latin name of the Kranjska province, a historical region that comprised parts of what is now Slovenia.

rDNA sequence analysis. Cluster analyses of the D2-D3 expansion regions of the 28S rDNA nuclear gene sequences of *L. carniolensis* sp. n. and closely related species (Table 1) were performed and a phylogenetic tree was constructed (Fig. 12). The sequences of both populations of *L. carniolensis* sp. n. from Drašiči and Krmačina were identical. They formed a distinct clade within a cluster of the closely related sequences of *L. poessneckensis, L. helveticus, L. macrosoma, L. caespiticola* and *L. latocephalus*. The closest sequence to *L. carniolensis* sp. n. was the sequence of *L. poessneckensis* (Acc. No EF538750) with 91.9% of similarity.

Discussion

There are some characteristic morphological features observed in *L. carniolensis* sp. n. such as the presence of vestigium, hemizonid and hemizonion, and the abberant ventral pore. The vestigium was present in all specimens (males and females), it was located in the slender pharynx, behind odontophore, in few specimens in the odontophore area. Such a vestigium has been reported also for *Longidorus fursti* Heyns, Coomans, Hutsebaut & Swart, 1987 from South Africa; two Chinese *Longidorus* species (Xu and Cheng 1992); it is more frequently observed in *Xiphinema* spp. (Kruger and Heyns 1987, Swart 1994, Swart and Quénéhervé 1998; Mincheva et al. 2008), reported also for several species of *Xiphidorus* (Decraemer et al. 1996) and *Paraxiphidorus brevistylus* (Decraemer et al. 1998).

Hemizonid and hemizonion are not commonly observed structures in dorylaimids (Jairajpuri and Ahmad 1992), the hemizonid was seen both in adults and in the last two juvenile stages of the new species and hemizonion in only two male specimens. Both structures were reported also for *L. fursti* (Heyns et al. 1987), *L. iranicus* (Sturhan and Barooti 1983); only hemizonid – for *L. litchii*, *L. henanus* (Xu and Cheng 1992).

L. carpetanensis Arias, Fé Andres & Navas, 1986, *L. pawneensis* Luc & Coomans, 1988, *L. brevis* Swart et al., 1996, *L. africanus* (Bravo and Roca 1995), *L. kheirii* (Pedram et al. 2008), *L. laevicapitatus* Williams, 1959 (Heyns and Luc 1987), in a few specimens of *L. fagi* Peneva, Choleva & Nedelchev, 1997, for one *Xiphidorus* and some *Paralongidorus* species (Siddiqi et al. 1963, Fisher 1964, Luc and Doucet 1984).

The only available data on the excretory system in *Longidorus* refers to *L. macrosoma* in which a ventral excretory pore at the level of the nerve ring, leading to a non-canalicular tissue in its anterior part has been observed together with two nucleated glands embedded in the tissues of a ventrally located ampulla-like structure (Aboul-Eid 1969). In *L. carniolensis* sp. n. we observed an aberrant ventral pore in all adults, differing in structure from the other ventral pores and also having a longer duct (Figs 1A, 4F and 6H), it probably functions as more specialised part of the excretory system. It was also detected in juvenile stages (Fig. 8B, D).

The data on D2D3 rDNA regions of majority of longidorid species, particularly of those belonging to the genus *Longidorus* is far to be complete; this does not facilitate the reconstruction of the phylogenetic relationships among the members of this widely distributed group of ectoparasitic nematodes. Despite of this, based on the rDNA results as well as a combination of morphological features the new species is included in a clearly defined group of closely related species (*L. poessneckensis* (92% similarity), *L. macrosoma* and *L. caespiticola* (90%), *L. helveticus* (89%), sharing some common characters – amphids with pouch-like fovea, not bilobed, amphidial duct well discernable, tapering lip region, which is continuous with the rest of body, normal arrangement of pharyngeal glands, bluntly conoidal to hemispherical tail, much shorter or equal to the anal body width; and the development through 4 juvenile stages. All these species occur in Europe, more frequently in West and Central Europe. The correlation between the amphid structure and clustering of longidorid species has been underlined by Rubtsova et al. (2001) and He et al. (2005) and it is supported by our study.

Acknowledgements

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RESEARCH ARTICLE

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Stenosoma stephenseni sp. n. (Isopoda, Idoteidae), from the southwestern Mediterranean, with a note on the nomenclatural status of *Synisoma* Collinge, 1917

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Abstract

Recent collections of isopods in Alboran Island and Algeria included several specimens of the species *Stenosoma stephenseni* **sp. n.** This is the fourteenth species described in the genus *Stenosoma* Leach, 1814. Examination of two specimens collected during the Danish oceanographic cruises of the Thor (1908–10) close to the Galite Islands, and identified as *S. acuminatum* Leach, 1814, revealed that both belong to *S. stephenseni* **sp. n.** In light of these findings, the Mediterranean records of *S. acuminatum* are revised, and it is proposed that *S. acuminatum* is a strictly Atlantic species. An updated diagnosis for the genus *Stenosoma* is given, together with a key for the identification of its species. The nomenclatural status of the name *Synisoma* Collinge, 1917 is addressed, and although it is in prevailing usage, it is shown that *Stenosoma* Leach, 1814 is the valid name of the genus.

Keywords
new species, North Africa, Mediterranean, Alboran Island, Idoteidae

Introduction

In his work on the isopods collected during the Danish oceanographic cruises of the Thor (1908–10) in the Mediterranean and the Black Sea, Stephensen (1915) identified three species belonging to the genus *Stenosoma* Leach, 1814 (=*Synisoma* Collinge, 1917): two specimens of *S. acuminatum* Leach, 1814, from the Galite Islands (northern Tunisia), two specimens of *S. capito* (Rathke, 1837), from the Aegean Sea, and one specimen of *S. appendiculatum* (Risso, 1826), from Cabo da Gata (Spain). Stephensen noted that although the two specimens from the Galite Islands agreed broadly with the figures and descriptions of *S. acuminatum* provided by Dollfus (1896) and Tattersall (1911), they were "somewhat broader" and the abdomen was "[...] by no means so sharply pointed". Upon dissection, he also noted that "there is a considerably similarity to *S. capito* (Rathke, 1837), the appendages being, however, far thicker and heavier".

In his revision of the British Idoteids, Collinge (1917: 752) noted that "Stephensen's *S. acuminatum* (Leach), represented by two examples from different localities – is in one case referable to *S. capito* (Rathke), the other approaching *S. lancifer* (Leach), but I am inclined to regard it as a different species". Later, Monod (1925) corrected Collinge's assertion, noting that the two specimens from Stephensen came from the same locality (Galite Islands) and were actually a new species (referred to by him as "*Synisoma sp.?*"), whilst Stephensen's *S. capito* was a good species collected in a different location (Greece). Since then, the status of Stephensen's *S. acuminatum* has been addressed by several authors, most of whom suggest that it is indeed a distinct yet undescribed species of *Stenosoma* (e.g., Amar 1957; Prunus and Pantoustier 1976), and that records of *S. acuminatum* in the Mediterranean are dubious and should be revised (Junoy and Castelló 2003). Although Stephensen's material has been available from the Zoological Museum of the University of Copenhagen, Denmark (ZMUC) no further attempt was made to clarify the taxonomic status of the two specimens.

While studying the phylogeography of *Stenosoma nadejda* (Rezig, 1989) we received several specimens from the Alboran Island (provided by JM Guerra García). Analysis of the mitochondrial gene cytochrome c oxidase subunit I revealed that the Alboran specimens belonged to a very divergent lineage from "*S. nadejda*" and were potentially a new species (Xavier et al. 2011). However, because all individuals from this new lineage were *mancas*, no morphological analysis was possible. Successful sampling of adults from Algeria in 2009 allowed us to start a detailed morphological analysis of this lineage. Morphological similarities between these recently collected individuals and Stephensen's description of *S. acuminatum*, led us to request the material from the Thor campaign (1908–10), deposited at the ZMUC.

In this work, we describe a new species of *Stenosoma*, in which we include the specimens of Stephensen (1915) from the Galite Islands, and we discuss the implications of this finding on the distribution of *S. acuminatum* in the Mediterranean. Additionally, we address the nomenclatural status of the name *Synisoma* Collinge, 1917, which is in prevailing usage. An amended key is given for the species of the genus *Stenosoma* based on the one provided by Castellanos and Junoy (2005).

Material and methods

Specimens were collected on intertidal algae during low tides, in the winter of 2005 (Alboran Island) and the summer of 2009 (Algeria). All specimens were preserved in 96% ethanol. Description is based on the male holotype unless otherwise stated. Body length measured dorsally from midpoint of cephalon's anterior margin to posterior of pleotelson. The holotype is deposited in the Zoological Museum, University of Copenhagen, Denmark. All taxonomic work is attributed to A. M. dos Santos and R. Xavier.

Abbreviations

BMNH	The Natural History Museum, London, UK
MNHNP	Muséum National d'Histoire Naturelle, Paris, France
ZMUC	Zoological Museum, University of Copenhagen, Denmark
CIBIO-UP	Centro de Investigação em Biodiversidade e Recursos Genéticos, Universidade do Porto, Portugal
ICZN	International Code of Zoological Nomenclature (ICZN, 1999).

Taxonomy

Order Isopoda Latreille, 1817
Familiy Idoteidae Samouelle, 1819

Genus *Stenosoma* Leach, 1814
http://species-id.net/wiki/Stenosoma

Stenosoma Leach, 1814: 433.– Leach, 1815: 365.– Samouelle, 1819: 107.– Desmarest, 1823: 374.– Desmarest, 1825: 290.– Latreille, 1829: 139.– Moore, 1839: 294.– Lucas, 1840: 259.– Hope, 1851: 26.– Dollfus, 1894: 5.– Dollfus, 1896: 54.– Gerstaecker, 1901: 218.– Norman, 1904: 444.– Norman & Scott, 1906: 47.– Tattersal, 1911: 230.– Stephensen, 1915: 15.

Leptosoma Risso, 1826: 107 (no type species designated, see text).– Rathke, 1837: 384.– Lamarck, 1838: 270.– Hope, 1851: 26.

Synisoma Collinge, 1917: 750 (type species *Stenosoma acuminatum* Leach, 1814, by subsequent designation of Kussakin, 1982). Monod, 1923: 97.– Monod, 1925: 70.– Amar, 1957: 74.– Daguerre de Hureaux, 1968: 87.– Naylor, 1972: 46.– Nunomura, 1974: 6.– Prunus & Pantoustier, 1976: 259.– Kussakin, 1982: 184. Brusca, 1984: 107.– Rezig, 1989: 30.– Ormsby, 1991: 758.– Hedo & Junoy, 1999: 88.– Poore, 2001: 221.– Castellanos & Junoy, 2005: 1461.

Type species. *Stenosoma acuminatum* Leach, 1814, by subsequent designation of Kussakin, 1982 (under Article 67.8).

Remarks. The genus *Stenosoma* was described by Leach (1814) simultaneously in two different parts of the Brewster's Edinburgh Encyclopaedia: in the main section "Crustaceology" (p. 404), and in the Appendix which was published as an integral part of that section (pp. 429–434). Leach (1815) also re-described *Stenosoma* in his popular work "A tabular view of the external characters of four classes of animals, which Linné arranged under Insecta", a reference erroneously cited as the original description by many authors (e.g. Collinge 1917; Kussakin 1982; Junoy and Castelló 2003). In neither of those publications was a type species designated.

In page 404 of the section "Crustaceology", *Stenosoma* was clearly described as a tentative subdivision of the genus *Idotea.* After the general description of *Idotea* (numbered as Genus LXIV), Leach (1814) split it into "Genus *Stenosoma* of Leach. ● body linear, external antennae very long" and "●● Body thickest in the middle. *Idotea*, Leach". In the first division, Leach placed only one nominal species, *Idotea hectica* Pallas, 1772, and in the second division he placed two nominal species, *Oniscus entomon* Linnaeus, 1758 and *O. oestrum* Linnaeus, 1758. The fact that neither "*Stenosoma* of Leach" nor "*Idotea*, Leach" are numbered (as are all other genera in the section) and do not appear either in the list of genera and families at the beginning of the section (as does "Genus LXIV. *Idotea*", on page 386) or in the marginal notes or the index, shows that at this stage Leach was not yet sure whether genus rank should be accorded to these divisions.

In the Appendix (p. 433), however, *Stenosoma* is re-described as a genus on its own, this time numbered "XI", immediately after *Idotea* (which is Genus X). There, Leach reformulated the diagnosis of *Stenosoma* ("external antennae longer than the body, the third longer than the fourth joint; body linear"), and included two nominal species, *Idotea hectica* Pallas, 1772 and *Stenosoma acuminatum* Leach, 1814. So, under Articles 12.1 and 12.2.5, the name *Stenosoma* Leach, 1814 is available from page 404, where it is treated as a division of *Idotea* Fabricius, 1798, and from page 433 of the same publication where it is ranked as a genus. Under Article 24.1, precedence must be accorded to the name proposed at higher rank, i.e., *Stenosoma* as a genus, in page 433 of the Appendix. The important point here is that on page 433 Leach included in his genus the nominal species *Idotea hectica* Pallas, 1772 and *Stenosoma acuminatum* Leach, 1814. Therefore, *Stenosoma acuminatum* Leach, 1814 is eligible as type species of *Stenosoma* Leach, 1814 (Articles 67.2 and 67.2.1).

The genus *Stenosoma* was quickly adopted by some leading French zoologists (e.g., Desmarest 1825; Latreille 1829), but others saw no reason to separate the species included within it from the well established genus *Idotea* Fabricius, 1798 (e.g., Milne-Edwards 1840; Bate and Westwood 1868). Meanwhile, congeneric species were being described from the Mediterranean. Risso (1816) described *Idotea lanciformis* from Nice (France) and later (Risso 1826) described two species from the same region in the new genus *Leptosoma* (*L. appendiculatum* Risso, 1826, and *L. lanceolatum* Risso 1826), establishing, in part, the diagnosis for the genus that is still in use: the postabdomen (pleotelson) is unarticulated, resulting from the coalescence of the last four pleomeres, without (almost) any trace of segmentation. Rathke (1837) described *Leptosoma capito* from the Black Sea, and Lucas (1849) described *Idotea carinata* and *I. angustata* from Algeria. By the end of the 1880s there were at least 11 different species names (in the genera *Stenosoma*, *Leptosoma* and *Idotea*) for idoteids with unarticulated post-abdomen occurring in the North East Atlantic and the Mediterranean.

In his comprehensive monograph of the Idoteidae, Miers (1881) followed the more conservative approach of Milne-Edwards (1840) and Bate and Westwood (1868) and placed in the genus *Idotea* all species described as *Stenosoma* and *Leptosoma.* Later, Dollfus (1896) opted to separate the genera *Idotea* Fabricius, 1798, and *Stenosoma* Leach, 1814, laying the basis for the current taxonomy of this group. He recognized problems with Leach's oversimplified diagnosis of *Stenosoma* (see above), noting that the taxonomy behind *Leptosoma* Risso, 1826 made it "a better established genus". Hence, he retained the name *Stenosoma* Leach, 1814 based on precedence, but explicitly used the diagnosis proposed by Risso (1826) to set *Stenosoma* apart from *Idotea*.

In his revision of the British idoteids, Collinge (1917) took a different approach. Based on the wrong assumption that *Leptosoma* Risso, 1826 was preoccupied, and that the name *Stenosoma* had "been used with so many varied conceptions that, with Miers, I agree that it cannot be employed for any section or division of the family" (Collinge 1917: 727), he proposed the replacement name *Synisoma*, together with an emended diagnosis of the genus. Collinge (1917) included two nominal species in *Synisoma* (*Idotea acuminata lancifer* Miers, 1881 and *Stenosoma acuminatum* Leach, 1814) but did not designate a type species for the genus name.

Kussakin (1982) designated *Stenosoma acuminatum* Leach, 1814 (under Article 67.7, cited as "*Stenosoma acuminatum* Leach, 1815") as type species of *Synisoma* Collinge, 1917. Since that was one of the originally included nominal species, Kussakin's is a valid subsequent designation. Moreover, because *Synisoma* Collinge, 1917 is a replacement name for *Stenosoma* Leach, 1814 and, as discussed above, *Stenosoma acuminatum* Leach, 1814 is also one of the nominal species originally included in *Stenosoma* Leach, 1814, under Article 67.8 Kussakin's is also a valid subsequent designation of *Stenosoma acuminatum* Leach, 1814 as the type species of *Stenosoma* Leach, 1814. As for *Leptosoma* Risso, 1826, as far as we can ascertain, no type species has yet been designated, and there is no indication on the present whereabouts of Risso's type material.

Synisoma Collinge, 1917 is currently in prevailing usage, as it has been used virtually in all works published after 1917. To promote nomenclatural stability, the ICZN allows for a reversal of precedence (Article 23.9) whenever a junior synonym is in prevailing usage provided that the two conditions defined in Articles 23.9.1.1 and 23.9.1.2 are both met. In this case, however, the first condition, that the senior synonym has not been used as a valid name after 1899, is not met. In fact, *Stenosoma* Leach, 1814 was used as a valid name in at least six works posterior to 1899: Nobre (1903), Norman (1904), Norman and Scott (1906), Tattersall (1911), Issel (1912), and Stephensen (1915).

Given the complex taxonomic history of the genus *Stenosoma* and its synonyms, their diagnoses have been modified on an ad-hoc basis to accommodate each new species described. For example, both Dollfus' (1894) diagnosis of *Stenosoma* and Collinge's (1917) diagnosis of *Synisoma* exclude species with an antennal flagellum reduced to a single clavate article. The most recent revision of the genus made by Rezig (1989) did not account for the two Pacific species, *S. pacificum* (Nunomura, 1974) and *S. wetzerae* (Ormsby, 1991). Recently, Hedo and Junoy (1999) and Castellanos and Junoy (2005) concluded that the two most important characters distinguishing *Synisoma* (=*Stenosoma*) from the other Idoteidae are a pleon lacking distinct somites and a maxillipedal palp composed of four articles. According to these authors, all other characters display a high degree of intra-generic variability. We hereby present an updated diagnosis for the genus, which is broadened from that given by Rezig (1989).

Diagnosis. Body elongate, lateral margins parallel or sub-parallel, sometimes widening slightly towards pereonites III–IV. Cephalon with pronounced anterolateral lobes, smooth or with a pronounced dorsal tubercle; eyes lateral, small. Antennulae with first article expanded, flagellum composed of a single article. Antenna articles 3–4 longer, flagellum multiarticulated or composed of a single clavate article. Maxillipedal palp with 4 articles. Pereonites smooth, frequently with a shallow dorsal keel, seldom developing into a dorsal triangular tooth; pereonites I–III often with a pair of lateral tubercles. Coxal plates small, round, rarely medium sized and triangular, invisible in dorsal view, or visible dorsally on perionites II–VII or V–VII. Pereopods ambulatory, slender and sub-equal, terminating in a biungulate dactyl with simple setae. Pleon without articulating pleonites (pleotelson), pleonites I–III frequently indicated by incomplete sutures visible ventrolaterally or dorsally (pleotelsonic formula 0+3); pleotelson long, not less than one third of body length, terminally pointed; dorsal surface smooth or with a shallow keel. Penes attached to posterior ventral margin of pleonite 1, fused basally as a penial plate divided over most of its length. Uropod uniramous, endopodite more or less triangular in shape.

Species included. *S. acuminatum* Leach, 1814; *S. appendiculatum* (Risso, 1826); *S. capito* (Rathke, 1837); *S. carinatum* (Lucas, 1849); *S. lancifer* (Miers, 1881); *S. spinosum* (Amar, 1957); *S. bellonae* (Daguerre de Hureaux, 1968); *S. pacificum* (Nunomura, 1974); *S. nadejda* (Rezig, 1989); *S. mediterraneum* (Rezig, 1989); *S. wetzerae* (Ormsby, 1991); *S. raquelae* (Hedo & Junoy, 1999); *S. albertoi* (Castellanos & Junoy, 2005); *S. stephenseni* sp. n.

Stenosoma stephenseni Santos and Xavier, sp. n.

urn:lsid:zoobank.org:act:EDEC2356-58AE-4DBA-B99D-41042CCB0607
http://species-id.net/wiki/Stenosoma_stephenseni

Material examined. *Holotype:* ♂ (13.0 mm, partially dissected, preserved in ethanol 96%), Dellys, Boumerdès, Algeria, 36°55'27.14"N, 3°53'42.30"E, 6 Aug 2009, intertidal seaweeds (ZMUC-CRU-20458).

Paratypes: ♂ (12.5 mm), ♀ (11.0 mm), Galite Islands, Bizerte, Tunisia, (approx. 37°31'27.21"N, 8°56'23.54"E), 5 Feb 1909, 'on the shore' (Stephensen, 1915) (ZMUC-CRU-20228). 2♂ (10.5, 8.9 mm), Dellys, Boumerdès, Algeria, 36°55'27.14" N,3°53'42.30"E, 6 Aug 2009, intertidal seaweeds, (CIBIO-UP, SstDel5 and SstDel9). 3♂ (10.1, 9.9, 10.5 mm), 3♀ (1 ovig. 11.8 mm, 2 non-ovig. 9.1, 9.8 mm), Tighremt, Bejaïa, Algerie, 36°52'0.60"N, 4°51'25.29"E, 4 Aug 2009, intertidal seaweeds (CIBIO-UP, SstTit4, SstTit2, SstTit18, SstTit1, SstTit15, SstTit17, respectively). 2♂ (13.2, 7.9 mm), Sidi Khaled, Tigzirt, Tizi-Ouzou, Algerie, 36°53'48.52"N, 4°10'52.46"E, 28 Jul 2009, intertidal seaweeds (CIBIO-UP, SstTiz16, SstTiz17). 3 mancas (3.8, 4.1, 4.3 mm), Alboran Island, Spain, 35°56'58.06"N, 3°01'48.57"W, 12 Feb 2005, intertidal seaweeds (CIBIO-UP, SstAlb1-3).

Diagnosis. The species is characterised by a smooth and domed cephalon, with a prominent dorsal boss in lateral view; pereonites smooth, lacking lateral tubercles; pereopods II–VII robust, with merus and carpus 1.2 and 1.1 times as wide as long, respectively; pleotelson margins parallel or subparallel, curving regularly towards distal extremity at one third of its length; pleotelson with three pairs of lateral sutures only visible in ventral view; appendix masculina long, extending beyond apical margin of the endopod by more than one fifth of its length, but not beyond apical spines of endopod.

Description. *Body* elongate, five times as long as wide (Figure 1). No secondary sexual dimorphism observable. Length of specimens in type series: 4.3–13.2 mm. Colour light brown to pale yellow, lightly pigmented.

Cephalon 1.3 times as wide as long, posterior margin immersed in pereonite I, smooth (no signs of mid-dorsal tubercle) but domed, with a prominent dorsal boss in lateral view; eyes dark, triangular or round, on lateral edge of cephalon; supra antennal line straight, anterolateral angles acute. *Pereonites* smooth, without dorsal carina. Coxal plates small, present on pereonites II–VII and hardly visible in dorsal aspect. All pleonites medially fused, with three pairs of small antero-lateral sutures in ventral view only. *Pleotelson* 2.4 times as long as wide, approximately one third of total body length.

Antennule: peduncle of three articles, article 1 ovoid, articles 2–3 cylindrical, similar in size; flagellum bearing seven pairs of aesthetascs. *Antenna*: peduncle of five articles, article 1 reduced, article 2 as wide as long, articles 3–5 progressively longer; flagellum of 17 articles, the distal one with minute vestigial apical article bearing a brush of short setae; flagellum varying from 14 to 17 articles on type series.

Mandible: Right mandible incisor 4 toothed; lacinia mobilis with one or two incisors; spine row with seven curved serrate spines; molar process truncate, without tooth. *Maxillule*: inner lobe with three distal plumose spines, inner margin with thin simple setae; outer lobe 1.8 times longer than inner lobe, with eight stout spines, four of them serrate; outer margin with small simple setae. *Maxilla*: trilobate, endopod with seven recurved plumose spines and eight simple setae; inner and outer lobes of exopod with five and four pectinate spines, respectively. *Maxilliped*: palp 4–articulate; exopod round; endite with a single coupling hook, five spines and a few simple setae along the distal margin.

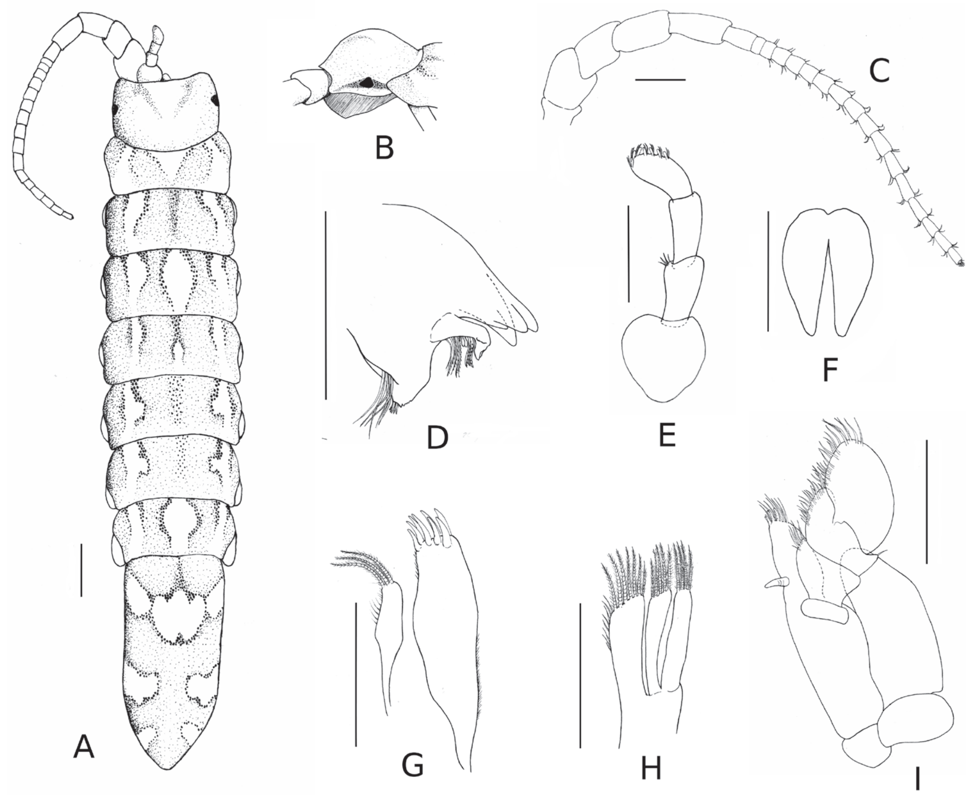

Figure 1. *Stenosoma stephenseni*, sp. n., holotype: **A** dorsal view **B** detail of cephalon **C** antenna **D** left mandible **E** antennula **F** penis **G** maxillule **H** maxilla **I** maxilliped. Scale bars are 500 µm, except for whole specimen (1 mm).

Pereopods I–VII ambulatory (Figure 2), robust, with merus 1.2 times as wide as long, and carpus 1.1 times as wide as long, terminating in a biungulate dactyl with simple setae; pereopod I with simple spines on inner surface of propodus, and weak setation on ventral margin; pereopods II–VII subsimilar; pereopods II and VI with 8–12 palmate setae on distal margin of propodus.

Ventral penis smooth. Pleopods I–II rami with plumose marginal setae (Figure 3); pleopod II with long appendix masculina, extending beyond endopod by more than one fifth of its length, but not beyond its apical spines, apex distal inner margin serrated, with five minute spines; pleopods III–V 1.1 times longer and 1.2 times wider than I–II, without setae. *Uropod:* uniramous, with small plumose seta on lateral distal angle of peduncle.

Etymology. The epithet honours Knud Hensch Stephensen (1882–1947), former curator of the crustacean collections at the ZMUC, who first noticed that some specimens he placed in *S. acuminatum* were likely to be a new species from the Mediterranean (Stephensen, 1915).

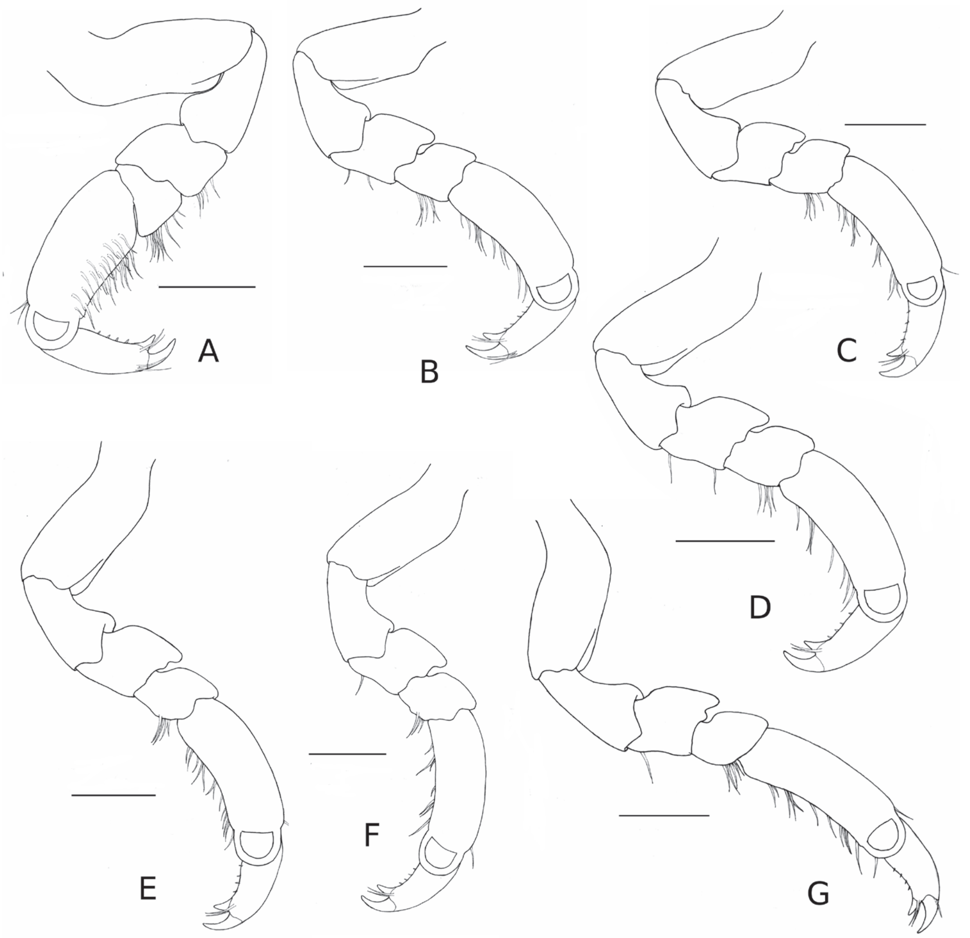

Figure 2. *Stenosoma stephenseni*, sp. n., holotype: **A** pereopod I **B** pereopod II **C** pereopod III **D** pereopod IV **E** pereopod V **F** pereopod VI **G** pereopod VII. Scale bars are 500 µm.

Discussion. The material from *Thor* campaigns in 1908–1810, originally described by Stephensen (1915) fits in well with the present description of *Stenosoma stephenseni* sp. n. (see figures from Stephensen, 1915: 15–16). In particular, the male appendix masculina (also drawn in Stephensen's figures) leaves no doubt on the taxonomic status of both specimens.

There are three sympatric species with which *S. stephenseni* sp. n. can be confounded: *S. nadejda* (Rezig, 1989), *S. mediterraneum* (Rezig, 1989) and *S. capito* (Rathke, 1837). *S. stephenseni* sp. n. can be easily distinguished from all three species, as these have a mid-dorsal tubercle on the cephalon, one pair of lateral tubercles on the first two (*S. capito*) or three (*S. nadejda* and *S. mediterraneum*) pereonites, and more slender pereopods, with carpus and merus at least 1.5 times as long as wide. The appendix masculina does not extend beyond the apical margin of the endopod in *S. nadejda* (see Rezig 1989: 72), and extends beyond the apical margin of the endopod by 0.05 and

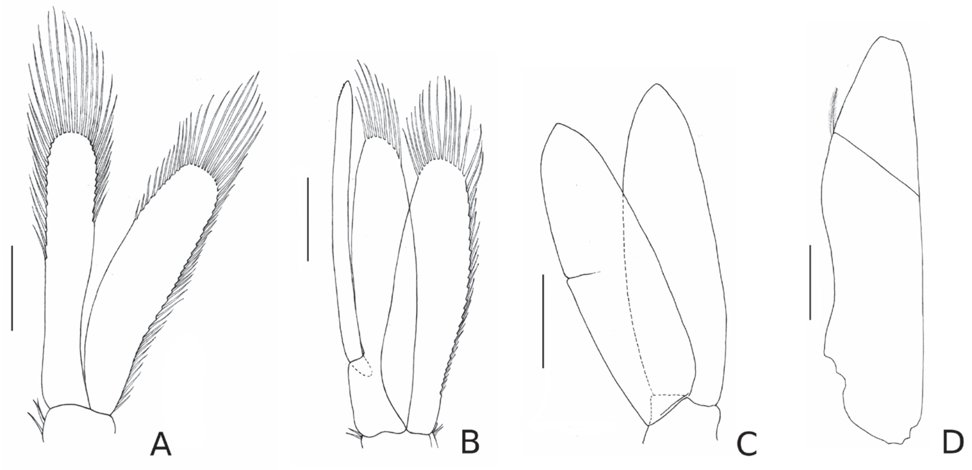

Figure 3. *Stenosoma stephenseni*, **sp. n.**, holotype: **A** pleopod I **B** pleopod II **C** pleopod III **D** uropod. Scale bars are 500 μm.

0.14 of its length in *S. mediterraneum* and *S. capito*, respectively. However, in the latter two species, the appendix masculina reaches the tip of the apical spines of the endopod (see Rezig 1989: 49, 65), whereas in *S. stephenseni* sp. n. it does not (Figure 3B).

As discussed below, the inclusion of Stephensen's specimens labeled "*S. acuminatum*" in *S. stephenseni* sp. n. has implications for the distribution of *S. acuminatum*. According to Naylor (1972, 1990), *S. acuminatum* ranges from the southwest coasts of Britain to the Mediterranean, Adriatic and Black Sea. However, no factual information (reference, site/date) is given for the presence of this species in the Mediterranean. Stephensen's (1915) record remains as the only published and verifiable record of *S. acuminatum* in the Mediterranean.

After the description of *S. acuminatum* by Leach (1814), many authors opted to synonymise it with *S. appendiculatum* (Risso, 1826) or *S. capito* (Rathke, 1837). White (1847: 95), in his "List of the specimens of Crustacea in the collection of the British Museum", listed a single specimen of *Idotea acuminata* from England (Leach's own *S. acuminatum* from Devon, see also White 1850) and three specimens from Tripoli (unknown collector). As Leach never mentioned any material other than the one from Devon in his descriptions of *S. acuminatum* (Leach, 1814, 1815), the specimens from Tripoli must have been acquired later.

Bate and Westwood (1868: 394) re-described *I. acuminata* from the British Isles, basing their drawings and description on Leach's specimen, but included "*Idotea capito*" from the Black Sea (attributed to Rathke 1937) in the list of synonyms. Thus, although they did not mention explicitly the Mediterranean, their popular reference clearly led the unaware reader to infer the presence of *S. acuminatum* in that region. Gourret (1891) corrected the error of Bate and Westwood (1868), but subsequent authors acknowledged their synonymy (e.g. Carus 1885; Stebbing 1893; Gerstaecker 1901; Monod 1923), always referring the presence of *S. acuminatum* in both the Mediterranean and the Atlantic. Yet, none of these works added a single new record of *S. acuminatum* from the Mediterranean, data being copied from earlier literature without further checking of taxonomic consistency. For example, Carus (1885) lists *I. acuminata* from the Mediterranean, synonymising it with "*S. acuminatum* Leach, *I. capito* Rathke, *Leptosoma lanceolatum* Risso, *I. lanciformis* Risso", and ranging from "Mare Brittanicum" (data taken from Leach, 1814), "Pontus Euxinus" (Black Sea, data taken from Rathke 1837), Nice (data taken from Risso 1816), and Lissa, Lesina and Curzola (Croatia, Adriatic) which are records of *I. capito* (=*S. capito*) from Heller (1866).

Neither Miers (1881) nor Collinge (1917) helped in eliminating this confusion. Miers (1881) united all described *Stenosoma* species (except *S. carinatum*) under a single species: *Idotea acuminata*. However, he mentioned that "This is a very variable species, and I have been obliged to unite under one name several types that have usually been considered distinct". He correctly placed the specimens from Tripoli belonging to the collections of the British Museum in the variety "*appendiculata*", which he synonymised with *S. appendiculatum* (Risso, 1826). Collinge (1917) who did not examine any British specimens of *S. acuminatum*, copied literally the description of Miers (1881), along with its presumed distribution (Mediterranean, Adriatic, Black Sea and Atlantic, up to Scotland). These inaccuracies made their way into popular references (Naylor 1972, 1990), and although some authors questioned the presence of *S. acuminatum* in the Mediterranean (Amar 1957; Prunus and Pantoustier 1976; Junoy and Castelló 2003), the record of Stephensen (1915) has always been there to attest to the contrary.

By including the two specimens from the campaigns of the Thor (Stephensen 1915) in *S. stephenseni* sp. n. the only published and verifiable record of *S. acuminatum* in the Mediterranean is eliminated. Other published records (e.g. Graeffe 1902; Argano and Campanaro 2011) should be checked if collections are available. These are likely to be misidentifications of *S. appendiculatum*, as is the case of the unpublished record of A. Dohrn from Naples (1957-06-16), labeled "*Synisoma acuminata* Leach", and deposited at the Stazione Zoologica Anton Dohrn. Specimens can be observed online (see movie for CRU072 at http://szn.i.hosei.ac.jp/HTML/Prep_list.php?Family=Idoteidae&ListType=icon). Their pereon margins are clearly serrated (triangular coxal plates) and the pleotelson shape is like an ink pen nib, two features characteristic of *S. appendiculatum*.

A note on *Idotea angustata* Lucas, 1849

During this work, the description of *Idotea angustata* Lucas, 1849 came to our attention. This species was described from Algiers (Algeria), and judging from its original description, clearly belongs to the genus *Stenosoma,* together with *I. carinata* Lucas, 1849. Carus (1885) included Lucas' record in his list of the Mediterranean fauna, but since then *I. angustata* has never been used as a valid name again. Some authors synonimised it with *S. acuminatum* (e.g., Miers 1881), others with *S. capito* (Monod, 1925; Kussakin, 1982). Both the drawing and the description of *I. angustata* bear some similarities with *S. stephenseni* sp. n. but also with three other sympatric species: *S. mediterraneum* (Rezig, 1989), *S. nadejda* (Rezig, 1989), and *S. capito* (Rathke, 1837)

Lucas refers that “La tête est légèrement gibbeuse” [the head is slightly convex] and that “Les organes de la locomotion sont courtes et assez robustes” [the organs of locomotion are short and rather robust], but the lack of any reference to the presence/absence of lateral tubercles in the first pereonites, and the exact shape of the pleotelson and the protuberance of the cephalon make this description ambiguous. Hence the name *Idotea angustata* which, according to the rules of the ICZN, is available from Lucas (1849), could be either a junior subjective synonym of *S. capito* (Rathke, 1837) or a senior subjective synonym of *S. meditarraneum* (Rezig, 1989) , *S. nadejda* (Rezig, 1989) or *S. stephenseni* sp. n. According to Rezig (1989), Lucas’ specimens were deposited at the MNHNP, but they could not be found there and currently there is no indication as to their present whereabouts (Danièle Defaye, *pers. comm.*). Unless these material is found, *S. angustata* (Lucas, 1849) has to be treated as a *nomen dubium*.

Key to the species of the genus *Stenosoma*

1	Antenna with multiarticulated flagellum	**2**
–	Antenna with single clavated flagellar article	**12**
2	Pleotelson without anterolateral sutures in either dorsal or lateral views	**3**
–	Pleotelson with one or three anterolateral sutures in dorsal or lateral views	**8**
3	Pleotelson with three suture lines in ventral view	**4**
–	Pleotelson without suture lines in ventral view	**5**
4	Cephalon with mid-dorsal tubercle; pereopods II–VII slender, with carpus and merus longer than wider; pereonites I–III with lateral tubercles	***S. nadejda* (Rezig, 1989)**
–	Cephalon smooth, domed; pereopods II–VII robust, with carpus and merus slightly wider than longer; pereonites I–III smooth	**S. stephenseni sp. n.**
5	Cephalon with a mid-dorsal tubercle or spine	***S. wetzerae* (Ormsby, 1991)**
–	Cephalon smooth	**6**
6	Pereon sides straight and parallel, coxal plates barely visible from above; pleotelson sides narrowing fairly evenly to an acute terminal projection	**7**
–	Pereon sides appearing serrated, coxal plates triangular in dorsal view; pleotelson shape like an ink pen nib	***S. lancifer* (Miers, 1881)**
7	Antenna large, flagellum with more than seven articles	***S. acuminatum* Leach, 1814**
–	Antenna short, flagellum with 5–7 articles	***S. pacificum* (Nunomura, 1974)**
8	Pleotelson with one anterolateral suture in dorsal or lateral views	**9**
–	Pleotelson with three anterolateral sutures in dorsal or lateral views	**10**
9	Cephalon with a bilobed mid-dorsal tubercle; pereonites bearing a mid-dorsal spine	***S spinosum* (Amar, 1957)**
–	Cephalon smooth; body with dorsal carina	***S. appendiculatum* (Risso, 1826)**

10 Dorsal surface of anterior pereonites with tubercles; pleotelson narrow **11**

– Dorsal surface of anterior pereonites smooth, not tuberculate; pleotelson wide, shield-shaped (about 1.2 times as long as wide) ....***S. carinatum* (Lucas, 1849)**

11 Pereon with a mid-dorsal carina; one pair of lateral tubercles on the first two pereonites; pleotelson shape like an ink pen nib, with three anterolateral sutures visible laterally only .... ***S. capito* (Rathke, 1837)**

– Pereon without carina; one pair of lateral tubercles on the first three pereonites; pleotelson sides narrowing fairly evenly to an acute terminal projection, with three anterolateral sutures visible in dorsal view ....***S. mediterraneum* (Rezig, 1989)**

12 Pleotelson wide (length about 1.2 times width), shield-shaped, first suture larger than others .... ***S. bellonae* (Daguerre de Hureaux, 1968)**

– Pleotelson narrow (length equal to or more than 1.5 times width), lateral sutures short, all of the same length **13**

13 Cephalon smooth; body without dorsal carina; maxilliped with one coupling hook .... ***S. raquelae* (Hedo & Junoy, 1999)**

– Cephalon with a bilobed mid-dorsal tubercle; body with dorsal carina; maxilliped with two coupling hooks ...... ***S. albertoi* (Castellanos & Junoy, 2005)**

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RESEARCH ARTICLE

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Dayao gen. n. of the subtribe Tyrina (Coleoptera, Staphylinidae, Pselaphinae) from South China

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Abstract

Dayao pengzhongi **gen. et sp. n.** is described and illustrated based on the material collected in Guangxi Province, South China. The genus is placed in the oriental '*Pselaphodes complex*' of genera of the subtribe Tyrina and its taxonomic placement is discussed.

Keywords

Staphylinidae, Pselaphinae, Tyrina, new genus, new species, taxonomy, Dayao Mountain, Guangxi, South China

Introduction

According to the most recent catalog of the tribe Tyrini (Hlaváč and Chandler 2005), 13 genera of the subtribe Tyrina have been known from the Oriental region. Eight of 13 genera centered on the genus *Pselaphodes* Westwood grouped as the '*Pselaphodes* complex' of genera (Hlaváč 2002: 283): *Indophodes* Hlaváč, *Labomimus* Sharp, *Lasinus*

Sharp, *Linan* Hlaváč, *Nomuraius* Hlaváč, *Paralasinus* Hlaváč & Nomura, *Pselaphodes* Westwood and *Taiwanophodes* Hlaváč. Determination of the generic placement within the group is usually based on the form of maxillary palpi, in the combination with the foveal pattern on the head, pronotum and thorax and the relative length of the scape.

Recently a small series of pselaphine was collected at Dayao Mountain in the Guangxi Province, South China. The pselaphines were identified as a member of the '*Pselaphodes* complex' upon an examination of morphological characters, but eventually found not matching any current generic conception of a known genus. The aim of this paper is to describe the new genus and species in detail, provide illustrations of the diagnostic characters, and discuss its taxonomic placement.

Material and methods

All specimens were collected from the leaf litter of the forest floor by sifting. They were killed with ethyl acetate and then dried. Dissections were done in 75% ethanol. The genital organs and other dissected parts were mounted in Euparal (Chroma Gesellschaft Schmidt, Koengen, Germany) on plastic slides that were placed on the same pin as the specimen. Photos were taken by a Canon EOS 40D Camera mounted with an MP-E 65 mm Macro Photo Lens; line drawings were made using Adobe Illustrator CS2 based on the photos taken by a Canon G9 Camera mounted on an Olympus CX31 microscope.

A slash (/) is used to separate lines on the same label, and a double slash (//) is used to separate different labels on the same pin.

The following acronyms are used in the text:

AL	length of the abdomen;
AW	maximum width of the abdomen;
BL	length of the body (= HL + PL + EL + AL);
EL	length of the elytra, measured along sutural line;
EW	maximum width of the elytra;
HL	length of the head, measured from the anterior clypeal margin to the occipital constriction;
HW	width of the head across eyes;
PL	length of the pronotum along midline;
PW	maximum width of the pronotum;
SHNU	Shanghai Normal University, Shanghai, P. R. China.

The type series are deposited in the Insect Collections of Shanghai Normal University, Shanghai, China (**SNUC**).

The terminology of foveal system follows Chandler (2001), except for using 'ventrite' instead of 'sternite'.

Taxonomy

Dayao **Yin, Li & Zhao, gen. n.**

urn:lsid:zoobank.org:act:12861B33-83EB-466C-BF28-FDE4F6F6C17B
http://species-id.net/wiki/Dayao
Figs 1–13

Type species. *Dayao pengzhongi* Yin, Li and Zhao, here designated. Gender masculine.

Diagnosis. Head and pronotum finely punctate. Head with vertexal foveae small, lacking frontal foveae; maxillary palpi with apical three segments elongate, each basally pedunculate and strongly protrude laterally. Pronotum with median and lateral antebasal foveae, lacking antebasal sulcus. Median metaventral fovea absent. Abdomen with tergite IV longest.

Description. Length 2.95–2.99 mm. Head with narrow, long and prominent frontal rostrum, antennal tubercles faint; small vertexal foveae nude, with median carina between foveae; lacking postantennal notches and lateral postantennal pits; antennae with 11 antennomeres, antennal club formed by three enlarged apical antennomeres; maxillary palpi (Fig. 9) elongate, lateral projections of antennomeres II–IV each setose at their apices, fourth palpomeres with apical palpal cones; with lateral genal spines; gula flat, gular foveae close in median impression.

Pronotum with nude median and setose lateral antebasal foveae; lateral procoxal foveae present.

Each elytron with two basal foveae; discal stria extending from second basal fovea and exceeding elytral midpoint.

Thorax with median and lateral mesoventral foveae; lateral mesocoxal foveae present; lacking median metaventral fovea, metaventral apex broad and shallowly notched medially.

Legs with tarsomeres simple, third tasomeres about 0.75 times as long as second tarsomeres.

Abdomen with tergite IV (visible tergite I) longer than V–VII combined; tergite IV with deep basal sulcus connecting basolateral foveae, lacking mediobasal fovea in sulcus; with long discal carinae; tergites V–VII each with basolateral foveae. Sternite IV largest, longer than V–VII combined, with deep basal sulcus densely covered by short setae.

Males with antennomeres IX, pronotum and protibiae modified. Aedeagus with median lobe asymmetric; parameres long and symmetric; dorsal diaphragm oval.

Distribution. A single species in known from Dayao Mountain, Guangxi Province, South China.

Comparative notes. *Dayao* is placed near the genera of *Pselaphodex* complex with simple, linear tarsomere II not strongly bilobed, only slightly extending beneath tarsomere III: *Paralasinus* Hlaváč & Nomura, *Lasinus* Sharp, *Linan* Hlaváč, *Indophodes* Hlaváč, *Labomimus* Sharp and *Pselaphodes* Westwood. Among these genera, *Dayao* can be readily separated from *Paralasinus* and *Lasinus* by the clearly asymmetrical palpomeres II–IV, which are simple in both genera. *Dayao* is separated from *Indophodes* and *Labomimus* by the lack of a frontal and a median metaventral fovea; from *Pselaphodes* by the lack of a frontal fovea, the indistinct pronotal lateral antebasal foveae and the longer scape. The lack of a median metaventral fovea, the pronotum being finely punctate and the basal carinae of the tergite IV being much longer separate *Dayao* from *Linan* in which the median metaventral fovea is present, the pronotum is roughly and densely punctate and the basal carinae are much shorter.

Remarks. The published key to the world genera of Tyrini (Hlaváč and Chandler 2005) may be modified as the following to accommodate the new genus:

18(16) Head with vertexal foveae indistinct, lacking frontal fovea; lacking median longitudinal sulcus on the pronotal disc **18a**
– Head with distinct setose vertexal and frontal foveae; pronotum with median longitudinal sulcus on the disc variably present **19**
18a Head and pronotum roughly punctate; median metaventral fovea present; discal carinae of tergite IV short or indistinct. (Northwestern Thailand; China: Yunnan, Zhejiang, Hainan, Anhui, Guizhou and Jiangxi Provinces) .... ***Linan* Hlaváč**
– Head and pronotum finely punctate (Figs 4–5); median metaventral fovea absent (Fig. 6); long discal carinae of tergite IV distinct (Fig. 1). (China: Guangxi Province) .... ***Dayao* Yin, Li & Zhao, gen. n.**

Etymology. The generic name is taken from the collection site of the type series, Dayao Mountain.

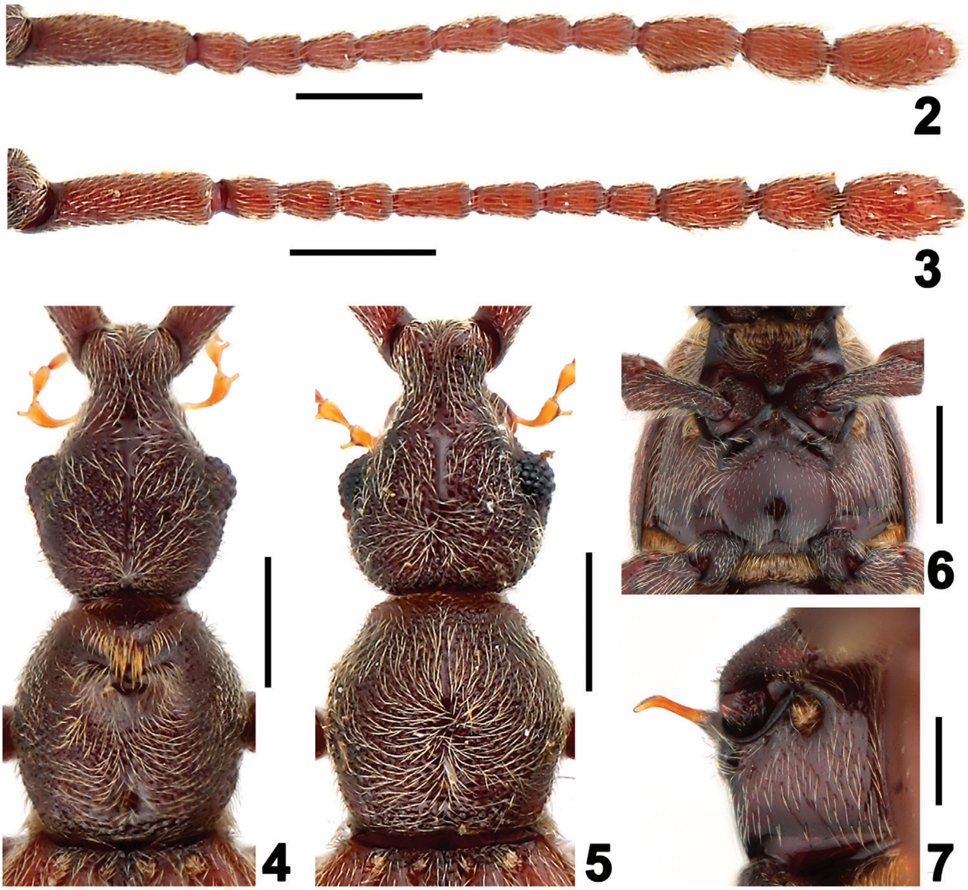
***Dayao pengzhongi* Yin, Li & Zhao, sp. n.**

urn:lsid:zoobank.org:act:CA2D75C0-637D-439A-96A3-B0A9585E3601
http://species-id.net/wiki/Dayao_pengzhongi
Figs 1–13

Type material. (1 ♂, 3 ♀♀). Holotype: ♂, labelled '**CHINA:** Guangxi Prov. / Laibin City, Jinxiu County / Dayao Mt., 7 km / 1,200–1,400 m, 22.vii.2011 / Z. Peng leg. // [red label] HOLOTYPE / *Dayao pengzhongi* Yin et al. / SHNU Collections'. Paratypes: 3 ♀♀, same label data as holotype, except '23.vii.2011 / Z.W. Yin & J.Y. Hu leg.', all bear the following label: '[yellow label] PARATYPE / *Dayao pengzhongi* Yin et al. / SHNU Collections'.

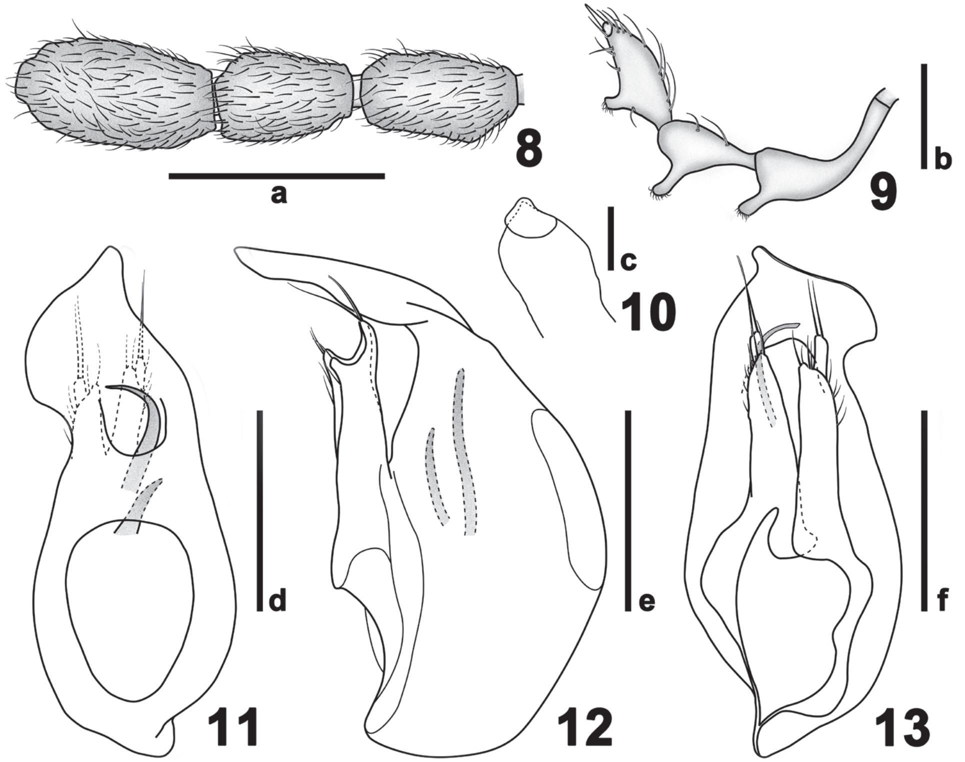
Description. Male (Fig. 1). Length 2.95 mm (holotype). Head lengthily and bluntly triangular, HL 0.74 mm, HW 0.59 mm, with decumbent setae. Vertexal foveae located posterior to point level with posterior margin of eyes. Eyes prominent, each with about 35 facets. Antennae elongate (Fig. 2), scape longer than II–IV combined, II–IV each short, of same width, V–VIII each longer than II–IV, slightly narrower, of

Figures 1. Male habitus of *Dayao pengzhongi*, holotype. Scale: 1.0 mm.



Figures 2–7. Details of *Dayao pengzhongi*. **2** male right antenna **3** same, female **4** male head and pronotum **5** same, female **6** male meso- and metathorax **7** male metaventral process, in lateral view. Scales: 0.3 mm.

same width, shortened distally, antennomeres of club (Fig. 8) of about same width, IX slightly expanded laterally at basal third, X shorter than IX and XI, XI longer than IX, with rounded apex. Pronotum (Fig. 4) as long as wide, PL 0.66 mm, PW 0.64 mm, with 'Y'-shaped sulcus in anterior half, tufts of long golden setae at anterior margin of sulcus directed posteriorly. Elytra wider than long, EL 0.81 mm, EW 1.05 mm, lacking ridges. Venter (Fig. 6) with long metaventral process (Fig. 7) bent posteriorly near apex; metaventrite smooth, convex medially in apical half, with dense long setae at lateral portions and sparse minute setae at middle. Legs long, protibiae with small apical spines, pro- and mesofemora with distinct erect setae at ventral margins. Abdomen wider than long, AL 0.74 mm, AW 1.03 mm; discal carinae on tergite IV extending two-fifths of tergal length; tergite VIII transverse, narrowed apically in posterior half, with shallow median emargination, tergite IX (Fig. 10) semi-membranous, with apical portion strongly sclerotized; sternites VIII transverse. Aedeagus (Figs 11–13) length 0. 48 mm.



Figures 8–13. Details of *Dayao pengzhongi*. **8** male antennal club, enlarged **9** male left maxillary palpus **10** male sternite IX **11** aedeagus, in dorsal view **12** same, in lateral view **13** same, in ventral view. Scales: a = 0.3 mm, b–c = 0.1 mm, d–f = 0.2 mm.

Female. In general similar to male. Antennomere IX (Fig. 3) and pronotum (Fig. 5) unmodified, metaventrite lacking process, protibiae simple. BL 2.81–2.99 mm, HL 0.71–0.73 mm, HW 0.57–0.59 mm, PL 0.63–0.66 mm, PW 0.62–0.64 mm, EL 0.74–0.78 mm, EW 1.07–1.10 mm, AL 0.73–0.82 mm, AW 1.12–1.15 mm. Eyes each with about 30 facets.

Etymology. The specific name recognizes the efforts of Zhong Peng in collecting the male holotype.

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RESEARCH ARTICLE

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Two new species of genus *Ateleute* Förster (Hymenoptera, Ichneumonidae, Cryptinae) with a key to the Oriental species

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Abstract

Three species of *Ateleute* Förster 1869 belonging to the tribe Cryptini of the subfamily Cryptinae (Hymenoptera, Ichneumonidae), collected from Jiangxi Province, China, are reported, of which two are new for science: *Ateleute ferruginea* Sheng, Broad & Sun, **sp. n.** and *A. zixiensis* Sheng, Broad & Sun, **sp. n.** One, *A. densistriata* (Uchida, 1955), was previously known from China and Japan. A key to the species of genus *Ateleute* known in the Oriental Region is provided.

Keywords

Phygadeuontini, *Ateleute*, new species, Key, Oriental Region, taxonomy

Introduction

Ateleute Förster 1869, belonging to the subfamily Cryptinae of Ichneumonidae (Hymenoptera), comprises 33 described species (Yu et al. 2005), of which 3 are known from the Oriental, 3 from the Palearctic, 1 from the Nearctic (Townes 1967, also in the Neotropics), 3 from the Neotropical and 24 from the Ethiopian Region.

The species distributed in Ethiopian Region were reported by Seyrig (1952) and catalogued by Townes and Townes (1973). Kasparyan and Hernandez (2001) described two new species and one new subspecies and provided a key to the species known in the Neotropical Region. Four species are known in Japan (Ashmead 1906, Momoi 1970, Uchida 1955). The European and Oriental species were catalogued by Gupta (1987). So far, one species, *A. densistriata* (Uchida, 1955), is known in Taiwan, China.

In the last four years the authors have been exploring Jiangxi Province, situated near the northern border of the Oriental part of China, and have collected large numbers of ichneumonids. In this article, the species belonging to *Ateleute*, collected in Jiangxi Province, P.R. China, are reported.

Materials and methods

Specimens were collected using entomological sweep nets in the forests of Anfu, Ji'an, Longnan, Qianshan, Quannan and Zixi Counties, Jiangxi Province (CHINA).

Images of whole bodies were taken using a CANON Power Shot A650 IS. Other images were taken using a Cool SNAP 3CCD attached to a Zeiss Discovery V8 Stereomicroscope and captured with QCapture Pro version 5.1.

The morphological terminology is mostly that of Gauld (1991). Wing vein nomenclature is based on Ross (1936) and the terminology on Mason (1986, 1990).

The new species were checked against the species described by Seyrig (1952) from Madagascar by the provided key and original descriptions.

Type specimens are deposited in the Insect Museum, General Station of Forest Pest Management (GSFPM), State Forestry Administration, People's Republic of China.

Ateleute Förster, 1869

http://species-id.net/wiki/Ateleute

Ateleute Förster, 1869. Verhandlungen des Naturhistorischen Vereins der Preussischen Rheinlande und Westfalens, 25(1868): 171. Type-species: *Ateleute linearis* Förster.

Psychostenus Uchida, 1955: 32. Type-species: *Psychostenus minusculae* Uchida.

Talorga Cameron, 1911: 63. Type-species: *Talorga spinipes* Cameron; monobasic.

Tsirirella Seyrig, 1952: 44. Type-species: *Tsirirella tsiriria* Seyrig; designated by Townes, Townes and Gupta 1961.

Diagnosis. *Ateleute* can be distinguished from all other genera of Cryptini by combination of the following characters: Apical margin of clypeus sharp, truncate or concave. Lower tooth of mandible as long as or slightly longer than upper tooth. Epomia absent. Genal carina joining base of mandible or joining hypostomal carina near base of mandible. Sternaulus weak and shallow. Posterior transverse carina of mesosternum complete. Areolet large, receiving 2m-cu basal of its middle, 3rs-m absent or almost absent. Hind wing vein M+Cu strongly arched, 2-1A absent or very short. First tergum without median dorsal carina, often with longitudinal wrinkles, spiracle near its middle. Ovipositor sheath about 0.65 times as long as hind tibia. Tip of ovipositor distinctly elongate.

Host. According to previous records (Momoi 1977, Townes 1967, Uchida 1955), hosts are *Cryptothelea minuscula* Butler and *Astala confederata* (Grote & Robinson) (Psychidae).

Key to species known in Oriental region

1 Female **2**
– Male **5**
2 Forewing vein 1cu-a distinctly distal of 1/M. Forewing vein 2m-cu situated approximately at middle of areolet. Propodeum blackish brown. (Japan: Okinawa) .... ***A. mesorufa*** **Momoi**
– Forewing vein 1cu-a at or slightly distal of 1/M. Forewing vein 2m-cu situated at basal 0.3 of areolet. Propodeum reddish brown **3**
3 Median terga or apical terga black. Terga with or without white **4**
– All terga entirely brown, without white spot. (Male unknown). (China: Jiangxi) .... ***A. ferruginea*** **Sheng, Broad & Sun, sp.n.**
4 Tergum 1 approximately 1.7 times as long as apical width. Vertex entirely black. Scape and pedicel white or yellowish white. Terga 7 and 8 with white spots. (China: Jiangxi, Taiwan; Japan: Okinawa) ...... ***A. densistriata*** **(Uchida)**
– Tergum 1 approximately 2.6 times as long as apical width. Vertex black, with lateral white spots. Scape and pedicel brownish black entirely. Terga 7 and 8 entirely black. (Male unknown). (China: Jiangxi) .... ***A. zixiensis*** **Sheng, Broad & Sun, sp.n.**
5 Fore wing vein 2m-cu approximately at middle of areolet. Gonosquama very slender, apex pointed .... ***A. mesorufa*** **Momoi**
– Fore wing vein 2m-cu distinctly before middle of areolet. Gonosquama broad **6**
6 Propodeum with fine and dense punctures. Dorsolateral carina of first tergum complete. Body dark brown (Figure 13). (Female unknown). (Malaysia) .... ***A. spinipes*** **(Cameron)**
– Propodeum with fine leathery texture. Dorsolateral carina of first tergum between spiracle and apex absent. Body black (Figure 11) .... ***A. densistriata*** **(Uchida)**

Ateleute ferruginea Sheng, Broad & Sun, sp.n.

urn:lsid:zoobank.org:act:34931ABC-632E-4AC7-B3CD-44D8BE899142
http://species-id.net/wiki/Ateleute_ferruginea
Figures 1–5

Etymology. The specific name is derived from the terga being entirely brown.

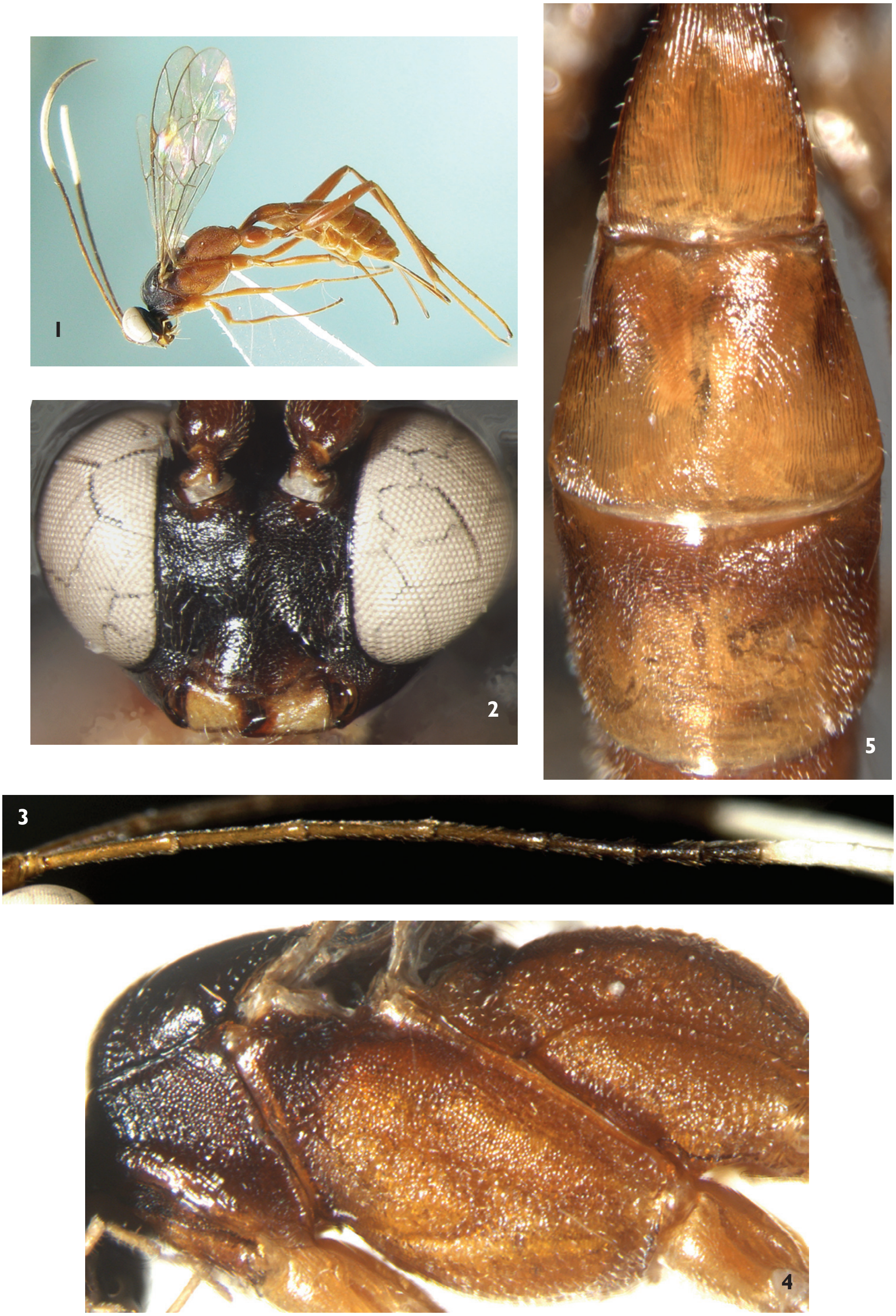
Types. *Holotype*, Female, CHINA: Shuangjiang Forest Farm, Ji'an County, 174 m, Jiangxi Province, 10 May 2009, leg. Lin-Da Li. Paratypes: 2 females, same data as holotype except 24 May 2009.

Diagnosis. *Ateleute ferruginea* can be distinguished from all other species of *Ateleute* by combination of the second tergum having circular, concentric striations (Fig. 5) and the following colour pattern: mesopleuron, mesosternum, propodeum, legs and metasoma brown to reddish brown; lateral portions of vertex and upper portion of inner orbits broadly white.

Description. Female. Body length 5.5 to 6.0 mm. Fore wing length 4.0 to 4.5 mm. Antenna length 6.0 to 6.5 mm. Ovipositor sheath length 1.5 to 1.8 mm.

Head. Face (Figure 2) 1.4 to 1.5 times as wide as long, lateral margins almost parallel, with fine granulose texture, median portion weakly convex. Clypeal suture weak. Clypeus evenly convex, with texture as that of face; median section of apical margin almost truncate, slightly concave centrally. Mandible and cheek with fine leathery texture. Mandible short, upper tooth as long as lower tooth. Malar space approximately 0.6 times as long as basal width of mandible. Gena very short, with fine leathery texture, strongly convergent backwardly. Vertex and frons with texture as that of gena. Posterior portion of vertex from hind margin of interocellar area to occipital carina slanted almost vertically, distinctly concave medially. Postocellar line slightly shorter than ocular-ocellar line. Frons almost flat, lower portion nearby antennal socket concave. Antenna longer than body, with 28 to 30 flagellomeres, median portion slightly thickened, ventral profile slightly flat, suddenly shortened from fifth flagellomere (Figure 3). Ratio of length from first to seventh flagellomeres: 8.0:7.9:7.7:6.9:5.6:4.0:3.7. Occipital carina dorso-medially interrupted.

Mesosoma. Pronotum, mesoscutum and dorsal and ventro-posterior portions of mesopleuron with fine granulose texture. Anterior margin of pronotum with indistinct fine longitudinal wrinkles; lateral concavity with indistinct and short transverse wrinkles. Mesoscutum slightly convex, median portion with dense oblique longitudinal wrinkles. Notaulus evident, reaching about 0.7 the distance to posterior margin of mesoscutum. Scutellum weakly convex, with texture as that of mesoscutum, but relatively finer than that; subapical portion with indistinct transverse concavity; lateral carina reaching to the concavity. Postscutellum weakly convex, posterior margin with fine carina-shaped edge. Median portion of mesopleuron (Figure 4) shallow oblique transverse concave. Sternaulus reaching middle coxa, posterior portion weak. Mesopleural fovea indistinct. Posterior transverse carina of mesosternum complete. Metapleuron with dense and unclear granulose texture. Subbasal portion of submetapleural carina triangularly convex, posterior end vanishing. Wings hyaline. Fore wing vein



Figures 1–5. *Ateleute ferruginea* Sheng, Broad & Sun, sp.n. Holotype. Female **1** Body, lateral view **2** Head, anterior view **3** Basal portion of flagella **4** Mesosoma, lateral view **5** Terga 1 to 3.

1cu-a slightly distal of 1/M. Areolet pentagonal, vein 3rs-m disappearing, receiving 2m-cu at its basal 0.3 to 0.4. 2m-cu inclivous, with one bulla. Hind wing vein 1-cu approximately as long as cu-a, cu-a strongly reclivous. Legs slender. Dorsal profiles of tibiae and ventral profiles of tarsomeres with irregular and short spines, the spines separated by more than a spine length. Dorsal apex of hind first trochanter distinctly projecting. Ratio of length of hind first to fifth tarsomeres 5.7:2.4:1.5:0.6:1.0. Claws small. Propodeum with weak and indistinct fine transverse wrinkles. Area petiolaris with weak longitudinal wrinkles. Posterior transverse carina, pleural carinae and lateral carinae of area petiolaris present. Propodeal spiracle small, circular, approximately located basal 0.35.

Metasoma. First tergum 2.1 to 2.2 times as long as apical width, evenly and strongly narrowed toward base, median portion strongly arched, with dense, even and fine longitudinal wrinkles, dorsolateral carinae indistinct, ventrolateral carinae complete. Spiracle located slightly anterior of middle. Second tergum trapeziform, median portion with fine arcuate to circular lines (Figure 5), lateral with fine longitudinal wrinkles. Remaining terga with slightly fine leathery texture. Basal portion of third tergum with fine and weak transverse lines. Ovipositor sheath 0.5 to 0.6 times as long as hind tibia, apex truncated. Apical portion of ovipositor gradually pointed.

Color. (Figure 1) Main body and legs brown to reddish brown, except the following: head, dorsal portion of pronotum and mesoscutum black. Scape, pedicel and flagellomeres 1 to 3 (4) dark brown. Flagellomeres 5 to 7 and apical portion black; 8 to 17 (18) white. Mandible except black teeth, maxillary and labial palpus yellow. Lateral portions of vertex and upper portion of frontal orbits broadly white. Lower portion of pronotum and scutellum darkish brown. Tegula brown. Stigma yellowish brown. Veins brownish black.

Remarks. This new species is similar to *Ateleute mesorufa* Momoi, 1970, but can be distinguished from it by the following combination of characters: areolet receiving 2m-cu at its basal 0.3 to 0.4; scape and pedicel dark brown; all terga entirely brown. *Ateleute mesorufa*: areolet receiving 2m-cu approximately at its middle; scape and pedicel white; apical portions of terga 1 to 3 and spot of tergum 6 white.

***Ateleute zixiensis* Sheng, Broad & Sun, sp.n.**

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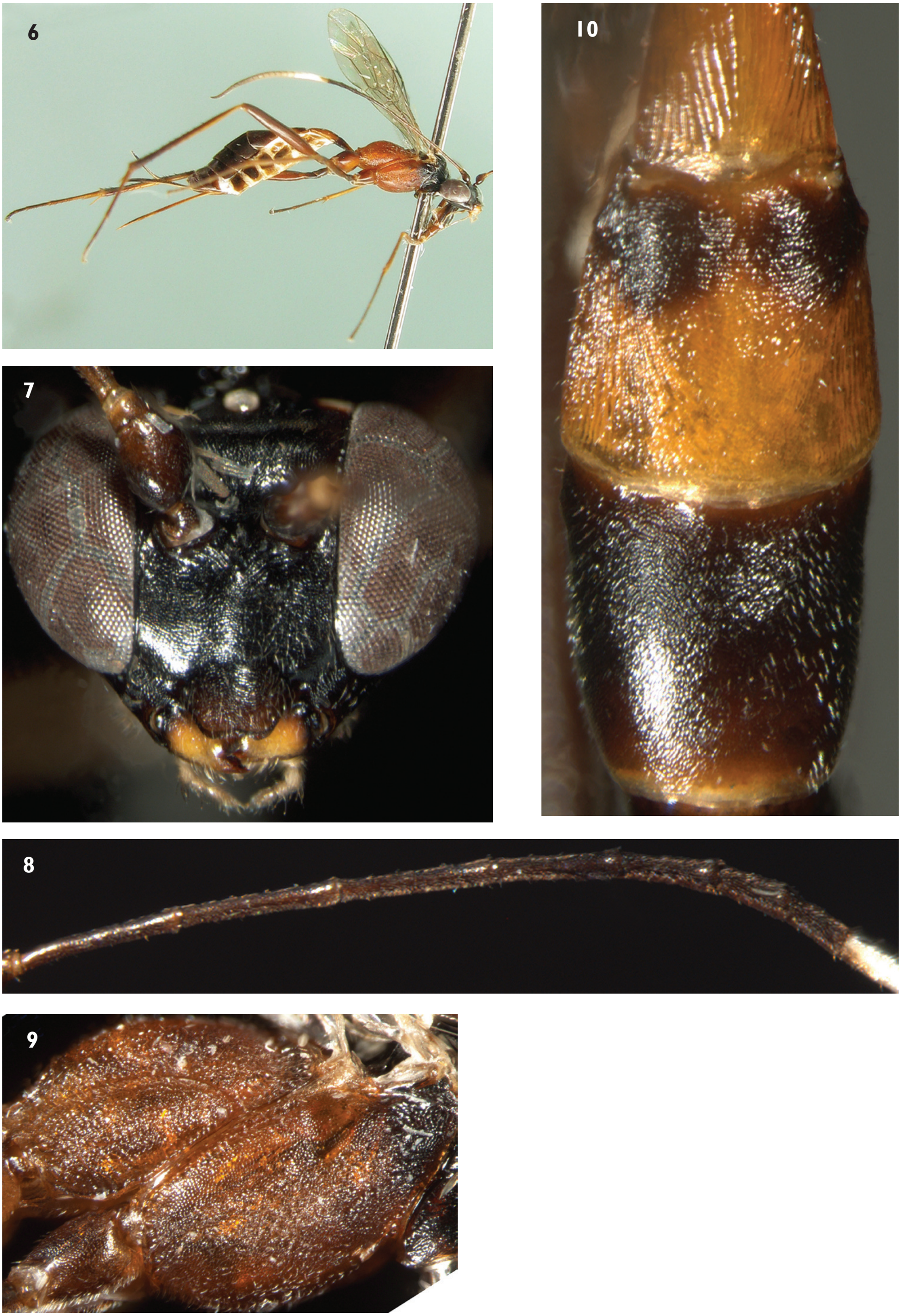
http://species-id.net/wiki/Ateleute_zixiensis
Figures 6–10

Etymology. The specific name is derived from the locality of type.

Types. *Holotype*, Female, CHINA: Zixi County, 174 m, Jiangxi Province, 24 July 2009, leg. Mei-Juan Lou.

Diagnosis. *Ateleute zixiensis* can be distinguished from all other species of *Ateleute* by combination of: malar space approximately 0.9 times as long as basal width of mandible; first tergum 2.6 times as long as apical width; gena, vertex and frons almost



Figures 6–10. *Ateleute zixiensis* Sheng, Broad & Sun, sp.n. Holotype. Female **6** Body, lateral view **7** Head, anterior view **8** Basal portion of flagella **9** Mesosoma, lateral view **10** Terga 1 to 3.

smooth and shining; basal-median portion of second tergum (Figure 10) with fine and almost transverse lines, lateral portion with fine oblique longitudinal lines and the pronotum and main portion of terga black.

Description. Female. Body length about 7.5 mm. Fore wing length about 4.7 mm. Antenna length about 7.8 mm. Ovipositor sheath length about 2.0 mm.

Head. With fine granulose texture. Face (Figure 7) 1.6 times as wide as long, almost flat, with irregular indistinct transverse wrinkles; median portion convex. Clypeal suture weak. Clypeus approximately 1.5 times as wide as long, strongly convex, with sparse and fine punctures; median section of apical margin almost truncate, slightly concave centrally. Mandible short, with fine leathery texture; upper tooth slightly shorter than lower tooth. Malar space approximately 0.9 times as long as basal width of mandible. Gena, vertex and frons almost smooth and shining. Gena very short, strongly convergent backwardly. Posterior portion of vertex, from posterior ocelli to occipital carina, slanted almost vertically. Postocellar line approximately as long as ocular-ocellar line. Upper half of frons almost flat; lower half concave, with fine longitudinal wrinkles. Antenna filiform, with 32 flagellomeres, slightly thickened beyond middle; from middle to subapex with ventral profile slightly flat; suddenly shortened from fifth flagellomere (Figure 8). Ratio of length from first to seventh flagellomeres: 10.0:9.3:9.2:8.0:5.9:4.5:4.2. Occipital carina dorso-medially interrupted widely.

Mesosoma. Pronotum with irregular fine granulose texture; anterior and upper-median portions with longitudinal wrinkles, lower-posterior portion with oblique longitudinal wrinkles. Mesoscutum smooth, with distinct fine leathery texture; median portion rough, with oblique transverse wrinkles. Notaulus evident, reaching about 0.7 the distance to posterior margin of mesoscutum. Scutellum evenly convex, with texture as that of mesoscutum; lateral carina reaching to middle. Postscutellum small, rough, posterior portion with fine and weak transverse edge. Upper portion of mesopleuron (Figure 9) with fine granulose texture; upper anterior portion, under subalar prominence, with oblique transverse wrinkles; Remaining portion rough. Epicnemial carina laterally present on lower half of mesopleuron. Mesopleural fovea vestigial. Median portion of sternaulus present vestigially. Posterior transverse carina of mesosternum complete. Metapleuron rough. Submetapleural carina complete. Wings grayish hyaline. Fore wing vein 1cu-a opposite 1/M. Areolet pentagonal, vein 3rs-m disappearing, receiving 2m-cu at its basal 0.4. 2m-cu straight, inclivous, with one bulla. Hind wing vein 1-cu longer than cu-a, cu-a strongly reclivous. Legs slender. Dorsal apex of hind first trochanter distinctly projecting. Hind tibia except inner side and tarsomeres with short spines, spines on tibia separated by more than a spine length, distance between spines on tarsomeres as long as or shorter than a spine length. Hind fifth tarsomere more or less depressed. Ratio of length of hind first to fifth tarsomeres 10.0:5.0:2.7:1.2:2.0. Claws very small. Propodeum rough, dorsal profile with weak, fine and indistinct transverse wrinkles. Posterior transverse carina and pleural carinae present and strong. Propodeal spiracle small, circular, approximately located at basal 0.3.

Metasoma. First tergum 2.6 times as long as apical width, strongly narrowed toward base, smooth, with dense and fine longitudinal wrinkles. Basal and apical end of dorsolateral carina vestigially present. Ventrolateral carinae complete. Spiracle located slightly before middle of first tergum. Second tergum (Figure 10) rough, basal-median portion with fine and almost transverse lines, lateral portion with fine oblique longitudinal lines. Third tergum with fine granulose texture. Remaining terga almost shining. Fourth and fifth terga with indistinct transverse lines. Ovipositor sheath approximately 0.65 times as long as hind tibia, apex truncate. Apical portion of ovipositor gradually pointed.

Color. (Figure 6) Black, except the following. Scape, pedicel and flagellomeres 1 to 3 brownish black. Flagellomeres 8 to 12 white. Lateral spots of vertex and median portions of mandibles yellowish white. Labial palpus, basal portion and ventral profiles of hind tibia buff. Maxillary palpus, tegula, front and middle legs and hind tarsomeres dark brown. Ventral and dorsal profiles of hind coxa, hind trochanter and femur blackish brown. Mesopleuron except black upper-anterior portion, mesosternum, metanotum, metapleuron, postscutellum and propodeum reddish brown. First tergum except subbasal portion more or less blackish brown, second tergum except large brownish black spot, hind narrow margin of third tergum yellowish brown. Third and the following terga brownish black. Stigma and veins brownish black.

Remarks. This new species is similar in colour to *A. ferruginea* Sheng, Broad & Sun, but can be distinguished from the latter by the following combination of characters: malar space approximately 0.9 times as long as basal width of mandible; first tergum 2.6 times as long as apical width; third and the following terga brownish black (Figure 6). *A. ferruginea*: malar space approximately 0.6 times as long as basal width of mandible; first tergum 2.1 to 2.2 times as long as apical width; terga entirely brown to reddish brown (Figure 1).

Ateleute densistriata **(Uchida, 1955)**

http://species-id.net/Ateleute_densistriata
Figures 11–12

Psychostenus densistriatus Uchida, 1955: 33.

Remarks. The propodeum of the female was described as reddish brown (Momoi 1970). The female specimen, deposited in Osaka Museum of Natural History, Japan, has the apical portion of the propodeum darkish brown and the basal portion brownish black (Figure 12). The specimen, collected from Jiangxi province, China, has the propodeum reddish brown.

Specimens examined. 1 female 1 male, CHINA: Ji'an County, Jiangxi Province, 21 May 2008, leg. Yi Kuang. 1 male, CHINA: Quannan County, 530 m, Jiangxi Province, 28 May 2008, leg. Shi-Chang Li. 1 male, CHINA: Quannan County, 630 m, Jiangxi Province, 7 November 2008, leg. Shi-Chang Li. 18 males, CHINA: Shuangjiang Forest Farm, 174 m, Ji'an County, Jiangxi Province, 25 April to 15 June 2009, leg.

Figures 11–12. *Ateleute densistriata* (Uchida, 1955) **11** Male body, lateral view **12** Female body, lateral view.

Lin-Da Li. 2 males, CHINA: Matubei, 330 m, Quannan County, Jiangxi Province, 27 May 2009, leg. Shi-Chang Li. 3 males, CHINA: Wuyishan, 1170 to 1200 m, Qianshan County, Jiangxi Province, 22 June to 11 July 2009, leg. Zhi-Yu Zhong. 2 males, CHINA: Quannan County, Jiangxi Province, 4 to 11 October 2009, leg. Shi-Chang Li. 1 male, CHINA: Quannan County, Jiangxi Province, 31 May 2010, leg. Shi-Chang Li. 17 males, CHINA: Jiulianshan, 580 m to 680 m, Longnan County, Jiangxi Province, 20 April to 6 June 2011, leg. Mao-Ling Sheng and Shu-Ping Sun. 1 female, CHINA: Shizikou, 200 m to 210 m, Anfu County, Jiangxi Province, 21 June 2011, leg. Zhong-Ping Yu.

Figures 13. *Ateleute spinipes* (Cameron, 1911). Holotype. Male body, lateral view.

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RESEARCH ARTICLE

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A new species of *Quexua* from southeastern Peru (Hymenoptera, Crabronidae)

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Abstract

A distinctive new species of the crabronine wasp genus *Quexua* Pate is described and figured from a single male collected from lowland Amazonian rain forest in southeastern Peru. *Quexua cicra* **sp. n.** is the only species in the genus known with a sessile metasoma.

Keywords

Apoidea, apoid wasp, Crabroninae, Crabronini, new species, taxonomy

Introduction

The Latin American crabronine genus *Quexua* consists of relatively small, dark wasps found from Costa Rica to the State of São Paulo in Brazil (Leclercq 2002). It is easily recognized by the strong carina spanning the height of the gena which ends dorsally in a distinctive tubercle (Fig. 1). First recognized by Pate (1942), the genus has since been revised several times by Leclercq (1955, 1980, 2002, 2005). Information concerning its biology is sparse. Cooper (1986) observed a female of *Quexua verticalis* (F. Smith) enter a burrow in a bank which contained a hymenopteran larva and several adult cicadellid prey. According to him, this implied progressive provisioning which, if true, would be unusual for the tribe. Leclercq (2005) indicated that a specimen of *Q. increta* Leclercq was accompanied by its prey. Apparently disfigured, he supposed it to be a microlepidopteran. Clearly, more observations are needed before much definitive can be said of predatory behavior in the genus. Given the flat form of the pygidial plate throughout the genus, all are likely subterranean nesting; Pate's (1942) contention that the genus likely includes stem and twig-nesting species is doubtful.

The following provides a description and figures for a new species of *Quexua* recently captured in southeastern Peru. It represents the 17th species of the genus and the ninth known from Peru (Pulawski 2011, Rasmussen and Asenjo 2009). It is unique among the genus in several respects, most notably for its sessile metasoma.

Material and methods

The single specimen known is deposited in the Museo Nacional de Historia Natural, Lima, Peru (MUSM). Terminology follows Prentice (1998) for morphological structures and Harris (1979) for integumental sculpture. Measurements were made with an ocular micrometer on a Nikon SMZ800 microscope. Images were captured with a Canon 5DII digital camera attached to a Canon EF-S 60mm f/2.8 macro lens. Comparative material was available for the following species: *Q. cashibo* Pate, *Q. nericata* Leclercq, *Q. pano* Pate, *Q. ricata* Leclercq, and *Q. verticalis* (F. Smith).

Systematics

Genus *Quexua* Pate, 1942

Quexua cicra Bennett sp. n.

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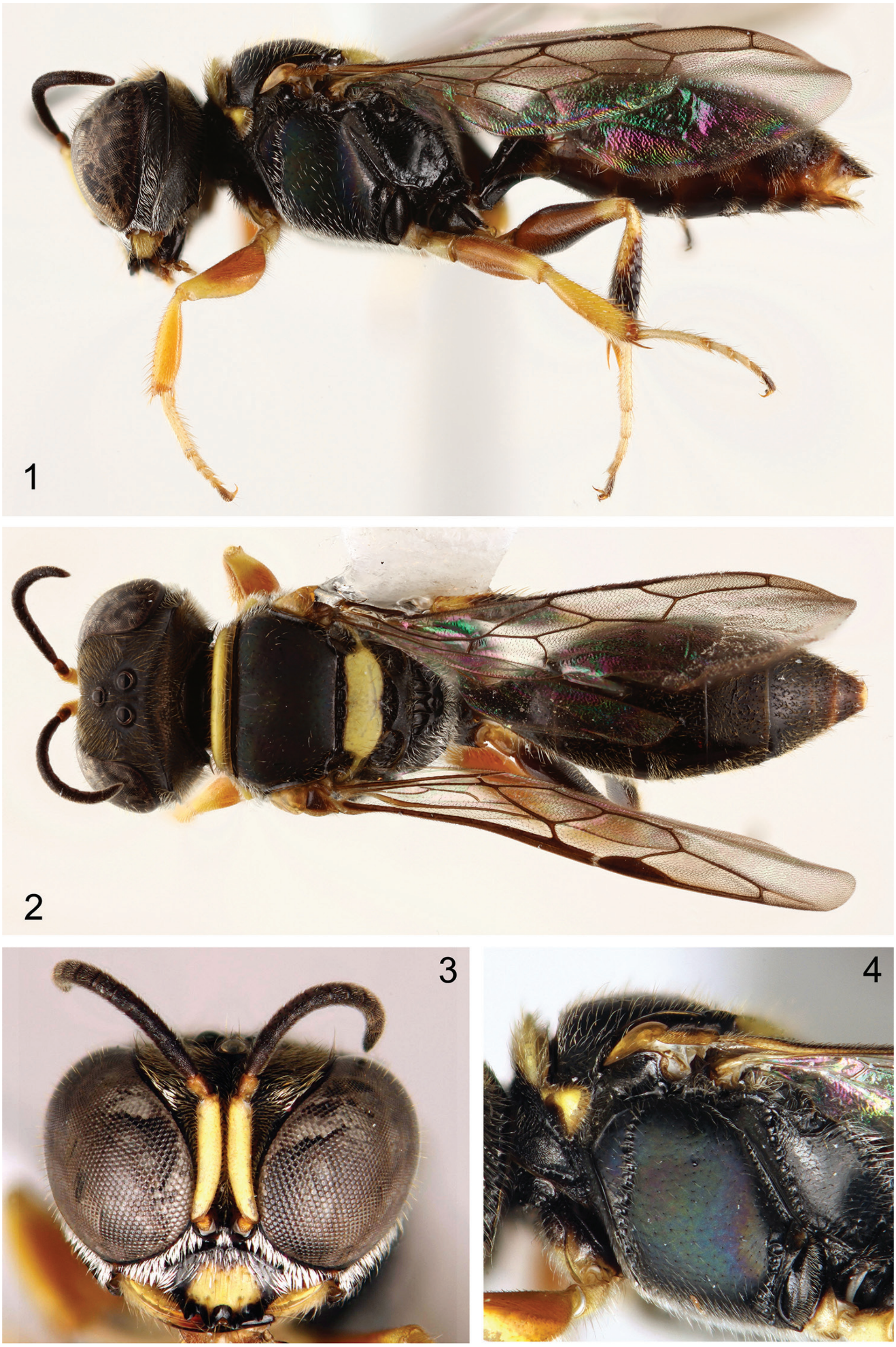
http://species-id.net/wiki/Quexua_cicra
Figs 1–4

Holotype. ♂, Peru: Madre de Dios: CICRA Field Station, 12.5526°S, 70.1101°W, 295 m, 11–13.VII.2010, Chaboo team, ex. flight intercept trap (MUSM).

Diagnosis. The sessile metasoma alone will serve to distinguish this species from its congeners (Figs 1–2). Also of diagnostic significance are the relatively long pubescence of the compound eyes (Fig. 3); mat sculpture and blue-green iridescence of the head, metanotum, and mesopleuron (Fig. 4); and lack of a carina along the inner orbit.

Description. *Male:* Body length 7.3 mm (front of compound eye to apex of pygidial plate); head height 1.5 mm, width 1.8 mm; forewing length 4.8 mm (not including tegula); intertegular distance 2.0 mm (including tegulae). Antennal scape elongate, with a single, weak longitudinal carina on inner side of outer surface; flagellum 11-segmented, each



Figures 1–4. Male holotype of *Quexua cicra* Bennett, sp. n. **1** Lateral habitus **2** Dorsal habitus **3** Facial aspect **4** Mesosoma in lateral view.

article about as long as wide. Clypeus apically with four stout, rounded teeth of similar size (Fig. 3). Toruli separated by less than 1/2 width of torulus, positioned against epistomal sulcus, scapal basin shallow and ecarinate. Facial fovea inconspicuous, roughly size of mid ocellus. Ocellar triangle about as broad as high; mid ocellus slightly smaller than hind ocellus. Gena laterally with strong dorsoventral carina dorsally producing a rounded point. Vertex with narrow pit dorsomedially and low, rounded transverse swelling continuous with more prominent lateral carina of gena. Occipital carina present dorsally, laterally and ventrally; laterally expanded into a lamella and foveate along anterior side (not foveate dorsally), ventrolaterally pointed at a junction between a segment produced towards mandible (mandibular branch of occipital carina of Bohart and Menke [1976]) and a transverse segment meeting the hypostomal margin lateral of midline. Compound eyes converging medially, reaching margins of toruli; with facets larger medially (Fig. 3). Mandible simple and apically acuminate, ventral margin entire (only external surface visible). Labial palpus 4-segmented, first segment longest (about as long as palpomeres II+III); maxillary palpus 6-segmented. Stipes simple, prementum with a median ridge. Pronotal collar rounded, ecarinate, medially slightly depressed (Fig. 2). Mesoscutum with admedian lines distinct but not impressed or ending in foveae, diverging posteriorly; notauli inconspicuous, indicated anteriorly only; parapsidial lines present (Fig. 2). Mesoscutellum and metanotum simple, prescutellar sulcus foveate (9 scallops) (Fig. 2), axillae with sharp edge on inner side. Mesopleuron with postspiracular carina, acetabular carina and omaulus proper present (dorsomedial segment of omaulus absent [that portion mediad junction of omaulus and spiracular carina, crossing omaular area beneath spiracular lobe]); verticaulus, sternaulus, hypersternaulus and mesopleuralus absent; mesepisternal sulcus foveate; scrobe and signum distinct; mesepisternal sulcus foveate over lower 3/4 (Fig. 4). Propodeum anteromedially with six, roughly rectangular enclosures, central pair longest and posterolaterally pointed (Fig. 2); subanteromedially with central fovea surrounded by polished, flat semicircular disk; anterolaterally with about four longitudinal carinae; lateral propodeal carina well developed. Metapleuron smooth (Fig. 4). Forewing marginal cell squarely truncate apically, about as long as submarginal cell, R1 not much extending beyond apex; 1m-cu (recurrent vein) meeting posterior margin of submarginal cell near latter's midpoint; cu-a positioned proximal of M + Cu junction by a distance about equal to that of cu-a (Figs 1–2). Hind wing with two closed cells, medial and submedial, latter not quite half as long as former, medial extending to just short of first hamulus; anterior margin with six hamuli, with a distinct elongate, seta (about twice height of basal hamulus) just basal to first hamulus; claval and jugal lobes well-developed, latter rounded apically and reaching nearly to cu-a. Legs simple and fairly slender, pretarsal claws simple, arolia present; fore and mid femora moderately expanded medially, hind femur less so; midtibial calcar distinct, extended beyond apical margin of mid tibia by about half its length. Metasoma simple, sessile, relatively compact, tergum I about 1.1 × longer than posterior breadth (Figs 1–2); tergal graduli apparently absent; tergum I with oblique lateral carina present, laterotergite pendant but not reaching midline of sternum I; pygidial plate more or less quadrate, flat, apex slightly rounded, lateral margin carinate; sternum I with single median ridge over anterior 3/4; sternum VII evenly and fairly broadly rounded apically.

Black except following areas light brown: tegula, proximal 4/5 of fore and mid femora, inner surface of fore tibia, apical tarsomeres, and hind trochanter in part; darker brown are pedicel ventrally, palpi, wing veins, outer surface of hind femur over proximal 4/5 and metasoma laterally and ventrally; yellow areas are entire scape, clypeus largely (broadly over central area, margins black), mandible in proximal half, pronotum, pronotal lobe, mesoscutellum in full, fore coxa anteroventrally, mid coxa lateroventrally, hind coxa narrowly apicoventrally, trochanters, femora apically narrowly (extended basally on posterior surface of fore and meso femora), outer surfaces of fore and mid tibiae, basal 1/3 of outer side of hind femur, and preapical tarsomeres (Figs 1–3). Wings iridescent and mostly hyaline, browned along leading marginal areas of forewing apically. Mesopleuron (Fig. 4), metanotum and (to a lesser a degree) gena and vertex with a distinct blue-green iridescence.

Pubescence overall sparse, mostly off-white to silver, light brown on metasoma and dorsal portions of head and mesosoma; clypeus laterally with fairly dense silver setae, medially mostly bare except for about four prominent, fairly long, thin, brown setae; compound eyes with sparse yet distinctive, long setae (length equal to about half ocellus diameter) (Fig. 3); propodeum with moderately dense silver setae posterolaterally; wings moderately densely setose apically, less so basally; legs sparsely to moderately spinose, the latter particularly on hind tibia. Metasomal tergum I sparsely setose, remaining terga moderately setose, becoming more dense posteriorly; sterna II–VII sparsely setose posteriorly, with a few conspicuously long setae sublaterally.

Surface sculpture overall very fine. Gena, vertex, mesonotum, mesopleuron, mesoscutellum and metanotum dull mat, weakly and sparsely punctate (Fig. 2). Propodeum, metapleuron, legs, sterna (more or less) and terga nitid (characterization of the terga possibly in error, at least partially influenced by residue); tergum I smooth, sparsely and weakly punctate; sterna II–VII imbricate.

Female: Unknown.

Etymology. The specific epithet refers to the field station adjacent to the type locality of this species and is treated as a noun in apposition. CICRA (also known as Los Amigos Biological Station) is an acronym for Centro de Investigación Capacitación Río Los Amigos.

Comments. This is the first species of the genus known to have a sessile metasoma. In all others, the length of the first metasomal tergum is distinctly greater than its posterior breadth. Also notable, and possibly unique, are the widespread mat, iridescent sculpture and the length of pubescence of the compound eyes (at least much greater than the *Quexua* species listed above). It is hoped that a female is soon captured and that biological observations of the genus at large will be made.

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Leioproctus rosellae sp. n., the first record of the genus from northern South America (Hymenoptera, Colletidae)

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Abstract

Leioproctus Smith is a diverse colletine genus found in the Australian region and primarily temperate areas of South America. A new species of *Leioproctus* subgenus *Perditomorpha* Ashmead, *L. rosellae* Gonzalez, **sp. n.**, from a tropical dry forest of the Caribbean coast of Colombia is described and figured. This is the first record of the genus from northern South America.

Keywords

Anthophila, Apoidea, *Bicolletes*, Paracolletini, taxonomy

Introduction

The purpose of this paper is to describe a new species of the Paracolletini genus *Leioproctus* Smith (*sensu* Michener 2007) from a tropical dry forest of the Caribbean coast of Colombia. *Leioproctus* is a species-rich genus found in the Australian region and primarily temperate areas of South America. It consists of more than 300 species grouped into 35 subgenera (Michener 2007) that are treated at the generic level by some authors (e.g., Almeida 2008; Moure et al. 2008; Ascher and Pickering 2011). In South America, species of the 18 subgenera of *Leioproctus* are currently known from Chile and Argentina to central Peru and northeastern Brazil (Michener 2007; Moure et al. 2008; Ascher and Pickering 2011); thus, this Colombian record considerably extends the distribution of the genus in the Western Hemisphere.

Leioproctus s.l. is "a practical solution to an uncomfortable problem", as stated simply by Michener (2007) [quotations added]. The genus has long been suspected to be paraphyletic (Michener 1989, 2007), and a recent higher level phylogenetic analysis of Colletidae using molecular data supports this view (Almeida and Danforth 2009). It may seem straightforward to treat all subgenera of *Leioproctus* s.l. at the generic level to solve this problem, as adopted by other authors and suggested by Almeida and Danforth (2009), but work still remains to develop a stable, informative generic and subgeneric classification. Some authors (e.g., Silveira et al. 2002; Moure et al. 2008) not only recognize at the generic level all South American subgenera of *Leioproctus sensu* Michener (2007), but also those unusual species or species groups synonymized by him (e.g., *Belopria* Moure, *Edwyniana* Moure). The recognition of such unusual species or species groups at the generic level seems an unnecessary splitting that conveys little information regarding phylogenetic relationships. Others authors (i.e., Ascher and Pickering 2011), recognize only some of Michener's subgenera at the generic level while synonymizing others. This is the case for *Perditomorpha* Ashmead, the largest subgenus of *Leioproctus* in South America containing more than 40 described species. Michener (1989) synonymized *Bicolletes* Friese, *Edwyniana*, and *Belopria* with *Perditomorpha* given the morphological variation among species and the existence of taxa with intermediate morphologies among groups. However, Ascher and Pickering (2011) treat *Perditomorpha* at the generic level, with the inclusion of *Bicolletes* Friese, *Perditomorpha* s. str. and *Kylopasiphae* Michener as only subgenera; *Kylopasiphae* is included here even though it is considered a separated subgenus by Michener (1989, 2007) or genus by Moure et al. (2008).

The species described herein belongs to *Perditomorpha* (*sensu* Michener 2007), a taxon currently known from both sides of the Chilean and Argentinean Andes, north to Peru and Bolivia, and the state of Ceará, Brazil (Michener 2007). The Colombian species is allied to the *neotropicus* species group, an assemblage containing the majority of *Perditomorpha* species that are or have been placed in the genus or subgenus *Bicolletes*. Thus, depending of the classification followed, the new species could be described as a member of *Leioproctus*, *Perditomorpha* or *Bicolletes*. Until a comprehensive morphological phylogenetic study is done to help us evaluate the relative merits of recognizing separate genera within this group of colletines, we have conservatively decided to follow Michener's generic and subgeneric classification of *Leioproctus*.

The presence of this new species in the dry forests of the Colombian Caribbean is interesting but not surprising given that bees from this region are poorly collected and underrepresented in collections. Tropical dry forests in Colombia are primarily found along the Caribbean coast and the valleys of the Magdalena and Cauca rivers (Espinal and Montenegro 1977). These forests are known to contain not only several endemic species [e.g., *Acamptopoeum colombiensis* Shinn] but, recently, also taxa previously unknown from South America or restricted to southern South America. For example, the osmiine genus *Heriades* Spinola (Megachilidae), a taxon previously known from North and Central America (Gonzalez and Griswold, personal observations), and the oil-collecting genus *Tapinotaspoides* Moure (Apidae, Tapinotaspidini), previously known from Argentina and Paraguay and southeastern Brazil, have been recently collected in these coastal forests (Gonzalez and Ospina 2006; Melo and Aguiar 2008). Such records, as well as the species described here, suggest the existence of an interesting bee fauna that deserves to be thoroughly explored.

Material and methods

Morphological terminology follows that of Engel (2001, 2009) and Michener (2007). As in Engel (2009), the projections from the inner metatibial spur are herein called branches, instead of teeth. Measurements were taken using an ocular micrometer on a Leica® MZ12 stereomicroscope. Photomicrographs were taken using a Keyence® VHX-500F Digital Imaging System.

Systematics

***Leioproctus* (*Perditomorpha*) *rosellae* Gonzalez, sp. n.**
urn:lsid:zoobank.org:act:093B2989-D44D-4F90-B245-9693AB38335F
http://species-id.net/wiki/Leioproctus_(Perditomorpha)_rosellae
Figs 1–5

Holotype. ♀, Colombia: Magdalena, Santa Marta, via a Nenguange, cerca a Bonda [11°24'N, 74°12'W], Enero 3, 2007, J. Florez. Deposited in the Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá, Colombia.

Diagnosis. The female of this species belongs to the *neotropicus* species group *sensu* Michener (2007) mainly distinguished by the coarsely pectinate inner metatibial spur and weakly developed sternal scopa. It can easily be recognized by the following combination of characters: inner metatibial spur with few, elongate branches (Fig. 5); scutum uniformly punctate, with coarse punctures separated by a puncture width or less (Fig. 3); metasomal terga largely impunctate, with minute, faint, scattered punctures, without integumental or apical hair bands (Fig. 4); body pubescence ferruginous; and tibial scopa with sparse, long (2.5–3.0 times median ocellar diameter), apically branched hairs. Among species of the *neotropicus* group, *L. rosellae* resembles those having an inner metatibial spur with few (8 or less), elongate branches such as the Argentinean species *L. neotropicus* (Friese) and *L. stilborhinus* (Moure). However, those species have

Figures 1–5. Female holotype of *Leioproctus* (*Perditomorpha*) *rosellae* Gonzalez, sp. n. **1** Lateral habitus. **2** Frontal view **3** Detail of scutum and scutellum **4** Detail of metasoma in dorsal view **5** Left metatibial spurs.

a different combination of characters, have the clypeus and scutum sparsely punctate, and the metasomal terga more coarsely and densely punctate than in *L. rosellae*.

Description. *Female*: Body length 6.56 mm; forewing length 5.0 mm; head width 2.23 mm. Head 1.2× wider than long; inner orbits of compound eyes slightly converging below (Fig. 2); intertorular distance 1.6 times median ocellar diameter, 1.2 times length of torulorbital distance; torulus diameter subequal to median ocellar diameter; ocellocular distance 2.5 times median ocellar diameter, 1.8 times greater than ocelloccipital distance; interocellar distance subequal to ocellocular distance, about 2.4 times median ocellar diameter; compound eye about twice as long as broad; clypeus about twice as broad as long, flat in profile view; gena 0.8 times narrower than compound eye in profile; supraclypeal area gently convex; frontal line distinct, carinate just above inferior torular margin to one-half distance between upper torular margin and median ocellus, ending at that point; facial fovea absent; scape 4.1 times longer than broad; antennal flagellum about twice as long as scape; pedicel subequal to first flagellomere, slightly longer than broad, first flagellomere 1.2 times longer than broad, about twice as long as F2 and F3 individually, remaining flagellomeres broader than long, except last flagellomere longer than broad; glossal lobes broader than long; labial palpus four-segmented; maxillary palpus six-segmented. Propodeum with subhorizontal basal area about as long as metanotum, marginal groove continuous, not pitted; protibial spur with apical portion of rachis long, about half of malus length, with distinct row of 5 elongate branches (not including apical portion of rachis); basitibial plate with apex rounded; mesotibial spur gently curved apically, ciliate, more than one-half of mesobasitarsus length; inner metatibial spur straight, pectinate (Fig. 5), with distinct row of 7 elongate branches on left spur, 5 on right spur (not including apical portion of rachis); pretarsal claws cleft, inner ramus shorter than the outer; arolia present in all legs; forewing with basal vein distal to cu-v.

Color black, except outer surface of mandible and anterior surface of antennal flagellum yellowish and the following areas light to dark reddish brown: antennal scape, tegula, legs excluding coxae and trochanters, and metasoma. Wing membranes brownish, veins and pterostigma dark brown.

Pubescence light ferruginous, whitish on face. Head with short (less than median ocellar diameter), sparse, plumose hairs except long (≤ 2 times median ocellar diameter), simple, stout hairs on preapical margin of clypeus. Pronotal lobe, mesepisternum dorsally, scutum, scutellum, and metanotum with strongly plumose hairs partially obscuring integument; hairs long (≥ 2 times median ocellar diameter) on scutellum, metanotum, posterior surface of propodeum, and mesepisternum ventrally; femoral and tibial scopa with sparse, long (2.5–3.0 times median ocellar diameter), apically branched hairs (cf. Michener 2007; fig. 13-1a); inner surface of metatibia with simple, shorter hairs than on scopa. Metasomal terga mostly bare, with scattered, minute (~0.2 times median ocellar diameter), erect simple hairs on discs, hairs becoming longer, denser and branched towards apical terga, longer and denser on fifth and sixth terga (Figs. 1, 4); second to fifth metasomal sterna distally with long (about 3 times median ocellar diameter), poorly branched hairs.

Integument in general smooth and shiny between punctures, weakly imbricate on metasomal sterna. Outer surface of mandible with sparse, minute punctures; clypeus with larger punctures than on mandible separated by 1–2 times a puncture width; supraclypeal area with sparser punctures than on clypeus; subantennal area and inferior paraocular area with punctures separated by a puncture width; frons with small punctures separated by 1–2 times a puncture width, punctures becoming smaller towards interocellar area; vertex with coarse punctures separated by a puncture width or less; gena with faint, small punctures separated by more than two times a puncture width. Scutum uniformly punctate, punctures coarser than on vertex, separated by a puncture width or less; scutellum sparsely punctate on disc; axilla with small punctures separated by a puncture width or less (Fig. 3); metanotum with large punctures as on scutum separated by a puncture width or less; mesepisternum with punctures separated by more than two times a puncture width; metepisternum minutely punctate. Propodeum impunctate basally, posterior surface with coarse, scattered punctures, punctures becoming sparser and faint on lateral surface. Metasomal terga largely impunctate, with minute, faint, scattered punctures on discs, punctures coarser and denser on fifth tergum; distal margins of terga shiny, smooth and impunctate except on apical terga; sterna with coarse, scattered punctures.

Male: Unknown.

Etymology. This species is named after my newly born daughter Rosella Amparo Betancourt, who was born July 28, 2011, and has already brought us immeasurable love and joy.

Comments. The holotype is in somewhat poor condition. The left foreleg is missing, the distal margins of the wings are worn out, and the hairs are plastered against the integument (Fig. 1). It is likely that *L. rosellae* also occurs along the valleys of the Magdalena and Cauca rivers where tropical dry forests occur. Such a distribution pattern is exhibited by some solitary (e.g., *Anthidium sanguinicaudum* Schwarz) as well as social bees [e.g., *Melipona favosa* (Fabricius), *Frieseomelitta paupera* (Provancher)] that also inhabit the same type of forests (Gonzalez, personal observations).

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RESEARCH ARTICLE

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A new bush anole (Iguanidae, Polychrotinae, *Polychrus*) from the upper Marañon basin, Peru, with a redescription of *Polychrus peruvianus* (Noble, 1924) and additional information on *P. gutturosus* Berthold, 1845

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Abstract

We herein describe a new colorful species of *Polychrus* with a conspicuous sexual dimorphism from the dry forest of the northern portion of Región de La Libertad, Peru. The new species differs from all other *Polychrus* species, in that this species has very small dorsal scales and thus a higher number of scales around midbody and in the middorsal line from behind the occipital scales to the level of the posterior edge of the thigh. Furthermore, we redescribe *P. peruvianus* whose original description is short and lacks information on intraspecific variation and sexual dimorphism. Also, we add some information on intraspecific variation and ecology of *P. gutturosus*. Finally, we synonymize *P. spurrelli* Boulenger with *P. gutturosus.*

Resúmen

Describimos una colorida nueva especie de *Polychrus*, caracterizada por un acentuado dimorfismo sexual, proveniente de los bosques secos situados en la porción noreste de la Región de La Libertad en Perú. Esta nueva especie se diferencia de las otras especies de *Polychrus* por poseer escamas dorsales muy pequeñas que se presentan en mayor cantidad, alrededor de la zona media del cuerpo y a lo largo de la línea media dorsal, desde detrás de las escamas occipitales hasta el borde posterior de los muslos. Además, redescribimos la especie *P. peruvianus*, debido a su breve descripción original que no incluye información sobre la variación intraespecífica ni el dimorfismo sexual. También agregamos información sobre la variación intraespecífica y ecología de *P. gutturosus*. Finalmente, optamos por sinonimizar *P. spurrelli* Boulenger con *P. gutturosus*.

Keywords

Andes, dryforest, new species, lizard, bush anoles, reptiles, *Polychrus jacquelinae sp. n., Polychrus peruvianus, Polychrus gutturosus, Polychrus spurrelli*

Introduction

The polychrotine iguanid lizards of the genus *Polychrus* (Cuvier, 1817) occur in Central America northward to Nicaragua and in large parts of South America, on both sides of the Andes (Avila-Pires 1995). The genus is composed of six species: *Polychrus acutirostris* Spix, 1825; *P. femoralis* Werner, 1910; *P. gutturosus* Berthold, 1845; *P. liogaster* Boulenger, 1908; *P. marmoratus* (Linnaeus, 1758); *P. peruvianus* (Noble, 1924), of which four are believed to occur in Peru (*P. femoralis, P. liogaster, P. marmoratus*, and *P. peruvianus*). Boulenger (1914) described *Polychrus spurrelli* as a seventh species in the genus which is, however, currently considered to be a subspecies of *P. gutturosus* by many herpetologists (e.g. Parker 1935, Peters 1967, Peters and Donoso-Barros 1970, 1986). However, the status of this taxon is still unclear.

Although the existence of all the currently recognized species in the genus has been known for quite a long time, with the latest discovered species being described more than 86 years ago (Noble 1924), little is still known about most of the species. Original descriptions of all species in this genus are brief and lack information on intraspecific variation and sexual dimorphism. Therefore, they seem to be inadequate by today's standards.

Avila-Pires (1995) gave detailed redescriptions of *Polychrus acutirostris, P. liogaster* and *P. marmoratus.* Savage (2002) gave a more detailed redescription of an unknown number of male and female specimens of *P. gutturosus* but, as did the original description (Berthold 1845), he failed to provide scale counts. Taylor (1956) provided a detailed description with some measurements and scale counts on two individuals but the small number of specimens still tells little regarding variation. We examined 27 specimens from museum collections and will herein provide more information on intraspecific variation based on measurements and scale counts.

We further redescribe *Polychrus peruvianus*, a comparatively common species which occurs in northern Peru and southern Ecuador. Originally, Noble (1924) described this species as belonging to a new genus *Polychroides*, and thus did not compare it with other species of the genus *Polychrus*, where it was later placed by Etheridge (1965). The original description is based on only a single male individual and thus information on intraspecific variation and on female specimens is still lacking. Yánez-Muñoz et al. (2006) and Schlüter (2010) recently provided a brief diagnoses for this species but failed to provide a comprehensive description.

To contribute to the knowledge of the herpetofauna of Andean dry forests, three of the authors (P. J. Venegas, A. W. Garcia Bravo, and C. Koch) surveyed the inter-Andean valleys of the upper Marañon basin between March 2008 and November 2010. The investigations resulted in the discovery of an obviously undescribed species of *Polychrus* which is described herein. During their fieldwork, they also collected 47 *P. peruvianus* and were able to note several important data on the natural history of this species.

Materials and methods

All collected specimens were preserved in 96% ethanol and stored in 70% ethanol. The new species is described on the basis of 6 collected specimens (2 males and 4 females). The redescription of *Polychrus peruvianus* is based on 47 specimens (24 males, 23 females), and the information given on *P. gutturosus* is based on 27 specimens (10 males, 15 females, 2 undefined juvenile) including the holotype. We further examined the two female syntypes of *P. spurrelli* and two male specimens that were deposited under this species epithet in the British Museum of Natural History, London, England.

Comparative data for other *Polychrus* species were taken from Avila-Pires (1995), in addition to the examination of preserved specimens housed in the Museo de Historia Natural San Marcos, Lima, Peru (MUSM), the Centro de Ornitología y Biodiversidad, Lima, Peru (CORBIDI), the Senckenberg Forschungsinstitut und Naturmuseum, Frankfurt, Germany (SMF), the Museo de Zoología de la Pontificia Universidad Católica del Ecuador, Quito, Ecuador (QCAZ), the División de Herpetología, Museo Ecuatoriano de Ciencias Naturales, Quito, Ecuador (DHMECN), the British Museum of Natural History, London, England (BM), the Muséum d'Histoire Naturelle, Geneva, Switzerland (MHNG), and the Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany (ZFMK). All measurements of the head, body, and limbs were taken with a Vernier caliper (to the nearest 0.1 mm), tail measurements were taken with a tape measure. To facilitate comparison within the genus we tried to structure our species descriptions analog to that of Avila-Pires (1995) and used the same terminology in the diagnoses and descriptions. In the tables, ranges of morphometric and pholidosis characters are presented, followed by mean values and standard deviations in parenthesis.

Altitudes above sea level and geographic coordinates were determined with a GPS (Garmin GPSMap 60CSx) using the geodetic datum WGS84. Humidity and air temperatures were taken with a digital thermo-hygrometer (Extech) with an external sensor.

Results

Polychrus jacquelinae sp. n.

urn:lsid:zoobank.org:act:A5E0F6FD-F3A5-4DDE-9827-9D3D485E4682
http://species-id.net/wiki/polychrus_jacquelinae

Holotype. CORBIDI 7725 (Fig. 1A–E, 2A,B), an adult male from a new road, that was still under construction and is intended to connect San Vicente/Pusaq and Uchumarca (06°59'S, 77°54'W, approximately 1460–1570 m above sea level), Province Bolivar, Región de La Libertad, Peru, collected by W.A. Garcia Bravo on 01 July 2010.

Paratypes. CORBIDI 5742 (Fig. 2D) and CORBIDI 7724, two adult females collected with the holotype; ZFMK 91763 (Fig. 2C) subadult male and ZFMK 90834, ZFMK 91764 (Fig. 2E) two adult females from the type locality, collected by W.A. Garcia Bravo and C. Koch on 24 April 2009.

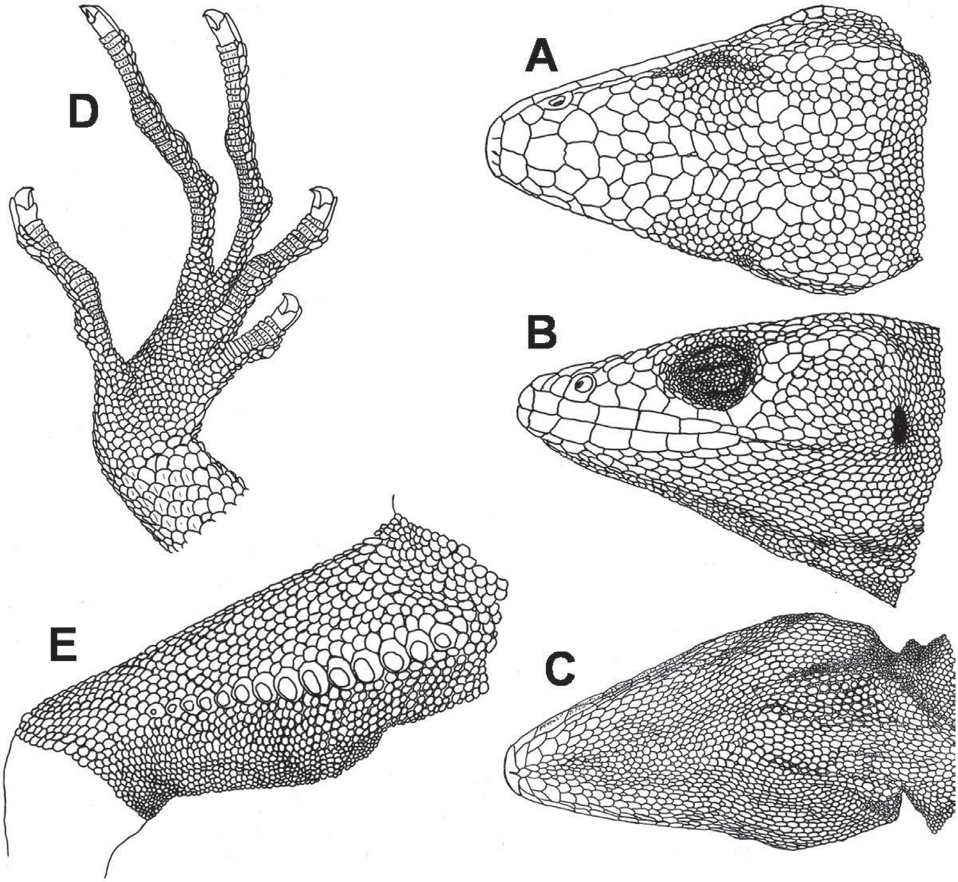

Figure 1. Male holotype of *Polychrus jacquelinae* sp. n. CORBIDI 7725 dorsal **A**, lateral **B** and ventral **C** views of head, ventral aspect of right foot **D**, ventral view of right thigh with femoral pores **E**.

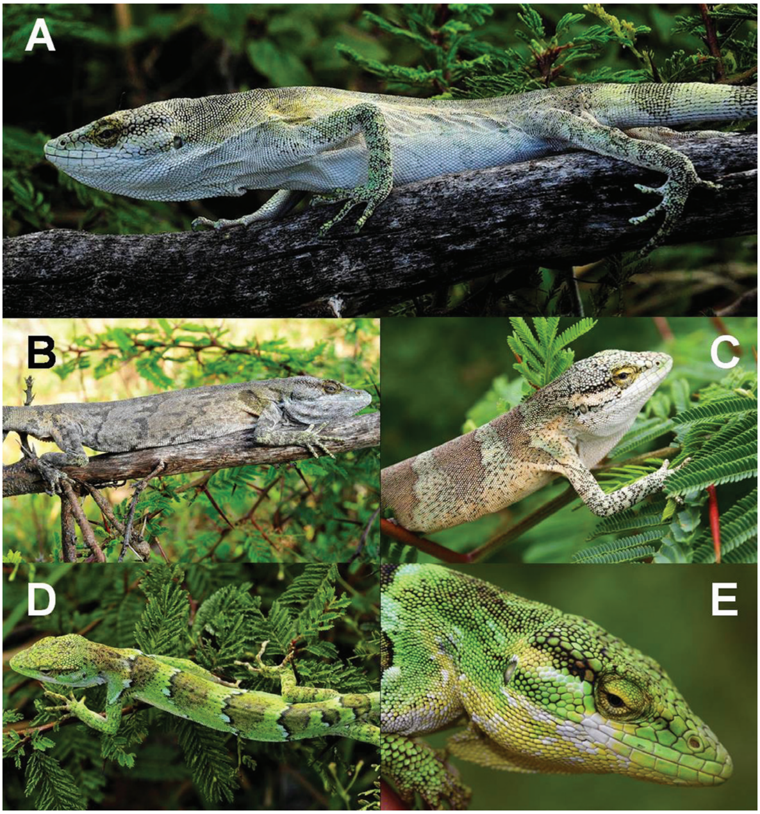

Figure 2. *Polychrus jaqcuelinae* sp. n. from La Libertad, Peru: male holotype CORBIDI 7725 with normal colouration **A** photograph by M. León, in stress colouration **B** photograph by M. León, subadult male **C** ZFMK 91763, female **D** CORBIDI 5742, photograph by M. León, close-up of the head of one female **E**, ZFMK 91764.

Diagnosis. (Tab. 1). (1) A *Polychrus* with a maximum known snout-vent-length (SVL) of 144 mm; (2) dorsal and gular crests absent; (3) 131 to 186 scales around midbody; (4) 198 to 215 scales in middorsal row from behind the occipital scales to the level of the posterior edge of the thigh; (5) femoral pores 13 to 15 on one side; (6) lamellae on finger IV 33–36; (7) lamellae on toe IV 42–48; (8) tail 2.13–2.33 times SVL; (9) dorsal and ventral scales small and smooth (10) a prominent sexual dichromatism present.

Polychrus jacquelinae sp. n. differs from other species of *Polychrus* by having more than 130 scales around midbody and more than 198 scales in middorsal row from behind the occipital scales to the level of the posterior edge of the thigh (*P. acutirostris* has fewer than 73 and 126 scales; *P. femoralis* fewer than 100 and 156; *P. gutturosus* fewer than 81 and 105; *P. liogaster* fewer than 95 and 125; *P. marmoratus* fewer than 90 and 118; and *P. peruvianus* fewer than 74 and 70 (paravertebrals), respectively). Furthermore, the new species is easily distinguished from *P. acutirostris* and *P. femoralis* by the absence of keeled ventral scales; from *P. gutturosus* by the absence of multicari-

Table 1. Summary of morphometric and pholidosis characters of *Polychrus jacquelinae* sp.n.

Sex	All (n=6)	Males (n=2)	Females (n=4)
Axilla-groin length/SVL	0.46–0.55 (0.48 ± 0.03)	0.46–0.5 (0.48 ± 0.03)	0.48–0.55 (0.51 ± 0.03)
Head length/SVL	0.23–0.25 (0.24 ± 0.01)	0.25 (0.25 ± 0.00)	0.23–0.24 (0.24 ± 0.01)
Head length/Head width	1.46–1.63 (1.55 ± 0.06)	1.51–1.56 (1.54 ± 0.04)	1.46–1.63 (1.56 ± 0.08)
Head width/Head height	0.98–1.1 (1.03 ± 0.05)	1.01–1.06 (1.04 ± 0.03)	0.98–1.1 (1.03 ± 0.06)
Tail length/SVL	2.13–2.33 (2.23 ± 0.08)	2.16–2.22 (2.19 ± 0.04)	2.13–2.33 (2.25 ± 0.09)
Scales around midbody	131–186 (164.17 ± 20.45)	139–186 (162.5 ± 33.23)	131–149 (138 ± 7.87)
Vertebral scales	198–215 (206.17 ± 6.94)	198–202 (200 ± 2.83)	202–215 (209.25 ± 6.29)
Gular scales	72–83 (75.67 ± 4.18)	73–83 (78 ± 7.07)	72–78 (74.5 ± 2.65)
Diameter eye/head length	0.17–0.23 (0.19 ± 0.02)	0.18–0.19 (0.18 ± 0.01)	0.17–0.23 (0.19 ± 0.03)
Subdigitals finger IV	33–36 (34.67 ± 1.21)	34–35 (34.5 ± 0.71)	33–36 (34.75 ± 1.5)
Subdigitals toe IV	42–48 (45.33 ± 2.16)	46–47 (46.5 ± 0.71)	42–48 (44.75 ± 2.5)
Forelimbs/SVL	0.38–0.46 (0.42 ± 0.07)	0.41–0.42 (0.42 ± 0.01)	0.38–0.46 (0.42 ± 0.03)
Hindlimbs/SVL	0.51– 0.59 (0.53 ± 0.07)	0.51–0.53 (0.52 ± 0.01)	0.52–0.59 (0.54 ± 0.04)
Femoral pores (left)	13–15 (14 ± 0.63)	14 (14 ± 0)	13–15 (14 ± 0.82)

nate ventral scales and by the presence of very small gular scales; from *P. liogaster* and *P. marmoratus* by the presence of a sexual dimorphism in colouration (absent in the two latter species); and from *P. peruvianus* by the absence of vertebral and gular crests.

Description of holotype. Adult male with a snout-vent-length (SVL) of 140.5 mm. Head 0.25 times SVL, 1.51 times longer than wide, as wide as high. Snout pointed; canthus rostralis distinct posteriorly. Neck narrower than the head, and almost as wide as the anterior part of the body. Body compressed. Limbs well developed, forelimbs 0.41 times SVL, hindlimbs 0.53 times SVL, tibia 0.17 times SVL. The tail almost round in cross section, tapering toward the tip; 2.22 times SVL. Rostral trapezoid, almost two times as wide as high, visible from above. Posterior margin with 3 sutures that do not partition the rostral, bordered posteriorly by 2 large scales. Scales on snout heterogeneous in size, irregularly polygonal, juxtaposed, flat, rugose, some are swollen; 3 scales across snout between second canthals. 3 canthals between nasal and supraciliaries, anterior one wide. Supraorbital semicircles more or less distinct, with 9–10 scales, separated medially by 1 row of scales, slightly smaller in size than those of supraorbital semicircles (Fig. 1A). Scales on supraocular region distinctly smaller than those on snout, polygonal to rounded, juxtaposed, flat, and smooth, irregularly arranged, except for a row of smaller scales adjacent to supraciliaries. Supraciliaries 12–13, juxtaposed, smooth, anterior ones slightly longer; in a continuous series with canthals. 15 supraoculary scales on the dorsal surface of the orbit counted in a transverse line across its greatest width. Scales on parietal region, irregular polygonal, some almost rounded, juxtaposed, flat, smooth, intermediate in size between those on snout and on supraocular region. Scales on interparietal region polygonal, juxtaposed, rugose, some are somewhat swollen. Parietal eye absent. Loreal region with two scales. Nostril directed laterally, in the centre of a single nasal. Nasal in contact with second supralabial. 5 internasals. Eye diameter 0.18 times as long as head length. Eyelids partially fused, covered by granules of almost same size throughout the eyelids. A continuous series of 2 preoculars, 3–4 suboculars, which are in direct contact with supralabials, and 4 postoculars. Supralabials 7; followed to commissure of mouth by 1–2 relatively small scales. Temporal region with polygonal or rounded, juxtaposed, flat, and smooth scales, smaller toward the ear opening; delimited dorsally by a single row of enlarged supratemporal scales. Ear opening vertically oval, with smooth margin; tympanum superficial (Fig. 1B).

Mental bell-shaped, almost 2.5 times as wide as high, posterior half divided by a median sulcus. Postmentals 3, lateral ones distinctly larger than median scale. Infralabials 6; followed to commissure by 2–3 distinctly smaller scales. Lateral scales on chin almost the same size as those on median part of chin, irregular polygonal, juxtaposed, flat, smooth, and slightly convex. No elevated scales on the median part of chin and gular region present. Gular fan has scales the same size and structure as chin scales, which are separated from each other by an extensible skin covered with granules (Fig. 1C). Gular fan reaches level of forelimbs. 73 gular scales in transverse line between the two tympani.

Scales on nape anteriorly relatively small, granular and almost rounded, juxtaposed, convex; posteriorly grading into dorsals. Scales on the sides of the neck are slightly larger than those on the nape, merging ventrally with the gulars. Dorsals polygonal to rounded, juxtaposed, flat, to some extent convex; 198 scales in a mid-dorsal line between the occiput and the posterior margin of the hindlimbs. Scales on flanks are of a similar size and same shape as those of dorsum, convex, smooth, in poorly defined, oblique rows. Ventrals larger than dorsals, flat, smooth, lanceolate, and imbricate, in poorly defined, oblique and transverse rows. A gradual transition between dorsal, lateral and ventral scales. Scales around midbody 186. Preanal plate has scales which are smaller than ventrals, approximately the same size as dorsals. Preanal pores absent. Femoral pores 14 per side, almost in the centre of a slightly larger scale (Fig. 1E).

Tail has rhomboid, flat, sharply keeled scales, distinctly larger than the dorsals, arranged in longitudinal and oblique rows; keels aligned longitudinally; on ventral surface of the tail, scales are slightly larger and more rectangular. Tail not regenerated ending somewhat bluntly.

Scales on forelimbs slightly larger than dorsals, polygonal to rounded, flat, smooth, mostly imbricate but more juxtaposed on upper arm; slightly smaller on ventral aspect of forearms; towards posterior aspect ventrals become smaller. Scales on hindlimbs are as large as dorsals, polygonal to rounded, flat, smooth, imbricate on thigh and ventrally, juxtaposed on dorsal surface of tibia, slightly larger and slightly keeled on ventral part of tibia, and slightly lanceolate; toward posterior aspect of thighs, both dorsally and ventrally, scales become distinctly smaller. Subdigital lamellae of fingers and toes single, short, multicarinate, 35 under fourth finger, 47 under fourth toe (Fig. 1D).

Measurements of holotype (in mm). Snout-vent length 140.5; axilla-groin length 64; length of leg 74; length of arm 58; length of tail 311.5; body height at midbody 25.3; body width at midbody 22.4; length of head 35.7; height of head 23.4; width of head 23.7; length of snout 25; diameter of eye 6.3; distance from tip of snout to anterior margin of nostril 7.1; distance from nostril to eye 7.9; distance from eye to ear 14.

Colouration of holotype. In life, when unstressed (Fig. 2A), the dorsal surface of the head of the male holotype is grey to greenish-grey on the snout and the parietal region, muddy yellow on the frontal region and more or less shiny yellow on the supraocular region. Most of the dorsal head scales as well as the dorsal body scales have dark edges. The sides of the head are white to slightly yellow. The granules on the eyelids and the scales surrounding the eye are shiny yellow. The dorsum is pale grey, and in some parts fades to a pale yellow or pale green with hardly any special markings, except for some slightly darker saddle blotches. The body parts above and behind the insertion of the front legs are almost as shiny yellow as the granules of the eyelids. The dorsal surface of the limbs is pale grey-green and of the tail white-grey. The tail is ringed with 12 darker grey bands, with each band being 10–13 scales in width, and thus of the same width as the ground coloured interspaces. The bands are indistinct at the beginning but become more distinct towards the tip. The chin scales, gular fan, venter and ventral surface of the limbs are white.

Under stress (Fig. 2B), colouration of whole body changes into a moderate grey, being the darkest in the middorsal region. Colouration grades laterally into beige, especially behind the limbs, with darker, frazzled, transverse stripes on the dorsum and limbs.

The species may also change its colours to camouflage itself, but this behaviour was not observed during our short investigation.

In preservative, the general dorsal colour is mainly brown-grey and the head and middorsal stripe are darker than the lateral body parts. Bands on the tail alternate in pale brown-grey and dark grey-brown. The ventral region is white to pale grey.

Variation. (Tab. 1) Female paratypes (n=4) reach a maximum SVL of 144 mm and a maximum tail length of 306 mm. Tails of paratypes (n=5) are 2.13–2.33 times SVL and axilla-groin lengths are 0.48–0.55 times SVL. Heads reach 0.23–0.25 times SVL, are 1.46–1.63 as long as they are wide and 0.98–1.1 times as wide as they are high. Eye diameter is 0.17–0.23 times the head length. Scales around the midbody vary between 131–149 and the vertebral scale number from behind the occiput to the level of the posterior edge of the thigh varies between 202–215. The rostral scale is posteriorly bordered by 2–4 scales and exhibits 1–4 posterior sutures that do not completely divide the rostral. There are three scales across the snout between the second canthals. There are three to four canthals between the nasal and the superciliaries. The supraorbital semicircles consist of 9–10 scales, and are separated medially by one to two rows of scales. Superciliaries 9–13 and supraocularies 13–17. In 4 paratypes, the nasal was in contact with the second supralabial, and in one specimen it was separated from the labials by small scales.

There is a continuous series of 2–4 preoculars, 3 suboculars, which are in direct contact with the supralabials, and 3–4 postoculars. Supralabials 5–7; followed to commissure of mouth by 1–4 scales. Internasals in all paratypes 5. Supratemporals 6–7.

Mental half divided by a median sulcus in three paratypes, almost divided in one paratype and completely divided in another specimen. Postmentals 4 in all paratypes. Gular scales 72–83. Infralabials 6–8; followed to commissure by 2–6 scales. Femoral pores 13–15 per side. Subdigital lamellae 33–36 under fourth finger, 42–48 under fourth toe.

Colour variation. In life, the dorsal surface of the head of the subadult male paratype (ZFMK 91763, Fig. 2C) is pale grey-green on the snout and frontal region, grey-blue in the parietal region and pale green-yellow on the supraocular region. Most dorsal head scales as well as dorsal body scales have dark edges. The sides of the head are pale green-grey to white in the region anterior to the eye, and pale peach-coloured in the temporal region. There is a dark stripe from the posterior margin of the eye, reaching below the supratemporals to the level of the ear opening. The labials and suboculars are mostly white and the dorsum is pale mint green with 6 brown to peach-coloured saddle blotches, 16–29 scales in width, being widest on the middorsal part and tapering towards the flanks. The dorsum is spotted black. There is a mint colour grading into pale peach-colour on the sides of the neck and flanks. The dorsal surface of the forelimbs is mint green and of the hindlimbs, it is peach-coloured intermixed with some mint scales. Both front and hindlimbs are spotted black. The ground colour of the tail is pale beige with 12 darker brownish bands, 10–18 scales in width. The venter, chin scales, gular fan, and limbs are white to whitish-grey.

In life, the dorsal ground colouration of females (CORBIDI 5742, CORBIDI 7724, ZFMK 90834, ZFMK 91764) on the head, back, limbs and tail is lime green with most parts spotted black (Fig. 2 D); granules of eyelids are shiny yellow to lime green (Fig. 2E); sides of head posteriorly of eye between supratemporals and the beginning of the gular fan in some of the specimens are intermixed with numerous blue toned scales; dorsum has 5–6 undulated transversal black bands, 2–6 scales in width, first band on level of forelimbs, is continued on the limbs, last one on level of hindlimbs; bulges of the undulated black lines are anteriorly filled with bluish blotches, 3–5 scales in width; posteriorly, the black bands are followed by darkly

Figure 3. The type locality of *Polychrus jacquelinae* sp. n. CORBIDI 7725 near San Vicente, La Libertad, Peru.

shaded green stripes, 12–20 scales in width; followed by ground colour, 8–10 scales in width; adjacent starts the repetition of the whole pattern, beginning with the bluish blotches, followed by the undulated transversal black band; tail with 12 darkly shaded greenish bands, 9–12 scales in width and of almost same width as ground colour interspaces. On ventral surface, chin scales and gular fan are shiny yellow, and in some parts, spotted with white (Fig. 2E); one gravid female (ZFMK 91764) has pale green chin scales and pale orange gular fan. Venter and limbs are white; tail white to whitish-grey annulated with darker grey bands, indistinct at the beginning but becoming more distinct towards the tip. No colour changes were observed in the female specimens of this species.

In preservative, dorsal pattern remains similar to the pattern in life but colouration mainly consist of different shades of blue, only the darkly shaded green stripes on the dorsum are brownish-blue to brown in some of the specimens; head grey-blue to greenish-blue; on tail brownish to greyish-brown bands, alternating with pale greyish-brown, pale green or blue toned bands. On ventral surface, gular fan, venter, limbs and tail white to greyish-white; chin also white to greyish white, but in one gravid specimen (ZFMK 91764) it is intermixed with pale bluish scales.

Etymology. The species is dedicated to Jacqueline Maria Charles (Leicester, England) in recognition of her support of nature conservation and taxonomic research through the BIOPAT initiative.

Distribution and natural history. This new species is only known from the type locality (Fig. 3) in the inter-Andean valley on the western slope of the northern portion of the Cordillera Central (see Duellman and Pramuk 1999), at an elevation of 1460 to 1570 m above sea level. All individuals were collected near a road between San Vicente/Pusaq and Uchumarca (06°59'S, 77°54'W), Province Bolivar, Región de La Libertad, Peru. *Polychrus jacquelinae* inhabits the equatorial dry forest eco-region in the upper Marañón basin, fide Brack (1986). One subadult male (ZFMK 91763) and two females (ZFMK 90834, ZFMK 91764) were found on 24 April 2009 between 9.45 p.m. and midnight, sleeping in trees of *Acacia macracantha* in heights between 1.8 m and 5 m above the ground, at an air temperature of 22°C and a humidity of 63%. One adult male (CORBIDI 7725) and two adult females (CORBIDI 5742, CORBIDI 7724) were found on 01 July 2010 between 7.30 p.m. and 8.30 p.m., sleeping, at an air temperature of 25°C and a humidity between 34–38%, in a bush of Fabaceae sp. approximately 2 m above the ground, in a bush of *Croton* sp. approximately 4 m above the ground, and in a tree of *Bombax sp.* approximately 3.5 m above the ground, respectively. One female (ZFMK 91764) was gravid and contained 6 oval eggs (3 in each of the oviducts). On average, these eggs had a length of 27.7 mm and a width of 15.8 mm.

Polychrus peruvianus (Noble, 1924)

http://species-id.net/wiki/polychrus_peruvianus

Polychroides peruvianus Noble, Occasional Papers of the Boston Society of Natural History, 5: 109. – Terra typica: near Querocotilla, province of Cajamarca, Peru. – 1924

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Polychroides peruvianus – Peters and Donoso-Barros, Smithsonian Institution Press, Washington D.C. & London: 232. – 1986
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Polychrus peruvianus – Yánez-Muñoz et al., Check List, 2 (2): 63. – 2006

Diagnosis (Tab. 2). (1) A *Polychrus* with a maximum known SVL of 152 mm; (2) males larger than females; (3) a prominent dorsal and gular crest present; (4) 52 to 74 scales around midbody; (5) 56 to 70 paravertebral scales from the occipital region to the level of the posterior edge of the thigh; (6) femoral pores 6 to 13 on one side; (7) lamellae on finger IV 25–33; (8) lamellae on toe IV 32–43; (9) tail 1.29–3.15 times longer than SVL; (10) paravertebral scales unicarinate; (11) ventral scales uni- to tricarinate, rarely multicarinate; (12) gular scales oval, striated, much larger than ventrals; (13) a prominent sexual dichromatism present.

Table 2. Summary of morphometric and pholidosis characters of *Polychrus peruvianus*

Sex	All (n=47)	Males (n=24)	Females (n=23)
Axilla-groin length/SVL	0.43–0.53 (0.49 ± 0.03)***	0.43–0.53 (0.47 ± 0.03)**	0.47–0.52 (0.5 ± 0.02)*
Head length/SVL	0.21–0.28 (0.25 ± 0.02)	0.24–0.28 (0.26 ± 0.01)	0.21–0.26 (0.24 ± 0.01)
Head length/Head width	1.37–1.84 (1.58 ± 0.10)***	1.37–1.66 (1.54 ± 0.09)**	1.49–1.84 (1.61 ± 0.09)*
Head width/Head height	0.69–1.08 (0.95 ± 0.09)***	0.84–1.06 (0.96 ± 0.06)**	0.69–1.08 (0.93 ± 0.11)*
Tail length/SVL	1.29–3.15 (2.71 ± 0.47)	1.53–3.15 (2.67 ± 0.55)	1.29–3.11 (2.76 ± 0.21)
Scales around midbody	52–74 (61.49 ± 5.15)	52–67 (58.75 ± 3.42)	56–74 (64.35 ± 4.92)
Elevated vertebrals (crest)	9–28 (22.19 ± 6.16)	20–28 (25.92 ± 1.77)	9–28 (18.3 ± 6.82)
Gular scales	28–38 (33.7 ± 2.58)***	28–36 (32 ± 2.36)**	31–38 (35 ± 1.96)*
Diameter eye/head length	0.25–0.31 (0.27 ± 0.02)***	0.25–0.28 (0.26 ± 0.01)**	0.25–0.31 (0.28 ± 0.02)*
Subdigitals finger IV	25–33 (29.74 ± 1.81)	28–33 (30.13 ± 1.54)	25–33 (29.35 ± 2.06)
Subdigitals toe IV	32–43 (37.15 ± 3.01)	33–43 (36.75 ± 3.0)	32–41 (37.57 ± 3.1)
Forelimbs/SVL	0.46–0.57 (0.52 ± 0.03)***	0.46–0.57 (0.53 ± 0.03)**	0.48–0.57 (0.51 ± 0.03)*
Hindlimbs/SVL	0.58–0.69 (0.61 ± 0.04)***	0.58–0.69 (0.63 ± 0.04)**	0.52–0.65 (0.59 ± 0.04)*
Femoral pores (left)	6–13 (9.74 ± 1.45)	6–13 (9.77 ± 1.55)	7–12 (9.15 ± 1.34)

***(n=23), **(n=10), *(n=13)

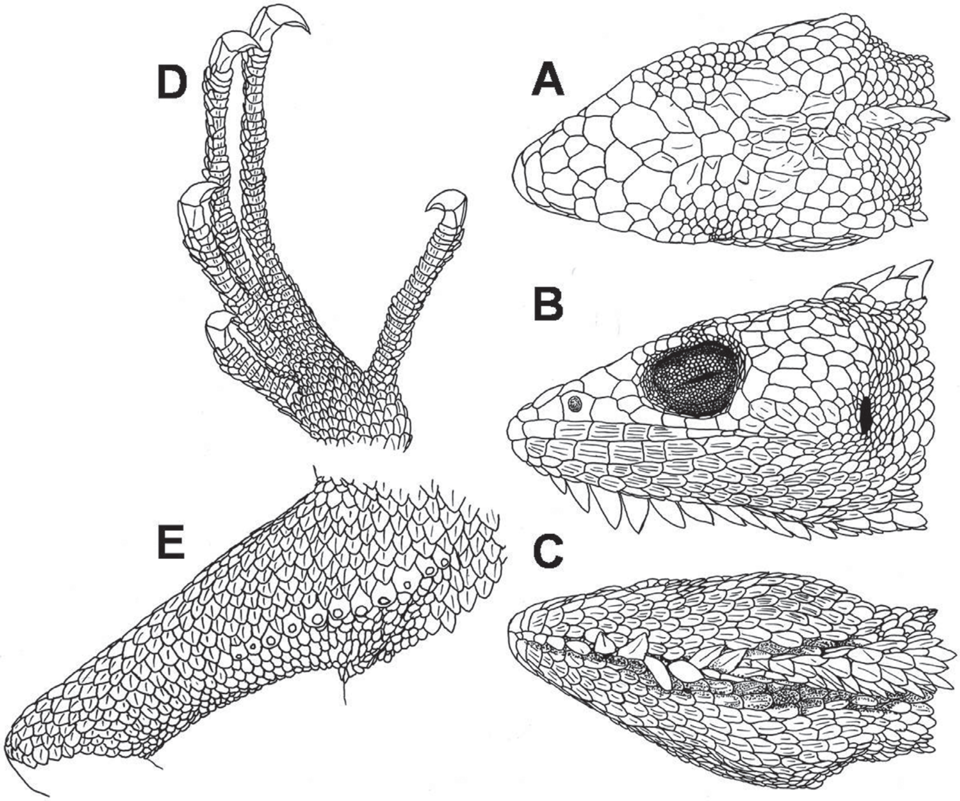

Figure 4. Male specimen of *Polychrus peruvianus* ZFMK 90821: dorsal **A**, lateral **B** and ventral **C** views of head; ventral aspect of left foot **D**, ventral view of right thigh with femoral pores **E**.

Description. A *Polychrus* with a maximum SVL in males of 152 mm, in females of 147 mm. Head 0.21–0.28 times SVL, 1.37–1.84 times as long as wide and 0.69–1.08 times as wide as high. Snout bluntly pointed; canthus rostralis well pronounced. Neck narrower than the head, and slightly narrower than the anterior part of the body. Limbs well developed, forelimbs 0.46–0.57 times SVL, hindlimbs 0.58–0.69 times SVL. Tail almost round in cross section, tapering toward the tip; 1.29–3.15 times SVL.

Rostral trapezoid, striated, about two times as wide as high. Most of the individuals (18/23) lack sutures on the posterior margin of the rostral, three specimens possess one very short median suture, one specimen exhibits a median suture that half divides the rostral and another specimen exhibits two short sutures on the posterior margin. Rostral bordered posteriorly by 2–4 scales, mostly 3 (17/23). Postrostral scales striated. Scales on snout heterogeneous in size, irregularly polygonal, juxtaposed, rugose or swollen; 1–4 scales, mostly 2 (14/23) across snout between second canthals. Two striated canthals between nasal and supraciliaries (3 in one specimen: ZFMK 90829). Supraorbital semicircles distinct, with 8–12 scales, separated medially by 1 scale (Fig. 4A). Scales on supraocular region distinctly smaller than those on snout, polygonal, juxtaposed, flat, smooth or slightly striated; irregularly arranged, except for a row of smaller scales adjacent to the supraciliaries. Supraciliaries 8–12 (n=23), juxtaposed, smooth; in a continuous series with canthals. Scales on parietal region, irregular polygonal, juxtaposed, flat, smooth or slightly striated, slightly smaller than those on snout. Scales on interparietal region polygonal, juxtaposed, rugose or swollen, almost the same size as those on the parietal region. Parietal eye absent. Loreal region has one striated scale. Nostril directed laterally, in the centre of a single nasal or slightly anterior to the center. Nasal scale has polygonal margins and is in broad contact with second supralabial. 3–6 internasals. Eye diameter 0.25–0.31 (n=23) times as long as head length. Eyelids partially fused together, covered by granules of almost same size throughout the eyelids. A continuous series of 1–3 preoculars, 2–4 suboculars, which are in direct contact with supralabials, and 3–5 postoculars. Supralabials 5–10, strongly striated with 2–5 keels; followed to commissure of mouth by 2–4 slightly smaller scales. Temporal region has polygonal or rounded, juxtaposed, flat, and smooth or slightly striated scales, nearly the same size as those of parietal region; delimited dorsally by a single row of 3–5 (n=23) enlarged supratemporal scales. Ear opening, vertically oval, with smooth margin; tympanum superficial (Fig. 4B).

Mental striated, two to 2.5 times as wide as high, posteriorly notched, followed by a median sulcus that almost or at least divides the mental half. Postmentals 3–4 (n=23), striated, lateral ones larger than median scale. Infralabials 5–10, strongly striated with 3–8 keels; followed to commissure by 2–4 distinctly smaller scales. Lateral scales on chin and gular flap oval, in posterior part more or less drawn-out, imbricate, flat and strongly striated with 1–8 keels. A row of 8–14 (n=23) raised, lobe-shaped, striated scales forming a mid-chin crest and merging into a gular flap that reaches the posterior level of the forelimbs (Fig. 4C). 28–38 (n=23) gular scales in transverse line between the two tympani. In posterior part of gular fan, most of the scales are separated from each other by a narrow stripe of extensible skin covered with granules.

Scales on nape anteriorly relatively small, almost rounded, juxtaposed and convex; posteriorly grade into dorsals and merge ventrally with gulars. Middorsal crest present; in adult males it is composed of 20–28 lobe-shaped scales, reaching from behind the occiput to the level of the hindlimbs, in females or juvenile males it is composed of 7–19 lobe-shaped scales, present only on anterior part of the dorsum. Lateral dorsals are oval or slightly lanceolate and are almost the same size throughout body, imbricate, flat; unicarinate in paravertebral region; number of keels augments in direction of ventral body part.

56–70 scales in a paravertebral line between occiput and posterior margin of hindlimbs. Ventrals imbricate, distinctly more overlapping and slightly smaller than dorsals, strongly lanceolate, uni- to multicarinate; in thorax region slightly smaller, in abdominal region arranged in oblique and transverse rows. A gradual transition between dorsal, lateral and ventral scales. Scales around midbody 52–74 (n=47). Preanal pores absent. Femoral pores 6–13 (n=47) (Fig. 4E).

Tail with imbricate, rhomboid, flat, sharply keeled scales, slightly larger than dorsals; in longitudinal and oblique rows, keeles aligned longitudinally. Original tail ending more or less pointed.

Scales on forelimbs slightly smaller than dorsals, imbricate and more or less lanceolate, uni- to tricarinate. Scales on hindlimbs slightly smaller than dorsals, imbricate and more or less lanceolate, unicarinate on dorsal surface and uni- to tricarinate on ventral surface. Subdigital lamellae of fingers and toes single, short, multicarinate, 25–33 (n=47) under fourth finger, 32–43 (n=47) under fourth toe (Fig. 4D).

In life, when unstressed, the dorsal ground colouration of males (Fig. 5A) and females (Fig. 5C), is lime green on body, limbs and tail. Back and tail with dark blotches that are at least as broad as the green interspaces, with the first blotch beginning directly behind the head in females, or adjacent to a small white nuchal crossline in most males. Most specimens possess 5 of such saddle blotches on the dorsum, which are broadest in the vertebral region and decrease in width on the flanks. Blotches are more distinct in males, and are rarely found, or even absent, in females, and normally intermixed with scales of green ground colour. Additionally, some specimens possess white or pinkish and/or turquoise scales or small blotches on the lateral body parts (Fig. 5E). Head in females dorsally, laterally and ventrally lime green; in males dorsally and laterally brownish or orange brown and in some individuals spotted with white, ventrally lighter brown or yellowish, sometimes almost whitish. Scales of gular crest are white in most specimens of both sexes and extensible skin of exposed gular sac is orange, yellowish or pinkish (Fig. 5A). Females mostly with an oblique white line on both sides from behind the eye to the insertion of the forelimbs and with a straight line, about 3 to 4 scales in width, laterally between the axilla and the insertion of the hindlimbs. Venter of both sexes, lime green without special markings.

Under stress, colouration of body, limbs and tail changes into a dark brown in both sexes (Fig. 5B, D), in which case the dark saddle blotches become less evident. If the animal possesses white markings, these become even more prominent. Head colouration of females (Fig. 5D) changes into dark brown, but remains as in the unstressed mood in males (Fig. 5B).

In preservative, dorsal pattern remains similar to the pattern in life but colouration changes into bluish or brownish. Heads of males are dorsally and laterally brownish, and ventrally cream colour or whitish. Venter of both sexes pale blue, green or brown.

Distribution and natural history. In Peru, this species is distributed in the regions of Amazonas, Cajamarca, and Piura in the drainage basins of Río Huancabamba, Río Utcubamba and Río Marañón (Schlüter 2010, Noble 1924, Gorman et al. 1969, Peters and Donoso-Barros 1970, Carrillo and Icochea 1995). Yánez-Muñoz et al. (2006) collected a male specimen from Pucabamba (04°57'01"S, 79°10'30"W, 1400 m a.s.l.), Province of Zamora-Chinchipe, and hence provided the first country record from Ecuador. *Polychrus peruvianus* inhabits the equatorial dry forest eco-region fide Brack (1986), but is also occasionally found in humid forests, at elevations of 600 to 1750 m a.s.l. (Duellman 1979; Gorman et al. 1969; Noble 1924). We found the species at an elevation of 400 to 1330 m above sea level. Besides the few specimens we collected for preservation, we found many more animals of the same species in each sampled area and noted additional observations we could make. All lizards were exclusively found on trees or shrubs (preferred plant species: *Acacia macracantha, A. riparia, Hura crepitans, Mutingia calabura, Sapindus riparium, Schinus molle, Solanum riparium*) alongside roads, paths, or small streams in heights

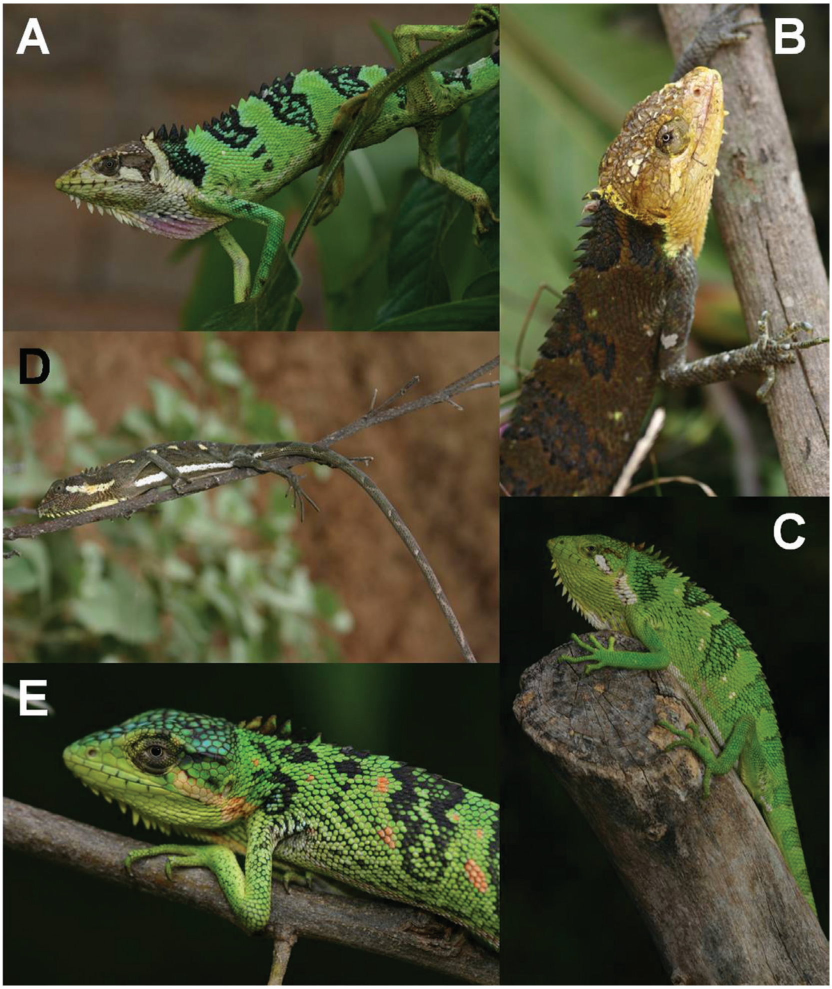

Figure 5. *Polychrus peruvianus* from Cajamarca, Peru: male with normal colouration **A** CORBIDI 1852, in stress colouration **B** CORBIDI 1846, female with normal colouration **C** ZFMK 88712, in stress colouration **D** ZFMK 90819, a very colourful juvenile female **E** CORBIDI 5725.

between 1.5 m and 7 m above the ground. Hence the species can be considered as being highly arboreal. Only some specimens were found during the day (investigation hours: 9.30 a.m. to 4 p.m.) as they are perfectly camouflaged in the vegetation and difficult to detect between the green leaves. Daytime temperatures, when animals were found, were between 28.7°C and 35.9°C and humidity was between 41% and 63%. Most specimens were discovered after nightfall (investigation hours: 7 p.m. to 2 a.m.), when they were sleeping on branches and their bellies were shining brightly in the light of the headlamps. Nighttime temperatures were between 20.8°C and 28.3°C and humidity was between 53% and 75%. In Pucará, one individual could be observed at around 10 a.m., while it was eating little fruits of the tree *Trema micrantha*. Several times we found two, sometimes even three, specimens sleeping on the same tree. In Pucará, the species seemed to be very abundant and in one night we counted 24 adult and 3 juvenile specimens on 22 trees along a two kilometer long path section. One male and one female were found about only 0.5 m away from each other. This represents the encounter with the lowermost distance between two individuals. Other individuals were found with a distance of at least 1–2 m to the next conspecific, irrespective of sex. Although it seems that members of this species have small activity ranges, they live solitarily. Adult males exhibit a pronounced territorial behaviour and do not tolerate other males close to their branches. Under artificial conditions, a male being confronted with another male or even with its own mirror image, opened its mouth widely and extended its gular flap. Efforts to keep two males together in a cage of 3 × 2 m floor space and 2 m in height started with a non-ritualized damaging fight which lasted for around 10 minutes. After the fight the bigger male persecuted the other male in the cage and two days later the smaller male was found dead.

When discovered in a tree, the animals first react similarly as a chameleon: they compress their body laterally and try with very slow movements to take cover behind a stick or branch. Once grabbed, they expand their gular fan, open their mouth widely and try to bite the captor while they try, simultaneously, to free their bodies with strong twisting and turning movements. Similar observations were also made by Gorman et al. (1969) for *Polychrus peruvianus* and by Vanzolini (1983) for the genus *Polychrus* in general. In addition, we could observe a change in colouration in most captured animals to the above described stress colouration.

One gravid female (ZFMK 90822) was found in April 2009 at 10.35 p.m. sleeping in a tree at about 2.5 m above the ground, with an air temperature of 24.9°C and a humidity of 73%. It contained 5 oval eggs, 3 in the left and 2 in the right oviduct. In average these eggs had a length of 27.5 mm and a width of 16.2 mm. In December 2009, we collected 4 gravid females (ZFMK 90824, 90827, 90829, 90830) in different stages of gestation between 8–10.30 p.m. sleeping on trees in 2–5.5 m above the ground. Air temperature was between 25.5°C–28°C and humidity was between 55–75%. ZFMK 90824 contained 10 almost spherical eggs with a diameter of 12 mm, of which 7 were positioned in the left and 3 in the right ovary. ZFMK 90827 contained 7 almost spherical eggs with a diameter of 6 mm of which 3 were positioned in the left and 4 in the right ovary. ZFMK 90829 contained 7 almost spherical eggs with a diameter of 8.9 mm of which 4 were positioned in the left and 3 in the right ovary. ZFMK 90830 contained 4 almost spherical eggs with a diameter of 9.4 mm, 2 were positioned in each of the ovaries.

Polychrus gutturosus **Berthold, 1845**

http://species-id.net/wiki/polychrus_gutturosus

Polychrus gutturosus Berthold, Nachrichten von der Georg-Augusts Universität und der Königlichen Gesellschaft der Wissenschaften zu Göttingen, 3: 38. — Terra typica: Popayán, western Colombia. – 1845

Table 3. Summary of morphometric and pholidosis characters of *Polychrus gutturosus*

Sex	All[#] (n=27)	Males (n=10)	Females (n=15)
Axilla-groin length/SVL	0.45–0.61 (0.53 ± 0.03)	0.45–0.55 (0.53 ± 0.03)	0.45–0.61 (0.53 ± 0.04)
Head length/SVL	0.16–0.25 (0.22 ± 0.02)	0.18–0.25 (0.22 ± 0.02)	0.16–0.24 (0.22 ± 0.02)
Head length/Head width	1.10–1.6 (1.42 ± 0.15)	0.93–1.56 (1.38 ± 0.20)	1.10–1.6 (1.44 ± 0.13)
Head width/Head height	0.9–1.34 (1.11 ± 0.13)	0.97–1.34 (1.07 ± 0.13)	0.9–1.29 (1.14 ± 0.14)
Tail length/SVL	2.36–3.55 (3.10 ± 0.28)	3.08–3.55 (3.30 ± 0.16)	2.36–3.55 (2.99 ± 0.28)
Scales around midbody	63–82 (73.0 ± 5.4)	63–75 (68.4 ± 3.27)	66–82 (76.33 ± 4.42)
Vertebral scales	75–105 (89.15 ± 7.15)	75–93 (84.6 ± 5.56)	84–105 (93.13 ± 5.97)
Gular scales	22–33 (28.59 ± 2.36)	22–30 (26.9 ± 2.28)	27–33 (29.8 ± 1.78)
Diameter eye/head length	0.27–0.49 (0.33 ± 0.05)	0.30–0.49 (0.35 ± 0.05)	0.27–0.41 (0.31 ± 0.03)
Subdigitals finger IV	25–36 (31.52 ± 2.79)	30–36 (33.0 ± 1.94)	25–36 (30.87 ± 2.8)
Subdigitals toe IV	35–45 (40.81 ± 2.43)	38–44 (41.2 ± 2.15)	37–45 (41.07 ± 2.28)
Forelimbs/SVL	0.37–0.54 (0.47 ± 0.04)	0.37–0.54 (0.49 ± 0.04)	0.38–0.53 (0.46 ± 0.04)
Hindlimbs/SVL	0.46– 0.73 (0.59 ± 0.06)	0.56– 0.73 (0.63 ± 0.06)	0.46– 0.63 (0.57 ± 0.05)
Femoral pores (left)	9–21 (14.76 ± 3.15)	14–19 (15.7 ± 1.49)	9–21 (13.93 ± 3.87)

[#] 10 males, 15 females, 2 juveniles

Polychrus gutturosus – Berthold, Nachrichten von der Georg-Augusts Universität und der Königlichen Gesellschaft der Wissenschaften zu Göttingen, 8-10: 11. – 1846

Polychrus (*Chaunolaemus*) *multicarinatus* Peters, Monatsberichte der königlich Akademie der Wissenschaften zu Berlin 1869 (11): 768. – Terra typica: Costa Rica. – 1869

Polychrus gutturosus – Boulenger, Catalogue of the lizards in the British Museum, 2: 100. – 1885

Polychrus spurrelli Boulenger, Proceedings of the Zoological Society of London, 1914: 814. – Terra typica: near Peña Lisa, Condoto, Colombia. – 1914

Polychrus gutturosus – Burt and Burt, Transactions of the Academy of Science of St. Louis, 28: 40. – 1933

Polychrus gutturosus gutturosus – Parker, Proceedings of the Zoological Society of London, 105 (3): 516. – 1935

Polychrus gutturosus spurrelli – Parker, Proceedings of the Zoological Society of London, 105 (3): 516. – 1935

Polychrus gutturosus – Etheridge, Herpetologica, 21: 167. – 1965

Polychrus gutturosus – Peters and Donoso-Barros, Smithsonian Institution Press, Washington D.C. & London: 233. – 1970

Polychrus gutturosus spurrelli – *Pe*ters and Donoso-Barros, Smithsonian Institution Press, Washington D.C. & London: 234. – 1970

Polychroides gutturosus – Peters and Donoso-Barros, Smithsonian Institution Press, Washington D.C. & London: 233. – 1986

Polychrus gutturosus spurrelli – Peters and Donoso-Barros, Smithsonian Institution Press, Washington D.C. & London: 234. – 1986

Polychrus gutturosus – Roberts, Herpetological Review, 28 (4): 184. – 1997

Polychrus gutturosus – Köhler, Herpeton Verlag, Offenbach: 83. – 2000

Polychrus spurrellii – Torres-Carvajal, Smithsonian Herpetological Information Service, 131: 21. – 2001

Polychrus gutturosus – Savage, University of Chicago Press, 2nd edition: 445. – 2002

Polychrus gutturosus – Köhler, Herpeton Verlag, Offenbach: 137. – 2003

Polychrus spurrelli – Yánez-Muñoz et al., Check List, 2 (2): 63. – 2006

Diagnosis (Tab. 3). (1) A *Polychrus* with a maximum known SVL of 170 mm; (2) dorsal and gular crest absent; (3) 63 to 82 scales around midbody; (4) 75 to 105 scales in middorsal row from behind the occipital scales to the level of the posterior edge of the thigh; (5) femoral pores 9 to 21 on one side (Fig. 6E); (6) lamellae on finger IV 25–36; (7) lamellae on toe IV 35–45 (Fig. 6D); (8) tail 2.36–3.55 times longer than SVL; (9) dorsal scales smooth or with 1–3 keels; (10) ventral scales with 1–5 keels; (11) gular scales oval, mostly striated, much larger than ventrals, those on gular fan widely separated by granular skin (Fig. 6C); (12) a sexual dichromatism present.

Description. For detailed descriptions of shape, structure and arrangement of the scales see Taylor (1956) and Savage (2002).Our examined female specimens (n=15) had a maximum SVL of 152 mm, a maximum tail length of 539 mm, a maximum total length of 691 mm, a maximum head length of 33.3 mm and a maximum head width of 26.4 mm. The male specimens (n=10) had a maximum SVL of 122 mm, a maximum tail length of 429 mm, a maximum total length of 549.8 mm, a maximum head length of 28.1 mm and a maximum head width of 22.2 mm. Rostral bordered posteriorly by normally 4 striated scales (3 in one specimen: ZFMK 40832; 5 in another specimen: MHNG 2531.062). Scales on snout heterogeneous in size, irregularly polygonal, juxtaposed, rugose and striated; 1–6 scales across snout between second canthals. 2–3 striated canthals between nasal and supraciliaries. Supraorbital semicircle distinct (Fig. 6A), with 7–13 scales, separated medially by normally one scale (0 in two specimens: BM 1901.3.29.19, MHNG 2531.062; 2 in another specimen: ZFMK 19047). Supraciliaries 7–11, juxtaposed, striated; in a continuous series with canthals. Supraocularies 12–18. Internasals 3–5.Supralabials 4–8, strongly striated with 2–6 keels; followed to commissure of mouth by 2–4 slightly smaller scales.

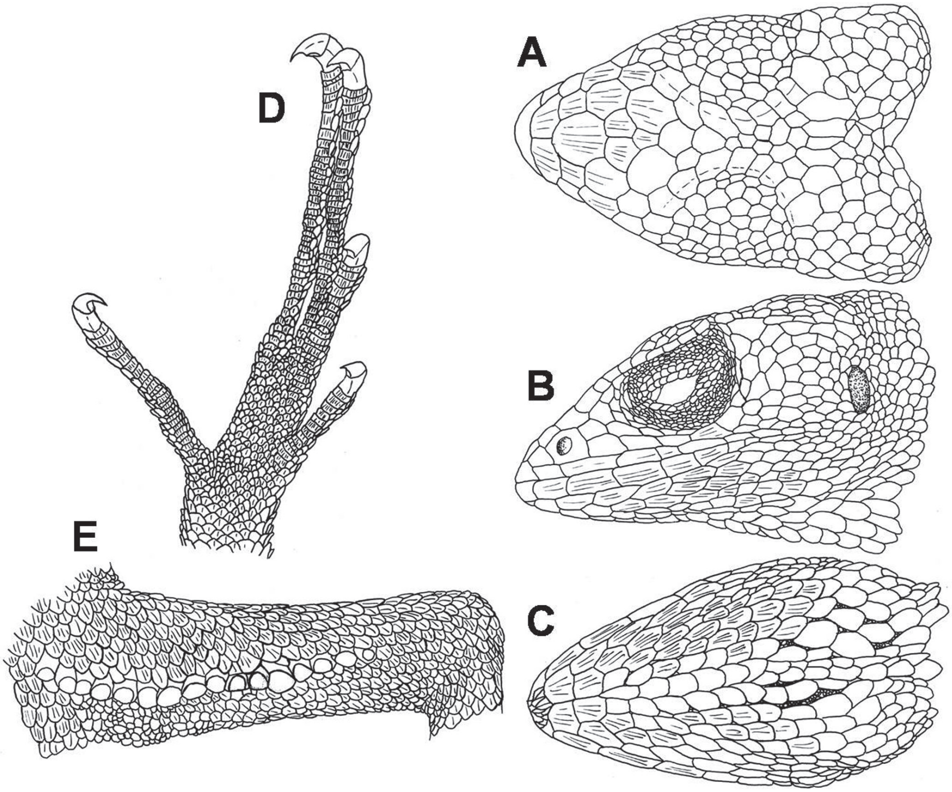

Figure 6. Male specimen of *Polychrus gutturosus* (SMF 83024): dorsal **A** lateral **B** and ventral **C** views of head; ventral aspect of right foot **D** ventral view of left thigh with femoral pores **E**.

Infralabials 4–6, strongly striated with 3–8 keels; followed to commissure by 1–4 distinctly smaller scales (Fig. 6B). Mental approximately half divided by a median groove in 17 specimens, almost divided in 5 specimens, medially divided in one specimen and divided into numerous small scales in one specimen. Postmentals striated (Fig. 6C), normally 2 (5 in one specimen: ZFMK 25729). Supratemporals 4–5; scales in temporal region striated.

Paravertebral scales mostly keeled, only some are smooth; lateral body scales smooth or with 1–3 keels, fore- and hindlimbs dorsally with one or more keels, ventrally multicarinate. Ventral body scales with 1–5 keels.

Other morphological characters of the 27 examined individuals are summarized in Table 3.

Descriptions of the colouration in life (Fig. 7A, B) are given by Breder (1946), Köhler (2003b), Ortleb and Heatwole (1965) and Savage (2002) and a description of the colour in preservative is provided by Taylor (1956).

Distribution and natural history. From northwestern Honduras and western Costa Rica to northwestern Ecuador (Köhler 2003a, Savage 2002) from sea level to

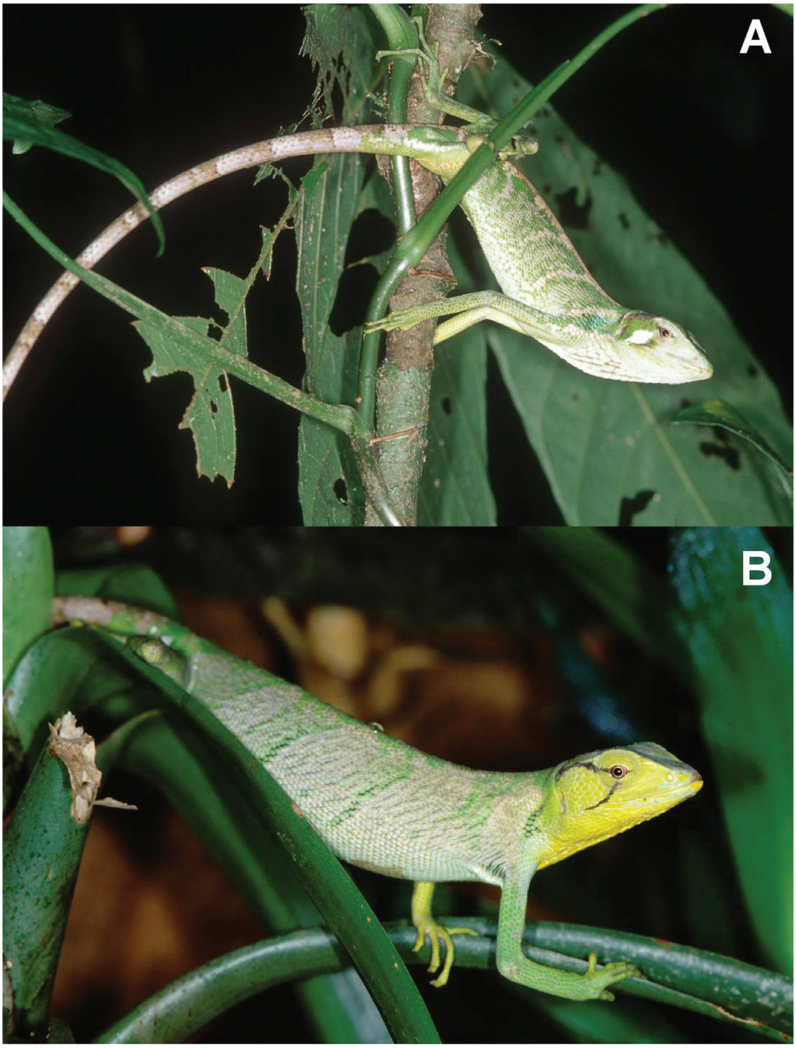

Figure 7. *Polychrus gutturosus* from near Río San Juan, Nicaragua (photographs by G. Köhler): male **A** SMF 83024 and female **B** SMF 83422.

1300 m elevation (Castro-Herrera and Vargas-Salinas 2008). According to Duellman (1979), the species occurs on the Pacific slopes of the Cordillera Occidental in Colombia and Ecuador, the northern parts of the Colombian cordilleras and in the high lands in lower Central America. According to Peters (1967) and Peters and Donoso-Barros (1970, 1986), *Polychrus gutturosus gutturosus* is distributed from the higher western Andean slopes of Ecuador and Colombia and northward to Costa Rica and Nicaragua; whereas *P. gutturosus spurrelli* occurs in lowland rain forests of northwestern Ecuador and Colombia. According to Savage (2002), the species occurs in undisturbed lowland moist and wet forests and marginally along stream courses which lead into the adjacent Premontane Moist Forest.

Despite its restriction to humid forests, it is strictly diurnal and arboreal and is rarely seen (Savage 2002). A female specimen from Turrialba, Cartago Province, Costa Rica examined by Taylor (1956) contained 4 ovarian eggs in the right and 5 in the left ovary, respectively. Eggs were nearly spherical and measured 12 mm in diameter. Roberts (1997) observed a pair of *Polychrus gutturosus* copulating in a tree 2 m above the ground at La Selva Biological Station, Heredia Province, Costa Rica on 9 May and further reports of a gravid female, that was found in a *Heliocarpus* sp. tree next to Puerto Viejo river at La Selva on 24 July. According to Savage (2002), juveniles have a SVL of 53.5–57 mm when hatching. We examined 2 juveniles with a SVL of 87 mm (ZFMK 31444) and only 44 mm (QCAZ 06749), respectively. Two specimens which were not examined any further had a SVL of 39 mm (BM 94.5.29.5) and 57 mm (BM 1901.3.29.84), respectively. Based on the so far reported cases of copulating animals and gravid females, Savage (2002) suggested a rainy season productive period (May to December). He stated that eggs are apparently laid in the leaf litter on the ground. Köhler (2003B) kept a couple of *P. gutturosus* from near Rio San Juan, Nicaragua, in a terrarium. On 26 October the female laid 5 eggs, which decayed and could not be incubated successfully. We examined a gravid female (ZFMK 40830) from Comatré, Limón, Costa Rica, which was collected in October 1983. It contained a total of 6 oval eggs of which 3 were positioned in each of the oviducts. On the average, these eggs had a length of 21 mm and a width of 15 mm.

Discussion

Polychrus peruvianus is the only representative in the genus with a prominent middorsal and gular crest. Due to this character it was originally described as belonging to a new genus *Polychroides* (Noble 1924). Burt and Burt (1933) followed this nomenclature, whereas Parker (1935) and Roberts (1997) accepted only 5 species of *Polychrus* and thus consider *peruvianus* as not belonging to this genus. In contrast, Williams (1988) and Savage (2002) recognized 7 species of *Polychrus*, signifying that they considered *peruvianus* as belonging to this genus. Osteological (Etheridge 1965, Etheridge and De Queiroz 1988) and cytological data (Gorman et al. 1969) show a very close relationship to the genus *Polychrus,* and lead the authors to the assumption that *peruvianus* belongs to this genus. Due to phylogenetic examination of morphological data, Frost et al. (2001) placed *peruvianus* in the genus *Polychrus*. Yánez-Muñoz et al. (2006), who provided the first country record of the species for Ecuador, also considered the species as belonging to the genus *Polychrus*. Analysis of molecular data is still lacking to definitely determine the position of this species.

Polychrus gutturosus is the only species in the genus assumed to be composed of two subspecies (*P. g. gutturosus* and *P. g. spurrelli*). However, disagreement still exists on the status of the latter, which was described by Boulenger (1914) as a distinct species *Polychrus spurrelli* and later placed as a subspecies of *P. gutturosus* (Parker 1935). According to Parker's identification key, the pectoral scales of *P. g. gutturosus* are multicarinate whereas those of *P. g. spurrelli* are smooth. Peters (1967) and Peters and Donoso-Barros (1970, 1986) also consider *spurrelli* as a subspecies of *P. gutturosus*. According to the key provided by them, the canthus rostralis is somewhat rounded and the scales on the pectoral region are smooth, or only very weakly keeled in *P. g. spurrelli,* whereas in *P. g. gutturosus* the canthus rostralis is distinctly angular and the scales on the pectoral region are strongly keeled, usually unicarinate but may be bi- or tricarinate. According to Frost et al. (2001), Pough et al. (2004), and Avila-Pires (1995) the genus *Polychrus* contains 6 species and according to Roberts (1997), it contains only 5 species. Hence these authors do not accept *spurrelli* as being a distinct species. In a species list of Colombian lizards provided by Ayala (1986), the only *Polychrus* species mentioned to occur in the country are *P. gutturosus* and *P. marmoratus,* equally revealing that the author did not accept *spurrelli* as a valid species. In contrast, Williams (1988) and Savage (2002) accept 7 species in the genus *Polychrus*, which signifies that they considered it as a distinct species. Torres-Carvajal (2001) and Yánez-Muñoz et al. (2006) also considered *P. spurrelli* as a valid species.

As explained in very detail by Myers and Böhme (1996), it is not sure whether the type locality provided by Boulenger (1914) for *P. gutturosus* is really the highland city Popayán (1760 m a.s.l.), as referenced to by several authors (e.g. Barbour 1934, Peters and Orejas-Miranda 1970, Myers 1974), but rather a colonial province named Popayán which seems to have existed until 1820 and which once included nearly all of what is now western Colombia. Thus, the chance is quite high that the type specimen of P. gutturosus was originally collected at some other place in western Colombia and probably at lower elevation. Hence the original location of *P. gutturosus* within the old province of Popayán cannot be determined, and the existence of a geographic isolation of *P. gutturosus* and *P. spurrelli* is not proven. The assumption that both taxa represent different subspecies of *P. gutturosus* (i.e. by definition allopatric forms) is not supported. To shed light on the taxonomic status of *spurrelli*, we revised the two syntypes (BM 1946.8.8.33–34) on which Boulenger (1914) based his species description and two further specimens (BM 1916.4.25.2–3) in the British Museum of Natural History which were also collected by Dr. H.G.F. Spurrell in Colombia (Andagoya, Chocó) and were also designated as *P. spurrelli*. The two syntypes represent subadult females and the two other specimens represent adult males. We could not find any difference in either morphometric or pholidosis characters (Tab. 4) or in colouration between these four *Polychrus* and the 27 specimens of *P. gutturosus* formerly examined for this study. The shape of the canthus rostralis is more rounded in some specimens, whereas it is more angular in others. We found the scales in the pectoral region of the four *spurrelli* to be smooth, or slightly uni- or tricarinate in one specimen (BM 1946.8.8.34), uni- or tricarinate in two specimens (BM 1946.8.8.33, BM 1916.4.25.2) and multicarinate with 2–5 keels in one specimen (BM 1916.4.25.3). Again, there was no difference to the specimens of *P. gutturosus* studied by us, which exhibited pectoral scales with 1–5 keels.

Based on our observations, there is no evidence to support the recognition of *P. spurrelli* as a distinct species; thus, we synonymize it here with *P. gutturosus*. Genetic examination could further help to better determine the status of *spurrelli*.

Table 4. Summary of morphometric and pholidosis characters of *Polychrus spurrelli*

Sex	All (n=4)	Males (n=2)	Females (n=2)
Axilla-groin length/SVL	0.5–0.55 (0.52 ± 0.02)	0.52–0.54 (0.53 ± 0.01)	0.5–0.55 (0.52 ± 0.01)
Head length/SVL	0.19–0.24 (0.21 ± 0.03)	0.19 (0.91 ± 0.0)	0.24 (0.24 ± 0.03)
Head length/Head width	1.16–1.84 (1.49 ± 0.28)	1.16–1.84 (1.50 ± 0.48)	1.41–1.55 (1.48 ± 0.17)
Head width/Head height	0.9–1.12 (1.00 ± 0.08)	0.93–0.95 (0.94 ± 0.01)	1.01–1.12 (1.07 ± 0.13)
Tail length/SVL	2.97–3.20 (3.07 ± 0.12)	2.97–3.20 (3.09 ± 0.16)	2.97–3.14 (3.06 ± 0.0)
Scales around midbody	64–82 (67.5 ± 4.73)	64–74 (66.0 ± 2.83)	64–68 (69.0 ± 2.83)
Vertebral scales	85–94 (87.75 ± 4.72)	85–87 (86.0 ± 1.41)	85–94 (89.5 ± 1.41)
Gular scales	24–29 (27.25 ± 2.36)	27–29 (28.0 ± 1.41)	24–29 (26.5 ± 3.54)
Diameter eye/head length	0.35–0.42 (0.38 ± 0.03)	0.40–0.42 (0.41 ± 0.01)	0.35 (0.35 ± 0.04)
Subdigitals finger IV	27–31 (29.0 ± 1.63)	29–31 (30.0 ± 1.41)	27–29 (28.0 ± 1.41)
Subdigitals toe IV	36–38 (37.25 ± 0.96)	36–38 (37.0 ± 1.41)	37–38 (37.5 ± 0.71)
Forelimbs/SVL	0.43–0.51 (0.47 ± 0.04)	0.45–0.51 (0.48 ± 0.04)	0.43–0.50 (0.46 ± 0.06)
Hindlimbs/SVL	0.54– 0.64 (0.60 ± 0.04)	0.54– 0.60 (0.57 ± 0.04)	0.63– 0.64 (0.64 ± 0.02)
Femoral pores (left)	12–15 (13.75 ± 1.26)	14–15 (14.5 ± 0.71)	12–14 (13.0 ± 2.12)

Our field work resulted in the discovery of yet another undescribed species of *Polychrus* from northern Peru. We will provide a comprehensive description of this new species in a further publication.

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Appendix I: specimens examined

Polychrus peruvianus–PERU: *Cajamarca*: Jaén: Santa Rosa (05°26'S, 078°33'W, 1250–1300 m a.s.l.), ZFMK 88710, CORBIDI 5731, CORBIDI 5732; Bellavista (05°39'49.8"S, 78°40'13.9"W, 411 m a.s.l.), CORBIDI 1863, CORBIDI 1857–8, ZFMK 88707; (05°38'06.6"S, 078°39'36.2"W, 405 m a.s.l.), CORBIDI 5728, ZFMK 90819, CORBIDI 5727, ZFMK 90818; (05°34'35.7"S, 078°38'10.8"W, 700 m a.s.l.), ZFMK 90820; Gota de Agua (05°41'S, 078°46'W), ZFMK 88708; Perico (05°21'16.5"S, 078°47'30.6"W, 443 m a.s.l.), CORBIDI 1933, ZFMK 88709; Perico (05°21'S, 078°47'W, 460–720 m a.s.l.), CORBIDI 5730, ZFMK 90822, CORBIDI 5729, ZFMK 90821; Pucará (06°02'S, 079°07'W, 900–930 m a.s.l.), ZFMK 88711, CORBIDI 1846, CORBIDI 5726, ZFMK 90817, CORBIDI 5725, CORBIDI 5724; *Amazonas*: Bagua: Bagua Grande (05°47'33.3"S, 078°23'04.9"W, 570 m a.s.l.), ZFMK 88712, CORBIDI 1852, ZFMK 88713; Utcubamba: Zapatalgo (06°04'S, 078°29'W, 900–130 m a.s.l.), CORBIDI 5733, ZFMK 90824, CORBIDI 5734, ZFMK 90823, CORBIDI 5735, ZFMK 90825; Puerto Malleta: (06°03'S, 078°36'W, 480–510 m a.s.l.), ZFMK 90824, 90826–7, CORBIDI 5736–8, ZFMK 90828; (06°04'S, 078°36W, 535 m), ZFMK 90829, CORBIDI 5739; Cumba (05°56'S, 078°39'W, 450–500 m a.s.l.), CORBIDI 5741, ZFMK 90830, CORBIDI 5740, ZFMK 90831–2, ZFMK 90833.

Polychrus gutturosus–COLOMBIA: BM 1923.10.12.16; *Chocó*: Condoto, ca.100 m: BM 1913.11.12.18–19; *Popayan*: ZFMK 21341 (holotype); COSTA RICA: ZFMK 19047, ZFMK 25729, ZFMK 45355 (from animal trade, place and date not further specified); Pozo Azul: BM 1907.6.28.2; *Turrialba*, 900 m: ZFMK 31444 (from animal trade in 1980); *Limón*: Comatré: ZFMK 40830–31; *Punta Arenas*: Palmar: ZFMK 40832, ZFMK 40833; NICARAGUA: Rio San Juan: near Rio San Juan, SMF 83024 (from animal trade on 21 May 2001, place not further specified); PANAMA: BM 94.6.29.10; ECUADOR: St. Javier (NW Ecuador): BM 1901.3.29.19–20; Paramba: BM 98.4.28.33; *Esmeraldas*: Comunidad Selva Alegre, Rio Santiago: QCAZ 3490, QCAZ 6934, QCAZ 8817, QCAZ 9788; *Pichincha*: La Union del Toachi: QCAZ 6749; Santo Domingo de los Colorados: MHNG 2437.029, MHNG 1117.036; *Cotopaxi*: San Francisco de Las Pampas: MHNG 2437.028; *Imbabura*: Lita: MHNG 2531.062.

Polychrus spurrelli–COLOMBIA: *Chocó*: Condoto: Peña Lisa: BM 1946.8.8.33–34 (syntypes); Andagoya: BM 1916.4.25.2–3.