

# Description of two new species of *Rissoella* Gray, 1847 (Mollusca, Gastropoda, Heterobranchia) from Venezuela, with a key to the Caribbean species known for the genus

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## Abstract

Two new species of the genus *Rissoella* Gray, 1847 are described from Venezuela, one from the National Park Morrocoy, *Rissoella morrocoyensis* **sp. n.** and the other from the Wildlife Refuge Isla de Aves, *Rissoella venezolanicola* **sp. n.** *R. morrocoyensis* **sp. n.** has a deep umbilicus (partly closed), preumbilical cord, black head, hypobranchial gland marked by a pale yellow boomerang-shaped ribbon and it lives on the leaves of the seagrass *Thalassia testudinum* Banks & König, 1805. *R. venezolanicola* **sp. n.** has an angled preumbilical cord which extends to the columella delimiting a trapezoid, a hypobranchial gland marked by a yellow quaver-shaped ribbon and protoconch with fuchsia highlights. It lives on the brown alga *Dictyota* spp. The records of *Rissoella* in the Caribbean are revised and illustrations, a comparative table and a key to the Caribbean species known for the genus are provided.

## Keywords

Rissoellidae, new species, *Thalassia*, *Dictyota*, Morrocoy, Isla de Aves, Southern Caribbean, Venezuela

## Introduction

The genus *Rissoella* Gray, 1847 consists of minute, less than 2 mm long gastropods, living on algae in shallow waters around the world. Their transparent shells have few distinguishing characters (Ponder and Yoo 1977), but the body exhibits pigmented organs that allow the separation of species (Ortea and Espinosa 2001; Ortea and Espinosa 2004; Rolán and Hernández 2004; Espinosa and Ortea 2009). Ponder and Yoo (1977) in the Pacific and Ortea and Espinosa (2004) in the Atlantic Ocean recognized a number of characteristic traits of the shell for identifying the different species using the proportions and the angle of the different whorls, the protoconch and especially the shape of the umbilicus, in addition to the colour of the body.

The natural history of *Rissoella* in western Atlantic was recently revised by Ortea and Espinosa (2004), who established 4 valid species for the area and described 7 new taxa from Cuba. Posteriorly, *Rissoella aliciae* Espinosa and Ortea, 2009 (Fig. 31), was added to the list. Nevertheless, the inventory of species is still incomplete. 10 species had been described in northern Caribbean, one in Central America (Tab. 1) and one in Brazil (*Rissoella ornata* Simone, 1995), but none in southern Caribbean, where only one species, *Rissoella caribaea* Rehder, 1943, has been recorded. The discovery of two members of the genus *Rissoella* with characters that differentiate them from other known species in the American Atlantic motivated this work.

## Material and methods

The specimens were collected by snorkelling in two localities of Venezuela; the National Park Morrocoy (March 2010) and the Wildlife Refuge Isla de Aves (August 2010). A Carl Zeiss stereomicroscope was used to take data on external anatomy and color patterns. The animals were photographed alive and preserved in ethanol 96 %. To prevent the progressive deterioration of the shells due to ethanol, the holotypes and some of the paratypes were kept dried.

To compare with other species of the genus, diagrams were made of shell, protoconch and umbilicus using an Olympus SZ16 stereomicroscope. A caliper was used to take measurements of each specimen. For other measurements such as the angle of the spire or umbilical angle, the methodology of Ortea and Espinosa (2004) was used.

SEM images were taken using a Hitachi S-2400 at the Central University of Venezuela. As umbilicus were partially closed by the expansion of the columellar edge, they were photographed (SEM) at an oblique angle (Figs 9–12) for better observation of preumbilical cord.

Abbreviations: SOM-IVIC, Marine Organisms Section of the Biological Collections of the Venezuelan Institute for Scientific Research (Register number 028), Miranda, Venezuela; FUDENA, Nature Defense Foundation, Falcon, Venezuela; PNM, National Park Morrocoy; RFSIA, Wildlife Refuge Isla de Aves.

## Systematics

### Family Rissoellidae Gray, 1850

#### Genus *Rissoella* Gray, 1847

**Type species:** *Rissoa? glaber* Alder (= *Rissoella glaber* (err. pro *glabra*) J. E. Gray, 1847; = *Rissoa? diaphana* Alder, 1848; = *Rissoa albella* Alder, 1844), by monotypy.

#### *Rissoella morrocoyensis* sp. n.

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[http://species-id.net/wiki/Rissoella\\_morrocoyensis](http://species-id.net/wiki/Rissoella_morrocoyensis)

Figs 1–5, 9–10, 13–17, Tabs 1, 2, 4

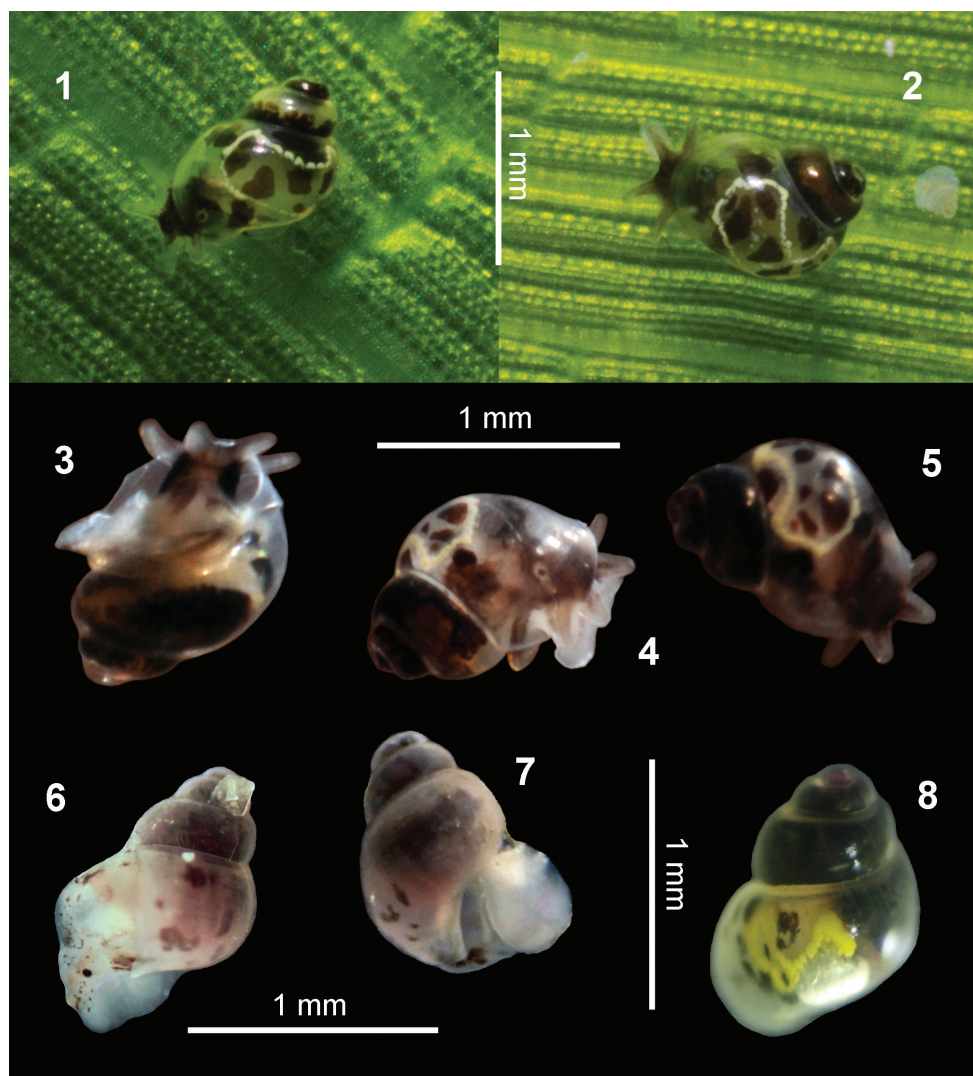
**Description.** Shell very small (Tab. 2), smooth, translucent and fragile (Fig. 13); protoconch about half a whorl after the nucleus (Fig. 14); teleoconch of two and a half whorls to two and three quarters, convex profile, well marked suture; aperture semicircular, columella almost straight; umbilicus small, very narrow and deep, partially closed by the expansion of the columellar edge, with a preumbilical cord (Figs 9–10, 15), average height of the last whorl, 85% of shell length; average height of the aperture, 60% of shell length (Tab. 2); shell length/width ratio = 1.32; spiral angle = 60°; umbilical angle = 21°–28°.

Operculum semicircular, translucent amber, rather opaque in the center, 453 µm long by 255 µm wide in a shell of 0.92 mm length; inner side with a triangular projection with spearhead-shaped apex.

Head dark brown to black; black eyes set in a circular area of translucent white colour; oral lobes wider and shorter than the cephalic tentacles; both translucent, dark brown or

**Table 1.** Valid species of the genus *Rissoella* Gray, 1847 in the Caribbean.

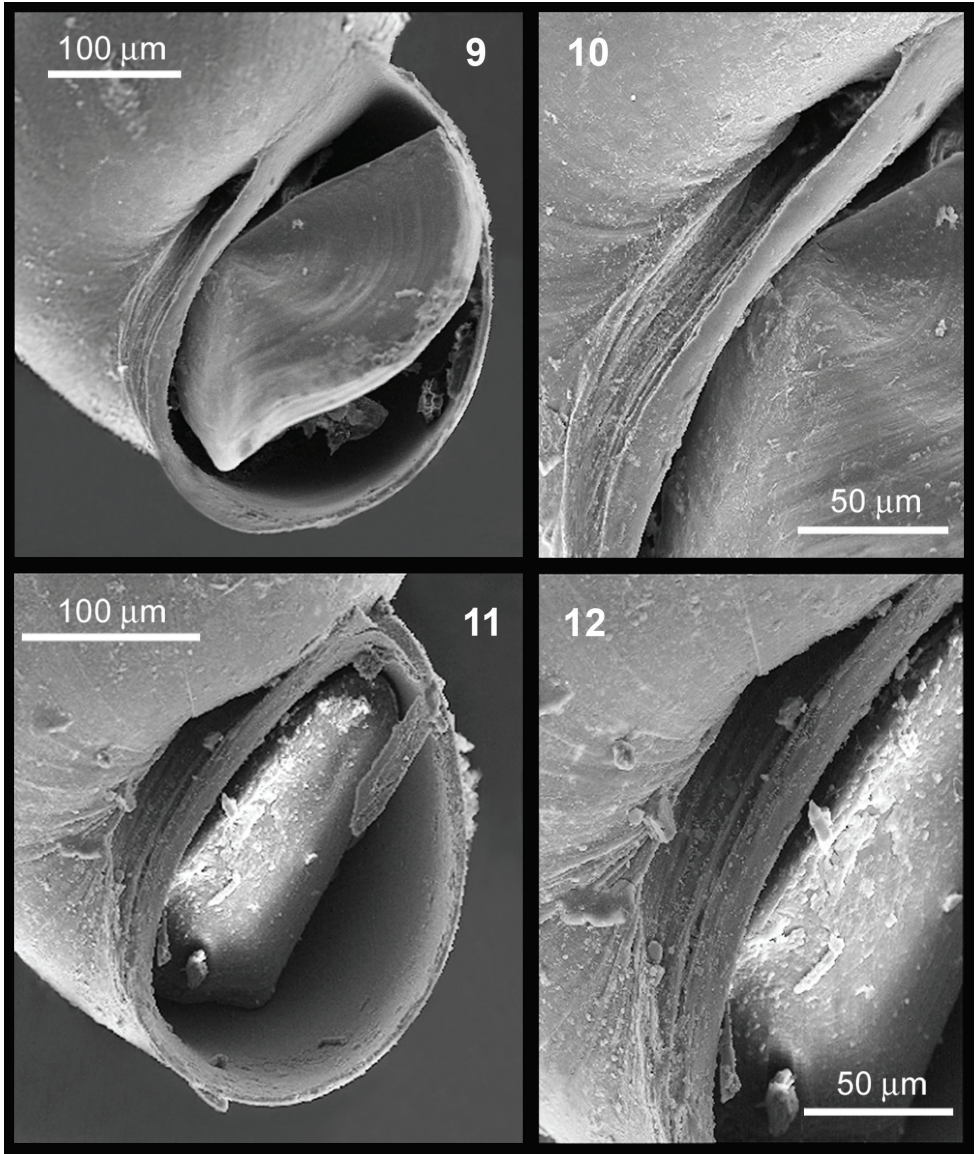
Species	Type locality
<i>Rissoella caribaea</i> Rehder, 1943	USA
<i>Rissoella galba</i> Robertson, 1961	Bahamas
<i>Rissoella gandocaensis</i> Ortea & Espinosa, 2001	Costa Rica
<i>Rissoella ameliae</i> Ortea & Espinosa, 2004	Cuba
<i>Rissoella belkisiae</i> Ortea & Espinosa, 2004	Cuba
<i>Rissoella diana</i> Ortea & Espinosa, 2004	Cuba
<i>Rissoella zaidae</i> Ortea & Espinosa, 2004	Cuba
<i>Rissoella floriae</i> Ortea & Espinosa, 2004	Cuba
<i>Rissoella elsae</i> Ortea & Espinosa, 2004	Cuba
<i>Rissoella taniae</i> Ortea & Espinosa, 2004	Cuba
<i>Rissoella aliciae</i> Espinosa & Ortea, 2009	Cuba
<i>Rissoella morrocoyensis</i> sp. n.	Venezuela
<i>Rissoella venezolanicola</i> sp. n.	Venezuela



**Figures 1–8.** *Rissoella morrocoyensis* sp. n. **1–5:** on a leaf of *Thalassia testudinum* (**1–2**), ventral view (**3**), lateral view (**4**), dorsal view (**5**). *Rissoella venezolanicola* sp. n. **6–8:** lateral view (**6**), ventral view (**7**), dorsal view (**8**).

black, completely or just at the base (Figs 1–2); foot slightly bilobed, with a white hyaline sole; dorsal part of the foot, white or with an irregular dark drawing (Fig. 3); flanks of the animal the same colour as the head (Fig. 4); mantle white, with several black blotches around the hypobranchial gland; hypobranchial gland translucent white, with white spots, irregular black blotches and a pale yellow band marking its boomerang-shaped contour with no transversal bands (Fig. 5); visceral mass in the first whorls, dark brown to black.

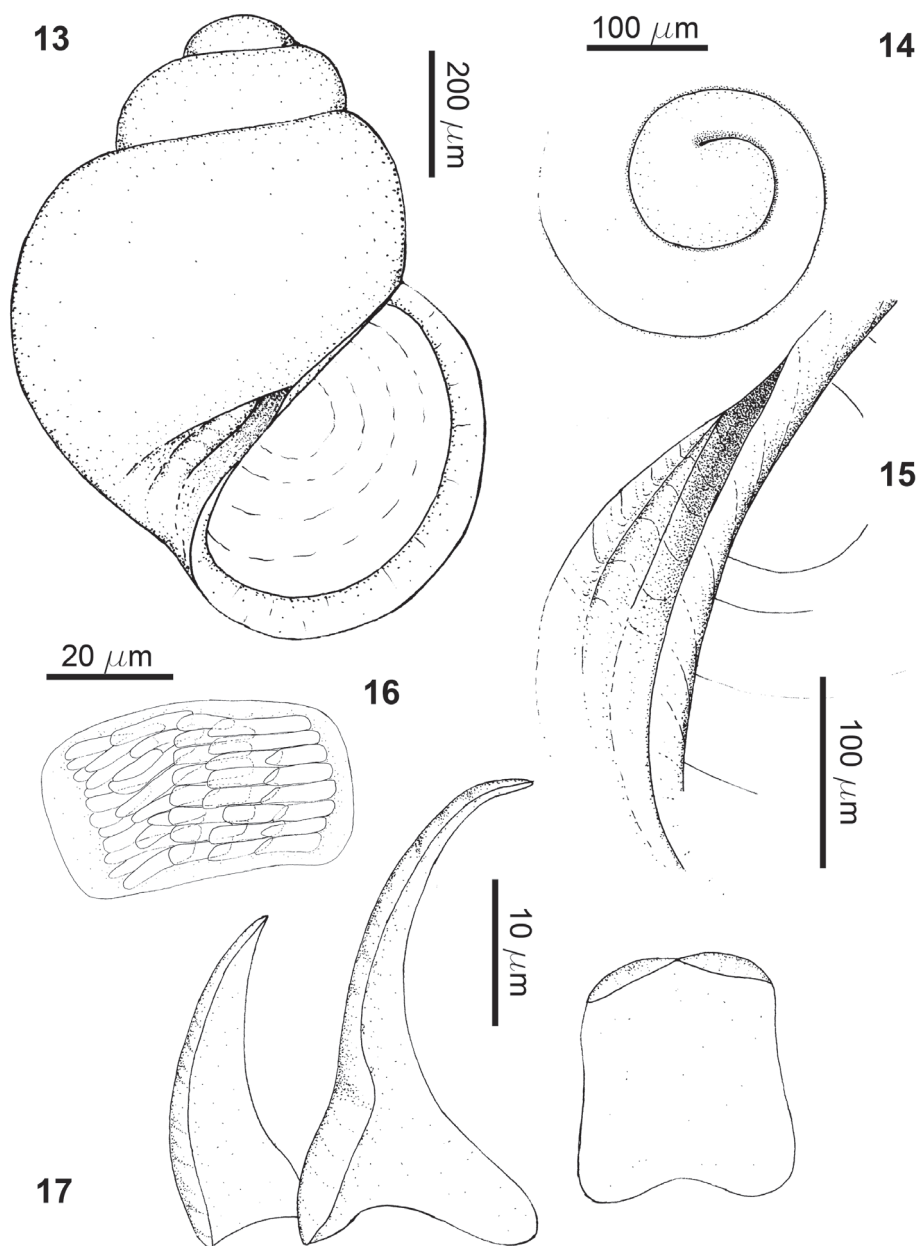
Odontophoral cartilages rectangular, with polygonal uncini of 10–16  $\mu\text{m}$  long, regularly imbricated (Fig. 16); radular formula of a specimen 1.02 mm shell length,



**Figures 9–12.** *Rissoella morrocoyensis* sp. n. **9–10:** view of the aperture and the umbilicus (**9**) detail of the umbilicus (**10**). *Rissoella venezolanicola* sp. n. **11–12:** view of the aperture and the umbilicus (**11**), detail of the umbilicus **12**.

15 × 1.1.R.1.1; rachidian tooth wide, with bilobed apex forming two smooth cusps (Fig. 17), slightly shorter than marginal tooth; lateral tooth thorn-shaped, 34.2 µm long, with the apex hooked and smooth, imbricated with the opposite tooth above the rachidian; marginal tooth triangular, 26.1 µm long, with sharp apex.

**Types.** Holotype, 1.06 mm × 0.82 mm, collected alive (June 10, 2010), preserved dry and deposited in SOM-IVIC (IVICMT005). Paratypes 1–2, 1.25 mm × 0.86



**Figures 13–17.** *Rissoella morrocoyensis* sp. n.: shell (13), protoconch (14), detail of the umbilicus (15), odontophoral cartilages (16), radular teeth (17).

mm and 1 mm × 0.69 mm, preserved in etanol 96%, SOM-IVIC (IVICCMT006). Paratypes 3–4, 1.16 mm × 0.80 mm and 1.06 mm × 0.82 mm, preserved dry, SOM-IVIC (IVICCMT007). Paratypes 5–7, 0.90 mm × 0.68 mm; 0.86 mm × 0.78 mm and 1.10 mm × 0.80 mm, preserved dry, FUDENA (CFPM0001).

**Table 2.** *Rissoella morrocoyensis* sp. n. Measurements of specimens. (%) means percentage compared to the total length of the shell.

	Protoconch (whorls)	Last whorl (mm)	Aperture (mm)	Length /width
<b>Holotype</b>				
1.06 × 0.82 mm	1.5	0.92 (87%)	0.64 (60%)	1.29
<b>Paratypes</b>				
1–1.25 × 0.86 mm	—	—	—	1.45
2–1 × 0.69 mm	—	—	—	1.44
3–1.16 × 0.80 mm	1.25	0.92 (79%)	0.70 (60%)	1.45
4–1.06 × 0.82 mm	1.15	0.90 (85%)	0.64 (60%)	1.29
5–0.90 × 0.68 mm	1	0.80 (89%)	0.54 (60%)	1.32
6–0.86 × 0.78 mm	1.5	0.76 (88%)	0.58 (67%)	1.10
7–1.10 × 0.80 mm	1.25	0.92 (84%)	0.66 (60%)	1.37
<b>Further material</b>				
1.02 × 0.86 mm	1	0.85 (83%)	0.57 (56%)	1.18
0.92 × 0.70 mm	—	—	0.46	1.31
<b>Average</b>		<b>85%</b>	<b>60%</b>	<b>1.32</b>

**Further material.** 1.02 mm × 0.86 mm, collected (March 24, 2010) in Boca Grande, PNM (10°51'01.71"N, 68°14'16.48"W), used to obtain the radula, therefore the specimen was destroyed.

**Type locality.** Boca Grande, National Park Morrocoy, Venezuela (10°51'28.85"N, 68°13'17.04"W), at the base of the leaves of *Thalassia testudinum*, 1 m depth.

**Etymology.** *morrocoyensis*, latinization of *morrocoy*, place name of National Park Morrocoy, Venezuela, where the type locality is located.

**Remarks.** According to the classification given by Ortea and Espinosa (2004), *R. morrocoyensis* sp. n. would cluster within the Caribbean species group with a preumbilical cord, which include: *Rissoella zaidae* Ortea & Espinosa, 2004 (Fig. 27), *Rissoella floriae* Ortea & Espinosa, 2004 (Fig. 28), *Rissoella elsae* Ortea & Espinosa, 2004 (Fig. 29) and *Rissoella taniae* Ortea & Espinosa, 2004 (Fig. 30). *R. morrocoyensis* sp. n. has a preumbilical cord thicker than these four species, all of which have their type locality on the shores of Cuba. Additionally, the body colouration of *R. floriae*, *R. elsae* and *R. taniae* is very different as well as the shape and proportions of their shells, which are larger.

The shell of *R. zaidae* is similar in size to that of *R. morrocoyensis* sp. n., but the animal has a different colour and the oral palps equal the cephalic tentacles, while in *R. morrocoyensis* sp. n., they are shorter. Additionally, *R. zaidae* has transverse yellow bands in the hypobranchial gland.

*Rissoella contrerasi* Rolan & Hernandez, 2004, from Africa, has the design on the hypobranchial gland similar to *R. morrocoyensis* sp. n., but it distinguishes by the curved inner edge of the columella, by the oral lobes being longer than the cephalic tentacles,

and by its different body colour (black), which is displayed even on the sole of the foot and on the hypobranchial gland. In addition, the whorls of the shell and the aperture are different and it has a wider umbilicus.

***Rissoella venezolanicola* sp. n.**

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[http://species-id.net/wiki/Rissoella\\_venezolanicola](http://species-id.net/wiki/Rissoella_venezolanicola)

Figs 6–8, 11–12, 18–22, Tabs 1, 3, 4

**Description.** Shell very small (Tab. 3), smooth and translucent (Fig. 18); protoconch about half a whorl after the nucleus (Fig. 19); teleoconch of two whorls and three quarters; aperture oval, with the columella slightly bowed and arched; umbilicus narrow and deep, slightly closed by the expansion of the columellar edge; preumbilical cord extended, with an angle delimiting and closing the umbilicus forming a trapezoid (Figs 11–12, 20); average height of the last whorl, 82.9% of shell length; average height of the aperture, 49.6% of shell length (Tab. 3); Shell length/width ratio = 1.52; spiral angle = 58°; umbilical angle = 23°–25°.

Operculum oval, translucent with an amber tinge, membranous consistence; head, flanks, oral lobes and cephalic tentacles translucent white with scattered black to greenish brown dots (Fig. 6); eyes black; foot translucent white (Fig. 7); hypobranchial gland translucent white with scattered blotches black to greenish brown and a distinctive yellow design quaver-shaped (Fig. 8); visceral mass in the first whorls, black; protoconch with fuchsia highlights in live animals.

Odontophoral cartilages kidney-shaped, with large uncini placed longitudinally (Fig. 21); radular formula of an specimen 0.96 mm shell length,  $16 \times 1.1.R.1.1$ ; rachidian tooth wide, with bilobed apex forming two smooth cusps (Fig. 22), slightly larger than marginal tooth; lateral tooth triangular, 28.3  $\mu\text{m}$  long, with the apex hooked and smooth; imbricated with the opposite tooth above the rachidian; marginal tooth triangular and curved, 16.3  $\mu\text{m}$  long, with blunt apex.

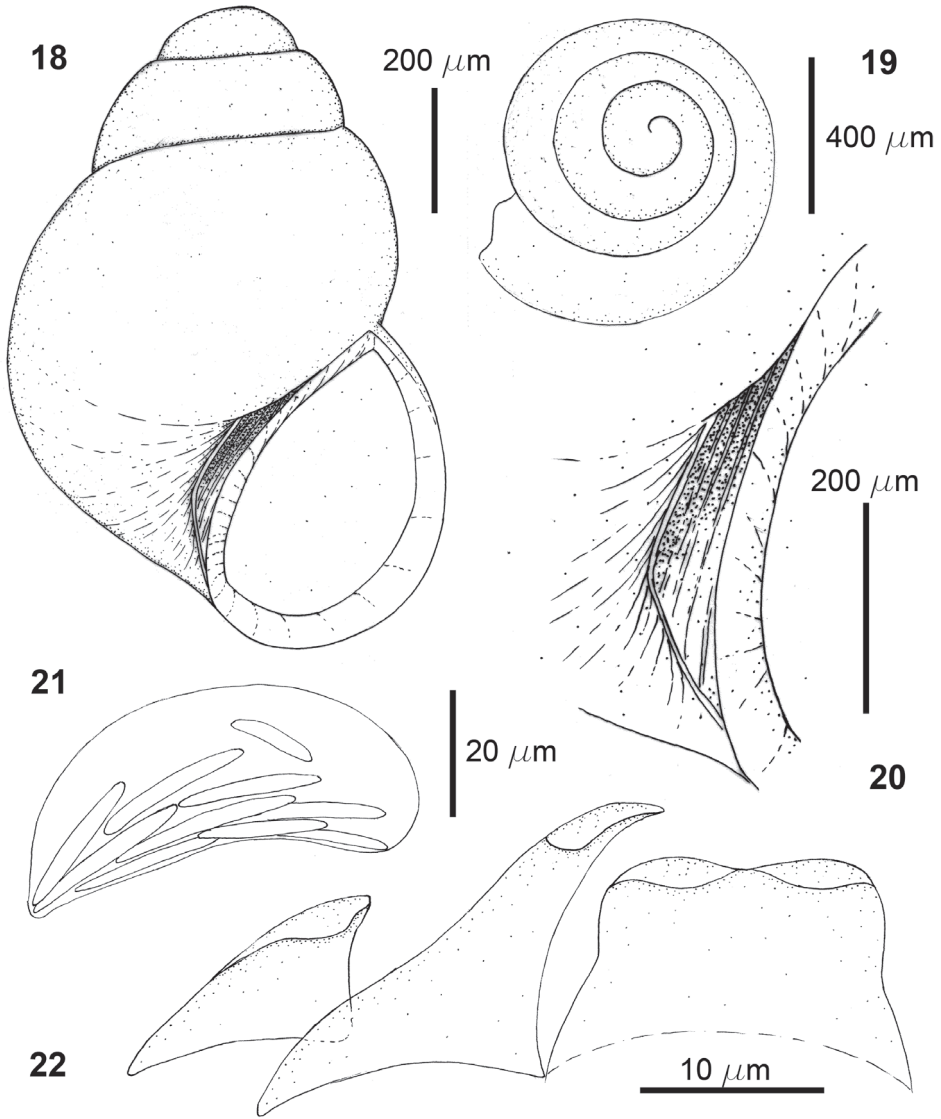
**Types.** Holotype, 1.02  $\mu\text{m} \times 0.66 \mu\text{m}$ , collected alive (August 2, 2010), preserved dry and deposited in FUDENA (CFRFSIA0002). Paratype 1, 0.96  $\times$  0.64  $\mu\text{m}$ , SOM-IVIC (IVICCMT008), used to get the radula, shell preserved dry. Paratype 2, 0.54  $\times$  0.46  $\mu\text{m}$ , preserved dry, SOM-IVIC (IVICCMT009).

**Type locality.** Leeward patch reef, Isla de Aves, Venezuela (15°39'54.2"N, 63°37'17.6"W), on *Dictyota* spp., 10 m depth.

**Further localities.** Paratypes: Northern end, Isla de Aves, Venezuela, (15°40'24.7"N, 63°37'11"W), on *Dictyota* spp., 10 m depth.

**Etymology.** *venezolanicola* latinization of *venezolana*, inhabitant of Venezuela.

**Remarks.** Due to the presence of the preumbilical cord, *R. venezolanicola* sp. n., is comparable to *R. zaidae*, *R. floriae*, *R. elsae*, *R. taniae* (Ortea and Espinosa 2004) (listed above) and *R. morrocoyensis* sp. n. But it is different because in none of them the preumbilical cord delimits and closes the umbilicus, neither the hypobranchial gland



**Figures 18–22.** *Rissoella venezolanicola* sp. n.: shell (18), protoconch (19), detail of the umbilicus (20), odontophoral cartilages (21), radular teeth (22).

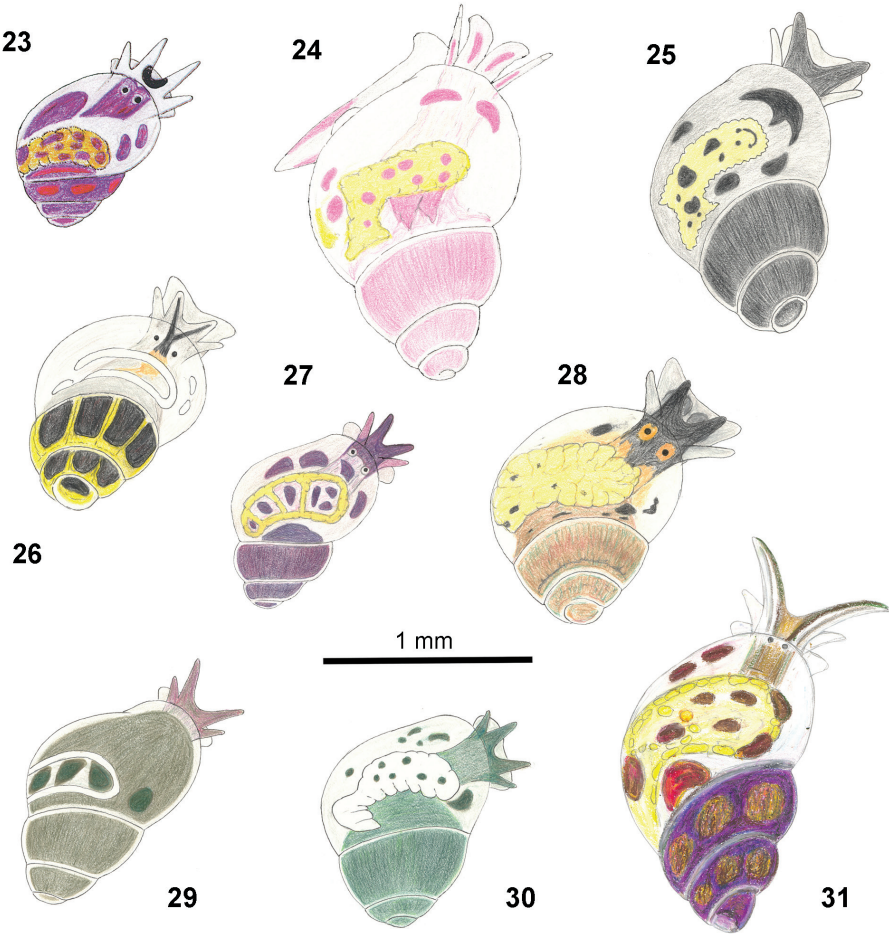
has a yellow quaver-shaped design. Additionally, *R. venezolanicola* sp. n. differs from all these species by:

- *R. zaidae*: (shell length/width ratio = 1.63, spiral angle = 50°, umbilical angle = 30°) the whorls of the spire are more angled and tilted, the umbilicus is in the middle of the last whorl, the head, oral lobes, cephalic tentacles and the visceral mass in the first whorls are lilac and the hypobranchial gland is kidney-

**Table 3.** *Rissoella venezolanicola* sp. n. Measurements of specimens. (%) means percentage compared to the total length of the shell.

	Protoconch (whorls)	Last whorl (mm)	Aperture (mm)	Length /width
<b>Holotype</b>				
1.02 × 0.66 mm	1.25	0.82 (80%)	0.46 (45%)	1.54
<b>Paratypes</b>				
0.96 × 0.64 mm	1.25	0.80 (83%)	0.52 (54%)	1.50
0.54 × 0.46 mm	1.5	0.46 (85%)	0.38 (70%)	1.18
<b>Average</b>		<b>83%</b>	<b>*50%/57%</b>	<b>*1.52/1.4</b>

\* Excluding the juvenile specimen.



**Figures 23–31.** Color illustrations adapted from the original descriptions (Ortea and Espinosa 2001; 2004; Espinosa and Ortea 2009). *R. gandocaensis* (23), *R. ameliae* (24), *R. belkisae* (25), *R. diana*e (26), *R. zaidae* (27), *R. florae* (28), *R. elsa*e (29), *R. tania*e (30), *R. alicia*e (31).

**Table 4.** Synthesis of characters of the Caribbean species of *Rissoella* Gray, 1847 based on Robertson (1961), Wise (1998), Ortea and Espinosa (2001; 2004), Espinosa and Ortea (2009). Aa = Average height of the aperture vs shell length, Al = Average height of the last whorl vs shell length, E = Eyes, H = Habitat, HG = Hypobranchial gland, LW = Shell length/width ratio, Pc = Preumbilical cord, Pf = Pigmentation of the body in the firsts whorls, Rf = Radular formula, Rt = lateral and marginal teeth, Sa = Spiral angle, U = Umbilicus, Ua = Umbilical angle.

	Shell	Al	Aa	LW	Sa	Ua	U	Pc	E	HG	Band around HG	Pf	Rf	Rt	H
<i>R. caribaea</i>	Transparent To 1.8 mm length	75– 80%	50%	1.42	60°	25°	Narrow with a keel. Partly closed by columnellar edge	Absent	Black on unpigmented areas	Grey with black blotches	Pale yellow. Boomerang- shaped with transversal bands	Homogeneous black	30 × 1.1.R.1.1.	Slightly serrated	Clean rocks and coral rubble  Red and green algae on mangrove roots Shallow
<i>R. galba</i>	Transparent with white band around umbilical region To 0.68 mm length	-	-	-	-	-	Narrow	Absent	Black	Pale yellow	Absent	Homogeneous pale brown	-	-	Filamentous green algae on rocks or filamentous red algae on mangrove roots Intertidal
<i>R. gandacaensis</i>	Transparent To 0.8 mm length	-	-	-	-	-	With a slight keel	Absent	Black on clear areas	Yellow with violet blotches	Absent	Violet with red blotches	-	-	-
<i>R. ameliae</i>	Transparent To 1.62 mm length	75%	50%	1.57	45°	18°	Narrow and deep	Absent	Unpigmented or absent	Yellow with pale violet blotches	Absent	Homogeneous pale violet	-	-	Rocks and coral rubble on sand in the coral slope 15–18 m deep
<i>R. belkisiae</i>	Transparent To 1.2 mm length	80%	50%	1.38	60°	25°	Narrow but not deep	Absent	Unpigmented or absent	Yellow with black blotches	Absent	Homogeneous dark grey	-	-	Rocks and coral rubble on sand in the coral slope 20–27 m deep
<i>R. dianae</i>	Transparent To 1.15 mm length	75%	44%	1.6	40°	30°	Wide and deep. Partly closed by columnellar edge	Absent	Black	Translucent	Curved, Yellowish white, broken at the back	Brilliant Yellow with big square- shaped black blotches	-	-	Rocks and coral rubble on sand in the coral slope 25–30 m deep

	Shell	Al	Aa	LW	Sa	Ua	U	Pc	E	HG	Band around HG	Pf	Rf	Rt	H
<i>R. zaidae</i>	Transparent To 1 mm length	78%	50%	1.63	50°	30°	Narrow and deep	Present	Black on unpigmented areas	Kidney- shaped, pale violet with lilac blotches	Gold-yellow with transverse bands	Homogeneous lilac	-	-	Rocks and coral rubble on sand in the coral slope 15–18 m deep
<i>R. floriae</i>	Transparent To 1.2 mm length	79%	55%	1.35	60°	18°	Narrow and deep	Present	Black on lighter areas of orange hue	Intense yellow with black spots	Absent	Homogeneous brown-grey	-	-	Rocks and coral rubble on sand in the coral slope 25–30 m deep
<i>R. eliae</i>	Transparent To 1.2 mm length	76%	50%	1.69	45°	25°	Nearly closed by columnar edge	Present	Unpigmented or absent	White with big green blotches	Kidney-shaped, white without transverse bands	Homogeneous green	-	-	Rocks and coral rubble on sand in the coral slope 15–25 m deep
<i>R. taniae</i>	Transparent To 1.1 mm length	82%	52%	1.4	65°	43°	Wide	Present	Unpigmented or absent	Curved. White with big green spots	Absent	Homogeneous dark green	-	-	Rocks and coral rubble on sand in the slope 15 m deep
<i>R. aliciae</i>	Transparent To 1.45 mm length	67%	40%	1.52	45°	22°	Wide and deep	Absent	Black on lighter areas	Pale yellow with black blotches	Yellow. Discontinuous, broken at the back	Violet with circular brown blotches	-	-	Filamentous algae on rocks in sandy bottoms 35 m deep
<i>R. morocoyensis</i> sp. n.	Transparent To 1.25 mm length	85%	60%	1.32	60°	21°– 28°	Very narrow and deep. Partly closed by columnar edge	Present	Black on unpigmented areas	Translucent white, with black blotches	Pale yellow. Boomerang- shaped with no transversal bands	Homogeneous black	15 x 1.1.R.1.1.	Smooth	Leaves of <i>Thalassia</i> near mangroves 1 m deep
<i>R. venezolanicola</i> sp. n.	Transparent To 1.02 mm	83%	57%	1.52	58°	23°– 25°	Narrow and deep	Long, with an angle, forming a trapezoid	Black on unpigmented areas	Translucent white with black to greenish brown blotches	Yellow. Quaver- shaped	Homogeneous black	16 x 1.1.R.1.1.	Smooth	Coral reef on on <i>Dicoryna</i> spp. 10 m deep

shaped, pale violet with lilac blotches and bounded by a yellow ribbon with transverse bands.

- *R. floriae*: (shell length/width ratio = 1.35, umbilical angle = 18°) the head and oral lobes are black, the cephalic tentacles are different in colour than the oral lobes, the eyes are located in lighter areas of orange hue, the visceral mass in the first whorls is brown or orange and the hypobranchial gland is lemon-yellow without any design on it.
- *R. elsae*: (shell length/width ratio = 1.69, spiral angle = 45°) the shell is more conical, the preumbilical cord is higher than the columellar wall, the head, oral lobes and cephalic tentacles are lilac, the mantle is green and hides the eyes, and the hypobranchial gland has large patches of dark green and is enclosed by a white ribbon with transverse bands.
- *R. taniae*: (shell length/width ratio = 1.4, spiral angle = 65°, umbilical angle = 43°) the shell is spherical with slightly globose whorls, the umbilicus is very open, the head, oral lobes, cephalic tentacles and visceral mass in the first whorls are dark green, there are no eyes apparently and the hypobranchial gland is white with green spots.
- *R. morrocoyensis* sp. n.: (shell length/width ratio = 1.32) the umbilicus is deeper and more closed by the expansion of the columellar edge and the head, oral lobes and cephalic tentacles are black.

Two species from Africa have a design on the hypobranchial gland similar to *R. venezolanicola* sp. n.: *Rissoella luteonigra* Rolan & Rubio, 2001 and *Rissoella trigoi* Rolan & Hernández, 2004. *R. venezolanicola* sp. n. differs from these species in:

- *R. luteonigra*; is bigger (1.8 mm), with a narrower and longer shell, lacking preumbilical cord. Animals are black homogeneous (Rolan and Rubio 2001).
- *R. trigoi*; has a rough protoconch with cavities in the suture, the preumbilical cord parallel to the expansion of the columellar edge until it converges (divergent in *R. venezolanicola* sp. n.) and the animals are black with a white drawing in the hypobranchial gland (Rolan and Hernández 2004), very simple and very different.

## Discussion

The species of the family Rissoellidae are difficult to study and to identify, because their small transparent shells have only a few characters. Thus, identification should also be based on the color patterns of the animals facilitating correct recognition (Sasaki, 2008). The lack of consensus on the correct characters to segregate species could explain why it is one of the least studied families of micromolluscs (Okutani 2000). For example in Japan, which is a country with a long malacological tradition, there are at least 10 morphospecies known, but most of them yet undescribed (Hasegawa 2000).

Species from this family belonging to the genus *Rissoella* have low dispersal abilities because of the absence of a pelagic larval stage. They are usually found in very specific habitats (Ortea and Espinosa 2004) and they tend to be microendemic, although their small size could facilitate passive transport in floating elements covered by algae. Therefore, their distribution should be established solely on the basis of publications that provide sufficient data for unambiguous identification. Concluding from this, most of the historical records of *Rissoella* species in Western Atlantic have to be considered doubtful.

In the Caribbean Sea, *R. caribaea* is the most controversial species with the widest known distribution (Ortea and Espinosa 2004). The original description of *R. caribaea* by Rehder (1943) did not allow to distinguish it from other species of the genus in the West Atlantic, but Wise (1998) compared his specimens from Florida with the holotype of this species (USNM No. 536046) and published a detailed redescription. According to him, *R. caribaea* has a deep and narrow umbilicus without preumbilical cord, several strands or streaks of uniform height leaving from the umbilicus, a characteristic and prominent keel, bifid nose, gray-black body and hypobranchial gland, the last surrounded by a yellow ribbon with transverse bands, and a radula with 30 rows of serrated teeth. Although there is some theoretical geographic overlap, these characters clearly separate it from *R. morrocoyensis* sp. n. and *R. venezolanicola* sp. n.

*R. caribaea* has been cited from:

- Florida (type locality).
- Florida, Bahama and Puerto Rico by Robertson (1961), who interprets the large differences in shell, body color and habitat along its distribution as intraspecific variation.
- Puerto Rico by Ortiz-Corps (1985) just as a compilation of references.
- Florida to Puerto Rico by Abbott (1974), with a description and figures.
- Curaçao by Jong and Coomans (1988), based on the species description given by Abbott (1974).
- Mexico by Vokes and Vokes (1983), with a black and white photograph that doesn't permit to distinguish this species.
- Northern Brazil, where Rios (1994) reproduced the same image that appeared in Abbott's book (1974).
- Bahamas by Redfern (2001), with images of the shell and the live animal. Curiously, the shell shown lacks the characteristic keel of the species shown by Wise (1998).
- Nicaragua by Rolan and Hernández (2004) in the legend of an illustration.
- Mexico by Felder and Camp (2009), on a checklist based on Vokes and Vokes (1973), Wise (1998) and Hicks et al. (2001).
- Venezuela by Bitter et al. (2009), in a table without anatomic confirmation nor supply of images of the shell or the animal body.
- Puerto Rico, Mexico, Belize and Aruba-Bonaire-Curaçao by Miloslavich et al. (2010) in a checklist of previous records.

Most of these authors repeat previous records (mainly Abbott's), but very few of them give anatomical data or useful images to distinguish the species. Therefore, we consider it more likely that the real distribution of *R. caribaea* is that given by Abbott (1974), from Florida to Puerto Rico. All other records require anatomical confirmation.

The record of Bitter et al. (2009) probably refers to *R. morrocoyensis* sp. n. because of the proximity to its type locality.

*R. galba* (Tab. 4) is a very rare and characteristic species (Robertson 1961), which has been cited from:

- Bahama Islands (type locality) in low abundance cohabiting with hundreds of *R. caribaea* (Robertson 1961).
- Cozumel Island (Mexico) by Moore (1973), from shells in sediments, on a checklist without data or images.
- Puerto Rico by Ortiz-Corps (1985) just as a compilation of references.
- Bahamas (Abaco) by Redfern (2001), who only got a few empty shells in sediments from 10 to 23 m depth.

Abbott (1974) considers this species endemic for the Bahama Islands, we agree with this statement. Specimens from Mexico and Puerto Rico possibly refer to a related but undescribed species.

*R. ornata* has been recorded from the coasts of Yucatan (Mexico) by Rolan and Hernández (2004), but their specimens are different from the species of Simone (1995) (Ortea and Espinosa 2004). So, the record in the Caribbean for *R. ornata*, whose type locality is in southern Brazil, is considered to represent a misidentification.

None of the species of *Rissoella* described by Ortea and Espinosa (2001; 2004) and Espinosa and Ortea (2009) has been recorded from outside Cuba or Costa Rica, respectively. A synthesis of their main characters based on the original descriptions is shown in Figs 23–31 and Tab. 4.

This is the second record of species of the genus *Rissoella* for Venezuela and the mainland of the southern Caribbean, the first confirmed by anatomical characters. Thus, the the list of valid species in the Caribbean is now raised to 13 (Tab. 1). Even when the number of species of the genus in the Caribbean is likely to increase with future targeted searches and the exploration of new areas, a key is provided to allow the user to distinguish whether their specimens are already described or not.

In conclusion, we suggest that information on additional characters should be supplied when describing and characterising species of the genus *Rissoella* in the Caribbean. At least, detailed descriptions of the umbilicus (preumbilical cord, keel) displayed by line drawings or SEM photos, and colour illustrations of the living animals (including observations on the presence/absence and shape of the band around the hypobranchial gland) are urgently needed for an unambiguous identification.

**Key to the *Rissoella* species known from the Caribbean**

- 1 Shell with wide umbilicus. No preumbilical cord ..... 2
- Shell with preumbilical cord in the umbilicus ..... 8
- 2 Gonad and digestive gland of uniform colouration in the first whorls ..... 3
- Gonad and digestive gland with different colouration in the first whorls ..... 6
- 3 Shell with an opaque white spiral band extending around de umbilical region ..... *R. galba*
- Shell lacking a white band around de umbilical region ..... 4
- 4 Hypobranchial gland surrounded by a yellow ribbon kidney-shaped, with transverse bands ..... *R. caribaea*
- Hypobranchial gland not surrounded by a ribbon ..... 5
- 5 Oral lobes same color than the cephalic tentacles. Hypobranchial gland yellow with pink/violet blotches. Pink head ..... *R. ameliae*
- Oral lobes different in color than the cephalic tentacles. Hypobranchial gland yellow with black blotches. Dark grey or black head ..... *R. belkisiae*
- 6 Hypobranchial gland not conspicuous, surrounded by a discontinuous pale band, interrupted around the perimeter. White operculum ..... *R. diana*
- Hypobranchial gland conspicuous and yellow ..... 7
- 7 Hypobranchial gland not surrounded by a ribbon ..... *R. gandocaensis*
- Hypobranchial gland surrounded by a yellow ribbon kidney-shaped, without transverse bands ..... *R. aliciae*
- 8 Eyes lacking or not visible ..... 9
- Eyes present and visible ..... 10
- 9 Hypobranchial gland white with green blotches, surrounded by a white ribbon kidney-shaped, without transverse bands. Lilac head ..... *R. elsa*
- Hypobranchial gland white, not surrounded by a ribbon. Green head ..... *R. tainae*
- 10 Hypobranchial gland surrounded by a band or with a design ..... 11
- Hypobranchial gland intense yellow, not surrounded by a ribbon. Eyes in lighter areas of orange hue ..... *R. floriae*
- 11 Hypobranchial gland translucent white, surrounded by a yellow quaver-shaped ribbon ..... *R. venezolanicola*
- Hypobranchial gland surrounded by a kidney-shaped ribbon ..... 12
- 12 Hypobranchial gland violet with lilac blotches, surrounded by a gold-yellow band with transverse bands ..... *R. zaidae*
- Hypobranchial gland translucent white, surrounded by a pale yellow band without transverse bands ..... *R. morrocoyensis*

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# Notes on Pauropoda (Myriapoda) from USA, with descriptions of two new species

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## Abstract

Two new species of Pauropoda are described from USA, *Kionopauropus alyeskaensis* **sp. n.** (Pauropodidae), and *Eurypauropus arcuatus* **sp. n.** (Eurypauropodidae). The genus *Kionopauropus* is reported from the Western Hemisphere for the first time.

## Keywords

Myriapoda, Pauropoda, new species, taxonomy, USA

## Introduction

The collection of Pauropoda lodged in the Department of Entomology, Smithsonian Institution, Washington, has been studied. The specimens are preserved in alcohol, most specimens are old, opaque and/or covered by small particles and not possible to recognize. The species which could be identified are treated below.

Abbreviations: ad., subad., and juv. = an adult, a subadult or juvenile specimen with the number of pairs of legs indicated.

Measurements: length of body in mm, otherwise the text refers to relative lengths (reference value in text); range of variation in adult paratypes given in brackets. Quotations from labels are given in inverted commas.

## Systematics

### Family Pauropodidae

#### Genus *Pauropus* Lubbock, 1867

In 1896 O.F. Cook described *Pauropus bollmani* from specimens in the National Museum collected by C.H. Bollman. The description is meager and this species has long been considered as species *incertae sedis*. Cook's material seems to be five specimens now in a vial with four labels "*Pauropus bollmani* Cook Bloomington, Indiana Bollman, no. 112", "Type", "Type 3213" and "USNM 2053511". The specimens are brown and opaque and more or less defect (antennae, many legs, most bothriotricha lost, body two-parted or crushed). None of the specimens (three adults, two females and one male, and two ones stad.?) could be identified. *Pauropus bollmani* Cook has still to be on the list of species *incertae sedis*.

#### *Pauropus huxleyi* Lubbock, 1867

**Material.** USA, Pennsylvania, Spring Brook Twp., Expt. no. C4b, 1 ad. (♀), 1945.v.12, and same locality, no. C4e, 6 ad. (1♂, 5♀), 1 juv. 5, both R.I. Sailor leg.

#### Genus *Kionopauropus* Scheller, 2009

The genus was erected for three species from Indonesia and the Philippines (Scheller 2009). At least two more species have to be included here, *Kionopauropus* (ex *Decapauropus*) *facetus* (Remy, 1956) comb. n. from Madagascar and *Kionopauropus* (ex *Decapauropus*) *lituiger* (Remy, 1957) comb. n. from West Australia, both with the anterodistal corner of the sternal antennal branch more truncated than the posterodistal corner, the antennal globulus *g* with long stalk and the pygidial sternum with the setae combination  $b_1 + b_2$ . With the species described below the genus has six species distributed from Madagascar and Australia in the South to Alaska in the North. It probably occurs also in Japan (Y. Hagino, Natural History Museum and Institute, Chiba Museum, Japan, pers. com.).

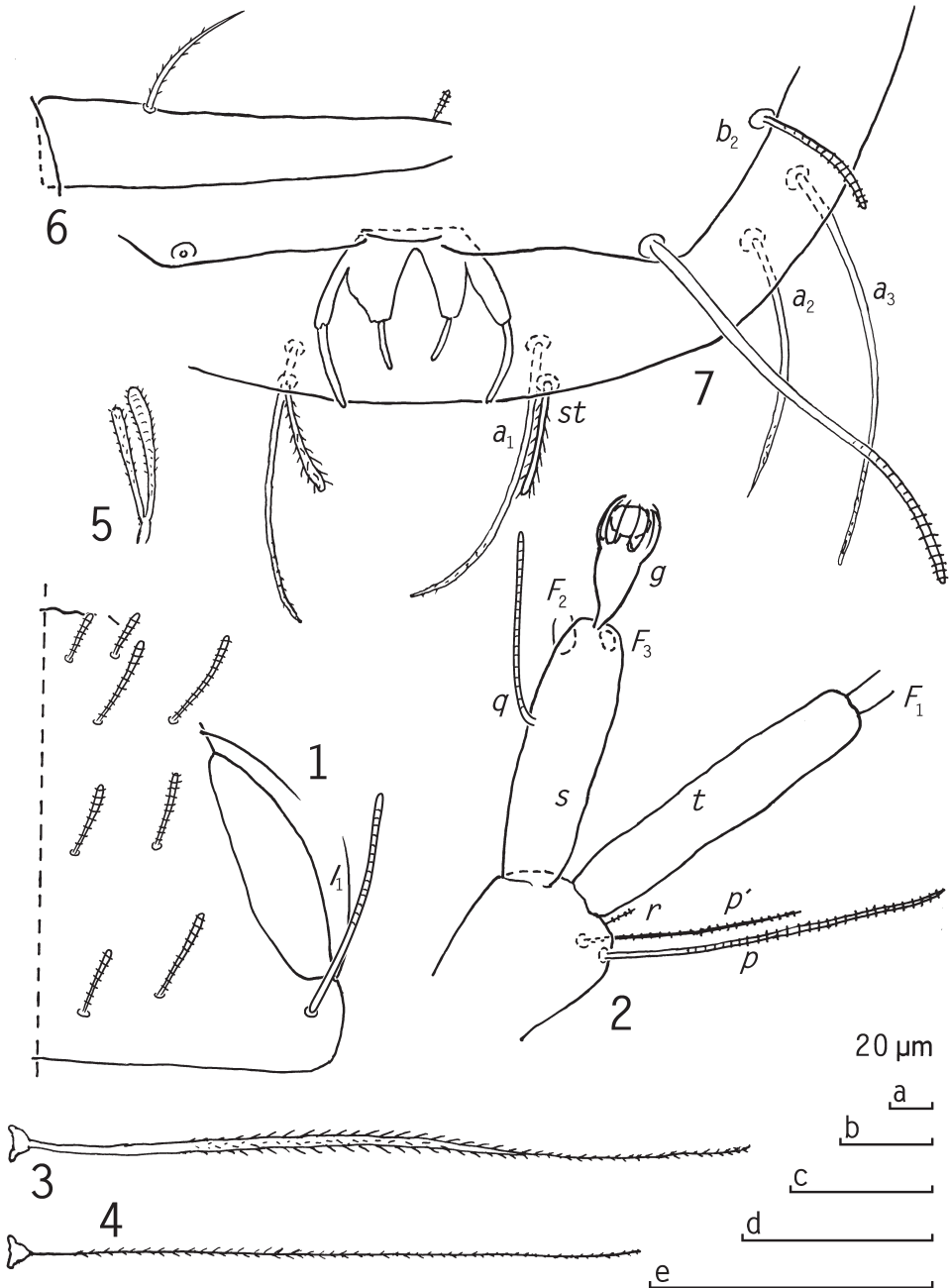
#### *Kionopauropus alyeskaensis* sp. n.

urn:lsid:zoobank.org:act:C6931196-AB1D-4C90-B42C-69017D41A2CD

[http://species-id.net/wiki/Kionopauropus\\_alyeskaensis](http://species-id.net/wiki/Kionopauropus_alyeskaensis)

Figs 1–7

**Type material.** Holotype, ad. 9 (♀), USA, Alaska, 15 mls N of Fairbanks, 1949.iv.28, S. Lienk leg.



**Figures 1–7.** *Kionopauropus alyeskaensis* sp. n., holotype ad. 9 (♀) **1** head, median and right part, tergal view **2** right antenna, inner view **3**  $T_3$  **4**  $T_5$  **5** seta on trochanter of leg 9 **6** tarsus of leg 9 **7** pygidium, sternal view. Scale bars: a: 4; b: 1, 3, 6; c: 2; d: 5; e: 7.

**Etymology.** Latinised from the old Aleut word ‘alYESKA’, meaning mainland (referring to the collecting site on the Alaskan mainland).

**Diagnosis.** *Kionopauropus alyeskaensis* n. sp. seems to be in a group of its own because it has long and slender antennal branches and 4-parted anal plate, characters not found in species described up to now.

**Description.** Length. ?, specimen two-parted. Head (Fig. 1). Setae of medium length, striate, tergal ones somewhat clavate, lateral ones cylindrical. Relative lengths of setae, 1st row:  $a_1=a_2=10$ ; 2nd row:  $a_1=16$ ,  $a_2=17$ ,  $a_3=20$ ; 3rd row:  $a_1=12$ ,  $a_2=13$ , 4th row:  $a_1=12$ ,  $a_2=15$ ,  $a_3=?$ ,  $a_4=37$ ; lateral group setae:  $l_1=25$ ,  $l_2=20$ ,  $l_3=?$ . Ratio  $a_1/a_1-a_1$  not possible to measure. Temporal organ in tergal view narrow, short,  $\approx 0.8$  of shortest interdistance; pistil and pore not ascertained. Head cuticle glabrous.

Antennae (Fig. 2) not complete, on segment 4 only three setae found, all thin, cylindrical, striate, their relative lengths:  $p=100$ ,  $p'=67$ ,  $r=10$ .  $p$  as long as tergal branch  $t$ , the latter cylindrical, 5.2 times as long as greatest diameter and 1.2 times as long as sternal branch  $s$ . The latter branch 3.6 times as long as greatest diameter, anterodistal corner more truncate than posterodistal one. Seta  $q$  thin, cylindrical, striate, 0.7 of the length of  $s$ . Flagella lost. Globulus  $g$  longish, with stalk included 2.7 times as long as wide, 0.5 of the length of  $s$ , diameter of  $g$  0.9 of greatest diameter of  $t$ ,  $\approx 11$  bracts, capsule subspherical. Antennae glabrous.

Trunk. Collum segment hidden. Setae on tergites only partly available for study, those studied thin, cylindrical, proportionately long.

Bothriotricha (Figs 3, 4).  $T_1$ ,  $T_2$  and  $T_4$  lost; proximal 2/3 of  $T_3$  (Fig. 3) with thickened axes with distinct oblique pubescence, distal 1/3 very thin with short pubescence;  $T_5$  (Fig. 4) thin with short pubescence.

Legs (Figs 5, 6). Setae on coxa and trochanter (Fig. 5) of leg 9 furcate, main branch clavate, secondary branch subcylindrical, a little shorter than main branch, both branches with short oblique pubescence. Tarsus of leg 9 (Fig. 6) straight, tapering, 4.7 times as long as greatest diameter; proximal seta outstanding, curved, tapering, pointed, with depressed pubescence, 4 times longer than straight, cylindrical, blunt, striate distal seta. Cuticle of tarsus glabrous.

Pygidium (Fig. 7).

Tergum. Posterior margin rounded. a-group setae thin, tapering, pointed, curved inward;  $st$  cylindrical, blunt, distinctly pubescent, curved inward and converging; relative lengths of setae:  $a_1=10$ ,  $a_2=9$ ,  $a_3=13$ ,  $st=4$ . Distance  $a_1-a_1$  0.8 of the length of  $a_1$ , distance  $a_1-a_2$  3.3 times as long as distance  $a_2-a_3$ , distance  $st-st$  2.3 times as long as  $st$  and inconsiderably longer than distance  $a_1-a_1$ .

Sternum. Posterior margin with shallow indentation below anal plate. Relative lengths of setae (pygidial  $a_1=10$ ):  $b_1=15$ ,  $b_2=5$ . Both setae cylindrical, blunt, striate.

Anal plate 4-branched by three deep posterior V-shaped incisions, median one deepest and broadest, lateral branches cylindrical, submedian branches triangular, cut squarely distally; each branch with cylindrical appendages projecting backward, those of inner branches about 0.5 of the length of those on lateral branches, appendages curved inward; plate and appendages glabrous.

**Family Eurypauropodidae**

**Genus *Eurypauropus* Ryder, 1879**

***Eurypauropus spinosus* Ryder, 1879**

**Material.** USA, Indiana, Bloomington, 37 ad. (36♀, 1 sex?), 1 ?ad.(sex?), 2 subad. 8(♀), 2 stad. ?(sex?), “*Eurypauropus* 93 Bollm. Col.”.

***Eurypauropus arcuatus* sp. n.**

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[http://species-id.net/wiki/Eurypauropus\\_arcuatus](http://species-id.net/wiki/Eurypauropus_arcuatus)

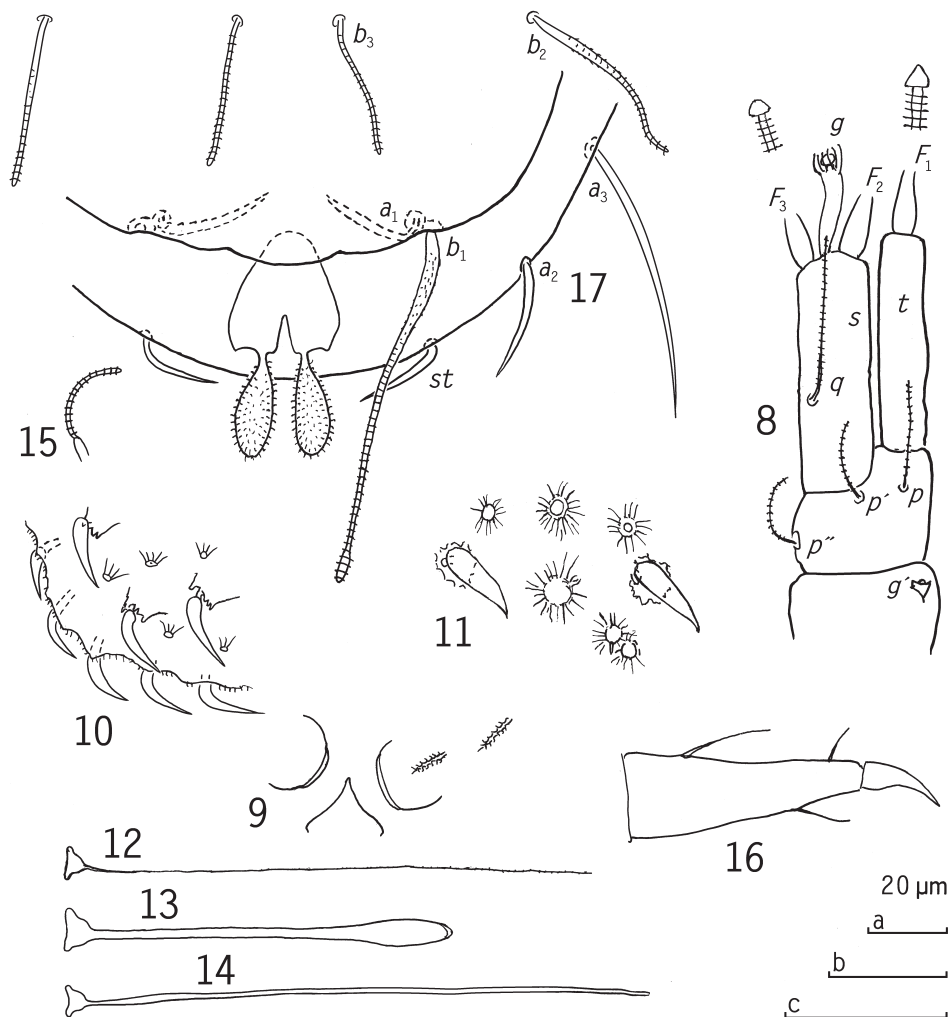
Figs 8–17

**Material.** Holotype, ad. 9(♀), USA, Virginia, Fairfax County, Dead Run, 1948.x.10, E.A. Chapin leg. – Paratype, 1 ad. (♀), same data as holotype. – Non type material, 1 subad. 8 (♀), same data as holotype.

**Etymology.** From the Latin ‘arcuatus’ = bend like a bow (referring to the curved antennal globulus *g*).

**Diagnosis.** *Eurypauropus arcuatus* is close to the two species earlier known from North America, *E. spinosus* Ryder, 1879, and *E. washingtonensis* Scheller, 1985, the former wide-spread in USA, the latter known from National Olympic Park in Washington only. The new species is distinguished from both these species by the shape of the antennal globuli, *g*, curved in *E. arcuatus*, not straight, globulus *g*’ of 3rd antennal segment, as long as wide, not at least twice longer than wide, by the shape of the sternal antennal branch *s*, anterior and posterior margins subsimilar in length, not the posterodistal margin distinctly shorter than the anterodistal one, by the shape of the setae *st* of the pygidial tergum, simply curved inwards, not S-shaped, and by the shape of the anal plate, no posterolateral appendages, distinct in both *E. spinosus* and *E. washingtonensis*.

**Description.** Length 1.37–1.42 mm. Antennae (Fig. 8) glabrous. Segment 3 with two setae and globulus *g*’, segment 4 with three setae. Globulus *g*’ short, as long as wide. Relative lengths of setae on 4th segment: *p*=100, *p*’=84, *p*”=88. These setae cylindrical, pointed, striate. Tergal seta *p* 0.5 of the length of tergal branch *t*. The latter cylindrical, 4.5 times as long as greatest diameter and as long as sternal branch *s*. The latter branch cylindrical, 4.0 times longer than greatest diameter, anterodistal and posterodistal corners equally truncate; its seta *q* as setae similar to those of segment 4, and inserted 0.4 from proximal end of *s*, with length 0.7 of the length of *s*. Relative lengths of flagella (base segments included) and base segments: *F*<sub>1</sub>=100, *bs*<sub>1</sub>=(10-)11, *F*<sub>2</sub>=66, *bs*<sub>2</sub>=10, *F*<sub>3</sub>=85(-87), *bs*<sub>3</sub>=12. *F*<sub>1</sub> 0.9 of the length of *t*, *F*<sub>2</sub> and *F*<sub>3</sub> 1.3 and 1.7 times as long as *s* respectively. Distal calyces of flagella conical, glabrous. Globulus *g* slender, 4 times longer than wide, stalk thin, curved, ≈10 thin bracts; diameter of *g* 0.6 of greatest diameter of *t*.



**Figures 8–17.** *Eurypauropus arcuatus* sp. n., holotype ad. ♀ **8** right antenna, sternal view **9** collum segment, median and left part, sternal view **10** tergite II, left posterior corner with large setose and small crater-like protuberances, lateral view **11** tergite I, central part, large setose and small crater-like protuberances, tergal view **12**  $T_1$  **13**  $T_3$  **14**  $T_5$  **15** seta on trochanter of leg 9 **16** tarsus of leg 9 **17** pygidium, sternal view. Scale bars: a: 8–10, 12–15; b: 11; c: 16, 17.

Trunk. Setae of collum segment (Fig. 9) short, probably simple, subsimilar, short, tapering, pointed, densely pubescent. Sternite process triangular, pointed anteriorly. Appendages short, wide, caps thin. Process and appendages glabrous.

Tergites with two types of protuberances (Figs 10, 11), large, curved, setose, glabrous, pointed spines, proximally scale-like and evenly spaced on background of more numerous, small crater-like protuberances with pleated sides.

Bothriotricha (Figs 12–14). Relative lengths:  $T_1=100$ ,  $T_2=97(-112)$ ,  $T_3=67(-71)$ ,  $T_4=117$ ,  $T_5=102(-104)$ .  $T_1$  (Fig. 12) and  $T_2$  with very thin axes, distal half with short erect pubescence;  $T_3$  (Fig. 13) glabrous, with thick axes and distal longish end-swelling,  $T_4$  and  $T_5$  (Fig. 14) glabrous too but thin, somewhat tapering, blunt distally.

Legs (Figs 15–16). All legs 5-segmented. Setae on coxa and trochanter (Fig. 15) of leg 9 thin, simple, cylindrical, striate. Tarsus of leg 9 distinctly tapering (Fig. 16), (2.8-)3.2 times as long as greatest diameter, two tergal setae and one sternal, all pointed glabrous; proximal tergal seta longest, almost 0.4 of the length of tarsus, (1.8-)2.2 times as long as distal tergal seta and 1.6 times as long as sternal seta. Length of main claw 0.4 of the length of tarsus.

Pygidium (Fig. 17).

Tergum. Posterior margin evenly rounded. Relative lengths of setae:  $a_1=a_2=10$ ,  $a_3=(22-)23$ ,  $st=7$ .  $a_1$ ,  $a_2$  and  $st$  similar, tapering, pointed,  $a1$  and  $st$  curved inwards with a knee close to proximal end,  $a_2$  evenly curved,  $a_1$  and  $st$  strongly and  $a_2$  inconsiderably converging;  $a_3$  evenly curved inward and somewhat diverging. Distance  $a_1-a_1$  (2.1-)2.4 times as long as  $a_1$ , distance  $a_1-a_2$  about as long as distance  $a_2-a_3$ ; distance  $st-st$  3.2 times as long as  $st$  and 1.1 times as long as distance  $a_1-a_1$ .

Sternum. Posterior margin with low posteriomedian bulge below anal plate. Relative lengths of setae (pygidial  $a_1=10$ ):  $b_1=(23-)27$ ,  $b_2=13$  and 16 in the holotype, and 18 in the paratype,  $b_3=12$ .  $b1$  with fusiform, and shortly pubescent base, tapering into a subcylindrical, striate distal half terminated with a small, striate end-swelling;  $b2$  similar to  $b_1$  but with cylindrical distal part, proportionately much shorter and without end-swelling;  $b_3$  subcylindrical, striate. Length of  $b_1$  (as long as -) 1.2 times as long as interdistance,  $b_2$  0.7-0.9 of distance  $b_1-b_2$ ,  $b_3$  on the same level as  $b_2$ , length 1.4 times as long as interdistance.

Anal plate narrowest at base and consisting of two broad lobes posteriorly separated by V-shaped incision  $\approx 0.3$  of the length of plate; posterolateral corners without appendages but each with very small tooth; each lobe with a bladder-shaped posteriorly directed appendage with distinct erect pubescence, length of appendages 0.9 of the length of plate.

## Remarks

The Pauropoda was reported from USA for the first time by Packard (1870) only four years after the group was discovered in London in 1866 (Lubbock 1867). Despite that more than 140 years have passed and about one hundred species have been found the knowledge of their occurrence in the USA is still most imperfect.

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# A new species of *Buthus* Leach, 1815 from Cyprus (Scorpiones, Buthidae)

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## Abstract

During the last decade, several contributions to the genus *Buthus* Leach, 1815 (family Buthidae) and especially to the '*Buthus occitanus*' species complex were proposed. These contributions led to the definition of several species, previously considered only as subspecies or varieties, and also to the description of new species. In the present study, the questionable presence of the genus *Buthus* in the Cyprus is rediscussed and a new species *Buthus kunti* **sp. n.** is described.

## Keywords

Scorpion, *Buthus*, new species, Cyprus

## Introduction

The genus *Buthus* was described by Leach, 1815 with the type species (by original designation), *Scorpio occitanus* Amoreux, 1789. The type species was described from Sauvignargues in the South of France. In his study about the scorpions of North Africa,

Vachon (see 1952), revised the composition of the genus *Buthus* and proposed a revised diagnosis, closer to the generic type *B. occitanus*. Consequently, quite many species placed in the genus *Buthus* have been transferred to other genera. Some were already available as subgenera, while others have been described by Vachon at this occasion. Can be cited, *Androctonus* Ehrenberg, 1828, *Buthacus* Birula, 1908, *Leiurus* Ehrenberg, 1828, *Compsobuthus* Vachon, 1949 and *Buthotus* Vachon, 1949 (= *Hottentotta* Birula, 1908). (see Lourenço 2002, 2003 for details). However, the classification proposed by Vachon (1952) for the species of *Buthus*, and in particular for those belonging to the “*Buthus occitanus*” species complex, remained unsatisfactory. A more precise definition of the *Buthus* species has been attempted recently by Lourenço (2002, 2003) which was followed by the elevation of several subspecies to species rank and the description of a new species.

*Buthus occitanus* (Amoreux, 1789) was first recorded from Cyprus by Kraepelin (1891). Levy and Amitai (1980) confirmed it to Cyprus, and also stated that this population was distinct from that of *Buthus israelis* (Shulov and Amitai, 1959), as follows: “Some specimens of *Buthus* from our region resemble specimens of the Moroccan *B. o. mardochei*”. - “On the other hand, specimens from Cyprus, Tunisia, Libya and Somalia are different”. Subsequently, the presence of a *Buthus* population in the island was again questioned (Gantenbein et al. 2000).

During this study, the third author (WRL) was able to find one adult female previously studied by E. Simon by the end of the 19<sup>th</sup> century (Simon’s Collection N° 3228) in the collections of the Muséum national d’Histoire naturelle, Paris. In his notes, Simon indicates that the specimen was collected in Cyprus and represented a new species, ‘*Buthus orientalis*’. This species name, however, was never published.

Here we confirm the presence of a *Buthus* population in Cyprus, and a new species belonging to the “*Buthus occitanus*” complex is described. This new *Buthus* population is certainly endemic to Cyprus.

## Materials and methods

Illustrations and measurements were made with the aid of a Wild M5 stereo-microscope with a drawing tube (camera lucida) and an ocular micrometer. Measurements follow Stahnke (1970) and are given in mm. Trichobothrial notations follow Vachon (1974), and morphological terminology mostly follows Vachon (1952) and Hjelle (1990). Specimens were photographed using a Nikon d100 (lens AF micro-NIKKOR 60 mm f/2.8D). Digital images were edited with the assistance of Photoshop CS3 software.

## Abbreviations

- MNHN** Museum National d’Histoire Naturelle, Paris, France.  
**MTAS** Museum of Turkish Arachnology Society, Ankara, Turkey.

## Results

### Description of the new species

#### *Buthus kunti* sp. n.

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[http://species-id.net/wiki/Buthus\\_kunti](http://species-id.net/wiki/Buthus_kunti)

Figs 1–12

**Type material:** Cyprus, 1 female holotype, Karpaz Region, Dipkarpaz Town (İskele), 2 km south east, 35°35'05" N, 34°25'23" E, leg. H. Koç (MTAS). Paratypes: 1 subadult male, Karpaz Region, Zafer headland, 2 km west, 35°41'29" N, 34°33'43" E, leg. M. Z. Yıldız and B. Göçmen (MTAS). 1 subadult male, Güzelyurt District (Morphou), about 5 km south east of Güzelyurt town, leg. H. Koç (MNHN) (Fig. 13).

**Note:** Although Simon's female specimen may belong to the new species, we decided not to include it among the type material because (i) it is poorly preserved (ii) the precise collecting site is unknown.

**Derivatio nominis:** The species is dedicated to Kadir Boğaç Kunt who is the founder of the Turkish Arachnological Society.

**Diagnosis:** Scorpion of medium to large size, reaching a total length of 73 mm. General coloration yellow to pale yellow, with brownish spots on the carinae of carapace; legs with diffused brownish spots. Carinae moderately to strongly marked; granulations moderately to weakly marked. Fixed and movable fingers with 12 rows of granules. Pectines with 27 to 29 teeth in males, 24–25 in female.

**Relationships:** *Buthus kunti* sp. n., belongs to the "*Buthus occitanus*" species complex. It can be distinguished from the other species of *Buthus* and in particular from *B. israelis* Shulov & Amitai, 1959, a species distributed in the nearby region of the Middle East, by the following characters: (i) *B. israelis* is smaller, measuring up to 62 mm in total length for females; (ii) according to Levy and Amitai (1980) pectinal teeth 28–33 in males, 22–28 in females, the new species has a slightly reduced number of pectinal teeth; (iii) metasomal segment II is longer than wide in the female of the new species, whereas it is wider than long in the female of *B. israelis*; (iv) pedipalp segments are oligotrichous (sense Vachon 1952) in the new species, whereas they are polytrichous in *B. israelis*.

**Taxonomic note:** As already exposed in a recent paper (Lourenço et al. 2010), the Israeli and Sinai populations were originally described only as a variety: *Buthus occitanus mardochei* var. *israelis* Shulov & Amitai, 1959. Subsequently, this form was raised to subspecies level as *Buthus occitanus israelis* (Levy and Amitai 1980). This decision followed the previous taxonomic position adopted by Vachon (1952), who considered almost all *Buthus* populations from North Africa and Middle East as subspecies of *Buthus occitanus*. However, a revision of the genus *Buthus* (Lourenço 2003) revealed that the species *Buthus occitanus* is limited to France and Spain. Most of the populations of *Buthus*, previously defined as subspecies and even varieties, were raised to the species level, or described as new species. In the case of *Buthus occitanus israelis*, it seemed that

this population could no longer be considered as a subspecies of *B. occitanus*, both for morphological and especially geographical reasons. Consequently, it was raised to species level, as *B. israelis* (Lourenço et al. 2010). Kovařík (2006) examined material from Egypt and Israel and synonymized *Buthus occitanus mardochei* var. *israelis* Shulov & Amitai, 1959 and *Buthus occitanus israelis* with *B. intumescens*. But Lourenço et al. (2010) didn't follow this synonymization and accept *Buthus occitanus israelis* as valid and elevated to species range.

**Description based on female holotype:** Measurements in Table 1. Coloration basically yellowish to pale yellow (Figures 1–3). Prosoma: carapace yellowish; carinae and eyes marked by dark pigment (Figs 1–2).

Mesosoma yellowish with carinae also marked by dark pigment, but less conspicuous than carapace. Metasomal segments yellowish; vesicle yellowish; aculeus yellowish at its base and dark reddish at its extremity. Venter yellowish; pectines pale yellow.

**Table 1.** Morphometric values (in mm) of the female holotype of *Buthus kunti* sp. n.

<b>Total length</b>	<b>73.3</b>
Carapace:	
- length	8.2
- anterior width	5.8
- posterior width	9.4
Mesosoma length:	21.4
Metasomal segment I:	
- length	5.5
- width	5.7
Metasomal segment II:	
- length	6.6
- width	5.7
Metasomal segment V:	
- length	8.7
- width	4.8
- depth	3.7
Telson:	
- length	8.0
- width	4.0
- depth	3.5
Pedipalp:	
- Femur length	6.6
- Femur width	2.2
- Patella length	7.6
- Patella width	3.1
- Chela length	13.2
- Chela width	3.4
- Chela depth	3.6
Movable finger: length	8.9

Chelicerae yellowish with vestigial variegated spots; fingers yellowish with dark reddish to blackish teeth. Pedipalps yellowish; fingers with dark oblique rows of denticles. Legs pale yellow with diffuse brownish spots.

**Morphology:** Carapace moderately to strongly granular; anterior margin almost straight and without a median concavity. Carinae strong; anterior median, central median and posterior median carinae strongly granular, with 'lyre' configuration. All furrows moderate to strong. Median ocular tubercle at the centre of carapace. Eyes separated by almost three ocular diameters (one median eye absent on the holotype). Three pairs of lateral eyes of moderate size (Fig. 1). Sternum triangular, wider than



1



2



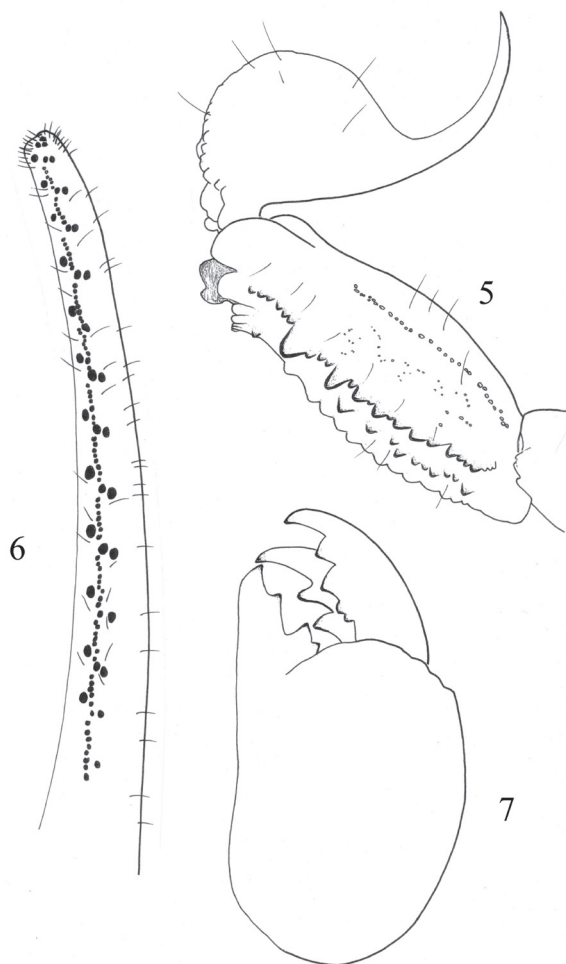
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**Figures 1–3.** *Buthus kunti* sp. n. **1** Carapace of female holotype **2** female holotype from Karpaz **3** Ditto, ventral view.

long. Mesosoma: tergites moderately granular. Three longitudinal carinae moderately crenulate in all tergites; lateral carinae reduced in tergites I and II. Tergite VII pentacarinat. Venter: genital operculum divided longitudinally, which plate with a semi-triangular shape. Pectines: pectinal tooth count: 25–24 in female holotype (28–27, 29–29 in male paratypes); middle basal lamella of the pectines not dilated. Sternites without granules, smooth with elongated spiracles; four carinae on sternite VII; other sternites acarinated and with two vestigial furrows. Metasomal segments I to III with ten crenulated carinae, ventral strongly marked on II–III with lobate granules; segment IV with eight carinae, crenulated; the first four segments with a smooth dorsal depression; segment V with five carinae; the latero-ventral carinae crenulate with 2–3 lobate denticles posteriorly (Fig. 5); ventral median carina not divided posteriorly; anal arc composed of 5–6 ventral teeth, and two lateral lobes. Intercarinal spaces weakly granular. Telson almost smooth; aculeus curved and only slightly shorter than the vesicle, without a subaculear tubercle (Fig. 5). Cheliceral dentition as defined by Vachon (1963) for the family Buthidae; external distal and internal distal teeth approximately the same length; basal teeth on movable finger small but not fused (Fig. 7); ventral aspect of both fingers and manus covered with long dense setae. Pedipalps: Femur pentacarinat; patella with eight carinae; all faces weakly granular; chela smooth, without carinae. Fixed and movable fingers with 12 oblique rows of granules. Internal and external accessory granules present, strong; three accessory granules on the distal end



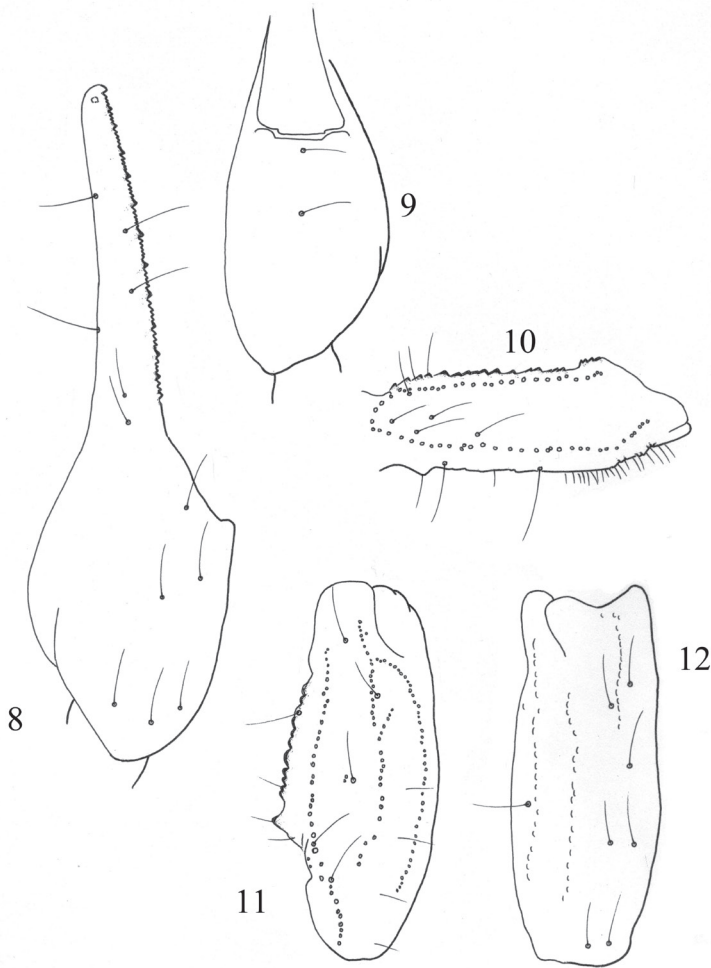
**Figure 4.** *Buthus kunti* sp. n., subadult male paratype from Zafer headland.



**Figures 5–7.** *Buthus kunti* sp. n. Female holotype **5** Metasomal segments V and telson, lateral aspect **6** Movable finger of pedipalp chela with rows of granules **7** Chelicera, dorsal aspect.

of the movable finger next to the terminal denticles (Fig. 6). Legs: Tarsus with two longitudinal rows of thin and long setae ventrally; tibial spur strong on legs III and IV; pedal spurs moderate on legs I to IV. Trichobothriotaxy: trichobothrial pattern of Type A, orthobothriotaxic as defined by Vachon (1974). Dorsal trichobothria of femur arranged in  $\beta$ -configuration (Vachon 1975) (Figs 8–12).

**Ecological notes and biogeography:** Cyprus Island exhibits the Mediterranean climate which is warm and rainy in winter and hot and dry in summer. Rainy season is rare and only occurs in winter in plain areas (İlseven et al. 2006). Sandy soil exists at Zafer headland locality, where the vegetation is composed of *Pancratium maritimum*, *Cakile maritima*, *Limonium albidum* and *Pistacia lentiscus* (Fig. 14). Redzina soil is present at Güzelyurt, where the habitat was steppe vegetation with small bushes. *Buthus kunti* sp. n. has allopatric distribution with another species endemic to Cyprus, *Mesobu-*



**Figures 8–12.** Trichobothrial pattern of *Buthus kunti* sp. n., female holotype. **8–9** Chela, dorso-external and ventral aspects **10** Femur, dorsal aspect **11–12** Patella, dorsal and external aspects.

*thus cyprius* Gantenbein & Kropf, 2000. Interestingly, Cyprus Island is the only territory where representatives of *Buthus* and *Mesobuthus* genera have been found together.

The geological evolution of the eastern Mediterranean region, has run a series of prominent geological movements, together with the world wide sea levels rising and falling accompanying the continental glaciations leading to join and split of Cyprus and Anatolia (Robertson 1998). It is thus clear that no consensus yet as to the geological history of Cyprus; Schmidt (1960) express Cyprus was part of a united landmass of the mainland and then was broken piece of the mainland, but according to the modern geological history of the eastern Mediterranean region, Cyprus became due to tectonic movements occurring in the area, Gass (1987) supports during Mesozoic time Mt. Troodos is originated a submarine volcano that arise an oceanic island which occurred at Cretaceous-Palaeocene. Whereas Kyrenia Mts (which include Pentadactylos Mt.) may-



**Figure 13.** Map of Cyprus, showing the site where the new species was collected. **1** Collecting locality of holotype, Karpaz Region, Dipkarpaz Town (İskele) **2** Collecting locality of paratype, Karpaz Region, Zafer headland **3** Ditto, Güzeyurt District (Morphou).

be as a second island or as a part of the southern Taurus Mts range originated in Eocene then later separated from each other to the south (Cavazza and Wezel 2003). According to widely accepted theory is Mediterranean salinity crisis that the Mediterranean sea dried out and these two island or the Trodos island and southern Tauruian-Kyrenian peninsula connected via landbridges about 5.6 Myrs (Hsü et al. 1977; Cavazza and Wezel 2003). When the refilling of the Mediterranean basin, Cyprus terrestrial animals was isolated for around 5.2 – 5.3 Myrs (Robertson 1998; Gantenbein and Keightley 2004). This isolation played a major role in forming actual scorpion fauna of Cyprus and molecular and morphological phylogenetic analysis has revealed that populations of the island of Cyprus represent a divergent lineage; so these have been assigned to the species rank (i.e., *Mesobuthus cyprius* Gantenbein and Kropf, 2000). On the other hand, the other discussions about endemism of some snake species occurring in the two island origin of Cyprus (Troodos and Kyrenia island); *Hierophis cypriensis*, in only southern Cyprus (i.e., Troodos island) while *Platyceps najadum* (non-endemic) and *Natrix tessellata* (non-endemic) is distributed only in northern Cyprus (i.e., Kyrenia island) and also on the mainland (Göçmen et al. 2009). Gantenbein and Keightley (2004) stated his analyses shows that *Mesobuthus cyprius* occurring in Cyprus is autochthonous. *Mesobuthus cyprius* recorded in both southern and northern Cyprus. While *Mesobuthus cyprius* recorded at high elevation in Cyprus, *Buthus kunti* sp. n. collected at low altitude in dry condition. It is not yet clear if the distribution of new species restricted to Kyrenia island (northern Cyprus). However, Mt. Troodos run vertically and Kyrenia Mts. lay horizon-



**Figure 14.** *Buthus kunti* sp. n. Habitat from Zafer headland (Sandy soil habitat).

tally with less high in Cyprus, are not usually a zoogeographic barrier there. When we take in consideration for this situation we expect the distribution of new species is all over Cyprus. Another point of view explains that as a result of the geological process, it is a localized endemic species in Kyrenia island (Pentadactylos Mt.).

Since the second record of scorpion species, a museum material, Simon's material the precise collecting site is unknown and poorly preserved, no other species have been seen in several recent field works, so the species might be very rare on the island, and should be investigated again for male specimens under suitable seasonal conditions.

Unplanned urban settlement destroys the habitats of these endemic species. Government agencies are required to take precautions to not destroy habitats.

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# Two new species of the genus *Leenurina* Najt & Weiner, 1992 (Collembola, Neanuridae, Caputanurinae) from Primorskij Kraj (Russia)

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## Abstract

*Leenurina khualaza* sp. n. and *Leenurina pomorskii* sp. n., two new species from East Russia (Primorskij Kraj) are described. They are closely related to *Leenurina jasii* Najt & Weiner, 1992 from North Korea, from which they differ mainly in the number of tibiotarsal chaetae (19, 19, 18 in the new species versus 18, 18, 17 in *Leenurina jasii*), several chaetotaxic features and organization of dorsal granulation. The two new species may be separated by tertiary granulation (large areas fringed with large secondary granules in *L. pomorskii*, small rounded or hexagonal areas with smaller secondary granules in *L. khualaza*), coloration (light blue in *L. khualaza* versus white in *L. pomorskii*) and number of eyes (2+2 eyes in *L. khualaza* versus 3+3 eyes in *L. pomorskii*). An updated diagnosis of the genus *Leenurina* Najt & Weiner, 1992 and a key to species of Caputanurinae are given.

## Keywords

Taxonomy, chaetotaxy, integument granulation, Eastern Asia

## Introduction

Caputanurinae is a small subfamily of Neanuridae defined by a remarkable synapomorphy, unique among Collembola: the fusion of prothoracic tergite to head. It includes two genera: *Caputanurina* Lee, 1983 and *Leenurina* Najt & Weiner, 1992. *Koreanurina* Najt & Weiner, 1992, assigned to Pseudachorutinae, is very similar to these genera, but its prothorax is separated from head (Najt and Weiner 1992). These three genera represent different degrees in head-prothorax fusion, from separate to completely fused, challenging the validity of the subfamily Caputanurinae as currently defined.

Najt and Weiner (1992) established the genus *Leenurina* for two species: *L. jasioi* Najt & Weiner, 1992 from North Korea as type species, and *Caputanurina nana* Lee, 1983 from South Korea. This genus is closely related to *Caputanurina* Lee, 1983, the nominal genus of the Far Eastern subfamily Caputanurinae. Differences between these two genera are summarized in the Table 2 of Najt and Weiner (1992: 204) and in Table 1 of the present paper.

Caputanurinae and the related genus *Koreanurina* are only known for temperate regions of Far-East Asia, i.e. South Korea (Lee 1983), North Korea (Najt and Weiner 1992), and northeastern China (Wu and Yin 2007).

Among a large material of Collembola collected in Primorskij Kraj, two new representatives of the genus *Leenurina* were found. They are described in this paper, and led us to correct and complete the diagnosis of this genus. They are the first Caputanurinae described from Russia, though an unidentified species of *Caputanurina* was already mentioned from Far East Russia – South Primorie (Kuznetsova 1988).

## Abbreviations used

<b>MNHN</b>	Muséum national d'Histoire naturelle de Paris (France)
<b>ISEA</b>	Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków (Poland)
<b>DBET</b>	Department of Biodiversity and Evolutionary Taxonomy, Wrocław University (Poland)
<b>MSPU</b>	Moscow State Pedagogical University, Moscow (Russia)

## Material and methods

The specimens were extracted from forest litter samples using Berlese funnels, and stored in 90% ethanol. They were cleared in lactic acid, mounted on slide in Marc-André II and examined using a microscope Leica DMLB. Photographs were taken with a ProgRes C3 camera mounted on the microscope, using either phase contrast (Fig. 6) or DIC interferential contrast (Figs 2A, 4, 5). Chaeta numbering in the text and figures follows Yosii (1960) and Cassagnau (1974).

Abbreviations used in tables and key: abd., abdominal tergum; PAO, postantennal organ; th., thoracic tergum; ant., antennal segment;

## Systematics

### Neanuridae

### Caputanurinae

#### *Leenurina* Najt & Weiner, 1992

<http://species-id.net/wiki/Leenurina>

**Type species:** *Leenurina jasii* Najt & Weiner, 1992

**Diagnosis.** Body wide, flattened dorso-ventrally. Thoracic tergum I fused to head. Suture between abdominal tergum IV and V normal or as a shallow inverted V. Integument strongly granulated dorsally, with tertiary granulations variously arranged and underlying of hexagonal regular reticulations on head, thorax II and III, and abdomen I to V. Eyes and postantennal organ located dorsally. Postantennal organ made of 9-14 entire vesicles in one row. Mandibles with five teeth, maxillae thin. Labial organite x present. Papillated chaeta L absent on labium. Antenna with distinct apical vesicle. Antenna IV with 6 thickened sensilla and one microsensillum dorsally. Dorsal chaetotaxy of short and pointed ordinary chaetae and thin s-chaetae. Chaetal arrangement strongly disrupted on head, with a large central area devoid of chaetae. Dorsal chaetotaxy reduced. Claw toothless. Furca reduced to two small swellings, each with one chaeta.

**Discussion.** On thoracic terga, p1 correspond to chaeta m1 of Najt and Weiner 1992, and p2 to p1. As a result, the s-chaeta is assumed to be in p4 (p5 as in Najt and Weiner 1992). *Leenurina* differs from *Caputanurina*, the other genus of the subfamily Caputanurinae, by the characters listed in Table 1. *Caputanurina intermedia* Najt & Weiner, 1992 exhibits intermediate characters between the two genera, which are closely related.

**Table 1.** Differential characters between *Leenurina*, *Caputanurina* and *C. intermedia*.

	<i>Leenurina</i>	<i>Caputanurina</i>	<i>C. intermedia</i>
Eye position	dorsal	dorso-lateral or lateral	dorso-lateral
PAO position	dorsal	latero-ventral or ventral	lateral
Abd. IV-V suture	as shallow inverted V	as deep inverted V	as deep inverted V
Habitus	slightly flattened	strongly flattened	flattened
Number of chaetae between the anterior line of chaetae and the posterior margin of the central plate on head	1-3+1-3 in one or two rows	>3+3 in several rows	3+3 in two rows
Number of chaetae p between axis and S on abd. II-III	2	3	3

## List of species

*Leenurina nana* (Lee, 1983) – South Korea (Gang-weon-do province);

*Leenurina jasii* Najt & Weiner, 1992 – North Korea (Kangwon and North Hamgyong provinces), type species of the genus;

*Leenurina khualaza* sp. n. – Russia (Primorskij Kraj);

*Leenurina pomorskii* sp. n. – Russia (Primorskij Kraj).

### *Leenurina khualaza* sp. n.

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[http://species-id.net/wiki/Leenurina\\_khualaza](http://species-id.net/wiki/Leenurina_khualaza)

Figs 1A–H, 6C, D, H; Table 2

**Type locality.** Russia: Primorskij Kraj, Shkotovsky area, Livadiysky Range, Anisimovka (43° 10' 11" North, 132° 47' 37" East), Khualaza Mt. Litter in mixed deciduous and coniferous forest, Berlese funnel extraction, L. Deharveng and A. Bedos leg, 19.IX.04 (samples RU-032, RU-031, RU-029).

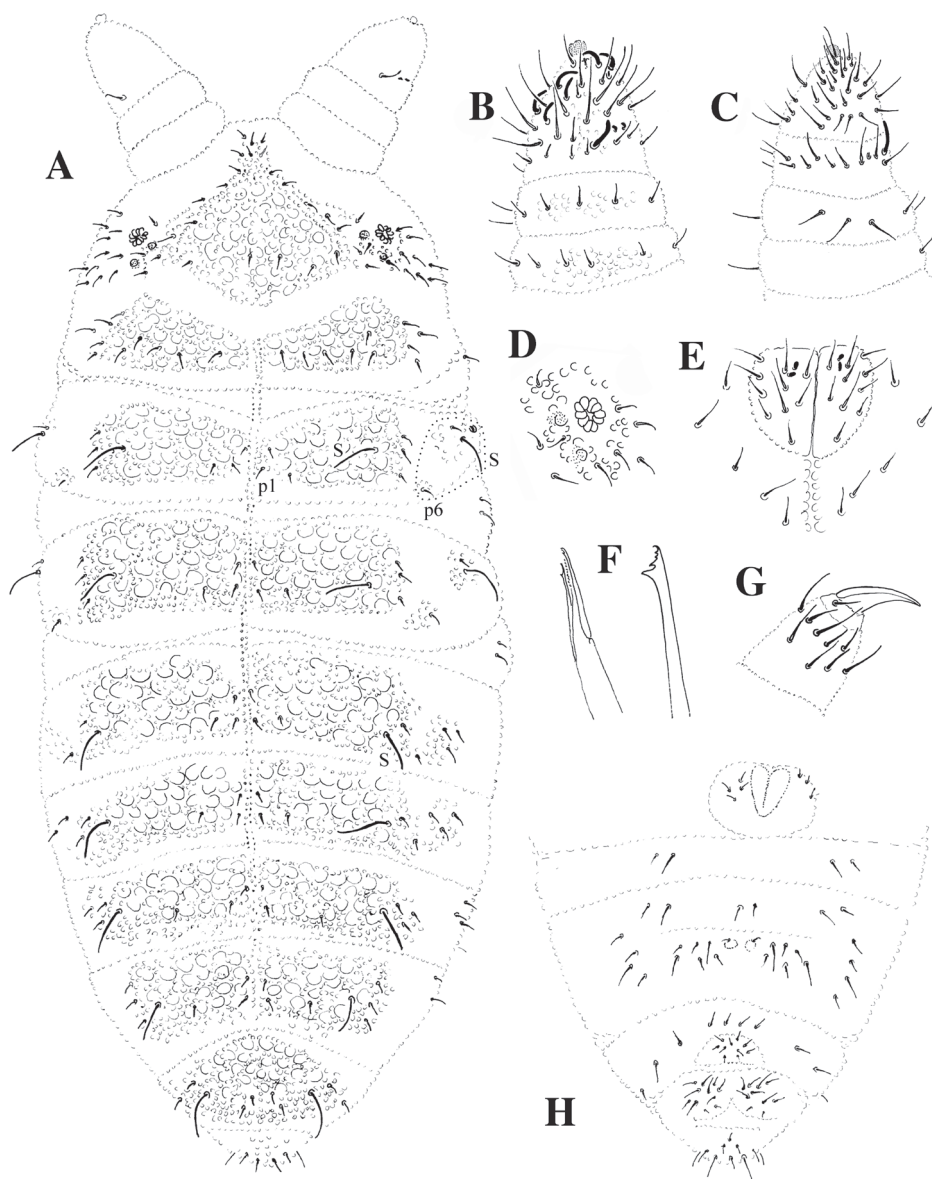
**Type material.** Holotype, female adult (RU-032/1) and 7 paratypes, on slides. Holotype and 1 paratype male adult (RU-032/5) in MNHN; 2 paratypes: female (RU-032/2), male juvenile (RU-031) in ISEA; 2 paratypes: female (RU-032/3), male juvenile (RU-032/4) in DBET; 2 paratypes: females (RU-032/6, RU-029) in MSPU.

**Etymology.** After the name of the type locality, the Khualaza mountain.

**Description.** Holotype: 0.70 mm (female adult); paratypes: 0.60–0.70 mm (females), 0.45 (male RU032/5) to 0.61–0.62 mm (males juvenile). Habitus typical for the genus *Leenurina*. Abdominal tergum VI small, not hidden under V. Color in alcohol very light blue with blue-black 2+2 ocelli. Integument very strongly granulated dorsally, with tertiary granulation arranged in rather small and smooth subhexagonal areas encircled by 5 to 9 secondary granules, underlined by strong reticulations, and grouped as large plates on head (Figs 6C, H), on thorax II–III and on abdomen I to V (Fig. 6D). Two parallel lines of secondary granules along the axis from posterior part of head to abdominal tergum IV. Thoracic tergum I fused with head, sternum normal.

Antennae shorter than head. Antennal segment I with 7 chaetae, antennal segment II with 12 chaetae. Sensory organ on antennal segment III consisting of two small sensilla bent in the same direction, two almost equal, subcylindrical guard sensilla and a small ventral microsensillum. Antennal segment IV with 6 thick subcylindrical sensilla, a microsensillum, a subapical organite and a simple apical vesicle (Figs 1B, C).

Two ocelli per side, a little larger than surrounding integument granulation, indicated by blue-black pigment patches, but not distinct from surrounding secondary granules under microscopic examination. Postantennal organ slightly oval, about three times longer and two times broader than ocellus A, with 9–10 vesicles (Figs 1A, D). Buccal cone typical for the genus. Labrum truncated, labral chaetotaxy: 4/2,3,5,2, with



**Figure 1.** *Leenurina khualaza* sp. n.; **A** dorsal chaetotaxy (dorso-lateral chaetae circled with dotted line) **B** antenna, dorsal side **C** antenna, ventral side **D** postantennal organ and ocelli **E** labium **F** maxilla (left) and mandible (right) **G** tibiotarsus III **H** chaetotaxy of abdominal sterna I–VI.

prelabral chaetae as 2 axial and 2 lateral; the later assigned here to labrum might be as well lateral labial chaetae. Labium short, with 4 basal (E, F, G, f), 3 distal (A, C, D) and 3 lateral chaetae; papillated chaeta L absent; 2+2 hyaline vesicles arranged one above the other between chaetae A and C (x papillae of Deharveng 1983) (Fig. 1E). Mandible

with three small apical teeth and two strong basal ones. Maxilla with two lamellae (each with two apical teeth) and capitulum denticulate with minute teeth (Fig. 1F).

Dorsal chaetotaxy as on Fig. 1A, with thin short pointed ordinary chaetae and long thin s-chaetae, 4–5 times longer than ordinary chaetae. Some asymmetry observed. Ocular area with 3 chaetae. One lateral chaeta (Fig. 1A) located on what could be the subcoxa 1. Dorso-lateral chaetae of thoracic terga II and III in two groups (p6 shift posteriorly far from the s-chaeta, Fig. 1A). Formula of s-chaetae per half tergum: 022/11111; s-microchaeta present on thoracic tergum II, close and anterior to the lateral s-chaeta; s-chaeta on abdominal tergum IV almost as long as on abdominal terga II and III. From thoracic tergum II to abdominal tergum IV, 3 chaetae between the axis and the proximal s-chaeta: a1, p1 and a chaeta moving from a “p2” (usually on thoracic tergum II to abdominal tergum II) to a “p3” position (usually on abdominal tergum III-IV), with variation from one specimen and sometimes one side to the other.

**Table 2.** Differential characters between *Leenurina* species.

Characters	<i>L. nana</i> (after original description)	<i>L. jasii</i>	<i>L. kbualaza</i> sp. n.	<i>L. pomorskii</i> sp. n.
Colour	orange alive	light blue in alcohol	very light blue in alcohol	white in alcohol
Dorsal tertiary granulation	?	grouping of 2-3 secondary granules	subhexagonal areas encircled by 5 to 9 secondary granules	very large plates fringed with secondary granules
Number of ocelli	2+2	3+3	2+2	3+3
Number of vesicle in PAO	11 in circle	11-14, oval	9-10, slightly oval	10-12, oval
Chaeta p6 and dorso-lateral s-chaeta on th.II–III	?	grouped	widely separate	grouped
Number of chaetae between the anterior line of chaetae and the posterior margin of the central plate on head	2+2 in one row	1-2+1-2 in one row	2+2 in one row	3+3 in two rows
Number of chaetae in the posterior row between s-chaetae of abd. IV	6	4	4	2
Number of chaetae on tibiotarsi I, II, III	18,18,17	18,18,17	19,19,18	19,19,18
Number of chaetae on subcoxae 2 of legs I, II, III	?	0,1,1	0,1,1	0,2,2

Thoracic sterna without chaetae. Chaetotaxy of abdominal sterna I–VI as in Fig. 1H. Lateral anal valves with two, upper valve with three hr-chaetae.

Tibiotarsi I, II and III with 19, 19 and 18 chaetae (chaeta M present). Femora I, II and III with 12, 11 and 10 chaetae, trochantera I, II and III each with 5 chaetae, coxae I, II and III with 3, 6 and 7 chaetae, subcoxae 2 of legs I, II and III with 0, 1 and 1 chaetae, subcoxae 1 of legs I, II and III with 1, 2 and 2 chaetae. Praetarsi with 1+1 strong chaetae. Claw short and thick, toothless (Fig. 1G).

Ventral tube with 4+4 chaetae, without chaetae at its basis. Furca reduced to two small swellings, each with one chaeta (Fig. 1H).

**Discussion.** See the discussion of *Leenurina pomorskii* and Table 2.

***Leenurina pomorskii* sp. n.**

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[http://species-id.net/wiki/Leenurina\\_pomorskii](http://species-id.net/wiki/Leenurina_pomorskii)

Figs 2A–B, 3A–F, 4, 5, 6E, F, I; Table 2

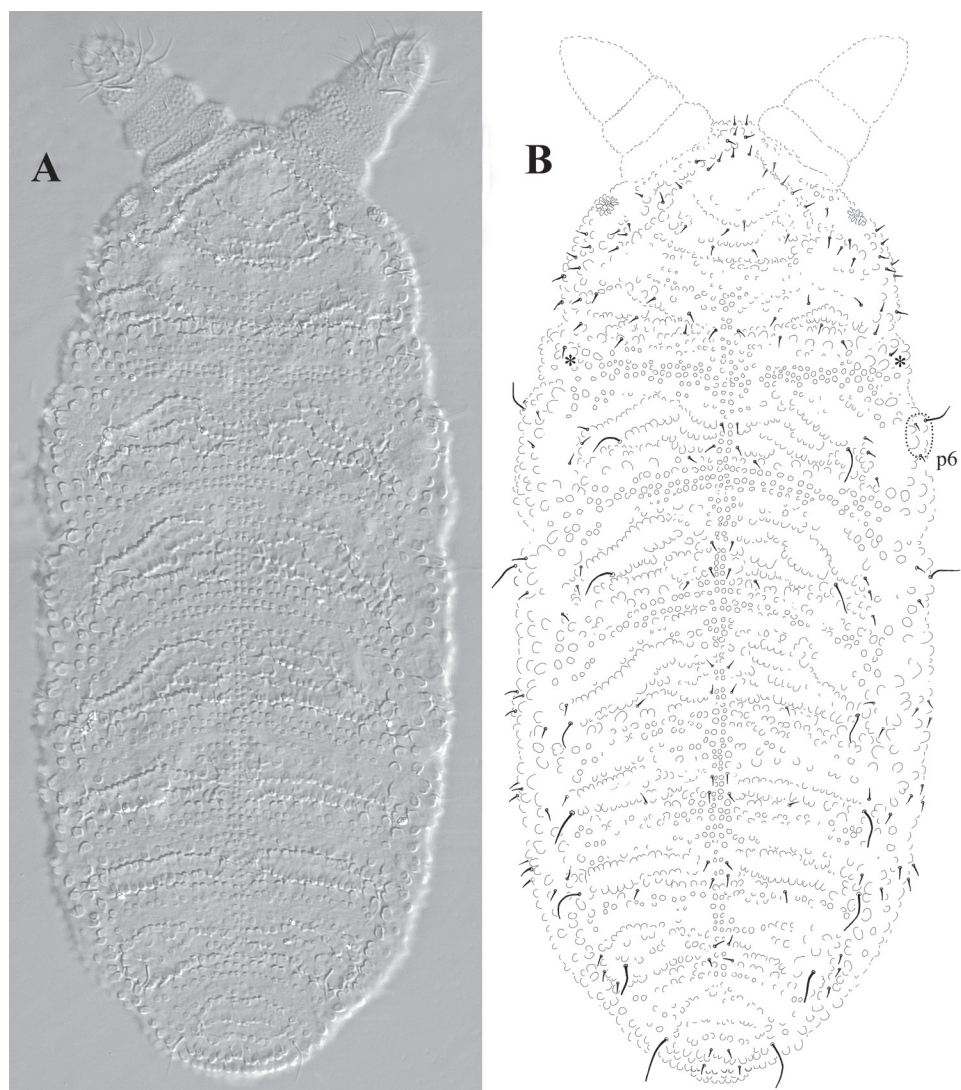
**Type localities.** Russia: Primorskij Kraj, Khasan Region, Pos'et Bay, Point Mramornyj (42° 34' 16" N, 130° 47' 27" E), litter in mixed deciduous forest, Berlese funnel extraction, 28.IX.04, 5 specimens, L. Deharveng and A. Bedos leg. (sample RU-120). Russia: Primorskij Kraj, Khasan Region, ~ 5 km E of Mayachnoye, Gora Chertova Gorka (42° 37' 02" N, 130° 42' 31" E), in mixed deciduous forest, Berlese funnel extraction, 28.IX.04, 3 specimens, R. J. Pomorski leg. (sample 3a).

**Type material.** Holotype: female adult on slide (RU-120/2) in MNHN. Paratypes: "one female juvenile on slide (RU-120/1) in MNHN; one female juvenile (RU-120/3) and one juvenile (RU-120/4, skin obtained after DNA extraction for barcoding) on slide in ISEA; one female juvenile (3a/1) and one juvenile (3a/3) on slides in DBET; one female (RU-120/5) and one juvenile (3a/2) on slides in MSPU.

**Etymology.** The new species is dedicated to Professor R. Jacek Pomorski, the eminent taxonomist of Collembola and our friend, who left us in 2010.

**Description.** Holotype: 0.92 mm (female adult); paratypes: 0.84 mm (female), 0.6–0.9 mm (female juvenile), 0.58 mm (juvenile). Habitus typical for the genus *Leenurina*. Abdominal tergum VI small, sometimes hidden under V (Fig. 2A). Color in alcohol white with 3+3 blue-black ocelli. Integument very strongly granulated dorsally, with tertiary granulation arranged in large smooth plates fringed with lines of strong secondary granules (Figs 2A, B, 6E, F, I). Well marked underlying small hexagonal reticulations (Fig. 5), each reticulation mesh connected with two or three secondary granules. Secondary granules rounded, the lateral ones very large. Two parallel lines of secondary granules along the axis from posterior part of head to abdominal tergum IV. Thoracic tergum I fused with head, sternum normal.

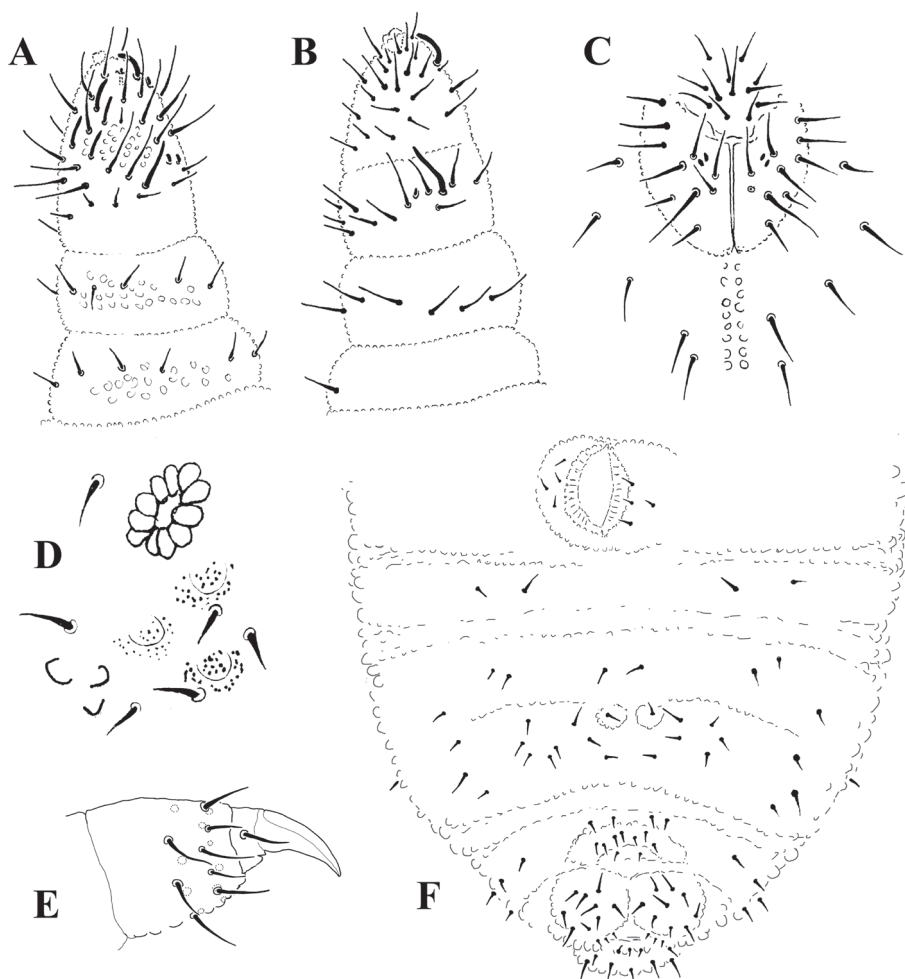
Antennae shorter than head. Antennal segment I with 7 chaetae, antennal segment II with 12 chaetae. Sensory organ on antennal segment III consisting of two small sensilla bent in the same direction, two almost equal, subcylindrical guard sensilla and a small



**Figure 2.** *Leenurina pomorskii* sp. n. in dorsal view; **A** photo Leica DIC **B** tubercles and chaetotaxy. \*, lateral chaeta of the first thoracic tergum; dorso-lateral chaetae circled with dotted line.

ventral microsensillum. Antennal segment IV with 6 thick subcylindrical sensilla, a microsensillum, a subapical organite and a very slightly bilobed apical vesicle (Figs 3A, B).

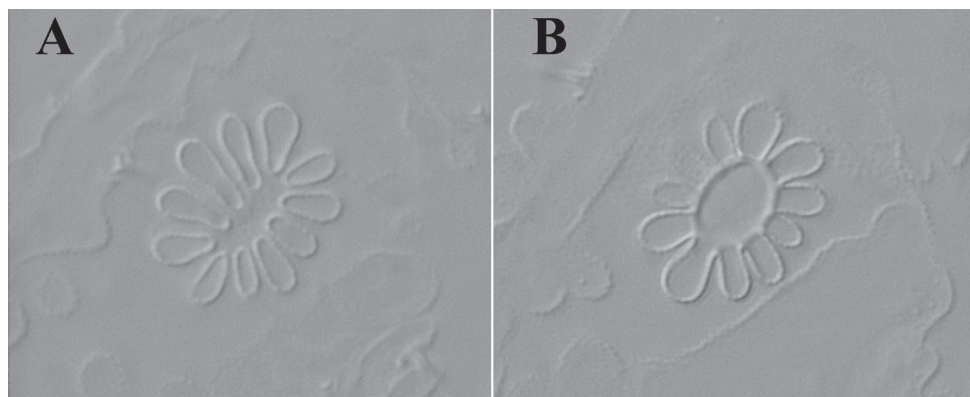
Three ocelli per side, slightly bigger than surrounding integument granulation, indicated by blue-black pigment patches, but not distinct from surrounding secondary granules under microscopic examination. Postantennal organ oval, 2-3 times longer and about 1.5-2 times broader than ocellus A, with 10-12 vesicles (Figs 3D, 4). Buccal cone typical for the genus. Labrum truncated, 1-2 prelabral chaetae, labral chaetotaxy uncertain, probably: ?2,3,5,2. Labium short, with 4 basal (E, F, G, f), 3 distal (A, C, D) and 3 lateral (c, d, e) chaetae; papillated chaeta L absent; 2+2 small hyaline vesicles



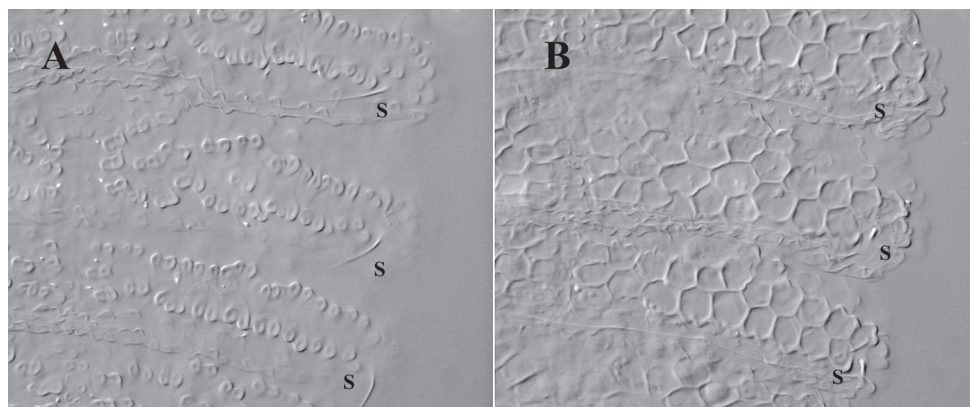
**Figure 3.** *Leenurina pomorskii* sp. n.; **A** antenna, dorsal side **B** antenna, ventral side **C** labrum and labium **D** postantennal organ and ocelli **E** tibiotarsus III **F** chaetotaxy of abdominal sterna I–VI.

arranged one above the other between chaetae A and C (x papillae of Deharveng 1983) (Fig. 3C). Mandible with three small apical teeth and two strong basal ones. Maxilla with two lamellae (each with two apical teeth) and capitulum denticulate with minute teeth like *L. khualaza*.

Dorsal chaetotaxy as on Fig. 2, with short thin pointed ordinary chaetae and long thin s-chaetae, 3–5 times longer than ordinary chaetae. Some asymmetry observed. Ocular area with 3 (or 4 chaetae, probably as a result of a shift of a dorsal cephalic chaeta towards ocular area). One lateral chaeta on what could be the poorly individualized lateral part of thoracic tergum I (Fig. 2B), and another ventro-lateral chaeta on subcoxa 1. Dorso-lateral chaetae of thoracic terga II and III in one group (p6 close to s-chaeta, Fig. 2B).



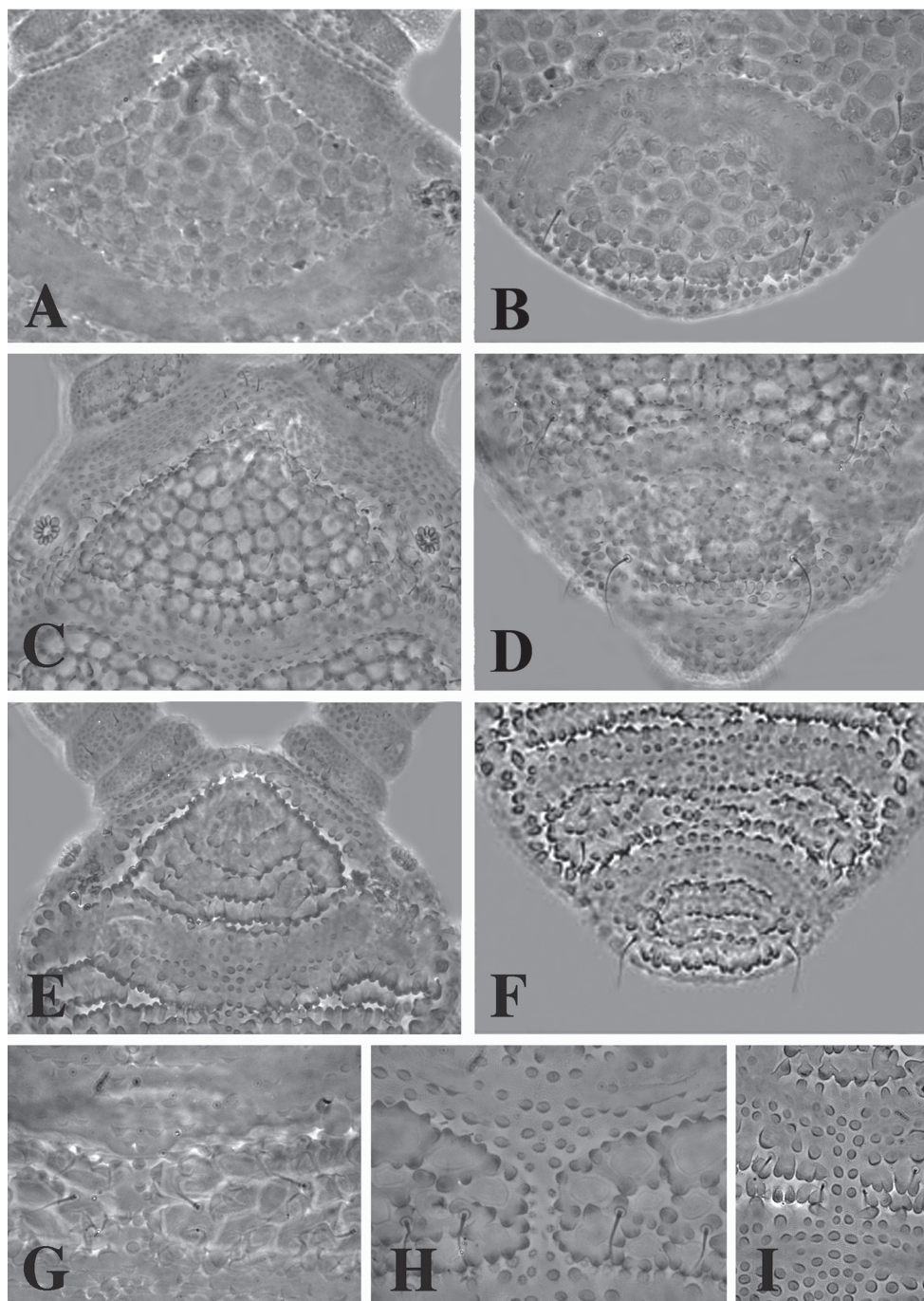
**Figure 4.** *Leenurina pomorskii* sp. n.; **A** postantennal organ of a same specimen, at two different focus (**A**, surface; **B**, deeper).



**Figure 5.** *Leenurina pomorskii* sp. n.; **A** abdominal terga II and III at two different focus in a same specimen (**A**, surface showing tertiary plates; **B**, deeper showing underlying reticulations).

Formula of s-chaetae per half tergum: 022/11111; s-microchaeta present on thoracic tergum II, close and anterior to the lateral s-chaeta; s-chaetae slightly thicker and shorter on abdominal tergum IV than on other terga. From thoracic tergum II to abdominal tergum III, 3 chaetae present between the axis and the proximal s-chaeta: a1, p1 and a chaeta in a “p2” position on thoracic tergum II-III and usually a “p3” position abdominal terga I-III. Abdominal tergum IV with only 2+2 chaetae between the axis and the proximal s-chaeta (a1, p1). Some specimens slightly depart from this pattern on details: one specimen with 4 chaetae present between the axis and the proximal s-chaeta on abdominal tergum I (a1, p1 and 2 other chaetae in row p); one specimen with 2 chaetae present between the axis and the proximal s-chaeta on abdominal tergum I (a1 and p1); one specimen with an additional chaeta antero-internal and close to the s-chaeta on abdominal tergum IV.

Thoracic sterna without chaetae. Chaetotaxy of abdominal sterna I–VI as in Fig. 3F. Anal valves with three hr-chaetae each.



**Figure 6.** Central area of the head; **A** *Leenurina jasioi* Najt & Weiner, 1992 **C** *Leenurina khualaza* sp. n. **E** *Leenurina pomorskii* sp. n. Abdominal terga IV–VI **B** *Leenurina jasioi* Najt & Weiner, 1992 **D** *Leenurina khualaza* sp. n. **F** *Leenurina pomorskii* sp. n. Posterior part of head **G** *Leenurina jasioi* Najt & Weiner, 1992 **H** *Leenurina khualaza* sp. n. **I** *Leenurina pomorskii* sp. n.

Tibiotarsi I, II and III with 19, 19 and 18 chaetae (chaeta M present). Femora I, II and III with 13, 12 and 11 chaetae, trochantera I, II and III with 6, 6 and 5–6 chaetae, coxae I, II and III with 3, 6 and 7 chaetae, subcoxae 2 of legs I, II and III with 0, 2 and 2 chaetae, subcoxae 1 of legs I, II and III with 1, 2 and 2 chaetae. Praetarsi with 1+1 strong chaetae. Claw short and thick, toothless (Fig. 3E).

Ventral tube with 4+4 chaetae, without chaetae at its basis. Furca reduced to two small swellings, each with one chaeta (Fig. 3F).

**Discussion.** Dorsal chaetotaxy of both described species exhibits some variability and frequent asymmetries. The four species of *Leenurina* are closely related, but easily distinguished on a combination of characters including eye number, pigmentation, leg and dorsal chaetotaxy (Table 2).

### Key to species of the subfamily Caputanurinae (after Wu and Yin 2007 *pro parte*)

- 1 Eyes and PAO in dorsal position, body slightly flattened ..... 2 *Leenurina* Najt & Weiner, 1992
- Eyes and PAO in lateral or dorso-lateral position, body flattened or strongly flattened..... 5 *Caputanurina* Lee, 1983
- 2 Tibiotarsi I–III with 18, 18, 17 chaetae ..... 3
- Tibiotarsi I–III with 19, 19, 18 chaetae ..... 4
- 3 2+2 eyes, abd. IV with 6 chaetae in the posterior row between s-chaetae, orange alive ..... *L. nana* Lee, 1983; South Korea
- 3+3 eyes, abd. IV with 4 chaetae in the posterior row between s-chaetae, light blue in alcohol ..... *L. jasioi* Najt & Weiner, 1992; North Korea
- 4 2+2 eyes, abd. IV with 4 chaetae in the posterior row between s-chaetae, dorsal tertiary tubercles small, hexagonal or rounded, very light blue in alcohol..... *L. khuazala* sp. n.; Russia, Primorskij Kraj
- 3+3 eyes, abd. IV with 2 chaetae in the posterior row between s-chaetae, dorsal tertiary tubercles as fringed areas, white in alcohol ..... *L. pomorskii* sp. n.; Russia, Primorskij Kraj
- 5 2+2 eyes, PAO in latero-ventral or ventral position ..... 6
- 3+3 eyes, PAO in dorso-lateral position, tibiotarsi I–III with 18, 18, 17 chaetae, mandible with 5 teeth ..... *C. intermedia* Najt & Weiner, 1992; North Korea
- 6 Abd. III and IV separate, PAO with 8–12 vesicles..... 7
- Abd. III and IV fused, PAO with 13–14 vesicles, on head 3+3 dorso-medial chaetae, vestigial furca with 1+1 chaetae ..... *C. sinensis* Wu & Yin, 2007; China, prov. Liaoning
- 7 Claw without teeth ..... 8

- Claw with interno-lateral tooth, mandible with 5 teeth, tibiotarsi I–III with 18, 18, 17 chaetae.....  
..... ***C. turbator* Najt & Weiner, 1992; North Korea**
- 8 Head with 2+2 dorso-medial chaetae, mandible with 5–6 teeth, vestigial furca with 1+1 chaetae..... **9**
- Head with 5+5 dorso-medial chaetae, mandible with 4 teeth, tibiotarsi III with 17 chaetae, vestigial furca with 2+2 chaetae .....  
..... ***C. serrata* Lee, 1983; South Korea**
- 9 Tibiotarsi I–III with 18, 18, 17 chaetae, mandible with 5 teeth, ant. III with ventral guard sensillum inserted on an integument swelling, maxillary external lamella long with bent apex.....  
..... ***C. major* Najt & Weiner, 1992; North Korea**
- Tibiotarsi I–III with 19, 19, 18 chaetae, mandible with 6 teeth, ant. III with ventral guard sensillum not inserted on an integument swelling, maxillary external lamella long with 7–10 teeth .....  
..... ***C. sexdentata* Najt & Weiner, 1992; North Korea**

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# On *Hypolycaena* from Maluku, Indonesia, including the first description of male *Hypolycaena asahi* (Lepidoptera, Lycaenidae)

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## Abstract

The taxonomy and distribution of the five species of *Hypolycaena* in Maluku are discussed and new locality records given. Corrections are made to the published taxonomy and distribution of *H. phorbas* (Fabricius, 1793). This clarification enables a better understanding of the biogeography of the genus. *Hypolycaena asahi* Okubo, 2007, was originally described from a single female from Ambon and is here recorded from Seram. The male is described for the first time.

## Keywords

*Hypolycaena*, *asahi*, *danis*, *dictaea*, *erylus*, *phorbas*, *pigres*, *silo*, *sipylus*, Indonesia, Maluku, Lepidoptera, Lycaenidae

## Introduction

The Indonesian provinces of North Maluku and Maluku consist of numerous islands, yet their butterfly fauna remains less well described than those of the principal surrounding areas of the Philippines, Sulawesi and New Guinea. Vane-Wright and Pegg (1994) comment that, geologically, the northern islands of Halmahera, Ternate, Morotai and Bacan form a complex of land areas variously related to New Guinea, while the Buru, Ambon, Seram arc is related to North-West Australia. The Sula islands of Taliabu, Mangole and Sanana, in the west of Maluku were included faunistically in

the “Sulawesi region” by Vane-Wright and de Jong (2003), while Burrett et al. (1991) link Sula geologically with Banggai and Obi. The islands of the Aru group in the south east of Maluku share the continental shelf of, and are faunistically close to, the New Guinea mainland.

Thus Maluku *sensu lato* remains an area of immense biogeographical interest, with the largest of its islands forming the northeasterly part of Vane-Wright’s “Wallacea”: the land between the Sunda and Sahul shelves. To facilitate testing of biogeographical hypotheses, it is important that the taxonomy and distributional data of all butterfly families represented in Maluku is accurate and as comprehensive as possible. The extensive lycaenid fauna is perhaps the least understood.

The genus *Hypolycaena* C. & R. Felder, 1862, (Lycaenidae, Theclinae, Hypolycaenini) consists of about 25 species in the Indo-Australian region as well as about 20 species in Africa. Fiedler (1992) included *Chliaria* Moore, 1884, and *Zeltus* de Nicéville, 1890, within *Hypolycaena* whilst Eliot (1992), retained these as separate genera in his subtribe Hypolycaeniti. *H. asahi* was described by Okubo, in 2007, from a single female specimen. The male is described here for the first time and enables its relationship with other species of the genus to be more closely determined.

This paper is primarily concerned with *Hypolycaena* species in Maluku. However, it is necessary to discuss in some detail the taxonomy and wider distribution of *H. phorbas* (Fabricius, 1793) and its allies. These taxa form a species group in which the males exhibit a large circular dark band of apparently normal scales on the upperside of the forewing and in which the early stages are polyphagous and strongly myrmecophilic (Fiedler, 1992). This study will confirm the identity of the taxon found on Aru Islands and also clarify D’Abrera’s record of *H. erasmus* Grose-Smith, 1900, in Halmahera. A more accurate understanding of the taxonomy and distribution of the *phorbas* species group will in turn lead to a better understanding of the biogeography of the Papua mainland and the islands to the East and West of it.

Note that the frequent references to Parsons and D’Abrera refer to Parsons (1998) and D’Abrera (1978).

## Geopolitical terminology

The Indonesian western half of the Island of New Guinea and its associated offshore islands, which has previously been known as Irian Jaya, now consists of two provinces: Papua and West Papua. However “Papua” has also been used to denote this whole area. For simplicity we will use the term “Papua mainland” to describe the whole area excluding offshore islands.

## Equipment and methods

The preserved material forming the basis of this study is primarily that of the collections of the Natural History Museum London (BMNH) and of the second author. Where their reliability is assured, other distributional data have been accepted in correspondence from curators of other private collections.

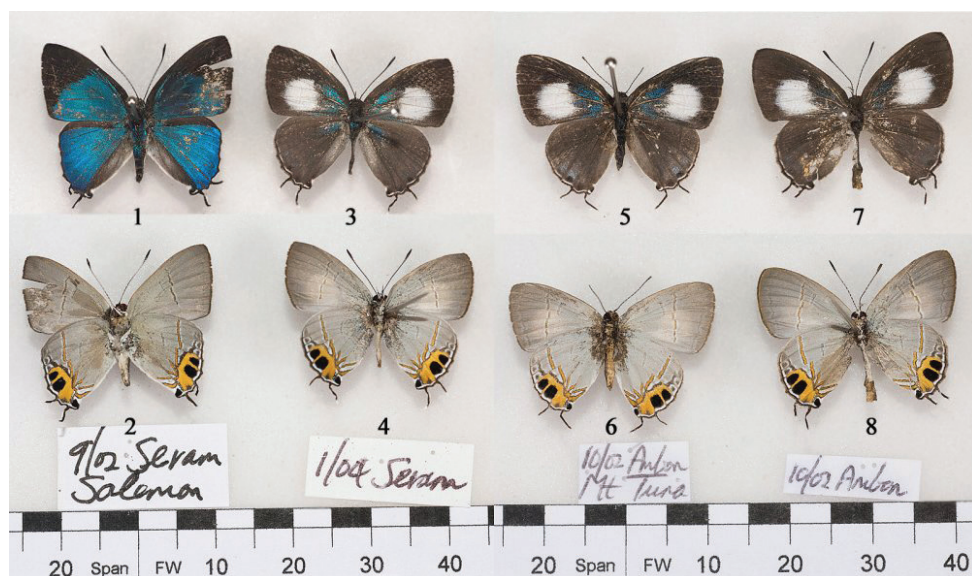
Male genitalia were prepared by soaking in 0.1N potassium hydroxide solution for 24 hours at room temperature prior to dissection. Micro-photography of the genitalia, while suspended in 80% Iso-Propanol, was with an AIGO GE-5 digital microscope and the images were subsequently processed using Helicon-Focus 5.0 software (Helicon Soft Ltd. 2010) to enhance depth of field.

All photographs of preserved adult specimens, except those kindly provided by Mr. Yusuke Takanami, were taken using a Nikon D80 digital SLR camera fitted with a Micro-Nikkor 60mm macro lens. The photographic images presented were post-processed for exposure compensation, cropping, resizing and sharpening using Adobe Photoshop Elements 6.0. The scale on photographs represents multiples of 5mm.

### *Hypolycaena asahi* Okubo, 2007

♂ Figs 1,2, 10, Fig. 9 genitalia; ♀ Figs 3–8, 10.

The holotype female was captured in March 2000. The type location was given by Okubo as “Mt. Tuna, ca 900m, Ambon Island, North Moluccas [sic], Indonesia”. Four further specimens of *Hypolycaena* were captured in Central Maluku in 2002 and 2004, comprising three females and one male. These four specimens are



**Figures 1–8.** *Hypolycaena asahi*, top row recto, bottom row verso. **1, 2** male, Seram **3, 4** female, Seram **5–8** females, Ambon.



**Figure 9.** Male genitalia of *Hypolycaena asahi* Okubo, 2007, from Seram, showing ventral view of armature and lateral view of aedeagus.

illustrated in Figs 1–8. Two of the three female specimens are from the *H. asahi* type location in Ambon, while a male and female are recorded for the first time from Salemon in Seram.

The external morphology of all of these new females is inseparable from that of the *H. asahi* holotype, and their identification as examples of *H. asahi* is assured. We propose the hypothesis that the male specimen is also *H. asahi* because of its underside markings and its sympatry with the aforementioned female from Seram.

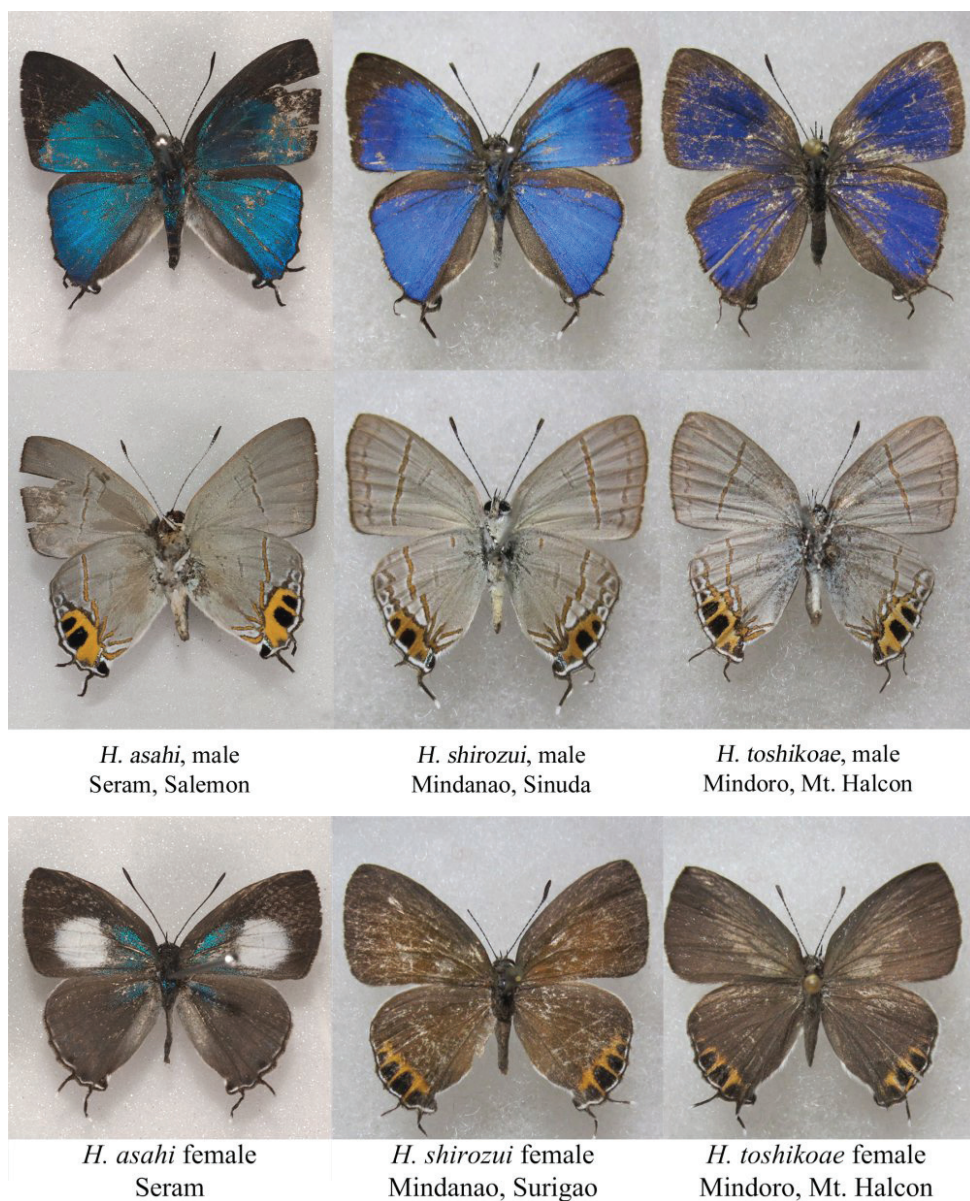
♂ **Upperside.** Forewing length 13mm. Both fore and hindwings metallic blue with dark borders. The forewing black border about 1mm wide at the tornus but rapidly widening along the termen to meet the costa at its mid-point, then running down to the base above vein 12, but not quite entering the cell. The forewing also with basal swelling of veins 2, 3 and 4 with a faint band of seemingly normal (not androconial) scales surrounding these swollen veins. The hindwing black between veins 7 and 8, and with a dark grey dorsal border in spaces 1 and 1a. In space 1a a small black tornal lobe with a white marginal streak. Filamentous white-tipped black tails at veins 1b and 2, 2mm and 3mm long respectively.

**Underside.** No significant differences exist between the undersides of the females from Ambon and those of both sexes from Seram.

♂ **Genitalia.** Saccus short, bluntly pointed. Brachia long and tapering to a fine point, with a broad elbow and a pronounced lobe at the proximal junction with the tegumen. Valvae short, broad and conjoined basally, tapering distally with the apex rounded and the inner margins finely serrate. Aedeagus medium length, the sub-zonal portion shorter than the supra-zonal portion.

**Remarks.** The early stages are unknown. The females of *H. asahi* (Figs 3–8) from both locations show varying amounts of basal blue scaling not evident in the holotype. Otherwise, they conform closely to Okubo's description.

Okubo notes the similarity between this species and two allied species from the Philippines: *H. shirozui* (Hayashi, 1981) and *H. toshikoeae* Hayashi, 1984 (Fig. 10).



**Figure 10.** *H. asahi* Okubo, compared with *H. shirozui* Hayashi and *H. toshikoe* Hayashi from the Philippines. Philippine photos courtesy of Mr. Yusuke Takanami.

In all three species the underside hindwing tornal orange area extends into space 3 and the sub-marginal black spot in space 3 is much larger and darker than in space 4. On the underside in both sexes, *asahi* shows a much more marked dislocation of the post-discal band than in *shirozui*, while this dislocation is absent in *toshikoe*. On the male upperside, the apical black border in *asahi* is much broader than in either of the other two species, most notably in spaces 2, 3 and 4. On the female upperside, neither

*H. shirozui* nor *H. toshikoae* exhibits the white forewing discal patch of *H. asahi*. Both Philippine species have orange inwardly surrounding the hindwing sub-marginal lunules, which is absent in *H. asahi* from both Seram and Ambon.

In the male genitalia, *H. asahi* is distinguished from these other species by the more elongate valvae, which have more rounded apices, and by the shorter suprazonal portion of the aedeagus.

### Taxonomy and distribution of Other *Hypolycaena* species in Maluku

In addition to *H. asahi* there are four other *Hypolycaena* species in Maluku. Fiedler, 1992, pointed out that two of these, *H. phorbas* and *H. erylus* (Godart, [1824]) shared characteristics of larval polyphagy and strong mymecophily and referred to them as the *phorbas* species group. Adult males in this group also have a large circular black brand on the upperside of the forewing. It group includes the taxa *erylus*, *phorbas*, *dictaea* C. & R. Felder, 1865, (TL: Waigeo) and *periphorbas* Butler, 1882 (TL: New Britain), all of which Parsons treated as separate species.

D'Abrera treated *H. erasmus* (TL: New Ireland) as a valid species name and *moutoni* Ribbe, 1899 (TL: Duke of York Island) as a subspecies of *H. erylus*. Parsons synonymised *erasmus* and *moutoni* with *periphorbas*, giving *periphorbas* species status. D'Abrera had listed *periphorbas* as a subspecies of *phorbas*. Parsons noted that *H. periphorbas* is restricted to the Bismarck Archipelago. We accept Parsons' synonymies.

D'Abrera illustrated the upperside of a female *Hypolycaena* specimen from Halmahera which he labelled "*H. erasmus* subsp.?" We examined this specimen in BMNH which carries a label stating: "Specimen photographed by B. D'Abrera, 1970". The specimen is clearly *H. erylus thyrius* and matches other *thyrius* specimens in the same column. This specimen is shown here in Figs 29 and 30 which should be compared with Figs 17 and 18 from Bacan.

Therefore we conclude there is no record of *H. periphorbas* (= *H. erasmus*) occurring in Maluku. In the Maluku fauna, *H. phorbas* can be readily distinguished from *H. erylus* by its broader dark forewing margin in the male (Fig. 31) and its white forewing patch in the female (Figs 33, 35).

### *Hypolycaena erylus* (Godart, [1824]) (Type Locality (TL): "De Java")

This species ranges from India to Indonesia, the Philippines and New Guinea. Within Maluku *H. erylus* is known from N. Maluku, the Sula Islands and there are a few specimens in BMNH (The Natural History Museum in London) from S.E. Maluku (see below).

*Hypolycaena erylus gamatius* Fruhstorfer, [1912] (TL: Toli-Toli, N. Sulawesi). Figs 11–14.

*H. erylus gamatius* Fruhstorfer has been recorded from Mangole (Vane-Wright & de Jong, 2003) in the Sula Islands.

Specimens received by the second author from Taliabu (Jorjoga - 1♂, 1♀, ii/2001, 1♂, 1♀ x/2001, 1♂ v/2002, 1♂ iii/2004) represent a new island record. We also add the islands of Muna (1♂, 1♀ iii/2008) and Timpaus (5♂♂, 7♀♀ vii/2006) as new locality records, although not in Maluku Province.

***Hypolycaena erylus thyrius*** Fruhstorfer, [1912] (TL: Halmahera). Figs 15–18.

= *Hypolycaena erylus pigres* Fruhstorfer, [1912] syn. nov. (TL: Obi). Figs 19–22.

= *Hypolycaena erasmus* ssp; D'Abrera 1978: 304. [Misidentification].

Fruhstorfer described *H. erylus thyrius* from “Halmaheira, Batjan” but listed only a single female type. This taxon is known from Halmahera, Ternate and Bacan. To this we add Morotai (Daeo – 2♂♂ 3/vi/1992, 1♂ ii/1998, 1♂ iii/1998, 2♀♀ iv/2004, 1♀ 25/viii/1995, 1♀ 2/xi/1995), Buho-Buho (1♂ 8/xii/90) and Kasiruta (1♂ iv/2003).

In the same paper Fruhstorfer described *H. erylus pigres* from Obi, based on a series of eight males. Having examined the *pigres* and *thyrius* holotypes, as well as a long series of Obi and Halmahera specimens, we can not see any clear differences between the two taxa and therefore consider *pigres* to be a synonym of *thyrius*, which appears earlier in Fruhstorfer's work.

***Hypolycaena erylus incertae sedis***. Figs 23–28.

Although *H. erylus* is widespread in the South-East Asian islands and into New Guinea, material from South and South-East Maluku is scarce. We have seen a single male from Banda and BMNH has three males of *H. erylus* from Tanimbar (20 miles north of Saumlaki, Yamdena - 1917–1918, Frost). These are all difficult to assign to a particular named subspecies (the males of the different subspecies tend to be fairly similar whilst the females vary more). See Figs 23–26.

In addition BMNH holds one female from Manawoka Island (label reads: Manovolka. 13.xi.(18)99. H. Kühn) in the Gorong Islands, which is unlike any other subspecies, having extensive pale areas on the upperside - especially the forewing - and may represent a new subspecies. See Figs 27, 28.

We await further confirmatory material before naming any further subspecies based on these few specimens.

***Hypolycaena phorbas*** (Fabricius, 1793) (TL: “Ins. Papuanæ”). Figs 31–42.

Parsons reviewed *H. phorbas* from Papua New Guinea stating that two subspecies occur there: *silo* Fruhstorfer, [1912] and *infumata* Fruhstorfer, 1910. He synonymised *latostrigatus* van Eecke, 1915, *pseudophorbas* Fruhstorfer, [1914], *phorbanta* Rothschild, 1916 and *walteri* Fruhstorfer, [1916a] with *silo*. He gave the range of *phorbas* as Waigeo, Biak, Roon, mainland New Guinea, various outlying islands and Australia.

D'Abrera and Seitz, 1926, considered Felder's taxon *dictaea* to be a subspecies of *phorbas* found on Waigeo only, whereas Parsons “provisionally treated” *dictaea* as a

separate species and stated the range to include Aru, Waigeo, mainland New Guinea and its varying outlying islands as far south east as Australia. He went on to specify a number of island localities.

Therefore according to Parsons, two “species”, *H. phorbas* and *H. dictaea*, occur on Waigeo as well as mainland New Guinea. However, we consider that *phorbas* and *dictaea* are conspecific and that only one subspecies, *H. p. silo*, occurs in political Maluku, on Aru, its type locality and on mainland Papua. As Aru is separated from mainland New Guinea only by shallow water, and may well have been directly connected at the surface during the last glaciation, it can be regarded biogeographically as part of Papua.

***Hypolycaena phorbas dictaea*** C. & R. Felder, 1865 (TL: Waigeo) Figs 37, 38, 41, 42.

Parsons did not locate the holotype female of *dictaea* although it is deposited in BMNH. We have examined this specimen along with a series of female specimens in BMNH from Waigeo and it is clear that they all have undersides that are significantly paler in ground colour and weaker in the post discal striae than the underside of the holotype female of *silo* (also at BMNH).

We have also examined females, whose undersides are dark and therefore match that of the *silo* holotype, from Papua mainland, Aru, Roon, Biak and Yapen in BMNH and the collection of the 2<sup>nd</sup> author.

Additionally, we have studied a series of males from Waigeo. Unlike the females, the Waigeo males’ undersides vary, ranging from the paleness of the holotype female *dictaea* to the much darker underside of the holotype female of *silo*.

***Hypolycaena phorbas silo*** Fruhstorfer, [1912] (TL: “Neu-Guinea Fr. Wilh. Hafen.”) Figs 31–36, 39, 40.

Within Maluku this subspecies is only found on Aru Islands. We have examined five males and five females from Aru. All display the typical *silo* phenotype with the exception of one female from Wokam (Figs 35,36), which has a slightly lighter underside than the other four.

We present new records of this subspecies from Wokam Island in the Aru group, (1♂ xi/2004, 1♂ xii/2005, 1♀ x/2006).

### **Other *phorbas* material examined, from outside Maluku.**

Undersides of series of males from Batanta, Papua mainland, Aru, Roon, Biak and Yapen are all of the darker form matching the holotype female *silo* underside. The three males and three females from Misool in BMNH all have the paler undersides matching the *dictaea* type specimen. There is one male from Salawati in BMNH whose underside is of this form.

We have also examined male genitalia from specimens from Waigeo (Fig. 75), Aru (Fig. 76), Batanta (Fig. 77), Yapen (Fig. 78) and Papua mainland (Fig. 79). We can

find no consistent differences between them. We therefore conclude that these should all be considered conspecific.

We therefore consider that *H. dictaea* is not a separate species but is a subspecies (or possibly just a form) of *H. phorbas* occurring on the islands of Waigeo, Misool and possibly Salawati, which all lie to the west of mainland New Guinea. We consider that the taxon present in Papua mainland, Aru, Roon, Biak and Yapen is *H. phorbas silo*.

Batanta is a new distribution record for *H. phorbas*. We have examined four males collected in October 2009 on the South Coast of the island. These all have the darker underside pattern. In the absence of females we prefer not to assign subspecific status.

We also make the following comments on Parsons' suggested wider eastern distribution of *dictaea*, in the sense that he uses that name. The males from Waigeo, Misool, Batanta, Salawati, Papua mainland, Aru, Roon, Biak and Yapen, all localities within the western part of the species' range, share the same shade of dark blue upperside. These contrast with the more purple colour of nominate *phorbas* and a number of unnamed specimens in BMNH from the eastern islands of Papua New Guinea including Yule, Woodlark and Kiriwina (= Trobriand Islands).

In addition these more purple males have much darker undersides than the *dictaea* type. The origins of these un-named specimens match many of the localities given by Parsons included in his distribution of *dictaea*.

We believe he mistakenly included these together with Waigeo specimens in his provisional assessment of *dictaea*. As this latter, more purple, group is beyond the geographical scope of this article, we do not describe any of these specimens further, but await a more comprehensive revision of the genus. Nevertheless, the clarification herein of the status of the Maluku fauna should aid in such a revision.

### ***Hypolycaena sipylus* (Felder, 1860) (TL: Ambon)**

*H. sipylus* is widespread in Indonesia as well as occurring in the Philippines and New Guinea region (Rawlins 2007). It is the Type Species of *Hypolycaena*, although little is known of its early stages. In Maluku there are three recorded subspecific taxa.

### ***Hypolycaena sipylus giscon* Fruhstorfer, 1912 (TL: Sulawesi). Figs 43–46.**

Within Maluku *H. sipylus giscon* is known from Mangole and Sanana in the Sula Islands (Vane-Wright & de Jong, 2003). To this we add Taliabu (1♂ i/2005).

### ***Hypolycaena sipylus sipylus* (Felder, 1860) (TL: Ambon). Figs 47–50.**

The range of *H. sipylus sipylus* is recorded by D'Abrera as "The Moluccas generally". We have specific records from Morotai, Halmahera, Bacan and Obi in N. Maluku as well as Buru, Manipa, Kelang, Ambon, Seram and Kasa Island (off Seram) in C. Maluku.

### ***Hypolycaena sipylus numma* Fruhstorfer, [1912] (TL: Sumbawa, Flores). Figs 51–54.**

*H. sipylus numma* occurs on Wetar Island (Rawlins 2007) within S. W. Maluku as well as along the Lesser Sunda chain.

***Hypolycaena danis*** (C. & R. Felder, 1865) (TL: Halmahera)

This species occurs in Maluku Province in Indonesia as well as the New Guinea region and N. E. Australia. Fiedler (1992) points out that the morphology and biology of its early stages are nearly identical to those of *H. othona* (Hewitson, 1865) and proposes an *othona* species group for those with elaborately camouflaged, orchid-feeding larvae with reduced myrmecophily.

***Hypolycaena danis danis*** (C. & R. Felder, 1865) (TL: Halmahera). Figs 55–58.

= *Hypolycaena danis batjana* Fruhstorfer, [1916b] (TL: Bacan)

D'Abrera records *H. danis danis* from Bacan and Halmahera in N. Maluku. To this we add Morotai (Daeo – 1♂ ii/1998, 1♀ v/2005, 1♀ vi/2005).

***Hypolycaena danis danisoides*** de Nicéville, 1897 (TL: “Key” Islands). Figs 59–70.

*H. danis danisoides* occurs on the Kei Islands. BMNH has specimens from Little Kei (Kei Kecil) and to this we add Kei Besar (Yamtimur - 3♀♀ v/2002).

Neither D'Abrera nor Parsons record *H. danis* as occurring in C. Maluku but there are four males from Seram in BMNH. The second author has received several further specimens from Seram (1♂ and 1♀ vii/2001, 1♀ viii/2001, 1♀ vii/2002, 1♂ viii/2002, 2♂♂ and 1♀ x/2002, 1♀ x/2003, 1♀ vii/2004, 1♂ x/2007) and Ambon is added as a new locality record (Hila – 5♂♂ iv/2003, 1♀ ii/2008). The Seram specimens show a slight variation in phenotype of both males and females (Figs 63 - 66) but we include them within subspecies *danisoides*.

BMNH also has one male and three females from Obi which match this taxon. However there is a second male labelled Obi which is typical of the nominate subspecies from Halmahera. The specimen bears two labels:

1. “Obi, ex J. Waterstradt, 1904”.
2. “Ex Oberth Coll, Brit. Mus. 1927–3”.

Without further males to examine it is hard to draw a conclusion from this, but based on the other four Obi specimens we include these within *danisoides*. Therefore we extend the range of *H. danis danisoides* to include Obi, Seram and Ambon as well as Kei.

***H. danis derpiha*** (Hewitson, [1878]) (TL: Aru). Figs 71–74.

= *Hypolycaena danis deripha* [sic] D'Abrera, 1978.

D'Abrera records distribution as: “Aru (?) Papua and islands of Louisade Archipelago”. We assume he intends the “(?)” to refer to Aru, although Hewitson states the holotype to have been collected in Aru by Wallace. Although we could find no specimens from Aru in BMNH, M. Nagai (pers. comm.) says his son, K. Nagai, has

collected three males and five females in Aru, confirming the type locality. This subspecies also occurs widely on the island of New Guinea including both Papua New Guinea (Parsons) and Papua mainland (Timika – 1♂ vi/2002, Nabire – 1♀ ii/2003, 1♀ iii/2003, Fak Fak – iv/2003).

## Discussion

Vane-Wright and Peggie (1994) conclude that the fauna of Central Maluku (Buru, Ambon, Seram, Seram Laut) is most strongly related to New Guinea and to Sulawesi plus the Philippines. The distribution of *H. asahi* in Ambon and Seram, with two similar species in the Philippines, conforms to this pattern and supporting evidence for the theory. It also suggests that a closely-related species might occur in Sulawesi. *H. umbrata* Seki and Takanami (1988) is a strong but not quite conclusive candidate. It shares with *asahi*, *shirozui* and *toshikoe* the larger hindwing tornal orange spot and deeply conjoined valvae, although the outer edges of the valvae are noticeably excavate with a sub-apical point. These four taxa might be shown in future to constitute the *shirozui* species group, but their monophyly is as yet uncertain.

Our extensive study of the *phorbas* species group taxa from Maluku, Papua Mainland and the islands of West Papua has clarified the status of the taxa *dictaea* and *erasmus*. This new information, when combined with further study of the related specimens from the islands to the East of Papua Mainland, should provide valuable evidence about the biogeography of the island arc from North Maluku to the East of Papua New Guinea and confirm the apparent monophyletic status of the species group.

## Conclusions

Examination of the male confirms the specific status of *H. asahi* which is now recorded from Seram as well as the type locality Ambon. The species of *Hypolycaena* most closely resembling *asahi* occur in Sulawesi, Mindanao and Mindoro.

There is no confirmed record of *H. periphorbas* (= *H. erasmus*) occurring in Maluku. The distribution of this species remains extralimital, to the East of the region studied.

We synonymise *H. erylus pigres* Fruhstorfer, [1912], with *H. erylus thyrius* Fruhstorfer, [1912], the latter having page priority. The low number of specimens of *H. erylus* available at this time from South and South East Maluku, especially of females, makes determination at subspecific rank for those islands speculative.

The *phorbas* species group sensu Fielder comprises *H. phorbas*, *H. erylus* and *H. periphorbas*. *H. dictaea* sensu Parsons, 1998, deserves at most subspecific rank and is restricted to certain islands to the west of Papua mainland.

Summary of distribution of *Hypolycaena* species and subspecies in Maluku

<i>H. asahi</i>	C. Maluku: Ambon, Seram.
<i>H. erylus gamatius</i>	Sula Islands: Taliabu, Mangole.
<i>H. erylus thyrius</i>	N. Maluku: Morotai, Halmahera, Ternate, Bacan, Kasiruta, Obi.
<i>H. erylus ssp?</i>	SE. Maluku: Tanimbar - Yamdena Island, Gorong Islands - Manawoka Island.
<i>H. phorbas silo</i>	SE. Maluku: Aru.
<i>H. sipylus giscon</i>	Sula Islands: Taliabu, Mangole, Sanana.
<i>H. sipylus sipylus</i>	N. Maluku: Morotai, Halmahera, Bacan, Obi. C. Maluku: Buru, Manipa, Kelang, Ambon, Seram, Kasa Is.
<i>H. sipylus numa</i>	SW. Maluku: Wetar.
<i>H. danis danis</i>	N. Maluku: Morotai, Halmahera, Bacan.
<i>H. danis danisoides</i>	N. Maluku: Obi; C. Maluku: Ambon, Seram; SE. Maluku: Kei.
<i>H. danis derpiha</i>	SE. Maluku: Aru.

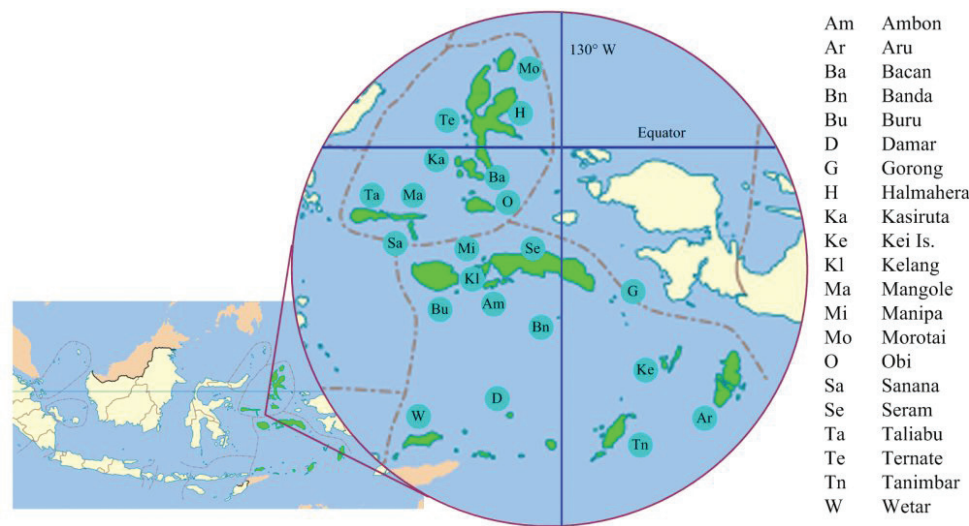
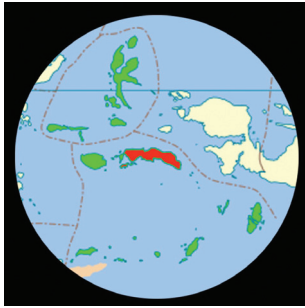


Plate I. Islands of North Maluku and Maluku Provinces, shaded green, with key to named islands.



*H. asahi*



*H. erylus gamatius*



*H. erylus thyrus*



*H. erylus ssp*



*H. phorbas silo*



*H. sipylus giscon*



*H. sipylus numa*



*H. sipylus sipylus*



*H. danis danis*



*H. danis danisoides*



*H. danis derpiha*

**Plate 2.** North Maluku and Maluku Provinces shown in green. Provincial boundaries chain dotted in red. Ranges of taxa shown in red.

## Acknowledgements

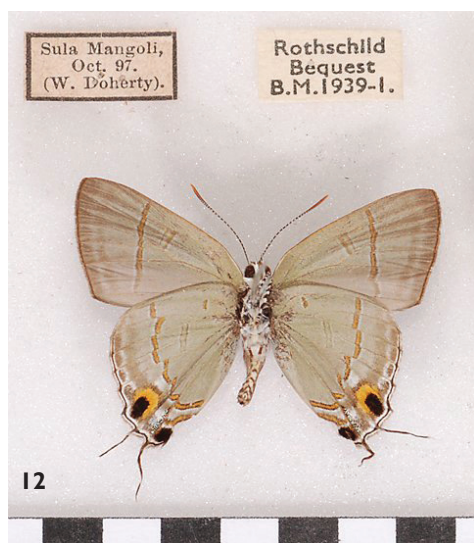
The authors would like to acknowledge the help of the following individuals in the preparation of this paper:

Blanca Huertas, British Museum (Natural History) for access to the collections. Stefan Schröder for comments on the manuscript. Makoto Nagai for collection records and Yusuke Takanami for supplying photographs of some species.

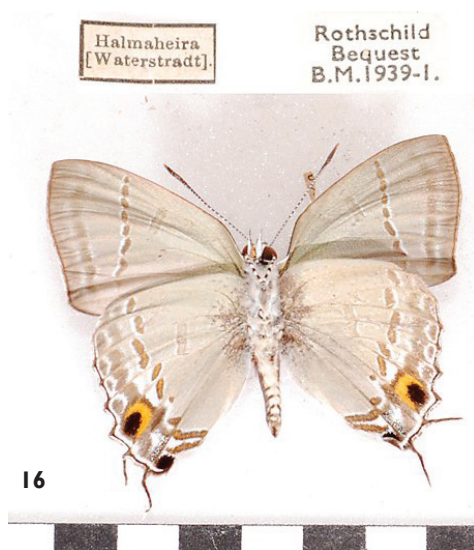
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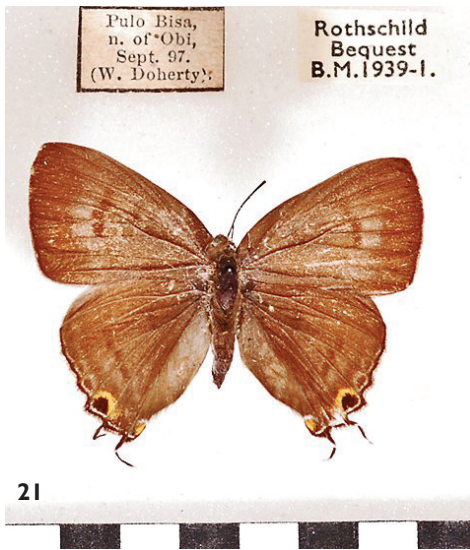
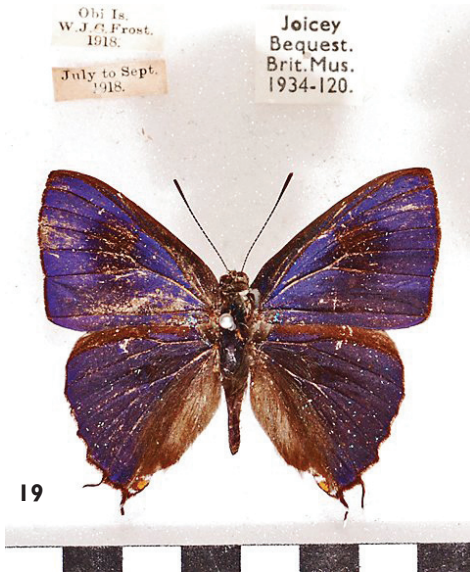
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Figures 11–14. *H. erylus gamatius*, Sula Islands, Mangole, I. to r.: ♂ Up, Un, ♀ Up, Un.



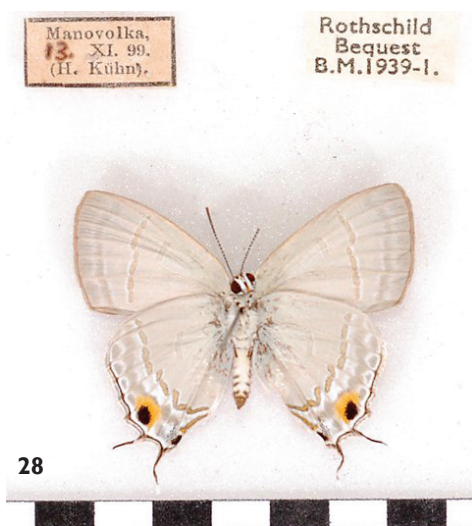
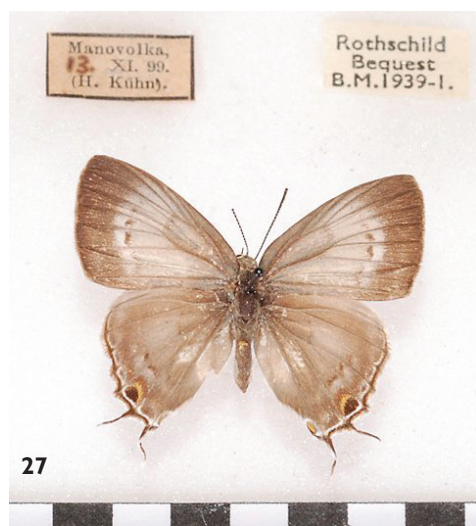
Figures 15–18. *H. erylus thyrus*, l. to r.: ♂ Halmahera Up, Un, ♀ Bacan Up, Un.



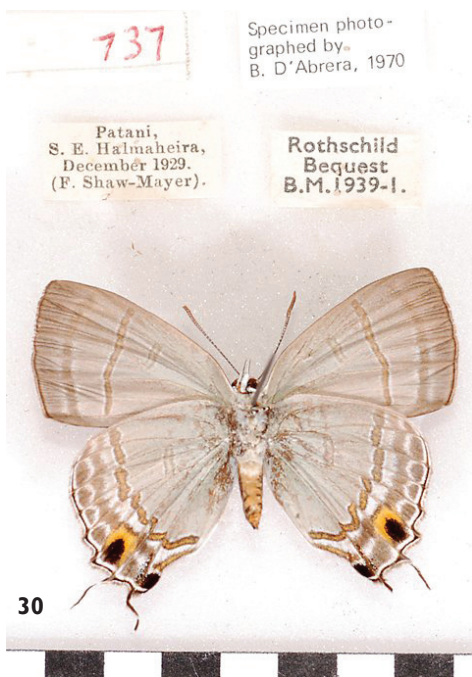
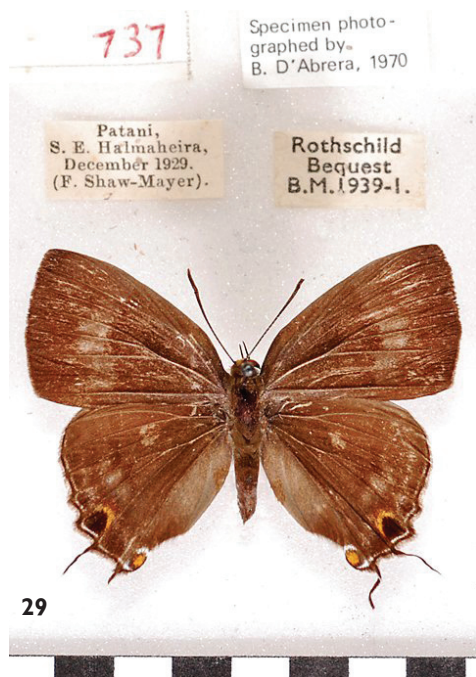
Figures 19–22. *H. erylus thyrius* (= *pigres*), Obi, I. to r.: ♂ Up, Un, ♀ Up, Un.



Figures 23–26. l. to r.: *H. erylus* ssp ♂ Banda Up, Un, ♂ Tanimbar Up, Un



Figures 27–28. *H. erylus* ssp., ♀ Gorong Islands, Manawoka, Up, Un.



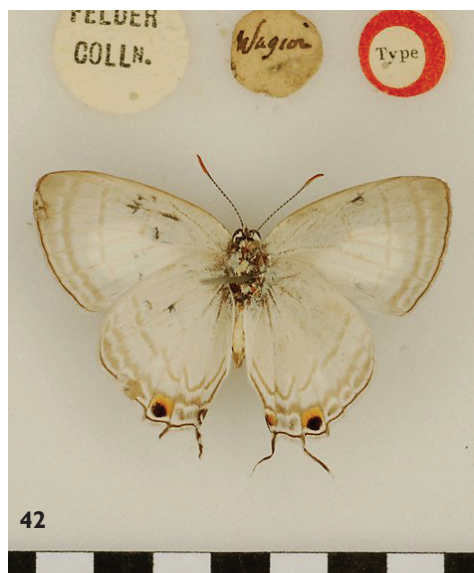
Figures 27–30. “*H. erasmus* ssp” D’Abrera, 1977: 304 recte *H. erylus thyrius* ♀, Halmahera.



**Figures 31–34.** *H. phorbas silo*, l. to r.: Aru, Wokam, ♂ Up, Un, Aru, ♀ Up, Un.



**Figures 35–38.** *H. phorbas silo* Aru, Wokam, ♀; *H. phorbas dictaea* Up, Un, Waigeo, ♂ Up, Un.



**Figures 39–42.** *H. phorbas silo* ♀ Holotype Up, Un, New Guinea; *H. phorbas dictaea* ♀ holotype, Up, Un, Waigeo.



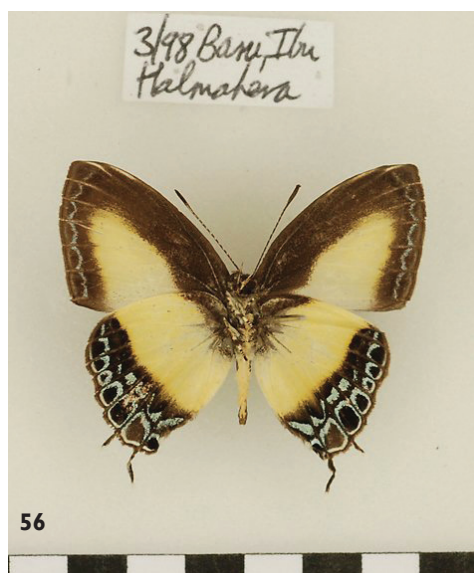
**Figures 43–46.** *H. sipylus giscon*, l. to r.: Sula Islands, Mangole, ♂ Up, Un, Sula Islands, Sa-nana, ♀ Up, Un.



Figures 47–50. l. to r.: *H. sipylus sipylus*, Bacan, l. to r.: ♂ Up, Un, ♀ Up, Un.



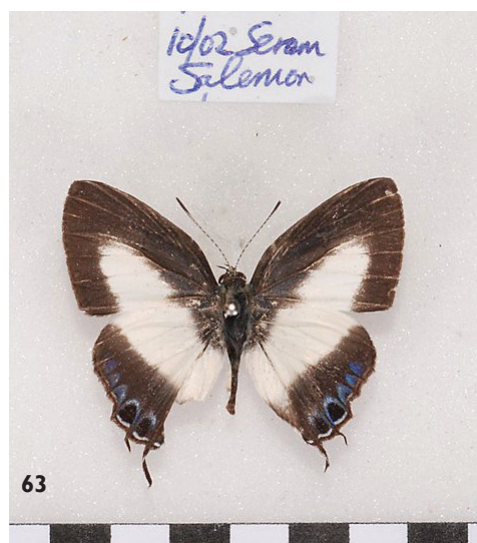
**Figures 51–54.** l. to r.: *H. sipylus numa*, l. to r.: Wetar, ♂ Up, Un, Timor, Dili, ♀ Up, Un.



Figures 55–58. *H. danis danis*, l. to r.: ♂ Halmahera, Up, Un, ♀ Bacan, Up, Un.



**Figures 59–62.** *H. danis danisoides*, Obi, I. to r.: ♂ Up, Un, ♀ Up, Un.



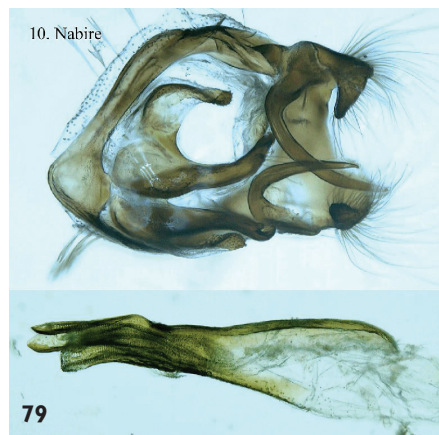
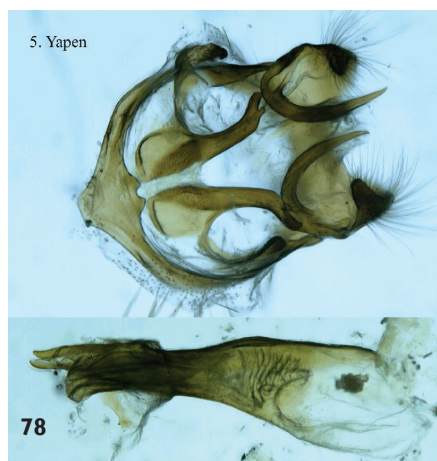
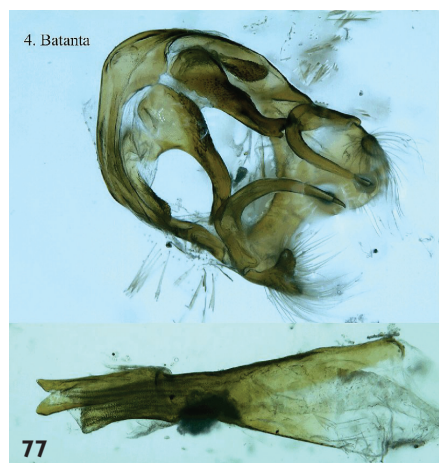
Figures 63–66. *H. danis danisoides*, Seram, I. to r.: ♂ Up, Un, ♀ Up, Un.



Figures 67–70. *H. danis danisoides*, Kei, l. to r. ♂ Up, Un, ♀ Up, Un.



**Figures 71–74.** *H. danis derpiha*, Papua mainland, Arfak, I. to r.: ♂ Up, Un, ♀ Up, Un. Similar to specimens to be found in Aru.



**Figures 75–79.** *Hypolycaena. phorbas*, ♂ genitalia. Above: Armature in ventral or latero-ventral aspect. Below: Aedeagus in lateral aspect. **75.** *H. p. dictaea* Waigeo Is. **76.** *H. p. silo* Aru Is. **77.** *H. p. silo* Batanta Is. **78.** *H. p. silo* Yapen Is. **79.** *H. p. silo* Nabire, Papua mainland.

# The subfamily Cheloninae (Hymenoptera, Braconidae) from Egypt, with the description of two new species

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<sup>‡</sup> [urn:lsid:zoobank.org:author:AAAD30C4-3F8F-4257-80A3-95F78ED5FE4D](http://urn:lsid:zoobank.org:author:AAAD30C4-3F8F-4257-80A3-95F78ED5FE4D)

<sup>§</sup> [urn:lsid:zoobank.org:author:E73C1A3D-E08E-485A-B2ED-2C083190454F](http://urn:lsid:zoobank.org:author:E73C1A3D-E08E-485A-B2ED-2C083190454F)

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## Abstract

A key to the chelonine species (Braconidae) (both recorded and recently collected) from Egypt is given. It includes 16 species, of which five species are new to the Egyptian fauna and two (*Phanerotoma* (*Phanerotoma*) *elbaiensis* sp. n. and *Phanerotoma* (*Bracotritoma*) *ponti* sp. n.) are new for science. A faunistic list and the description for the two new species are added.

## Keywords

Cheloninae, Braconidae, Hymenoptera, Egypt, new species

## Introduction

Cheloninae is a moderately large subfamily within the important parasitoid family Braconidae. The subfamily comprises more than 1300 described species worldwide (Yu et al. 2005). Members of this subfamily are present in all zoogeographical regions. In spite of their worldwide distribution, only the tribes Chelonini and Phanerotomini

are represented in the Palaearctic fauna (van Achterberg 1990, Yu et al. 2005, Aydogdu 2008).

Chelonines are small to medium-sized wasps (1.8–6.0 mm long), with a rigid non-articulated metasomal carapace which is formed by the fusion of the first three metasomal tergites. This carapace is open ventrally and encloses the soft parts of the metasoma.

Wasps of the subfamily Cheloninae are known to be solitary egg-larval endoparasitoids of many lepidopterous families, and may be considered as potential bio-control agents (Walker and Huddleston 1987, Inayatullah and Naeem 2004).

In Egypt, very little attention has been paid to the taxonomy of this group of parasitoids despite their potential importance as biocontrol agents. The first work mentioning some chelonines from Egypt was that of Szépligeti (1908) who recorded two species (*Ascogaster excisa* (Herrich-Schäffer, 1838) and *Chelonus basalis* Curtis, 1837). Five other species (*Chelonus blackburni* Cameron, 1886, *C. sulcatus* Jurine, 1807, *Phanerotoma dentata* (Panzer, 1805), *P. hendecasisella* Cameron, 1905 and *P. leucobasis* Kriechbaumer, 1894 [as *P. ocularis* Kohl, 1906]) were listed for the Egyptian fauna by Shenefelt (1973). In 1976, Morsy recorded five species including those of Szépligeti but only *Chelonus sulcatus* Jurine, 1807 and *Phanerotoma dentata* (Panzer, 1805) from Shenefelt's catalogue, in addition to *Chelonus inanitus* (Linnaeus, 1767). Finally, two chelonine species (*Phanerotoma leucobasis* Kriechbaumer, 1894 and *P. masiana* Fahringer, 1934) were listed by van Achterberg (1990) for Egypt, thus raising the total number to nine species.

In the present paper, a key is presented for 16 chelonine species collected and recorded from different regions of Egypt in the period between 2008 and 2010. Five species are recorded for the first time in Egypt, and two are new species: *Phanerotoma (P.) elbaiensis* sp. n. and *P. (Bracotritoma) ponti* sp. n.

## Material and methods

Regular surveys of chelonine wasps were undertaken from the beginning of 2008 to the end of 2010, covering various regions of Egypt. Sampling was done by means of net sweeping and light trapping.

Morphological terms and wing venation terminologies are based on van Achterberg (1988, 1993); body sculpture terminology is based on Harris (1979). Drawings were made using a camera lucida attached to an Olympus stereo-microscope (SZX9). Measurements were made using an ocular micrometer.

Global distribution and synonyms of the listed species are based mainly Yu et al. (2005).

The characters of the tribes, genera and subgenera (of genus *Phanerotoma*) in the key are based on van Achterberg (1990). New records are marked with an asterisk.

**Abbreviations:** M= medial vein; OOL= ocellocular line; POL= posterior ocellar line; R= radial vein; r= transverse radial vein; SR= radial sector vein; T= metasomal tergite.

**List of depositories:**

<b>ASUC</b>	Ain Shams University collection
<b>CUC</b>	Cairo University collection
<b>MAC</b>	Ministry of Agriculture collection
<b>ESEC</b>	Entomological Society of Egypt collection

**Key to the chelonine species from Egypt**

- 1 Metasoma without distinct transverse sutures (Figs 19, 22); body usually dark brown or black (Tribe Chelonini Foerster, 1862) ..... **2**
- Metasoma with two distinct sutures (Figs 4, 36, 44); body usually yellowish-brown (Tribe Phanerotomini Baker, 1926; genus *Phanerotoma* Wesmael, 1838)..... **10**
- 2 Vein 1-SR+M of fore wing present (Fig. 9); male carapace without apical aperture; vein r of fore wing usually arises far distad of middle of pterostigma (Fig. 23) (Genus *Ascogaster* Wesmael, 1835)..... **3**
- Vein 1-SR+M of fore wing absent (Fig. 10); male carapace with or without apical aperture; vein r of fore wing arises near middle of pterostigma (Figs 10, 24) (Genus *Chelonus* Panzer, 1806)..... **4**
- 3 Propodeum with four sharp medium-sized teeth posteriorly (Fig. 7); hind tibia entirely black except basally; carapace 0.8 times length of head and mesosoma combined..... ***A. quadridentata* Wesmael, 1835**
- Propodeum with two small teeth posteriorly (Fig. 8); hind tibia entirely brown except apically; carapace as long as head and mesosoma combined..... ***A. excisa* (Herrich-Schäffer, 1838)**
- 4 Female antenna always with 16 flagellomeres, male with more than 16 flagellomeres; male carapace with apical aperture (Figs 12, 13); length of body not exceeding 3.6 mm. (Subgenus *Microchelonus* Szépligeti, 1908)..... **5**
- Antenna of both sexes with more than 16 flagellomeres; male carapace without apical aperture; carapace usually with two subbasal yellowish spots; length of body exceeding 4.4 mm. (Subgenus *Chelonus* Panzer, 1806) ..... **8**
- 5 Female carapace with yellowish basal band extending to half its length (Fig. 11), entirely black in male; male apical aperture small and rounded, not exceeding half width of carapace (Fig. 12); body length 1.8 or 1.9 mm..... ***C. basalis* Curtis, 1837**
- Carapace of both sexes entirely black or with yellowish, whitish or ivory subbasal band usually extended to about half (slightly longer or shorter) of its length; male apical aperture slit-like, transversely elongated, significantly exceeding half width of carapace (except for *C. blackburni*) (Fig. 13); body length 2.8–3.6 mm..... **6**

- 6 Carapace entirely black, coarsely longitudinally rugose; male antenna with 23 flagellomeres ..... ***C. sulcatus* Jurine, 1807**
- Carapace with whitish (or ivory) subbasal band of variable length, densely reticulate; male antenna with 25–26 flagellomeres (only for *C. curvimaculatus*) ..... **7**
- 7 Maximum length of female carapace about 2.1 times its maximum height; POL as long as (or very slightly longer than) OOL (Fig. 16); coloured band of carapace mostly extended to 0.4 of its length (Fig. 14) ..... ***C. blackburni* Cameron, 1886**
- Maximum length of female carapace 2.4–2.7 times its maximum height; POL 0.6–0.7 times OOL (Fig. 17); coloured band of carapace usually extended to half (or slightly more) of its length (Fig. 15) ..... ***C. curvimaculatus* Cameron, 1906**
- 8 Vertex with weak transverse striae behind ocelli; maximum length of female carapace 2.3 times its maximum height (Fig. 19); POL 1.5–1.6 times as long as OOL (Fig. 18) ..... ***C. obscuratus* Herrich-Schäffer, 1838**
- Vertex with coarse transverse striae behind ocelli (Fig. 20); maximum length of female carapace 2.6–2.9 its maximum height (Fig. 22); POL 1.1–1.2 times as long as OOL (Fig. 20) ..... **9**
- 9 Ovipositor thick (Fig. 21); vein r of fore wing distinctly angled with vein 3-SR (Fig. 24); vein 1-M of fore wing yellowish; yellowish spots of carapace usually more or less rounded and may be absent; body length 5.2–6.0 mm .. ***C. inanitus* (Linnaeus, 1767)**
- Ovipositor slender (Fig. 22); vein r of fore wing nearly linear with 3-SR (Fig. 25); vein 1-M of fore wing dark brown; yellowish spots of carapace usually more or less quadrate; body length 4.4–5.1 mm ..... ***C. oculator* (Fabricius, 1775)**
- 10 Maximum width of pterostigma 1.1–5.3 times length of vein 3-SR (in the Egyptian specimens 1.7–4.1 times); vein r of fore wing 1.0–2.1 times length of vein 3-SR (Figs 1, 31) (Subgenus *Bracotritoma* Csiki, 1909) ..... **11**
- Maximum width of pterostigma 0.5–1.1 times length of vein 3-SR ((in the Egyptian specimens 0.5–0.8 times); vein r of fore wing 0.1–0.5 times length of vein 3-SR (Figs 3, 9, 27) (Subgenus *Phanerotoma* Wesmael, 1838) ..... **12**
- 11 Vein r of fore wing about 2.1 times as long as 3-SR (Fig. 1); scape 1.5 times as wide as first antennal flagellomere (Fig. 2); vein 1-M and parastigma pale yellow; length of eye in dorsal view 2.7 times temple ..... ***P. masiana* Fahringer, 1934**
- Vein r of fore wing as long as 3-SR (Fig. 31); scape slightly wider than first antennal flagellomere (Fig. 32); vein 1-M and parastigma dark brown; length of eye in dorsal view nearly twice as long as temple (Fig. 29)... ***P. ponti* sp. n.**
- 12 Metasomal T<sub>3</sub> truncate posteriorly, with protruding corners posteriorly (Figs 28, 44) ..... **13**
- Metasomal T<sub>3</sub> rounded posteriorly, without protruding corners posteriorly (Figs 4, 36) ..... **14**

- 13 Parastigma yellowish except basally; length of eye in dorsal view 1.9 times as long as temple (Fig. 38); vein r of fore wing 0.5 times length of vein 3-SR (Fig. 39).....***P. elbaiensis* sp. n.**
- Parastigma dark brown; length of eye in dorsal view 1.1 times as long as temple (Fig. 26); vein r of fore wing 0.2 times length of vein 3-SR (Fig. 27).....***P. rufescens* (Latreille, 1809)**
- 14 Veins SR1 and 2-SR straight or nearly so (Fig. 3)....***P. dentata* (Panzer, 1805)**
- Vein SR1 nearly straight and vein 2-SR obviously curved (Figs 6, 9).....**15**
- 15 Vein 2-SR slightly bent; vein r of fore wing 0.2–0.3 times as long as vein 3-SR (Fig. 9).....***P. leucobasis* Kriechbaumer, 1894**
- Vein 2-SR distinctly bent; vein r of fore wing 0.1 times as long as vein 3-SR (Fig. 6).....***P. hendecasisella* Cameron, 1905**

## Checklist of the Egyptian chelonine species

### Tribe Chelonini Nees

#### Genus *Ascogaster* Wesmael, 1835

*Ascogaster* Wesmael, 1835: 226. Type-species: *Ascogaster instabilis* Wesmael. Designated by Foerster 1862.

#### ***Ascogaster excisa* (Herrich-Schäffer, 1838)**

[http://species-id.net/wiki/Ascogaster\\_excisa](http://species-id.net/wiki/Ascogaster_excisa)

*Chelonus excisus* Herrich-Schäffer 1838: 153, ♀.

*Ascogaster longiventris* Tobias 1964: 148, ♂.

**Distribution.** Egypt [without specific locality (Szépligeti 1908); Alexandria (Morsy 1976), Bulgaria, France, Germany, Kazakhstan, Russia, Spain, Switzerland and former Yugoslavia.

#### **\**Ascogaster quadridentata* Wesmael, 1835**

[http://species-id.net/wiki/Ascogaster\\_quadridentata](http://species-id.net/wiki/Ascogaster_quadridentata)

*Ascogaster quadridentata* Wesmael 1835: 237.

**Material.** 1♀, Arish (31°8'11.148"N; 33°49'57.5754"E), 14.III.2009 [CUC].

**Distribution.** New to Egypt, Europe (Central, Southeast and Western), Mongolia, New Zealand [introduced (Walker and Huddleston 1987)], North Africa and Russia (Central, Northwest and South).

### Genus *Chelonus* Panzer, 1806

*Chelonus* Panzer, 1806: 164. Type-species: *Ichneumon oculator* Fabricius. (Monobasic).

#### *Chelonus (Chelonus) inanitus* (Linnaeus, 1767)

[http://species-id.net/wiki/Chelonus\\_\(Chelonus\)\\_inanitus](http://species-id.net/wiki/Chelonus_(Chelonus)_inanitus)

*Cynips inanita* Linnaeus 1767: 919.

**Material.** 1♀, Alexandria (31°12'58.248"N; 29°45'58.248"E), VI.1965 [ESEC]; 1♀, 2♂♂, Assuit (27°16'3.756"N; 31°9'6.9834"E - 27°23'29.1834"N; 31°32'26.484"E), IX.1972 [ASC]; 1♀, Beni-Suef (29°13'59.9874"N; 31°1'0.012"E), IX.1972 [ASC]; 2♀♀, Kerdasa (30°1'56.136"N; 31°6'32.6874"E), 29.X.2008 [CUC]; 2♀♀, 1♂, Nahia (30°1'55.2354"N; 31°6'39.4194"E), 28.X.2008 [CUC]; 1♀, 2♂♂, Ismailia (30°32'54.168"N; 31°47'0.2754"E - 30°38'20.7954"N; 32°16'7.572"E), 25.XI.2009 [CUC]; 1♀, 1♂, Fayoum [Karanis] (29°21'N; 30°40'59.988"E), 23.VIII.2010 [CUC].

**Distribution.** Egypt [El-Menia, El-Sharqia (El-Zagazig and Menia El Qamh), Gharbia, Sheiben El Kom and Qena (Morsy 1976)], Europe, Israel, Japan, North Africa, Russia and USA [California, introduced (Shenefelt 1973)].

#### \**Chelonus (Chelonus) obscuratus* Herrich-Schäffer, 1838

[http://species-id.net/wiki/Chelonus\\_\(Chelonus\)\\_obscuratus](http://species-id.net/wiki/Chelonus_(Chelonus)_obscuratus)

*Chelonus obscuratus* Herrich-Schäffer 1838: 154.

**Material.** 1♀, 1♂, El- Menia (28°29'18.96"N; 30°50'55.8954"E), 19.VII.1974 [ASC]; 2♀♀, Borg el Arab (30°52'9.4434"N; 29°24'44.8194"E), 13.IV.2009 [CUC]; 1♀, Matruh (31°36'54.3234"N; 25°55'35.2554"E), 30.IX.2009 [CUC].

**Distribution.** New to Egypt, Europe, Mongolia, North Africa and Russia (Central, East and South)

**\*Chelonus (Chelonus) oculator (Fabricius, 1775)**

[http://species-id.net/wiki/Chelonus\\_\(Chelonus\)\\_oculator](http://species-id.net/wiki/Chelonus_(Chelonus)_oculator)

*Ichneumon oculator* Fabricius 1775: 338.

**Material.** 1♂, 1♀ Damanhour (31°1'59.9874"N; 30°28'0.012"E) 4.XI.2008 [CUC]; 1♀ Banha (30°27'27.4314"N; 31°10'12.42"E) 15.X.2009 [CUC]; 1♀ Desouq (31°7'47.1"N; 30°38'45.3834"E) 29.XII.2009 [CUC].

**Distribution.** New to Egypt, Europe, Mongolia and Russia.

**Chelonus (Microchelonus) basalis Curtis, 1837**

[http://species-id.net/wiki/Chelonus\\_\(Microchelonus\)\\_basalis](http://species-id.net/wiki/Chelonus_(Microchelonus)_basalis)

*Chelonus (Microchelonus) basalis* Curtis 1837: 672.

**Distribution.** In Egypt previously recorded with no specific locality (Szépligeti 1908), Europe (Central and Southwest), Israel, Russia (Northwest) and West Asia.

**Chelonus (Microchelonus) blackburni Cameron, 1886**

[http://species-id.net/wiki/Chelonus\\_\(Microchelonus\)\\_blackburni](http://species-id.net/wiki/Chelonus_(Microchelonus)_blackburni)

*Chelonus carinatus* Cameron 1881: 599 (not Provancher, 1881).

*Chelonus blackburni* Cameron 1886: 242, replacement name.

*Chelonus cameronii* Dalla Torre 1898: 200, replacement name for *carinatus* Cameron.

**Material.** 2♀♀, Ismailia (30°24'16.2354"N; 32°17'38.868"E), 20.IV.2008 [CUC]; 1♀, El Tal el-kabeir (30°32'54.168"N; 31°47'0.2754"E), 21.IV.2008 [CUC]; 1♀, Ras El-esh (31°45'15.2"N; 32°18'30.008"E), 17.V.2010 [CUC].

**Remarks.** The extreme basal part of the carapace has a black bilobed (kidney-shaped) marking, but in some specimens it may be semi-circular; the hind tibia has a whitish median band which in some cases is weakly developed.

**Distribution.** Egypt [introduced (Shenefelt 1973)], Australia, Fiji [introduced (Shenefelt 1973)], Hawaii, Kure Island, Mexico, Puerto Rico [introduced (Shenefelt 1973)] and USA [Texas, introduced and not established (Shenefelt 1973)].

**\**Chelonus (Microchelonus) curvimaculatus* Cameron, 1906**

[http://species-id.net/wiki/Chelonus\\_\(Microchelonus\)\\_curvimaculatus](http://species-id.net/wiki/Chelonus_(Microchelonus)_curvimaculatus)

*Chelonus curvimaculatus* Cameron 1906: 34.

**Material.** 2♀, 1♂, Sonnores (29°24'55.0434"N; 30°51'54.108"E), 11.XI.2008 [CUC]; 1♀ Ebshwai (29°21'58.6074"N; 30°40'57.8274"E), 11.XI.2008 [CUC]; 1♀, Tahta (26°46'1.6314"N; 31°29'44.1954"E), 20.X.2009 [CUC]; 1♀, 1♂, Armant (25°37'20.3154"N; 32°32'33.936"E), 17.XII.2009 [CUC].

**Remarks.** The subbasal ivory band of the carapace is usually curved or rounded apically; in one specimen it is more or less V-shaped.

**Distribution.** New to Egypt, Africa (North- and Southeast), Congo and Senegal.

***Chelonus (Microchelonus) sulcatus* Jurine, 1807**

[http://species-id.net/wiki/Chelonus\\_\(Microchelonus\)\\_sulcatus](http://species-id.net/wiki/Chelonus_(Microchelonus)_sulcatus)

*Chelonus sulcatus* Jurine 1807: 291.

**Material.** 1♀, Menia El Kamh (30°30'55.404"N; 31°20'58.02"E), 12.XI.1973 [ASC]; 3♀, 1♂, Arab El Raml (31°14'35.0514"N; 29°57'36.756"E), 4.III.1975 [ASC]; 1♀, Samanoud (30°57'35.928"N; 31°14'15.8994"E), X.1981 [MAC]; 1♀, Beba (28°55'25.4274"N; 30°59'2.2914"E), 25.IV.2008 [CUC].

**Remarks.** The examined specimens have the carapace entirely black, but in a single specimen (from Samanoud), a peculiar crown-shaped basal orange reddish spot is present.

**Distribution.** Egypt [Beni Suef, Minya and Sids (Morsy 1976)], Europe, Israel, Mongolia and Russia.

**Tribe Phanerotomini Baker****Genus *Phanerotoma* Wesmael, 1838**

*Phanerotoma* Wesmael 1838: 165. Type-species: *Chelonus dentatus* Panzer. Designated by Haliday, 1804 in Westwood.

***Phanerotoma (Bracotritoma) masiana* Fahringer, 1934**

[http://species-id.net/wiki/Phanerotoma\\_\(Bracotritoma\)\\_masiana](http://species-id.net/wiki/Phanerotoma_(Bracotritoma)_masiana)

*Phanerotoma (Bracotritoma) masiana* Fahringer 1934: 573.

**Material.** 1♀, Arish (31°8'5.028"N; 33°48'40.752"E), 15.VII.1980 [CUC].

**Distribution.** Egypt [Sinai-Wadi Isla, Khammissa (van Achterberg 1990)], Libya and Saudi Arabia.

***Phanerotoma (Bracotritoma) ponti* sp. n.**

urn:lsid:zoobank.org:act:F999AA12-8376-4F61-A323-9033A4DD0031  
[http://species-id.net/wiki/Phanerotoma\\_\(Bracotritoma\)\\_ponti](http://species-id.net/wiki/Phanerotoma_(Bracotritoma)_ponti)

**Description.** (Figs 29–37) ♀: Length of body: 3.4 mm. Length of fore wing: 2.4 mm.

Colour: Generally yellowish-brown, with the following parts dark brown to black: stemmaticum, mesoscutum (especially laterally), metanotum, sides of scutellum, propodeum posteriorly, third metasomal tergite ( $T_3$ ) (except laterally), pterostigma (except basal and apical 0.2), parastigma, apex and sub-basal part of middle tibia (except extreme apex which is paler), apical 0.3 and subbasal ring of hind tibia, apical half of hind basitarsus and telotarsus; apical eight antennal flagellomeres, tegula and humeral plate slightly pale brown; vein 1-M slightly paler than parastigma; apical third of fore wing infuscate; middle tibia whitish medially and basally.

Head: Slightly wider than maximum width of mesosoma; eyes slightly divergent below; preapical antennal flagellomeres cylindrical, slightly narrowed basally, apical flagellomere 1.1 times length of preapical one, scape slightly wider than first flagellomere; vertex and frons with fine transverse striae; face nearly smooth; inner tooth of mandible slightly shorter than outer tooth; length of eye in dorsal view nearly twice as long as temple; POL twice diameter of posterior ocellus; POL 0.6 times OOL; length of malar space 0.7 times basal width of mandible; longitudinal eye diameter as long as transverse diameter.

Mesosoma: Mesoscutum finely granulated; propodeum finely punctate. Fore wing with vein r as long as vein 3-SR; maximum width of pterostigma 1.7 times vein 3-SR; veins 2-SR and 1-SR straight; middle tibia without distinct blister; outer hind tibial spur 1.1 times the inner one and 0.3 times basitarsus, basitarsus about 0.9 times as long as following tarsomeres combined.

Metasoma: Ovoid, more or less parallel-sided, narrowed posteriorly; metasomal  $T_1$  and  $T_2$  with irregular fine longitudinal striae,  $T_3$  with dense reticulations, its maximum length slightly more than 1.3 times of that of  $T_2$ ; ovipositor not protruding beyond apex of metasoma.

**Male:** Unknown.

**Diagnosis.** This species is closely related to *Phanerotoma (Bracotritoma) bouceki* van Achterberg, but *ponti* has the parastigma dark brown, vein 1-M slightly paler than in *bouceki*, middle tibia is darker and the blister of the middle tibia is much less apparent than in *bouceki*.

**Etymology.** This species is named in the honour of Dr. Adrian Pont (Oxford University Museum of Natural History, UK).

**Type Material.** Holotype, ♀, Gabal Elba – El Shallal (22°2'59.604"N; 36°32'4.2"E), 15.II.2010. [CUC].

***Phanerotoma (Phanerotoma) dentata* (Panzer, 1805)**

*Chelonus dentatus* Panzer 1805: 88.

**Material.** 2♀♀, 1♂ Abu Rawash (30°3'13.86"N; 31°4'36.0834"E), 11: 12.IX.1932 [MAC]; 2♀♀, Banha (30°27'27.4314"N; 31°10'11.676"E), 18.VIII.1972 [ASC]; 1♀, 2♂♂, Cairo (29°57'18.684"N; 29°57'18.684"E), 6.V.1975 [ASC]; 2♀♀, Wadi El Natroun (30°29'57.6024"N; 29°58'54.177"E), 14 X .2009 [CUC].

**Distribution.** Egypt [without specific locality, (Shenefelt 1973); Alexandria (Abd-Rabou 2008)], Europe, Israel, Japan, Kenya, Korea and Russia (East, Northwest and South) USA [California, introduced (Shenefelt 1973)].

***Phanerotoma (Phanerotoma) elbaiensis* sp. n.**

urn:lsid:zoobank.org:act:830B2EDF-9596-473C-8CCB-BB9474C3728C

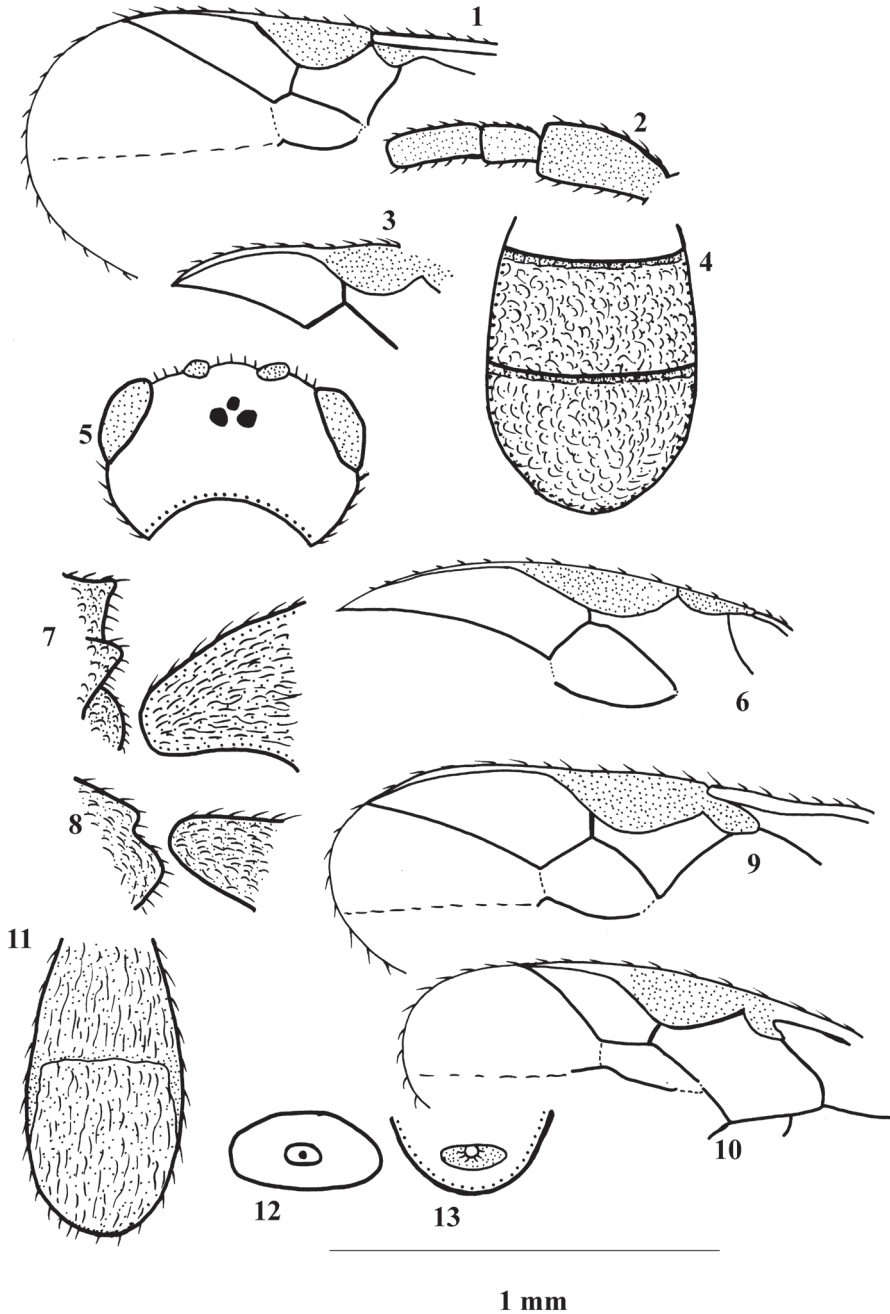
[http://species-id.net/wiki/Phanerotoma\\_\(Phanerotoma\)\\_elbaiensis](http://species-id.net/wiki/Phanerotoma_(Phanerotoma)_elbaiensis)

**Description. (Figs 38–45)** ♀: Length of body: 4.1mm. Length of fore wing: 3.5mm.

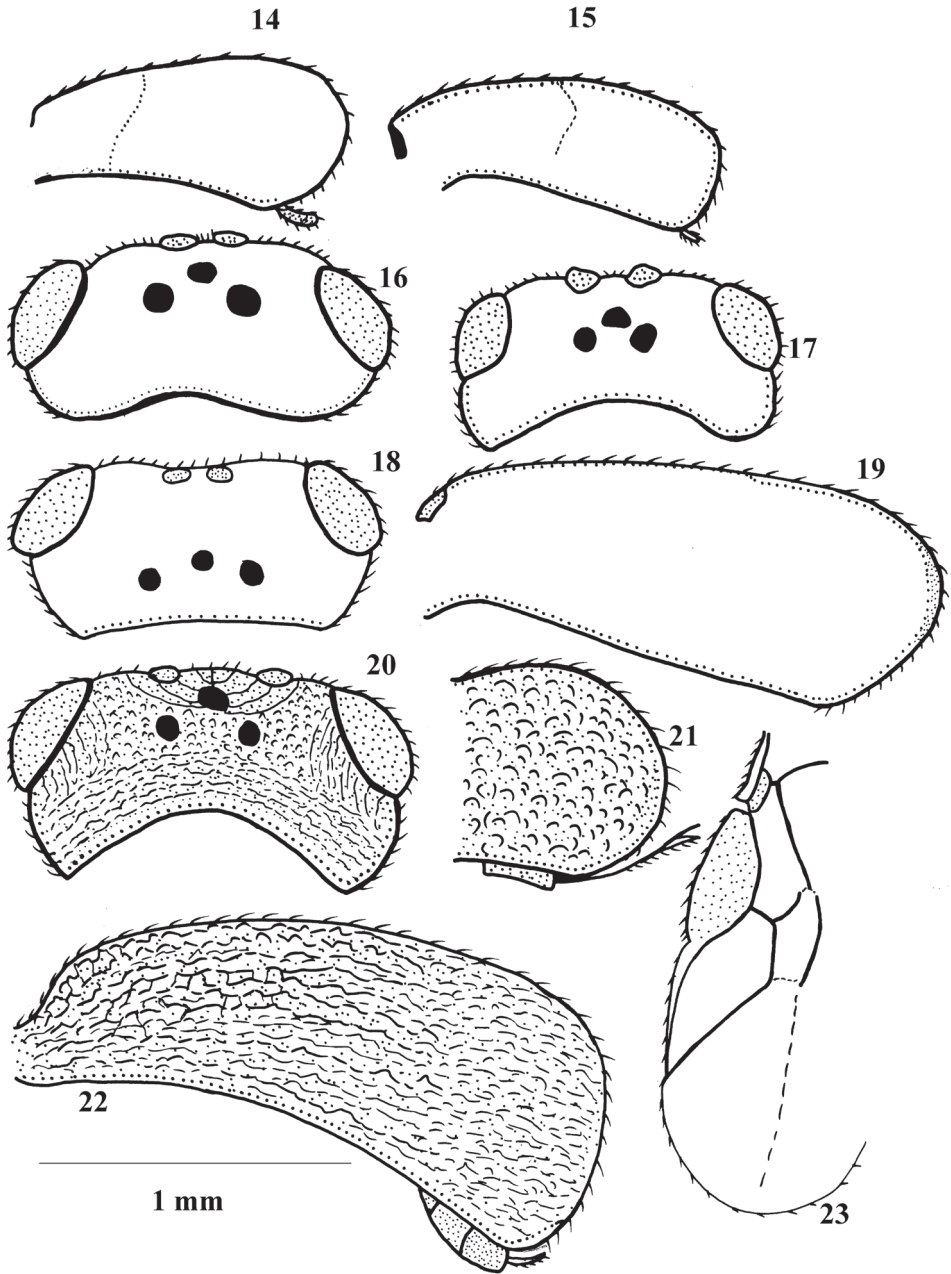
Colour: Generally yellowish-brown with black stemmaticum; the following parts are dark-brown: shiny scape, seven apical antennal flagellomeres, lateral margin of mesoscutum, sides of scutellum, medio-posterior depression of scutellum, lateral sides of first metasomal tergite ( $T_1$ ), lateral side and a central rounded spot on  $T_2$ , entire  $T_3$ , apical half of middle tibia, apical 0.3 as well as subbasal ring of hind tibia, apical half of hind basitarsus and about the basal 0.7 of the other tarsomeres; tegula, humeral plate, pterostigma (except basal 0.3) and vein 1-M. Veins 1-R1 and 2-SR pale yellow; parastigma yellowish (but brown basally).

Head: Slightly wider than maximum width of mesosoma; eyes slightly divergent above and below; preapical antennal flagellomeres moderately moniliform, apical flagellomere 1.3 times length of preapical one, scape 3 times as wide as first flagellomere; vertex smooth and shiny medially, weakly rugose laterally; frons rugose but much coarser than vertex; face densely and finely punctate laterally, with fine transverse rugulae medially; inner tooth of mandible slightly less than half as long as outer tooth; length of eye in dorsal view about 1.9 times temple; POL 0.5 times diameter of posterior ocellus; POL 0.3 times OOL; length of malar space 0.8 times basal width of mandible; longitudinal eye diameter slightly longer than transverse diameter.

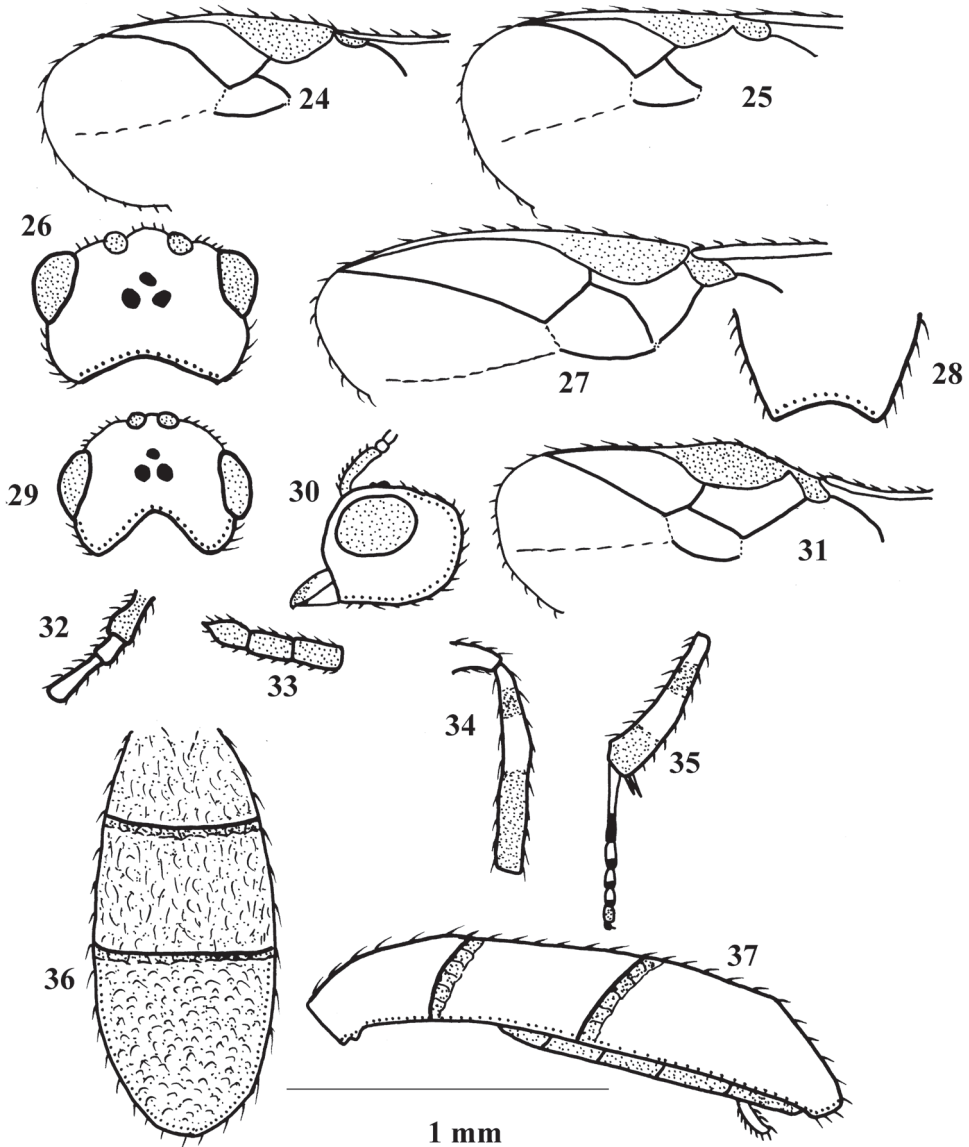
Mesosoma: Finely and densely punctate; mesoscutum coarsely striated laterally (near base of fore wing); metanotum smooth and shiny; propodeum with very fine longitudinal rugae that are curved towards its center and become transverse and much coarser postero-medially. Vein r of fore wing 0.5 times 3-SR; maximum width of pter-



**Figures 1–13.** 1, 2 *Phanerotoma masiana* 3–5 *P. dentata* 6 *P. benedecasisella* 7 *Ascogaster quadridentata* 8 *A. excisa* 9 *P. leucobasis* 10–12 *Chelonius basalis* (after Lozan and Tobias 2002) 13 *C. sulcatus*. 1, 3, 6, 9, 10, part of fore wing (1.6 × scale line, 3.4 ×, 5.3 ×, 2.9 ×, 1.9 ×); 2, basal flagellomeres (1.0 ×); 4, 11, dorsal aspect of carapace (2.7 ×, 1.8 ×); 5, dorsal aspect of head (2.8 ×); 7, 8, lateral aspect of propodeum (2.6 ×, id.); 12, 13, apical aperture (1.8 ×, 2.2 ×).

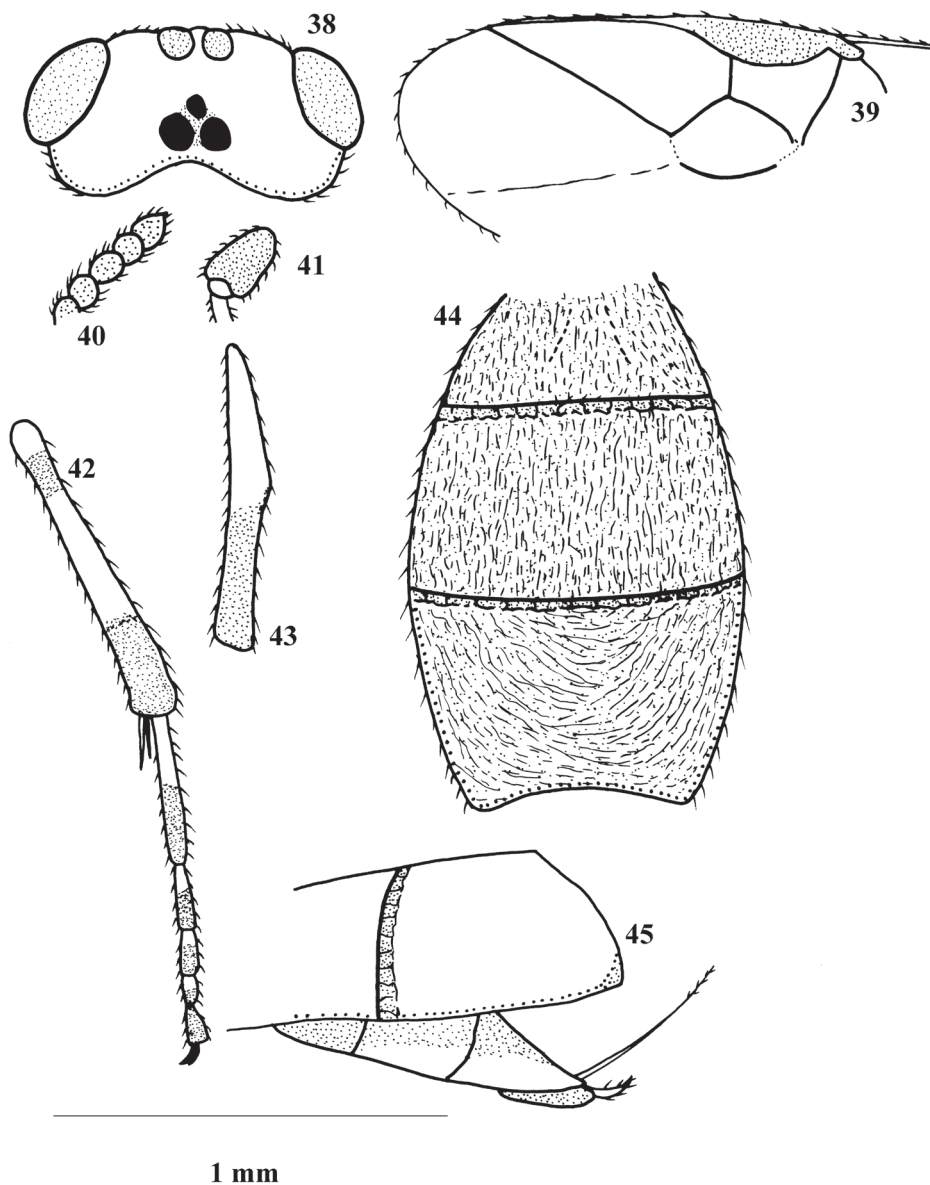


**Figures 14–23.** 14, 16 *Chelonus blackburni* 15, 17 *C. curvimaculatus* 18, 19 *C. obscuratus* 20, 22 *C. inanitus* 21 *C. oculator* 23 *Ascogaster quadridentata*. 14, 15, 19, 22, lateral aspect of carapace (4.8 × scale line, 5.0 ×, 2.0 ×, 2.1 ×); 16–18, 20, dorsal aspect of head (1.6 ×, id., id., 1.74 ×); 21, apical part of carapace (lateral aspect) (2.0 ×); 23, part of fore wing (2.1 ×).



**Figures 24–37.** 24 *Chelonus inanitus* 25 *C. oculator* 26–28 *Phanerotoma rufescens* 29–37 *P. ponti*. 24, 25, 27, 31, part of fore wing ( $3.5 \times$  scale line,  $3.1 \times$ ,  $3.4 \times$ ,  $2.2 \times$ ); 26, 29, dorsal view of head ( $3.2 \times$ ,  $3.3 \times$ ); 28, apical part of carapace (dorsal aspect) ( $2.5 \times$ ); 30, lateral aspect of head ( $6.0 \times$ ); 32, basal flagellomeres ( $5.1 \times$ ); 33, apical flagellomeres ( $3.1 \times$ ); 34, middle tibia ( $1.7 \times$ ); 35, part of hind leg ( $1.7 \times$ ); 36, dorsal aspect of carapace ( $1.8 \times$ ); 37, lateral aspect of carapace ( $2.5 \times$ ).

ostigma 0.6 times 3-SR; 2-SR and 1-SR are nearly straight; middle tibia with distinct blister; outer hind tibial spur 1.2 times as long as inner one, slightly longer than 0.3 times basitarsus; hind basitarsus about 0.6 times the following tarsomeres combined.



**Figures 38–45.** *Phanerotoma elbaiensis*: **38** dorsal aspect of head (3.1 × scale line) **39** part of fore wing (3.1 ×) **40** apical flagellomeres (14.1 ×) **41** basal flagellomeres (14.1 ×) **42** part of hind leg (5.8 ×) **43** middle tibia (5.8 ×) **44** dorsal aspect of carapace (2.1 ×) **45** lateral aspect of carapace (2.0 ×).

Metasoma: Ovoid, truncate posteriorly;  $T_1$  and  $T_2$  with irregular longitudinal reticulation, much denser and curved on complete  $T_3$ ;  $T_3$  with protruding corners latero-posteriorly and excavated posteriorly; maximum length of  $T_3$  slightly more than 1.1

times maximum length of  $T_2$ ; ovipositor greatly protruding beyond apex of metasoma; hypopygium modified, with a relatively small apical spine.

**Male:** Unknown.

**Diagnosis.** This species is related to *Phanerotoma* (*Bracotritoma*) *bilinea* Lyle, but *elbaiensis* has the middle tibia with a distinct blister; the parastigma brownish basally; the vein 1-M darker and the apical spine of the hypopygium relatively small. It is similar to *Phanerotoma* (*Bracotritoma*) *maculata* (Wollaston), especially because of the long protruding ovipositor, but differs by its general colour, especially by the yellowish parastigma and basal third of pterostigma (dark brown in *maculata*). In addition, the characters of the subgenus *Phanerotoma*, to which the new species belongs, are different.

**Etymology.** The species name *elbaiensis* refers to its type locality (Gabal Elba).

**Type material.** Holotype, ♀, Gabal Elba – Wadi Aeibed (22°19'28.092"N; 36°25'24.636"E), 27.I.1982. [CUC].

***Phanerotoma* (*Phanerotoma*) *hendecasisella* Cameron, 1905**

[http://species-id.net/wiki/Phanerotoma\\_\(Phanerotoma\)\\_hendecasisella](http://species-id.net/wiki/Phanerotoma_(Phanerotoma)_hendecasisella)

*Phanerotoma hendecasisella* Cameron 1905: 80.

**Material.** 2♀♀, Alexandria (31°11'0.42"N; 29°56'44.304"E), 14.V.1980 [MAC]; 1♀, Tanta (30°54'2.6634"N; 31°9'50.8386"E), without date [CUC].

**Distribution.** Egypt (with no specific locality, Shenefelt 1973), Australia, Burma, Ceylon and India.

***Phanerotoma* (*Phanerotoma*) *leucobasis* Kriechbaumer, 1894**

[http://species-id.net/wiki/Phanerotoma\\_\(Phanerotoma\)\\_leucobasis](http://species-id.net/wiki/Phanerotoma_(Phanerotoma)_leucobasis)

*Phanerotoma leucobasis* Kriechbaumer 1894: 62.

**Material.** 5♀♀, 1♂ Kerdasa (30°1'56.136"N; 31°6'32.6874"E), II.1965 [MAC]; 3♀♀, El Mansouria (30°8'14.1"N; 31°3'46.656"E), IX.1995 [MAC]; 4♀♀, 1♂ Safaga (26°44'25.764"N; 33°58'54.5514"E), VII.2007 [CUC]; 2♀♀, 1♂ Giza (29°37'18.048"N; 31°15'14.508"E), 13.II.2008 [CUC]; 1♀, Ismailia (30°38'20.7954"N; 32°16'7.572"E), 28.III.2008 [CUC]; 1♀, 1♂ Alexandria (31°5'1.3914"N; 29°45'53.316"E), 4.X.2008 [CUC]; 2♀♀, 1♂ Assuit (31°32'55.248"N; 27°23'33.2514"E), 12.I.2009 [CUC].

**Variation.** The colour of the head varies from yellowish brown to nearly black; the terminal flagellomeres are usually blackish, but in few cases paler; the third metasomal tergite is usually brownish, but blackish in a few specimens, and the second tergite sometimes has brownish spots laterally.

**Distribution.** In Egypt previously recorded from Alexandria, Dokki, Gara, Maadi, Sinai (van Achterberg 1990), Africa (Central, North and Southeast), Israel, USA [California, introduced (Shenefelt 1973)] and West Asia

**\**Phanerotoma (Phanerotoma) rufescens* (Latreille, 1809)**

[http://species-id.net/wiki/Phanerotoma\\_\(Phanerotoma\)\\_rufescens](http://species-id.net/wiki/Phanerotoma_(Phanerotoma)_rufescens)

*Sigalphus rufescens* Latreille 1809: 13.

**Material.** 1♀, Balteem (31°18'42.6954"N; 31°9'23.9394"E), 13.VII.2010 [CUC].

**Distribution.** New to Egypt, Europe (Central, Southwest and West) and Russia (Central, East and Northwest).

## Acknowledgements

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