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Contributions to the genus *Opisthodorylaimus* Ahmad & Jairajpuri, 1982 (Nematoda: Dorylaimida), with descriptions of two new species

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Abstract. Two new species of the genus *Opisthodorylaimus* are described. *O. mitis* sp. n. from Guadeloupe and Ecuador is characterized by a transverse vulva, very long egg, lack of an anterior uterine sac, and by a filiform tail. *O. papuanus* sp. n. from Papua New Guinea is distinguished by a longitudinal vulva, lack of a prevulval uterine branch, and by a long, filiform tail. Two known species of the genus are also presented: *O. cavalcantii* (Lordello, 1955) from Vietnam and *O. maqsoodi* Ahmad & Jairajpuri, 1982 from Seychelles. The taxonomic position of *Opisthodorylaimus* is commented, and the distribution of its ten species outlined. A key to species is added.

INTRODUCTION

The genus *Opisthodorylaimus* was established by Ahmad and Jairajpuri (1982) when they described the first three species*, O. caudatus* Ahmad & Jairajpuri, 1982, *O. chamoliensis* Ahmad & Jairajpuri, 1982 and *O. maqsoodi* Ahmad & Jairajpuri, 1982, and designated the latter as type. Carbonell and Coomans (1986) provided then the first comprehensive work on the genus. They placed *Dorylaimus cavalcantii* Lordello, 1955 and *Dorylaimus sylphoides* Williams, 1959 under *Opisthodorylaimus,* and redescribed them in detail. Besides, they described three new species, *O. baqrii* Carbonell & Coomans, 1986, *O. filicaudatus* Carbonell & Coomans, 1986 and *O. paracavalcantii* Carbonell & Coomans, 1986. Andrássy (1987) when revised the family Thornenematidae, redefined the genus *Opisthodorylaimus,* and provided a key to species. Subsequently, several authors added further informations on one or the other species. Recently, Gagarin (2004) enriched the genus with a ninth species, *O. major* Gagarin, 2004.

In this article two known but rather rare species of *Opisthodorylaimus – O. cavalcantii* (Lordello, 1955) from Vietnam and *O. maqsoodi* Ahmad & Jairajpuri, 1983 from the Seychelles – are presented, and two new species, *O. mitis* sp. n. from the Caribbean and *O. papuanus* sp. n. from Papua New Guinea, described. Besides, some remarks on the taxonomic position of the genus are added, and a distribution pattern of its species is outlined. Finally, a new key to species is provided.

MATERIALS AND METHODS

The nematodes discussed herein were sampled by Hungarian scientists during their collecting trips to tropical regions of Earth between 1968 and 2000. The soil samples were

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fixed *in situ* with FAA, and washed out in the laboratory by flotation techniques and screens. The nematodes were picked out by hand and fixed again with FAA. Subsequently, they were processed to pure glycerine by a slow method, and finally mounted on permanent glass slides.

Measurements were taken by an ocular micrometer, curved structures were measured along the curved medial line. All nematode specimens, holo- and paratypes, are at moment preserved in the nematode collection of the author, but later they will be deposited at the Zoological Department of the Hungarian Natural History Museum, Budapest. It may be mentioned that also the oldest slides (nearly forty years) contained well-preserved, fresh-like animals.

DESCRIPTIONS

Opisthodorylaimus mitis sp. n.

(Fig. 1 A–E)

Holotype female: L = 1.32 mm; a = 36; b = 4.3; c = 4.6; c' = 14; V = 40 %.

Paratype females from Guadeloupe (n = 5): L = 1.23–1.34 mm; a = 34–36; b = 4.3–4.5; c = 4.2–4.4; c' = 14–16; V = 39–41 %.

Females from Ecuador (n = 4): L = 1.33–1.37 mm; a = 28–33; b = 4.3–4.7; c = 3.7–4.2; c' = 14–16; V = 38–40 %.

General description. Body mostly straight or nearly so after fixation, moderately slender, 35–40 µm wide at mid-region. Cuticle smooth, thin, 1 µm in most part of body and 2.5–3.0 µm on dorsal side of tail, consisting of a very thin outer and a somewhat thicker inner layer. In the narrowing part of tail the outer layer becomes thicker than the inner layer. Lip region not set off in any manner, 10–11 (exceptionally 12) µm wide at level of labial papillae; lips completely amalgamated, rounded. Amphidial aperture one half the corresponding labial diameter or a little narrower.

Odontostyle cylindroid, rather robust, 15–17 µm long and 2.5–3.0 µm thick, about 6 times as long as thick, 1.5 times the labial width, or 5–6 % of oesophagus length; slightly sinuate with aperture occupying one-third of stylet length. Odontostyle much thicker than cuticle at the same level. Guiding ring thin, at proximal end of stylet aperture. Oesophagus 285–306 µm long, 21–23 % of entire length of body, at 55–57 % enlarged. Distance between posterior end of oesophagus and vulva 0.7–0.8 times as long as oesophagus, and 5.4–6.2 times as long as body diameter. Glandularium 115–123 µm long. Oesophageal gland nuclei rather inconspicuous due to the heavy muscular structure of cylindrus. Dorsal nucleus relatively small, at 13–14 % of total length of body. Posterior subventral nuclei comparatively far from posterior end of cylindrus. Cardia conical, 12–15 mm long. Intestine with straight walls. Prerectum 1.2–2.4, rectum 1.5–1.7 anal body widths long.

Oesophageal gland nuclei in Opisthodorylaimus mitis

D = 59–62 %	AS_1 = 24–26 %
	AS_2 = 36–38 %
	PS_1 = 56–58 %
	PS_2 = 57–59 %

Female. Vulva a long transverse slit with sclerotized, 8–9 µm wide inner lips. Vagina 15–16 µm, nearly half as long as body diameter. Genital system mono-opisthodelphic, with a very short, about only one-quarter body width long prevulval sack. Posterior gonad generally on left side of intestine, in younger females 2.8–3.8 body widths long or occupy-

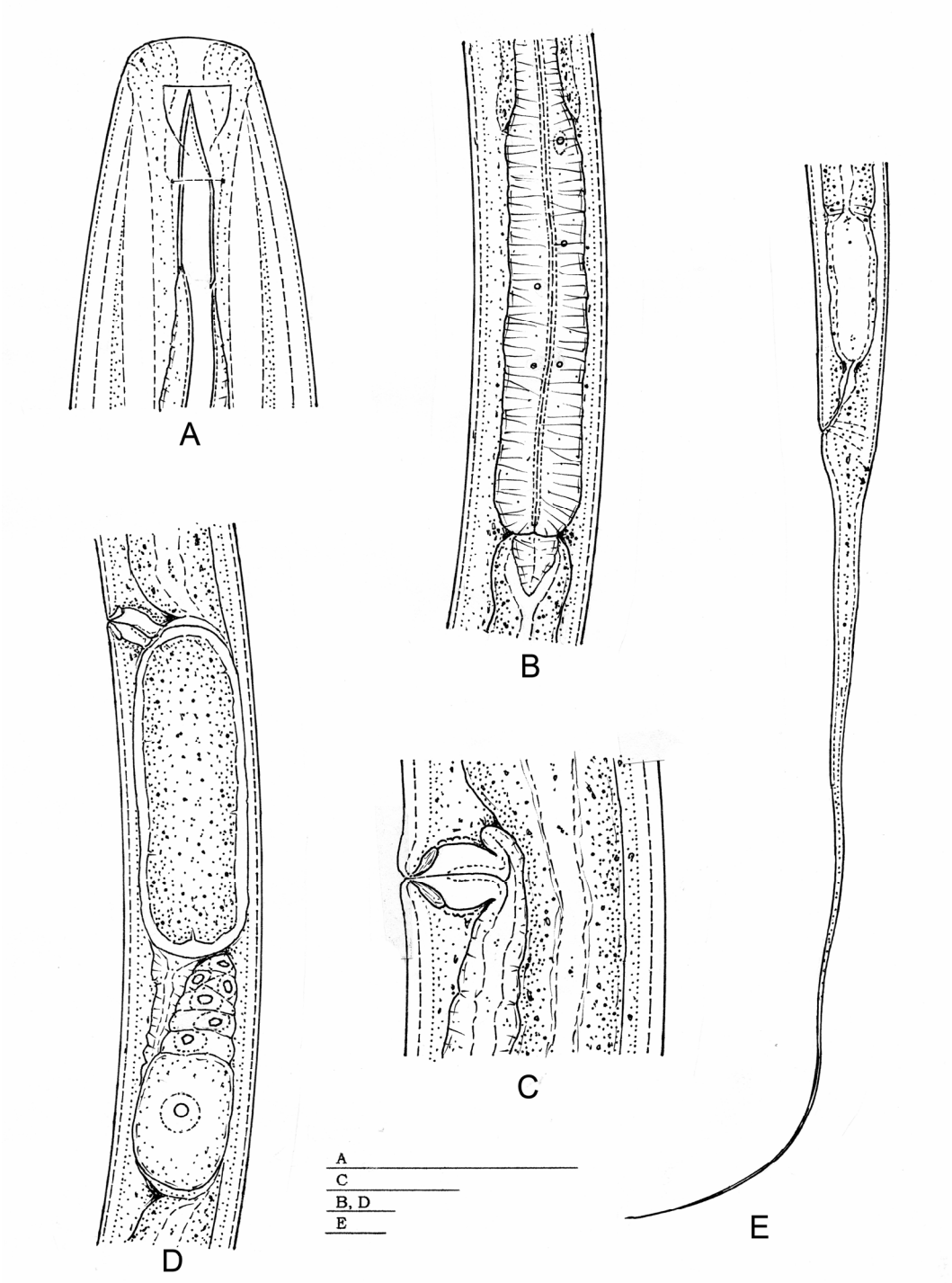

Figure 1. *Opisthodorylaimus mitis* sp. n. A = anterior end; B = posterior half of oesophagus; C = vulval region; D = genital organ; E = female tail. (Scale bars 20 µm each)

ing 8–10 % of body length, in older females 5–7 body widths long or occupying 13–14 % of body length. Uterus hardly longer than one body diameter, distally with a sphincter muscle. Ovary consisting of few cells. Only one large egg in uterus: 90–97×28–31 µm, 2.4–2.7 times longer than body diameter. Spermatozoa not observed even in egg-bearing females. Vulva–anus distance equal to 1.5–1.8 tail lengths. Tail very long, 280–360 µm or 22–27 % of total length of body, initially conoid-rounded then attenuated, filiform, ending in a sharp tip. Two pairs of small caudal papillae at distal end of the conoid section.

Male. Not found.

Diagnosis and relationships. Body moderately long, head continuous with neck, cuticle thin, stylet medium-sized, vulva transverse with sclerotized lips, practically no prevulval sack, egg very large, tail long and filiform.

Among the members of the genus possessing a transverse vulva, the new species shares similarities with *O. maqsoodi* Ahmad & Jairajpuri, 1982. It can be differentiated from that by some constant characters as follows. The body is a little shorter (1.2–1.3 *vs*. 1.4–1.5 mm), labial region narrower (10–12 *vs*. 14–15 µm), stylet shorter (15–17 *vs*. 19–21 µm), glandularium shorter (115–123 *vs*. 135–150 µm), egg much longer (2.4–2.7 *vs*. 1.6–1.7 times the body width), and the tail is longer (14–16 vs. 8–12 anal body diameters).

Opisthodorylaimus mitis sp. n. can be distinguished also from the other three species with transverse vulva. So, it immediately differs from *O. cavalcantii* (Lordello, 1955) and *O. paracavalcantii* Carbonell & Coomans, 1986 by the well-sclerotized vulval lips (*vs*. unsclerotized), and from *O. baqrii* Carbonell & Coomans, 1986 by the conspicuously longer tail (14–16 *vs*. 6–8 times anal body width long).

Type specimens. Holotype female on slide No. 13551. Paratypes: five females and four juveniles. – Further specimens (from Ecuador): four females and two juveniles.

Type locality. Soufrière, Guadeloupe, Caribbean Islands, soil from rain forest at 800 m above sea-level, collected in August 1996 by A. Fodor. – Other locality: Triunfo, Prov. Pastaza, Ecuador, grassy soil in a clearing of a rain forest, collected in September 1987 by I. Loksa and A. Zicsi.

Etymology. The species epithet comes from the Latin and means: gentle or mild. *Opisthodorylaimus mitis* sp. n. appears to be a peaceful little animal.

***Opisthodorylaimus papuanus* sp. n.**

(Fig. 2 A–E)

Holotype female: L = 1.42 mm; a = 36; b = 4.1; c = 6.8; c' = 9.2; V = 46 %.

Paratype females (n = 5): L = 1.32–1.49 mm; a = 28–36; b = 4.1–4.6; c = 5.6–8.1; c' = 7.5–8.5; V = 40–46 %.

General description. Body slightly ventrally curved to almost straight when fixed, 40–48 µm wide at mid-region. Cuticle thin and smooth, 1.0–1.5 µm on most body, 2.5–3.5 µm thick on dorsal side of tail. Lips amalgamated, labial region at level of posterior papillae 12–13 µm wide, roundish, not offset in any manner. Body at posterior end of oesophagus 3.1–3.6 times as wide as head. Amphidial aperture occupying half width of corresponding body.

Odontoystyle strong, twice as thick as cuticle at the same level, 17–18 µm long and 3.5 µm wide, about five times longer than wide, or 1.4 times as long as head diameter, occupying 5–6 % of oesophagus length; slightly sinuated with aperture occupying 1/3 or some-

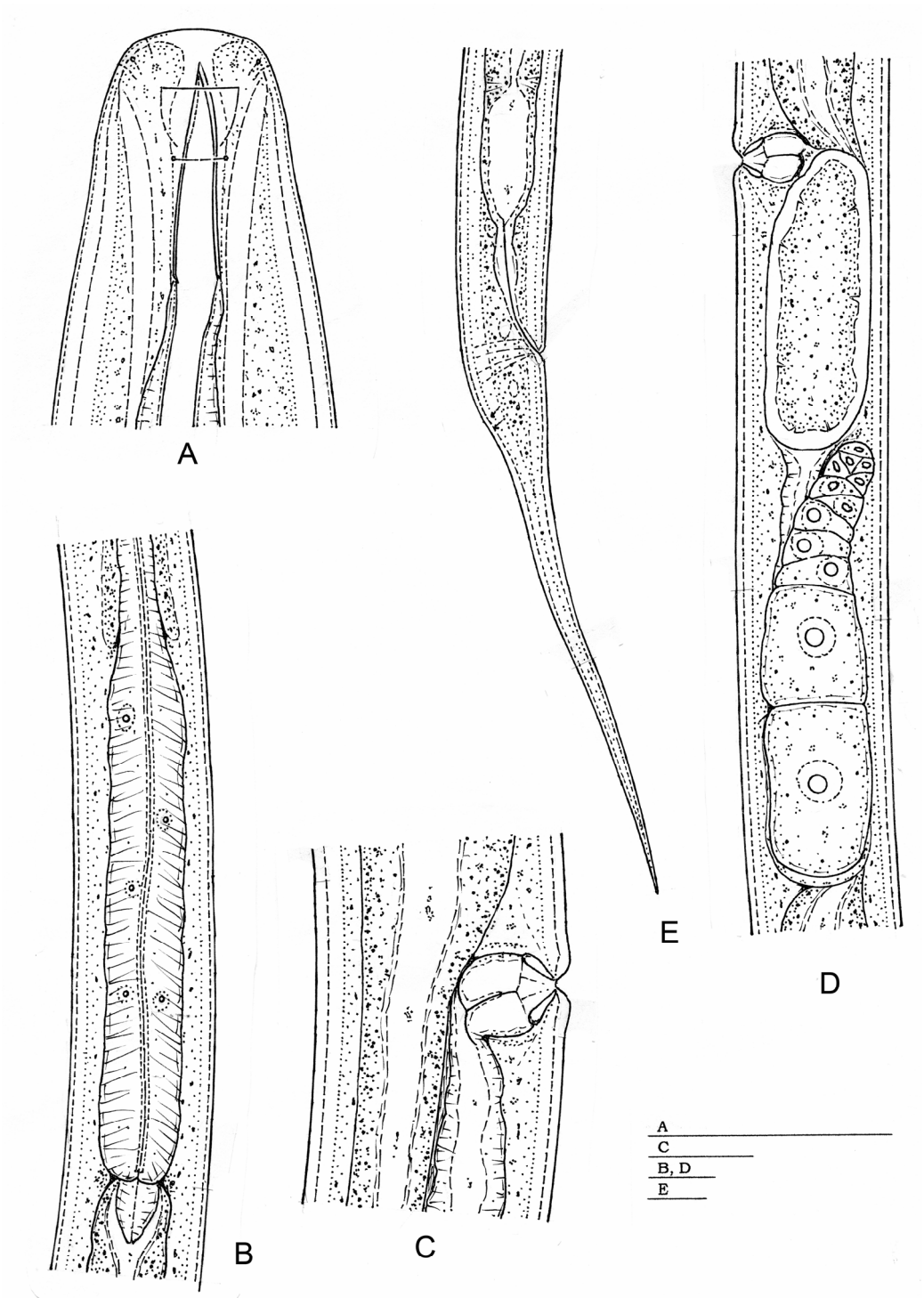

Figure 2. *Opisthodorylaimus papuanus* sp. n. A = anterior end; B = posterior half of oesophagus; C = vulval region; D = genital organ; E = female tail. (Scale bars 20 µm each)

what more of its length. Guiding ring thin, located at first third of stylet length. Oesophagus 286–354 µm long, at 55–57 % widened. Musculature of cylindrus obliquely structured. Glandularium 127–138 µm long. Oesophageal gland nuclei less conspicuous, dorsal nucleus located at 13–15 % of entire length of body. Distance between posterior end of oesophagus and vulva 0.8–1.0 times as long as oesophagus. Cardia conical, 20–26 µm long. Intestinal walls moderately thick, covered by intima. Rectum 1.4–2.0 times, prerectum 1.4–2.8 times the anal body width long.

Oesophageal gland nuclei in Opisthodorylaimus papuanus

D = 58–60 %	AS_1 = 23–24 %
	AS_2 = 37–39 %
	PS_1 = 60–64 %
	PS_2 = 63–64 %

Female. Vulva longitudinal with well-sclerotized, 14–15 µm wide inner lips. Vagina straight or bent backwards, 16–18 µm long, penetrating into less than half width of body. Reproductive system opisthodelphic, without anterior uterine sac. Gonad in younger females 3.2–3.5 body widths long or occupying 9–10 % of body length, in egg-bearing females 4.0–5.6 body widths long or occupying 13–16 % of body length. One large egg at a time: 92–100×35–36 µm, 2.0–2.3 times the body width long. Uterus not containing spermatozoa. Vulva–anus distance equal to 2.4–3.4 tail lengths. Tail 180–220 µm long, 12–16 % of entire length of body, first elongate conoid-rounded, then filiform with pointed tip.

Male. Not observed.

Diagnosis and relationships. A medium-sized species, with continuous head, thin cuticle, medium long and plump stylet, opisthodelphic gonad without anterior uterine sac, longitudinal and sclerotized vulva, and with filiform tail.

Of the eight known valid species of *Opisthodorylaimus* described so far, four possess a longitudinal vulva. Among them, this new species most closely resembles *O. chamoliensis* Ahmad & Jairajpuri, 1982, but differs from it in having smooth cuticle, the head completely continuous with neck, plumper stylet (5 times *vs*. 7 times as long as wide), shorter tail (180–220 *vs*. 250 µm), and in having no anterior uterine sac.

From the other three species showing longitudinal vulva, *Opisthodorylaimus papuanus* sp. n. can be differentiated as follows. It differs from *O. caudatus* Ahmad & Jairajpuri, 1982 mainly in having a longer tail (180–220 *vs*. 90–114 µm, or 7.5–9.2 *vs*. 4–5 anal body diameters long); from *O. filicaudatus* Carbonell & Coomans, 1986 by the much shorter tail (c' = 7.5–9.2. *vs*. 20–30); from *O. sylphoides* (Williams, 1959) by the shorter body (1.3–1.5 *vs*. 1.7–2.4 mm), shorter tail (7.5–9.5 *vs*. 14–25 anal body widths), and by the lack of an anterior uterine branch.

Type specimens. Holotype female on slide No. 12964. Paratypes: 7 females and 3 juveniles. Further specimens: 3 females and 2 juveniles. All in the collection of the author.

Type locality and habitat. McAdam Parc, Wau, Papua New Guinea, wet leaf litter and humus from a rain forest (8 females and 3 juveniles). Further specimens: Mt. Kaindi, Wau, Papua New Guinea, from around the roots of *Pandanus* sp. near a rivulet (2 females, 2 juveniles); Masham River, Wau, Papua New Guinea, fallen leaves in a secondary rain forest (1 female). All the specimens were collected in August 1968 by J. Balogh.

Etymology. The species is named after the territory.

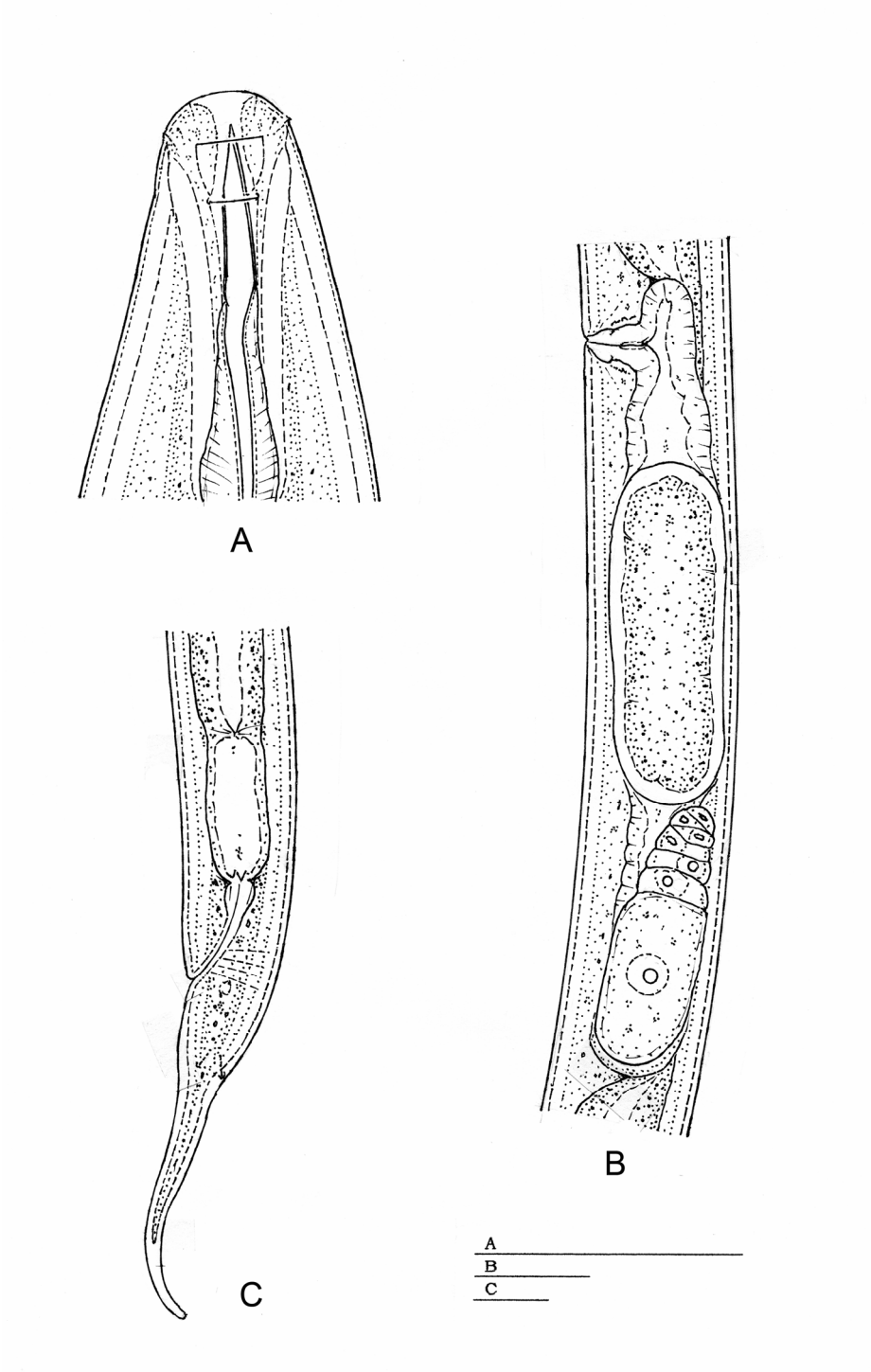

Figure 3. *Opisthodorylaimus cavalcantii* (Lordello, 1955) Carbonell & Coomans, 1986. A = anterior end; B = genital organ; C = female tail. (Scale bars 20 µm each)

Opisthodorylaimus cavalcantii (Lordello, 1955) Carbonell & Coomans, 1986

(Fig. 3 A–C)

Females (n = 3): L = 1.00–1.17 mm; a = 25–30; b = 3.8–4.2; c = 10.0–11.2; c' = 4.7–5.2; V = 41–43 %.

General description. Body nearly straight after fixation, 38–40 µm wide at middle. Cuticle smooth, 1.5–2.0 µm thick. Labial region practically continuous with adjacent body, 8–9 µm wide at base. Lips amalgamated. Amphidial aperture half as wide as corresponding body. Odontostyle short and thick, 12–13 µm, 1.3–1.5 times the labial diameter long, or as long as 4.5–5.0 % of oesophagus; nearly as thick as cuticle at the same level. Aperture occupying about 2/5 of stylet length. Guiding ring thin. Oesophagus 266–276 µm long, 23–24 % of body length, at 57–58 % enlarged. Oesophageal gland nuclei moderately distinct. Distance between posterior end of oesophagus and vulva 0.6–0.8 times as long as oesophagus. Rectum 1.4–1.7, prerectum 1.6–1.8 anal body widths long.

Female. Mono-opisthodelphic with a quite short – 1/4 or 1/3 body width long – prevulval uterine sac. Vulva transverse, its inner lips narrow, not sclerotized. Vagina 14–15 µm long, somewhat shorter than half width of body. Gonad 155–230 µm long or 15–18 % of body length. One uterine egg: 97×28 µm, 2.6 times as long as body width. Distance vulva–anus equal to 4.8–6.5 tail lengths. Tail 98–104 µm long, occupying 9–10 % of total body length, first conoid-rounded, then tapered to the dorsally bent, finely rounded tip.

Locality and habitat. Santa Maria, 20 km from Bao Loc, Vietnam, fallen leaves from a secondary rain forest, collected in October 1988 by S. Mahunka and T. Vásárhelyi.

Remarks. This is the widest distributed representative of the genus, recorded from every continent except for Europe. It can easily be identified by the transverse, not sclerotized vulva and the lack of a reduced anterior ovary. The present specimens well correspond to the previous descriptions.

Opisthodorylaimus maqsoodi Ahmad & Jairajpuri, 1982

(Fig. 4 A–E)

Females (n = 4): L = 1.41–1.47 mm; a = 28–29; b = 4.1–4.3; c = 4.8–5.7; c' = 10–11; V = 40–42 %.

General description. Body varying in shape when fixed, 48–52 µm wide at middle. Cuticle smooth, 1.0–1.5 µm thick on most body, 2.5 µm thick on anterior region of tail. Labial region practically continuous with neck, 14–15 µm wide; lips amalgamated. Body at posterior end of oesophagus 3.4–3.6 times as wide as head. Odontostyle almost twice as thick as cuticle, slightly sinuate, 19–20 µm long, or 5–6 % of oesophagus length. Aperture occupying more than 1/3 stylet length. Guiding ring thin and simple. Oesophagus 328–360 µm long, occupying 23–24 % of entire length of body, at 52–55 % widened. Distance between posterior end of oesophagus and vulva about 70 % of oesophagus length. Oesophageal gland nuclei well discernible, glandularium 135–150 µm long. Dorsal nucleus located at 13–14 % of total body length. Cardia elongate conical, 25–27 µm long. Intestine thick-walled with intima. Rectum 1.3–1.5, prerectum 1.5–2.3 anal body widths long. Intestine–prerectal junction tongue-like.

Oesophageal gland nuclei in Opisthodorylaimus maqsoodi

D = 56–58 %	AS_1 = 23–30 %
	AS_2 = 25–33 %
	PS_1 = 54–56 %
	PS_2 = 54–56 %

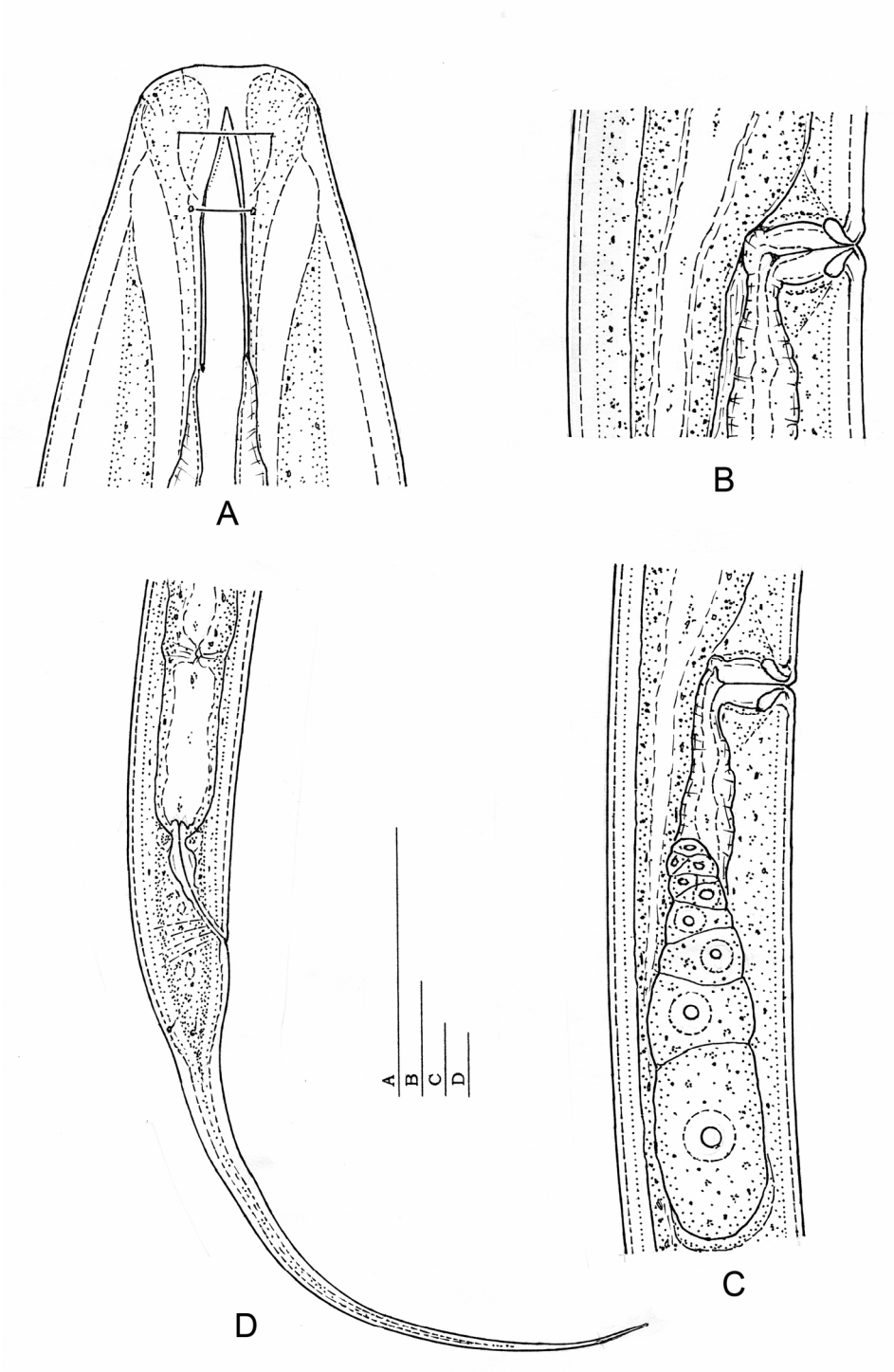

Figure 4. *Opisthodorylaimus maqsoodi* Ahmad & Jairajpuri, 1982. A = anterior end; B = vulval region; C = genital organ; D = female tail. (Scale bars 20 µm each)

Female. Mono-opisthodelphic, without anterior uterine sac. Vulva a long transverse slit, with well-sclerotized inner lips. Vagina 17–19 µm long, shorter than half width of corresponding body. Gonad 3.0–3.7 body widths long, occupying 10–13 % of body length. No uterine egg observed. Vulva–anus distance equal to 1.8–2.3 tail lengths. Tail filiform, 260–304 µm long, occupying 17–21 % of entire length of body.

Locality and habitat. Northern region of Le Niol, Isle de Mahé, Seychelles Archipelago, leaf litter on the bank of a rivulet, collected in June 2000 by L. Hufnágel.

Remarks. This species is characterized by the medium-sized body, comparatively wide head, strong stylet, transverse and sclerotized vulva, and by a fairly long tail. It was described by Ahmad and Jairajpuri (1982) from grassy soil in India, and subsequently discovered by Andrássy (1987) from forest litter in North Korea. The present specimens fit well to both descriptions.

SOME COMMENTS ON THE GENUS OPISTHODORYLAIMUS

1) *Opisthodorylaimus major* Gagarin, 2004. – Gagarin described this species from reservoirs on the Kuril Islands, Russia. He compared it with *O. paracavalcantii* Carbonell & Coomans, 1986, and enumerated the following distinguishing features: body larger, stylet, prerectum and tail longer, vulva more anterior and supplements more numerous.

However, the taxonomic position of this species of Gagarin can not be stated with confidence, namely whether it is close to *Opisthodorylaimus,* or it belongs to another genus, or, what is more, to another family. On the one hand, it resembles the *Opisthodorylaimus* species in its general body shape, the non-offset head, the short stylet, and in the longitudinal vulva. On the other hand, however, it shows some morphological features that are strange for *Opisthodorylaimus,* such as *a)* the great length of body (2.4–3.0 mm *vs*. 0.7–2.4 mm), *b)* the female genital system is amphidelphic and symmetrical, with normally developed anterior ovary (*vs*. anterior ovary lacking, or if present, rudimentary), *c)* the male prerectum is very long, beginning far anterior to the row of supplements (vs. short, starting within the range of supplements or quite close to it), *d)* the ventromedial supplements are too numerous (18 *vs*. 5–11) and contiguous (*vs*. spaced to far spaced). Unfortunately, the original description does not contain information on the oesophageal gland nuclei, although their arrangement would be important to know (see next paragraph). Finally, it is worth noting that Gagarin found his species in freshwater habitats, whereas all the (valid) members of the genus *Opisthodorylaimus* are definitely soil inhabitants, never observed in freshwater biotopes.

Considering the above discrepancies, I suggest *Opisthodorylaimus major* Gagarin, 2004 to be considered, at least for the moment, a *species incertae sedis.*

2) *Dorylaimidae or Thornenematidae?* – As regards the taxonomic position of *Opisthodorylaimus* – whether it belongs to the family Dorylaimidae or Thornenematidae – the opinions are different. Baqri and Jairajpuri (1982), Carbonell and Coomans (1986), Andrássy (1987), Baqri (1991), and Jairajpuri and Ahmad (1992) placed the genus in Thornenematidae or Thornenematinae, respectively. Coomans and Carbonell (1988) as well as Loof (1999) regarded it as a member of the subfamily Mesodorylaiminae within Dorylaimidae. Coomans and Carbonell supposed that *Opisthodorylaimus paracavalcantii* forms a link between *Mesodorylaimus* and the other species of *Opisthodorylaimus*.

Whereas, I am of the opinion that *Opisthodorylaimus* should be separated from the members of Dorylaimidae and assigned to the Thorne-

nematidae. I have two main arguments. *1)* Within the so rich family Dorylaimidae all the species (of 23 nominal genera) are amphidelphic with equally developed female gonads, and there is no tendency among them towards reducing the anterior ovary. In the genera of Thornenematidae the female genital system is rarely didelphic or pseudo-didelphic, in the majority of species it is mono-opisthodelphic, with or without a reduced anterior uterine branch. *2)* On the basis of several observations (Baqri and Jairajpuri, 1967; Loof and Coomans, 1970; Mehdi Ali & Prabha, 1974; Baqri and Jana, 1980; Sauer, 1981; Ahmad and Jairajpuri, 1982; Carbonell and Coomans, 1986, 1987; Andrássy, 1987; Coomans and Carbonell, 1988; Baqri, 1991; Fadaei-Tehrani and Coomans, 2005; present paper) it can be stated that all the thornenematid species have a special and very constant pattern of the oesophageal gland nuclei which clearly differs from that of the members of Dorylaimidae. While in the latter family the PS nuclei are predominantly located far back, fairly close to the posterior margin of the cylindrus (in general at 70–80 % of glandularium), the species assigned to Thornenematidae all show a much more anterior location of PS nuclei; these are situated at not farer than 2/3 of glandularium length. Just this is the situation in each representative of *Opisthodorylaimus:* the PS nuclei are located at a longer distance from the posterior margin of the oesophagus, namely at 52 to 64 % of the glandularium (= distance between the D nucleus and posterior end of cylindrus). Concretely, they are situated as follows: in *O. baqrii* at 61 %, in *O. caudatus* at 58–60 %, in *O. cavalcantii* at 52–56 %, in *O. chamoliensis* at 58–59 %, in *O. filicaudatus* at 55–60 %, in *O. maqsoodi* at 52–56 %, in *O. mitis* at 56–59 %, in *O. papuanus* at 60–64 %, in *O. paracavalcantii* at 56 % and in *O. sylphoides* at 54–55 %.

Within the family Thornenematidae Siddiqi, 1969 fifteen nominal genera may be listed, twelve of them being probably valid. Among them, *Opisthodorylaimus* is characterized by the absence of labial sclerotization or lack of sublabial collare (sclerotized thickenings of cuticle behind the head).

3) *Distribution pattern.* – Although the genus *Opisthodorylaimus* belongs to the less frequent genera of dorylaimid nematodes, its representatives are distributed all over the world. Their dispersion is however not uniform. While Europe is represented by a single species, in Asia five and in Africa six species occur. Accordingly, the distribution of species on the continents is as follows.

Europe: *sylphoides.*

Asia: *caudatus, cavalcantii, chamoliensis, maqsoodi, sylphoides.*

Africa: *baqrii, cavalcantii, filicaudatus, maqsoodi, paracavalcantii, sylphoides.*

North America: *cavalcantii.*

South America: *cavalcantii, consobrinus, mitis.*

Australasia: *cavalcantii, papuanus.*

As may be seen, *baqrii, caudatus, chamoliensis, filicaudatus, maqsoodi, mitis, papuanus* and *paracavalcantii* each are distributed on one continent. Whereas, *sylphoides* occurs on three, *cavalcantii* even on all continents with exception of Europe.

To the best of our knowledge, the ten species have been recorded from the following countries.

O. baqrii: Cameroon (Carbonell & Coomans, 1986).

O. caudatus: India (Ahmad & Jairajpuri, 1986).

O. cavalcantii: Georgia (Eliava *et al.,* 1975), Azerbaijan (Eliava *et al.,* 1975), India (Siddiqi, 1965; Baqri & Khera, 1977; Ahmad & Jairajpuri, 1982; Baqri, 1991; Baniyamuddin & Ahmad, 2006), Malaysia (Sauer, 1981), Indonesia (Sauer, 1981), Vietnam (present paper), South Korea (Choi, 1999), Japan (Khan & Ara-

ki, 2002), Cameroon (Carbonell & Coomans, 1986), Nigeria (Loof & Coomans, 1970), Ivory Coast (Carbonell & Coomans, 1986), Kenya (Carbonell & Coomans, 1986), Zaire (Carbonell & Coomans, 1986), South Africa (Carbonell & Coomans, 1986), United States: South Carolina (Carbonell & Coomans, 1986); Venezuela (Loof, 1964; Loof & Coomans, 1970), Brazil (Lordello, 1955; Monteiro, 1970; Carbonell & Coomans, 1986), Australia (Sauer, 1981).

O. chamoliensis: India (Ahmad & Jairajpuri, 1982).

O. filicaudatus: Ivory Coast (Carbonell & Coomans, 1986).

O. maqsoodi: India (Ahmad & Jairajpuri, 1982), North Korea (Andrássy, 1987), Seychelles (present paper).

O. mitis: Guadeloupe, Ecuador (present paper).

O. papuanus: Papua New Guinea (present paper).

O. paracavalcantii: Uganda (Carbonell & Coomans, 1986).

O. sylphoides: Netherlands (Bongers, 1988; De Goede & Bongers, 1998; Loof, 1999), Germany (Loof, 1999), Hungary (Andrássy, 1991), Romania (Popovici, 1990, 1998), Spain (Abolafia & Peña-Santiago, 1996; Liébanas *et al.,* 2002; Peña-Santiago *et al.,* 2003), France (Carbonell & Coomans, 1986), Italy (Carbonell & Coomans, 1986; Manfredi *et al.,* 1995), Georgia (Eliava *et al.,* 1975), Iraq (Carbonell & Coomans, 1986), Iran (Fadaei-Tehrani & Coomans, 2005), Mauritius (Williams, 1959, 1964).

Opisthodorylaimus cavalcantii is the most widespread species of the genus, it has been observed in 18 countries so far. *Opisthodorylaimus sylphoides* was recorded from 11, *O. maqsoodi* from 3 and *O. mitis* from 2 countries; all the other species have been found in one country each.

KEY TO SPECIES OF OPISTHODORYLAIMUS

Then ten valid species of *Opisthodorylaimus* can immediately be divided into two equal groups with five species each: species with transverse vulva *(baqrii, cavalcantii, maqsoodi, mitis* and *paracavalcantii)* and those with longitudinal vulva *(caudatus, chamoliensis, filicaudatus, papuanus* and *sylphoides)*. The members of the first group can be subdivided: species with well-sclerotized vulva *(baqrii, maqsoodi* and *mitis)* and those with unsclerotized vulva *(cavalcantii* and *paracavalcantii)*. Besides, the other morphological features (presence or absence of an anterior rudimentary gonad or uterine sac, length of tail, body size, etc.) also well characterize the species, so that their identification does not make difficulties.

1 Vulva transverse 2
– Vulva longitudinal 6

2 Vulval lips distinctly sclerotized 3
– Vulval lips not sclerotized 5

3 Anterior uterine sac present, 2–3 body widths long; tail shorter, 6–8 anal body diameters. L = 1.2–1.4 mm; a = 38–47; b = 4.0–5.3; c = 8–11; c' = 6–8; V = 42–44 % ..... …….. *baqrii* Carbonell & Coomans
– Anterior uterine sac practically absent; tail longer, 10–16 anal body diameters 4

4 Stylet 15–17 µm; tail 14–16 anal body widths long. L = 1.2–1.3; a = 34–36; b = 4.3–4.5; c = 4.2–4.6; c' = 14–16; V = 39–41 % ..... ……..…… *mitis* sp. n.
– Stylet 19–21 µm; tail 9–12 anal body widths long. L = 1.3–1.5 mm; a = 28–35; b = 4.0–4.5; c = 4–7; c' = 9–11; V = 40–42 % .... *maqsoodi* Ahmad & Jaiarjpuri

5 Female genital organ pseudodidelphic with reduced anterior ovary; body longer. L = 1.3–1.4; a = 34–39; b = 4.1–4.6; c = 16–23; c' = 2.5–3.0; V = 48–52 % ..... ……..*paracavalcantii* Carbonell & Coomans
– Female genital organ mono-prodelphic, an anterior reduced ovary only exceptionally present; body mostly shorter. L = 0.9–1.4 mm; a = 24–38; b = 3.5–4.8; c = 10–12; c' = 2.0–5.2; V = 40–47 % ..... *cavalcantii* (Lordello)

6 Large and slender species, 1.7–2.4 mm; anterior uterine sac present, short but distinct. L = 1.7–2.4 mm; a = 42–64; b = 5.4–6.3; c = 3.5–6.0; c' = 14–25; V = 35–38 % ..... ……. *sylphoides* (Williams)
– Smaller and less slender species, 0.7–1.6 mm; anterior uterine sac completely or practically absent 7

7 Tail filiform, 20–30 times the anal body width long; body shorter than 1 mm. L = 0.7–0.8 mm; a = 30–37; b = 4.1–5.1; c = 2.3–2.6; c' = 20–30; V = 33–38 % ..... …….*filicaudatus* Carbonell & Coomans
– Tail shorter, 4–12 times the anal body width long; body longer, 1.2–1.6 mm …….8

8 Tail short, 4–5 anal body diameters, dorsally bent. L = 1.5–1.6 mm; a = 31–44; b = 4.0–4.6; c = 11–15; c' = 4–5; V = 44–48 % ……. ……. *caudatus* Ahmad & Jairajpuri
– Tail longer, 8–12 anal body diameters, straight 9

9 Cuticle finely but distinctly annulated; tail 250 µm long. L = 1.2 mm; a = 30–34; b = 4.3–4.6; c = 5; c' = 11–12; V = 36–40 % …….. . ..... *chamoliensis* Ahmad & Jairajpuri
– Cuticle smooth; tail 180–220 µm long. L = 1.3–1.5 mm; a = 28–36; b = 4.1–4.6; c = 5.6–8.1; c' = 7.5–9.2; V = 40–46 % .... *papuanus* sp. n.

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Megascolex (*Promegascolex*) *mekongianus* Cognetti, 1922 - its extent, ecology and allocation to *Amynthas* (Clitellata/Oligochaeta: Megascolecidae)

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Abstract. Cognetti (1922) miscounted segments of his *Megascolex* (*Promegascolex*) *mekongianus* and, believing the gizzard in 7 was intermediate between *Megascolex*, with gizzard in 5, and *Pheretima*, with gizzard after 7/8, he proposed the subgenus *Promegascolex*. Next, Gates (1934: 260) redescribed the immature, poorly preserved and abnormal type as *Pheretima mekongiana*. However, Sims & Easton (1972: 223) listed it as *species incertae sedis*, excluded it from their *Pheretima*-group of genera and postulated its gizzard was "clearly in segment 5". The latter authors also mistook the River Mekong, "Annam" type locality as "Vietnam". Recently collected material from the River Mekong in Laos is herein described that complies with the corrected type description allowing new designation as *Amynthas mekongianus* comb. nov**.** Moreover, *A. fluvialis* (Gates, 1939) from the Mekong in Thailand is found to be a synonym, although *Metaphire fluvialoides* (Huynh Thi Kim Hoi, 1998) comb. nov. from Central Highlands of Vietnam remains separate. Reallocation of the type species adds *Promegascolex* as syn. nov. to *Amynthas* and its generic diagnosis is amended from Sims & Easton (1972: 211) to permit: Clitellum annular, 14-16, rarely beginning on 13, sometimes extending into 17 (e.g. in *A. mekongianus*). The slender length and annulations of current specimens: measuring up to 2,900 mm with more than 500 segments, are near the maxima recorded for any earthworm; comparisons are given with "giants" in various families from other regions of the World. Brief comments are made on diversity and ecology of the River Mekong locality.

INTRODUCTION

Sims and Easton (1972) provided a numerical revision of all 746 nominal species names of pheretimoids (*Pheretima* auct.) then known, they did not discriminate between valid taxa and synonyms. Subsequently taxa have been greatly increased and updated checklists provided by Blakemore (2004, 2005, 2006) now catalogue approximately 920 valid names, with several *nomina nuda* and synonyms included as appropriate. Under a heading "*Species incertae sedis*", Sims & Easton (1972: 223) had detailed *Megascolex* (*Promegascolex*) *mekongianus* and suggested elevating the subgenus to generic status. As part of continuing revisions of this taxonomic group, this earthworm species is revisited.

The original Italian description in full by Cognetti (1922) is:

"***Megascolex (Promegascolex) mekongianus*** *n. subgen. n. sp.*

Un esemplare ancora sprovvisto di clitello e mediocremente conservato.

Caratteri esterni. - *Lunghezza 1 metro, diametro massimo (al 5o segmento) mm. 8, minimo (alla coda) mm. 4. Segmenti 370. Colore grigio, più scuro sul dorso. Prostomio mal distinto. Corona setigera di ciascun segmento un po' sporgente, in special modo nei tratti medio e posteriore del corpo; nel tratto anteriore i segmenti sonso piú allungati. Setole in corona continua, tranne al 2o segmento ove si contano soltanto 46 setole a cagione d'una larga interruzione*

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ventrale (fig. 4). Nei segmenti che seguono, fino al 25o, se ne contano circa 100 (93o al 17o). La forma delle setole è quasi rettilinea, il nodulo è spostato verso l'apice (fig. 5); lunghezza µ 400 circa, spessore µ 20. Primo poro dorsale all'intersegmento 10/11. Clitello non ancora sviluppato.

Pori maschili al 17o segmento, su tubercoli (peni) abbracciati ognuno da una intumescenze più estesa lateralmente che medialmente. Fra le due intumescenze si contano 10 setole (fig. 6). L'intervallo fra i pori maschili equivale a circa 1/6 del perimetro segmentale. Apertura delle spermateche quattro paia, in forma di brevi fessure trasverse, a labbra un po' tumide, distribuite negl' intersegmenti 4/5 5/6 6/7 7/8, allineate con i pori maschili. Mancano papillle genitali e setole copulatrici.

Caratteri interni. - *Disseptimenti 3/4 a 7/8 tutti molto ispessite e imbutiformi, 8/9 assente, 9/10 e seguenti sottili. Congolo nervoso nel 2o segmento. Ventriglio muscoloso al 7o, poco robusto, ma con spesso rivestimento cuticolare interno. L'intesinto p.d. comincia al 14o segemento ed è provivisto di un paio di ciechi digitiformi semplici, estesi nei segmenti 26-21o. Ghiandole calcifere assenti. Nefridi diffusi. Nella regione media e posterior del corpo sono evidentissimi gli organi fagocitari segmentali ai lati vaso dorsale; gli organi corrispondenti nei segmenti 4-7o sono voluminosi, espansi contro il dissepimento anteriore e infestati da gran numero di cisti di Gregarine. Un paio di capsule seminali al 10o sporgente in parte nell' 11o, un secono paio di capsule nell'11o sporgenti in parte nel 12o; le due capsule di ciascun paio non comunicano fra di loro nè c'e comunicazione fra le capsule del primo e quelle del secundon paio (1).*

Ciascuna capsula si continua all'indietro con un grosso cacco seminale a superfice leggermente mamillonare, compresso contro l'esofago; il primo paio di sacchi è contentuto nell'11o segmento, il secondo paio, più voluminoso, è contentuto nel 12` (fig. 8). Le prostate, contentute nel 17o segmento, hanno una porzione ghiandolare subreniforme a margine inciso; e un canale muscoloso a parete robusta, piegato ad ansa. I vasi deferenti s'insinuano nel punto di unione del canale con la prozione ghiandolare (fig. 7). Le spermateche sono in numero di quattro paia, distribuite nei segmenti 5o (due paia), 6o, e 7o; il volume decresce leggermente dal primo all'ultimo paio. In ogni spermateca si distingue una porzione prossimale sacciforme ampiamente comunicante con un canale piu breve della prozione suddetta; al poro esterno confluisce assieme al canale un diverticolo foggiato a clava, lungo quasi come l'intera spermateca (fig. 9). Habitat: Ban Leum sul Fiume Mekong, Annam; raccoglitore il Sig. Dott. MALCOLM SMITH.

L'esemplare sopra descrito ha indubbiamente strettissime affinità col gen. Megascolex, ma la posizione eccezionale dei pori maschili al 17o segmento non permette di annoverarlo tra le specie di quel genere finora note. L'esame di un solo esemplare della species in discorso può destare il sospetto ch'esso sia anomalo nella disposizione dei pori maschili, tuttavia non credo sia da escludere a priori la presenza, in senso alla subfam. Megascolecinae, di forme dotate normalmente di pori maschili al 17o segmento: nella vicina subfam. Acanthodrilnae (sic) i pori maschili possono essere appunto al 18o segmento o al 17o. Pertanto ho considerato la nuova species quale tipo do un nuovo sottogenere: ulteriori studi di materiale proveniente dall' Annam potranno dimonstrare l'opportunità o meno di conservare il sottogenere Promegascolex, o quanto menno la necessità di una lieve modificazione nella diagnosi della subfam. Megascolecinae relativa alla posizione dei pori maschili."

An approximate translation of Cognetti (1922) is:

"***Megascolex (Promegascolex) mekongianus*** n. subgen. n. sp.

A specimen unprovided with a clitellum and with mediocre conservation.

External characters. - Length 1 meter, the maximum diameter (at 5th segment) 8 mm, minimum (towards the tail) 4 mm. Segments: 370. Colour gray, darker on the back. Prostomium poorly distinguished. Setal ring of each segment protrudes in a special way especially in the mid and hind body; in the anterior they are slightly larger; they are in a continuous circle except in the 2nd segment where only 46 setae are recognized with a wide ventral interruption (fig. 4). In the segments that follow, until the 25th, they number approximately 100 (e.g. 93 on the 17th segment). In shape the setae are nearly rectilinear, the nodule is moved towards the apex (fig. 5); length approximately 400µ, thickness 20µ. First dorsal pore in 10/11. Clitellum not developed. Male pores on 17th segment, on tubercules (penises) extending more laterally than medially. Between the two intumescences are 10 setae (fig. 6). The interval between the male pores is equivalent to approximately 1/6 of the perimeter. Spermathecal openings are four pairs, in short traverse fissures, with slightly protruding lips in 4/5-7/8 aligned with the male pores. Genital papillae and copulatory setae are lacking.

Internal characters. - Septa 3/4 to 7/8 greatly thickened and funnel-shaped, 8/9 absent, 9/10 and following thin. Cerebral ganglion encircles segment 2. Gizzard muscular in the 7th segment, moderately sturdy, but with covering of inner cuticles. Intestine begins in 14th segment and is provided with a pair of simple digitiform caecae extending from 26-21. Calciferous glands absent.

Nephridia diffuse. Obvious in the mid and posterior regions of the body are segmental phagocytic organs on each side of the dorsal vessel; the corresponding organs in segments 4-7 are more voluminous, expanded against the anterior septum and infested with a great number of Gregarine cysts. A pair of seminal vesicles in the 10th and partly in the 11th segments; a second pair in 11 and partly in 12, each pair independent (fig. 8). The prostates are contained in the 17th segment with one glandular portion (racemose) and a muscular duct folded to exit joined by the vasa deferentia (fig. 7). The spermathecae number four, distributed in segments 5 (two pairs), 6, and 7; their volume decreases gradually from the first to ultimate pair. Each spermatheca with a sacciform proximal portion wide and communicating via a short channel to the external pore where it meets the duct of a clavate diverticulum (fig. 9). Habitat: Ban Leum on the River Mekong, Annam; collector Dr. MALCOLM SMITH."

MATERIALS AND METHODS

The following redescription allowing augmentation of the original description is based on new material with collection details given below and follows the procedures, format and system of classification presented in Blakemore (2000; 2002; 2005), complying with ICZN (1999). Voucher specimens are held in the Soil Ecology Research Group (SERG) at Yokohama National University.

TAXONOMIC RESULTS

Megascolecidae Rosa, 1891 sensu Blakemore (2000a, 2000b).

Amynthas mekongianus (Cognetti, 1922). **comb. nov.**

Megascolex (*Promegascolex*) *mekongianus* Cognetti de Martiis, 1922: 3 (figs. 4-8); Sims & Easton, 1972: 223 [et *mekongiana* (laps.): Sims & Easton, 1972: 244 "***Species incertae sedis***"]; Reynolds & Cook, 1976: 135. Type locality: Ban Leum on the River Mekong; collected by Dr. Malcolm Smith. Holotype Natural History Museum, London BMNH: 1921:7:30:4. Poorly preserved, aclitellate subadult with "the internal organs of the anterior end rather messed about as a result of the previous dissection" (Gates, 1934), possibly also heavily infected with gregarines; labelled "*Megascolex* (*Promegascolex*) *mekongianus*. 1921.7.30.4 (Type). R. Mekong (Ban Leum) Annam. Pres. Dr. Malcolm Smith." Specimen re-inspected by Gates (1934: 260) [and Sims & Easton (1972)?], not re-inspected here due to its stated poor condition.

Pheretima mekongiana : Gates, 1934: 260.

Pheretima fluvialis Gates, 1939: 89; Gates, 1972: 186, 215 (where he notes its similarity to *A. juliani*); Thai & Samphon, 1989: 62 Tabl. 2 (paper in Vietnamese). **Syn. nov.** [Type locality Chiengsen Kao, Thailand, in mud on bank of the Mekong River (ca. 20°15" N, 99°85" E). Types in U.S. National Museum, (#20564): described as three batches of 5 juveniles, one juvenile, and 3 partially clitellate plus 4 clitellate specimens (total 13) all collected from mud on bank of Mekhong (sic) River, Chiengsen Kao [also spelt "Chiang Saen", "Chieng Saen Kao", or "Chieng-sen-kao'], collected 15-16th January, 1937 by H. G. Deignan. [Ornithologist Herbert Girton Deignan (1906-1968) was an authority on the birds of Thailand (Deignan, 1945) who on the same trip also collected fish that are deposited in the Smithsonian Institution. Ecological information of the region can be found: http://www.arcbc.org.ph/arcbcweb/wetlands_/thailand/tha_chisaebas.htm (December, 2004)]. [Non *Pheretima fluvialoides* Huynh Thi Kim (H.T.K.) Hoi, 1998: 10, figs 1-5. From Dak Lak, Central Highlands of Vietnam].

Amynthas fluvialis : Sims & Easton, 1972: 235, 242 [*A. diffringens* (= *A. corticis*) species-group]; Reynolds & Cook 1976: 102.

Locality Note: The locality was given as "Ban Leum on Mekong River, Annam" by Cognetti and, because Annam = Central Vietnam, as "from Vietnam" by Sims & Easton (1972: 223). In the current revision the actual Mekong River type-locality is uncertain but, as argued in the Discussion below, is probably in Thailand or Laos, and not in Vietnam.

*Taxonomic Note***:** The following description is based upon Cognetti's original (in italics to which a segmental count of one must be added), on Gates' (1934) reinspection of the type, Gates' (1939) *Pheretima fluvialis*, the account in Sims & Easton (1972) and, especially, from recently collected material that is in better condition than the type.

Diagnosis: *Amynthas* with four pairs of spermathecal pores ca. 0.2 body circumference apart in furrows 5/6/7/8/9. Male pores paired superficial ca. 0.2 circumference apart on flat porophores on 18. Genital markings absent. Clitellum impinging on segment 17. Oesophageal gizzard weak in 8.

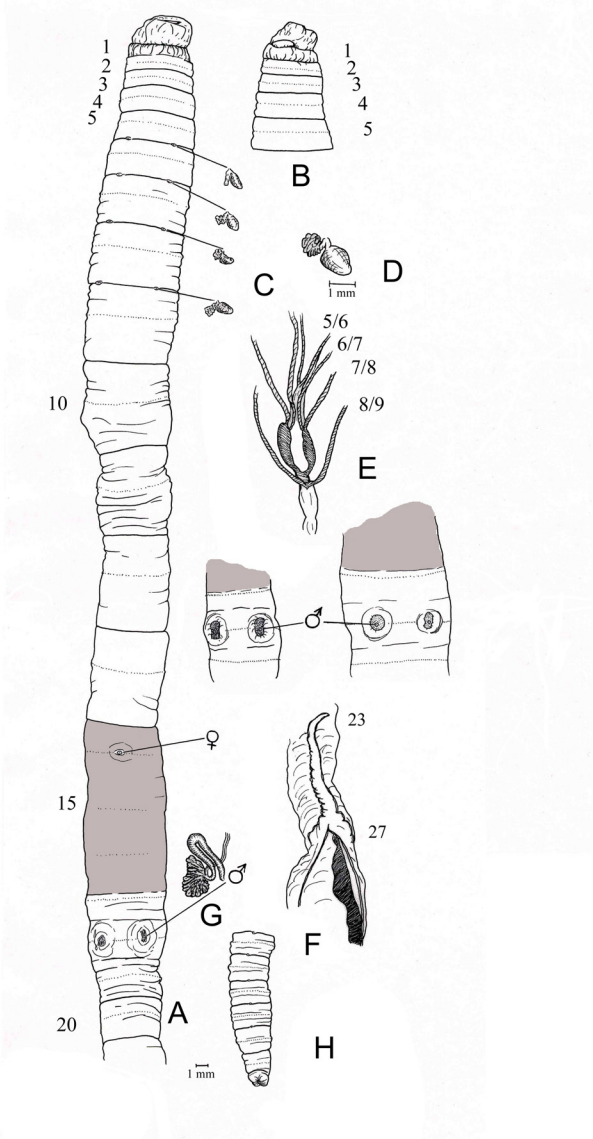


Figure 1. *Amynthas mekongianus* (Cognetti, 1922). A = anterior ventrum of medium sized Laos specimen, as sketched, dissected and described by the senior author; figure also shows B = dorsal view of prostomium, C = spermathecae *in situ* (with D = an enlargement of that from 9ths), E = a section of septa and gizzard in segment 8, F = intestinal caeca with incision to reveal dorsal typhlosole, G = prostate gland in 18 ducting to male pore with ental vasa deferentia, and H = dorsal view of ultimate posterior segments. Male pores of smallest and largest specimens from the current sample are shown for comparison. Clitella are shaded and all scale bars are 1mm.

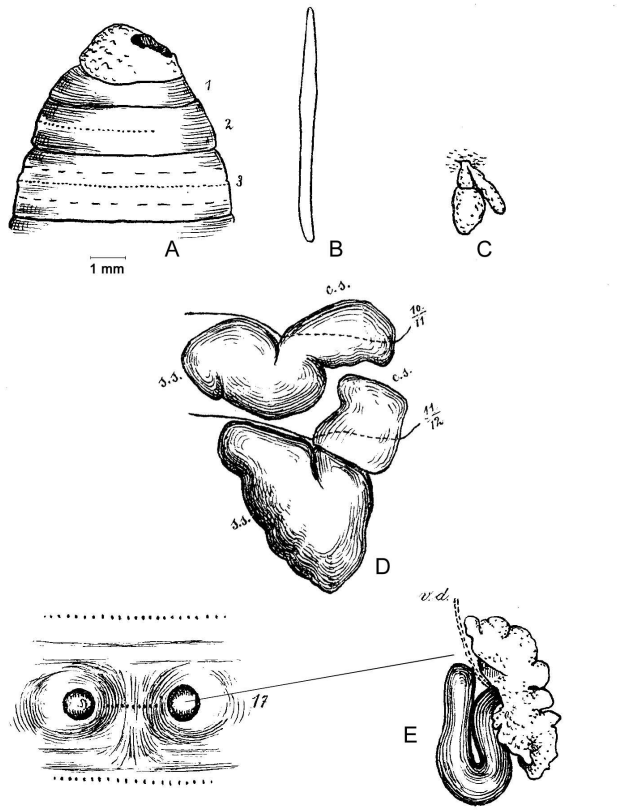


Figure 2. Original figures of *Megascolex (Promegascolex) mekongianus* after Cognetti (1922, figs 5-9) showing: A - deformed anterior (segments miscounted), B - one seta (approx. 400µ X 20µ), C - a spermatheca, D - seminal vesicles in 11 and 12, E - prostates in "*17*" (=18ths) ducting to male field in "*17*" (=18). Scales obviously vary, but an approximate scale for the anterior is added.

Intestinal caeca simple originating in 27. Length up to 2,900 mm. Septum 8/9 present and muscular. Spermathecal diverticula zig-zaged, each enveloped in thick sheath.

Distribution and habitats: Mud or sand of banks of the Mekong River.

Current specimens inspected: Six matures and one sub-adult, all clitellate, from banks of the Mekong River, 16 km upstream of Vientiane, Laos; collected and preserved in formalin collected in two batches on 19th December 1998, and 5th March, 2001 by Mr. Koiwaya and Tomoko Uchida of YNU. Details of specimens are: the smallest 690

Figures 3, 4. Photographs by Tomoko Uchida of colleagues re-collecting Mekong elongate specimens 16 km upstream from Vientiane, Laos on 5/V/2001 - showing typical habitats (and castings on the mud?).

mm with 305 segments (dissected and sketched), the largest 1,920 mm with 477 segments (male field sketched), a mature length 1,780 mm with 508 segments (this specimen fully dissected and figured here, it has segments 243, 300 and 306 fused and merged with adjacent segments), another mature was 1,430 mm long with 361 segments.

Body: Elongate and cylindrical. Lengths; 1,000 mm (Cognetti); 365-555 mm (Gates 1939); 690-1,920 mm (current preserved specimens), to 2,900 mm when collected from the field (Koiwaya, 1999). Widths: 4-8 mm (Cognetti); 6-8 mm (Gates 1939); 5.5-10.0 mm (current).

Segments: 370 (Cognetti); not recorded (Gates); 361-508 or as many as 580 (current); much secondary annulation and setal rings most prominent in hind segments.

Colour: Gray, darker on the back (Cognetti); dark greyish or brownish grey (Gates 1939); current specimens grey with darker brown clitellum, but alcohol in their jar has brownish tinge suggesting there is some colour leaching.

Behaviour: Limicolous (mud dwelling). No iridescence was noted in sperm funnels nor spermathecal diverticula of clitellate specimens (Gates 1939 and current), thus the species possibly has seasonal reproduction (with breeding season including January-March) or it may be incipiently parthenogenetic.

Cocoons: Information not available.

Prostomium: Poorly distinguished (Cognetti), perhaps because anterior segments were damaged or deleted in his specimen; not noted by Gates; small pro-epilobous (current).

First dorsal pore: 10/11 (Cognetti); 12/13 (Gates and current).

Setae: "*Setal ring of each segment protrudes in a special way especially in the mid and hind body; in the anterior they are slightly larger; they are in a continuous circle except in the 2nd segment where only 46 setae are recognized with a wide ventral interruption (fig. 4). In the segments that follow, until the 25th, they number approximately 100 (e.g. 93 on the 17th segment). In shape the setae are nearly rectilinear, the nodule is moved towards the apex (fig. 5); length approximately 400μ, thickness 20μ*" (Cognetti); mostly 99-118 per segment (Gates 1939); numerous, ca. 100 small black setae in continuous ring in each segment except peristomium and periproct (current).

Nephropores: Not found.

Clitellum: Not developed (Cognetti); annular in 14-16 and just into 17 with dorsal pores obscured (Gates, 1939); from 14 almost to setal arc of 17, some ventral setae visible (current).

Male pores: "*Male pores on 17th segment, on tubercules (penises) extending more laterally than medially. Between the two intumescences are 10 setae (fig. 6). The interval between the male pores is equivalent to approximately 1/6 of the perimeter*" (Cognetti); or as "short transverse slits on 17 each male pore towards lateral margin of a fairly large disc that is apparently retractile into the parietes. Just lateral to each male-pore disc there is a rather crescentric but deeply bowed groove, the concave side of the groove facing midventrally" (Gates, 1934). Similar in current specimens but superficial on 18 about 0.2 circumference apart with 10 or so setae between pores. Some variation in male pores allows either circular or hour-glass shaped low, flat porophores with actual male pores at centres; sometimes with a lateral bowed lines (seen on both sides in one specimens or on either rhs or lhs in two other specimens). Similarly, Gates (1939: 93) describes the pores as "tiny transverse slits on centres of disc-shaped porophores (that can be slightly retracted and covered by lid-like lateral flaps?)."

Female pores: Not mentioned by Cognetti; single on 13 (Gates 1934); not mentioned by Gates (1939); but as usual on 14 in current specimens.

Spermathecal pores: *Four pairs in 4/5/6/7/8 in line with male pores* (Cognetti and Gates, 1934); in 5/6/7/8/9 ca. 0.2 circumference apart (Gates, 1939 and current).

Genital markings: None (all descriptions).

Septa: *3/4 to 7/8 greatly thickened and funnel-shaped, 8/9 absent, 9/10 and following thin* (Cognetti); 4/5-8/9 thickened and extending posteriorly, 9/10 aborted, 10/11 thin, 11/12 is thin with web-like fibres on either side, following septa are all thin (Gates 1939 and current).

Dorsal blood vessel: Single (Gates 1939 and current).

Vascularization and hearts: Not mentioned by Cognetti; in current specimens hearts are in 10lhs only, and large, paired in 11-13 with complex capillary systems, plus in 5,6-8 are blood-glands with lateral vessels. Although these large blood glands have many tubercules, it is not possible to say whether they are parasitic gregarine cysts as per Cognetti who has them in 4-7, or acinous masses (i.e., with several small sacs) as per Gates (1939) who has them in 4-9 and gives much detail on other blood vessels: e.g. he notes that the heart in 9 is single and may be on either the left or right side and in 10 the hearts are replaced by looping vessels and that the last pair of hearts is in 13.

Gizzard: "*muscular in the 7th segment, moderately sturdy, but with covering of inner cuticles*" (Cognetti); weakly muscular to vestigial in 8 between septa 7/8 and 8/9 that extend backwards (Gates 1939 and current).

Calciferous glands: Oesophageal pouches absent.

Intestine origin (caeca, typhlosole): "*In 14 with simple paired, digitiform caeca in 26-21*" (Cognetti); in 15 with elongate paired caeca in 27-23 simple but with slightly incised posterior edge in older specimens; a dark (vascularized) deeply lamellar typhlosole develops from 25, 26 (Gates 1939 and current) plus Gates says the typhlosole ends about segment 150.

Nephridia: "*Diffuse*" (Cognetti); meroic, tubules numerous especially obvious on anterior septa and blood vessels, e.g. in segment 5; absent from spermathecal ducts (current).

Testis/sperm funnels: Testis not mentioned but "*A pair of seminal vesicles in the 10th and partly in the 11th segments; a second pair in 11 and partly in 12, each pair independent*" (Cognetti); in current specimens testis and funnels in combined sacs paired in both 10 and 11, with seminal vesicles in 11 and, a larger pair in 12. Gates (1939) describes a similar holandric arrangement in his specimens. Vasa deferentia (sperm ducts) can be traced back to the junctions of the prostatic ducts and glands.

Ovaries: Not discovered by Cognetti nor reported by Gates; small and difficult to see in current specimens paired in 13 with funnels passing to 14, as would be expected.

Prostates: "c*ontained in the 17th segment with one glandular portion (racemose) and a muscular duct folded to exit and joined by the vasa deferentia*" (Cognetti); ditto but in segment 18 in

current specimens with U-shaped duct as also described by Gates (1939). Copulatory pouches absent. *Spermathecae*: "*distributed in segments 5 (two pairs), 6, and 7; their volume decreases gradually from the first to ultimate pair. Each spermatheca with a sacciform proximal portion wide and communicating via a short channel to the external pore where it meets the duct of a clavate diverticulum*" (Cognetti); in current specimens in 6 (2 pairs), and paired in 7-9, diverticula flattened with irregular outline. Gates (1939) describes the diverticula as shortly zigzag looped, surrounded by a layer of tissue, which conceals the looping. It was not possible to tease out the diverticula in current specimens although the looping was visible through the membranous sacs. Spermathecal ducts free of nephridia.

Gut contents: Fine silty soil in current specimens; Gates (1939) describes gut as filled with sand in one of his specimens.

Ecology: Description and photographs of specimens collected from Mekong by Mr Satoshi Koiwaya (published in No. 9 Earthworm Newsletter, 1999 report; Japan January, 1999 edited by Dr S. Matsumoto in Japanese), in summary, says: "During research in Laos, stories of an earthworm greater than 1 m length in the banks of the River Mekong were told by the father of a friend from Vientiane. On 19th December 1998 there was the chance to collect worms. They produce copious surface casts and the worms were collected from the mud but were easier to obtain from below the water at depth of 40 cms. The worms easily exceeded 2 m when extended or held between 3 people. The maximum recorded was 2.9 m. Preserved specimens were donated to Dr Tomoko Uchida at Yokohama National University for study." These were the specimens newly described here by the senior author.

DISCUSSION

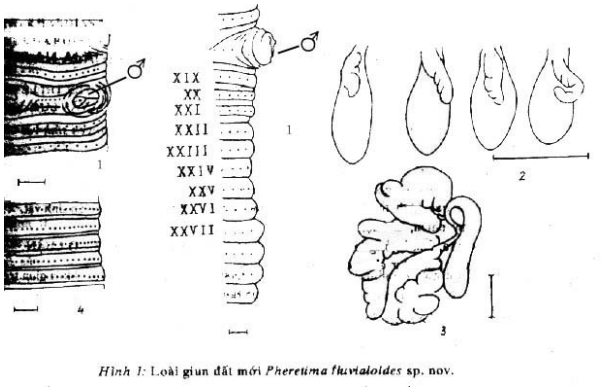
Systematics

It now seems obvious that a count of one needs to be added to Cognetti's description and, when this is done, *mekongianus* is seen to belong to the genus *Amynthas* where in normal specimens female pores and male pores are reasonably expected to be in 14 and 18, respectively, the gizzard behind 7/8, and intestinal caeca near 27. After inspection of the poorly preserved, damaged (and immature) type, Gates (1934: 260) thought that Cogenetti's description was of an abnormal specimen of a "*Pheretima*". However, Sims & Easton (1972: 223) conjectured that Cognetti miscounted the segments externally where segments "2 and 3 having either fused or one of them suppressed", yet for some reason they postulated the gizzard is "clearly in segment 5" so they provisionally retained it as *species incertae sedis* in Cognetti's subgenus *Promegascolex* of genus *Megascolex*.

From inspection of new material here, it now seems most likely that Cognetti's specimen was abnormal or mutilated and thus placement of his species, as with *A. fluvialis*, in the prior genus *Amynthas* as defined by Sims & Easton (1972) is warranted. From this new material and the descriptions in Cognetti's original and in both Gates' accounts, the male pores are classed as 'superficial' thereby qualifying for inclusion in *Amynthas*, albeit Gates (1934) said for *mekongianus* that the type has "a fairly large disc that is *apparently* retractile" and for his *fluvialis* he notes "*Presumably* the porophore can be slightly depressed" [Italics added]. In the current specimens some variability is permissible in the arrangement of the male pores that are, nevertheless, clearly superficial (cf. *Metaphire fluvialoides*). Gates' (1939) *P. fluvialis* differs inconsequentially from the corrected account of Cognetti's species so is placed in synonymy while also offering slight augmentation of the original description due to the more usual nature of his material compared to Cognetti's. Gates (1939) thought his *fluvialis* similar to *Amynthas juliani* (Perrier, 1875) from Ho Chi Minh City (Saigon), Vietnam that, however, has large genital markings in line with male pores in 17, 19-20 or 22. Despite his earlier redescription, the possibility that his new species was similar to *mekongianus* appears to have escaped Gates' attention.

Metaphire fluvialoides (Hoi, 1998) (Fig. 5) from Dak Lak province in the Central Highlands of Vietnam, although sharing general characteris-

tics (e.g. four pairs of spermathecae in 5/6-8/9; lack of genital markings, simple intestinal caeca), is maintained separately as it differs in size (125-180 mm by 4-6 mm), has only 130 segments, 34-89 setae per segment, mostly clavate spermathecal diverticula, and is distinct in having ventral region of 19-27 thick and pigmented (a preservation artefact?). Because the original figures (Fig. 5) show the male pores to be slightly everted, it is assumed that in the usual state they are somewhat pouched, and therefore possibly qualify it for *Metaphire* inclusion.



Hình 1: Loài giun đất mới *Pheretima fluvialoides* sp. nov.

Figure 5. *Metaphire fluvialoides* (Hoi, 1998: fig. 1) original figures showing 1 = male pores from ventral and lateral views, 2 = spermathecae, 3 = prostate, 4 = thick and pigmented ventral region of 19-27 (not clearly marked). Scale bars all different but = 1 mm.

Comparisons of Body Size with "Giant Earthworms" from around the World

The slender length of current specimens, measuring up to 2,900 mm with more than 500 segments are at the maxima recorded for any earthworm and, because of this, perhaps few complete specimens of *A. mekongianus* had hitherto been obtained hence earlier descriptions may have been based on truncated specimens, or those yet to obtain their full extent and segmental totals. Biometric data suggest a correlation between body length and number of segments, implying that segments are added with maturity.

Accounts of large earthworm species are provided by Stephenson (1930), Blakemore (2002: 13), and by Tsai et al. (2004). Family Moniligastridae: *Drawida nilamburensis* (Bourne, 1894) and *Drawida grandis* (Bourne, 1887) from India which may be as much as 760 and 1,080 mm, respectively, the latter species burrowing to depths of 3 m (Julka 1988: 33). Sumartran *Hastirogaster houteni* (Horst, 1897), previously in genus *Eupolygaster*, has size range of 1100-1500 mm (Gates 1972: 243).

The South African family Microchaetidae has a group of sometimes 'gigantic' species all to about 1 m or more long (Plisko 1999) including *Microchaetus microchaetus* (Rapp, 1849) which has a length of 1,800 mm by 16-18 mm wide with 792 segments. The type species of Acanthodrilidae *sensu* Blakemore (2000a, 2000b) is *Acanthodrilus ungulatus* Perrier, 1872 from New Caledonia that reaches sizes up to 700 mm by 10mm with more than 200 segments, but most other members of the family are small sized.

In family Glossoscolecidae: South American 'giants' are: *Thamnodrilus gigas* (Perrier, 1872: 50), 1,160 mm; *Rhinodrilus horsti* (Beddard, 1892: 117), 860 mm; *Glossoscolex paucisetis* Michaelsen, 1900: 445, 673 mm; and *Glossoscolex giganteus* (Leuckart, 1835/6: 764) [syns. *G. maximus* Leuckart, 1841: 104, *Titanus brasiliensis* Perrier, 1872: 57, *T. gigas* Perrier, 1881: 218] that measured 1,270 mm by 15 mm or more width, and 550 segments that was said by Leuckart to possibly extend up to 8 or 9 ft (ca. 2,743 mm) in life (Beddard 1895: 644). Stephenson (1930) stated that *Rhinodrilus fafner* Michaelsen, 1917, which measures when extended 2,100 mm in length and 24 mm in diameter, rates with *Megascolides australis* as probably one of the largest of all earthworms. *Martiodrilus* (*Cordilleroscolex*) *beddardi* (Cognetti, 1904), *M.* (*C.*) *crassus* (Rosa, 1895), *M.* (*C.*) *iserni* (Rosa, 1895), *M.* (*C.*) *columbianus* (Michaelsen, 1900), and *M.* (C.) *olivaceous* and *M.* (?) *panamensis* both by James (1990) are all about 400-800 mm by 16-25 mm. Other 'giants' are the recently described Ecuadorian *M.* (*C.*) *ischuros* Zicsi, 1990: 370 that exceeds 1,000 mm by 40-50 mm in life [cf. *M. crassus* (Rosa, 1895: 151) that also reaches these dimensions - see Zicsi & Csuzdi (1997)]; and the Amazonian *Andiorrhinus* (*Andiorrhinus*) *kuru* Moreno

and Paoletti, 2004 with a length of 500 mm (living specimens measure up to 1,100–1,300 mm) and diameter 20-30 mm, with 342 segments and mass 122.5 g for the holotype. This latter species is used as a local food resource (Moreno & Paoletti 2004) as are other species documented by the same authors.

In the family Megascolecidae sensu Blakemore (2000a, 2000b) the Australian *Megascolides australis* McCoy, 1878 from southern Victoria as originally recorded with a size of 1,230 mm, or a little over 4ft, but specimens attaining lengths of about 7ft 2in (2,184 mm) have been measured that each weighed 400-450 g with 300-500 body segments (Spencer 1888). There are unconfirmed reports of specimens being "stretched" to 13ft (3,960 mm), however, the average size is about 1,000 mm long by 20 mm wide and average weight of 210 g (but highest just under 400 g) according to Dr Beverley Van Praagh of the Museum of Victoria who studies the biology and ecology of this worm (e.g. Van Praagh 1992). *Notoscolex grandis* Fletcher, 1886 from Burrawang, NSW measures 760-1,060 mm long by 11 mm wide; it was recently rediscovered near there by one of the current authors (Blakemore 2001), and Victorian *Notoscolex hulmei* (Spencer, 1892) is up to 1,200 mm long. Several other Australian natives in the genera *Digaster*, *Heteroporodrilus*, *Fletcherodrilus* and *Diporochaeta* have species in the range 600-1,500 mm (see Blakemore 1994; 1997; 2000a). The largest known species from Tasmania is *Vesiculodrilus tasmanianus* (Fletcher, 1887) as redescribed by Blakemore (2000b) at over 610 mm and while this is much shorter than sizes attained by *Megascolides australis*, these two species are of equivalent width. Specimens of *V. tasmanianus* dug during forest trail building operations were found at about 1-1.5 m depth, but some burrows descended to 5 m (Blakemore 2000b).

The lumbricine megascolecid *Tonoscolex birmanicus* Gates, 1926 from Pyin U Lwin or Pyin-Oo-Lwin (formerly Maymyo) in the northern Shan States of Myanmar (Burma) is over 600 mm long by 10-15 mm and up to 7ft or 10ft (=2,130-3,050 mm) long in some reports - this species builds large tower-like casts, similar to those described and figured by Darwin (1881: figs. 3, 4), that may be 25 cm tall and weigh about 4lb (1.8 kg) according to Gates (1972: 227). From Karala State, India, *Megascolex konkanensis longus* Stephenson, 1915 is 345-570 mm long by only 3-4 mm with ca. 400-550 segments. New Zealand's *Celeriella gigantea* (Benham, 1906) may measure 990 mm when preserved, but 1,300-1,400 mm when alive and extended, with a width of 11 mm and ca. 450 segments (Lee 1959: 344). North American *Driloleirus americanus* (Smith, 1897) from eastern Washington and *D. macelfreshi* (Smith, 1937) from Oregon each grow up to "3 feet" long, or roughly one meter. A recently described Taiwan species, *Metaphire taiwanensis* Tsai *et al*., 2003 was 637-860 mm long by 16-17 mm wide with 185-228 segments and weight of 101-121 g.

Other 'giant' pheretimoids, i.e., *Pheretima* auct. species, the group to which *A. mekongianus* belongs, are usually in the range 555-700 mm with less than 300 segments (Tsai *et al.* 2004: 883) with the previous maximum of just over 700 mm long by 24 mm wide with 184 segments for *Metaphire magna* (Chen, 1938) from Hainan. Similarly large are *Metaphire musica* (Horst, 1883) and *Metaphire longa* (Michaelsen, 1892) from Java and Sumatra that are 370-570 mm by 10-48 mm. *Metapheretima jocchana* (Cognetti, 1911) from New Guinea is up to 600 mm long, 10 mm wide with 600 segments and as many as 200 setae per segment and, despite being smaller, the sympatric *M. sentanensis* (Cognetti, 1911) also has 300 setae per segment (Easton 1979: 88, 114). Cosmopolitan *Polypheretima elongata* (Perrier, 1872) had a reported range of up to 360 mm long (Easton 1979: 52) but the largest specimen in a series of Queensland studies reached >450 mm in life with mass 8 g (Blakemore 1994; 2002).

Distribution Range

At the time of publication of Cognetti's paper, the historic region of central Vietnam called Annam had been integrated into the French "Union of

Indochina" since 1887 and Laos was included as a protectorate in 1893. The Truong Son ridge (Annamese Cordillera) separates north and central Annam from Laos and the Mekong on the west; the ridge then swings south-eastward and runs along the coast of southern Annam, which includes plateaux stretching to the borders of Cambodia and Cochin China (South Vietnam). Thus it is unlikely that the type locality is in the current People's Republic of Vietnam where the Mekong only occurs in the south, it is more likely that the site is in Laos PDR or Thailand, possibly near to Vientiane.

Type-locality was given as "Ban Leum on Mekong River, Annam" by Cognetti and, because Annam = Central Vietnam, as "from Vietnam" by Sims & Easton (1972: 223). Yet, while there is a similar sounding "Ban Leun" in northern Vietnam (DMS 21°49'60 N, 103°52'0 E), it is a great distance from the Mekong River and unlikely to be the source. In Laos, however, there are "Ban Leum" (19°34"24'N, 103°5"21'E) and "Ban Leu" (18°98"N, 103°5"E) in Xiang Khoang Province, famous as the "Plain of Jars" at the northern end of the Annamese Cordillera, also nearby are "Ban Leun Gnai", "Ban Leun Noy" and "Ban Leun-U" (15°6"N, 106°28"E), but all are similarly far from the Mekong. Yet another "Ban Leum", possibly meaning "Village in the hollow" is in Muang District, Udon Thani, Thailand closer to the Laosian capital Vientiane (17°96"N, 102°6"E) that is on the Mekong. In these regions there are also half-a-dozen places named "Ban Len".

In the Lao/Siamese and upland Vietnamese dialects the term "Ban" can mean village - hence "Leum's Village", but often the names of smaller villages disappear as they merge or are spelt in a variety of ways after romanization to French and/or English. In these dialects "ban leum" can also translate as "[I] forget the place" so, although the actual Mekong River type-locality is uncertain; it is probably in Thailand or Laos, and not in Vietnam.

Geography and Ecology of Mekong River Habitat

The riverine habitat of the current species (*A. mekongianus*) is the Mekong that, flowing over 4,200 km, is the third largest river system in Asia after the Yangtze in China and the Ganges in India. This river originates in Tibet and China's Qinghai Province, passes through Yunnan province, next forming the border between Myanmar (Burma) and Laos then most of the border between Laos and Thailand. It enters Cambodia at Khone waterfall, drains Tonle Sap lake seasonally, and slows its pace in the nine arms of the low-lying Mekong delta in southern Vietnam before finally discharging into the South China Sea. This catchment is home to some 250 million people and approximately 70 million rely on the Mekong River for their transport and livelihood, according to the Mekong River Commission (http://www.mrcmekong.org). Earthworms are nutritious, are used as bait for fishing and domestic pigs forage for them along the riverbanks (pers. obs.). However, the extent to which this particular worm species is utilized, or endangered, locally is unknown. There would appear to be few natural barriers to migration of worms along the sedimentary embankments over much of the huge Mekong basin, although various proposals to build and extend 50 or more hydroelectric dams along the rivers and catchments, such as the Nam-Ngum and Ban-Koum dams in Laos, will affect flow and sedimentation.

Species Associations

Gates (1930: 355) said "Practically nothing is known about the earthworms of Siam (= Thailand)", and the situation has changed little to this day although further surveys along the Mekong and other river systems would be expected to yield many new species and to increase ecological information about the 27-30 taxa or so that are reported from Thailand (Gates 1939; 1972; Blakemore 2005). Less is known of

Laosian earthworms although their nematode parasites are reported e.g. by Spiridonov (1994) from the guts of several "*Pheretima*" spp hosts in the Mekong region of Laos such as *Homungella mekongianum* Spiridonov, 1994 (non *Pharyngonema mekongianum* Pierantoni, 1923) that was found inside *Amynthas juliani* (Perrier, 1875) collected in October, 1987 from near the river Pon, Sepon that, although in Laos, is some distance from the Mekong proper (S. Spiridonov pers. obs.). Some other pheretimoid species known from the Mekong River include *Amynthas gibbosus* (Thai and Samphon, 1990) **comb. nov.,** *Metaphire luongphabanganus* (Thai and Samphon, 1990) **comb. nov.**, ?*Metaphire packhanensis* (Thai and Samphon, 1990) **comb. nov.** and ?*Pheretima choana* Thai and Samphon, 1988 all from Laos, and *Amynthas polychaetiferus* (Thai, 1984) **comb. nov.** from the Mekong Delta of S. Vietnam. Despite some general similarities, these species are only about 150 mm long or less and considerably shorter than *A. mekongianus*. In a Vietnamese paper, Thai & Samphon (1989: 75) also list *Metaphire posthuma*, *Amynthas juliani*, *A. samphoni*, *A. unicipeniferus*, and possibly *M. peguana* and *M. bahli* from the "tide area of Mekong River".

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The enchytraeid fauna (Annelida: Oligochaeta) of the Sas-hegy Nature Conservation Area, Hungary

G. BOROS[1]

Abstract. The aims of the present study, which was part of our comprehensive investigation of rock grasslands of Hungary, were to explore the enchytraeid fauna of Sas-hegy Nature Conservation Area, and to get knowledge on some ecological characteristics of this family. Ten enchytraeid species of five genera were found during the investigations; one of them, *Achaeta antefolliculata* proved to be new to science. The fact that the species *Fridericia maculatiformis* and *Fridericia tubulosa* proved to be dominant in the opened rock grasslands of Hungary might lead to a conclusion that they are the most characteristics species of these kind of habitats. The investigations of rock grasslands of Sas-hegy and other Hungarian hills, e.g. Szent György Hill, Nagy Szénás Hill and Villányi Mountains, show that the enchytraeid fauna of these localities are affected by the actual status of microhabitats (organic matter content, soil moisture, plant covering).

INTRODUCTION

There are certainly no many capitals worldwide which would have such a precious and vivid nature conservation area rich in endemic elements like Sas-hegy (Sas Hill) in the centre of Budapest, Hungary. It is a small dolomite hill of late Triassic origin with narrow ridges and steep slopes, situated on the right side of river Danube (Fig. 1). It extents to approximately 30 hectares with maximal height of 254 m above sea level. Due to its relic flora and special fauna, it has been protected since 1958, and now is part of the Duna-Ipoly National Park

Concerning the earlier publications on the fauna and flora of Sas Hill, Loksa (1977) provided a good view. As for the invertebrate fauna, Balogh (1935), Bleicher *et al.* (1999), and Samu & Szinetár (2000) published valuable data. However, comprehensive investigations on the enchytraeid worms (Annelida: Oligochaeta) have not been carried out so far. Moreover, there is only one publication deling with enchytraeids living on rock grasslands: Schmidegg (1938) studied the corresponding fauna living in elevations of 2000-3000 metres in the Austrian Alps.

Rock grasslands build due to their location and shallow soils a special habitat that is rich in organic matter content, but can easily desiccate. Since enchytraeids prefer soils with high organic matter content on arid places, too, we have planned to study the enchytraeid fauna of the Sas-hegy Nature Conservation Area, and to get knowledge on some ecological characteristics of this family. This study is part of our comprehensive investigation of rock grasslands of Hungary.

MATERIALS AND METHODS

The present investigations were carried out in the period between autumn 2003 and spring 2005. Soil samples were taken continually when the worms were in active life period that is in spring and autumn. Preliminary monitoring ascertained that our worms get at inactive condition in the dry seasons, in summer and winter.

Three different plant associations were chosen for sampling:

1. *Seslerietum sadlerianae* on the Northern side of the hill.
2. Open rock grassland *Seseli leucospermo–Festucetum pallentis.*
3. Closed rock grassland *Festuco pallenti–Brometum pannonic;* both latter situated on the south-west slopes.

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Figure 1. Location of the Sas-hegy Nature Conservation Area in District XI, Budapest

Both qualitative and quantitative samples were collected; the latter were taken by using a convertible iron cylinder of 5,05 cm diameter (A = 20 cm^2). The samples were taken from 0 to 8 cm depth, and later divided into an upper (0–3 cm) and a lower (3–8 cm) section. Animals were extracted with the O'Connor wet funnel method (O'Connor, 1962). For microscopic investigations, the living worms were put on glass slides in a few drops of water and covered with cover slips. The pressure of the cover slip is necessary to immobilize the worms and to flatten the body, in order to make the internal organs visible. The large or too agile animals were narcotized with sparkling mineral water.

Drawings and photographs of the most important organs were taken by Zeiss Axioskop 2 microscope, using DIC (Differental Interference Contrast) illumination and an Olympus Colour View digital camera with DP-Soft software. The animals were anaesthetized in 30 % ethanol and preserved in 70 % ethanol containing one percentage of formaldehyde. The specimens of the species *Achaeta antefolliculata* were also anaesthetized in 30 % ethanol, but subsequently they were stained with a mixture of borax-carmine and bromphenol-blue, and mounted in euparal.

Since enchytraeids are terricolous animals, their presence and abundance might not be independent from certain soil parameters. Therefore, pH, organic matter content, $CaCO_3$ content were also measured to compare the three associations sampled

RESULTS

During the investigation the following ten enchytraeid species belonging to five genera were observed:

Achaeta antefolliculata Dózsa-Farkas & Boros, 2005
Achaeta pannonica Graefe, 1989
Buccholzia appendiculata (Buccholz, 1862)
Enchytraeus bulbosus Nielsen & Christensen, 1963
Enchytraeus variatus Bougenec & Gianni, 1987
Fridericia conculcata Dózsa-Farkas, 1986
Fridericia eiseni Dózsa-Farkas, 2005
Fridericia maculatiformis Dózsa-Farkas, 1972
Fridericia tubulosa Dózsa-Farkas, 1972
Henlea ventriculosa (Udekem, 1854)

One of them, *Achaeta antefolliculata* proved to be new to science (Dózsa-Farkas & Boros, 2005). It is worth to mention that the species *Fridericia maculateformis* and *Fridericia tubulosa* have also been found in other rock grasslands in Hungary, namely in Szent György Hill, Nagy Szénás Hill, Villányi Mountains, etc. (unpublished data). Their dominance suggests that they are the most characteristic species of the open rock grasslands in Hungary (Fig. 2).

The individuals of the species found had eggs at all times, which shows that their reproduction was continuous throughout their active life period. *Buchholzia appendiculata* proved to be the only exception. Sexually mature individuals of this species were not found at all. This fact coincides with the observations of Christensen *et al.* (2002) who found that this enchytraeid propagates either by fragmentation or some individuals of the population become mature but only for a short period of time.

The abundance of the animals though greatly varied, but it was relatively low, apart from the

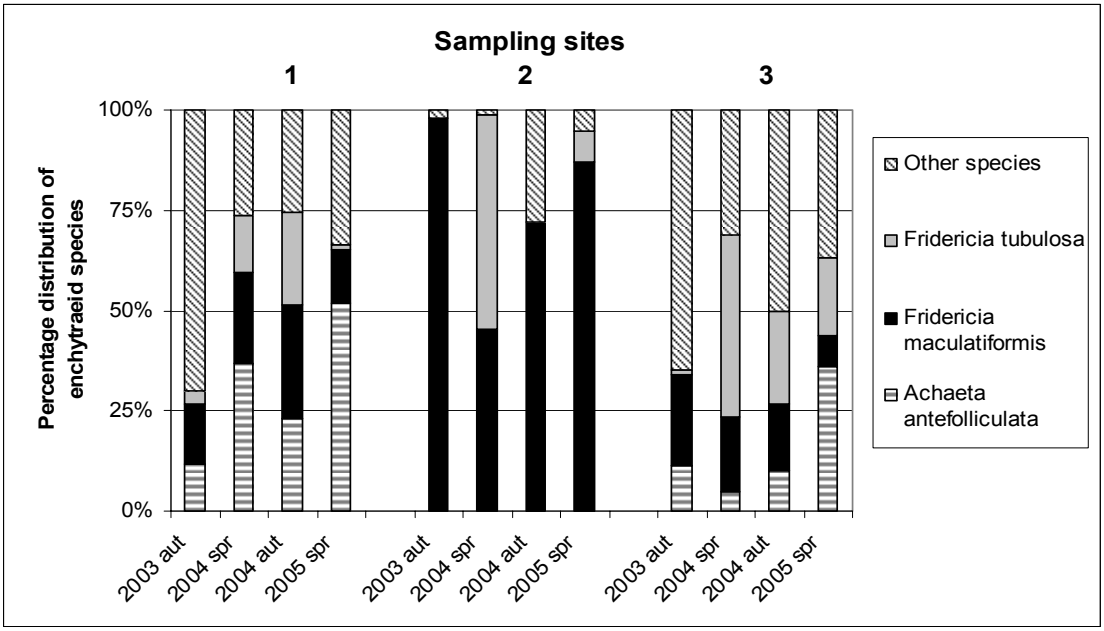

Figure 2. Distribution of enchytraeids in the three plant associations. 1 = *Seslerietum sadlerianae*, 2 = *Seseli leucospermo–Festucetum pallentis,* open rock grassland, 3 = *Festuco pallent– Brometum pannonici,* close rock grassland

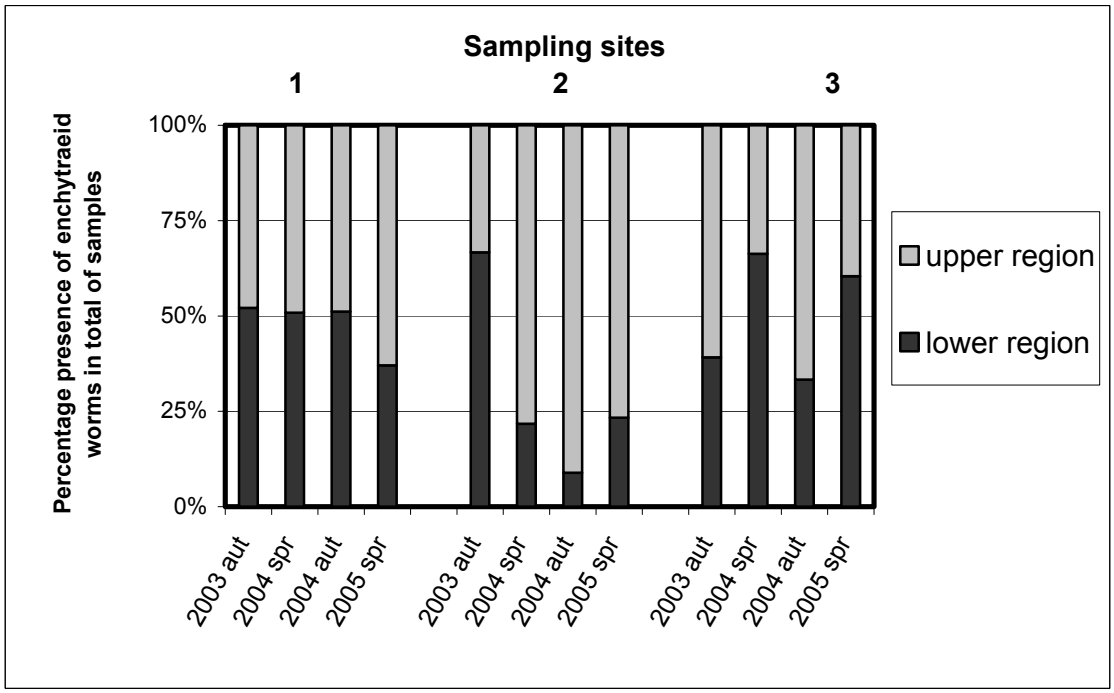

Figure 3. Vertical distributions of enchytraeids in the three plant associations. 1 = *Seslerietum sadlerianae*, 2 = *Seseli leucospermo–Festucetum pallentis,* open rock grassland, 3 = *Festuco pallenti– Brometum pannonici,* close rock grassland

closed rock grassland *(Festuco pallenti–Brometum pannonici)* in springs of the two consecutive years (Table 1). On the basis of these two outstanding values we may suppose that the dense plant cover keeps the soil moisture more efficiently and make possible for more enchytraeids to survive dry periods.

Table1. Abundance of enchytraeids (individual/m^2) in the three investigated associations. 1 = *Seslerietum sadlerianae*, 2 = *Seseli leucospermo–Festucetum pallentis,* open rock grassland, 3 = *Festuco pallenti–Brometum pannonici,* close rock grassland. Significant values signed with * (Mann-Whitney, p.= 0.05).

	1. association	2. association	3. association
Autumn, 2003	4100	6450	6000
Spring, 2004	2950	4600	22250*
Autumn, 2004	2150	2250	2050
Spring, 2005	5800	4250	12250*

As mentioned above, each sample was separated to an upper and a lower section, so that the vertical distribution of the animals could also be estimated. Seasonal period in their activity could be observed only in the closed grassland; most of the animals preferred the upper region in autumn and the lower one in springtime (Fig. 3).

Soil parameters are shown in Table 2. As for pH, there were no differences among the three investigated associations. The pH values varied around 7. However, this divergence is not considerable for enchytraeids and the similar domain is typical of most of their habitats. The organic matter content was high in *Seslerietum sadlerianae* and *Festuco pallenti–Brometum pannonici,* while it was much lower in *Seseli leucospermo–Festucetum pallentis*. In the open rock grassland the close of the vegetation was not complete, so the erosion prevents the humus from accumulating.

Diversity was higher in soil with high organic matter content, and the representatives of the genus *Achaeta* were found only at these places. The data of $CaCO_3$ content were not of use. They were extremely high; these values cannot be justified by the dolomite base rock. One might be able to give hypothetical explanations for this, though the problem can only be answered with the help of geological researches.

Table 2. Soil parameters of the three investigated association. 1 = *Seslerietum sadlerianae*, 2 = *Seseli leucospermo–Festucetum pallentis,* open rock grassland, 3 = *Festuco pallenti–Brometum pannonici*, close rock grassland.

	pH (H_2O/KCl)	Organic matter content (%)	$CaCO_3$ content (%)
1. association	7.2 ± 0.1 / 7.0 ± 0.1	11.5 ± 0.4	41.2 ± 13.4
2. association	7.3 ± 0.1 / 7.0 ± 0.2	5.6 ± 1.3	67,2 ± 4.1
3. association	7,3 ± 0.2 / 7.1 ± 0.1	14,7 ± 0.8	39,8 ± 2.5

It seems that the investigation of rock grasslands of Sas Hill (and other Hungarian hills and mountains, e.g. Szent György Hill, Nagy Szénás Hill and Villányi Mountains) prove that the enchytraeid fauna of these places are affected by the actual status of microhabitats (organic matter content, soil moisture, plant cover). Schmidegg (1938) came to similar conclusion, the enchytraeid fauna of rock grasslands strongly depends on the plant cover.

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New records for the Uropodina fauna of Bulgaria with descriptions of two new species (Acari: Uropodidae)

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Abstract. Nine Uropodina species are listed from different parts of Bulgaria. Four of them (*Neodiscopoma splendida, Dinychus perforatus, Trachytes aegrota, Urodiaspis pannonica*) are new for the fauna of Bulgaria and two species; *Discourella bulgarica* and *Dinychus rilaensis* spp. nov. to the science too. With 13 figures.

Bulgaria, regarding the mite fauna, is one of the most poorly-studied countries in the Balkan Peninsula. Only two papers were published so far dealing with the Bulgarian Uropodina mites. Wisniewski (1993) recorded two species for this country and later Kontschán (2004) listed nine other species found in the soil sample collection of the Hungarian Natural History Museum. Up till now only eleven species are recorded for this Balkan country lying in one of the major Ice Age refugial centre consequently supposed to possesses quite rich soil fauna.

In the framework of the research project (NKFP No. 3B023-04) entitled "Origin, genesis, values and focal areas of the Carpathian Basin" an intensive study of the soil mite fauna was also launched. During this research there have been several collecting trips to the Balkan including Bulgaria. I present herewith some new data on the uropodid mites of Bulgaria including descriptions of two new species.

The specimens were studied with traditional methods. Lactic acid was used to clear them. Drawings were made with camera lucida. All the specimens are stored in alcohol and deposited in the Soil Zoology Collections of the Hungarian Natural History Museum. The taxonomy and the nomenclature of the species are according to Wisniewski (1993). Measurements are given in micrometers (μm). All samples were collected by the author.

THE SPECIES OBSERVED

Trachytidae

Trachytes aegrota (C. L. Koch, 1841)

Material examined. Bulgaria, Rila, near the stream Prava Marica above the Marica mountain hut, from *Sphagnum* bog, 2000 m a.s.l., 08.09. 2005., Bulgaria, Rila, near river Rila, Tiha Rila, from moss, 2000 m a.s.l., 06.09.2005.

Previous record. None.
Distribution. Europe

Remarks. This is one of the most common *Trachytes* species in Europe, it is known in the Balkan Peninsula from Albania (Kontschán 2003a) and from Macedonia (Kontschán 2005).

Trachytes baloghi Hirschmann & Zirngiebl-Nicol, 1969

Trachytes baloghi: Kontschán, 2004.

Material examined. Bulgaria, Rila, near the stream Prava Marica above the Marica mountain hut, from moss, 2000 m a.s.l., 08.09.2005., Bulgaria, Rila, near the Rila river, Tiha Rila, from soil, 2000 m a.s.l., 06.09.2005., Bulgaria, Rila, near the Rila river, Tiha Rila, from moss, 2000 m a.s.l., 06.09.2005., Bulgaria, Black Sea coastal hills, Pobiti Kamani, from moss, 02-04.09.2005.

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Previous record. Rupite (Kontschán 2004).
Distribution. Central and South-Europe.

Remarks. This species is known from Albania (Kontschán 2003a) and Bulgaria (Kontschán 2004).

Urodinychidae

Dinychus perforatus (Kramer, 1882)

Material examined. Bulgaria, Rila, near the stream Prava Marica above the Marica mountain hut, from *Sphagnum* bog, 2000 m a.s.l., 08.09. 2005.

Previous record. None.
Distribution. Europe.

Remarks. This is one of the very common *Dinychus* species in Europe, however it is the first record from the Balkan Peninsula.

Dinychus rilaensis sp. n.
(Figs. 1-5.)

Material examined. Holotype: female, Bulgaria, Rila, under Rilski Monastir, beech forest, from leaf litter, 06.09.2005. leg Kontschán, J. Paratypes: one female and one male, locality and date same as that of the holotype.

Diagnosis. All dorsal setae needle-like, caudal part of the dorsal shield with three pairs of bulbiform setae. Postdorsal shield with two pairs of smooth and two pairs of bulbiform setae. Ornamentation of dorsal, ventral and marginal shield dotted. Anterior part of the peritreme long with one hook-form and one U-form regions. Genital shield of female scutiform, situated between coxae 3 and 4.

Description. Female. Length of idiosoma 585-600 µm, width 245-265 µm (n=2). Shape oblong, posterior margin rounded.

Dorsal side (Fig. 1): Most of the dorsal setae needle-like, three pairs of bulbiform setae sur rounded by protuberances. Dorsal and marginal shield fused on apical part, covered with dotted pattern (Fig. 2). Postdorsal shield with two pairs of smooth and two pairs of bulbiform setae.

Ventral side (Fig. 3). Sternal and ventral shields dotted (Fig. 2), sternal setae short, smooth and needle-like. One pair of lyriform fissures placed in anterior part of sternal shield. Ventral and ventroanal setae similar to the sternal setae. Stigmae situated near coxae 3. Peritreme long, with a hook-form region in the apical part and a U-form region in the central part (Fig. 4).

Genital shield scutiform with dotted pattern and without processes. Genital shield localized between coxae 3 and 4.

Gnathosoma. Corniculi horn-like, lacinia long and bifurcated on its apical part. Hypostomal setae are as follows: *h1* long, smooth and setiform, but there are two spines on the basal part, *h2* shorter than *h1*, smooth and setiform, *h3* setiform and with short hairs, *h3* shorter than *h2*, *h4* antler-shaped. Epistome, tritosternum and chelicerae are not clearly visible.

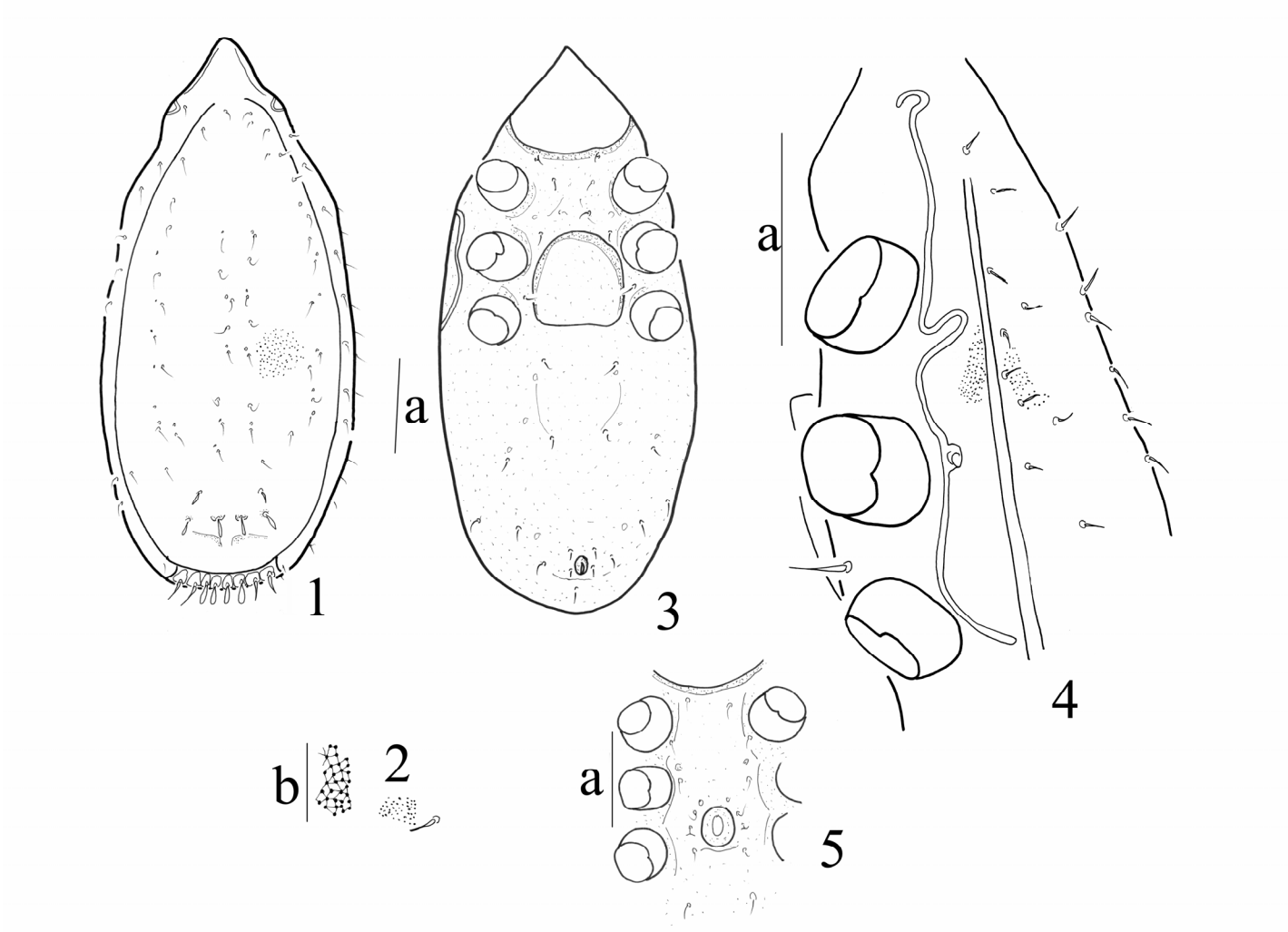
Male. Length of idiosoma 570 µm, width 280 µm (n=1). Shape oblong, posterior margin rounded. Dorsal side similar to that of the female.

Ventral side (Fig. 5). Sternal shield with dotted ornamentation. Sternal setae smooth, short and needle-like, one pair of lyriform fissure localized near the genital shield. Ventral setae similar to that of the female. Genital shield of male circular and situated between coxae 3 and 4.

Nymphs and larvae unknown.

Etymology. The name refers to the mountains (Rila) where the new species was collected.

Remarks. This species belongs to the *Dinychus septemtrionalis* species group, the shape of the peritreme and the ornamentation of the idiosoma of the new species are, however, unique for this species group.



Figures 1-5. *Dinychus rilaensis* sp. n.: 1 = dorsal view of female, 2 = pattern of dorsal, marginal and ventral shields, 3 = ventral view of female, 4 = peritreme, 5 = ventral view of sternal region of male (scale bar: a: 100 μm, b: 10 μm).

Urodiaspis pannonica Willmann, 1951

Material examined. Bulgaria, near in the vicinity of Black Sea, coastal hills, Pobiti Kamani, from moss, 02-04. 09. 2005.

Previous record. None.
Distribution. Central-Europe.

Remarks. This is the first record of this species from Bulgaria and the whole Balkan Peninsula.

Uropodidae

Neodiscopoma splendida (Kramer, 1882)

Material examined. Bulgaria, Rila, after Velingrad, above Marica, 1259 m, from moss, 08.09. 2005., Bulgaria, Stara planina, Mts Stidovska, stream at Gradec, from leaf litter, 05.09.2005.

Previous record. None.
Distribution. Europe.

Remarks. Up till now this species has been recorded in the Balkan Peninsula for Albania only (Kontschán 2003 a).

Cilliba minima (Krammer, 1882)

Uropoda minima: Kontschán 2004

Material examined. Bulgaria, Rila, Velingrad, above Marica, 1259 m, from moss, 08.09. 2005.

Previous record. Rupite (Kontschán 2004).
Distribution. Europe.

Remarks. This species is known from Albania (Kontschán 2003a) and Croatia (Kontschán 2005).

Discourella modesta (Leonardi, 1899)

Discourella modesta: Kontschán 2004

Material examined. Bulgaria, Black Sea coast, Zlatni pjasaci, from leaf litter, 04.09.2005., Bulgaria, Black Sea coastal hills, Pobiti Kamani, from leaf litter, 02-04.09.2005.

Previous record. Rhodope (Kontschán 2004).
Distribution. Europe.

Remarks. This species is known from Albania (Kontschán 2003a), Greece (Kontschán 2003b), Macedonia (Kontschán 2005), Turkey (Ali Bal & Özkan 2003) and Bulgaria (Kontschán 2004).

Discourella bulgarica sp. n.
(Figs. 6-13.)

Material examined. Holotype: female, Bulgaria, Rila, under Rilski Monastir, beech forest, from leaf litter, 06.09.2005. leg. Kontschán, J. Paratypes: two males, locality and date same as that of the holotype.

Diagnosis. All dorsal, marginal and postdorsal setae are needle-like. Postdorsal shield subdivided into four pairs of small platelets. Genital shield of female linguliform, placed between coxae 2 and 4, with alveolar ornamentation and with crown-like process on its anterior margin.

Description. Female. Length of idiosoma 560 µm, width 370 µm (n=1). Shape oval, posterior margin rounded.

Dorsal side (Fig. 6). All dorsal setae short and needle-like. Dorsal and marginal shield separate. Dorsal shield with alveolar sculpture, the ornamentation of marginal shield as shown in Fig. 7. Postdorsal shield subdivided into four pairs of platelets (Fig 8), each bearing one short, needle-like setae.

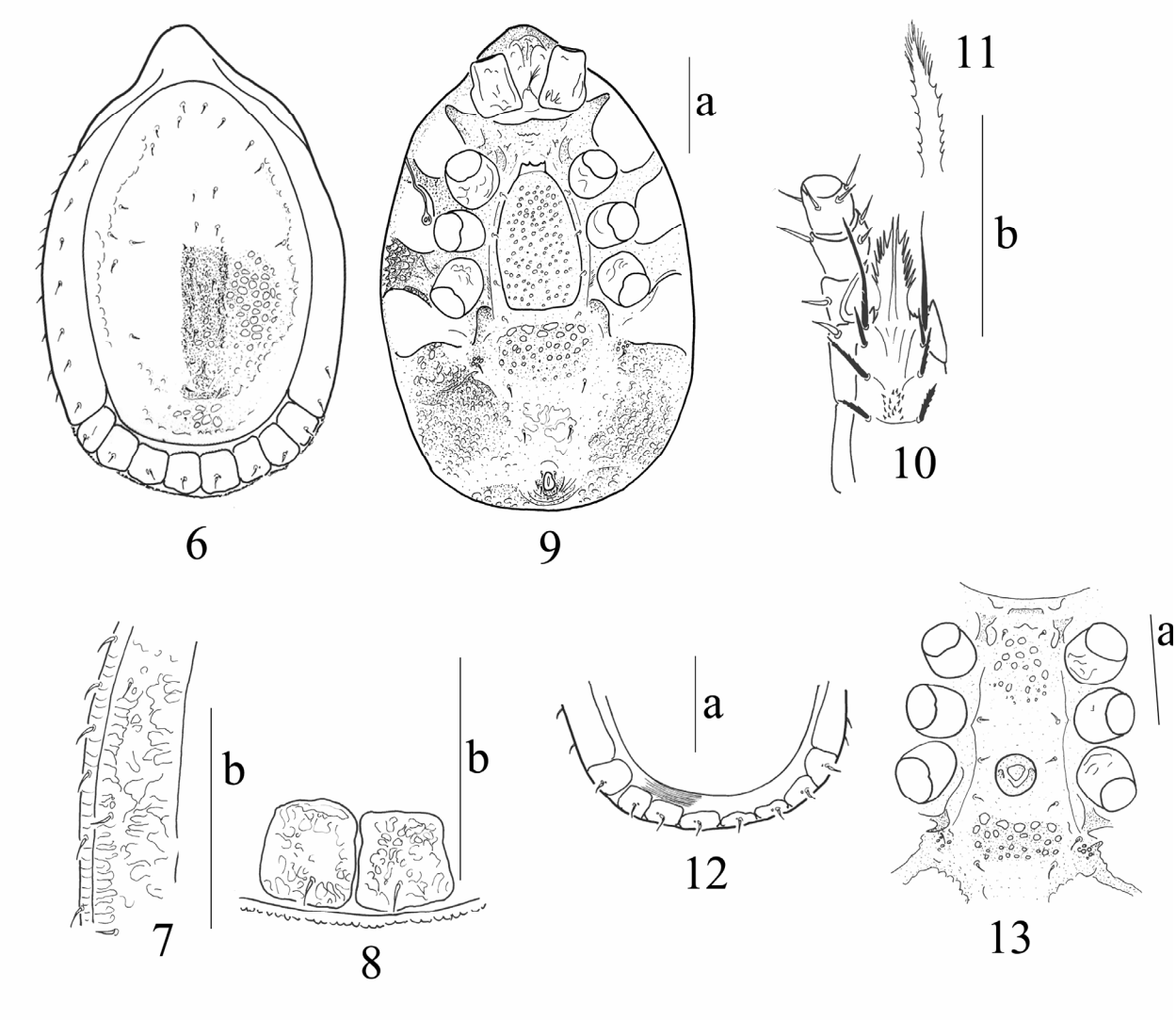
Ventral side (Fig. 9). Ornamentation of the sternal shield lacking, all sternal setae short, smooth and needle-like. One pair of lyriform fissures on the apical part of sternal shield. Ventral setae longer than the sternal ones, but all ventral setae are short, smooth and needle-like. Ornamentation near the basal part of the genital shield and near the metapodal lines alveolar, the other regions of the ventral shield smooth.

Stigmae situated near coxae 3. Peritreme is of linear form. Genital shield linguliform with dotted pattern and without processes. Genital shield of female linguliform, placed between coxae 2 and 4, with alveolar ornamentation and with crown-like process on its anterior margin.

Gnathosoma (Fig. 10). Corniculi horn-like, laciniae long and with serrated margin on its apical part. Hypostomal setae are as follows: *h1* long, smooth and setiform, but two spines on basal part, *h2* shorter than other hypostomal setae, smooth and setiform, *h3* and *h4* setiform and with serrated margin, *h3* longer than *h4*. Epistome with serrated margin on its basal part and with short hairs on its apical part (Fig. 11). Tritosternum with narrow basis, apical part of four branches. Chelicerae not clearly visible.

Male. Length of idiosoma 530-540 µm, width 350-360 µm (n=2). Shape oval, posterior margin rounded. Dorsal side similar to that of the female, but wide interscutellar membrane between dorsal and postdorsal shields (Fig. 12).

Ventral side (Fig. 13). Sternal shield with alveolar ornamentation. Sternal setae smooth, short and needle-like, without lyriform fissure.



Figures 6-13: *Discourella bulgarica* sp. n.: 6 = dorsal view, 7 = marginal shield, 8 = postdorsal shield, 9 = ventral view of female, 10 = ventral view of gnathosoma, 11 = epistome, 12 = caudal part of dorsal view of male, 13 = ventral view of sternal region of male (scale bar: a: 100 μm, b: 10 μm).

Ventral setae similar to that of the female. Genital shield of male circular, situated between coxae 4.

Nymphs and larva are unknown.

Etymology. The name of the new species refers to the type country.

Remarks. The new species belongs to the *baloghia* species group.

Key to the European species of the *Discourella baloghia* species group

1 (2) Genital shield with anterior crown-like process
D. bulgarica n. sp.

2 (1) Female genital shield without anterior processes

3 (4) V4 seta close to the anus
D. baloghia Hirschmann & Zirngiebl-Nicol, 1969

4 (3) V4 seta between the anus and V8 seta
D. baloghisimilis Wisniewski, 1984

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Trachyuropodid mites of the Carpathian Basin (Acari Uropodina: Trachyuropodidae)

J. KONTSCHÁN[1]

Abstract. Species of the family Trachyuropodidae occurring in the Carpathian Basin are summarized. Diagnoses of the family, subfamilies, genera and species are given, and keys to genera and species are provided. A new species, *Urojanetiella dentata* sp. n. is described. New combinations are: *Urotrachys formicariasimilis* (Hirschmann, 1975), *Urojanetia pecinai* (Hirschmann, 1976) and *Urojanetia cristiceps* (Canestrini, 1884). With 25 figures.

INTRODUCTION

In the suborder Uropodina the family Trachyuropodidae is one of the most widely distributed families. The family was erected by Berlese (1917) who described several genera belonging to this family. Later Hirschmann (1961) revised the group in his specific system ("Gangsystematik der Parasitiformes") and united them in two large, world-wide distributed catch-all genera. The species with well sclerotised dorsal shield were placed in the genus *Trachyuropoda*, while those without sclerotised dorsal shield in the genus *Oplitis*. Later, Hirschmann (1976 a) divided these two genera into several species groups. Recently about 100 species are known from all over the world occurring mainly in ant nests (Wiśniewski, 1993).

Only a few tachyuropodid records have been published from Hungary and the Carpathian Basin so far. The first Hungarian data are by Balogh (1938 a), who found two species, *Urojanetia excavata* (Wasm.) and *Uroplitella minutissima* Berl. in ant nests. In the very same year, Balogh (1938 b) published new records of other three species.

Hirschmann (1981) reported on two *Oplitis* species from the Hortobágy National Park, and prepared a list of the Uropodina species of the Bátorliget Nature Reserve, which contained only *Oplitis* species (Hirschmann, 1990). Wiśniewski and Hirschmann (1995) described a new species from the material collected in Bátorliget (*Oplitis mahunkai* Wiśniewski & Hirschmann, 1995), and Wiśniewski (1996) published the occurrence of *Oplitis conspicua* (Berlese, 1903) in the Bükk National Park.

Recently, Kontschán (2002 a) found five *Trahyuropoda* species new to the fauna of Hungary, and listed (2002 b) four Trachyuropodid species from county Komárom-Esztergom. Following this work, several other sporadic occurrences of trachyuropodid species were recorded (Kontschán, 2003 a, 2003 b, 2003 c, 2005), until Kontschán (2007) summarized all the Uropodina species known in Hungary.

In Slovakia the first record of this family was published by Pecina (1980). Mašán and Kaluz (1997) reported on eight trachyuropodid species from this country. In his recent monograph of the Slovakian Uropodina mites, Mašán (2001) summarized all the known records of trachyuropodid species from Slovakia.

Among the surrounding countries, Ukraine is less investigated than Hungary and Slovakia. Only Wiśniewski (1993) mentioned one trachyuropodid species, and later Kontschán (2004 b) described one new species from this country.

In the present paper I will summarize all the tachyuropodid species hitherto known from the Carpathian Basin, and provide keys to the genera and species.

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MATERIALS AND METHODS

The specimens were studied with traditional methods. They were cleared in lactic acid, stored in alcohol, and deposited in the Soil Zoology Collections of the Hungarian Natural History Museum, Budapest. Measurements are given in micrometers. Drawings were made with camera lucida.

RESULTS

Family **TRACHYUROPODIDAE Berlese, 1917**

Diagnosis. Gnathosoma: Corniculi horn-like, laciniae with several branches possessing long hairs. Hypostomal setae as follows: *h1* smooth, *h2*, *h3* and *h4* with serrated margin or spines. Chelicerae with nodus. Base of tritosternum narrow, its laciniae with four branches, two central branches with hairs on their apical part.

a) Subfamily **Trachyuropodinae Berlese, 1917**

Diagnosis. Dorsal, marginal and ventral shield strongly sclerotised. Genital shield of female scutiform. Epistome triangular with hairs on its margin.

Remarks. All species of this subfamily were placed previously in the genus *Trachyuropoda* (Hirschmann, 1961). Several acarologists (e.g. Błoszyk, 1999; Farrier & Hennessey, 1996) have not accepted this large catchall genus. I do not agree with Hirschmann's conception as well, and think that on the score of the structure of dorsal shield these species belong to several well separated genera (see the diagnoses below).

Key to genera of Trachyuropodinae

1 (2) Dorsal shield with two anvil-shaped bulges on the marginal region and some weakly sclerotised lines between the two bulges.....***Urotrachys*** Berlese
2 (1) Dorsal shield without anvil-shaped bulges and weakly sclerotised lines
3 (4) Dorsal shield without well sclerotised lines……... ***Urojanetia*** Berlese
4 (3) Dorsal shield with well sclerotised lines
5 (6) Dorsal shield with long well sclerotised lines and wide marginal shield……...***Leonardiella*** Berlese
6 (5) Dorsal shield without wide marginal shield, dorsal shield long or divided by well sclerotised lines……..…***Trachyuropoda*** Berlese

Genus ***Urotrachys* Berlese, 1903**

Trachyuropoda: Hirschmann 1990: 706 (part.), Mašán 2001: 237-238 (part.), Kontschán 2004b: 79, 236-237 (part.).

Diagnosis. Shape oval, posterior margin rounded. Dorsal shield with some well sclerotised lines. Two lines on the anterior region and one X-shaped well sclerotised bulge on the central region, furthermore two strongly sclerotised anvil-shaped bulges on the marginal region. Margin of the anvil-shaped bulges smooth or with finger-like processes. Some pilose setae near and on the anvil-shaped bulges. Some weakly sclerotised lines placed between the two anvil-shaped bulges. Ornamentation of dorsal shield alveolar.

Type species: *Urotrachys formicaria* (Lubbock, 1881).

Key to species of Urotrachys

1 (2) Margin of anvil-shaped bulges smooth…….. ***formicaria*** (Lubbock)
2 (1) Margin of anvil-shaped bulges with finger-like processes……***formicariasimilis*** (Hirschmann)

***Urotrachys formicaria* (Lubbock, 1881)**
(Fig. 1)

Uropoda formicaria Lubbock, 1881: 386.
Trachyuropoda formicaria: Hirschmann 1990: 706, Mašán 2001: 237-238, Kontschán 2004b: 79. Kontschán 2005: 115.

Diagnosis. Length of idiosoma 1020-1090 μm, width 680-750 μm. Shape oval, posterior margin rounded. Margin of anvil-shaped bulges smooth. Genital shield of female linguli-form, bearing short spines on its anterior margin.

Distribution. Europe.
Previous records from the Carpathian Basin. Hungary: Bátorliget (Hirschmann, 1990); *Slovakia*: Borská Nízina, Malé Karpaty, Povazsky Ino-

vec, Kremnické Vrchy, Slovensky Kras (Mašán, 2001); *Ukraine*: Krasznaja (Kontschán, 2004).

New records. *Hungary*: Magyarszombatfa, on marshland from soil, 23.05.2002, leg. S. Mahunka & L. Mahunka-Papp; Kercaszomor, nest of ants, 19.08.2004, leg. L. Peregovits. *Romania:* Transylvania, Torocko, Székelykő, from soil, 20.08.1999, leg. F. Mészáros; Maramures county, Maramures Mts, Petrova, Frumuseana, in pine-beech mixed forest. 25.05.2006, leg. L. Dányi, M. Földvári, J. Kontschán & D. Murányi

***Urotrachys formicariasimilis* (Hirschmann, 1975) comb. n.**
(Fig. 2)

Trachyuropoda formicariasimilis Hirschmann, 1975: 104, Mašán 2001: 236-237.

Diagnosis. Length of idiosoma 870-940 µm, width 610-660 µm. Shape oval, posterior margin rounded. Margin of anvil-shaped bulges with finger-like processes. Genital shield of female linguli-form; short spines can be seen on angular process of its anterior margin.

Distribution. Ukraine, Slovakia, Hungary.

Previous records from the Carpathian Basin. *Hungary*: Csesztreg (Kontschán, 2006). *Slovakia*: Bukovske Vrchy, Chvojnická Pahorkatina, Veporské Vrchy (Mašán, 2001).

Genus ***Urojanetia* Berlese, 1917**

Trachyuropoda: Hirschmann 1990: 706, Mašán 2001: 233-238, Kontschán 2002b: 51-52, 2002c: 347. Kontschán 2003a: 118, Kontschán 2003b: 55.

Diagnosis. Shape oval, posterior margin rounded. Dorsal shield without well sclerotised bulges or only with small well sclerotised semicircular, S- and C-shaped, tooth-like bulges and short lines. The ornamentation of dorsal shield alveolar, several T-like setae can be seen on dorsal shield.

Type species: Urojanetia coccinea (Michael, 1891).

Key to species of Urojanetia

1 (6) Well sclerotised bulges on dorsal shield present
2 (3) One pair of large tooth-like bulges on dorsal shield……...***excavata*** (Wasmann)
3 (2) Small bulges on dorsal shield
4 (5) One pair of S- and one pair of C-shaped, well sclerotised short lines on dorsal shield…….. ***coccinea*** (Michael)
5 (4) Three pairs of tooth-like strongly sclerotised bulges on dorsal shield…….……***dentata*** n. sp.
6 (1) Dorsal shield without well sclerotised bulges
7 (8) With small half-ring-shaped sculpture near marginal part of dorsal shield …..***pecinai*** (Hirschmann)
8 (7) Without small half-ring-shaped sculpture near marginal part of dorsal shield…..... ***cristiceps*** (Canestrini)

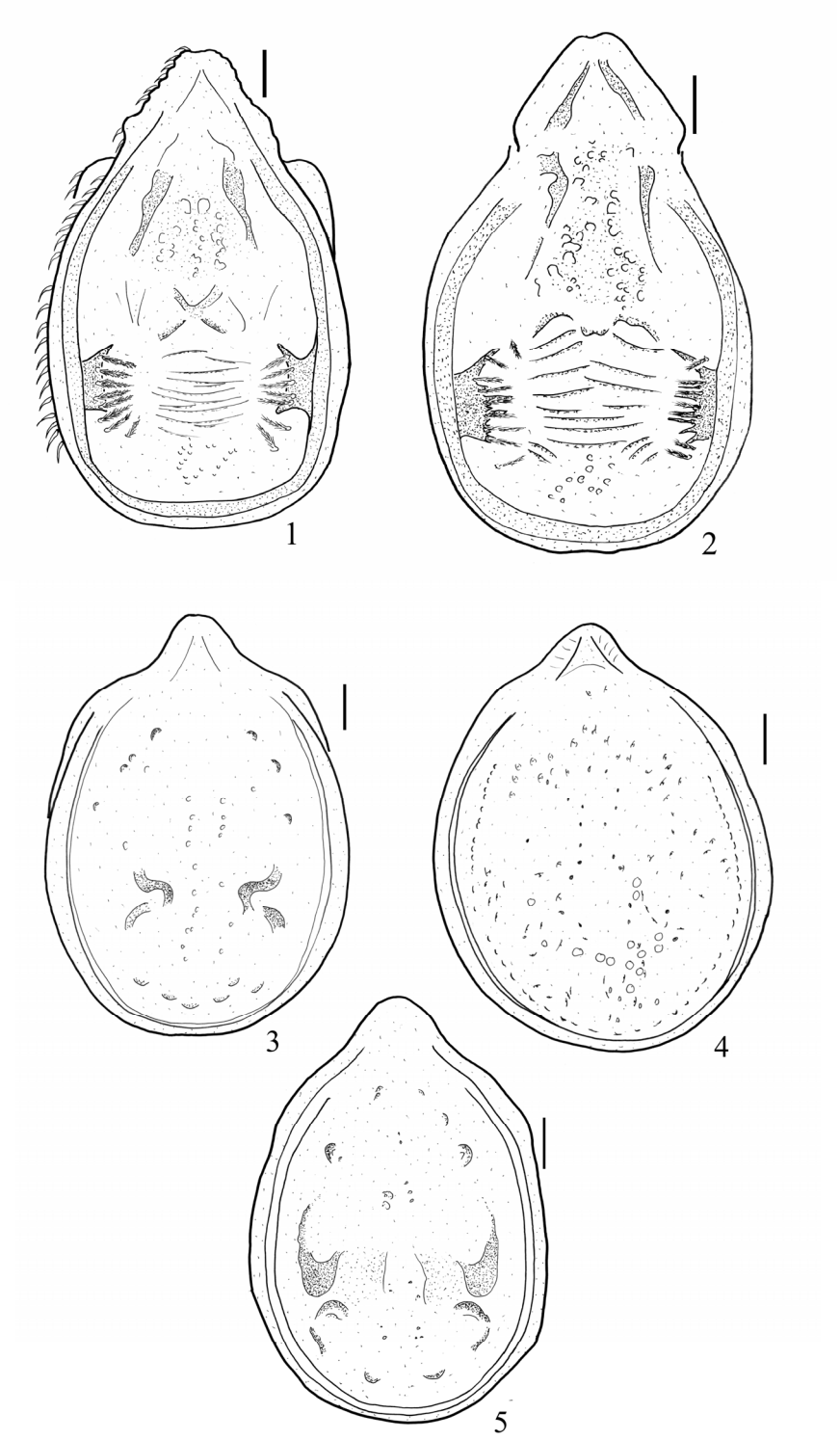
***Urojanetia coccinea* (Michael, 1891)**
(Fig. 3)

Uropoda coccinea Michael, 1891: 646.
Trachyuropoda coccinea: Mašán 2001: 233-235, Kontschán 2002b: 51-52, 2002c: 347.

Diagnosis. Length of idiosoma 760-860 µm, width 590-620 µm. Shape oval, posterior margin rounded. Dorsal shield with some semicircular, well-sclerotised bulges on anterior and caudal part of dorsal shield. One pair of S-shaped and one pair of C-shaped, well sclerotised, short lines placed at level of coxae 4 on dorsal shield. Central part of dorsal shield bearing alveolar pattern.

Distribution. Europe.

Previous records from the Carpathian Basin. Hungary: Budai Hegység (Kontschán, 2002b), Bársonyos (Kontschán, 2002c). *Slovakia*: Borská nízina, Malé Karpaty, Nízke Tatry, Povazsky Inovec, Slovensky kras, Vychodoslovenská rovina, Pozsky Inovec (Mašán, 2001).



Figures 1-5. *Urotrachys* and *Urojanetia* species from the Carpathian Basin. 1 = *Urotrachys formicaria* (Lubbock, 1881), 2 = *Urotrachys formicariasimilis* (Hirschmann, 1975), 3 = *Urojanetia coccinea* (Michael, 1891), 4 = *Urojanetia pecinai* (Hirschmann, 1976), **5** = *Urojanetia excavata* (Wasmann, 1899). (Scale bars 100 μm each)

Urojanetia pecinai (Hirschmann, 1976) comb. n.
(Fig. 4)

Trachyuropoda pecinai Hirschmann, 1976a: 16.

Diagnosis. Length of idiosoma 760-860 µm, width 590-620. Shape oval, posterior margin rounded. Dorsal shield without well scerotised bulges, only near marginal part of dorsal shield bearing small semicircular sculpture. Central part of dorsal shield with alveolar pattern.

Distribution. Czech Republic, Hungary.

New records. Hungary: Nagykovácsi, Nagyszénás, southern slope, from nest of ants, 10.04.1961, leg. S Mahunka & É. Molnos; Nagykovácsi, Nagyszénás, northern slope, ant nest, 10.04. 1961, leg. S. Mahunka & É. Molnos; Jósvafő, ant nest, 09.06.1973, leg. S. Mahunka & L. Mahunka-Papp. These are the first records from Hungary.

Urojanetia cristiceps (Canestrini, 1884) comb. n.

Uropoda cristiceps Canestrini, 1884: 720.
Trachyuropoda cristiceps: Hirschmann 1990: 706, Kontschán 2003a: 118.

Diagnosis. Length of idiosoma 770-800 µm, width 570-600 µm. Shape oval, posterior margin rounded. Similar to *U. pecinai*, but dorsal shield without well scerotised bulges, and small semicircular sculpture near marginal part of dorsal shield lacking.

Distribution. Italy, Austria, France, Germany, Hungary.

Previous records from the Carpathian Basin. Hungary: Bátorliget (Hirschmann, 1990); South-Transdanubian (Kontschán, 2003 c).

New records. Hungary: Budapest, Hármashatárhegy, from anthill under a stone, 15.03.1961, leg. S. Mahunka & É. Molnos.

Urojanetia excavata (Wasmann, 1899)
(Fig. 5)

Glyphopsis coccinea var. *excavata* Wasmann, 1899: 168-169.
Urajanetia excavata: Balogh 1938a: 108, Balogh 1938b: 71.
Trachyuropoda excavata: Mašán 2001: 235, Kontschán 2003a: 118, Kontschán 2003b: 55.

Diagnosis. Length of idiosoma 730-850 µm, width 460-540 µm. Shape oval, posterior margin rounded. Apical part of dorsal shield with one or two pairs of circular, well sclerotised bulges. One pair of large tooth-like, well sclerotised bulges on the central part of the dorsal shield. Central region with one converse Y-like and one U-like, well sclerotised line. Posterior part of dorsal shield with one pair of larger, and one pair of smaller, well sclerotised semicircular bulges.

Distribution. Europe.

Previous records from the Carpathian Basin. Hungary: Budapest (Balogh, 1938 a, b), South-Transdanubian (Kontschán, 2003 c), Aggtelek National Park (Kontschán, 2003 b). *Slovakia*: Chvojnická pahorkatina, Malé Karpaty, Tríbec (Mašán, 2001).

New records. Hungary: Kiskunhalas, Zsanai Újvilág TSZ, from soil, 01.06.1963, leg. T. Kassai.

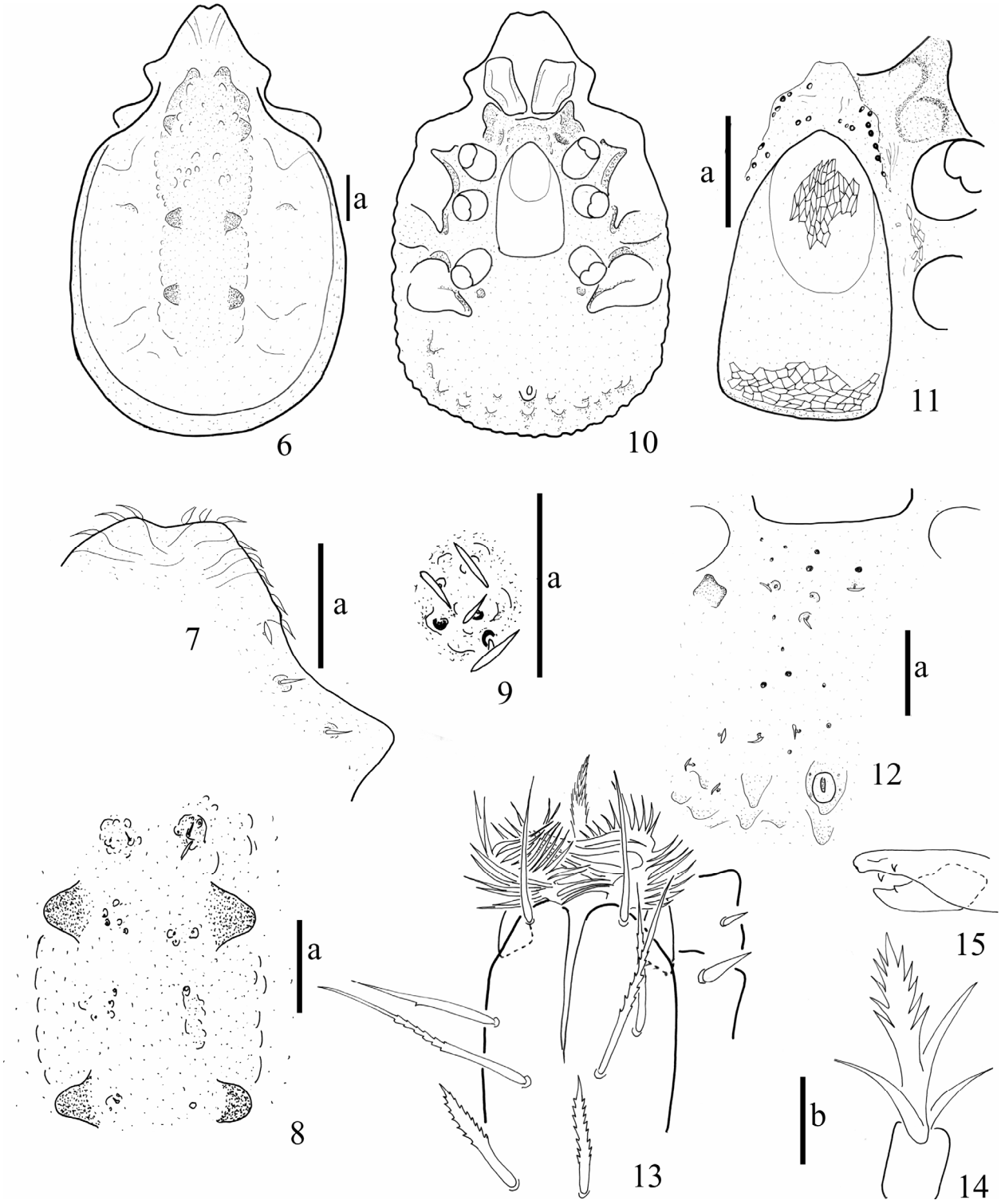
Urojanetia dentata sp. n.
(Figs. 6-15)

Material examined. Holotype: one female, Tata, Hungary, from pine forest, 02.02.1982, leg. T. Vásárhelyi.

Diagnosis. Idiosoma well sclerotised. Three tooth-like strongly sclerotised bulges on the central part of dorsal shield. Near these bulges there are several small humps, which bear T-form setae. Marginal setae spiniform, all dorsal and ventral setae short and T-form. Ornamentation of dorsal and ventroanal shield lacking, sculpture of genital shield reticulate.

Description. Female (n = 1). Length of idiosoma 940 µm, width 610 µm. Shape oval, posterior margin rounded.

Dorsal side (Fig. 6). Dorsal and marginal shield fused. Dorsal shield with well sclerotised central region, which bears three pairs of strongly sclerotised tooth-like bulges (Fig. 8). Near the bulges there are small humps, which bear T-form setae (Fig. 9). Anterior part of dorsal shield with



Figures 6-15. *Urojanetia dentata* n. sp. 6 = dorsal view, 7 = apical part of dorsal side, 8 = central region of dorsal side, 9 = small humps with T-form setae, 10 = ventral view, 11 = sternal region, 12 = ventroanal region, 13 = ventral view of gnathosoma, 14 = tritosternum, 15 = chelicera. (Scale bars: a: 100 μm, b: 20 μm)

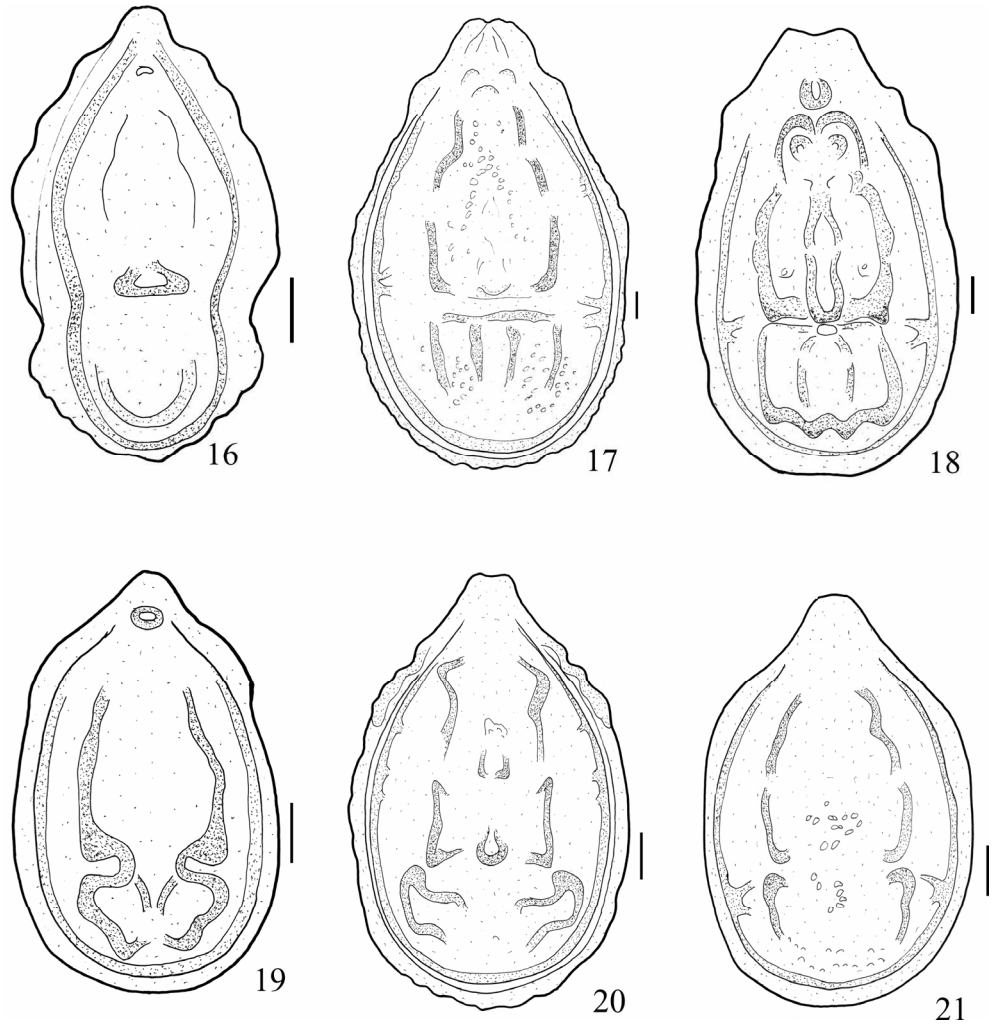
some spiniform and several T-form setae (Fig. 17). All marginal setae spiniform. Ornamentation of dorsal and marginal shield lacking.

Ventral side (Fig. 10). Sternal shield near the anterior margin of genital shield strongly sclerotised. This region bears several circle-shaped ornamentations which might be the basis of T-form setae. Sternal setae not clearly visible. Ornamentation of sternal shield between coxae reticulate (Fig. 11). Ventroanal shield with several T-form setae, and on posterior region with several well sclerotised V-like bulges (Fig. 12).

Stigmae and peritreme not clearly visible.

Genital shield located between coxae 2 and 4, scutiform with reticulate pattern and without processes (Fig. 11).

Gnathosoma (Fig. 13). Corniculi horn-like, laciniae long with some branches bearing several long hairs. Hypostomal setae as follows: *h1* long, smooth and setiform, *h2*, *h3* and *h4* with serrated margin, *h2* and *h4* as long as *h1*, *h3* longer than *h2*. Labrum with short hairs. Epistome not clearly visible. Tritosternum with narrow basis, laciniae with four branches, one of them with serrated margin (Fig. 14). Chelicerae with nodus. Digitus fixus bearing one tooth (Fig. 15).



Figures 16-21. Trachyuropodid mites from the Carpathian Basin. 16 = *Leonardiella riccardiana* (Leonardi, 1895), 17 = *Trachyuropoda bostocki* (Michael, 1894), 18 = *Trachyuropoda myrmecophila* Wiśniewski & Hirschmann, 1992, 19 = *Trachyuropoda hirschmanni* Pecina, 1980, 20 = *Trachyuropoda troguloides* (Can. & Franz., 1877), 21 = *Trachyuropoda wasmanniana* Berlese, 1903. (Scale bars 100 μm each)

Male, nymphs and larva are unknown.

Etymology. The name of the new species refers to the three pairs of strongly sclerotised tooth-like bulges.

Genus ***Leonardiella*** **Berlese, 1904**

Trachyuropoda: Kontschán 2002b: 51 (part.), Kontschán 2002c: 347 (part.), Kontschán 2003b: 55 (part.), Mašán 2001: 238-239 (part.).

Diagnosis. Shape oblong, posterior margin rounded. Dorsal shield with one long, well sclerotised line, marginal shield wide.

Type species: Leonardiella canestriana Berlese, 1891

Leonardiella riccardiana **(Leonardi, 1895)**
(Fig. 16)

Uropoda riccardiana Leonardi, 1895: 318.
Trachyuropoda riccardina (sic!)*:* Kontschán 2002b: 51; Kontschán 2002c: 347;
Trachyuropoda riccardiana: Kontschán 2003b: 55, Mašán 2001: 238-239.

Diagnosis. Length of idiosoma 680-720 µm, width 420-450 µm. Shape oblong, posterior margin rounded. Dorsal shield with one long, well sclerotised line, marginal shield wide. Central part of dorsal shield with one well sclerotised semicircular bulge.

Distribution. Austria, Slovakia, Romania, Italy, Hungary.

Previous records from the Carpathian Basin. Hungary: Budai Hegység (Kontschán, 2002 b), Bársonyos (Kontschán, 2002 c), Aggteleki Nemzeti Park (Kontschán, 2003 b). *Slovakia*: Malé Karpaty, Povazsky Inovec, Slovenksy Kras (Mašán, 2001).

New records. Hungary: Vértes Mts., Gánt, ant nest, 09.08.2002, leg. J. Kontschán; Csévharaszt, ant nest, 07.05.2002, leg. J. Kontschán; Aranyosgadány, Viszló völgy, ant nest, 15.08.1976, leg. S. Mahunka & L. Mahunka-Papp; Kám, wet medow, 09.04.1964, leg. T. Kassai & S. Mahunka; *Romania:* Transylvania, Tordai hasadék, from ant nest, 28.07.1992, leg. L. Peregovits.

Genus ***Trachyuropoda*** **Berlese, 1888**

Diagnosis. Shape oblong or oval, posterior margin rounded. Dorsal shield with several long, different-shaped lines, semicircular bulges and furrows. Several T-form setae can be found on dorsal shield.

Type species: Trachyuropoda festiva (Berlese, 1888).

Key to species of Trachyuropoda

1 (8) Long, well sclerotised dorsal lines divided into smaller parts
2 (5) U- and Y-shaped bulges between long, well sclerotised lines
3 (4) Third part of well sclerotised lines converse U-form……...***troguloides*** (Can. & Franz)
4 (3) Posterior part of well sclerotised lines in contact by one long, undulate lateral line……...
myrmecophila Wiśniewski & Hirschmann
5 (2) Not bulges between long, well sclerotised lines
6 (7) Additional two well sclerotized lines between third part of well sclerotised lines…….
bostocki (Michael)
7 (6) No additional well sclerotized lines between third part of well sclerotised lines……..
wasmanniana Berlese
8 (1) Long, well sclerotised dorsal lines not divided…..
hirschmanni Pecina

Trachyuropoda bostocki **(Michael, 1894)**
(Fig. 17)

Glyphopsis Bostocki Michael, 1894: 301-303.
Trachyuropoda rostocki (sic!): Balogh 1938b: 71.
Trachyuropoda bostocki: Mašán 2001: 240-241.

Diagnosis. Length of idiosoma 1600-1750 µm, width 1100-1200 µm. Shape oval, posterior margin rounded. The apical part of dorsal shield with three well sclerotised semicircular bulges. Central region of dorsal shield with two well sclerotised long lines divided into two or three parts. Posterior part of dorsal shield with two pairs of well sclerotised lines; near their anterior part there is a

transversal, well sclerotised line in a furrow. Central and posterior part of dorsal shield with alveolar ornamentation.

Distribution. The Netherlands, United Kingdom, Luxemburg, Austria, Hungary.

Previous records from the Carpathian Basin. Hungary: Pilisszentkereszt (Balogh,1938). *Slovakia*: Povazsky Inovec, Slovensky Kras (Mašán, 2001).

New records. Hungary: Szanda, Szanda-hegy, from beech forest, 14.05.1994, leg. O. Merkl; Bakony, Réde, 11.09.2002, leg. J. Kontschán.

Trachyuropoda myrmecophila Wiśniewski & Hirschmann, 1992
(Fig. 18)

Trachyuropoda myrmecophila Wiśniewski & Hirschmann, 1992: 8-15, Kontschán 2002b: 51, Mašán 2001: 241-242.

Diagnosis. Length of idiosoma 1250-1400 µm, width 800-850 µm. Shape oblong, posterior margin rounded. Apical part of dorsal shield with one circular and two semicircular well sclerotised bulges. Marginal part of central region of dorsal shield with two well sclerotised, long lines divided into two or three parts. Central part of central region with one converse Y-shaped and one U-shaped, well sclerotised line. Posterior part of dorsal shield with two pairs of well sclerotised lines. Posterior part of two marginal lines in contact by one long, undulate lateral line.

Distribution. Poland, Slovakia, Hungary.

Previous records from the Carpathian Basin. Hungary: Csévharaszt (Kontschán, 2002 b). *Slovakia*: Povozsky Inovec, Podunajská Rovina (Mašán, 2001).

Trachyuropoda hirschmanni Pecina, 1980
(Fig. 19)

Trachyuropoda hirschmanni Pecina, 1980: 373-376, Kontschán 2002b: 54, Mašán 2001: 235-236.

Diagnosis. Length of idiosoma 660-680 µm, width 420-480 µm. Shape oval, posterior margin rounded. The apical part of dorsal shield with one circular, well-sclerotised bulge. One pair of long, well-sclerotised lines of large S-form on their posterior region can be found on dorsal shield.

Distribution. Europe.

Previous records from the Carpathian Basin. Hungary: Budai Hegység (Kontschán, 2002 b). *Slovakia*: Malé Karpaty (Mašán, 2001).

New records. Romania: Transylvania, Tordai hasadék, from ant nest, 28.07.1992, leg. L. Peregovits; Transylvania, Tordai hasadék, from soil, 28.07.1992, leg. L. Peregovits.

Trachyuropoda troguloides (Can. & Franz., 1877)
(Fig. 20)

Trachynotus troguloides Canestrini & Fanzago, 1877: 62. Kontschán 2002c: 347, Mašán 2001: 239-240.

Diagnosis. Length of idiosoma 950-1050 µm, width 610-760 µm. Shape oval, posterior margin rounded. One pair of long, well sclerotised lines can be found on dorsal shield, divided into three parts. First part can be found on apical part of dorsal shield, its shape similar to number 7, second part similar to number 1 and third part similar to converse U. First and second pairs of lines can be seen as two U-shaped, well sclerotised bulges.

Distribution. West and Central Europe.

Previous records from the Carpathian Basin. Hungary: Bársonyos (Kontschán, 2002 c); South Transdanubian (Kontschán, 2003 c). *Slovakia*: Vychodoslovenská Rovina, Slovensky Kras (Mašán, 2001).

New records. Hungary: Nagykovácsi, 09.07. 1978, leg. L. Zombori.

Trachyuropoda wasmanniana Berlese, 1903
(Fig. 21)

Trachyuropoda (Janetiella) wasmanniana Berlese, 1903: 249-250.
Trachyuropoda wasmannia (sic!) Kontschán 2002b: 53.

Diagnosis. Length of idiosoma 980-1020 µm, width 700-780 µm. Shape oval, posterior margin rounded. One pair of long well sclerotised lines

on dorsal shield, divided into three parts. Central and posterior part of dorsal shield with alveolar ornamentations.

Distribution. Europe.

Previous records from the Carpathian Basin. Hungary: Csévharaszt (Kontschán, 2002 b).

b) Subfamily **Oplitinae Hirschmann & Zirngiebl-Nicol, 1962**

Diagnosis. Idiosoma oval or circular. Dorsal, marginal and ventral shield not strongly sclerotised. Dorsal shield without strongly sclerotised lines, rings and furrows. Genital shield of female large, oval. Epistome with three branches, their margin serrated.

Key to genera of Oplitinae

1 (2) Perigenital line and preanal line present……..
Oplitis Berlese
2 (1) Perigenital line and preanal line absent……..……
Urodiscella Berlese

Genus ***Urodiscella*** **Berlese, 1903**

Oplitis: Hirschmann 1981: 341, Mašán 2001: 247-249.

Diagnosis. Idiosoma oval, posterior margin rounded, anterior margin peaky. Genital shield oval, without perigenital line. Ventroanal shield with numerous smooth, short and needle-like setae.

Type species: Urodiscella alophora Berlese, 1903.

Key to species of Urodiscella

1 (2) Two lines on anterior region of sternal shield absent…….***philoctena*** (Touessart)
2 (1) Two lines on anterior region of sternal shield present
3 (4) Posterior part of genital shield of female without ornamentation……..***schmitzi*** (Kneissl)
4 (3) Posterior part of genital shield of female with alveolar ornamentation…….***wasmanni*** (Kneissl)

Urodiscella philoctena **(Touessart, 1902)**

Uropoda philoctena Touessart, 1902: 36-38.
Urodiscella philoctena: Balogh 1938b: 71.

Diagnosis. Length of idiosoma 550-570 µm, width 440-450 µm. Shape oval, posterior margin rounded. Sternal and ventroanal shield without sculpture, all sternal and ventroanal setae short, smooth and needle-like. Anterior part of sternal shield without lines. Genital shield of female large, oval, anterior region bearing reticulate ornamentation. Peritreme hook-like.

Distribution. France, United Kingdom, Ireland, Poland, Hungary.

Previous records from the Carpathian Basin. Hungary: Pilisszentkereszt (Balogh, 1938 b).

Urodiscella schmitzi **(Kneissl, 1908)**

Uropoda philoctena var. *schmitzi* Kneissl, 1908: 226-229.
Oplitis schmitzi: Hirschmann 1981: 341, Mašán 2001: 248-249.

Diagnosis. Length of idiosoma 500-600 µm, width 400-430 µm. Shape oval, posterior margin rounded. Sternal and ventroanal shield without sculpture, all sternal and ventroanal setae short, smooth and needle-like. Two lines on anterior part of sternal shield. Genital shield of female large, oval, anterior region with reticulate ornamentation. Peritreme hook-shaped.

Distribution. The Netherlands, Spain, Poland, Slovakia.

Previous records from the Carpathian Basin. Hungary: Hortobágyi Nemzeti Park (Hirschmann, 1981). *Slovakia*: Podunajská rovina, Trnavská Pahorkatina, Malé Karpaty, Slovensky Kras (Mašán, 2001).

Urodiscella wasmanni **(Kneissl, 1907)**
(Fig. 22)

Uroobovella wasmanni Kneissl, 1907: 190-191.
Oplitis wassmanni: Mašán 2001: 247-248.

Diagnosis. Length of idiosoma 460-500 µm,

width 390-420 μm. Shape oval, posterior margin rounded. Sternal and ventroanal shield without sculpture, all sternal and ventroanal setae short, smooth and needle-like. Two lines present on anterior part of sternal shield. Genital shield of female large, oval, anterior region with reticulate ornamentation, posterior region with alveolar ornamentation. Peritreme hook-form.

Distribution. Germany, Spain, Poland, Romania, Slovakia, Hungary.

Previous records from the Carpathian Basin. *Slovakia*: Borská nízina, Bukovské vrchy, Polana, Veporské vrchy (Mašán, 2001).

New records. *Hungary:* Kercaszomor, ant nest, 19.08.2004, leg. L. Peregovits. *Romania:* Transylvania, Torocko, Székelykő, from soil, 20.08. 1999, leg. F. Mészáros.

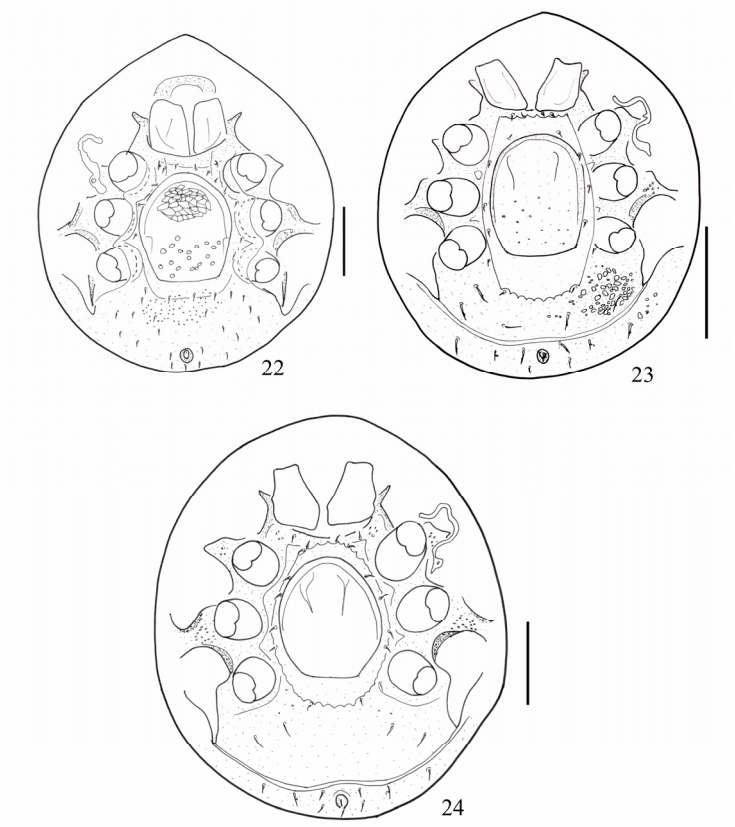
Genus ***Oplitis*** **Berlese, 1884**

Diagnosis. Idiosoma oval, posterior and anterior margin rounded. Genital shield oval, with perigenital line. Ventroanal shield with preanal line and 2-6 pairs of ventroanal setae.

Type species: Oplitis paradoxa (Canestrini & Berlese, 1884).

Key to species of Oplitis

1 (4) All perigenital lines undulate
2 (3) Peritreme U-shaped……***conspicua*** (Berlese)
3 (2) Peritreme M-shaped……..***pecinai*** Hirschmann
4 (1) Only anterior and posterior genital lines undulate
5 (6) Peritreme M-shaped……***leonardiana*** (Berlese)
6 (5) Peritreme U-shaped



Figures 22-24: Oplitinae mites from the Carpathian Basin: 22: *Urodiscella wasmanni* (Kneissl, 1907), 23: *Oplitis pecinai* (Hirschmann, 1984), 24: *Oplitis minutissima* (Berlese, 1903). (Scale bars 100 μm each).

7 (8) Ventroanal shield with small alveolar ornamentations…….***mahunkai*** Wiśniewski & Hirschmann
8 (7) Ventroanal shield with both smaller and larger alveolar ornamentations…....***minutissima*** (Berlese)

Oplitis conspicua (Berlese, 1903)

Uroplitella conspicua Berlese, 1903: 250.
Oplitis conspicua: Hirschmann 1981: 341; Hirschmann 1990: 705; Wiśniewski 1996: 485, Mašán 2001:252.

Diagnosis. Length of idiosoma 440-520 µm, width 370-450 µm. Shape oval, posterior margin rounded. Sternal and ventroanal shield with alveolar ornamentation, all sternal setae short, smooth and needle-like. Ventroanal setae arrow-like. Genital shield of female large, oval, with alveolar ornamentation. All perigenital line undulate. Peritreme U-shaped.

Distribution. Europe.
Previous records from the Carpathian Basin. Hungary: Hortobágyi Nemzeti Park (Hirschmann, 1981), Bátorliget (Hirschmann, 1990), Bükki Nemzeti Park (Wiśniewski, 1996). *Slovakia*: Malé Karpaty, Povazsky Inovec, Tríbec (Mašán, 2001).

Oplitis pecinai Hirschmann, 1984
(Fig. 23)

Oplitis pecinai Hirschmann, 1984: 159, Mašán 2001: 250-252, Kontschán 2004: 300-301.

Diagnosis. Length of idiosoma 440-540 µm, width 380-460 µm. Shape oval, posterior margin rounded. Sternal and ventroanal shield without ornamentation. All sternal setae short, smooth and needle-like. Ventroanal setae needle-like. Genital shield of female large, oval, without ornamentation. All perigenital line undulate. Peritreme M-shaped.

Distribution. Europe.
Previous records from the Carpathian Basin. Hungary: Gerecse (Kontschán, 2004). *Slovakia*: Malé Karpaty, Povazsky Inovec, Slovesky kras, Tíbec (Mašán, 2001).

Oplitis leonardiana (Berlese, 1903)

Uropoda leonardiana Berlese, 1903: 20-21.
Oplitis leonardiana: Wiśniewski 1993: 265.

Diagnosis. Length of idiosoma 540-550 µm, width 480-450 µm. Shape oval, posterior margin rounded. Ventroanal setae arrow-like. Genital shield of female large, oval, with alveolar ornamentation. Anterior and posterior margin of perigenital line undulate. Peritreme M-shaped.

Distribution. Italy, Austria, Hungary.
Previous records from the Carpathian Basin. Hungary (Wiśniewski, 1993).

Oplitis mahunkai Wiśniewski & Hirschmann, 1995

Oplitis mahunkai Wiśniewski & Hirschmann 1995: 215-217.

Diagnosis. Length of idiosoma 410 µm, width 350 µm. Shape oval, posterior margin rounded. Ventroanal setae arrow-like. Genital shield of female large, oval, with alveolar ornamentation. Anterior and posterior margin of perigenital line undulate. Peritreme U-shaped.

Distribution. Hungary.
Previous records from the Carpathian Basin. *Hungary:* Bátorliget (Wiśniewski & Hirschmann, 1995)

Oplitis minutissima (Berlese, 1903)
(Fig. 24)

Uroplitella minutissima Berlese, 1903: 318, Balogh 1938a: 108.
Oplitis minutissima: Hirschmann 1990: 705, Mašán 2001: 255-256, Kontschán 2002c: 347, Kontschán 2003b: 55, Kontschán 2003c: 297, Kontschán 2005: 115.

Diagnosis. Length of idiosoma 400-420 µm, width 290-330 µm. Shape oval, posterior margin rounded. Ventroanal setae blade-like. Genital shield of female large, oval, with punctuate ornamentation. Ventroanal shield with larger or smaller alveolar ornamentation. Anterior and pos-

terior margin of perigenital line undulate. Peritreme U-shaped.

Previous records from the Carpathian Basin. Hungary: Kőszeg (Balogh, 1938 a), Bátorliget (Hirschmann, 1990), Bársonyos (Kontschán, 2002 c), Aggtelek National Park (Kontschán, 2003 b), Bársonyos (Kontschán, 2003 c), Őrség (Kontschán, 2005). *Slovakia*: Bukovské Vrchy, Polana, Povazsky Inovec, Slovensky kras, Vychodoslovenská rovina (Mašán, 2001).

New records. Hungary: Vértes, Gánt, ant nest, 24.08.2002, leg. J. Kontschán; Csévharaszt, ant nest, 07.06.2002, leg. J. Kontschán; Szakonyfalu, ant nest, 22.05.1989, leg. S. Mahunka & L. Mahunka-Papp; Szín from soil, 16. 06.1986, leg S. Mahunka; Darány, Nagyberek, ant nest, 15.08. 1976, leg S. Mahunka & L. Mahunka-Papp. *Romania:* Transylvania, Tordai hasadék, 28.07. 1992, leg. L. Peregovits; Maramures county, Maramures Mts, Petrova, Frumuseana, sidebrook of Tomnatic stream in pine-beech mixed forest, 25.05.2006, leg. Dányi L., Földvári M., Kontschán J. & Murányi D.; Maramures county, Gutai Mts, left side stream of Mara river in a beech forest, 23.05.2006, leg. Dányi L., Földvári M., Kontschán J. & Murányi D.

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Opusc. Zool. Budapest, 2005 (2007), 36: 57-68

Oribatids from the Carpathian Basin with zoogeographical and taxonomical notes (Acari: Oribatida), II

S. MAHUNKA[1]

Abstract. A list of oribatids collected at several sites in Transylvania, Romania (Carpathian Basin) includes 17 species. The study yielded some species new for the examined area and three (*Dissorhina muranyii, Oppiella (Rhinoppia) mikoi, Conchogneta weigmanni* spp. n.) new to science. Some taxonomical notes on rare or little known species (e.g. *Hungarobelba visnyai, Dissorhina* spp.) and notes on zoogeographical distribution of some species are given. With 13 figures.

INTRODUCTION

The goals and possibilities of the oribatidological research in the Carpathian Basin* I had already summarised in the first part (Mahunka 2006 a) of this series of papers. Reference was made to the same also in the publication of the results obtained (Mahunka 2006 b) in the elaboration of the fauna of Máramaros (Romania). It was striking to notice already then that as far as the genesis of the fauna of the Carpathian Basin is concerned, what an important role is played by the fauna of Transylvania. In the progress of this work this impression became even stronger justifying the correctness of my "pincers" theory (Mahunka 1999, Mahunka & Mahunka-Papp 2004) which I formulated when examining the immigration of certain faunal elements during and after the glacial period from the Balkan Peninsula towards Transylvania and the other regions of the Basin.

For this very reason I continue to examine the various material derived form Transylvania. I discuss the total of 6 species, of which three are new to science, and several new to the fauna of this geographical region. The samples come from various areas of Transylvania. The collecting localities as given by the collectors have already been published in my earlier papers. Likewise, I made reference to the most important authors whose systems I used, in the majority of cases modified including the most comprehensive morphological works.

LIST OF LOCALITIES

E-1564 Transylvania, Băile Balvanyos (Bálványosfürdő), beach forest, moss from tree bark. 1000 m, 20.09.2007., leg. Zs. Jely and E. Horváth.

E-1567 Transylvania, Băile Balvanyos (Bálványosfürdő), beach forest, litter and soil. 1054 m, 21.09.2007., leg. Zs. Jely and E. Horváth.

E-1569 Transylvania, Băile Tuşnad (Tusnádfürdő), Szt. Anna lake, moss from the lake shore, 21.09.2007., leg. Zs. Jely and E. Horváth

E-1580 Transylvania, Bihar Mts., Nof Canda, beach forest, Arvenul Zuresti depression, 900 m, 25. 07. 2003. Leg. T. Pócs.

E-1588 Transylvania, Harghita Mts., below the summit, marshland, *Sphagnum* bog, 1750 m, 07.2003., leg. Cs. Csuzdi.

E-1677 Transylvania, Retezat (Retyezát) Mts., Lapusnyik-valley, cca. 1200 m, spruce-wood, 02.07.2005., leg. Cs. Csuzdi.

E-1679 Transylvania, Vladeasa (Vlegyásza) Mts., below the hospice, 1300 m, spruce-wood, 01.07.2005. leg. Cs. Csuzdi.

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LIST OF THE NEWLY IDENTIFIED SPECIES

BRACHYCHTHONIIDAE Thor, 1934

Eobrachychthonius borealis Forsslund, 1942
Locality: Romania, E-1677.

Liochthonius muscorum Forsslund, 1964
Locality: Romania, E-1569.

Liochthonius peduncularis (Strenzke, 1951)
Locality: Romania, E-1569.

COLLOHMANNIIDAE Grandjean, 1958

Collohmannia gigantea Sellnick, 1922
Locality: Romania, E-1580.

CARABODIDAE C. L. Koch, 1837

Odontocepheus elongatus (Michael, 1879)
Locality: Romania, E-1679.

ORIBELLIDAE Kunst, 1971

Oribella pectinata (Michael, 1885)
Locality: Romania, E-1677.

OPPIIDAE Sellnick, 1937

Berniniella sigma (Strenzke, 1951)
Locality: Romania, E-1567.

Dissorhina signata (Schwalbe, 1989)
Localities: Romania, E-1588, E-1677.

Lauroppia acuminata (Strenzke, 1951)
Locality: Romania, E-1564.

SUCTOBELBIDAE Jacot, 1938

Suctobelbella sarekensis (Forsslund, 1941)
Locality: Romania, E-1677.

ORIBATELLIDAE Jacot, 1925

Oribatella hungarica Balogh, 1943
Locality: Romania, E-1677.

DESCRIPTIONS OF NEW AND NOTES ON RARE SPECIES

HUNGAROBELBIDAE Miko & Travé, 1996

Hungarobelba visnyai (Balogh, 1938)

The species was already recorded for Transylvania, particularly from the Retyezát Mts. Miko & Travé (1996) thoroughly examined the species when describing a new species from the Pyrenees. The recently collected specimen by having a robust *Aa* protuberance on its pro-dorsum is unequivocally closer to *visnyai* than to *pyrenaica.* On the other hand, the *spinae adnatae* on the Transylvanian specimen are much narrower and longer too, and what is more, it has a further protuberance at the basis of the inter-lamellar seta. The prodorsal protuberance *(ptp)* is elongate, comparatively small, its brim comprises several small arches, and in front there is a semi-lunar rib being somewhat more robust than the rest. For this particular reason in case further specimens come forward, the examination will have to be made anew.

OPPIIDAE Sellnick, 1937

Dissorhina muranyii sp. n.
(Figs. 1-3.)

Material examined. Holotype: Romania, Transylvania, Vladeasa (Vlegyásza) Mts., below the hospice, 1300 m, spruce-wood, 01.07.2005. leg. Cs. Csuzdi (E-1679)[1]. 7 paratypes from the same sample. Holotype (1727-HO-2007) and 2 paratypes (1727-PO-2007): HNHM[2], 1 Paratype: MHNG[3].

[1] Collection number of the Soil samples material in the HNHM.
[2] HNHM: deposited in the Hungarian Natural History Museum, Budapest, with identification number of the specimens in the Collection of Arachnida.
[3] MHNG: deposited in the Muséum d'histoire naturelle, Genève.

Diagnosis. Rostrum tripartite with large and well-protruding median apex.

Two pairs of weak transversal costulae and one pair of short, longitudinal ones present basally. Sensillus gradually widened distally, with 5 (4) long branches. Postbothridial tubercles present. No essential difference – except the short setae *ta* - in length of the notogastral setae. Five pairs of genital setae arranged nearly in one row, g_5 much longer than the others.

Measurements. Length of body: 218-231 μm, width of body:118-129 μm.

Prodorsum. Rostral apex triangular, conspicuously protruding from the rostral part of prodorsum. Incisure wide, lateral teeth rounded, much shorter than the rostral apex. Prodorsal surface ornamented by a peculiar structure, consisting of 2-3 pairs short, slightly bent transversal and a pair of short, longitudinal ones basally (Fig. 1). Some weak maculae visible laterally. Rostral setae slightly pilose, arising in typical position on the rostral apex. Ratio of the prodorsal setae: *ro* = *exa* > *in* > *le*. Sensillus gradually dilated distally, with rounded distal end bearing 4-5 branches on its margin. A pair of well-developed posterobothridial tubercles present.

Notogaster. Anterior part well narrowed anteriorly, a short median part straight. Ten pairs of comparatively thick and long notogastral setae present, c_2 much shorter, setae p_2 and p_3 not shorter than the others. Setae h_1 characteristically bent outwards.

Lateral part of podosoma. Pedotecta I very small. Some maculae and some granulate spots present in this region, some well-sclerotised crests present above the legs (Fig. 3).

Ventral parts (Fig. 2). Apodemes and epimeral borders mostly weakly developed. *Ap 2* not connected medially and only a short, anterior part of the sternal apodemes observable. *Ap. 4* well developed, wide, a pair of postero-epimeral fossa also observable. Epimeral surface ornamented by polygonal pattern, epimere I granulate anteriorly. Epimeral setae short, some of them finely ciliate. All setae in the anogenital region short and simple, setae g_5 longer than the other genital ones. Lyrifissures *iad* in adanal position setae ad_1 arising on a short crest.

Legs. Not studied.

Remarks. See the notes on the *Dissorhina* Hull, 1916 species.

Etymology. I dedicate the new species to Dávid Murányi (Budapest, HNHM) for his intensive collecting activities, also in soil zoology.

Dissorhina carpatica Gordeeva et Melamud, 1991 stat. n. (Figs. 4-6.)

The taxon was described by the authors as a subspecies of *Oppia longipilosa* Kunst, 1958. On the basis of the rostral shape, the length of the setae of both the prodorsum and the notogaster, but more especially the shape of the sensillus, I consider it to be an independent species standing closer rather to *D. peloponnesiaca* (Mahunka, 1974) than to *D. longipilosa.*

Measurements. Length of body: 218-231 μm, width of body: 118-129 μm.

Prodorsum. Rostral apex triangular (Fig. 6). Prodorsal costulae compose a peculiar network (Fig. 4), a long transversal costula distinct, and a pair of longitudinal ones also well observable. Lamellar setae very short, interlamellar ones conspicuously long.

Notogaster. Ten pairs of long, well-ciliate notogastral setae present.

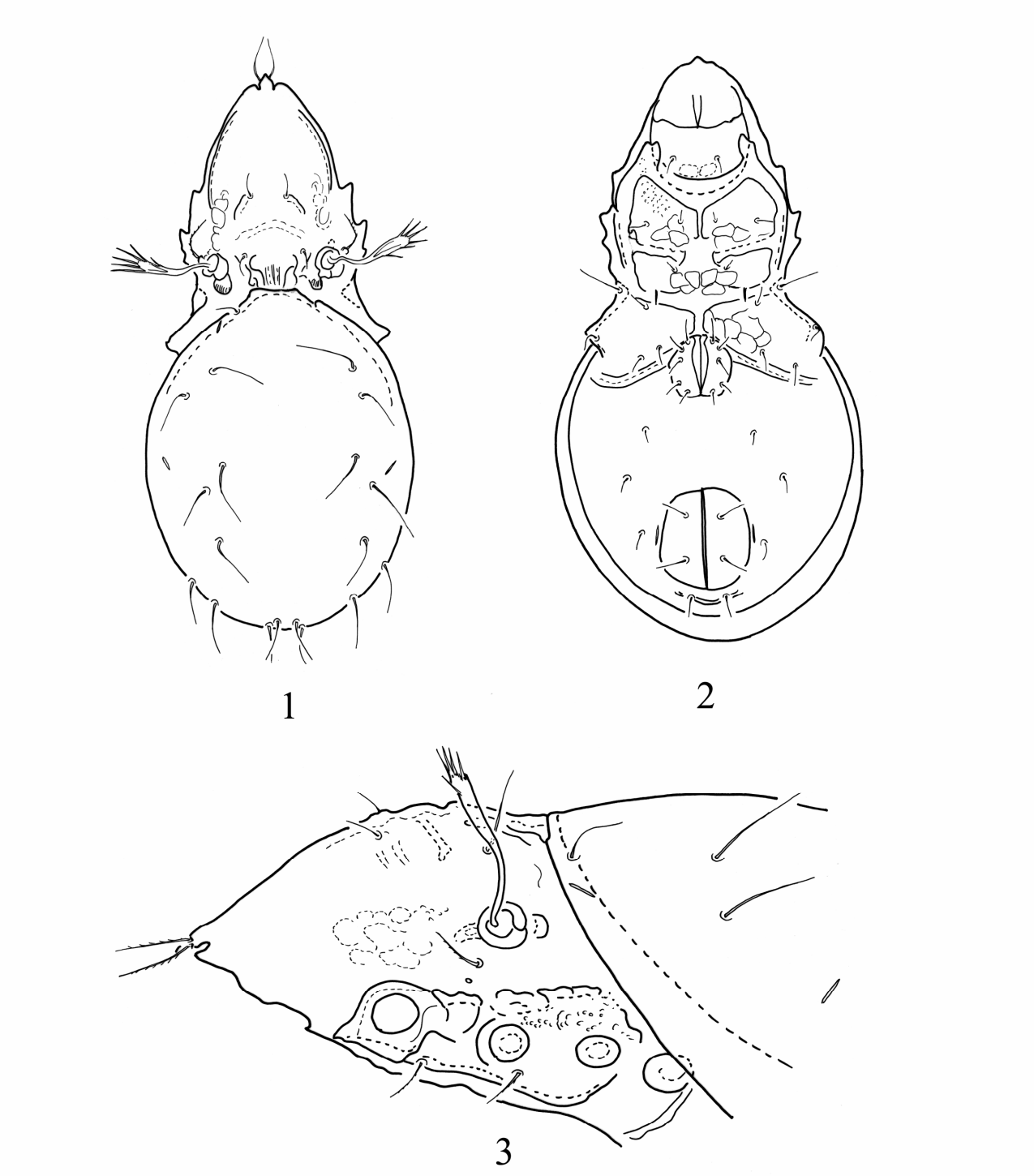
Ventral parts (Fig. 5). Epimeral borders well developed, but sternal one absent between *bo. 2.* and *bo. sej.* All epimeral setae comparatively long. A guttiform structure observable in posteromarginal position.

The genus *Dissorhina* Hull, 1916 and its taxa at species level

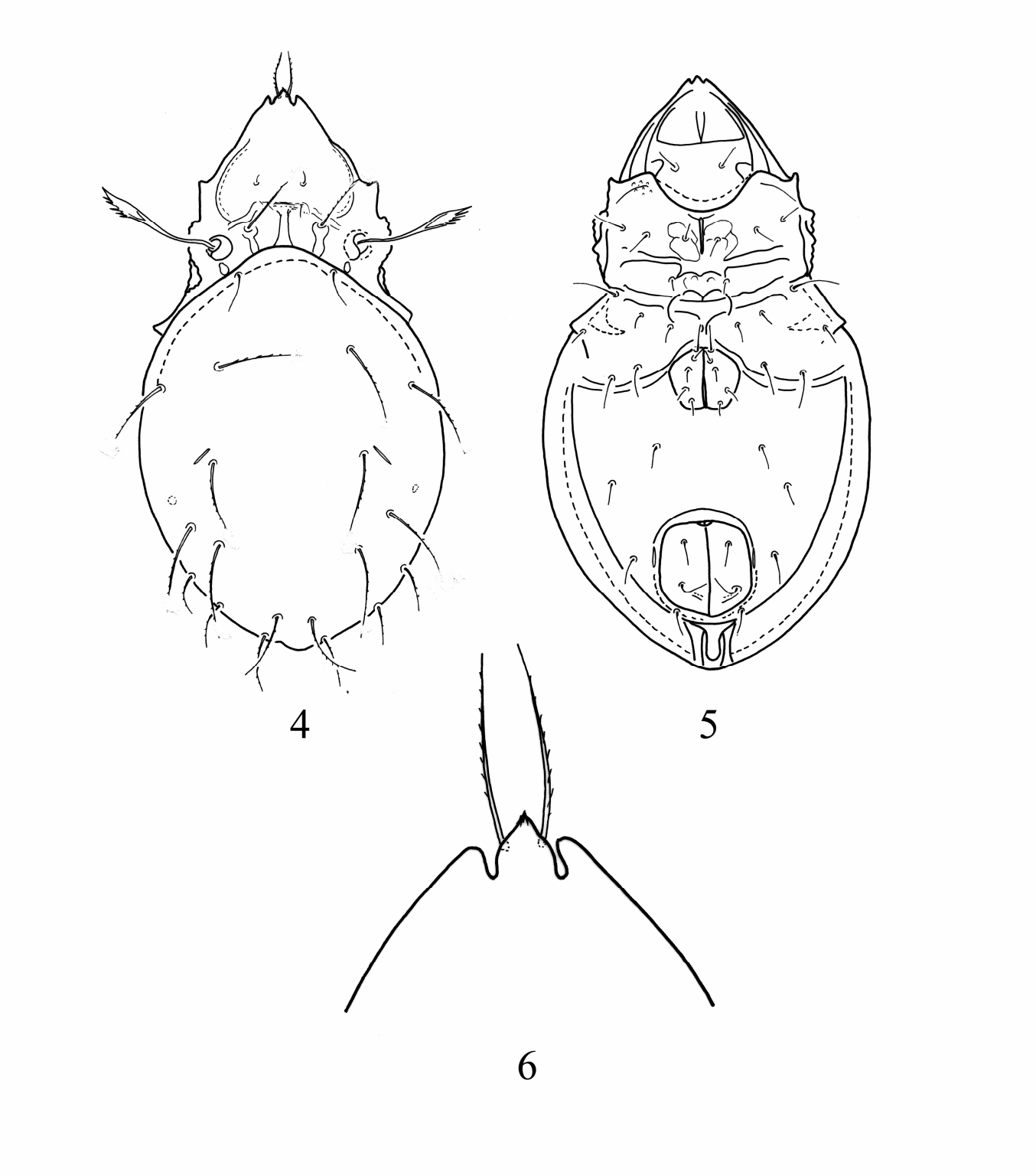
Dissorhina Hull, 1916: 401.

Type species: *Notaspis splendens* Koch, 1841 sensu Michael, 1888 = *Eremaeus ornatus* Oudemans, 1900.

Cosmoppia Balogh, 1983: 24.



Figures 1-3. *Dissorhina muranyii* sp. n. – 1 = body in dorsal view, 2 = body in ventral view, 3 = prodorsum in lateral view



Figures 4-6. *Dissorhina carpathica* Gordeeva et Melamud, 1991 – 4 = body in dorsal view, 5 = body in ventral view, 6 = rostral apex

Type species: *Eremaeus ornatus* Oudemans, 1900.

According to Subías (2004) the genus comprises seven species and five subspecies. He also records four synonyms of *D. ornata*.

Dissorhina bolei (Tarman, 1958)
Dissorhina bulganenesis Bayartogtokh, 1999
Dissorhina longipilosa longipilosa (Kunst, 1958)
Dissorhina longipilosa carpatica (Gordeeva et Melamud, 1991)
Dissorhina neotropicalis Mahunka, 1998
Dissorhina ornata ornata (Oudemans, 1900)
= *Dissorhina captator* (Hull, 1915)
= *Dissorhina lignivora* (Jacot, 1939)
= *Dissorhina tricarinata* (Paoli, 1908)
= *Dissorhina vetula* (Hull, 1914)
Dissorhina ornata corniculata (Paoli, 1908)
Dissorhina ornata globosa (Paoli, 1908)
Dissorhina ornata peloponnesiaca (Mahunka, 1974)
Dissorhina ornata tunisica (Mahunka, 1980)
Dissorhina signata (Schwalbe, 1989)
Dissorhina tricarinatoides (Dubinina, 1966)

Most of the synonyms are also accepted by Miko in Weigmann (2006), what is more, he also takes *globosa* as a synonym, which is distinct in Paoli's work. This concept is true as we look at the question. However, from among the subspecies we consider *D. carpatica* **stat. n.** independent besides the *D. ornata peloponnesiaca* and *D. ornata tunisica* **stat. n.**

Key to the *Dissorhina* species

1 (10) Distal end of sensillus with some long branches or cilia, at least some of them longer than the largest diameter of the sensillus.

2 (5) Transversal costulae absent, only short or longer longitudinal costulae present starting from the dorsosejugal region to the insertion of the lamellar setae.

3 (4) Only the short basal part of the longitudinal costulae present. They are shorter than the half distance between the dorsosejugal region and the insertion of the lamellar setae
tricarinatoides (Dubinina, 1966)

4 (3) In front of the basal costulae also short longitudinal costulae present, sometimes they are connected with the other ones reaching to the insertion of the lamellar setae
signata (Schwalbe, 1989)

5 (2) On the surface of prodorsum longer or shorter transversal costulae also present.

6 (7) One long, transversal costula present framing the basal part of the prodorsum. A median, long costula is connected to it from the dorsosejugal region, along it one pair of shorter, but stronger basal costulae or tubercles present
carpatica (Gordeeva et Melamud, 1991)

7 (6) Two pairs of short transversal costulae present, they are never connected medially.

8 (9) A pair of arched costulae starting from the bothridia, directed medially, present. Basal costulae weakly developed, directed laterally
peloponnesiaca (Mahunka, 1974)

9 (8) No costula starts from the bothridia, but a pair of short, independent costulae reaching to the insertion of lamellar setae. Basal costulae strongly developed
muranyii sp. n.

10 (1) Distal end of sensillus either smooth or at least with some minute aciculae or very short bristles.

11 (14) Notogastral setae at least partly very long, some of them reaching the insertion of the setae behind them.

12 (13) Sensillus very long and narrow, its distal end spiniform. Interlamellar setae reaching well over the insertion of lamellar ones. Notogastral setae setiform
longipilosa (Kunst, 1958)

13 (12) Sensillus much shorter and thicker, its distal end blunt, with some aciculae. Interlamellar setae not reaching the insertion of lamellar ones. Notogastral setae filiform
tunisica (Mahunka, 1980)

14 (11) Notogastral setae nearly equal in length, none of them reaching the insertion of the setae behind them.

15 (16) Sensillus very long, its distal end sharply spiniform, also long
longispina Mahunka, 2006

16 (15) Sensillus shorter, thicker, fusiform. Its distal end roundish, blunt at tip, sometimes covered by short aciculae or bristles.

17 (18) The middle surface of the prodorsum with some large tubercles

corniculata (Paoli, 1908)

18 (17) Prodorsal surface only with costulae.

19 (20) Basal costulae thick, reaching to the arched median ones. Insertion of the lamellar setae framed by a crest anteriorly

neotropicalis Mahunka, 1998

20 (19) Basal costulae narrow, directed laterally. Lamellar setae not framed anteriorly

ornata (Oudemans, 1900)

Oppiella (Rhinoppia) mikoi sp. n.
(Figs. 7-9.)

Material examined. Holotype: Romania, Transylvania, Vladeasa (Vlegyásza) Mts. below the hospice, 1300 m, spruce-wood, 01.07.2005. leg. Cs. Csuzdi (E-1679). 1 paratype from the same sample. Holotype (1726-HO-2007) and 1 paratype 1726-PO-2007): HNHM.

Diagnosis. Rostrum tripartite, median apex long protruding far anteriorly, lateral incisures small, roundish. Prodorsal costulae reduced, interbothridial region with one pair of arched laths. In this region one pair of punctate maculae exist. Rostral setae long, pilose, lamellar and interlamellar ones minute or short. Exobothridial setae curved inwards, pilose. Sensillus pectinate. Postbothridial tubercle present. Ten pairs of short notogastral setae. Lyrifissures *im* located conspicuously posteriorly. Epimeral setae ciliate, epimeral surface weakly polygonate. Apodemes and epimeral borders well developed, only the sternal apodeme between *ap. 2* and *ap. sej*. absent. Genito-anal setal formula: 6 – 1 – 2 – 3.

Measurements. Length of body: 389-402 μm, width of body: 194-208 μm.

Prodorsum. Rostral apex triangular, protruding from the anterior margin. Beside it a pair of small incisures present, the lateral teeth much shorter than the apex. Prodorsal costulae absent, only a pair of short, characteristically arched basal lath visible, which directed medially, and also forwards. In their arch a pair of punctate maculae present (Fig. 7). Rostral setae arising near to the rostrum on the dorsal surface of prodorsum, long and comparatively thick, well-ciliated. Lamellar and interlamellar setae short, fine, smooth, interlamellar one longer than the others. Exobothridial setae characteristically bent inwards, long, thin and pilose. Bothridium roundish without a drop-shaped posterior part, but one pair of posterobothridial tubercles present. Sensillus pectinate, with 5 long branches, its head sligthly dilated.

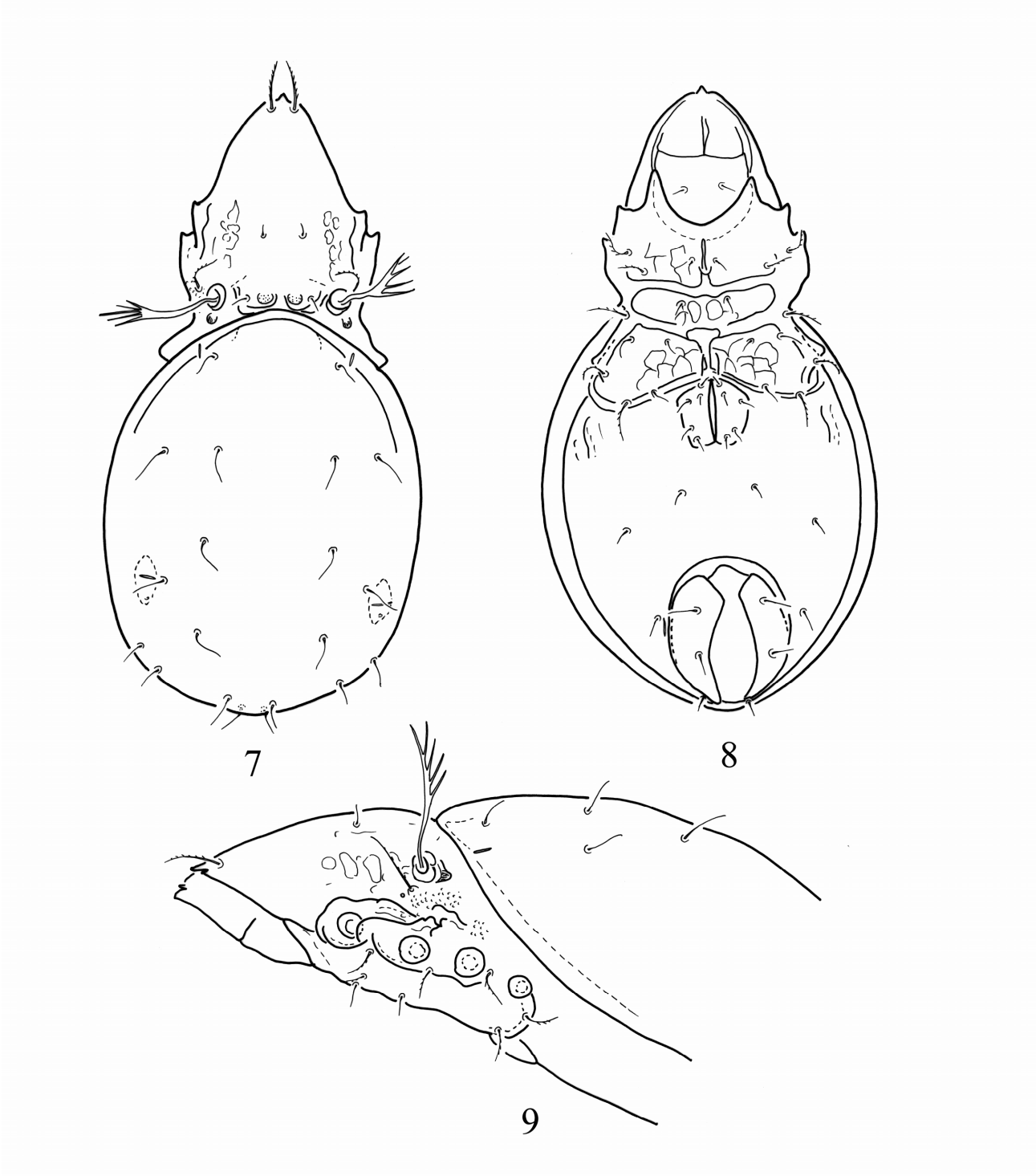
Notogaster. Dorsosejugal suture evenly protruding anteriorly. Ten pairs of short notogastral setae present, c_2 slightly shorter than the others. Setae *da* and *la* arising along a transversal line. Lyrifissures *ia* in normal, *im* in conspicuously posterior position, latter one very near to the glandular opening.

Lateral part of podosoma. Some irregular crests in exobothridial region, most part of this region granulate. Exobothridial setae very long (Fig. 9), slightly pilose, much longer than the other prodorsal setae.

Ventral parts (Fig. 8). Apodemes and epimeral borders – except the sternal ones – well developed, conspicuously bent and strong *ap. 4*. A part of the sternal apodeme reduced between *ap. 2* and *ap. sej*., a knot present on its anterior part. Epimeral surface ornamented by polygonal pattern. Epimeral setae comparatively long, most of them, firstly *1a*, *1b*, *3b*, *3c*, *4b* and *4c* well pilose. Genito-anal setal formula: 5 – 1 – 2 – 3. All setae – except setae g_5 – short, nearly equal in length.

Remarks. The new species belongs to the *subpectinata* group of the genus *Oppiella (Rhinoppia)*. It stands nearest to *O. (R.) epilata* Miko, 2006, however, the dorsosejugal suture of *epilata* is straight medially, and the punctate maculae in the interbothridial region are missing.

Etymology. I dedicate the new species to Dr. L. Miko (Brussels), the renown Chech specialist of Oribatida, a co-author with G. Weigmann in Die Tierwelt Deutschlands Oribatida volume.



Figures 7-9. *Oppiella (Rhinoppia) mikoi* sp. n. – 7 = body in dorsal view, 8 = body in ventral view, 9 = prodorsum in lateral view

Suctobelbella paracutidens Mahunka, 1983

This species stands very near to *S. acutidens acutidens* (Forsslund, 1941), *S. acutidens lobata* (Strenzke, 1951) and to *S. sarekensis* (Forsslund, 1941). However, the notogastral setae of these species are simple, smooth, on other hand, they are well pilose in *paracutidens*. Sensilli in the previous species smooth, or only with few, short cilia, but in *paracutidens* with much longer, and distinct cilia on its sensillus.

In the newly collected specimens from Transylvania the cilia are much longer than the diameter of the setae.

AUTOGNETIDAE Grandjean, 1960

Conchogneta weigmanni sp. n.
(Figs. 10-13.)

Material examined. Holotype: Romania, Transylvania, Bihar Mts., Nof Canda, beach forest, Arvenul Zuresti depression, 900 m, 25. 07. 2003. Leg. T. Pócs (E-1580) 1 paratype: Romania, Transylvania, Vladeasa (Vlegyásza) Mts., below the hospice, 1300 m, spruce-wood, 01.07.2005. leg. Cs. Csuzdi (E-1679). Holotype (1725-HO-2007) and 1 paratype: (1725-PO-2007): HNHM.

Diagnosis. Rostral apex with a deep incision. Costulae wide consisting of two laths. Along the costulae a well framed oval field present. Exobothridial region covered by small or large tubercles, partly granulate. Two pairs of basal tubercles present, a pair of short longitudinal seen, bearing the thin, setiform interlamellar setae. Sensillus long, directed outwards, its head lanceolate, with 2-3 short spines. Ten pairs of long, setiform notogastral setae present, their distal part filiform. Lyrifissures *iad* located far from the anal plates, setae ad_3 much shorter than the other two pairs. The latter ones arising on a weak lath.

Measurements. Length of body: 314-340 μm, width of body: 163-189 μm.

Prodorsum. Rostral incisure slightly narrowing basally, U-shaped. Rostral teeth sharply pointed. Distal part of lamellae strongly dilated, divided in two laths. Its inner margin running partly parallel, their distal end blunt at tip. (Fig. 10). There is a pair of large, nearly oval, well-framed lateral field, ornamented by hardly observable polygonal pattern (Fig. 12). The lateral tubercles absent. A fine transversal lath present in the interbothridial region, bearing two pairs of tubercles. Rostral and lamellar setae setiform, thin, rostral ones only slightly bent inwards. Interlamellar setae thin, setiform, with filiform distal end. Bothridium with large, guttiform protuberances posteriorly. Sensillus long, directed outwards and backwards, its head lanceolate, distal part covered by 2-3 small spines.

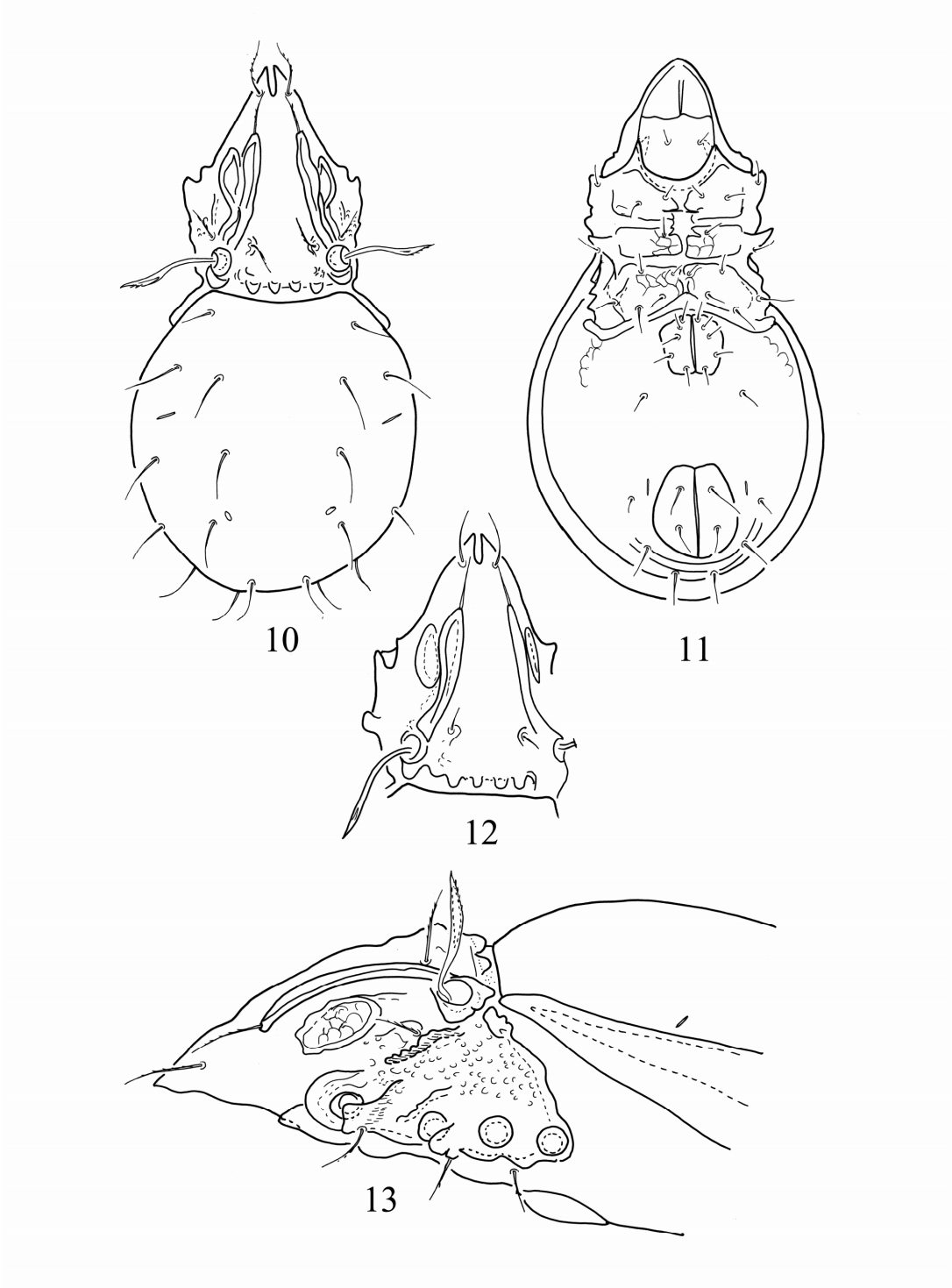
Notogaster. Humeral part of notogaster with a pair of very small protuberances. Ten pairs of setiform, mostly thin notogastral setae present, with filiform distal part. Without larger variation in length, only setae c_2 shorter, than the others.

Lateral part of podosoma. Along the lamellae a well framed oval field (Fig. 13) present, ornamented by weak polygonal pattern. Exobothridial region covered by characteristic, comparatively large granules and short laths. Anterior part of this field also granulate. Pedotecta I sharply pointed dorsally.

Ventral parts (Fig. 11). Apodemes and epimeral borders – except *ap. 3* – well developed, composing a thick network. Epimeral surface distinctly polygonate. All epimeral setae short, finely roughened, setae *1c* originating laterally, on pedotecta 1. Genito-anal setal formula: 5 – 1 – 2 – 3. All setae – excepting anal and adanal ones in posteromarginal position (ad_1 and ad_2) – much shorter than the others.

Remarks. The new species is well characterised by unique features: two pairs of basal tubercles in prodorsum and the shape of the costula with the large lateral oval field along it. This combination of features was unknown in this genus.

Etymology. I dedicate the new species to Prof. Dr. Gerd Weigmann (Berlin) for his outstanding work in Die Tierwelt Deutschlands Oribatida volume.



Figures 10-13. *Conchogneta weigmanni* sp. n. – 10 = body in dorsal view, 11 = body in ventral view, 12 = prodorsum in lateral view, 13 = prodorsum in dorsal view

ZOOGEOGRAPHICAL NOTES

According to the so far completed faunistical and taxonomical examinations the oribatid fauna of the Carpathian Basin is perhaps the richest in the whole of Europe. Especially true is this statement when we consider from among the four living-spaces (air, water, soil and vegetation) the fauna of the soil. Our current examinations (besides the faunistical and taxonomical ones) clearly show the richness of the oribatids prevailing here. Therefore, we would especially like to clarify the presence of the species living here, their origin, and the process and limits of their distribution.

It is highly probable that the present fauna comprises the remnants of the species having lived here during the glacial period enriched with species that immigrated to the Carpathian Basin afterwards. This duality has to be considered in spite of the fact that this regions had not been covered by ice, nevertheless, the selective effect of the glacial climate must have been in force. It is sure that more protected refuges and other warmed areas prevailed, whence in the post-glacial period with warmer and moister climate the spread of species might have occurred.

According to our earlier investigations we can definitely prove two directions of immigration which had become the basis for the whole soil mite fauna: the "pincers theory" (Mahunka 1991, Mahunka & Mahunka-Papp 2004). It is evident and we had already proved it that the decisive proportion of the immigrating species had spread through a south–north immigration route, either considering the western or the eastern branches. Considering even the quantity of the immigrating species, from the point of view of the origin of the whole fauna, special importance should be given to the Transylvanian route, to which we owe a great quantity of eastern-Mediterranean and affiliated elements.

Our recent investigations (Mahunka 2006 a, b) and the newest results clearly stress the importance of Transylvania when evaluating the fauna of the Carpathian Basin. Besides finding new proofs to demonstrate this kind of immigration, the following points were also discovered:

1. The oribatid fauna of Transylvania is extraordinarily rich. Exact numbers, of course, cannot be defined at the moment, but the preliminary calculations indicate that more species live in Transylvania than in the other parts of the Carpathian Basin collectively. Here we find the highest number of Pontian and Ponto-Mediterranean species.
2. The number of endemisms in Transylvania is outstandingly high, again, we find, there are more endemisms here than in the rest of the Basin collectively.
3. It would be a highly interesting case among the known European faunae, but the results justify us to postulate, that here, centres of species genesis had developed. According to my opinion, this is clearly proved by the recently found genera of *Dissorhina* Hull, 1916 or *Conchogneta* Grandjean, 1963, or the *"getica"* (*Oppiella (Rhinoppia*)) species group rich in species and its many allies.

Acknowledgements – I should like to thank the collectors of the examined materials. We should also like to thank Dr. Csaba Csuzdi for the help extended while preparing our manuscript and Dr. Lajos Zombori for reviewing the English text of our paper and for the translation of some paragraphs.

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Opusc. Zool. Budapest, 2005 (2007), 36: 69-77

Contribution to the knowledge of the Hungarian Oribatida fauna (Acari) II

S. MAHUNKA[1] and L. MAHUNKA-PAPP[2]

Abstract. Collecting at several sites in Hungary yielded six Oribatida species rare in Hungary [*Verachthonius diversus* Moritz, 1976, *Damaeolus ornatissimus* Csiszár, 1962, *Berniniella setilonga* Iturrondobeitia et Salofia, 1988, *Suctobelba discrepans* Moritz, 1970, *Suctobelbella messneri* Moritz, 1971, *Bipassalozetes striatus* (Mihelčič, 1955)] and two new to the science (*Amerioppia hortensis*, *Urubambates xerophilus* spp. n.). These results complement the knowledge of Hungarian oribatids and the distribution data in their catalogue published earlier (Mahunka and Mahunka-Papp 2004). Synonymies of some earlier described species from Hungary are given. With 16 figures.

INTRODUCTION

In the framework of our research project (NKFP No. 3B023-04) entitled "The origin, genesis, values and focal areas of the Carpathian Basin" (naturally including the fauna of Hungary) we intensively study the soil mite fauna (among them the Oribatida) of Hungary. As the result of this work we may declare that the Oribatida fauna of Hungary is comparatively well known, which is well shown in the Checklist and the Catalogue, the two recent publications of ours (Mahunka and Mahunka-Papp 2000, 2004).

In view of this list and the revision of our collection materials showed that, on the one hand, there are data lacking especially from taxonomic and geographical aspects, while, on the other, we possess numerous species identified meanwhile, but not published yet. For this purpose we decided to complete our fauna and naturally our detailed catalogue (see also Mahunka and Mahunka-Papp 2003). Besides these, in the species list published in the Hungarian Oribatida fauna catalogue numerous species crept in whose species identity is problematic and their validity is dubious, to which at the appropriate places we made references. The elucidation of all these is continuously our task.

In the present contribution we give the description of two species new to science, collected in Hungary. The speciality is that both originate from unusual collecting site, one was extracted from greenhouse soil, while the other from an entirely extreme site, for it came from the dry moss of loess walls. Furthermore, we list and partly describe some less known or rare species derived from quite new collecting localities. Finally, on the basis of studying the types we clarify the validity of some species and the synonymy of others.

We follow the system of Marshall et al. (1987), with some modifications introduced by Woas (2002), Subías (2004) and Weigmann (2006). In the description the morphological terminology of Woas (2002) was used with some modifications of the studied groups (e.g. Norton et al. 1997, Mahunka and Mahunka-Papp 2001, and the authors mentioned before).

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DESCRIPTION AND REDESCRIPTION OF NEW OR LITTLE KNOWN TAXA

Damaeolus ornatissimus Csiszár, 1962
(Figs. 1-4)

Material examined. Tihany. 04. 06. 2004. Leg. S. Mahunka (UTM: YM 19). From dry litter.

Remarks. In Europe it is not common, possibly a Ponto-Mediterranean species. This species is relatively frequent in Hungary, primarily in Transdanubian localities. We give some drawings from the newly collected material.

Amerioppia hortensis sp. n.
(Figs. 5-8)

Material examined. Holotype: Hungary, Eger, from soil of greenhouse. 07. 11. 2006. Leg. J. Kontschán. 3 paratypes from the same sample. Holotype (1722-HO-2006) and 2 paratypes (1722-PO-2006): HNHM[1], 1 paratype: MHNG.[2]

Diagnosis. Rostrum conical, rostral setae arising on its surface being much thicker than the lamellar ones. Interbothridial setae absent. Lamellar lines, three pairs of interbothridial maculae and some larger spots present on the prodorsal surface. Sensillus long, with lanceolate head. Ten pairs of notogastral setae, setae c_2 minute. Some of the epimeral setae (e.g. *1b, 3b, 4b*) conspicuously long, a pair of tubercles present on the sejugal borders. Genito-anal setal formula: 5 – 1 – 2 – 3.

Measurements. Length of body: 340-352 μm, width of body: 195-208 μm.

Prodorsum. Rostral apex conical, simple. Costula absent, a pair of well observable lamellar lines present, converging anteriorly. Two weak, transversal lines and a short, slit-like formation behind the rostral transversal lines also present. Lateral part of prodorsum with a well-framed field, covered by spots. Rostral setae well barbed, slightly curved inwards, much thicker than the sparsely pilose lamellar ones. Exobothridial setae shorter than the lamellar ones, interbothridial setae absent. Peduncle of sensillus (Fig. 6) long, its head lanceolate, bearing short cilia. Interbothridial region with three pairs of small, but distinct maculae (Fig. 5).

Lateral part of podosoma (Fig. 8). Exobothridial region distinctly granulate, without longitudinal crests. Pedotectum I large, partly covering the acetabulum of leg I. A porose field well observable in the sejugal region.

Notogaster. Median part of the anterior margin convex. Ten pairs of setiform, thin, – except setae c_2 – long, distinctly pilose notogastral setae (Fig. 5).

Ventral regions (Fig. 7). Epimeral surface with polygonal pattern, epimeral borders well developed, sejugal ones with a pair of drop-shaped tubercles medially. Length of epimeral setae varying, setae *1b, 3b* and *4b* conspicuously long. These are mostly smooth, but setae *3c* and *4c* well ciliate. Discidium sharply pointed, wide, setae *4c* arising on their median part. Genito-anal setae short, their position shown in Fig. 7. Adanal setae longer than the anal ones, setae ad_1 stand in post-, ad_2 and, ad_3 in paraanal position, the latter ones much longer than setae ad_1. An undulate rib visible in posteromarginal position.

Remarks. It is possible that this species lives in a tropical region, therefore this locality is only secondary, but an *Amerioppia* Hammer, 1961 species was described in Germany (*A. badensis* Woas, 1986). The new species is well characterised by the long and lanceolate sensillus, the long and well pilose notogastral setae and especially the peculiarly long epimeral setae. This species-group comprises *A. rudentigera* Hammer, 1961, *A. decemsetosa* Hammer, 1975, *A. longicoma* (Hammer, 1958), *A. trichosoides* Hammer, 1961. However, the new species is distinguishable by the transversal lines and other structures of the

[1] HNHM: deposited in the Hungarian Natural History Museum, Budapest, with identification number of the specimens in the Collection of Arachnida.
[2] MHNG: deposited in the Muséum d'histoire naturelle, Geneva.

prodorsum, and the ratio of the length of the epimeral setae.

Etymology. Named after the habitat, where it was collected.

Bipassalozetes striatus (Mihelčič, 1955)
(Figs. 9-11)

Material examined. Kisapostag, Com. Fejér, 29. 08. 2001, (UTM CS 49). Leg. S. Mahunka & T. Pócs. From dry moss.

Sculpture. Cerotegument of the dorsal and ventral aspect, as well as the legs ornamented by shorter or longer ridges and mostly in the lateral part of the dorsal surface by tubercles. These ridges are mostly longitudinal dorsally, partly transversal ventrally and ringwise on the legs.

Prodorsum. Rostrum broadly rounded, obtuse medially. Anterior part covered by irregular ridges, basal part separated from the anterior one by some, mostly parallel transversal lines and ridges (Fig. 9). Prodorsal setae setiform, glabrous, lamellar and rostral setae nearly equal in length, interlamellar one much shorter than these, exobothridial setae shortest of all, originating behind the bothridium, laterally. Sensillus setiform, smooth, directed outwards.

Notogaster. Distinct, elliptical lenticulus present (Fig. 9). In front of them some longer and characteristically posteriorly directed ridges visible (Fig. 11). Behind them a few running transversally present, the farther back ridges are shorter but longitudinal. Ten pairs of well-visible notogastral setae and 4 pairs of porose areae present. A_3 much smaller than the others, *Aa* the biggest of all. Lyrifissures *im* well, the others hardly observable.

Ventral sides (Fig. 10). The whole surface well sculptured. Infracapitulum and anterior part of the epimeral region ornamented with transversal, the surface behind them with irregular ridges. Epimeral setae well visible, epimeral setal formula: 3 – 1 – 3 – 3. Surface of genital and anal plates and the biggest part of the ventral plate with longitudinal ridges, behind the genital opening a field with transversal rugae observable. Genito-anal setal formula 4 – 1 – 2 – 2. Lyrifissures *iad* conspicuously long (Fig. 10).

Legs. All legs bi- and heterodactylous.

Remarks. It is a rare West-Mediterranean species, heretofore known only from Spain. New to the fauna of Hungary. Its morphology is only little known, therefore this short redescription was necessary.

Urubambates xerophilus sp. n.
(Figs. 12-15)

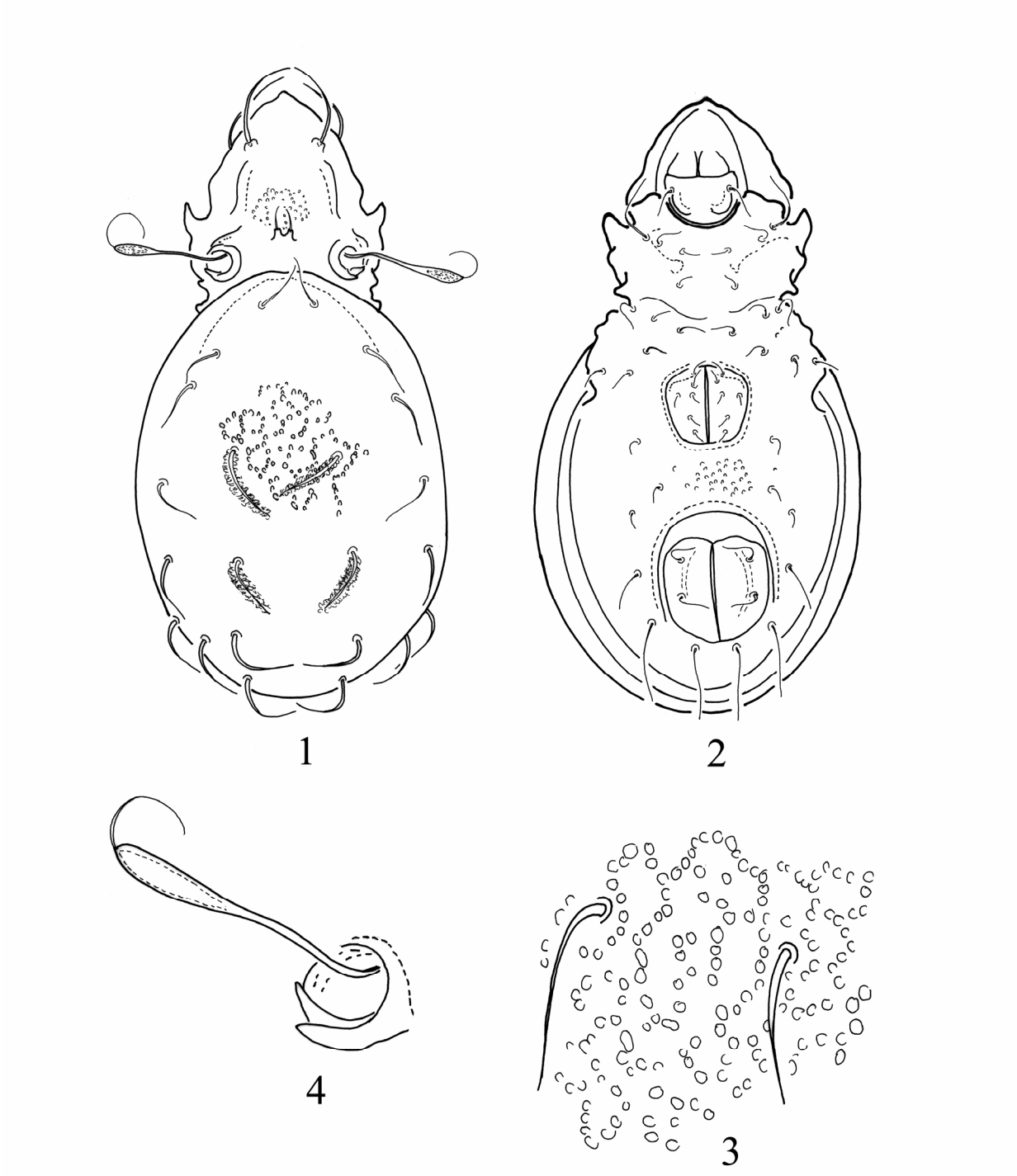
Material examined. Holotype: Kisapostag, Com. Fejér, 29. 08. 2001. (UTM CS 49). Leg. S. Mahunka and T. Pócs. 1 paratype from the same sample. Holotype (1734-HO-2007) and paratype (1734-PO-2007): HNHM.

Diagnosis. Rostrum conical. Lamellae narrow, prelamella weak, but distinct. Sensillus directed backwards, its head elongate, thickened medially. Dorsosejugal suture arched. Notogaster elongate, pteromorphae absent. A small humeral squama present, bearing setae c_2. Ten pairs of short notogastral setae and 4 pairs of sacculi present. Apodemes short, epimeral borders compose a network. Genito-anal setal formula: 4 – 1 – 2 – 3. Setae ad_3 arising in front of the anal aperture.

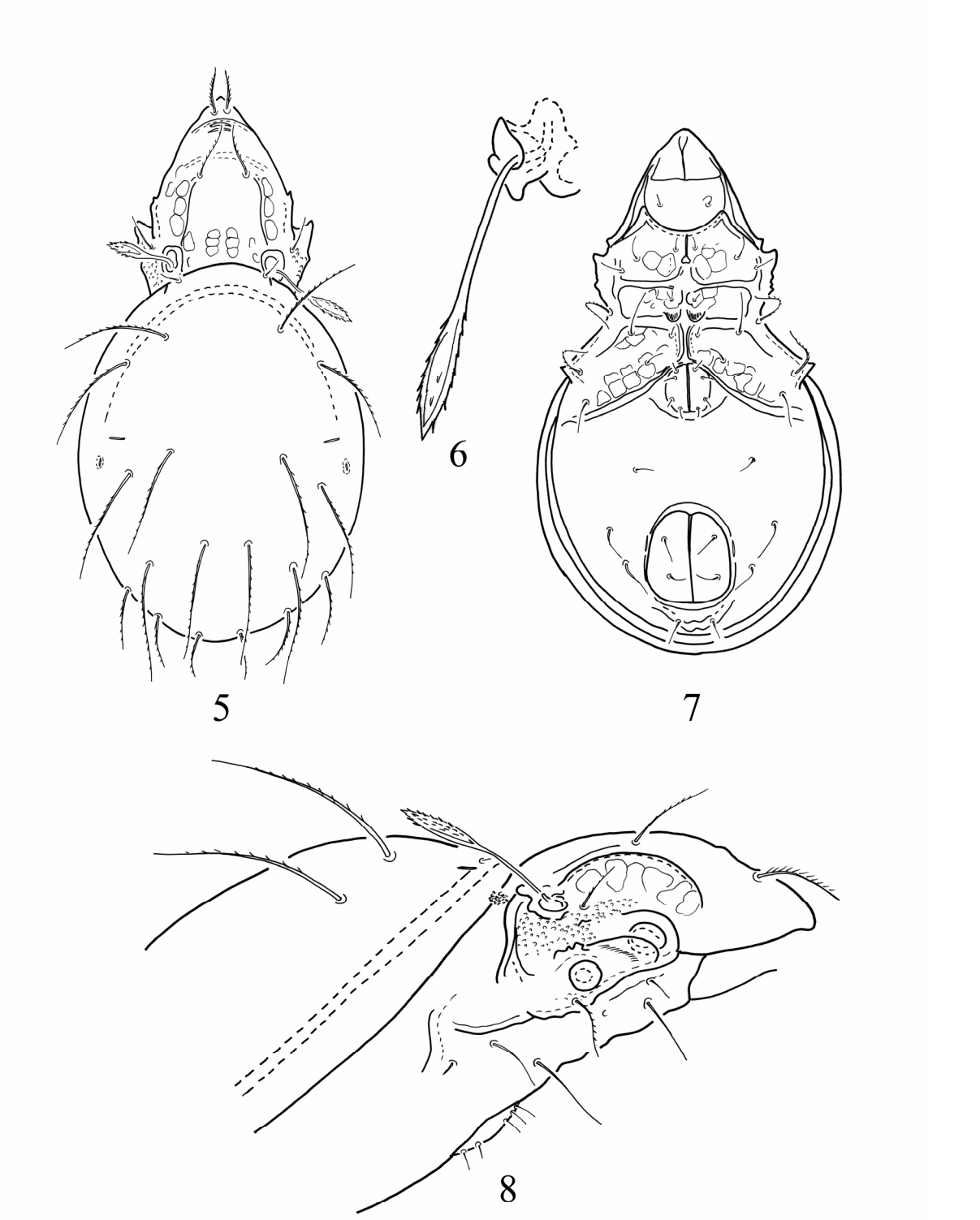
Measurements. Length of body: 351-370 μm, width of body: 175-182 μm.

Prodorsum. Rostral apex narrow, conical, roundish. Lamellae narrow, directed slightly inwards, prelamellae thinner, narrower than the lamellae, reaching to the insertion of the rostral setae. Three inner pairs of notogastral setae equal in length, all pilose (Fig. 12). Exobothridial setae shorter. Sensillus finely ciliate, directed backwards, elongate, clavate, with sharply pointed distal end (Fig. 13).

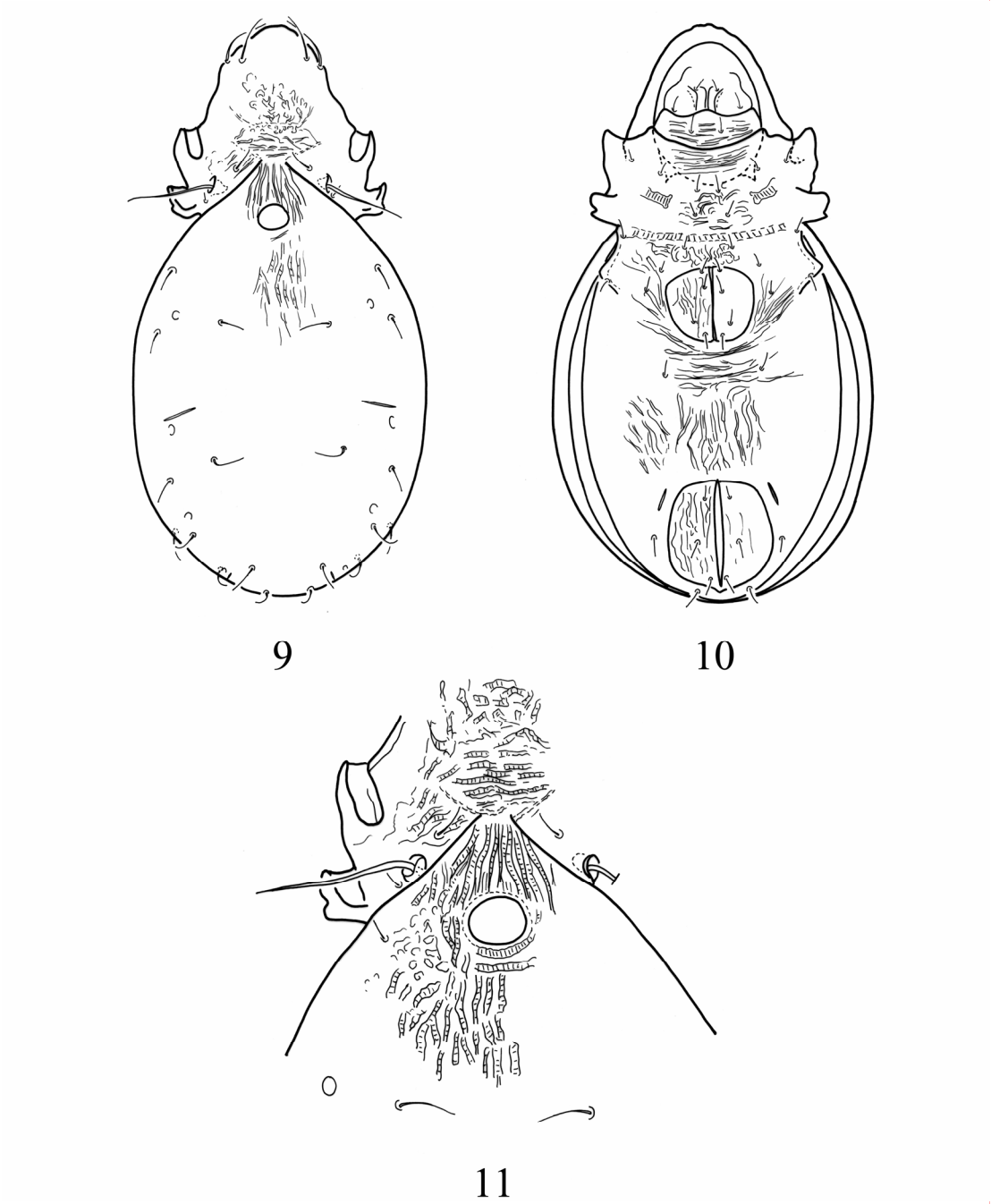
Notogaster. Characteristically elongate (Fig. 12). Dorsosejugal suture arched, a small humeral squama present. Ten pairs of equal notogastral setae and 4 pairs small but distinct sacculi present. Lyrifissures *im* conspicuously long.



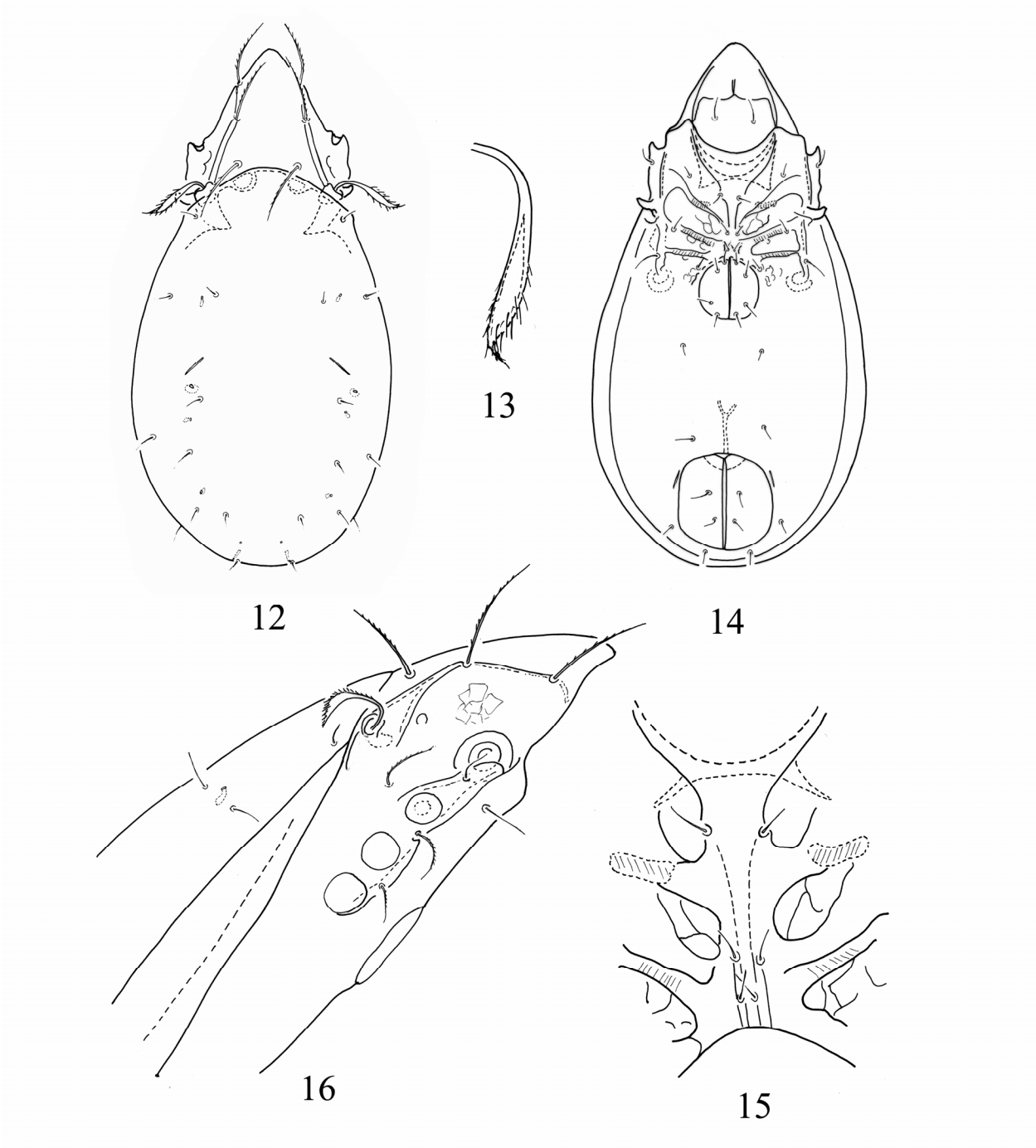
Figures 1-4. *Damaeolus ornatissimus* Csiszár, 1962 – 1 = body in dorsal view, 2 = body in lateral view, 3 = sculpture, 4 = sensillus



Figures 5-8. *Amerioppia hortensis* sp. n. – 5 = body in dorsal view, 6 = sensillus, 7 = body in ventral view, 8 = prodorsum in lateral view.



Figures 9-11. *Bipassalozetes striatus* (Mihelcic, 1955) – 9 = body in dorsal view, 10 = body in ventral view, 11 = sculpture of the notogaster



Figures 12-15. *Urubambates xerophilus* sp. n. – 12 = body in dorsal view, 13 = Sensillus, 14 = body in ventral view, 15 = epimeral region, 16 = body in lateral view.

Lateral part of podosoma. Pedotecta I narrow, bearing setae *1c*. Sublamella distinct (Fig. 16). A weak polygonal pattern visible along the lamella.

Ventral parts (Fig. 14). Epimeral surface with a distinct network composing the epimeral borders. A long sternal line medially also observable (Fig. 15). Epimeral surface partly ornamented by polygonal pattern. Discidium very low, hardly protruding from the lateral margin. Epimeral setae short, marginal setae (*1c, 3c* and *4c*) well pilose, all others smooth. All setae in the genito-anal region simple, very thin. Setae ad_1 postanal, setae ad_3 in preanal position. Distance between the setae ad_3 shorter than the diameter of the anal aperture.

Legs. All legs tri- and heterodactylous.

Remarks. On the basis of the characteristic form of the body and the sensillus the new species must belong to the genus *Urubambates* Hammer, 1961. The species of the genus are distributed in Europe only in Romania, from where 2 species (*U. perlongus* Vasiliu et Calugar, 1976 and *U. romanicus* Vasiliu et Calugar, 1981) were recorded. The new species is distinguished from both by the presence of the prelamellae, and the much thinner lamellae, from *romanicus* by the simple setae *1a* (well pilose in *romanicus*), and from *perlongus* by the position of the notogastral setae (setae *la* and *lm* arising far posteriorly in *perlongus*).

Etymology. Named after the characteristic, extremely dry and warm biotope.

LIST OF SPECIES NEW OR RARE TO HUNGARY

Verachthonius diversus Moritz, 1976

Material examined. Zselickisfalud, Marcado (UTM: YM 12). Litter from *Fagus*-forest. 11. 06. 2004. Leg. S. Mahunka.

Remarks. It had previously been shown from Germany, only from the type locality. This is the first record for the Hungarian fauna.

Berniniella setilonga Iturrondobeitia et Salofia, 1988

Material examined. Velem, Gyertyánkút (UTM: XN 14). 21-23. 05. 2001, from wet moss. Leg. S. Mahunka.

Remarks. The species was so far recorded only from Spain. It is new for the Hungarian fauna.

Suctobelba discrepans Moritz, 1970

Material examined. Kakasd, children camp (UTM: CS 13). 30. 08. 2006, humus from the base of a tree. Leg. Dányi, Garai & Kontschán.

Remarks. Besides the type locality, near Vienna, it is known from the single Hungarian locality at Aggtelek. It is found only in forests on warm mountain sides. This species is quite easily identifiable, although the granules on the surface of the prodorsum are becoming bigger towards the rostrum, the medial rostral incisure cannot be easily seen from above, but in anterior view it is readily recognizable. The rostral teeth are big.

Suctobelbella messneri Moritz, 1971

Material examined. Ibafa, Gyűrűfű (UTM: YM 21). 20. 05. 2006, wet *Salix*-litter, along a creek. Leg. L. Dányi.

Remarks. In Europe it is known from a few localities only (Germany, France). New for the Hungarian fauna.

SYNONYMOUS ORIBATID NAMES IN THE HUNGARIAN FAUNA

Suctobelbella acutidens (Forsslund, 1941)
Suctobelbella trichosa Bayoumi, 1979 **syn. nov.**

Material examined. There is a holotype and two paratypes in the collection. One of the paratypes is fragmentary thus precise identification is impossible. Surely it is not identical with the holotype, because its sensillus is densely pilose throughout. This specimen – to avoid further misunderstandings – is separately stored in a vial.

Remarks. The original description is short and unfortunately contains some inaccuracies. Thus, the striated ornamentation in the rostral region cannot be seen, instead the surface is simple granulated. The rostral teeth are pointed, the rostral tooth larger and wider than the two accessory teeth, of which the posterior one is very narrow. The sensillus is not wholly smooth bearing some short spines. Notogastral setae well pilose, though set sparsely, and not densely as it is figured by Bayoumi. The specimens may well be identified with the figures and the redescription of Woas (1986: 130).

Microppia minus hungarica Bayoumi, 1979 **comb. nov**.

Oppia hungarica Bayoumi, 1979
Microppia minus longisetosa Subías et Rodriguez, 1988 **syn. nov**.

Material examined. The collection houses the holotype and two paratypes of the species. All the specimens are damaged, still suitable for identification.

Remarks. Surprisingly the description in many occasions is opposite to the specimen features in the vials. The sensillus bears only tiny setae; the pattern of the prodorsum is different. The measurements are acceptable; the notogastral setae are indeed long. The specimens most likely belong to the subspecies of *Microppia minus longisetosa* Subías and Rodriguez, 1988. However, according to the nomenclatorial rules this subspecies should have the name of *Microppia minus hungarica* Bayoumi, 1979.

Zygoribatula exilis (Nicolet, 1855)

Zygoribatula zicsii Bayoumi, 1979 **syn. nov**.

Material examined. In the collection there is a holo- and a paratype. Both specimens are somewhat damaged, still suitable for identification.

Remarks. According to the present study this species shares all the characteristics of *Z. exilis*; consequently should be regarded as its junior synonym.

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Daphnia species (Crustacea, Cladocera) and the genetic characteristics of their populations based on allozyme studies in Lake Balaton, Hungary

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Abstract. Although the *Daphnia* species of Lake Balaton have long been studied, there was no consensus on the species composition. In this paper we attempted to clarify their specific status using allozyme electrophoresis. Zooplankton samples were collected between 2002 and 2004 from each basin of Lake Balaton. *Daphnia* specimens were counted and analysed using cellulose acetate gelelectrophoresis. The analysis revealed the presence of *Daphnia cucullata*, *D. galeata* and their hybrid in the lake. While *Daphnia galeata* was very rare, *D. cucullata* and the hybrids were abundant during the growing season.

Within the genus *Daphnia* three subgenera may be differentiated, *Daphnia, Ctenodaphni,* and *Hyalodaphnia*, of which *Daphnia* and *Hyalodaphnia* are monophyletic sistertaxa, based on phylogenetic studies of the small subunit ribosomal RNA (12S), cytochrome oxidase I and the internal transscribed spacer region (Schwenk *et al*. 2000). Out of the twelve species of subgenus *Hyalodaphnia* three are distributed in both North America and Europe. The remaining species are restricted to one of the continents, as for example *Daphnia cucullata* is widely spread only in European lakes.

D. galeata or *D. hyalina* coexist with *D. cucullata* in several lakes. Interspecific hybrids of them frequently occur, usually together with one or both parental species, and some local populations can even be dominated by hybrids. Morphological characters of the hybrids are stable across lakes (Flößner, 1993).

Wolf and Mort (1986) provided a useful tool for the identification of the species, since their allozyme study showed that morphologically typical specimens of *D. cucullata* and *D. galeata* are fixed for different alleles at the AAT enzyme locus and interspecific hybrids are heterozygous for these alleles. Although Gießler (1997) showed that the AAT locus *per se* is not sufficient to decide on the taxonomical status of the members of the subgenus *Hyalodaphnia*, in our case it is still applicable to differentiate between taxa. Gießler (1997) agrees that *D. cucullata* is fixed for a diagnostic allele (S) at the AAT locus, and beside examples of this genotype (SS) only a certain genotype of heterozygotes has been found.

Lake Balaton is the largest shallow lake in Europe. It extends 77 km in length, its width ranges from 1.5 to 15 km,and it is 3.5 m deep on the average. It can be divided into five large basins: Keszthely, Szigliget, Zánka, Tihany and Balatonkenese Basins (SW-NE direction). In differences between the basins, trophic level, abundance ratio of zooplankton species and other characteristics can be substantial.

Opinion is divided on the taxonomical status of *Daphnia* occurring in Lake Balaton. Ponyi (1965) recorded two *Daphnia* species: *D. cucullata* and *D. hyalina*, the latter can be found in two forms: *D. hyalina* var. *lacustris* and *D. hyalina* var. *galeata*. Flößner and Kraus (1986) concluded

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that these are actually the hybrid forms of *D. cucullata* and *D. galeata*. Later, Flößner (1993) named this form *Daphnia (Daphnia)* × *krausi* hybr. nat. nov., and referred again to the individuals from Balaton as being *D. cucullata* × *D. galeata* hybrids. In his summary, Ponyi (1997) mentioned two species in the lake: *D. cucullata* G. O. Sars, 1862 and *Daphnia galeata* G. O. Sars, 1864.

The main object of the present study was to clarify the controversy over the taxonomical status of *Daphnia* in Lake Balaton. Beside that we aimed to investigate the seasonal dynamics of the different *Daphnia* taxa and to describe the populations' genetic characteristics.

MATERIALS AND METHODS

Allozyme studies

Zooplankton for the genetic analysis were collected with a towed plankton net (60 × 60 cm netframe, 200 μm mesh size) from each of the five basins of Lake Balaton. We towed the net with a motorboat altering the speed, in order to cover the total water depth. Gravid females were picked up randomly from the sample and stored at -65°C until processing. The analysed populations, sample locations and dates are indicated in Table 1.

To reveal allelic variance at three enzyme loci (aspartate amino transferase - AAT, phosphoglucose-isomerase - PGI and phosphogluco-mutase - PGM) cellulose acetate gelelectrophoresis (Hebert *et al*., 1989) was applied, followed by the analysis of the dataset with the programmes GenAlEx 6 (Peakall *et al.,* 2005) and TFPGA (Miller 1997). Wright's F- statistics (Wright, 1965) and clustering with Unweighted Pair Group Method, Arithmetic Mean (UPGMA) based on Nei's original genetic distances (Nei, 1972) have been used as a measure of differentiation.

Zooplankton counts

Daphnia cucullata, *Daphnia cucullata* × *galeata* and *Daphnia galeata* individuals were counted based on Flößner (1993) separately, in three of the five basins: Keszthely, Szigliget and Tihany Basin, to define the abundance of the different taxa.

Sampling was carried out every third week between 15. 04. 2002. and 07. 10. 2002. Samples for the analysis have been collected using a Schindler-Patalas plankton trap of 34 litre, and fixed with 10% formaldehyde.

Samples containing limited numbers of individuals have been counted directly, and the abundance of the different *Daphnia* species was calculated using the following formule: $S_{ind} = Z_e$ / PAT/ 34 dm^3, where Z_e is the number of specimens in the sample, PAT means the number of merging the Schindler-Patalas plankton trap.

Samples, which contained a large number of animals have been diluted with distilled water to 200 ml from which five sub-samples, 5 ml apiece, were used for counting *Daphnia* individuals. If the standard deviation exceeded 10%, additional 5 ml units were included until the SD was less than 10%. In this case Z_e means the average number of individuals in sub-samples multiplied by the quotient of the total volume of the fixed sample (200 ml) and the volume of a sub-sample (5 ml).

RESULTS

Allozyme studies

We analysed 1294 randomly chosen gravid female specimens (Table 1) using cellulose-acetate gelelectrophoresis, 958 of that turned out to be *D. cucullata*, 335 *D. cucullata* × *galeata* and only one specimen *D. galeata* (Keszthely Basin, 26.04. 2004.) according to the species specific alleles of the AAT enzyme locus. Among the male specimens we discovered 9 *D. cucullata* and 7 hybrids.

The analysis revealed four alleles (S, M, F, F^+) both on the PGI and PGM loci. The F^+ allele on the PGI locus was found only in hybrid populations and the F^+ allele on the PGM locus was confined to one *D. cucullata* population. Mean allele frequencies are shown in Table 2.

Table 1. Populations scored for the different alleles at the three loci. Capitals (A, B) next to the number of individuals refer to the different analyses. Zeros indicate that no individual of the given taxon was found on the given sampling date among the randomly chosen animals

	Balatonkenese (BK) Basin		Tihany (T) Basin		Zánka (Z) Basin		Szigliget (S) Basin		Keszthely (K) Basin	
Sampling date	*D. cuc.*	hybrid	*D. cuc.*	hybrid	*D. cuc.*	hybrid	*D. cuc.*	hybrid	*D. cuc.*	hybrid
06.05.2002	–	–	7	32	–	–	–	–	22	45
23.06.2002	–	–	–	–	–	–	28	8	–	–
01.07.2002	–	–	18	3	–	–	–	–	–	–
31.07.2002	–	–	21	3	–	–	–	–	–	–
23.08.2002	53	0	48	0	48	0	43	4	42	4
19.06.2003	–	–	36	19	–	–	–	–	–	–
31.07.2003	–	–	29	13	–	–	–	–	40	15
21.08.2003	–	–	54	1	–	–	–	–	–	–
15.09.2003	–	–	44	9	–	–	–	–	–	–
02.10.2003	–	–	47	6	–	–	–	–	–	–
21.10.2003	–	–	35	19	–	–	–	–	–	–
07.11.2003	–	–	45	10	–	–	–	–	–	–
28.11.2003	–	–	35	19	–	–	–	–	–	–
26.04.2004	–	–	–	–	–	–	–	–	0	47
07.10.2004	52	17	65	16	43	16	39	15	60	8
Total number of individuals/ breeding season										
2002.	53 (**A**)	0	94 (**A**)	38 (**B**)	48 (**A**)	0	71 (**A**)	12	64 (**A**)	49 (**B**)
2003.	–	–	325 (**A**)	94 (**B**)	–	–	–	–	40 (**A**)	15 (**B**)
2004.	52 (**A**)	17 (**B**)	65 (**A**)	16 (**B**)	43(**A**)	16 (**B**)	39 (**A**)	15 (**B**)	60 (**A**)	55 (**B**)

Analysis of the genetic structure of the *D. cucullata* population in Lake Balaton was carried out for the samples marked with an „A" in Table 1. Wright's F_{IS} (Table 3) implied heterozygote excess on both loci, F_{ST} values indicated little genetic differentiation between the samples. Hybrid populations marked with a „B" in Table 1 have been studied to reveal differentiation. Wright's F-statistics (Table 3) show considerable heterozygote excess at the PGI locus and heterozygote deficiency at the PGM locus. Population differentiation is moderate (F_{ST}= 0,099). UPGMA clustering (Fig. 1) reveals that the observed moderate differentiation originates mainly from the separation of two clusters.

Zooplankton counts

Results of the zooplankton counts are summarized on Fig. 2. On the first sampling date in the breeding season almost no *Daphnia* individuals could be found in the water. Number of in-

Table 2. Mean allele frequencies of the different *Daphnia* taxa

		D. cucullata	*D. cuc.* × *gal.*
PGI	**S**	0.395	0.309
	M	0.604	0.205
	F	0.001	0.467
	F^+	0.000	0.019
PGM	**S**	0.697	0.175
	M	0.275	0.583
	F	0.028	0.242
	F^+	0.001	0.000

Table 3. Wright's F- statistics for the *Daphnia cucullata* and *Daphnia cucullata galeata* populations

		PGI	**PGM**	**Mean**
D. cucullata	**F_{IS}**	-0,408	-0,041	-0,225
	F_{ST}	0,008	0,070	0,039
D. cu.c. × *gal.*	**F_{IS}**	-0,594	0,452	-0,071
	F_{ST}	0,044	0,154	0,099

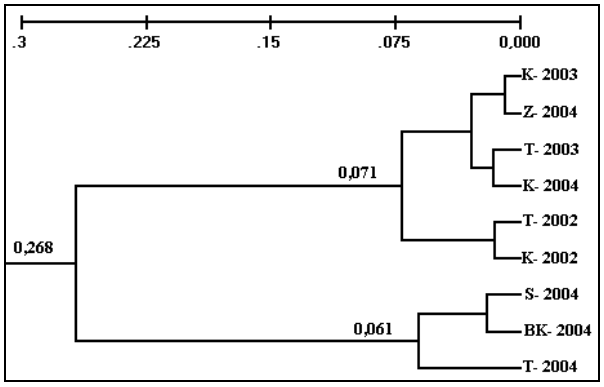

Figure 1. UPGMA clustering of the hybrid populations based on Nei's original genetic distances. K = Keszthely Basin, S = Szigliget Basin, Z = Zánka Basin, T = Tihany Basin, BK = Balatonkenese Basin, numbers combined with the capitals mean the different breeding seasons. Numbers above certain branches show Nei's distance for the given node

dividuals of *D. galeata* was very low throughout the studied period. Early in May the hybrids exceeded the number of *D. cucullata* individuals in two of the three basins (Keszthely and Tihany). *D. cucullata* dominated the assemblage in every basin later. In the middle of the summer the number of the hybrids decreased strongly and rose to a slight extent in September again. However, the abundance of *Daphnia* (every taxa together) never exceeded 28.7 individuum/litre (03. 06. 2002., Szigliget Basin).

DISCUSSION

Based on cellulose acetate gelelectrophoresis carried out in the present study, it has been concluded that the following *Daphnia* taxa are present in Lake Balaton: *Daphnia cucullata* G. O. Sars, 1862, *Daphnia galeata* G. O. Sars, 1864 and *Daphnia cucullata* × *Daphnia galeata*. The forms mentioned by Ponyi (1965) Flößner and Kraus (1986) and Flößner (1993) are probably really *D. cucullata* × *galeata* hybrids, as the latter authors claimed.

Spaak (1996) revealed similar mean allele frequencies for *D. galeata* and *D. cucullata* × *galeata* in Lake Tjeukemeer, but allele frequencies of the hybrid populations were markedly different from those of *D. cucullata*, as it was the case in Lake Balaton. Nei's genetic distance × *galeata* and *D. cucullata* was 0.71 (Spaak, 1996). Similarly, Nei's genetic distance was high (0.65) between the *D. cucullata* and hybrid populations in our case.

D. galeata occurs extremely rarely in Lake Balaton. Only one specimen has been found using electrophoresis and the zooplankton counts revealed *D. galeata* individuals only in samples from April, May and October in low numbers (its highest abundace was 0.3 ind/dm^3, Keszthely Basin, 15.04.2002.). Hence the photos of *D. galeata*, presented by Ponyi (1997) depict, in our opinion, *D. cucullata* × *galeata*. However *Daphnia* taxa are not typical of Lake Balaton since the total abundance throughout the growing season was low.

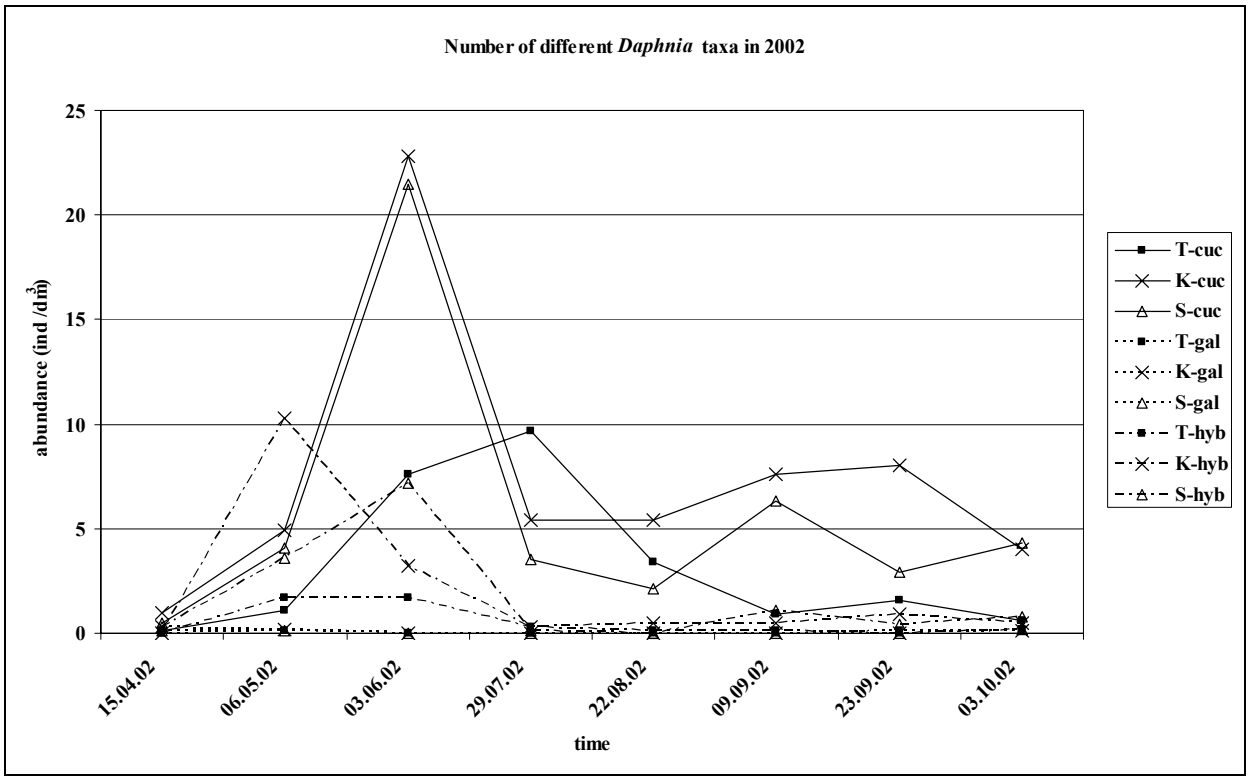

Figure 2. Abundance of different *Daphnia* taxa. Solid line = *D. cucullata*, dashed line = hybrid, dotted line = *D. galeata*, square = Tihany Basin, X = Keszthely Basin, triangle = Szigliget Basin

First year offspring of *Abramis brama* L. consumes solely zooplankton in Lake Balaton, it only occasionally switches to benthic feeding during fall (Specziár & Bíró, 2004). In three permanent lakes in Germany significant positive correlation was found between the intensity of selection and fish density for *D. galeata*, but not for *D. cucullata* × *galeata* hybrids (Müller & Seitz, 1995). Presumably, the abundance of *D. galeata*, the largest and most visible of the taxa is reduced by the predation pressure to a great extent. Since *D. cucullata* × *galeata* occurs together with *D. galeata* in most of the cases more detailed investigations of the ecological factors acting behind the absence of *D. galeata* are necessary.

Acknowledgements – We are grateful to G. Dobos and É. Hajdú for their indispensable help in the field and in the laboratory. Research was financially supported by the Hungarian Scientific Research Fund, T49098 and T32165 contracts.

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Illustrations and redescriptions of Simon's little known salticid taxa from West-Africa (Araneae: Salticidae)

T. SZŰTS[1]

Abstract. Redescriptions and illustrations are given for following taxa: *Hermotimus* Simon, 1903 – type species *H. coriaceus* Simon, 1903 from West Africa, *Longarenus* Simon, 1903 – type species *L. brachycephalus* Simon, 1903 from Gabon and *Uxuma* Simon, 1902 – type species *U. impudica* Simon, 1902 from Gabon. The genus *Polemus* Simon, 1902 from Sierra Leone is revised: *P. chrysochirus* Simon, 1902 – the type species and *P. galeatus* Simon, 1902 are redescribed, furthermore *P. squamulatus* Simon, 1902 is transferred to *Evarcha* Simon, 1902. The following species are also redescribed: *Encymachus livingstonei* Simon, 1902 – type secies of *Encymachus* Simon, 1902 from along the Zambezi River and *Rhene sulfurea* (Simon, 1885) from Senegal. With 42 original figures.

Eugène Simon, the famous arachnologist, has described a massive number of spider species. This is also true for jumping spiders where he described many taxa from Africa, and especially from West Africa (where France had colonies). Simon's descriptions – as it was quite usual in his era – were focusing mainly on the somatic characters, making almost impossible to recognize his taxa, since many species differs only in the male palp or in the female epigyne. Moreover they were noting the copulatory organs only if they were very special, and almost always without any illustrations. Therefore, considering the number of his species with the lack of their illustrations it is not surprising to see how far is behind the exploration of West Africa to compare it with other regions like South America.

During two visits funded by the IHP programme (COL-PARSYST and SYNTHESYS) I was able to study Simon's types at the Musée national d'Histoire Naturelle, in Paris. From both visits I have gained lots of drawings and digital images about unrelated salticids, only connected by their author, Eugéne Simon. My intention with this paper is to continue the redescriptions of little known West African genera I have started earlier (Szűts & Scharff 2005) and try to make their names available for common usage. Majority of the taxa I am presenting now is known from very few papers or even by the original descriptions only. This hinders the description of new taxa, since we still don't know what have already been described. Probably the lack of intensive studies are responsible for those disjunct geographical distributions as well, reported recently in the case of several genera, e.g. *Orsima* Simon, 1901 (*O. constricta – O. ichneumon* see Berland & Millot, 1941 and Żabka 1992), *Depreissia* Lessert, 1942 (*D. myrmex – D. decipiens* see Szűts & Wesołowska, 2003 and Deeleman-Reinhold & Floren 2003) and *Bristowia* Reimoser, 1934 (*B. afra – B. heterospinosa* see Szűts 2004) all having two species: one in West Africa and one in South East Asia. Although all of them are easy to recognize, they still haven't been found anywhere between these two areas.

I tried to focus illustrating taxa that are representatives of a genus as well like type species (marked with asterisk) or monotypic genera. The specimens I was to deal with are in very poor condition, so I focused mainly on the copulatory organs and illustrations.

The specimens were studied with traditional methods. Drawings made with a camera lucida attached to a stereo microscope. First drafts were made with a "photoblue" pencil, and then were outlined with ink and 2B pencils. Digital images were taken with a Nikon COOLPIX 900 attached to the Leica MZ16A microscope and edited using the software package Adobe Photoshop version 8.0. All morphological measurements are given in millimetres. Specimens are deposited in Musée national d'Histoire Naturelle, in Paris.

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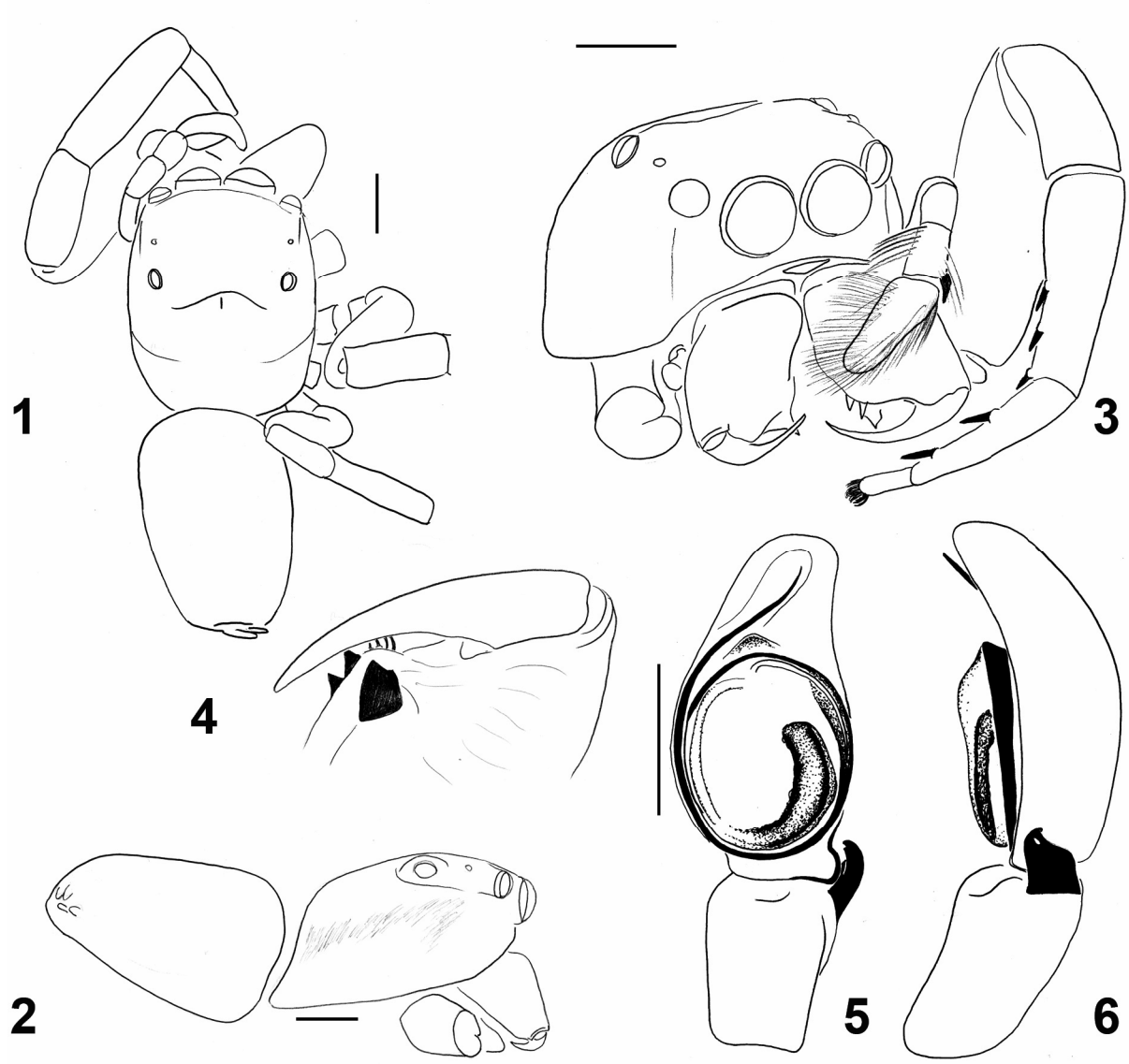


Figures 1-6. *Encymachus livingstonei* holotype: 1 = habitus, dorsal view, 2 = habitus, lateral view, 3 = habitus, antero-lateral view, 4 = chelicera, ventral view, 5 = male palp, ventral view, 6 = male palp, retrolateral view (scale bar: 1 mm)

TAXONOMY

Encymachus Simon, 1902

Encymachus livingstonei Simon, 1902*
(Figs 1-6)

E. livingstonei Simon, 1902: 370.

Material examined. Holotype male, Hand-written labels in the tube: "*2179 Encymachus Livingstonei E. S: Zambési"; "2179*" (MNHN, Paris; no. 2179).

Diagnosis. Male palp with long, filiform embolus situated around tegulum (Figs 5-6). Male with robust chelicerae (Figs 2-4).

Description. Male holotype. Type specimen bleached by ethanol, in poor condition. Large and robust spiders (Fig. 1). Carapace brown with

white lateral hairs, ocular area dark brown. Chelicerae with one retro- and two prolateral bifid teeth (Fig. 4). Abdomen white, with brown dotted pattern, and with a light median stripe. First two legs brown, other legs light brown.

Measurements. Total length 8.75. Cephalothorax 4.30 long, 3.50 wide, 2.5 high at PLE. Abdomen 4.1 long, 2.75 wide. OCA 1.8 long, 2.75 wide (anterior), 2.68 wide (posterior).

Pedipalp. Embolus medium sized (Figs 5-6), tibial apophysis short and stout.

Distribution. Known only from "Zambési".

Remarks. The genus is poorly known as mentioned only by two paper: Simon (1902) and Lawrence (1947). The other species, *E. hesperus* (known only by a female from Namibia) is very likely belongs elsewhere, although not much could be said before females of *E. livingstonei* have been found. The genus is most similar to the African *Hyllus* Koch C.L, 1848.

Hermotimus Simon, 1903
Hermotimus coriaceus Simon, 1903*
(Figs 7-15)

H. coriaceus Simon, 1903b: 120; Simon, 1903a: 762, f. 901-903; Prószyński, 1987: 43.

Material examined. *Syntype series*: 1 male and 1 female from Oguoé. Handwritten labels in the tube: "*20238 Herm coriaceus E. S: Ogoué (Mcq)"; "20238"; "Typus? M. E. Galiano VIII. 1959*" (MNHN, Paris; no. 20238).

One female from Cameroon. Handwritten labels in the tube: "*22088 Herm. coriaceus E. S: Cameroon (Mcq)"; "22088*"; (MNHN, Paris; no. 22088).

Diagnosis. Both sexes with elevated carapace (Figs 9-10). Thoracic slope very steep, almost vertical (Fig. 12). Thoracic region same level as ocular area. Male chelicerae long, with conspicuous bifid teeth (Fig. 11). Male palp with unique configuration (Figs 14-15). Embolus very short, blunt, ejaculatory openings visible from the lateral side. Epigynum of female with elongated openings (Fig. 13).

Description. Male syntype (Fig. 7). Type specimen bleached by ethanol, in poor condition (abdomen damaged). Carapace dark brown. The thoracic area at same level as ocular area, light brown. Thoracic slope steep. White hairs on the lateral side, and below the edge of carapace, on the clypeus and on the chelicerae. Chelicerae long, with two prolateral and one retrolateral teeth. Retrolateral teeth bifid, conspicuous (Fig. 11). Abdomen pale yellow, with light brown markings, but without any clearly visible patterns. First two legs brown, second two legs light brown with dark brown rings.

Measurements. Total length cannot be measured since abdomen damaged. Cephalothorax 3.0 long, 2.65 wide, 1.5 high at PLE. Abdomen 2.7 long, 1.75 wide. OCA 1.65 long, 1.87 wide (anterior), 1.62 wide (posterior).

Pedipalp. Tibial apophysis long and thin. Embolus short and blunt (Figs 14-15).

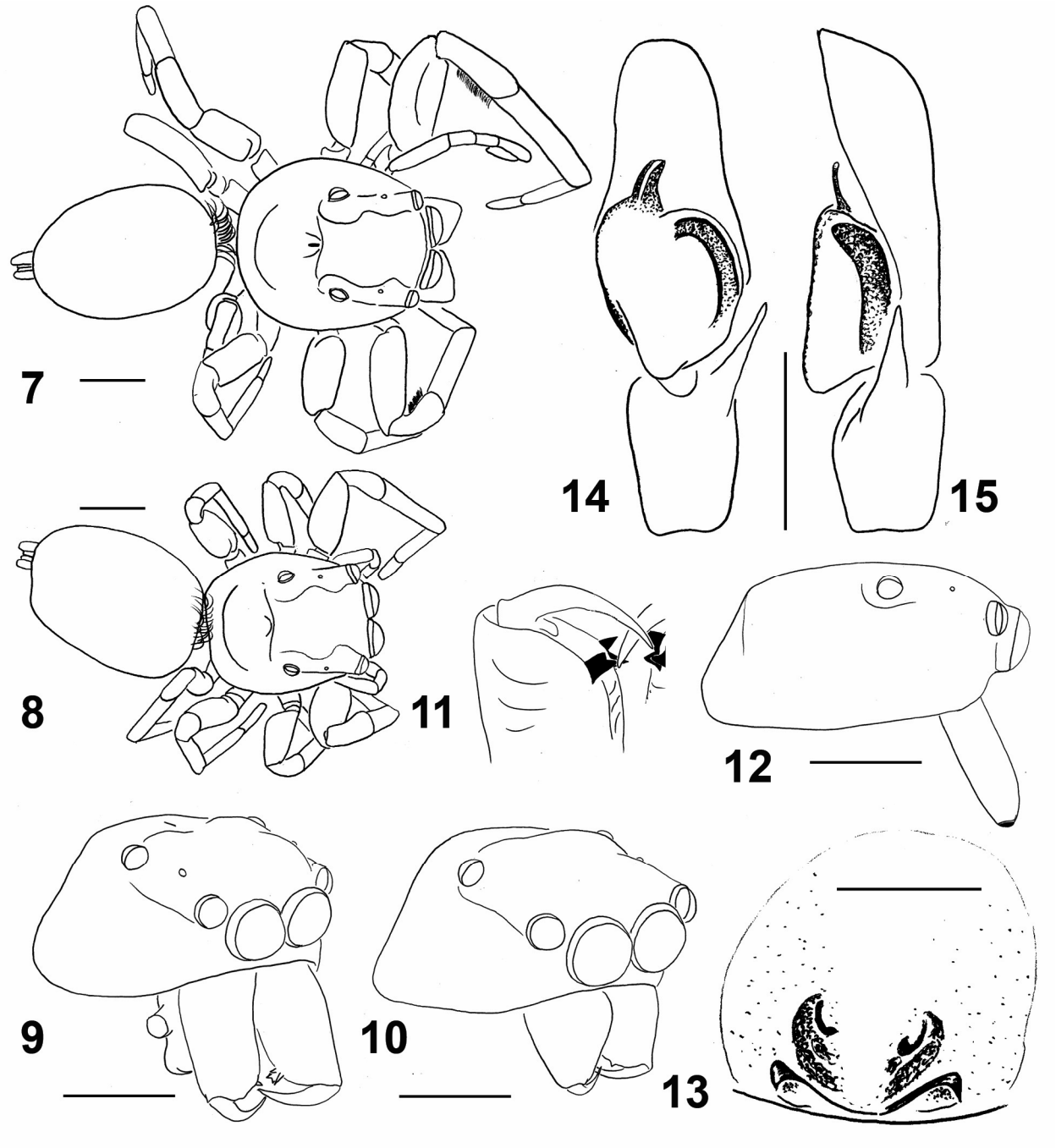
Female syntype (Fig. 8). Colour as in male, but paler, with fewer white hairs. Abdomen yellow, with a darker pattern. All legs light brown, almost yellow.

Measurements. Total length 5.7. Cephalothorax 2.75 long, 2.1 wide, 1.12 high at PLE. Abdomen 2.72 long, 2.37 wide. OCA 1.37 long, 1.75 wide (anterior), 1.6 wide (posterior).

Epigyne as in Fig. 13.

Distribution. Known from Ogoué (Gabon) and Cameroon.

Remarks. Prószyński examined a non-type female – tube Nr 22088 – in 1987. He illustrated the female vulva, which is excellent for identification of the females, therefore I don't repeat that drawing. I also examined that very same specimen. Since curating policy of MNHN does not allow dissection of primary types, only the epigyne illustrated here for comparison to show the conspecificy of the female with the one illustrated by Prószyński (1987).



Figures 7-15. *Hermotimus coriaceus* syntype series: 7 = male habitus, dorsal view, 8 = female habitus, dorsal view, 9 = male carapace, antero-lateral view, 10 = female carapace, antero-lateral view, 11 = male chelicera, ventral view, 12 = male carapace, lateral view, 13 = female epigyne, 14 = male palp, ventral view, 15 = male palp, rentrolateral view (scale bar: 1 mm)

Longarenus Simon, 1903

Longarenus brachycephalus Simon, 1903*

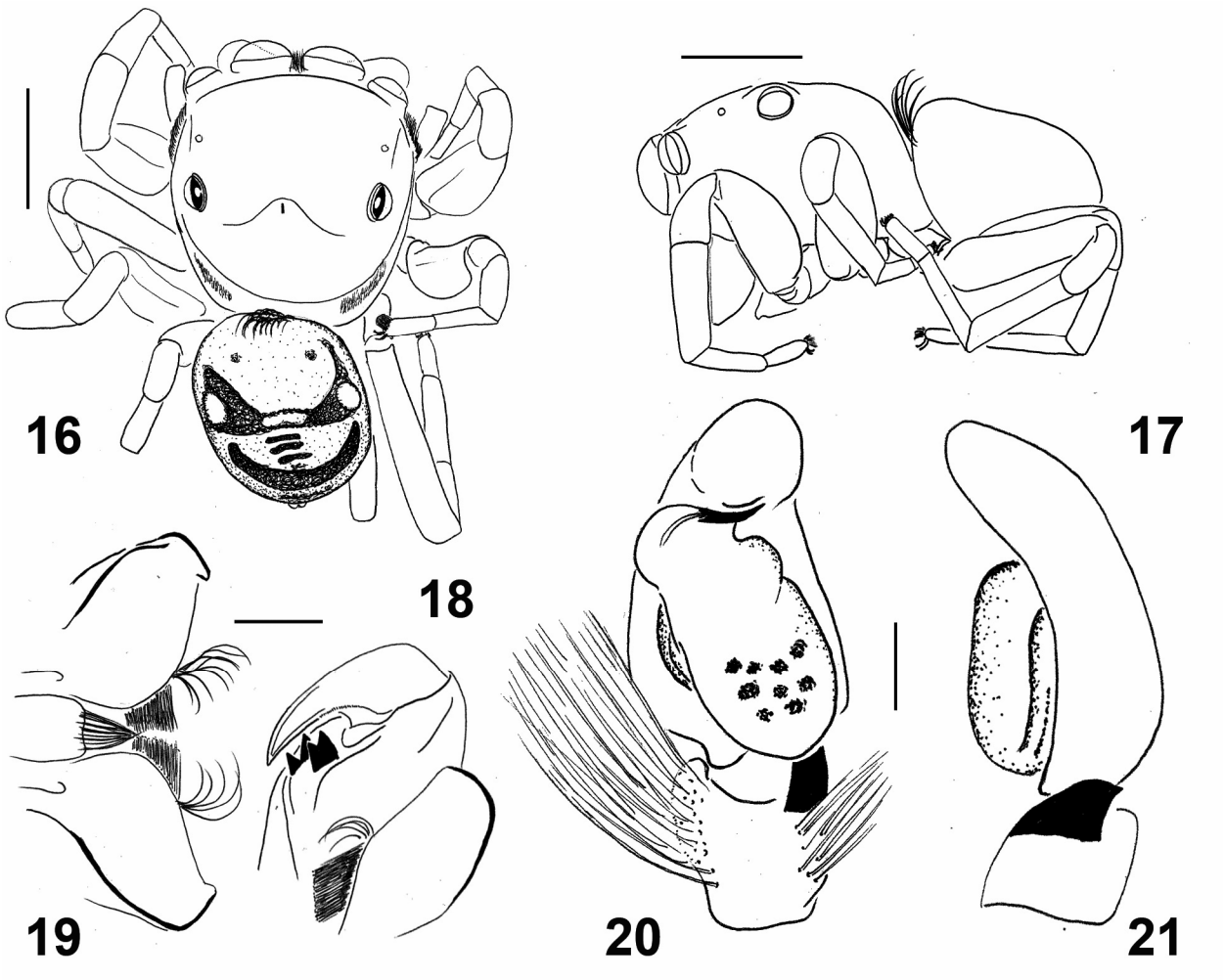
(Figs 16-21)

L. brachycephalus Simon, 1903b: 122; 1903a: 798, f. 924.

Material examined. Holotype male from Gabon. Handwritten labels in the tube: "*20295 Long brachycephalus E. S: Ogoué (Mcq)*"; "*20295*"; "*Typus? M. E. Galiano IX. 1959*" (MNHN, Paris; no. 20295).

Diagnosis. Small fissidentate salticid. Male palp with short and bent embolus (Figs 20-21).

Description. Holotype male (Fig. 16). Type material bleached out by ethanol but in good condition (both palps removed). Carapace light brown, ocular area darker. Lateral side of carapace with white hairs posteriorly and brownish hairs anteriorly. Thoracic slope steep (Fig. 17), cephalothorax squat. Chelicerae robust, with two prolateral and one retrolateral teeth. Retrolateral teeth bifid (Fig. 18). Gnathocoxae with a small anterior tip (Fig. 19). Abdomen whitish with two dark stripes and with several white dots (Fig. 16). Legs yellowish with darker markings.



Figures 16-21. *Longarenus brachycephalus* holotype male: 16 = male habitus, dorsal view, 17 = male habitus, lateral view, (Scale bar: 1 mm) 18 = chelicerae, ventral view, 19 = gnathocoxae, ventral view, 20 = male palp, ventral view, 21= male palp retrolateral view (scale bar: 0.2 mm)

Measurements. Total length 3.75. Cephalothorax 2.0 long, 1.88 wide, 1.9 high at PLE. Abdomen 1.5 long, 1.37 wide. OCA 1.25 long, 1.8 wide (anterior), 1.67 wide (posterior).

Pedipalp. Embolus short and stout (Figs 20-21) curved upwards.

Distribution. Known only from the type locality, Gabon.

Remarks. The specimen much resembles those of *Habrocestum* Simon, 1876. The bifid cheliceral tooth, the long third femur (Fig. 18), the stout carapace are also characteristic for both genera. However both male and female copulatory organs should be compared before concluding a solid opinion. Nevertheless the male palp differs significantly; therefore any concern about synonymy shall wait until females will be known.

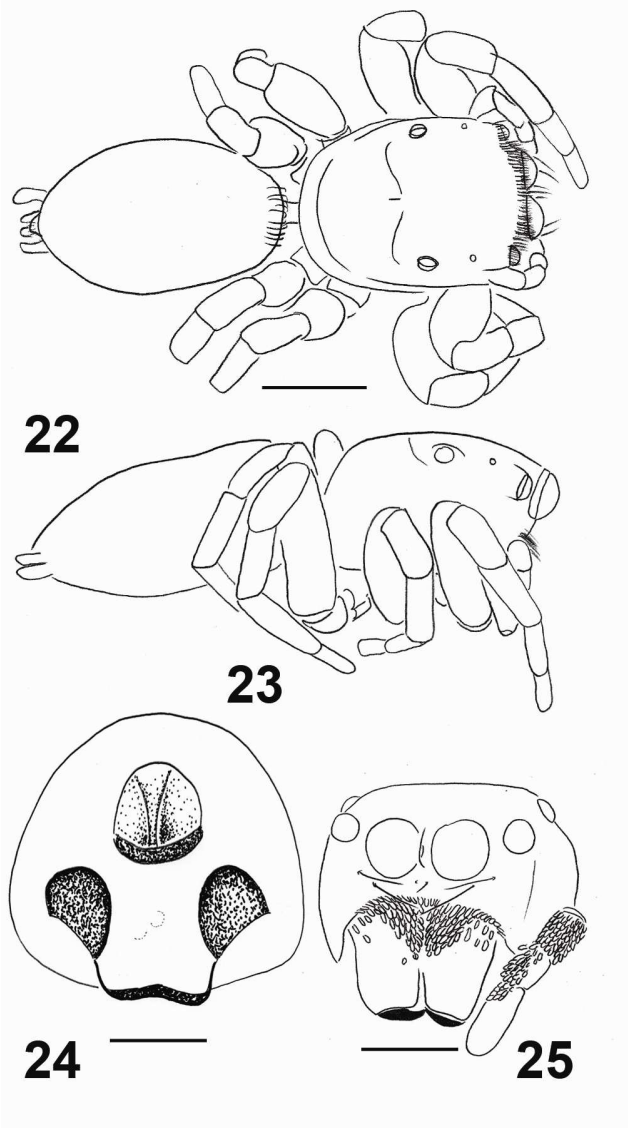
Polemus Simon, 1902
Polemus chrysochirus Simon, 1902*
(Figs 22-25)

P. chrysochyrus Simon, 1902: 43; Prószyński, 1987: 80

Material examined. Syntype series: 3 females from Freetown. Handwritten labels in the tube: "*20018 Pol. chrysochirus E. S: Freetown (Mcq)*"; "*20018*"; (MNHN, Paris; no. 20018).

Diagnosis. Medium sized salticids, with stout carapace. Chelicera and palp densely covered with scale hairs (Fig. 25). Thoracic slope steep (Fig. 23). Epigyne with the openings situated in a central pit (Fig. 24).

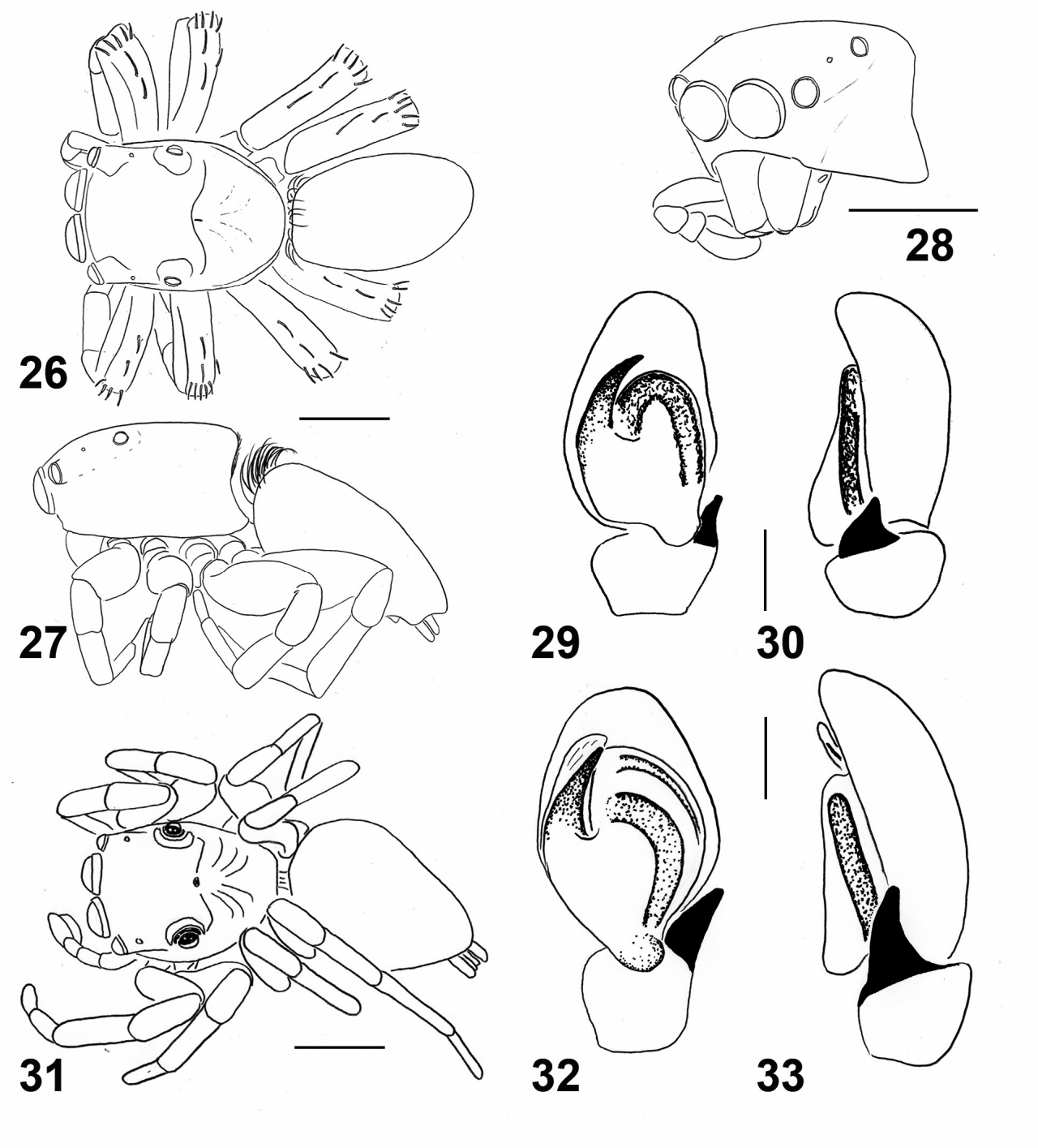
Description. Female syntype (Fig. 7). Type specimens old and bleached by ethanol, but in fair condition. Carapace dark brown. Thoracic slope steep. Basal segment of the chelicera, palp and prolateral side of the first leg covered with thick scales (with physical colour). Abdomen dark brown, with an unclear pattern, most likely with a yellow stripe. Legs dark brown, leg I and leg III with prolateral scales.



Figures 22-25. *Polemus chrysochirus* female syntype. 22 = female habitus dorsal view, 23 = same, lateral view, 24 = epigyne, ventral view, 25 = carapace, anterolateral view (scale bar: 22-23: 1 mm, 24: 0,1 mm)

Measurements. Total length 5.8. Cephalothorax 2.8 long, 2.0 wide, 1.64 high at PLE. Abdomen 2.8 long, 1.6 wide. OCA 1.6 long, 1.56 wide (anterior) 1.2 wide (posterior).

Epigyne. With one shallow pit accommodating the openings (Fig. 24), and with a central plate. Vulva and epigyne as illustrated by Prószyński (1987: p. 80).



Figures 26-30. *Polemus galeatus*: 26 = male habitus, dorsal view, 27 = same, lateral view, 28 = male carapace, antero-lateral view, 29 = male palp, ventral view, 30 = male palp, retrolateral view.
Figures 31-33. *Evarcha squamulata*: 31 = male habitus, dorsal view, 32 = male palp, ventral view, 33 = male palp, retrolateral view. (scale bar 26-28, 31: 1 mm 29-30, 32-33: 0.2 mm)

Distribution. Known only from the type locality, Sierra Leone.

Remark. Prószyński has examined one of the syntype females. – tube 20018 – in 1987. He did not mention any of the other specimens.

Polemus galeatus Simon, 1902
(Figs 26-30)

P. galeatus Simon, 1902: 44; Simon, 1903a: 680.

Material examined. Type material seems to be lost. One male from Freetown. Handwritten labels in the tube: "*20718 Pol. galeatus E. S: Freetown (Mcq)*"; "*20718*" "20718"; (MNHN, Paris; no. 20178).

Diagnosis. Medium sized salticids, unique carapace shape: carapace stout, thoracic slope with a hump (Fig. 28), carapace quadrangular as seen from lateral side, thoracic slope vertical (Fig. 27). Male palp simple (Figs 29-30).

Description. Male (Figs. 26-27). Specimen old and bleached by ethanol, but in fair condition. Carapace light brown. The thoracic area as high as the ocular area, thoracic slope vertical, carapace quadrangular as seen from the lateral side (Fig. 27). Pedipalp and prolateral side of the first legs covered with thick scales (with physical colour only, but could have other on the living specimens). Abdomen light brown, with black anterior side. Abdomen without any pattern.

Legs dark brown, leg I and leg III with prolateral scales.

Measurements. Total length 4.7. Cephalothorax 2.37 long, 1.7 wide, 1.25 high at PLE. Abdomen 2.5 long, 1.25 wide. OCA 1.05 long, 1.45 wide (anterior) 1.3 wide (posterior).

Pedipalp. With simple structure: embolus short, tegulum with proximal lobe (Figs. 29-30).

Distribution. Known only from Sierra Leone.

Remarks. The type material seems to be lost. I was unable to find them where they should be: the same jar as the other *Polemus* specimens. It is noticeable the type locality and the label of the examined male is the same, and the carapace (Simon 1902) is very similar. There is a slight chance that Simon has overlooked the male and described as a female (without mentioning the epigyne). Both *P. chrysochirus* and *P. galeatus* possess conspicuous scales at the same places (pedipalps, first legs). They are known from the other sexes, so there is a chance that they belong to the same species. As for the other cases newly identified material is required for any nomenclatural changes.

***Evarcha* Simon, 1902**

Evarcha squamulata (Simon, 1902) **comb. nov.**
(Figs 31-33)

Polemus squamulatus Simon, 1902: 45.

Material examined. Holotype male from Freetown. Handwritten labels in the tube: "*20151 Pol. squamulatus E. S: Freetown (Mcq)*"; "*20151*"; (MNHN, Paris; no. 20151).

Diagnosis. Medium sized salticids (Fig. 31). Male palp with a short embolus and a membranous conductor (Fig. 32).

Description. Male syntype (Fig. 7). Type specimen is old, but in fair condition. Carapace dark brown. Fovea circular. Abdomen dark brown, with black anterior side, with a dotted pattern. Legs dark brown.

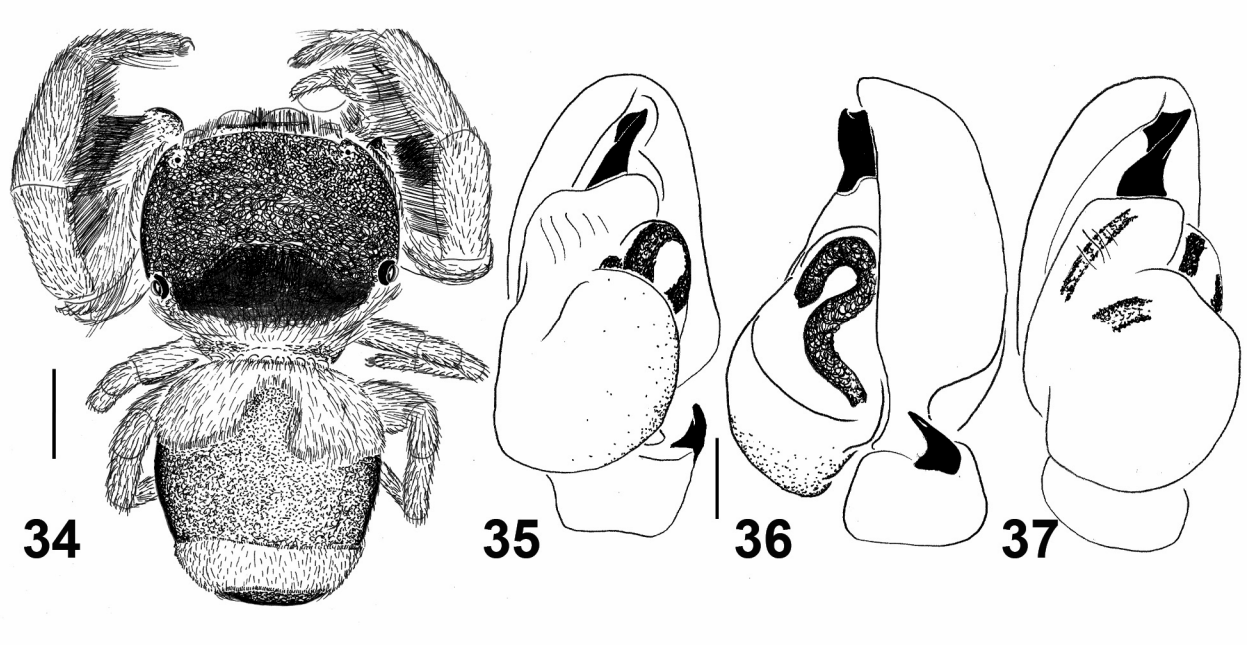
Measurements. Total length 4.5. Cephalothorax 2.4 long, 1.8 wide, 1.2 high at PLE. Abdomen 2.9 long, 1.7 wide. OCA 1.1 long, 1.56 wide (anterior) 1.4 wide (posterior).

Pedipalp. Embolus short. Bulbus with a conductor (Figs. 31-32) behind the embolar base.

Distribution. Known only from Sierra Leone.

Remarks. The presence of the conductor and the habitus show similarity to *Evarcha* (species like: *E. culicivora*, *E. praeclara*, *E. picta*) so I propose to place *P. squamulatus* there. The species clearly does not belong to *Polemus*, neither according to somatic nor copulatory characters.

The genus *Baryphas* also could be a candidate (see *B. jullieni*). Both genera need a revision. The placement to *Evarcha* seems to be more convenient, than to *Baryphas* as more species with very similar appearance belong to *Evarcha*. On the other hand, *Evarcha* is an older name.



Figures 34-37. *Rhene sulfurea* male holotype: 34 = male habitus, dorsal view, 35 = male palp, ventral view, 36 = male palp, retrolateral view, 37 = male palp, oblique view (scale bars: 34: 1 mm, 35-37: 0.2 mm)

Rhene Thorell, 1869

Rhene sulfurea (Simon, 1886)
(Figs 34-37)

R. sulfurea Simon, 1886: 352; Simon 1901: 635, 638, f. 747-748.

Material examined. Holotype male from Senegal. Handwritten labels in the tube: "*7293 Rh. Sulfurea E. S: St. Luis*"; "7293"; (MNHN, Paris; no. 7293).

Diagnosis. Typical *Rhene* species, with a twisted embolus (Figs. 35-37).

Description. Holotype male (Fig. 34). Type specimen in good condition. Carapace dark brown. Cephalothorax flat, densely covered with fine hairs. Abdomen dark orange, white dense hairs constitute two anterior spots of and a transversal stripe. Legs dark brown.

Measurements. Total length 6.4. Cephalothorax 3.4 long, 3.4 wide, 1.75 high at PLE. Abdomen 3.1 long, 2.9 wide. OCA 2.5 long, 2.12 wide (anterior) 3.24 wide (posterior).

Pedipalp. Embolus short, twisted (Figs. 35-37). Tibial apophysis short, curved forward.

Distribution. Known only from Senegal.

Remarks. There are a number of *Rhene* species known from West-Africa by females only. *Rhene sulfurea* may be a matching male for one of them. It also possesses a straight and twisted embolus, which is not typical for the genus, therefore worth to note.

Uxuma Simon, 1902

Uxuma impudica Simon, 1902*
(Figs 38-42)

U. impudica Simon, 1902: 372; 1903a: 797, f. 931.

Material examined. Holotype male from Gabon. Handwritten labels in the tube: "*17391 Uxuma impudica Gabon*"; (MNHN, Paris; no. 17391).

Diagnosis. Small sized salticids (Fig. 38). Male palp with a twisted embolus (Figs. 41-42).

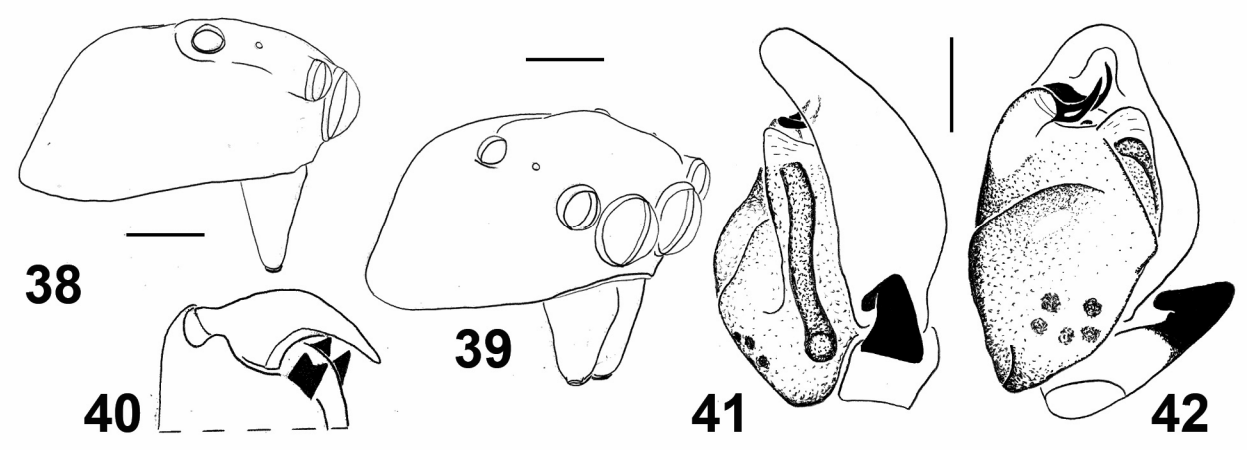
Description. Male holotype (Fig. 34). Type specimen bleached by ethanol, in poor condition: abdomen badly damaged. Carapace dark brown. Thoracic slope steep, starting well behind the ocular area. Legs dark brown.

Measurements. Total length cannot be measured. Cephalothorax 2.3 long, 1.2 wide, 1.0 high at PLE. OCA 1.1 long, 1.2 wide (anterior) 1.1 wide (posterior).

Pedipalp. Embolus short. Bulbus with a conductor (Fig. 41-42) behind the embolar base.

Distribution. Known only from Gabon.

Remarks. The specimen resembles those of *Habrocestum superbum* Wesołowska, 1999, but the "conductor" is unique. It is not possible to draw any significant conclusion before females are known.



Figures 38-42: *Uxuma impudica* male holotype: 38 = male carapace, lateral view, 39 = same, antero-lateral view, 40 = chelicerae ventral view, 41 = male palp, retrolateral view, 42 = male palp, ventral view (scale bars: 38-39: 1 mm, 40-42: 0.2 mm)

DISCUSSION

The huge diversity of spiders is far from full exploration. Although jumping spiders are belonging to the most species rich family, there are still a large number of new taxa to be discovered and described. The works in the last and in the 19th century do provide us with a largest number of names, but unfortunately a smaller portion could be used without any doubt or type examination. As rumour says M. E. Galiano has spent a half a year in the Musée national d'Histoire Naturelle only checking all the Salticidae types described by Simon. Her publication (Galiano 1963) has founded the salticid taxonomy in South America, since many known taxa were illustrated. Recently her labels are still good hints to find out whether a specimen is a name-bearer or not, since Simon did not distinguished his types from other material. Such a basic work for West-Africa is not exists, although the Diagnostic Drawing Library of Prószyński (2007), which is a web-based collection of original drawings of different salticid taxa, covers pretty much of the genera. My aim

was to fill out the remaining parts, with even an iconographic paper. If one could use this paper to identify African fresh material, there would be a new basis for future nomenclatural changes, which I am reluctant to do now, because of insufficient material and the specimens' poor condition.

During the study, a number of characters have been found which need further examination to resolve relationships among the genera.

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Opusc. Zool. Budapest, 2005 (2007), 36: 97-102

The habitat requirements of *Poecilimon brunneri* Frivaldszky, 1867 (Orthoptera: Phaneropteridae) and its Hungarian occurrence

Á. VÁRI[1] & G. SZÖVÉNYI[2]

Abstract. *Poecilimon brunneri* Frivaldszky, 1867, a bushcricket species about to be declared protected, has been known only from one place in the hilly area of Gödöllő from within the Carpathian Basin. The present study was conducted on this population in Hungary in order to gain knowledge of the species´ habitat requirements, as well as to discover more occurrences within the area. Looking at the habitat´s vegetation structure and species composition at different scales, it proved to be rather patchy, especially on a finer scale. We found patches of lower (cca. 10 cm), sparser vegetation alternating with patches of denser and higher vegetation. The distribution of *P. brunneri* between these two patch types changed during the season and with the larval development of the bush crickets. First instar larvae and females prefer more open soil surfaces (the latter for laying their eggs), whereas for older larvae and imagines it is the more densely and higher covered areas that play a leading role. For assessing the situation of the species in Hungary, it is necessary to know the extent of the populated area. In the course of exploring the terrain further around the already known place near Pécel we found the species on several smaller, more or less seperated habitat patches on the surrounding hills as well as on the Mountain of Küdő, lying somewhat further.

INTRODUCTION

As a representative of the *Poecilimon* genus of which the distributional centre lies mostly in the Aegean, Caucasian and Crimean areas, *P. brunneri* (Orthoptera: Phaneropteridae) is typically of a SE-European and a southern E-European distribution (Kis 1962, Heller 1984); it can be found both to the south and to the east of the range of the Carpathians. The only occurrence known from within the Carpathian Basin lies in the hilly area around Gödöllő, north of the town Pécel, where it was found in 2003 (Nagy 2003). Although there was given a short preliminary description of the habitat, for effective protection measures more detailed data is needed. The population first detected here consists of a very small number of individuals and regarding the distribution of the species as a whole, it is extremely isolated. Thus, it is seriously threatened by local extinction, as isolated populations in general are, where there are no nearby areas from which recolonization could take place (Boer 1981). It is essential for taking the appropriate measures that we are sufficiently well informed on the requirements of the target species. In order to achieve this, in 2005 we tried to reveal the ecological requirements of this species´ Hungarian population by examining vegetation structures of inhabited areas, along with the size of the population and its dispersal potential (Vári & Szövényi 2007). The importance of spatial structures has already been recognized by Sänger (1977), newer research promotes this idea, too (e.g. Behrens & Fahrtmann 2004, Krätzel *et al*. 2002, Schuhmacher 2002) and emphasizes their effect on the resulting microclimate, which is ultimately the determining agent in the occurrence of most orthopterans (Ingrisch 1979, Fartmann 1997).

Besides the area where the species was first found by Barnabás Nagy (2003), an estimated 1-2 ha, another place inhabited by *P. brunneri* in an adjacent valley became known. Our research was conducted on this latter site, which was about 12 ha, but we also aimed at the detection of further habitat patches of the species.

MATERIALS AND METHODS

The researched area lies at the southwestern edge of the Hilly Area of Gödöllő, which joins the plain of Pest. The Hilly Area consists mostly of sandy-gravel fluvial deposits on top of which pleistocene loess has settled (Marosi & Somogyi 1990). The researched site lies northeast of the

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town Pécel, on Látó Hill. At the present there is a degraded Pannonic loess steppe (*Festucetum rupicolae* Zólyomi ex Soó, 1964) which is sheep-run (Nagy *et al*. 2005).

The vegetation structure was assessed at different spatial scales (in sampling squares of 0.25 m^2 and of 25 m^2). In these estimates we used the structural growth-types and measured the horizontal structure at different heights as described by Fartmann (1997).

Data from the 25 m^2 plots was taken every 2-3 weeks starting in April 2005, altogether six times at 19 sites (at the grid-points of a 70 x 70 m grid-square). Apart from individual-countings (Vári & Szövényi 2007) we assessed different abiotic and biotic environmental parameters. Among the previous ones was the steepness of the plot (flat: 0-5°, gently sloping: 5-20°, steep: >20°) and its orientation, among the latter ones parameters characterizing the vegetation structure were recorded (the total vegetation cover, the cover of litter and the percentage of open ground, as well as the horizontally seen density of vegetation at a height of 10 cm and of 30 cm and the vegetation composition according to structural growth-types: the coverage of sward forming grasses, tussock grasses, rosette forming plants and wooden plants in percent).

The smaller plots (0.25 m^2) were examined on 15th July 2005 along three (50 x 0.5 m) transects. The vegetation cover (in percent), the mean vegetation height and the number of *P. brunneri* individuals found in the respective squares, as well as the height of each bushcricket´s position were noted. At the time of this examination about 23% were imagines (Vári 2005).

Developmental stages of the nymphs at the time of each counting were determined by measuring the length of their femura (Vári unpublished), thus gaining five distinctly seperable groups. This way we found on 23rd April and on 29th April solely 1st instars, on 13th May 2nd and 3rd instars, on 28th and 29th May mainly 4th instars, but also few 5th instars, on 13th and 14th June mainly 5th instars and few imagines were caught, whereas from 25th June all were imagines.

For data assessment Excel and STATISTICA (StatSoft) software was used: Spearman rank correlation for vegetation parameters and chi-square test for goodness of fit.

The surroundings of the known population were searched several times during 2005 and 2006. Samples were taken by sweep netting (at least 300 sweeps) on sites chosen according to different aspects like closeness to the known habitat patch or similarity of vegetation.

RESULTS

Big plots. The distribution of *P. brunneri* changed with the vegetation coverage during the season (Fig. 1). For first instar larvae an optimum curve is discernible, with an optimum at about 50 % coverage. Such a more densely inhabited range is also detectable for second instars, whereas with the progress of the season this range gets broader until the occurrences are more or less evenly distributed in plots covered about 60 to 90 %. Some sort of a preference for steepness could similarly only be shown at the first counting. At this time half of the first instar larvae inhabited „steep" squares, 30 % „gently sloping" ones and only 20 % were to be found in „flat" squares.

There was no difference in individuals´ distribution between the plots of the SE and of the SW hillsides. We couldn´t find any significant correlation between all the other measured environmental parameters and animal abundance, except one: the correlation with low herbaceous plants at the second counting (2nd and 3rd instars) was significantly correlated ($p<0.05$) according to Spearman rank correlation ($r = 0.73$, $n = 19$). Correlations with all other parameters were weaker than this and/or not significant.

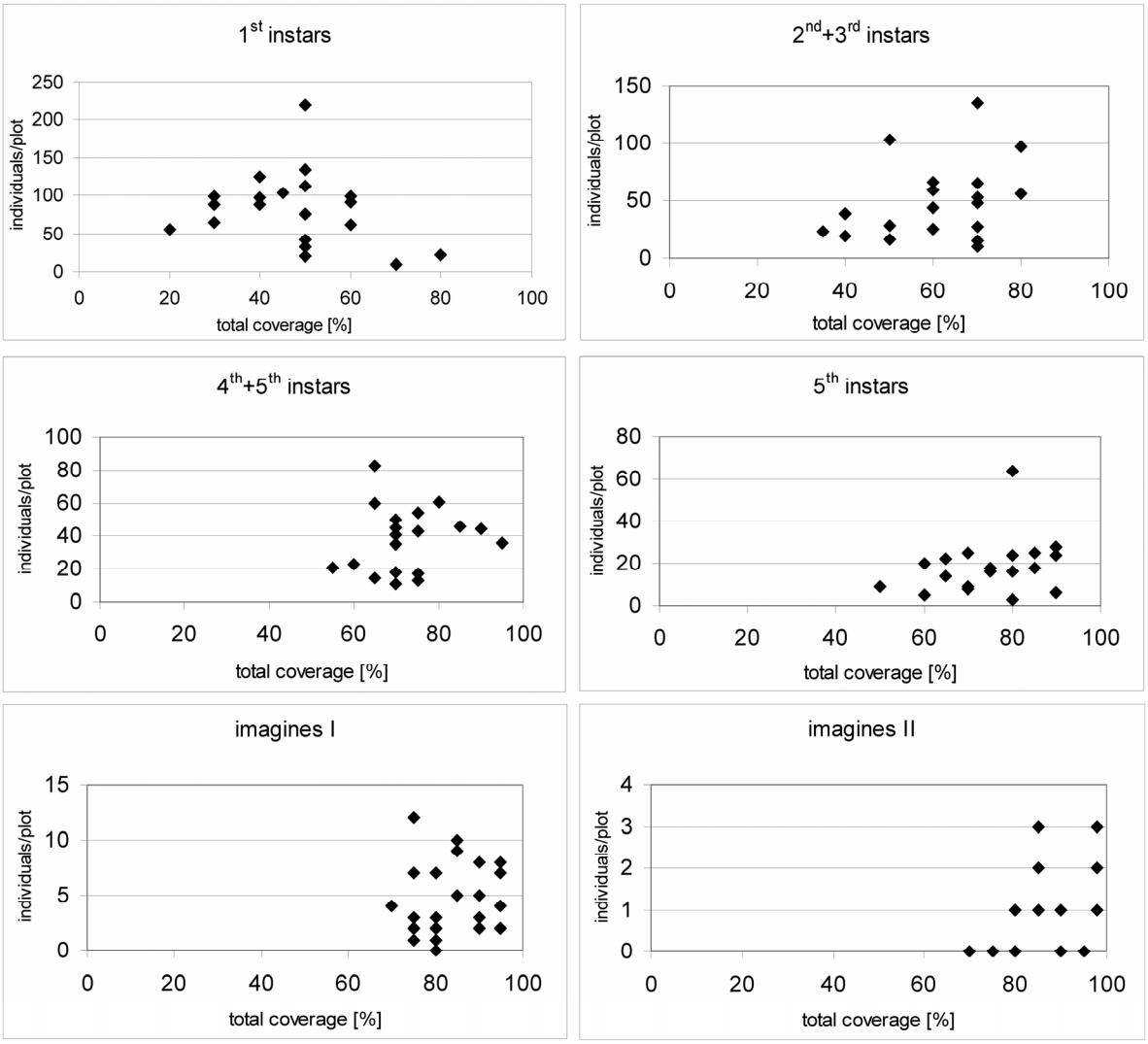

Figure 1. Number of individuals per plot and the plots´ total vegetation cover during the season: 29/04/05 (1st instars), 13/05/05 (2nd+3rd instars), 28/05/05 (4th+5th instars), 13/06/05 (5th instars),01/07/05 and 24/07/05 (imagines)

Small plots. In the smaller scale investigations we succeeded in showing up more definite correlations such as the (adult and 5th instar) bushcrickets´ predominantly sitting on plants protruding from the vegetation (Fig. 2). Their distribution, divided into three categories (higher than avarage vegetation height, at the same height or lower) deviated from an even distribution significantly (X^2=18,553 > $X^2_{(2,\ 0,005)}$ = 10,597). This was confirmed by nighttime investigations on imagines, too (Vári 2005).

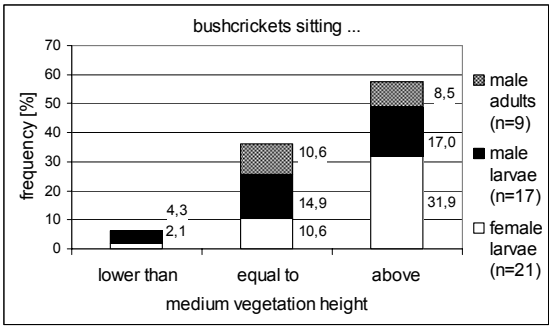

Figure 2. Height of the animals´ sitting places in relation to the surrounding vegetation

Exploring the surrounding hills, we searched an area of about 60 ha (Fig. 3) thoroughly around the investigated population, where, apart from the patch where *P. brunneri* was first recorded from in Hungary, we detected several other habitat patches of different size. Trespassing between these patches is uncertain, even though, physically, it cannot be excluded.

In the summer of 2006 a part of the investigated area (cca. 1 ha) and an adjacent area also populated with *P. brunneri* (cca. 4 ha) was ploughed and planted with oak saplings.

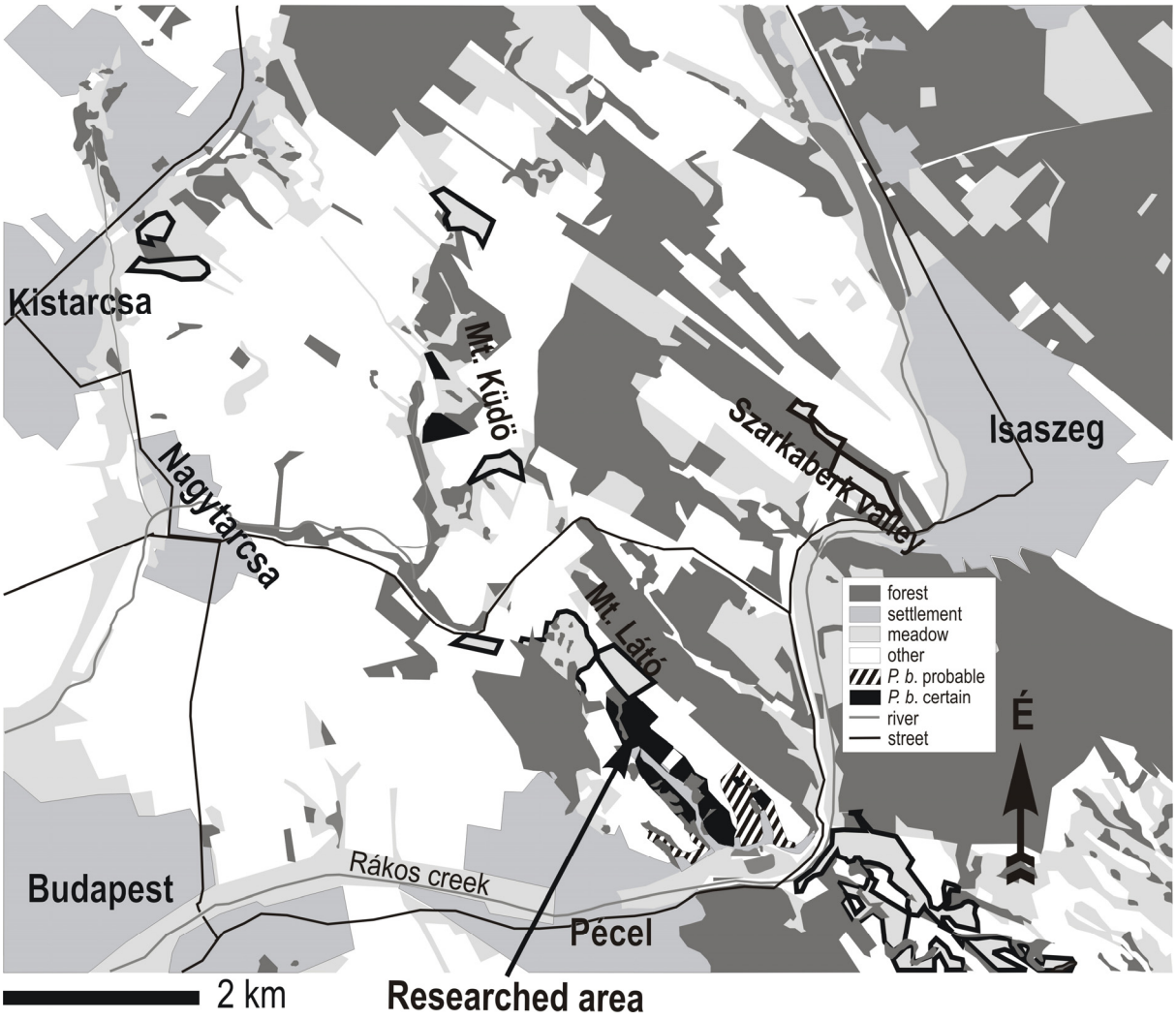

Figure 3. The occurrence of *P. brunneri* in the hilly area of Gödöllő. Areas with proved occurrence of *P. brunneri* are filled black. Areas searched but *P. brunneri* not found are framed with thick black line

Apart from the described patches, we found the species at another hill somewhat further (cca. 3.5 km, Mountain of Küdő). On other nearby places, even with similar vegetation composition, no *P. brunneri* could be detected. In all these inhabited patches the vegetation is denser than at the researched population´s place, probably due to a missing, regular grazing. The density of *P. brunneri* in all these habitat patches seems to be far less than at the researched site.

DISCUSSION

Knowing the dispersal capacity of first instar larvae (Vári & Szövényi 2007), it can be assumed that their observed distribution, according to which they were in greater numbers on plots covered to a certain degree with vegetation, does not result from their actively choosing these places. The clustering of the larvae on rather thinly covered spots could be ascribed on one side to the females preference of laying their eggs into rather open ground patches (own field observation) but also to the different survival chances for eggs and larvae, as both develop better in sparsely covered and in steeper places which warm up more easily (Bruckhaus 1992).

In contrast to other research´s results (Schuhmacher 2002, Walter 1994) we did not find the highest densities of larvae on the least covered patches, but somewhere in the middle of the range of all densities recorded at one time. Looking at the absolute numbers of recorded vegetation cover this can be easily explained as the lowest percentages of cover still reached about 80 to 90 % in the cited investigations, whereas we had up to 20-70 % uncovered ground (depending on the time of the year). As the vegetation provides also food and shelter, it seems logical that a certain minimum of vegetation is beneficial for their development. The correlation between bushcricket densities and lower herbaceous plants at the second counting seems plausible, as according to our knowledge of *P. brunneri´*s feeding habits it only eats various herbaceous dicotyledonous, but no monocotyledonous plants at all (Nagy 2003, Vári 2005). In the light of the above, it should be rather more the lack of other connections that is harder to interpret. It might be explained by a blurring effect of vegetation growth in other structural types later on, which were not present at the time of the second countings. Furthermore, we suppose that the lack of significant correlations between vegetation parameters and bushcricket abundance taken at the bigger scale is related to the fineness of the patchy pattern for which the 5 x 5 m squares were too rough to detect otherwise existing differences.

Regarding the preference of high sitting places, we have to take several facts into account, as we have seen *P. brunneri* exhibiting this behaviour during the day just as well as in the night. We might assume that during the day it is the insolation that influences the animals´ behaviour as in sunny weather protruding places are the thermally most beneficial ones and this is sought actively by some orthopterans (Samietz 1998, Chappell 1983) as it has been proven to have a positive influence on physiological processes like maturing of the eggs (Samietz 1998). In contrast to this, in the night, the search for mating partners is a more probable explanation, during which the bush crickets stridulate (as well as listen to others stridulating) preferably from acoustically advantageous places (Kalmring 1990). But other, microclimatic components of the observed behaviour cannot be excluded either.

Looking at the mapped occurrences of *P. brunneri* in the surroundings we can see a rather large area of altogether 70 ha inhabited patchily. In evaluating this, it is important to see the degree of fragmentation of these patches, also in relation to the rather poor dispersal abilities of the animals (Vári & Szövényi 2007). For this reason, even relatively small distances present serious obstacles, so there is actually not one big area that can be populated evenly, but several smaller spots and one bigger patch, which is threatened by being ploughed or built up.

The present study shows that there is not one single parameter that defines the habitat requirements of *P. brunneri* but rather more the complex structural diversity of the vegetation, the patchiness of the habitat that is of basic importance to the species. This structure of alternating sparsely and densely vegetated patches can be maintained by keeping up sheep grazing or by the early spring burnings.

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Opusc. Zool. Budapest, 2005 (2007), 36: 103-104

Remarks on the species *Dendrobaena jeanneli* Pop, 1948 and its proposed synonymy with *Octolasion cyaneum* (Savigny, 1826) (Oligochaeta: Lumbricidae)

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Abstract. The type specimen of the dubious species *Dendrobaena jeanneli* Pop, 1948 was found in the Zoological Museum, Babes-Bolyai University, Cluj. An investigation of the somewhat softened and fragmented specimen allowed us to recognise its most important taxonomic characters such as the position of the clitellum and tubercles, the setal arrangement, the structure of the calciferous glands and the nephridial bladders. According to these characters this species belongs to the genus *Octolasion* Örley, 1885, and on the position of the clitellum and tubercles it is clearly identical with *O. cyaneum* (Savigny, 1826).

The earthworm species *Dendrobaena jeanneli* was described by Pop (1948) from a cave material collected by René Jeannel in Grotte du Rochefort, France. Since the first description it has not been recollected although this species' name regularly occurs in the earthworm literature. Bouché (1972) mentions this species as valid in his book on the French earthworms, also Mršić (1991) and Blakemore (2005) cite this name among the *Dendrobaena* species. The last checklist in which this species name occurs is by Qiu & Bouché (1998).

During a search for the type species of *Allolobophora dugesi* var. *getica* Pop, 1947 in the Zoological Museum of the Babes-Bolyai University, Cluj we happened to find the type specimen of *Dendrobaena jeanneli* as well. Eventhough the specimen is not well preserved, its condition enabled us to give a short redescription

Dendrobaena jeanneli Pop, 1948

Dendrobaena jeanneli Pop, 1948: 15., Pop 1968: 244., Bouché 1972: 404., Zicsi 1982: 443., Blakemore 2005: 25., Mršić 1991: 550., Qiu & Bouché 1998: 194.

Material examined. *Dendrobaena jeanneli* **Typus**. CZMB No. 589 (Grotte de la Rochefort, Dépt. De la Mayenne, comm. De Thorigné, France. Leg. R. Jeannel, 30. XI. 1912. The specimen is softened and broken in two parts just at the clitellum.

Diagnosis. *External* – Body length cca 100 mm, diameter 3-4 mm. Colour brown (due to the preservation?), but pigmentation seems to be lacking. Head epilobous, dorsal pores cannot be found. Setae in closer pairs laterally and somewhat wider ventrally; setal arrangement after the clitellum: aa:ab:bc:cd:dd = 4.2:1.8:2:1:11 Clitellum extends on segments 29–34, saddle-shaped. Tubercles as white bands on ½29–½34. Male pore on 15 between setae *b–c*, great, usually intruding into the neighbouring segments. Nephropores not seen. *Internal* – Septa clearly seen but not tickened. Four pairs of seminal vesicles in 9–12. Spermathecae two pairs in 9/10, 10/11, open in setal lines c*d*. Calciferous glands in 10–14, with well-detached lateral diverticula in 10. Last pair of hearts in 11 and a pair of extraoesophageals in 12. Excretory system holoic. Nephridial bladders ocarina-shaped.

Remarks. Perhaps the darker brown colour of the specimen misled Pop (1948) in identifying its real generic placement. However, due to the shape of

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nephridial bladders and the structures of calciferous glands this species could not belong to *Dendrobaena* but to *Octolasion*. On the position of the clitellum and tubercles, this specimen is clearly identical with *O. cyaneum,* therefore *Dendrobaena jeanneli* Pop, 1948 must be regarded as synonym of *Octolasion cyaneum* (Savigny, 1826).

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