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Two new and a known species of the family Tripylidae (Nematoda: Enoplida) from the tropics

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Abstract. Two new species of the genus *Tripyla* and *Tripylella,* respectively, as well as a known but rare species of the genus *Tripylina* are described and illustrated. *Tripyla pulchella* sp. n. from Papua New Guinea belongs to the smallest members of the genus, and is characterized by the narrowed anterior end, the well developed cephalic setae, the sclerotized vulval lips, the medium long, conical tail and the long terminal spinneret. *Tripylella iucunda* sp. n. from La Réunion is the shortest species within the genus possessing short cephalic setae, discoidal cardia and dorsally abruptly narrowed tail. *Tripylina stramenti* was found in São Tomé and is redescribed for the first time after the original description.

Two new and a known but rare nematode species of the family Tripylidae found in tropical regions of Earth are presented and described. They belong to the genera *Tripyla, Tripylella* and *Tripylina,* respectively.

The specimens of the new species were collected in Papua New Guinea and La Réunion, respectively, those of the known species in São Tomé, during three collecting trips of Hungarian zoologists. The samples were fixed *in situ* in 4 % formaldehyde solution, and the nematodes transferred in the lab in anhydrous glycerine by a slow method. The permanent glass slides are preserved in the collection of the author, later they will be deposited at the Zoological Department of Hungarian Natural History Museum, Budapest.

Tripyla pulchella sp. n.

(Fig. 1 a–e)

Holotype female: L = 0.71 mm; a = 20; b = 4.6; c = 6.2; c' = 5.0; V = 55 %.

Paratype females (n = 2): L = 0.70–0.82 mm; a = 19–21; b = 4.3–4.7; c = 6.1–6.4; c' = 4.7–5.2; V = 54–59 %.

General description. A small and stout nematode, irregularly bent or twisted after fixation; body 36–42 µm wide at mid-region. Cuticle 1.5–2.0 µm thick; finely annulated, annules 1.0–1.5 µm wide; annulations most conspicuous at vulval region and tail. Labial region 18–19 µm wide, narrower than adjacent body. Body at posterior end of oesophagus 2.2–2.5 times as wide as head. Inner labial papillae small. Cephalic setae 6+4, arranged in two separate circles; the six longer setae 5–6 µm, 1/4 to almost 1/3 labial width long, the four smaller setae quite thin, situated nearly one length of a longer seta from the anterior circle. Amphids caliciform, apertures occupying one-sixth to one-fifth of corresponding body diameter.

Mouth opening somewhat dorsally shifted. Dorsal tooth small, lying in a small buccal pouch, and located about one labial width from anterior end. Oesophagus cylindrical, muscular, strongly gathered, 155–175 µm long. Distance between posterior end of oesophagus and vulva 1.5–1.6 times as long as oesophagus. Cardia disc-like. Intestine showing undulated walls and broad lumen.

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Rectum as long as or somewhat shorter than anal body width.

Female. Genital system amphidelphic. Vulval lips sclerotized, vagina occupying one-fourth to one-third of corresponding body width. Gonads rather short, each 72–88 µm, occupying 9–12 % of entire length of body. Mature eggs not observed. Vulva–anus distance 1.6–1.9 times as long as tail. The latter 112–130 µm long, 15–16 % of body length, conical, evenly tapered and ventrally curved. Caudal glands three. Spinneret strongly developed, 10–11 µm long, in first half conoid, in second cylindroid.

Male. Not observed.

Differential characters and relationships. Tripyla pulchella sp. n. is characterized by the small and plump body (it is one of the smallest representatives of the genus), the head narrower than neck, the fairly long cephalic setae, the small dorsal tooth, the sclerotized vulval lips, the medium long, conical tail, and by the unusually long terminal spinneret.

The genus *Tripyla* Bastian, 1865 contains 24 valid species (Andrássy, 2007). The present new species can easily be identified among them. There are only two members of the genus which are nearly so small as our species: *T. pygmaea* Micoletzky, 1922 and *T. minuta* (Brzeski, 1963) Brzeski & Winiszewska-Ślipińska, 1993. The new species differs from *T. pygmaea* by the longer body (0.7–0.8 vs 0.4–0.5 mm), the well developed cephalic setae (vs quite small, papilloid), and by the much longer tail (110–130 vs 20 µm, or c' = 5 vs 1). It differs from *T. minuta* by the more developed cephalic setae (5–6 vs 3 µm, or 1/4–1/3 vs 1/6–1/5 labial width), and especially by the shape of the tail which abruptly narrows at mid-region in *T. minuta.*

In its general appearance, *Tripyla pulchella* resembles the common species *T. setifera* Bütschli, 1873, but clearly differs from that by having a shorter body (0.7–0.8 vs 1.0–1.6 mm), separated head, much shorter cephalic setae (5–6 vs 20–25 µm), shorter vulva–anus distance (1.6–1.9 vs 2.3–3.0 tail lengths), and by the much more developed terminal spinneret.

Type specimens. Holotype female on slide No. 13015. Paratypes: two females. All in the collection of the author.

Type habitat and locality. Leaf litter and humus from a secondary rain forest, Masham River, Wau, Papua New Guinea; collected in September 1968 by J. Balogh (Budapest).

Etymology. The species epithet *pulchella* (Latin) means: pretty or nice-looking.

***Tripylella iucunda* sp. n.**

(Fig. 2 a–e)

Holotype female: L = 0.73 mm; a = 20; b = 4.6; c = 6.0; c' = 4.5; V = 47 %.

Paratype females (n = 3): L = 0.68–0.75 mm; a = 20–21; b = 4.5–4.7; c = 6.0–6.5; c' = 4.2–4.6; V = 47–49 %.

General description. Body small and plump, curved upon fixation, 35–38 µm wide at mid-region. Cuticle smooth and very thin, only 1 µm thick. Labial region rounded, 15–16 µm wide, slightly narrower than adjacent region. Body at posterior end of oesophagus 2.0–2.2 times wider than head. Inner labial papillae fine, setose. Cephalic setae 6+4, arranged in one circle; the six setae 2.0–2.5 µm long, about 1/8–1/6 of labial diameter, the four setae very small and thin. Amphids caliciform, levelling with dorsal tooth, their aperture 1/5 of corresponding body diameter.

Dorsal tooth sharp, lying in a buccal chamber at one labial width from anterior body end. Oesophagus cylindrical, well folded, 150–158 µm long, or 21–22 % of entire length of body. Distance between posterior end of oesophagus and vulva 1.1–1.2 times as long as oesophagus. Cardia discoidal, 17–20×9–12 µm. Intestine thick-walled,

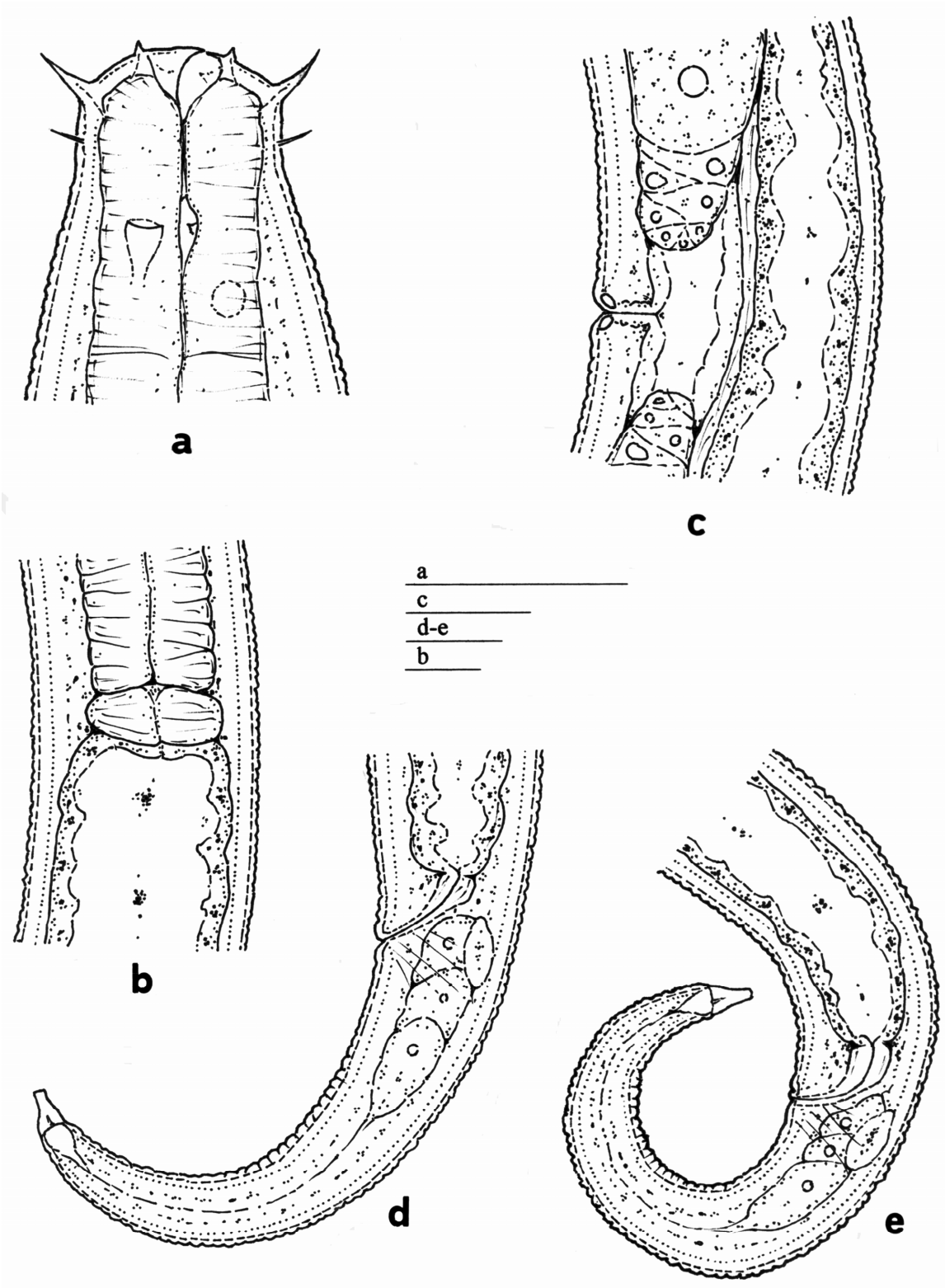

Figure 1. *Tripyla pulchella* sp. n. a: anterior end; b: cardial region; c: vulval region; d–e: female tail. (Scale bars 20 µm each)

strongly wrinkled, rectum thick, nearly as long as anal body width.

Female. Genital organ amphidelphic. Vulval lips sclerotized, heart-shaped, vagina short, occupying 1/4 to 1/3 of body width. Gonads rather short, each 50–80 µm long, or 7–11 % of body length, containing few oocytes. Uterine egg not observed. Vulva–anus distance equal to 2.1–2.3 tail lengths. Tail 105–120 µm long, occupying 15–17 % of body length, ventrally bent, in anterior half thick, hardly narrowed, then strongly tapered dorsally and becoming nearly cylindrical. Caudal glands three, well developed. Terminal spinneret short, 2.5–3.0 µm.

Male. Not found.

Differential characters and relationships. This new species is a small and stout representative of the genus. In addition to its size and shape it is characterized by the short cephalic setae, the anteriorly directed buccal tooth, the discoidal cardia, and especially by the shape of the tail.

The genus *Tripylella* Brzeski & Winiszewska-Ślipińska, 1993 has three species. They are *T. intermedia* (Bütschli, 1873) Brzeski & Winiszewska-Ślipinska, 1993, *T. maiuscula* Andrássy, 2006 and *T. minuscula* Andrássy, 2006. The new species at once differs from the two latter by the shape of the tail (abruptly narrowed before middle vs evenly tapered). It can be differentiated furthermore from *T. maiuscula* by the shorter body (0.7 vs 1.1–1.4 mm), the much shorter cephalic setae (2.0–2.5 vs 7–9 µm) and the discoidal cardia (vs spherical). Finally, *T. iucunda* can be distinguished from *T. intermedia* by the somewhat shorter body (0.7 vs 0.9–1.0 mm), the narrower head (15–16 vs 18–20 µm wide), the more strongly developed cephalic setae (vs very small, papilliform), as well as by the shape of the tail (thicker in anterior third vs in more than half its length).

Type specimens. Holotype female on slide No. 14867. Paratypes: three females. All in the collection of the author.

Type habitat and locality. Fallen leaves and humus from a moss forest, Forêt de Bébour, La Réunion (Indian Ocean); collected in June 2000 by L. Hufnagel (Budapest).

Etymology. The species name *iucunda* (Latin) means: nice or charming.

Tripylina stramenti **(Yeates, 1971) Tsalolikhin, 1983**

(Fig. 3 a–f)

Females (n = 7): L = 1.53–1.60 mm; a = 30–36; b = 5.7–6.2; c = 13.0–16.8; c' = 3.3–3.5; V = 62–64 %.

General description. Body relatively large, moderately slender, 44–51 µm wide at mid-region, C- or G-shaped upon fixation, more strongly curved in posterior half. Cuticle thin, 1.5–2.0 µm, smooth. Labial region rounded, not separated from neck, 26–28 µm wide. Body at posterior end of oesophagus 1.4–1.5 times as wide as head. Inner labial papillae setose. Cephalic setae 6+4, arranged in a whorl; the six setae 13–15 µm long, about half the labial diameter, the four setae 6–8 µm long. Amphids one head width from anterior end with apertures occupying 1/5 of correponding body width.

Dorsal tooth small, located at less than one head diameter from anterior end, subventral denticles minute. Oesophagus cylindrical, somewhat widened at buccal region, strongly striated, 258–268 µm long, or 16–17 % of body length. Distance between posterior end of oesophagus and vulva 2.5–2.8 times as long as oesophagus. Two thin ventral setae present in the neck region; the anterior 97–110 µm from body end, or at 36–40 % of oesophagus length, the posterior 294–316 µm from anterior end, or at 60–68 % of oesophagus length. Cardia lobe-like, often wider than intestine. Intestine with broad lumen. Rectum nearly equal to anal body diameter.

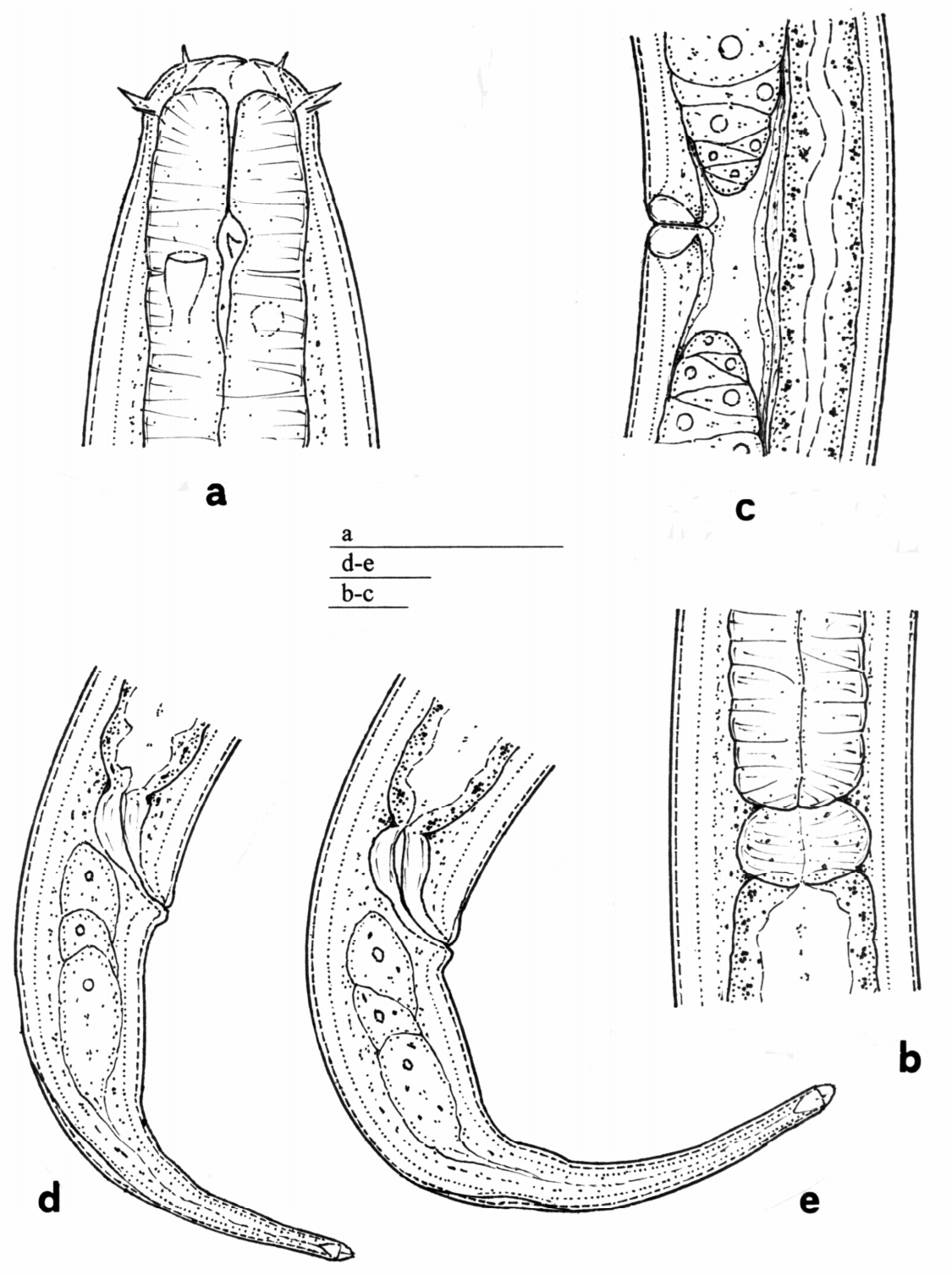

Figure 2. *Tripylella iucunda* sp. n. a: anterior end; b: cardial region; c: vulval region; d–e: female tail. (Scale bars 20 µm each)

Female. Genital organ prodelphic, without posterior uterine sac. Vulva slightly sclerotized, vagina very short, hardly 1/5 of corresponding body width. Gonad 294–312 µm long, occupying 19–20 % of body length. Ovary reflexed to near vulva. Uterine egg one at a time, 132–138×46–48 µm, about three times the body width long. Vulva–anus distance equal to 3.9–4.8 tail lengths. Tail 96–120 µm long, or 6.2–7.6 % of entire length of body, evenly tapered, S-shaped, first ventrally then dorsally curved, usually showing a break. Caudal glands three, large. Terminal spinneret short and thin

Remarks. Yeates described this species from New Zealand under the name *Trischistoma stramenti* Yeates, 1971. Tsalolikhin (1983) transferred it to the genus *Tripylina* which was then accepted by Brzeski and Winiszewska-Ślipińska (1993), Zullini (2006) and Andrássy (2007). *Tripylina stramenti* is a rare tripylid species, reported now for the first time since its description.

The present specimens (13 females and 1 juvenile) correspond well to the description by Yeates, with the only exception that the six cephalic setae are longer than originally measured (13–15 vs 10 µm). This small difference may be regarded as an intraspecific variation, particularly if we take the great geographical distance between the two localities (New Zealand and western Africa) into consideration.

The genus *Tripylina* Brzeski, 1963 consists of six species (Andrássy, 2007). Four of them have a lesser size, 0.8 to 1.3 mm, so that *T. stramenti* (1.5–1.7 mm) is easily differentiated from them. Concerning the body length, Yeates' species is close to *Tripylina longa* Brzeski & Winiszewska-Ślipińska, 1993, but the more anterior position of the vulva (60–64 vs 76–80 %) well distinguishes it from the related species.

Habitat and locality. Moss from rock, Lago Amelia, São Tomé and Principe, West Africa; collected in August 2000 by L. Hufnagel (Budapest).

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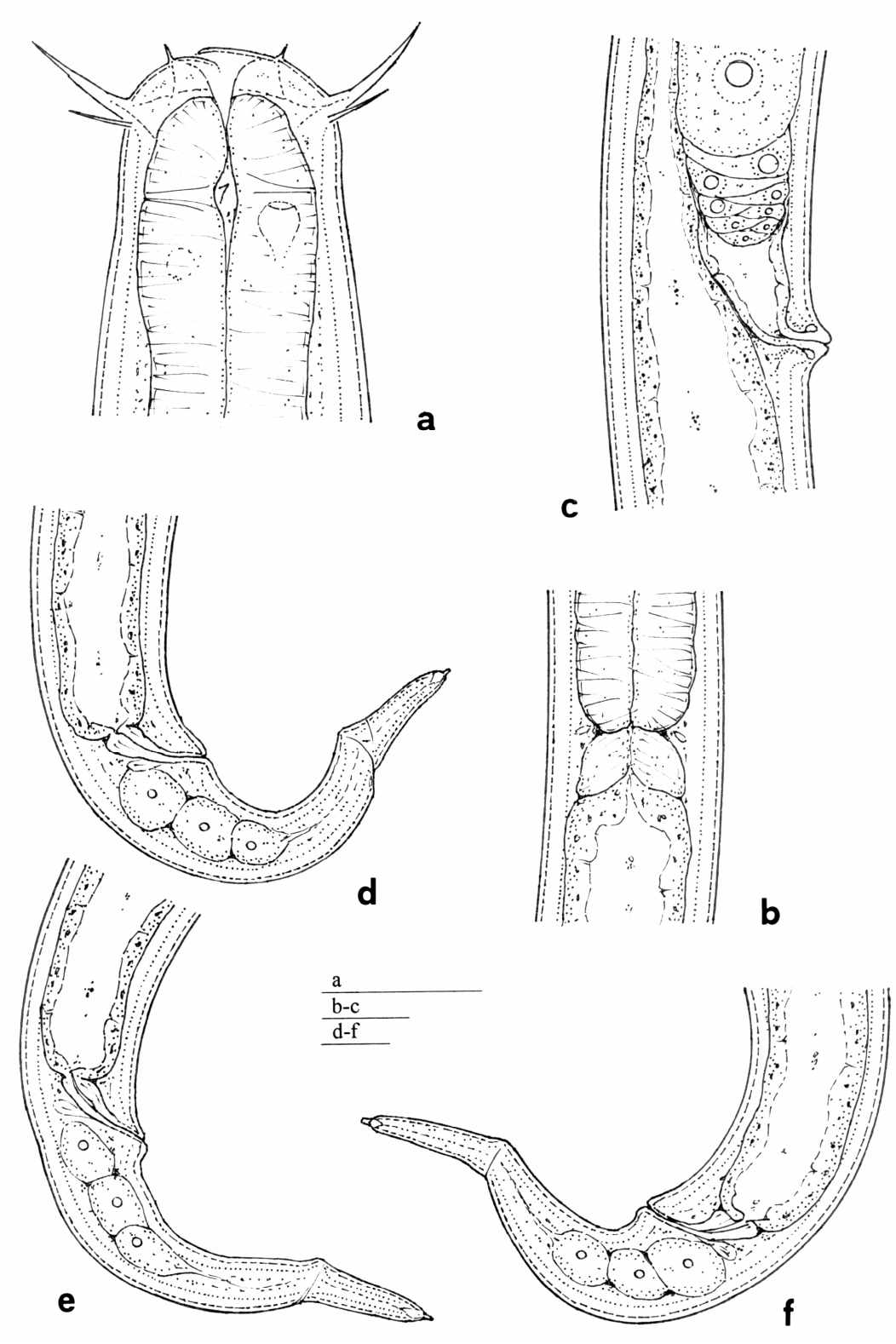

Figure 3. *Tripylina stramenti* (Yeates, 1971) Tsalolikhin, 1983. a: anterior end; b: cardial region; c: vulval region; d–f: female tail. (Scale bars 20 µm each)

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Review of Criodrilidae (Annelida: Oligochaeta) including *Biwadrilus* from Japan

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Abstract. Palaearctic family Criodrilidae Vejdovsky, 1884 is briefly reviewed and revised to reabsorb Biwadrilidae Brinkhurst & Jamieson, 1971, monotypic for lacustrine/limnic *Biwadrilus bathybates* (Stephenson, 1917) based on examination of new Lake Biwa material from recent earthworm surveys. Comparison is with type species: *Criodrilus lacuum* Hoffmeister, 1845. Synonymy in *Criodrilus* of monotypic genus *Hydrilus* Qiu & Bouché, 1998 from Algeria is accepted but with provisional restoration of its type as *Criodrilus ghaniae* (Qiu & Bouché, 1998) **comb. nov.**, if indeed it belongs in the Criodrilidae. Another recent taxon *Guarani camaqua* Rodríguez & Lima, 2007 from rice fields of Rio Grande do Sul, Brazil is **syn. nov.** of *Criodrilus lacuum* at species and genus level since its characteristics are easily embraced within interspecific variability. Moreover, the prior taxon, *C. lacuum*, was already known from its type-locality. Distribution, ecology and species associations of the criodrilids are briefly summarised including a report of *C. lacuum* maintained in a laboratory culture for >42 years (T. Timm pers. comm.). A key to species is provided.

INTRODUCTION

Michaelsen (1900: 420) had initially assigned the semi-aquatic and Palaearctic subfamily Criodrilinae under Glossoscolecidae, yet Michaelsen (1918) and Stephenson (1930: 888, 904) thought affinities of *Criodrilus* were common descent with Madagascan *Kynotus* from an original *Drilocrius*-form which probably inhabited Ethiopian Africa; they further thought *Criodrilus* was the ancestor of the Lumbricidae. In an alternative view, Stephenson (1930: 889, 904, 910) postulated that *Criodrilus* was a lumbricid modified though having adopted an aquatic life, and that origin of the Lumbricidae needed to be sought elsewhere. For Gates (1972: 50), the closest relationships of Criodrilidae, based on extra-oesophageal trunks of the vascular system lateral to the hearts, were with the Moniligastridae (here thought highly unlikely) or Alluroididae, if not also the Haplotaxidae and the Sparganophilidae (here thought more likely). Differences in the ovaries, he believed, contraindicates close relationships between the Criodrilidae and the Lumbricidae; but Sims (1980: 114), Rota & Omodeo (1992) and Sims & Gerard (1985: 40; 1999: 40), had Criodrilidae with greater affinities with superfamily Lumbricoidea (at that time comprising of Sparganophilidae, Ailoscolecidae, Hormogastridae, Lumbricidae, and Lutodrilidae), and recent molecular analysis by Pop *et al.* (2004) seems to support similarity to, but separation from, the Lumbricidae.

The following revision of Criodrilidae Vejdovsky, 1884 is augmented from the most recent review by Blakemore (2006) where within it was proposed to return to Criodrilidae the species *Biwadrilus bathybates* (Stephenson, 1917) that was originally in *Criodrilus* and later monotypic for *Biwadrilus* Brinkhurst & Jamieson, 1971 – the erstwhile type genus of their Biwadrilidae – based on newly collected material. This formal publication defines the current taxonomic *status quo* of the family with review of all three of its constituent species including the type *Criodrilus lacuum* Hoffmeister, 1845 which has been, at various times, included in the Lumbricidae.

MATERIALS AND METHODS

The family is reviewed and species are described using format and methodologies of Blakemore (2002; 2006). Taxonomy complies with

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ICZN (1999). The only widely distributed taxon, type-species, *C. lacuum*, is described below and is compared with *C. ghaniae* and a redescription of *Biwadrilus bathybates*. Voucher specimens of *Biwadrilus* and other earthworms are held in the Lake Biwa Museum (LBM) or Yokohama National University (YNU).

TAXONOMIC RESULTS

Family **Criodrilidae** Vejdovsky, 1884

Biwadrilidae Brinkhurst & Jamieson, 1971: 809, **syn. nov.**
Criodrilidae Vejdovsky, 1884: 63; Michaelsen, 1921: 141; Gates, 1972: 49; Sims, 1980: 107; Blakemore, 2000: 33, 2002: 243, 2006: 398.
Criodrilinae: Michaelsen, 1900: 463; Stephenson, 1930: 721.

Type genus: Criodrilus Hoffmeister, 1845 (syns. *Hydrilus* Qiu & Bouché, 1998; *Guarani* Rodríguez & Lima in Lima & Rodriguez, 2007 **syn. nov.**).

Type species: *Criodrilus lacuum* Hoffmeister, 1845.

A second less well-known and possibly dubious species is *Criodrilus ochridensis* Georgevitch, 1950 (author sometimes miscited as "Gjorgjevic, 1949") from Lake Ochrid, Macedonia. The *Hydrilus* taxon may merit provisional retention as species *Criodrilus ghaniae* (Qiu & Bouché, 1998) **comb. nov.** on such characters as its dorsal pores (?and tubercular pubertatis), but determination of presence or absence of nephridia from the anterior apparently needs further investigation. South American species included in *Criodrilus* by Michaelsen (1900) – e.g., *C. breymanni*, *C. buergeri*, *C. iheringi* – were transferred to *Drilocrius* Michaelsen, 1917 (Family Almidae) by Michaelsen (1918) as they possessed spermathecae rather than spermatophores. The English species from Suffolk *Anagaster fontinalis* Friend, 1921, now in synonymy of *Helodrilus oculatus* Hoffmeister. 1845, was erroneously associated with *Criodrilus* in the past and may account for the only British report. Trans-Aegean *Criodrilus dubiosus* Örley, 1881 was transferred as *Allolobophora dubiosa* by Örley (1885: 24) and now resides in *Aporrectodea* (Lumbricidae). A new inclusion in *Criodrilus lacuum* at both species and genus level is Brazilian *Guarani camaqua* Rodríguez & Lima,2007 **syn. nov.**. for reasons discussed below.

Diagnosis (from Michaelsen 1900; Stephenson 1930; Gates 1972; Sims 1980; Blakemore 2006): Fresh and brackish water worms. Body quadrangu lar in section (at least in posterior). Prostomium zygolobic (epilobic in *Hydrilus*). Nephropores in b lines (throughout?). Clitellum multilayered, annular in (14,15),16-45 or perhaps less extensive (cf. *Biwadrilus*, *Hydrilus*). Tubercula pubertatis typically absent (?cf. *Hydrilus*). Female pores paired on 14. Male pores on 13 (*Biwadrilus*) or 15 (*Criodrilus*) associated with internal bursae or 'prostatic glands'. Spermathecae absent but spermatophores, hornshaped, tubular, or saccular, attached near male pores. Oesophageal and intestinal gizzards, calciferous glands, and caeca absent (but possibly some thickening of oesophagus in 5-7 and intestine in 15-20,21). Intestinal origin around 15-20. Typhlosolate or atyphlosolate. Hearts in (6),7-11. Nephridia holoic (avesiculate?); absent from anterior segments. Ovaries fan-, pear- or paddle-shaped in 13 (but not terminating in a single egg-string). Ova microlecithal (i.e. not yolky). Cerebral ganglia between segments 1 and 2 (as in *Biwadrilus*, cf. Sims, 1980: 114). Lateral lines absent.

Distribution and diversity. Palaearctic: Europe from Mediterranean to Moldavia [e.g. Italy; Hungary (Budapest), Austria (Linz); Germany (Berlin); France; Spain, Portugal, Yugoslavia, Greece [reported by K. Michalis (1993, 2003) as "*Criodrilus lacuum* (Oligochaeta: Criodrilidae) earthworm species new to Greece" – from Internet search, publication unknown], Turkey, Asia Minor, the Maghreb (Tunisia and Algeria) and the Levant (Syria, Lebanon, Israel, Palestine), and from Latvia, Poland, Russia to Amur River region of Siberia on the Pacific coast, and Japan (*Biwadrilus*). Reports are of introduction of *Criodrilus lacuum* to America: plant pots in Baltimore and from rice paddies in Rio Grande do Sul, Brazil (Knäpper & Porto, 1979; Lima and Rodriguez, 2007 for *Guarani*) and, doubtfully, to UK (cf. *Anagaster fontinalis* above). The immature specimens from southern India that Stephenson identified with *Criodrilus lacuum* probably were glyphidriles according to Gates (1972: 50), but Julka (1988: 39) yet claims it from India. Omodeo (1984), Timm (1999) and Martin (2004) provide some additional distribution data for the species.

Biwadrilus bathybates (Stephenson, 1917) (Fig. 1)

Criodrilus bathybates Stephenson, 1917: 96; Stephenson, 1930; Yamaguchi, 1954 (syn. *miyashitai*). Type locality Lake Biwako Shiga-ken, Japan in sediment at a depth of 180 feet (= 60m). Types four immature specimens, sample No. 3 in

the Calcutta Museum.

Criodrilus miyashitai Nagase and Nomura, 1937: 361 figs. 1-43. From catchments of the River Yura, Komorimachi, near Kyoto south central Japan, and from rice paddy irrigation channels at Tsuruoka, Yamagata-ken in coastal NW Japan. Types unknown.

Criodrilus bathybathes: (*laps*.) Nagase and Nomura, 1937: 361.

Biwadrilus bathybates: Easton, 1981: 40 (syn. *Miyashitai*); Blakemore, 2003, 2005 (syn. *miyashitai*).

Biwadrilus batybates: (*laps*.) Ohtaka and Nishino, 1999: 46.

Taxonomic note. Name sometimes misspelt "*bathybathes*" or "*batybates*".

Material examined and localities. Current samples consisted of several mature and immature specimens, all collected by RJB 1-2.ii.2007, and 1-5.x.2007 and preserved in 80% EtOH, some deposited in the Lake Biwa Museum (batch accession number LBM Misc. Invert. FY2006-19 – Fig. 1) or Yokohama National University and some sent to Kansas Natural History Museum for DNA analysis. Specific localities are:

1.Fudogawa river in Ojiyama-koen on west shore of south basin, Lake Biwa (upper reaches under old bridge, and abundant beside the creek under exotic *Eucalyptus* trees).

2. On shoreline adjacent to Biwako Museum on west side of Kurasuma Hanto especially in mud around willow roots.

3. Harie (N 35°22'15.3", 136°02'58.5") on west side of north basin in mud under trees on shoreline.

Diagnosis. Unpigmented. Length 150—300 mm. Segments 200–250. Prostomium zyboloic. Body quadrangular and dorsally troughed, most noticeable posteriorly. Setae closely paired, aa=dd. Clitellum in most or all of 16–34. Female pores on 14; male pores on 13; spermathecal pores absent. Gizzards, calciferous glands, typhlosole and caeca absent. Holoic, avesiculate, absent from anterior 13 segments. Spermathecae replaced by spermatophores. Prostate-like glands (bursae) exit to male pores.

*Distribution***.** From the Lake Biwa/Kyoto region of southern central Honshu, Japan (as noted in synonymy above), also reported from Tsurugaoka, NW coastal Yamagata-ken and Mukogawa of SW coast Hyogo-ken (Yamaguchi, 1953). Known only from Japan.

Habitats. In lake sediments to 60 m in Lake Biwa (Stephenson), or stony shallows of clean flowing streams leading to River Yura, but not found in agriculturally polluted ditches; and in Yamagata from muddy bottoms of rice irrigation channels to a depth of 50 cm to 2 m, or mingling with roots of plants on embankments (Nagase & Nomura and pers. obs). Also reported by Dr. Machiko Nishino from ca. 10 m depth in the lake on a stony bottom and she also collected it below Amagase Dam on the Uji River and upstream of Seta River that drains Biwa (M.J. Grygier pers. comm.). In current studies found in, and just beside, streams leading to Lake Biwa apparently most abundant in light sandy deposits or submerged organic debris and muddy or stagnant substrates (e.g. in sapropel – the black fetid asphyctic mud). Generally absent from the coarse sandy beaches around the northern basin of Lake Biwa (pers. obs.). The worm has not been reconfirmed from depth >10 m at Lake Biwa despite repeated deep sampling since 1986 (Ohtaka & Nishino, 1999).

Behaviour. Wholly or semi-aquatic and limnic; the worms were observed to be feeding in stagnant or muddy habitats with the furrowed tails protruding 2-3 cm and waving about in the free or flowing water, presumably for respiration and gas exchange (Nagase & Nomura and pers. obs.). On touch and extraction the worms coil tightly, and rapidly succumb to decomposition on exposure, in minutes rather than hours (pers. obs.). Similar behaviour patterns are reported for *Criodrilus lacuum*. Spermatophores frequently observed on bodies of mature specimens, thus is it probable that the muscular male pores facilitate placement and attachment on con-copulant partners.

Length. 150–300 mm.

*Width***.** 3–4 but widest to greater than 5 mm at region of male pores.

Segments and body shape. 200–250; body rapidly tapers at fore and aft, the anterior is concave ventrally, the clitellum is cylindrical, and most of the remainder of the body is quadrangular with the posterior convex ventrally to give a dorsal gutter,

most pronounced in tail segments with setae at edges. (See Fig. 1.)

Colour. In life mostly transparent unpigmented so that blood vessels and ingesta can be seen through body wall except where the pale clitellum obscures, the tail portions are often noticeably vascularized (for gas exchange); on preservation the body becomes opaque, the clitellum more pink and the tail appears yellowy.

Prostomium. Zygolobous with some slight secondary annulation.

First dorsal pore. None.

Setae. (10/ratio of aa:ab:bc:cd:dd): 8 per segment, fairly closely paired (1:7:1:9:6 dd=aa); setae on 13 in immatures small and more closely paired; in matures these are penial in bundles of two to four (or more) small hooked setae. Genital setae are developed on 13 (said to consist of between 2–6 setal bundles by Nagase & Nomura, 1937).

Nephropores. Seen just in front of *a* or *ab* lines, especially obvious on clitellum (none in anterior).

Clitellum. Multilayered, annular in some or all of (14,15),16,17–31,32,(33,34); most pronounced in 18–32 (current specimens).

*Male pores***.** In deep slit on large laterally-extended porophores on 13 that protrude, even in juveniles, and are reported to open and close like pincers (Nagase & Nomura), perhaps for spermatophore molding and placement.

Female pores. In deep clefts on 14 just anterior to ventral setal pairs.

Spermathecal pores. Absent.

Genital markings. None.

Body wall. "*Bundles of irregularly or sometimes pinnately arranged longitudinal muscle fibres*" (Nagase & Nomura, 1937); = intermediate?

Septa. 5/6–11/12,12/13 slightly thickened, thereafter thin.

Vascularization. Dorsal blood vessel single, along with a ventral vessel and a very weak supra-oesophageal vessel (seen only in 9–11 in current specimens, reported in segments anterior to 9 by Nagase & Nomura). Lateral vessels seen in segments anterior to 14. Sub-neural vessel not found nor reported (?cf. *Criodrilus* – see discussion below).

Hearts. Small commissurals in 5–6, large, paired lateral hearts in 7-11.

Gizzard. Oesophageal and intestinal gizzards absent.

Calciferous glands. Absent.

Intestine origin. Origin difficult to determine but it appears to be in region of 20–21 where alimentary canal widens and thins, cf. indistinguishable from oesophagus (Nagase & Nomura, 1937); intestinal caeca and typhlosole absent.

Nephridia: Holoic from 14, avesiculate (cf. *Sparganophilus*, *Pontodrilus*); pharyngeal glands on septa posteriorly in 6 and 7 (and 8 – Nagase & Nomura, 1937).

Male organs. Holandric; iridescent testes and funnels free but invested in coagulum in 10 and 11; saccular seminal vesicles two pairs that fill segments 9 and 12; Stephenson (1917, 1930) said they were in 12 only in his immature specimens, but they are confirmed in 9 too (by Nagase & Nomura and herein).

Ovaries. Fan-shaped in 13 with funnels; ovisacs paired in 14. Ova not yolky.

Prostates. Large cluster of (prostatic?) glands ducting to exit above and below large elongate tubular bursae – what Stephenson called 'prostate' glands [also 'copulation glands' by Nagase & Nomura (1937) after 'Copulationstasche' of Michaelsen (1918), sometimes reported as 'cylindrical setal glands' or 'atrial glands'], in 13 that exit to male pore slits (not to setal bundles) and are probably involved in spermatophore production along with the glands and muscles of the male pores. [Note that Nagase & Nomura (fig. 30) show copulatory glands more rounded than in current specimens, perhaps an artefact of development.]

Spermathecae. Spermathecae absent but spermatophores, saccular, and often attached in pairs dorsally or dorso-laterally near, but often dorsally, on segment 13 from exchange with con-copulant(s).

Gut contents. Organic matter and dark material with grits.

Cocoons. Not found in current studies, but reported by Kawamura (1918, from Nagase & Nomura, 1837: 401) to be large, commensurate with the clitellum, and tapering towards both ends, each containing a number of eggs.

Remarks. No obvious internal parasites were found in dissected specimens. No lateral lines were demonstrated; cf. Nagase and Nomura (1937: 368)

who state: "*The lateral lines are present on both sides of the body, attached to the circular muscle layer with its distal base, being embedded in the longitudinal muscle layer*". It seems these are simply muscle fibres, not nerves, which Stephenson (1930: 36) noted. As remarked above, these lines may be due to lateral vessels that are particularly obvious in the anterior, as also recorded by Nagase and Nomura (1937: 385).

Ecology. Preliminary Lake Biwa surveys by current author (31st January – 2nd February, and 1st – 5th October, 2007) revealed a total of approximately 15 earthworm species plus several microdriles (e.g. *Branchiura* sp., ?*Tubifex* spp.) and at least one species of freshwater leech around the lake from approximately 25 sample sites. Species more closely associated with *B. bathybates*, especially at the Fudogawa site, were:

1. *Eukerria saltensis* (Beddard, 1895), Ocnerodrilidae (exotic) [reasonably abundant around lake, this only the 3rd record from Japan – see Blakemore *et al.* (2007)].
2. *Amynthas* spp. and *Metaphire* spp., Megascolecidae (native/exotic), 5–6 spp.
3. *Aporrectodea trapezoides* (Dugès, 1828) Lumbricidae (exotic).
4. *Dendrodrilus rubidus subrubicundus* (Eisen, 1874), Lumbricidae (exotic).
5. *Eisenia japonica* (Michaelsen, 1892), Lumbricidae (?native).
6. Leech (Hirudinea), possibly a predator on these worms as abundant in same habitat (?native).

There was evidence (footprints, spoor and holes in the sand/mud) of long billed bird(s) systematically probing for worms/leeches as food at Fudogawa site, species unknown.

Criodrilus ghaniae (Qiu & Bouché, 1998) **comb. nov.**

Hydrilus ghaniae Qiu & Bouché, 1998: 17, fig. 1; Omodeo, Rota & Baha, 2003/2004: 463; Omodeo & Rota, 2004: 222 (both latter publications proposing synonymy of this monotypic genus and species); Blakemore, 2005, 2006 (accepting its synonymy in *C. lacuum*). From Constantine, Algeria. Types in Monpellier: (H) CO-ECO Authorship 171/2860/5311; (P1-2) 2865/5311. [Note: of the taxon is slightly confused as the Table of Contents (page 1) lists authors as "Oiu Jiang-Ping, G; Ouahrani et Marcel.B. Bouché." with spelling and punctuation exactly as presented; however, publication (page 17) lists authors only as "Jiang-Ping Qiu et Marcel B. Bouché" (sic) with the taxon name dedicated to "Madame Ghania Ouahrani" for having provided the three specimens].

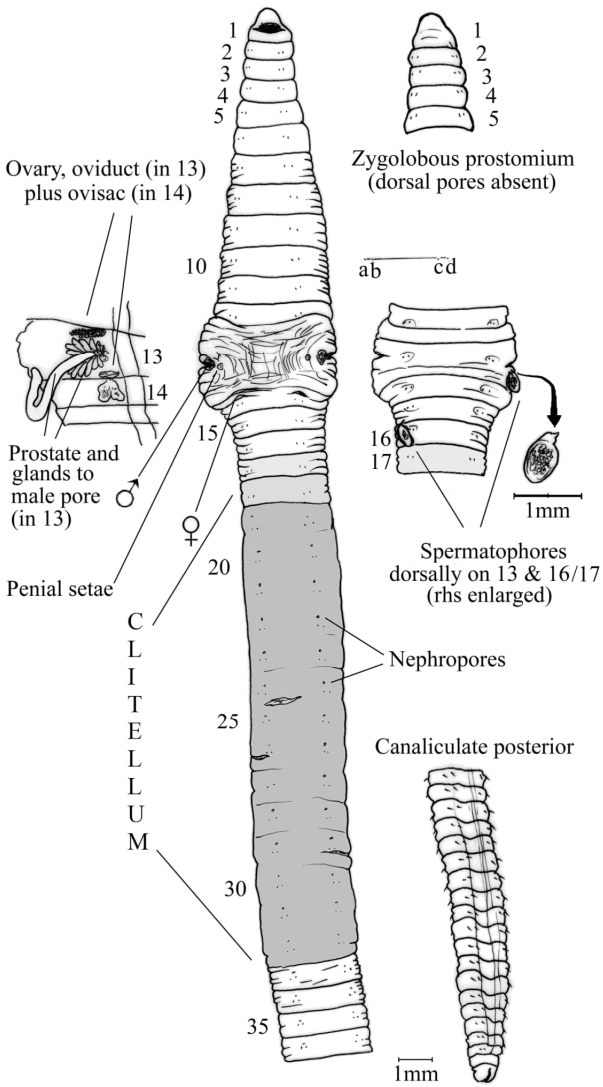

Figure 1. *Biwadrilus bathybates.* Lake Biwa specimen from sample LBM Misc. Invert. FY2006-19, figured and dissected by RJB

Diagnosis. Unpigmented. Length 125–150 mm. Segments 295–320. Prostomium epilobic (open). Dorsal pores obvious, present from 11/12. Body quadrangular. Setae closely paired, (ratio 6:1:8:1:8). Setae ab on 10–14 on large papillae, 16–22 on smaller papillae. Clitellum extensive on 22,23–34,35,36 (and with slight modification from 17–40). Tubercula pubertatis elongate and ventral to clitellum in mid-*bc* on 30–34,35. Female pores small lateral of *b* on 14; male pores on large porophores between *b–c* on 15; spermathecal pores absent. Longitudinal muscle fasciculated (the 'primitive' kind). Septa feeble from 4/5. Hearts 7–11. Gizzards, calciferous glands, intestinal caeca and typhlosole absent. Holoic, avesiculate. Holandric, seminal vesicles in 9–12 (those in 11–12 larger). Male pore has a "sac glandulaire au débouché du pore mâle" (= a roundish prostatic bursa). Spermathecae absent, spermatophores (form?) present in the region of the male pores.

Distribution. Constantine, Algeria.

Habitat. Limicolous, from mud of a refuse discharge channel.

Remarks. The incongruity between the original description and Omodeo & Rota's synonymy of this taxon indicates some major discrepancy. It should however be noted that, despite the glaringly obvious similarity to *Criodrilus*, the original authors (Qiu & Bouche, 1998), for unknown reasons, made neither connection nor comparison.

Criodrilus lacuum Hoffmeister, 1845
(Figs. 2–4)

Criodrilus lacuum Hoffmeister, 1845: 41, figs. 9a-c (of habitus, anterior and two spindle-shaped cocoons). Type locality Tegel-See, Berlin, Germany. Types Missing.

Criodrilus lacuum: Örley, 1887: 551, Pl. 38, figs. 1-18; Benham, 1887: 561, Pl. 38, figs. 9-19; Michaelsen, 1900: 468; Stephenson, 1930: 904; Gates, 1972: 50; Perel, 1979: 174; Blakemore, 2002, 2006.

Guarani camaqua Rodrigues & Lima in Lima & Rodrigues, 2007: 1, fig. 1. **Syn. nov.** From rice fields in Rio do Sul, Brazil. Types numbered 1-10 initially deposited in "the Ana Cláudia Rodrigues de Lima (ACRL) collection" although this may not be legitimate under the Code (ICZN, 1999).

Non "?*Criodrilus lacuum*": Stephenson, 1914: 256 nec "*Criodrilus* sp. (?*lacuum* Hoffmstr.)" Stephenson, 1925: 903, fig. 13 – both reports of immature specimens from India/Pakistan = *Glyphidrilus* sp. – see Gates (1972: 50).

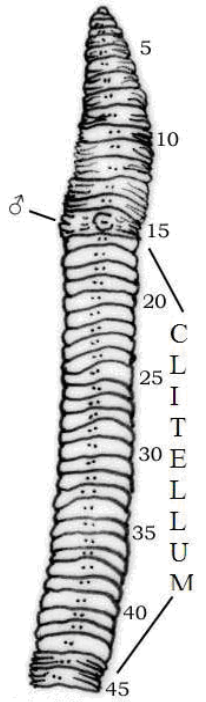

Figure 2. *Criodrilus lacuum* Hoffmeister, 1845. Figure after Perel' (1979: 175, fig. 40; 1997: 50: fig. 20)

Diagnosis. In life light- or dark-brown to greenish. Length of adults 120–320 mm. Segments 200–450. Prostomium zyboloic. Dorsal pores absent. Body quadrangular after segment 9 and most noticeable posteriorly. Setae closely paired, aa>dd. Setae *ab* on 10–14, 17 and 19 often on small papillae. Clitellum extensive, at full development in some or all of

16–47 (i.e. up to ca. 31 segments). Female pores on 14; male pores on 15; spermathecal pores absent. Gizzards absent (or rudimentary in 12–14); calciferous glands and caeca absent. Typhlosole present or absent. Holoic, avesiculate. Spermathecae absent, spermatophores often present.

Materials examined and localities. Not observed in current studies in Australasia/Asia.

*Distribution***.** As for family above excluding Japan, viz. – Tunisia and Algeria (Omodeo & Mar

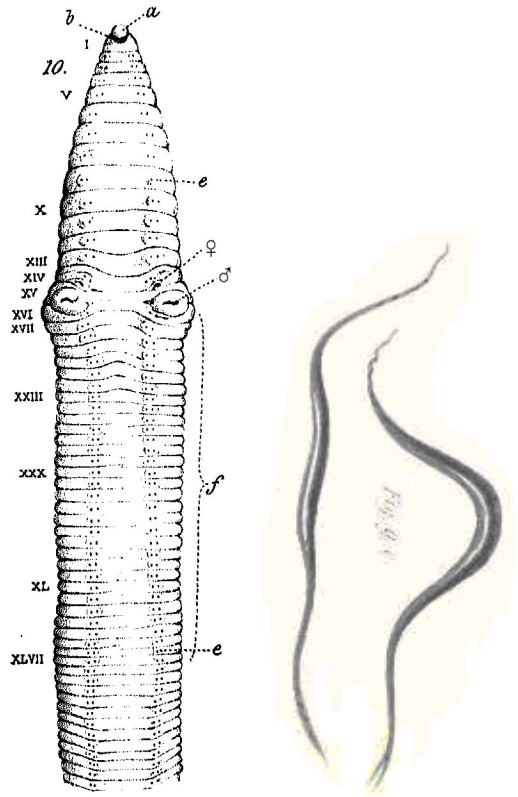

Figure 3. *Criodrilus lacuum*. Left: Modified from Örley, 1887: 551, Pl. 38, fig. 10. Right: Cocoons from Hoffmeister, 1845, fig. 9c (no scale provided but commensurate with clitellum).

tinucci, 1987); Syria; "Palestine" (Israel e.g. by Pavlicek *et al.*, 2003); Lebanon; Turkey [see http://jfas.ege.edu.tr/pdf/29_Yildiz_22_1-2005.pdf]; Southern Russia; Hungary (Budapest); Bulgaria (Srebrana Lake); Greece; Yugoslavia; Italy (Pavia, Treviso, Turin); Austria (Linz); Germany (Berlin); Rivers and tributaries of Danube and Po (e.g. Örley, 1887); France; Spain; Portugal; Latvia; Poland; Moldavia; Amur region of Siberia. Introduced into America [plant pots, Baltimore (Gates) and rice fields Brazil: Rio Grande do Sul (Knäpper & Porto, 1979; Lima & Rodriguez, 2007)]; UK (unconfirmed?); India (unconfirmed cf. Julka, 1988: 39).

Habitats. Mud of fresh and brackish waters (in roots of *Sium latifolium* L. in Europe).

Behaviour. Semi-aquatic; tail often protrudes above substrate (as in *Biwadrilus* for oxygenation?); and regeneration, particularly of 'tail' segments, common (Örley) while Gates (1972) notes anterior 'head' regeneration from as far back as 40/41 in *C. lacuum*.

Length. 40–320 mm.

Width. 4–10 mm.

Segments and body shape. 200–450; body quadrangular (after segment 9) and grooved dorsally on and after clitellum (to increase surface area for gas exchange). (See Figs. 2–3.)

Colour. In life light- or dark-brown to greenish; or colourless.

Prostomium. Zygolobous (cf. epilobous in *Hydrilus*).

First dorsal pore. None (cf. 11/12 *Hydrilus*).

Setae. (7/ratio of aa:ab:bc:cd:dd:U) 8 per segment, fairly closely paired (dd>aa).

Nephropores. In *b* lines (none in anterior).

Clitellum. Multilayered, annular in some or all of (14,15),16 – ca. 45; perhaps less detectable in some specimens to give variable (and unreliable) counts (e.g. *Guarani*).

Male pores. On large muscular porophores on 15, approximately in *b* lines (the "vulva" of Hoffmeister) which probably serve for construction of the cocoon.

Female pores. In 14 or towards 14/15 often on small tumescences near *b* lines (reported median to a lines in *Guarani*).

Spermathecal pores. Absent (cf. Örley as noted in Remarks below).

Genital markings. Tubercula pubertatis absent (cf. reported on 30–34,35 in *Hydrilus*); some setae in genital tumescences, e.g. some of 9,10-13,14, 17 and 19.

Septa. Feeble.

Vascularization. Single dorsal blood vessel complete, along with ventral subneural and supra-oesophageal vessels.

Hearts. (6?),7–11.

Gizzard. Oesophageal and intestinal gizzards absent [but some thickening of oesophagus in 5–7 and intestine in 15–20,21 (Sims), or slightly muscular in 12–14 (Michaelsen)].

Calciferous glands. None.

Intestine origin (typhlosole). Crop in 14–18 and intestinal origin in 19 (Benham), although it is sometimes quoted as 12 (Stephenson) or between 13–18. Typhlosolate according to Benham and others, atyphlosolate by some authors, more often not noted.

Nephridia. Holoic from 13 (sometimes nephridia reported only after 15 or 16), avesiculate (cf. *Sparganophilus*, *Pontodrilus*).

Male organs. Holandric; seminal vesicles four pairs in 9-12 (developed in just 11 & 12 in *Guarani*).

Ovaries. Fan-shaped in 13; ovisacs large in 14. Ova not yolky.

Prostates. Bursae or 'prostatic glands' in 15.

Spermathecae. Spermathecae absent [strangely, Örley (1887: 554) described them ventrally between segments 9/10 and 10/11 and he speculated that they produced the spermatophores, but since no other author found these it is possibly a mistake as suggested by Benham (1887: 569)]; spermatophores (Hoffmeister's "*penis-formige Ktirpehen*"), hornshaped, tubular or saccular, attached externally and usually ventrally although occasionally dorsally near male pores.

Gut contents. Mud?

Cocoons. "*spindle-shaped, parchment like structures with a colour that changes; they are about 5 cm. in length, rapidly diminishing towards each end. One end, drawn out into strongly fibrous threads, serves for attachment to the roots, or more rarely to the leaves and branches of water plants; the other end truncated, with a dentate edge, allows the embryos to escape. As is the form, so also is the color different. The perfectly newly laid cocoons are nearly transparent, horny yellow in color, but after a time they become darker, and towards the time of hatching of the embryos they are blackish in color.*" (Örley, 1887: 556) (Fig. 4).

Remarks. German types were supposedly atyphlosolate like those from Bohemia; while Italian specimens (all?) have a thick typhlosole. Genital setae are reported to have ectal grooving that supposedly demonstrates that *Criodrilus* is closely related to the Lumbricidae.

Criodrilus lacuum is diploid with chromosomes numbering 22 (Omodeo, 1984).

Ecology. Breeding occurs from March to July in Europe (Örley). In Italy *C. lacuum* is often associated with *Eiseniella neapolitana* (Örley, 1885) and *Haplotaxis gordioides* (Omodeo, 1984), and Örley (1887: 560) describes it with his *Aporrectodea dubiosa dubiosa* (Örley, 1881) and he also reports that "*amongst the Hirudinea, species of* Aulostoma *and* Nephelis *are their greatest enemies; these swallow three or four Criodrili at a time*". Benham (1887) noted presence of common parasitic gregarines near the ovaries in segment 14. Regeneration capacity is high and rapid, perhaps in response to predation relating to its behaviour, as already noted, of protruding its tail above the substrate allowing attack by predators.

DISCUSSION

Family Criodrilidae. Sims & Gerard (1985: 41) suggest the present Palaearctic distribution is relictual of a wider, possibly pre-Pangean range dating to late Palaeozoic times but, despite the return of family Biwadrilidae Brinkhurst & Jamieson, 1971, monotypic for *Criodrilus bathybates* Stephenson, 1917, the Holarctic range is extended only slightly to again include Japan. The diagnosis of Biwadrilidae by Easton (1981: 39) was within the ambit of Criodrilidae. Indeed, Sims (1980: 115; 1982: 285) had suggested that the family be recombined with Criodrilidae as it differs only in details of its vascular system – in particular the presence of a supra-oesophageal vessel and possible lack of a sub-neural vessel, although both these characters are poorly defined in *Criodrilus* (cf. Lima & Rodriguez, 2007). And, further, on the presence of male pores and "prostate glands" in 13 rather than 15. Regarding supposed presence or absence of "paired lateral lines" (as found in fish) – these have not been demonstrated satisfactorily in *Biwadrilus*, despite claims by Nagase & Nomura (1937: 368) as repeated by Sims (1980: 106, 115). The only possible 'lateral lines' are due to blood vessels clearly visible through the body wall in the anterior segments in live specimens (pers. obs.). In fact Stephenson (1917), who described the species, makes no mention and Stephenson (1930: 36) states:

"*In the Limicolae* [small aquatic microdriles, not earthworms *per se*] *there exists on both sides within the body-wall, in the lateral line of the body and extending through the length of the worm, a narrow longitudinal tract of cells, the cells of the lateral line. These are, as has been said, the cell-bodies of*

the circular muscle-layer and of the transverse muscle-bundles which stretch between the inner ends of the dorsal and ventral setal bundles of the same side. They are not, as has often been stated, nerve cells, though, according to a number of authors, ... a nerve from the cerebral ganglion does enter the line."

Justification for separation off of Biwadrilidae (or *Biwadrilus*) on this character now seems invalid (cf. Sims, 1980). Moreover, Stephenson (1930: 911) remarking on his *Criodrilus bathybates* under Criodrilinae further says: "*the forward shifting of the male pores is paralleled* [within the Lumbricidae] *in Eiseniella*" – thus there is little of significance in position of male pore in 13 or 15, and the species *B. bathybates* is returned to its home family, Criodrilidae.

Recent 18S, 16S rDNA and cytochrome c oxidase sequences molecular studies by Pop *et al.* (2004) show that *Criodrilus lacuum* is relatively primitive compared to lumbricids and is an adelphotaxon (or sister taxon) of either of their two lumbricid species: *Eiseniella tetraedra* (Savigny, 1826) or *Aporrectodea dubiosa* (Örley, 1881), that both share with it an aquatic habitat.

Absence of nephridia from anterior segments and loss of dorsal pores is an adaptation to aquatic life, also found in *Pontodrilus* and *Sparganophilus* and a few aquatic members of other genera; similarly, for the simplification and reduction of the digestive tract (Stephenson, 1930; M. Bouché pers. comm., 2004).

*Key to species of Criodrilidae**

1 Male pores on 13……..…***Biwadrilus bathybates***
– Male pores on 15……..……..2
2 Dorsal pores and tubercula pubertatis absent ……..…….
……..…..…….***Criodrilus lacuum***
– Dorsal pores present (tubercula pubertatis on 30-34,35) ……..***Criodrilus ghaniae***

**C. ochridensis* Georgevitch, 1950 from Lake Ochrid, Macedonia is a dubious species.

Genus Biwadrilus. This genus should possibly be maintained on the position of the male pores (as in key above). Gates (1972: 50) found that the atrial glands associated in 13 with the male pores of Japanese *Criodrilus bathybates* is a condition that characterizes certain parthenogenetic morphs of *Eiseniella tetraedra* and this may be indicative of mutual family origins (cf. Pop *et al.*, 2004 for molecular relationship of Criodrilidae to Lumbricidae).

A new finding is that *Biwadrilus bathybates* (Stephenson, 1917) persists around the shoreline of the southern basin of Lake Biwako, but appears less abundant beside polluted waterways and under cultivation (e.g. paddies around Ogoto on west side) and is absent from coarse sandy or gravelly beaches more prevalent for the northern basin. Sharing the same habitat with *Biwadrilus* are several native/exotic Lumbricidae, a few pheretimoids, and quite often the exotic semi-aquatic *Eukerria saltensis* (Beddard, 1895) that is considered a pest of rice in Australia (Blakemore *et al.*, 2007). The pheretimoids (Megascolecidae, e.g. *Amynthas* or *Metaphire* spp.) are more common and diverse in disturbed agricultural fields (or polluted soils) around the lake. A large Moniligastridae, *Drawida hattamimizu* Hattai, 1930, is also reported (in rice paddy) around the Lake, but it is a restricted species and was not located in current surveys, however a single specimen of the new native *Helodrilus hachiojii* Blakemore, 2007 was found in a paddy at Shiotsuhama, Nishiazai-cho to the north of the Lake (collected by R.J.B. on 4.X.2007) and this is now also in the Lake Biwa Museum collection. Thus, biodiversity and distributions of the various species may act as "indicators" to monitor agricultural pollution/health.

An interesting result of the Lake Biwa survey was unexpected activity of both clitellate (breeding) adults and juveniles of several species, including *B. bathybates*, in an unseasonably warm winter, despite deep snow on the final day of survey in February, 2007. This suggests breeding activity is facultative rather than fixed or seasonal.

Genus Criodrilus. Although Omodeo *et al.* (2003, 2004: 463) and Omodeo & Rota (2004: 222) synonymized *Hydrilus ghaniae* under *C. lacuum*, the species possibly merits restoration as *Criodrilus ghaniae* **comb. nov.**, as here, on its characteristics

noted in the key and diagnosis above. Omodeo & Rota (2004: 222) question the presence of tubercula pubertatis claiming prior inspection of specimens from Tunisia and Algeria but they mention neither the dorsal pores nor nephridia and, surprisingly, they failed to inspect types. Superficially it appears to belong to *Criodrilus* despite Qiu & Bouché (1998) failing to note absence (or presence?) of nephridia in anterior segments although they did state that the small nephropores were near *b* lines, the first in segment 4. Even so, it is not clear whether they meant in intersegment 3/4 or 4/5. Nephridia usually commence from segment 2 in Lumbricidae and further back, typically from 14-16, in Criodrilidae. As these are defining characteristics of the families, their exact origin requires confirmation from re-inspection of *C. ghaniae* types. Details of neither the vascular nor nervous systems were provided and the overall impression is of a poorly defined taxon.

Guarani camaqua is combined in *C. lacuum* as its justification relies on seminal vesicles in only 11 and 12, even though these vary at interspecific level and are certainly irrelevant at genus level, also Benham (1887: 567), at least, told us they are "*one on each side of each of the somites ix, x, xi, and xii ; they vary in size in these somites, and in different individuals*". As to its blood vessels, the vascular systems of classical taxa, especially those lacking types such as *C. lacuum*, are often poorly defined, however, on this point, Benham (1887: 566) at least reported "*The vascular system I have not traced to any extent.... A subneural vessel is present and a typhlosolar vessel, but neither latero-neural nor intestino-tegumentary vessels exist*" and it is perhaps rather irrelevant whether subneural vessels are attached or not. A prior report of *C. lacuum* from Rio Grande do Sul, Brazil by Knäpper & Porto (1979) although quoted by Lima & Rodriguez (2007) seem not to have initiated comparison to their rice field specimens, even though such an unnatural habitat suggests an introduced, exotic taxon rather than a new native.

Criodrilus lacuum appears a particularly long-lived culture species – the previous longevity record of 30 years was for *Lumbricus terrestris* L., from Sims & Gerard (1985, 1999: 22) – with survival more than 42 years as Dr Tarmo Timm (pers. comm. July, 2007) reports:

"*I have maintained aquatic oligochaetes in aquaria (Centre for Limnology, Estonian University of Life Sciences, Estonia) for many decades. Among them, an aquatic "earthworm"* Criodrilus lacuum*. A number of the latter were taken from the Daugava River (Latvia) in 1965, and then held in several small aquaria. Most of them survived but did not reproduce in aquaria. The only individual hatched from a cocoon laid in my aquarium, lived 34 years (1968-2002). Many of the individuals caught in the river as adults, spent in aquaria up to five years, and some single individuals considerably more: 6, 11, 12, 13, 14, 16, 17, 18, 22, >23 (several but dried up), and 38 years; the last individual is yet alive when having survived already 42 years (1965-2007). Published data on the same batch of* Criodrilus lacuum*: Timm, T. (1984)... [there: at least 17 years]*."

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Taxonomic and biogeographic analysis of the *Allolobophora sturanyi* species group (Oligochaeta, Lumbricidae)

CS. CSUZDI[1] and V.V. POP[2]

Abstract. Morphometric and biogeographic analysis of the *Allolobophora sturanyi* species group – containing *A. sturanyi* Rosa, 1895, *Eophila dacica* Pop, 1938 and *A. sturanyi dacidoides* Bouché, 1973 – proved that these taxa are distinct; consequently the proposed synonymy by Perel (1979) should be rejected. However, these taxa are morphologically close enough to regard them as subspecies of the polytypic *Allolobophora sturanyi.* The analysis also revealed a fourth, well separated group that represents a new species to science, *Allolobophora prosellodacica* sp. n.

INTRODUCTION

The species *Allolobophora sturanyi* was described by Rosa (1895) from Croatia and later, together with some other Central European earthworm species (*Eophila dacica* Pop, 1938, *Allolobophora dugesi* var. *getica* Pop, 1947, *Allolobophora opisthocystis* Rosa, 1895) was regarded by Pop (1949) as subspecies or variety of the Franco-Iberian species, *Allolobophora dugesi* (Rosa, 1886). In the early seventies Bouché (1973) added a further species to this group of earthworms, *Allolobophora sturanyi dacidoides*.

Zicsi (1995) examining the type specimens of *A. opisthocystis* revealed that their male pores are situated near to the clitellum and consequently this species belongs to the genus *Cernosvitovia.* Later Csuzdi and Pop (2007) proved the same for *Allolobophora dugesi* var. *getica*. Due to the high variability of the morphological characters the other species/subspecies were treated taxonomically quite differently by different authors (Černosvitov, 1935; Perel, 1979; Mrsic, 1991), however the most extreme view was proposed by Perel (1979) who regarded all the other species names as synonyms of *Allolobophora sturanyi*. Therefore, in the present study we aimed to clarify the taxonomic status of these species or subspecies and analyze their distribution patterns.

MATERIALS AND METHODS

During the revision we used the materials housed in the Hungarian Natural History Museum Budapest, in the Institute of Biological Research, Cluj-Napoca and in the earthworm collection of the Zoological Museum, Babes-Bolyai University, Cluj-Napoca (Pop's collection). In addition, new materials collected in various regions of Romania (Maramures Mts., Cerna valley, etc.) were also examined. The members of the *sturanyi* species group were morphometrically analyzed with ordination (NMDS) and Cluster Analysis using euclidean distance of six somatic characters, namely: *first segment of the clitellum, last segment of the clitellum*, *first segment of the tubercles, last segment of the tubercles, number of spermathecae* and *total segment number*.

RESULTS

The NMDS (and also the CA) resulted in four well differentiated groupings of the specimens which are geographically separated as well (Figs 1–2). The first group comprises specimens distrib-

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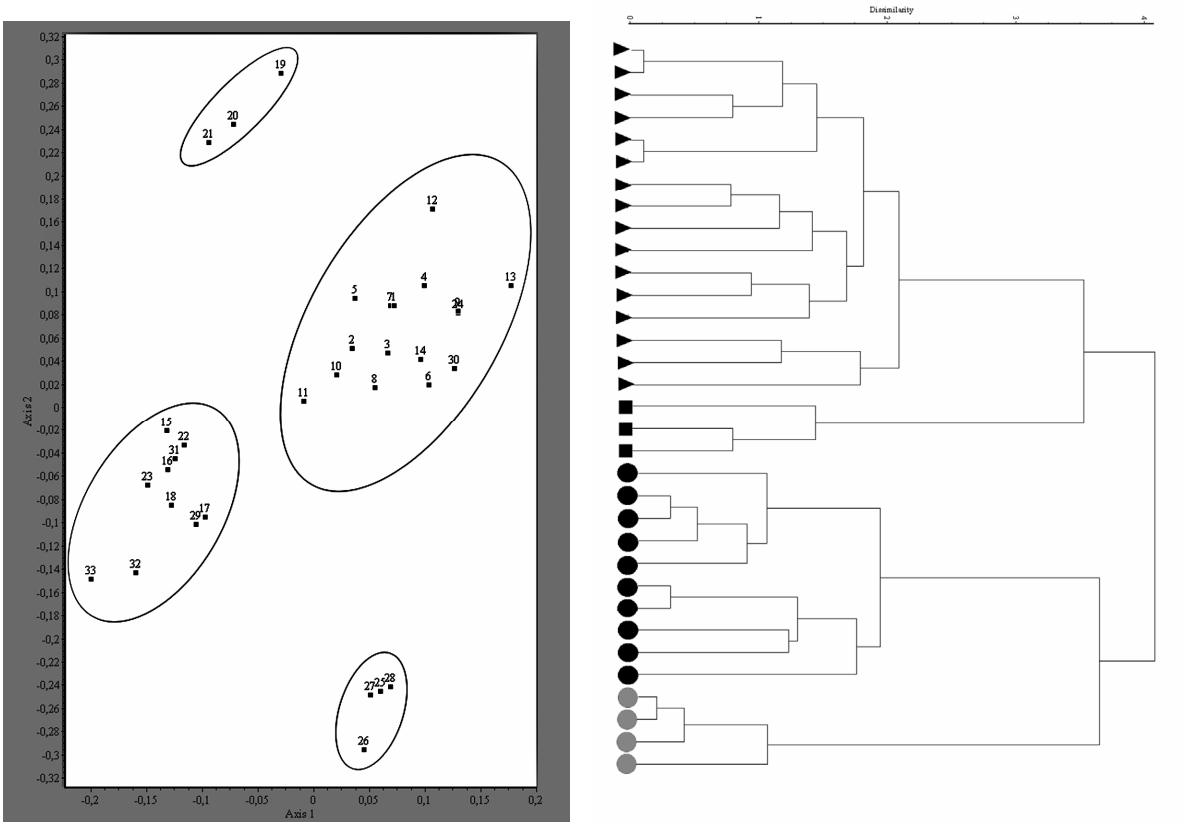

Figure 1. Ordination plot (left) and dendrogram (right) of the *Allolobophora sturanyi* species groups' specimens analysed. Numbers represent specimen numbers in Table 2, triangle = *A. s. dacica*, square = *A. s. sturanyi*, black circle = *A. s. dacidoides*, grey circle = *A. prosellodacica* sp. nov.

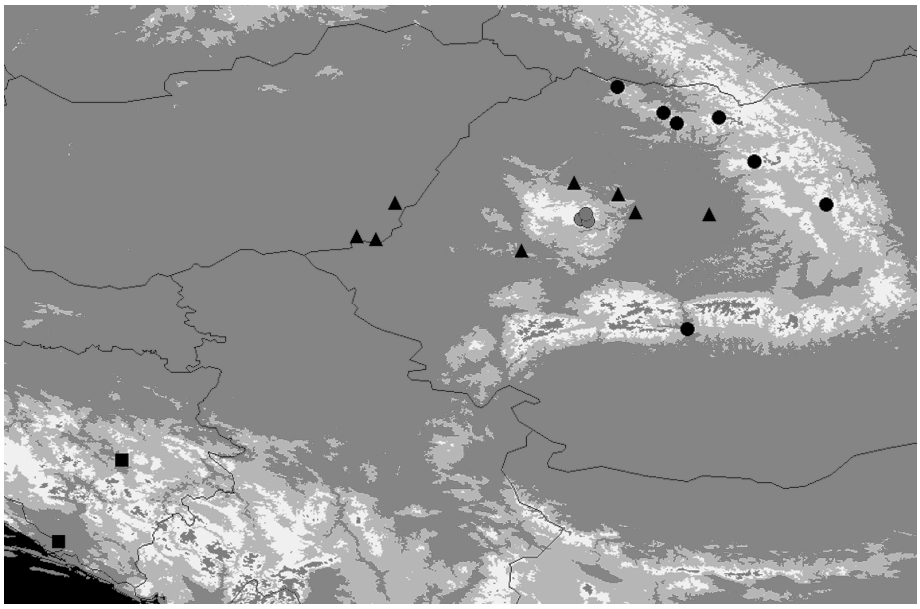

Figure 2. Distribution of the species of *A. sturanyi* species group. Legends are same as in Fig. 1

uted in the Transylvanian basin and the Apuseni Mts. Specimens collected in Hungary also belong to this group. The second group contains the specimens occurring in the Dinara and Kozara Mts., the third group consists of specimens from the Northern Carpathians, whereas the fourth group is distributed in the higher region of the Vladeasa Mountain (Apuseni Mts.) between 1000–1500 m asl. Taxonomically, the first group corresponds to the taxon *Eophila dacica* Pop, 1938, the second to *Allolobophora sturanyi* Rosa, 1895 and the third one to *Allolobophora sturanyi dacidoides* Bouché, 1973; therefore the synonymy proposed by Perel (1979) should not be accepted. Nevertheless, due to the morphological proximity of these taxa their independent specific statuses are not justified. Actually, they represent three subspecies of the polytypic *Allolobophora sturanyi*: *A. sturanyi sturanyi* Rosa, 1895, *A. sturanyi dacica* (Pop, 1938) and *A. sturanyi dacidoides* Bouché, 1973. The fourth group according to the clitellar characters is quite distinct and represents a new species.

TAXONOMY

Allolobophora prosellodacica sp. n.

Material examined. Holotype: Z/15335 Romania, Vladeasa Mts. cca 1400 m, 30. X. 1968. Leg. V.V. Pop (deposited in the Natutal History Museum, Budapest). *Paratypes*: ICB-93 1 ex. Locality same as that of the Holotype (Institute of Biological Research, Cluj), Z/15336 1 ex., ICB-158 1 ex. Romania, Vladeasa Mts. cca 1400 m, 6. VIII. 1965. V. V. Pop, ICB-160 1 ex. Romania, Vladeasa Mts.,17. IX. 1965. Leg. V. V. Pop.

Etymology. The new species' epithet refers to its forward placed clitellum.

Diagnosis. Length: 63–98 mm, diameter: 3–4 mm, setae closely paired. Pigmentation lacking. Clitellum on *xxv–xxxvi*, tubercles on *xxix–½xxxv*. Male pore on *xv* large. Dissepiments 5/6–9/10 strongly thickened. Two pairs of vesicles in *xi, xii* and three pairs of spermathecae in 9/10–11/12. Calciferous glands with small lateral diverticula in *x*. Nephridial bladders proclinate, hook-shaped, longitudinal musculature fasciculated.

Description. Holotype: length 63 mm, diameter just after the clitellum 4 mm. Number of segments 161. Paratypes: 65–98 mm long and 3–4 mm wide. Number of segments 167–173. Colour pale, pigmentation lacking. Prostomium epilobous ½ open. First dorsal pore at the intersegmental furrow 5/6. Setae closely paired, setal formula at segment *xl*: aa:ab:bc:cd:dd = 20:1.5:7:1:27.5. Male pore large, ventral on the segment *xv* intruding also in the neighbouring segments. Nephridial pores irregularly alternated between setal line *b-d*. Clitellum on segments *½xxiv, xxv–xxxvi*. Tubercula pubertatis on segments *½xxix, xxx–½xxxv* (Fig. 3). Nephridial pores irregularly alternate between *b* and above *d*. Genital papillae on 11–13, 15, 17, 23, 26–28, 30–34 *cd*.

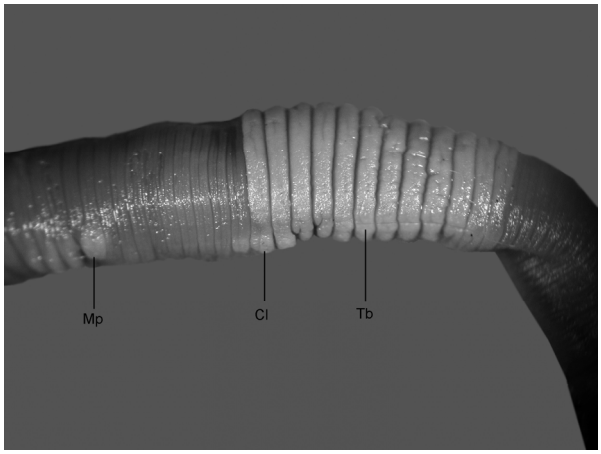

Figure 3. *Allolobophora prosellodacica* sp. n. Mp = male pore, Cl = clitellum, Tb = tubercles

Internal characteristics: Septa 5/6–9/10 strongly thickened. Free testes and funnels paired in segments *x–xi*. Seminal vesicles present in segments *xi* and *xii*. Three pairs of spermathecae in 9/10–11/12. Calciferous glands with lateral diverticula in segment *x*. Hearts appeared in segments *vi-xi* and a pair of extraoesophageal vessel in *xii*. Nephridial bladders proclinate, hook-shaped. Crop in segments *xv-xvi*, and gizzard in

segments *xvii-xviii*. Typhosolis large, bilobed. Longitudinal muscle layer is of fasciculated type.

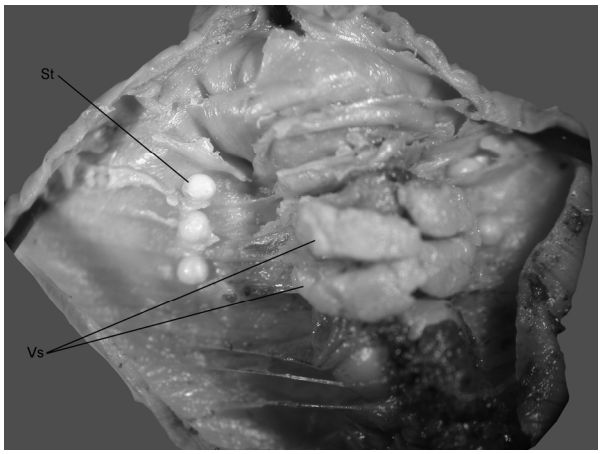

Figure 4. *Allolobophora prosellodacica* sp. n. St = spermathecae, Vs = vesicles

Remarks. The new species is close to *Allolobophora sturanyi dacica* (Pop, 1938), but differs from it by the more forward position of the clitellum and the shorter tubercula.

Allolobophora sturanyi sturanyi Rosa, 1895

Allolobophora sturanyi Rosa, 1895: 5.
Allolobophora sturanyi: Zicsi 1982: 439.
Allolobophora (A.) sturanyi: Perel 1979: 188. (part).
Karpatodinariona sturanyi: Mršić, 1991: 250.

Material examined. Z/6637 1 ex. Croatia, Metkovič, 07.05.1969., Leg. A. Zicsi. Z/6660 2 ex. Bosnia & Herzegovina, Semizovac, 08.05.1969. Leg. A. Zicsi.

Diagnosis. Length: 70–110 mm, diameter: 3–4 mm, setae closely paired. Pigmentation lacking. Clitellum on *xxvii, xxviii–1/n xxxix, xxxix*, tubercles on *xxix–xxxviii, 1/n xxxix*. Male pore on 15 large. Dissepiments 5/6–9/10 strongly thickened. Two pairs of vesicles in *xi, xii* and three pairs of spermathecae in 9/10–11/12. Calciferous glands with small lateral diverticula in *x*. Nephridial bladders proclinate, hook-shaped, longitudinal musculature fasciculated.

Remarks. This species is distributed in the North-Western Balkan and missing from the Carpathians. Perel's (1979) data from the North-East Carpathians probably refers to *A. sturanyi dacidoides*.

Allobophora sturanyi dacica (Pop, 1938)

Eophila dacica Pop, 1938: 142.
Allolobophora dugesi var. *dacica*: Pop 1949: 440.
Allolobophora dacica: Zicsi 1982: 427.
Scherotheca (Scherotheca) dacica: Omodeo 1988: 81.
Karpatodinariona dacica: Mršić, 1991: 246.

New records: Z/14759 1 ex. Romania, Lake Rosu, 25.07.2002. Leg. Cs. Csuzdi., Z/14760 3 ex. Romania, Turda Gorge, 23.07.2003. Leg. Cs. Csuzdi., Z/14763 4 ex. Romania, Stana, 01.08. 2003. Leg. Cs. Csuzdi.

Diagnosis. Length: 70–130 mm, diameter: 3–4 mm, setae closely paired. Pigmentation lacking. Clitellum on *xxviii, xxix–xxxvii, (1/n xxxviii)*, tubercles on (*xxix), xxx–xxxvii, (1/n xxxviii)*. Male pore on 15 large. Dissepiments 5/6–9/10 strongly thickened. Two pairs of vesicles in *xi, xii* and four or five pairs of spermathecae in 9/10–12/13, 13/14. Calciferous glands with small lateral diverticula in *x*. Nephridial bladders proclinate, hook-shaped, longitudinal musculature fasciculated.

Remarks. This subspecies is distributed mainly in inner Transylvania and in the eastern part of the Great Hungarian Plain.

Allolobophora sturanyi dacidoides Bouché, 1973

Allolobophora sturanyi dacidoides Bouché, 1973: 327.
Karpatodinariona dacidoides: Mršić, 1991: 248.

New records: Z/14745 10 ex. Romania, St. Anna Lake, 27.07.2002. Leg. Cs. Csuzdi., Z/15016 1 ex. Romania, Spermezeu 20.09.2005. Leg. V.V. Pop & Cs. Csuzdi., Z/15244 1 ex. Romania, Lapus, Valeni Secatura, 23.05.2006. Leg. J. Kontschán, L. Dányi & D. Murányi.

Diagnosis. Length: 60–110 mm, diameter: 3–4 mm, setae closely paired. Pigmentation lacking. Clitellum on *1/n xxvii, xxvii–xxxvi, xxxvii*, tubercles on (1/n *xxviii), xxviii–xxxvi, (1/n xxxvii)*. Male pore on 15 large. Dissepiments 5/6–9/10 strongly thickened. Two pairs of vesicles in *xi, xii* and three or four pairs of spermathecae in 9/10–11/12, 12/13. Calciferous glands with small diverticula in *x*. Nephridial bladders proclinate, hook-shaped, longitudinal musculature fasciculated.

Remarks. This species is distributed in the eastern Carpathians only in higher altitudes.

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Table 1. Distinguishing characters of *A. prosellodacica* and the subspecies of *A. sturanyi*

Species/subspecies	Clitellum	Tubercles	Receptacles	Segments
A. sturanyi sturanyi	27, **28**–*1/n* 39, **39**	**29**–38, ***1/n*39**	**3**; 9/10–11/12	170–210
A. sturanyi dacica	28, **29–37** (*1/n*38)	29, **30–37**, *1/n*38	**5** (4); 9/10–12/13,13/14	165–182
A. sturanyi dacidoides	*1/n*27, **27–36**, 37	*1/n*28, **28–36**, *1/n*37	**3,4**; 9/10–11/12, 12/13	119–152
A. prosellodacica sp.n.	*1/n*24, **25**–½36, **36**	**30–½35**, 35	**3**; 9/10–11/12	160–170

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Table 2. Locality data of the investigated *A. prosellodacica* and *A. sturanyi* specimens

No.	Locality
1	Hungary, Mezőhegyes, 13. VI. 1961. Leg. Zicsi, Szombathelyiné
2	Hungary, Mezőhegyes, 14. VI. 1961. Leg. Zicsi, Szombathelyiné
3	Hungary, Mezőhegyes, 13. VI. 1961. Leg. Zicsi, Szombathelyiné
4	Romania, Turda, 04. VIII. 1934. Leg. V. Pop
5	Hungary, Mezőhegyes, 13. VI. 1961. Leg. Zicsi, Szombathelyiné
6	Hungary, Mezőhegyes, 14. VI. 1961. Leg. Zicsi, Szombathelyiné
7	Hungary, Battonya, 15. VI. 1961. Leg. Zicsi, Szombathelyiné
8	Hungary, Mezőhegyes, 13. VI. 1961. Leg. Zicsi, Szombathelyiné
9	Romania, Manastur, 29. VIII. 1930. Leg. V. Pop
10	Hungary, Dombegyháza, III. 1956. Leg. Zsemberi
11	Romania, Targu Mures, 31. VIII. 1974. Leg. Zicsi
12	Moldova Leg. Perel
13	Romania, Cheile Turzii, 23. VII. 2002. Leg. Csuzdi
14	Romania, Stana, 01. VIII. 2003. leg. Csuzdi
15	Romania, Vadu Izei, 21. IX. 2005. Leg. Kontschán, Murányi
16	Romania, Varful Țiganului, 21. IX. 2005. Leg. Kontschán, Murányi
17	România, Spermezeu, 20. IX. 2005. leg. Pop, Csuzdi
18	România, Lapus, Valeni Secatura, 23. V. 2007. Leg. Kontschán, Murányi, Dányi
19	Croatia, Metkovic, 07. V. 1969. Leg. Zicsi
20	Bosnia and Herzegovina, Semizovac, 08. V. 1969. Leg. Zicsi
21	Bosnia and Herzegovina, Semizovac, 08. V. 1969. Leg. Zicsi
22	Ukraine, Leg. Perel
23	Ukraina, Kevell. Leg. Cernosvitov, 08. VIII. 1938.
24	Romania, Vata de Jos, 17. IX. 1971. Leg. V. V. Pop
25	Romania, Vladeasa, 06. VIII. 1965. Leg. V.V. Pop
26	Romania, Vladeasa, 17. IX. 1965. Leg. V.V. Pop
27	Romania, Vladeasa, 30. X. 1968. Leg. V.V. Pop
28	Romania, Vladeasa, 04. VIII. 1965. Leg. V.V. Pop
29	Romania, Mtii Hajmas, Poiana Alba, 08. VIII. 1992. Leg. T. Pasca
30	Romania, Cheile Turului, 06. VI. 1995. Leg. V.V. Pop
31	Romania, Mtii Calimani, 19. VI. 1997. Leg. V.V. Pop
32	Romania, Mtii Rodnei, 18. VI. 1997. Leg. V.V. Pop
33	Romania, Mtii Cozia, Faget, 07. VI. 2001. leg. T. Pasca

Opusc. Zool. Budapest, 2006 (2008), 37: 29-42

A review of the Neotropical family Tetrasejaspidae (Acari: Uropodina) with descriptions of three new species

J. KONTSCHÁN[1]

Abstract. The species of the family Tetrasejaspidae Hirschmann, 1979 are listed. Three species new to sciences are described and illustrated. Diagnoses and occurrences of all the hitherto known species are given, and a key to all species is presented. With 30 figures.

The genus *Tetrasejaspis* was described by Sellnick (1941) on the basis of a new Venezuelan species; *Tetrasejaspis dinychoides*. Later Hirschmann (1973 a) described eight new *Tetrasejaspis* species collected by the Hungarian Soil Zoological Expeditions to South-America. In another work, Hirschmann (1973b) gave a short key to all the then known *Tetrasejaspis* species.

Subsequently, Hirschmann (1979) redefined the families and genera of his Uropodina system (Gangsystematik) and placed the *Tetrasejaspis* species in the newly erected family Tetrasejaspidae. Unfortunately a diagnosis of the family had not been presented in this work, and later neither Hirschmann nor his co-workers mentioned this family again (Hirschmann, 1993; Wiśniewski, 1993 a, b; Wiśniewski & Hirschmann, 1993).

More than ten years later, Huțu (1991) described two new species from Venezuela, and recently Kontschán (2007) mentioned several Venezuelan Uropodid mites, including a new and a previously known *Tetrasejaspis* species. In the same year Vazquez and Klompen (2007) reported an unidentified *Tetrasejaspis* species from Mexico extending the known distribution of this South American family to Central America as well.

Surveying the "Berlese" samples of the Hungarian Natural History Museum collected in different parts of South and Central America, I have found four *Tertrasejaspis* species, of which three proved to be new to science and are herewith described.

MATERIAL AND METHODS

The specimens were studied with traditional methods. Lactic acid was used to clear the specimens. Drawings were made with camera lucida. The investigated type and other specimens are stored on slides and deposited in the Soil Zoology Collections of the Hungarian Natural History Museum (HNHM). All measurements are given in micrometers (µm).

TETRASEJASPIDAE Hirschmann, 1979

Diagnosis. Idiosoma pear-like. Dorsal and marginal shields fused on their anterior margin. Scalloping can be found between the marginal and dorsal shields. All dorsal setae long and smooth. Postdorsal shield present and subdivided into three parts by females and not divided by males. Genital shields of females are large, oval, quadrangular or pentagonal. Their anterior margin between coxae 4, other parts placed on ventral shield. Genital shields of males are rounded and placed between the posterior margins of coxae 4. All ventral setae very long, smooth and needle-like.

Gnathosoma: Corniculi horn-like, laciniae long, apical part with two short branches. Hypostomal setae are the follows: h1 long, smooth or with some spines, h2 two times shorter than h1, their margins with spines, h3 similar to h2. Setae h4 shorter than h3 and distally serrated. Epistome subdivided intoto two branches at its apical part, margins with several short spines. Basal part of epistome with some strong spines. Base of tri-

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tosternum wide, covered by coxae 1. Laciniae of tritosternum subdivided into two longer and two shorter branches. Chelicerae with nodes, processus hyalinus on digitus fixus is finger-form. Legs with wide, smooth or distally serrated setae.

Type genus: Tetrasejaspis Sellnick, 1941.

Distribution. All tetrasejaspid species occur in tropical Central and South America; there are records from Venezuela, Bolivia, and Brazil. Here are presented the first records for Costa Rica and Ecuador.

Systematic position. I have to agree with Hirschmann's (1979) conception. The *Tetrasejaspis* species do not belong to the family Uropodidae, because the base of tritosternum wide and covered by coxae 1 (see the superfamily Polyaspidoidea). These characters distinguish Tetrasejaspidae from the superfamily Uropodoidea (which includes the family Uropodidae) where the base of tritosternum narrow and not covered by coxae 1 (Krantz,1970).

Tetrasejaspis Sellnick, 1941

Tetrasejaspis Sellnick: 1941 p. 145.
Tetrasejaspis: Hirschmann 1973 pp. 88-89.

Diagnosis. See the family.
Distribution. See the family.
Type species: Tetrasejaspis dinychoides Sellnick, 1941.

Remarks. Up till now 12 species are known including the three which are described in the present work.

Tetrasejaspis dinychoides Sellnick, 1941

Tetrasejaspis dinychoides Sellnick: 1941: 145-156.
Tetrasejaspis dinychoides: Kontschán 2007 p. 337. figs p. 338.

Diagnosis (after Kontschán, 2007). Dorsal shield with alveolar ornamentation between setae j. Sternal shield without ornamentation. St2 very long, St4-5 short, St3 very short. St3 and St4 situated near to the anterior margin of genital shield. Ventral setae as long as St2. Sternal and ventral shields without ornamentation. Genital shield of female large, rounded, without ornamentation.

Distribution. Venezuela.

Tetrasejaspis muranyii Kontschán, 2007

Tetrasejaspis muranyii Kontschán: 2007 pp. 338-339. figs p. 338.

Diagnosis (after Kontschán 2007). The lateral part of dorsal shield smooth, central part with alveolar ornamentation. Central part of postdorsal shield without setae, but a pair of setiform setae can be seen on its posterior margin. Both lateral parts of postdorsal shield with one setiform seta. Sternal shield without ornamentation. The first sternal setae are shorter than others, all sternal setae smooth and setiform. Ventral setae are very long, smooth and setiform. Alveolar ornamentation can be seen on apical part of anal region. Genital shield large, rounded (length: width = 1:1), without ornamentation.

Distribution. Venezuela.

Tetrasejaspis carlosbordoni Huțu, 1991

Tetrasejaspis carlosbordoni Huțu: 1991 pp. 28-31, figs. pp. 29-30.

Diagnosis (after Huțu 1991). Ornamentation of the lateral part of dorsal shield is lacking, central part with alveolar pattern. Central part of postdorsal shield without setae, but a pair of setiform setae can be found near its posterior margin. Both lateral parts of postdorsal shield with one setiform seta. Sternal shield without ornamentation. The first sternal setae as short as St2 and St3, and St5 shorter than St1, St4 long, all sternal setae smooth and setiform. Ventral setae are very long, smooth and setiform. Alveolar ornamentation can be seen on apical part of anal region. Genital shield large, rounded (length: width = 1:3), without ornamentation.

Distribution. Venezuela.

Tetrasejaspis decui Huțu, 1991

Tetrasejaspis decui Huțu: 1991 pp.31-33. figs p. 32.

Diagnosis (after Huțu 1991). Lateral part of dorsal shield without pattern, central part with small alveolar ornamentation. Central part of postdorsal shield without setae, two lateral parts of postdorsal shield with a pair of setiform seta. Sternal shield without ornamentation. All sternal setae short, smooth and needle-like. Ventral setae very long, smooth and setiform. Genital shield large, quadrangular, with web-like ornamentation.

Distribution. Venezuela.

Tetrasejaspis baloghi Hirschmann, 1973

(Figs 1–2)

Tetrasejaspis baloghi Hirschmann: 1973 pp. 93, fig. 31.

Material examined. Holotype: male, on slide BRB 35f. Brazil, leg. J. Balogh, "Manaus, Amazonas State, INPA Schutzwald, 21.9.1967. dunes, fechtes Fallaub des Urwaldes."

Diagnosis. Dorsal and marginal shields with alveolar patter. Postdorsal shield subdivided to two parts, which with two pairs of needle-like setae. Surface of postdorsal shield lacking. Sternal and ventral shields ornamented by alveolar pattern. All sternal setae short, smooth and needle-like. Ventral setae are very long, smooth and setiform. Genital shield oval and placed between coxae 4.

Distribution. Brazil.
Remark. This species is known only by males.

Tetrasejaspis baloghisimilis Hirschmann, 1973

(Fig. 3)

Tetrasejaspis baloghisimilis Hirschmann: 1973 p. 91, fig. 30.

Material examined. Holotype: female, on slide BRB35d. Brazil, leg. J. Balogh, "Manaus, Amazonas Staat, INPA Schutzwald, 21.9.1967. Dünnes, fechtes Fallaub des Urwaldes."

Diagnosis: Dorsal shield with alveolar pattern on its central part and web-like pattern on its lateral parts. Postdorsal shield subdivided intoto three parts, central part withing a pair of needle-like setae, and one-one smooth and needle-like setae placed on the lateral parts. Sternal shield without ornamentation, ventral shield with reticulate pattern. All sternal setae short, smooth and needle-like. Ventral setae very long, smooth and setiform. Genital shield quadrangular and with alveolar ornamentation.

Distribution. Brazil and Bolivia.

Tetrasejaspis mahunkai Hirschmann, 1973

(Figs 4–5)

Tetrasejaspis mahunkai Hirschmann: 1973 pp. 94, fig. 32.

Material examined. Holotype: female. There is no further information on the slide. The collection date and locality of the holotype are missing from the description as well.

Diagnosis. Dorsal shield with reticulate pattern. Postdorsal shield subdivided into three parts, setae lacking on central part, and two-two smooth and needle-like setae placed on the lateral parts. Sternal shield without ornamentation, ventral shield with reticulate pattern. Most of the sternal setae short, smooth and needle-like, apart from St2, which three times longer than other sternal setae. Ventral setae very long, smooth and setiform. Genital shield oval and with alveolar ornamentation.

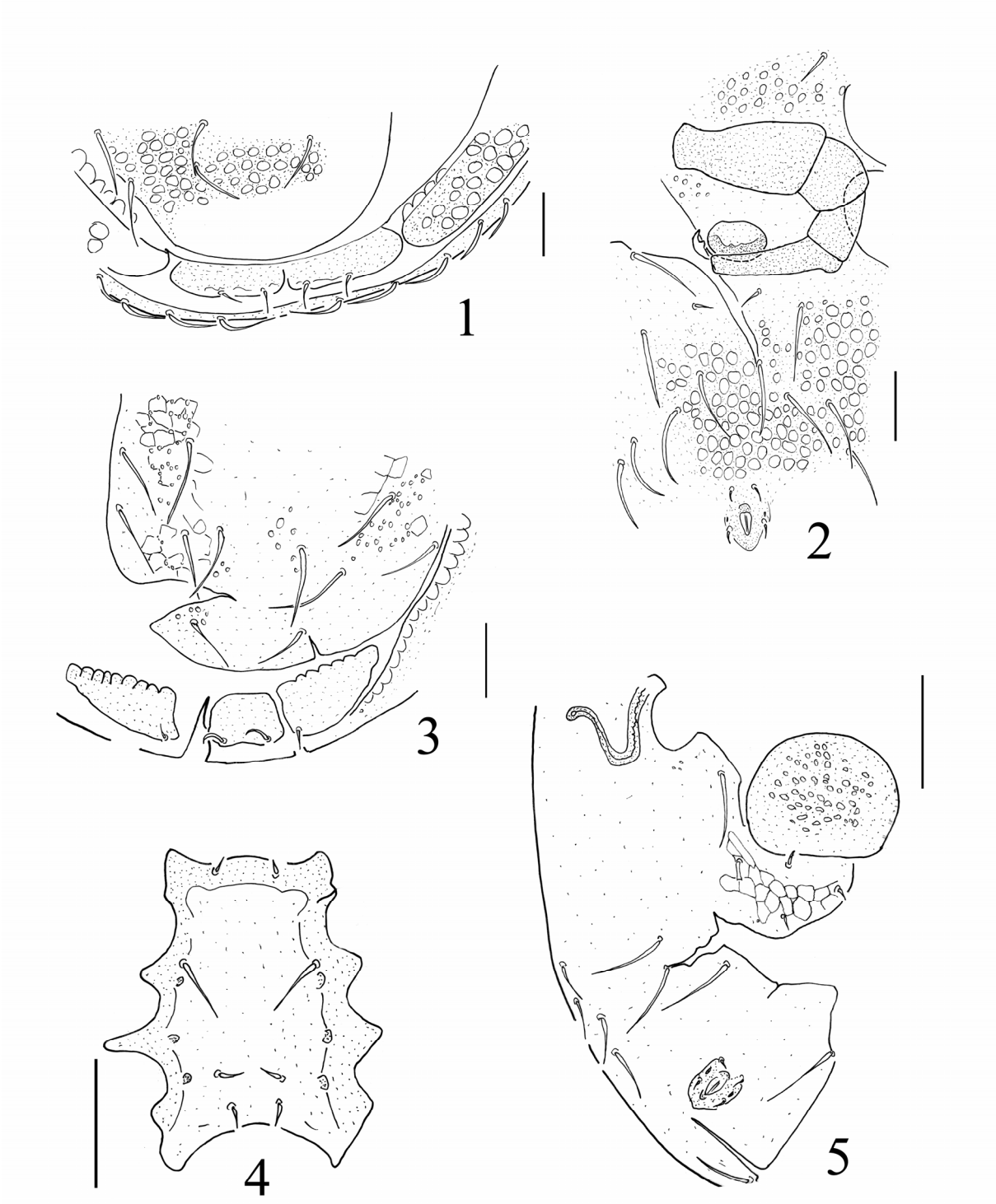
Distribution. Bolivia.

Tetrasejaspis kaszabi Hirschmann, 1973

(Figs 6–7)

Tetrasejaspis kaszabi Hirschmann: 1973 pp. 98, fig. 35.

Material examined. Holotype: female. There is no further information on the slide. The collection date and locality of the holotype are missing from the description as well.



Figures 1–5. *Tetrasejaspis* species. 1–2 = *Tetrasejaspis baloghi* Hirschmann, 1973, 1 = postdorsal region, 2 = ventroanal region; 3 = postdorsal region of *Tetrasejaspis baloghisimilis* Hirschmann, 1973; 4–5 = *Tetrasejaspis mahunkai* Hirschmann, 1973, 4 = sternal shield, 5 = ventral region (scale: 100 µm)

Diagnosis. Dorsal shield without ornamentation, only small alveolar patterns can be seen between setae j. Postdorsal shield subdivided into three parts, central part without setae, although a pair setae can be found near its posterior margin, and one-one smooth and needle-like setae placed on the lateral parts. Sternal and ventral shields without ornamentation. St3 and St4 short smooth and needle-like, St1 three times longer than St3, St2 four times longer than St3. Ventral setae very long, smooth and setiform. Genital shield oval and without ornamentation.

Distribution. Bolivia.

Tetrasejaspis sellnicki **Hirschmann, 1973**

(Fig. 8)

Tetrasejaspis sellnicki Hirschmann: 1973 pp. 97, fig. 34.

Material examined. Holotype: female, on slide BRB17a. Brazil, "Fazenda Agua Azul, Maranhao Staat, Serra do Gurupi, NW von Imperatriz; 9.9.1967. Feuchtes Fallaub vom Ufer des Brejo Creeks, Boden angehäft mit Ästen, vom Wasser getragen; leg. J. Balogh".

Diagnosis. Dorsal shield without ornamentation. Postdorsal shield subdivided into three parts and without setae. Sternal and ventral shields without ornamentation. St3 1.5 times shorter than St1 and St2, St4 two times longer than St2 and St1. Ventral setae very long, smooth and setiform. Genital shield pentagonal or triangular and without ornamentation.

Distribution. Brazil and Bolivia.

Tetrasejaspis eustructura **Hirschmann, 1973**

(Fig. 9)

Tetrasejaspis eustructura Hirschmann: 1973 pp. 99, fig. 37.

Material examined. Holotype: female, on slide BRB28b. Brazil, "Belém, Pará Staat, Icourassi; 18.9.1967. Primärer Urwald, in der Nähe des Flusses, aber oberhalb des Hochwasserstandes; modernes Fallaub; leg. J. Balogh".

Diagnosis. Dorsal shield with reticulate ornamentation. Postdorsal shield subdivided into three parts. Central part withs a pair of needle-like setae, and one-one smooth and needle-like setae placed on the lateral parts. Sternal and ventral shields without ornamentation. Sternal setae short, St1 with spines, other sternal setae smooth. Ventral setae very long, smooth and setiform. Genital shield quadrangular and with alveolar ornamentation.

Distribution. Brazil.

Tetrasejaspis zicsii **Hirschmann, 1973**

Tetrasejaspis zicsii Hirschmann: 1973 pp. 96, fig. 33.

Remarks. The adult specimens of this species are unknown. Only the larva and nymphs are described, perhaps this stage belongs to an other known species therefore the validity of this name in question.

Distribution. Bolivia.

Tetrasejaspis serrata **Hirschmann, 1973**

(Figs 10-11)

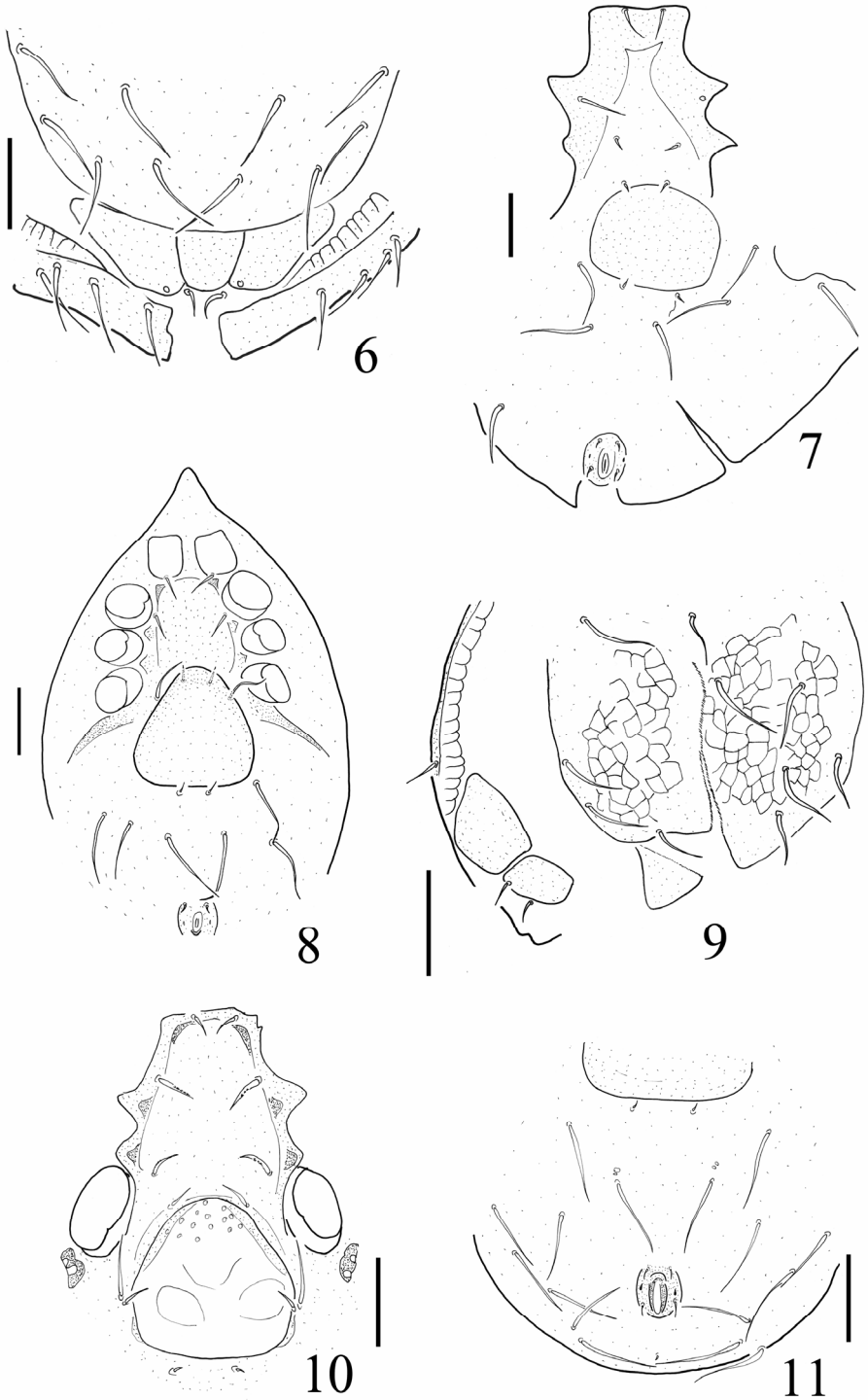
Tetrasejaspis serrata Hirschmann: 1973 pp. 99, fig. 36.

Material examined. One male and four females ECU 1987 B36. Ecuador, Chimborazo SW, Loma Yanausha, 4000 m, Cushion-plants from grazed area, 03.04.1987. leg. I. Loksa & A. Zicsi.

Diagnosis. Dorsal shield with reticulate ornamentation. Postdorsal shield subdivided into three parts and without setae. Sternal and ventral shields without ornamentation. Sternal setae short, St2 and St3 with spines on their margin, other sternal setae smooth. Ventral setae very long, smooth and setiform. Genital shield triangular and with alveolar ornamentation on its anterior part.

Distribution. Bolivia and Ecuador.

Remarks. This is the first record of this species from Ecuador.



Figures 6–11. Characteristics of *Tetrasejaspis* species. 6–7 = *Tetrasejaspis kaszabi* Hirschmann, 1973, 6 = caudal region, 7 = ventral region; 8 = ventral view of *Tetrasejaspis sellnicki* Hirschmann, 1973; caudal region of *Tetrasejaspis eustructura* Hirschmann, 1973; 10–11 = *Tetrasejaspis serrata* Hirschmann, 1973, 10 = sternal region, 11 = ventral region (scale: 100 µm)

Tetrasejaspis alveolaris n. sp.

(Figs 12–16)

Material examined. Holotype: female. 1987 ECU B128, Ecuador, Antisana volcano, road leading W, downwards to Pintag, 3000 m, soil and litter from below shrubs, about 50 m above stream level, 17.04.1987. leg. I. Loksa & A. Zicsi. Paratype: locality and date same as holotype.

Diagnosis. Anterior region of sternal shield with alveolar pattern. Alveolar ornamentation can be found on several parts of ventral- and dorsal shield as well. Caudal setae placed near to the anterior margin of marginal shield. Postdorsal shield without ornamentation and setae. Genital shield of female large, triangular and with alveolar pattern.

Description. Female. Idiosoma pear-like, 850–820 long, 470–460 wide (n=2).

Dorsal side (Fig. 12). Surface of the lateral part of dorsal shield is smooth, central part with alveolar ornamentation. All dorsal setae long, smooth and setiform. Postdorsal shield subdivided intoto three parts, without ornamentation and setae. Marginal shield smooth, all setae on marginal shield, smooth setiform and half as long as the dorsal setae. Marginal setae are similar to dorsal setae, but three times shorter than dorsal setae. Scalloping can be found between the marginal and dorsal shields (Fig. 13). Two pairs of caudal setae placed near to the anterior margin of marginal shield (Fig. 14).

Ventral side (Fig. 15). Sternal shield with alveolar ornamentation on its anterior region. First sternal setae (St1) near the anterior margin of sternal shield, St2 absent, St3 and St4 near to level of coxae 4. StX and StY are near to central part of genital shield. All sternal setae smooth and needle-like, StX three times longer than the other sternal setae. St5 near to the posterior margin of genital shield. All ventral setae long, smooth and needle-like. Near the basis of ventral setae there is alveolar ornamentation. Two pairs of adanal setae very short, smooth and needle-like.

Genital shield large, triangular, without processes and with alveolar pattern.

Peritreme and stigmata not clearly visible (covered by coxae 1 and 2).

Gnathosoma. Not clearly visible (covered by coxae 1).

Legs with serrated setae (Fig. 16).

Male, deuteronymph and protonymph are unknown.

Etymology. The name of new species refers to the ornamentation of the anterior region of sternal shield.

Tetrasejaspis ecuadorensis n. sp.

(Figs 17–22)

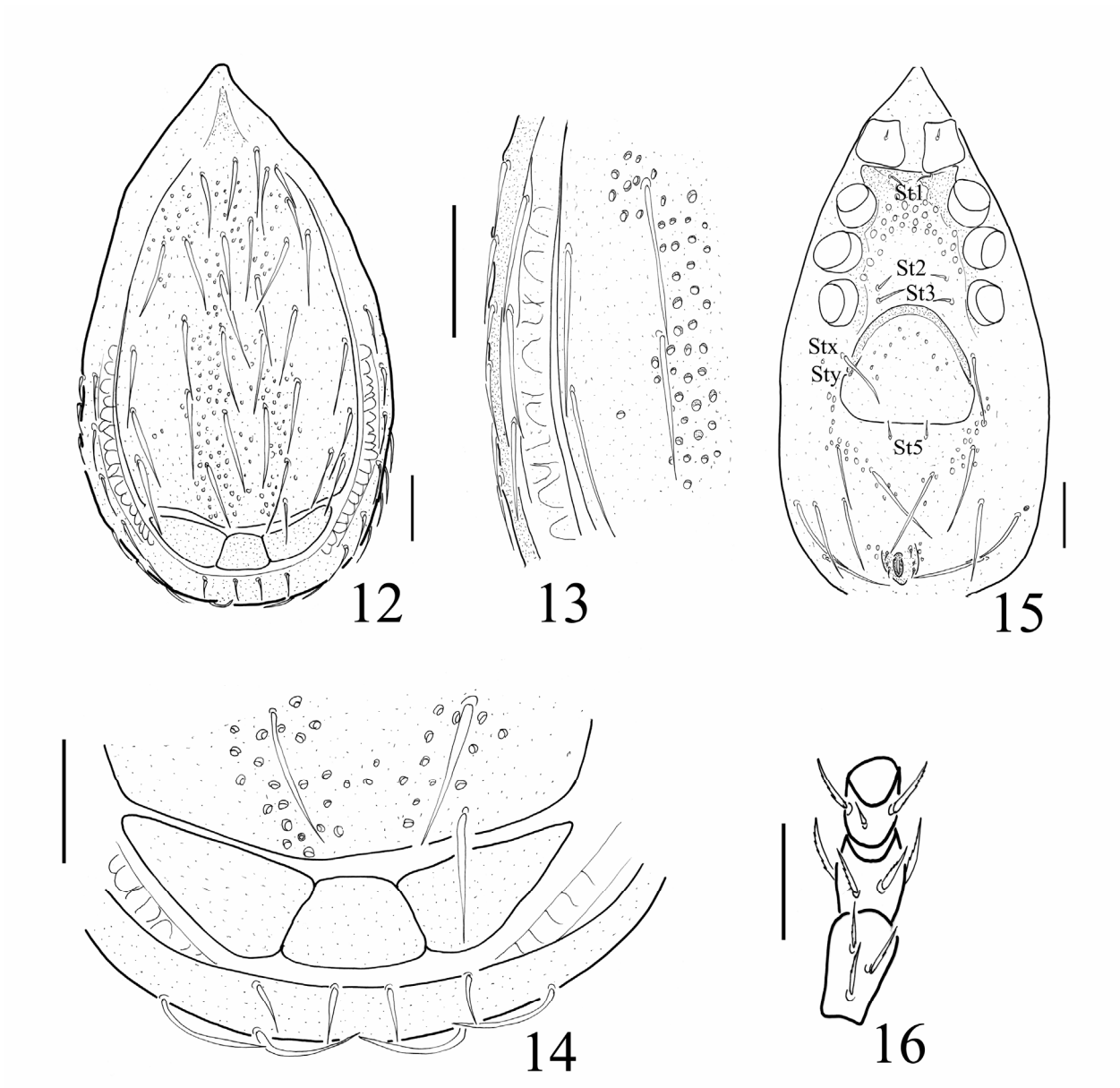
Material examined. Holotype: female. ECU 1987 B151, Pichincha Agua volcano (Prov. Pichincha), 4000 m, soil and litter from below bushes on a rock rim of a rock wall of S exposure, 19.04.1987. leg. I. Loksa & A. Zicsi. Paratypes: three females and one male. Locality and date same as holotype.

Diagnosis. Posterior region of sternal shield with alveolar pattern. Alveolar ornamentation can be found on several parts of ventral and dorsal shields. Caudal setae placed near anterior margin of marginal shield. Postdorsal shield without ornamentation and setae. Genital shield of female large, triangular and with alveolar pattern.

Description. Female. Idiosoma pear-like, 880–850 long, 480–460 wide (n=4).

Dorsal side (Fig. 17). Surface of the lateral part of dorsal shield is smooth, central part with alveolar ornamentation. All dorsal setae long, smooth and setiform. Postdorsal shield subdivided intoto three parts, without ornamentation and setae. Marginal shield smooth, all setae on marginal shield smooth and setiform, half as long as the dorsal setae. Marginal setae similar to dorsal setae, but three times shorter than dorsal setae. Scalloping can be found between the marginal and dorsal shields (Fig. 18). Two pairs of caudal setae placed near the anterior margin of marginal shield.

Ventral side (Fig. 19). Sternal shield with alveolar ornamentation on its posterior region.



Figures 12–16. *Tetrasejaspis alveolaris* n. sp. 12 = dorsal view, 13 = marginal and dorsal setae, 14 = postdorsal shield, 15 = ventral view, 16 = setae of leg 1. (scale: 100 µm)

First sternal setae (St1) placed near anterior margin of sternal shield, St2 near posterior margin of coxae 2, St3 and St4 can be found near level of coxae 4. St1 and St2 two times longer than St3 and St4. StX and StY are near central part of genital shield. All sternal setae smooth and needle-like, StX 3 times longer than St3 and St4. St5 placed near posterior margin of genital shield. All ventral setae long, smooth and needle-like. Near the basis of ventral setae can be seen alveolar ornamentation. Two pairs of adanal setae very short, smooth and needle-like.

Genital shield large, triangular, without processes and with alveolar pattern.

Peritreme hook-likie, stigmata placed near level of coxae 4 (Fig. 20).

Gnathosoma. Not clearly visible (covered by coxae 1).

Legs with serrated setae.

Male. Idiosoma pear-like, 780 long, 460 wide (n=1). Dorsal and marginal shields and setae similar to female, but postdorsal shield absent, caudal setae on caudal part of marginal shield (Fig. 21). Ventral side: Position and size of sternal setae similar to female, but StY absent and St3 placed near anterior margin of coxae 4. Position and size of ventral setae are similar to female. Genital shield can be seen near posterior margin of coxae 4, its shape is oval (Fig. 22).

Deuteronymph and protonymph unknown.

Etymology. The name of the new species refers to the country where the specimens were collected.

***Tetrasejaspis bloszyki* n. sp.**

(Figs 23–29)

Material examined. Holotype: female. Cr93 B104, Costa-Rica, Arenal, rain forest, litter and soil, 16.01.1993. leg. J. Balogh. Paratypes: female locality and date same as holotype. Two males and one female Cr93 B112, Costa-Rica, Arenal, secondary rain forest, litter, 16.01.1993. leg. J. Balogh.

Diagnosis. Sternal and genital shields without pattern. Alveolar ornamentation can be found only on dorsal shield. Genital shield of female large, rectangular and not with alveolar pattern.

Description. Female. Idiosoma pear-like, 690–650 long, 370–340 wide (n=3).

Deuteronymph and protonymph unknown.

Dorsal side (Fig. 23). Surface of the lateral part of dorsal shield is smooth, central part with only alveolar ornamentation. All dorsal setae long, smooth and setiform. Postdorsal shield subdivided into three parts, without ornamentation and setae. Marginal shield smooth, all setae on marginal shield smooth and setiform, 0.5 times shorter than dorsal setae. Marginal setae are similar to dorsal setae, but three times shorter than dorsal setae. Scalloping absent between the marginal and dorsal shields (Fig. 24). Two pairs of caudal setae near the anterior margin of marginal shield (Fig. 25).

Ventral side (Fig. 26): Sternal shield without pattern. First sternal setae (St1) placed near to the anterior margin of sternal shield, St2 near posterior margin of coxae 2, St3 near the level of coxae 4 and St4 near the anterior margin of genital shield. St1 and St2 three times longer than St3 and St4. StX and StY are near the central part of genital shield, StZ placed near the anterior margin of genital shield. All sternal setae smooth and needle-like, StX three times longer than St3 and St4. St5 placed near to the posterior margin of genital shield. All ventral setae long, smooth and needle-like. Ventral shield without ornamentation. Two pairs of adanal setae very short, smooth and needle-like, postanal setae similar to adanal setae.

Genital shield large, rectangular, without processes and pattern.

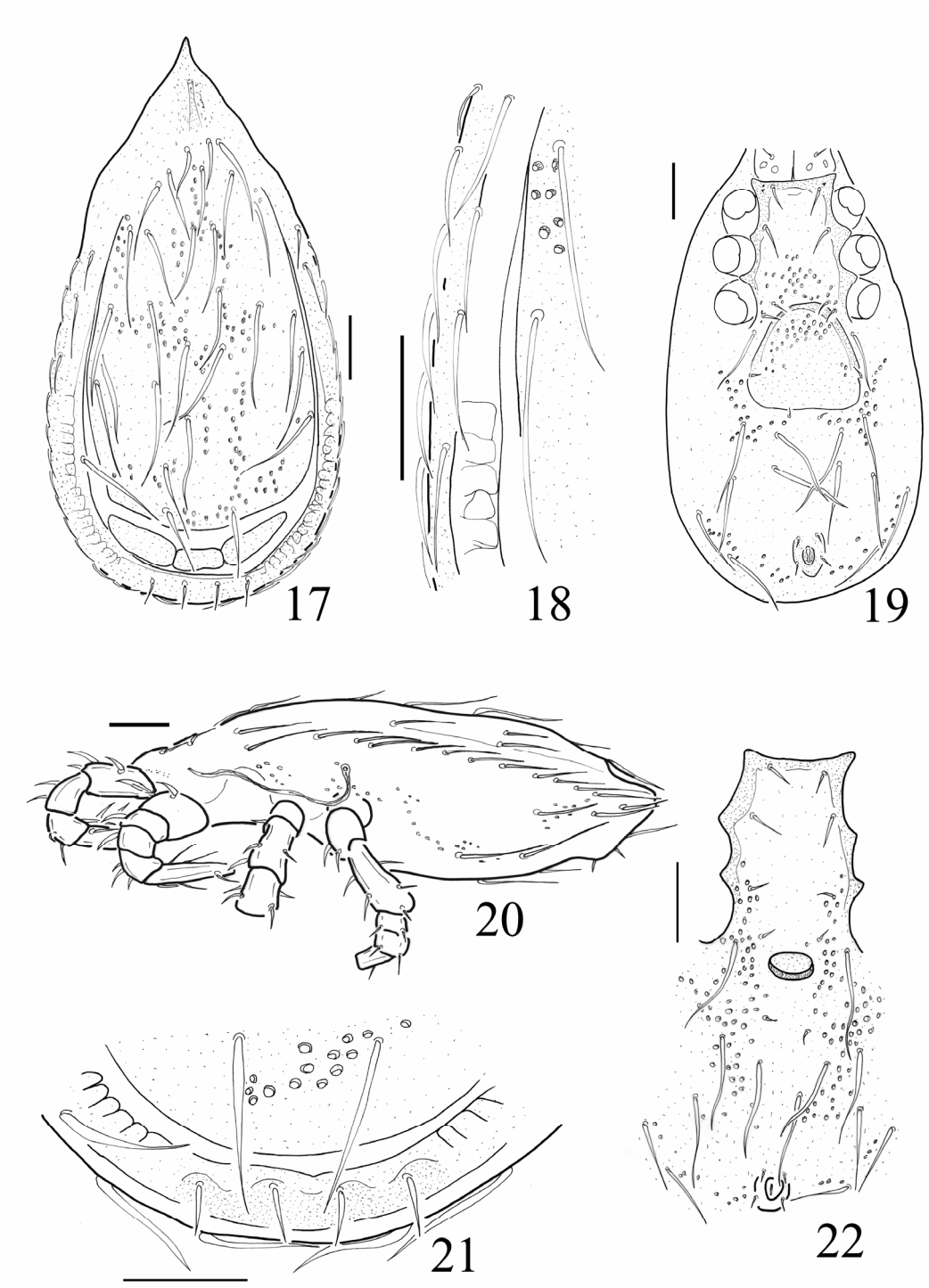
Peritreme and stigmata not clearly visible (covered by coxae 2 and 3).

Gnathosoma (Fig. 27). Corniculi horn-like, laciniae long and smooth. Hypostomal setae are follows: h1 long, smooth and needle-like, h2, h3 and h4 four times shorter than h1 and its margin serrated. Epistome and chelicerae not clearly visible. Tritosternum with wide basis, laciniae smooth and with tow long and two short branches.

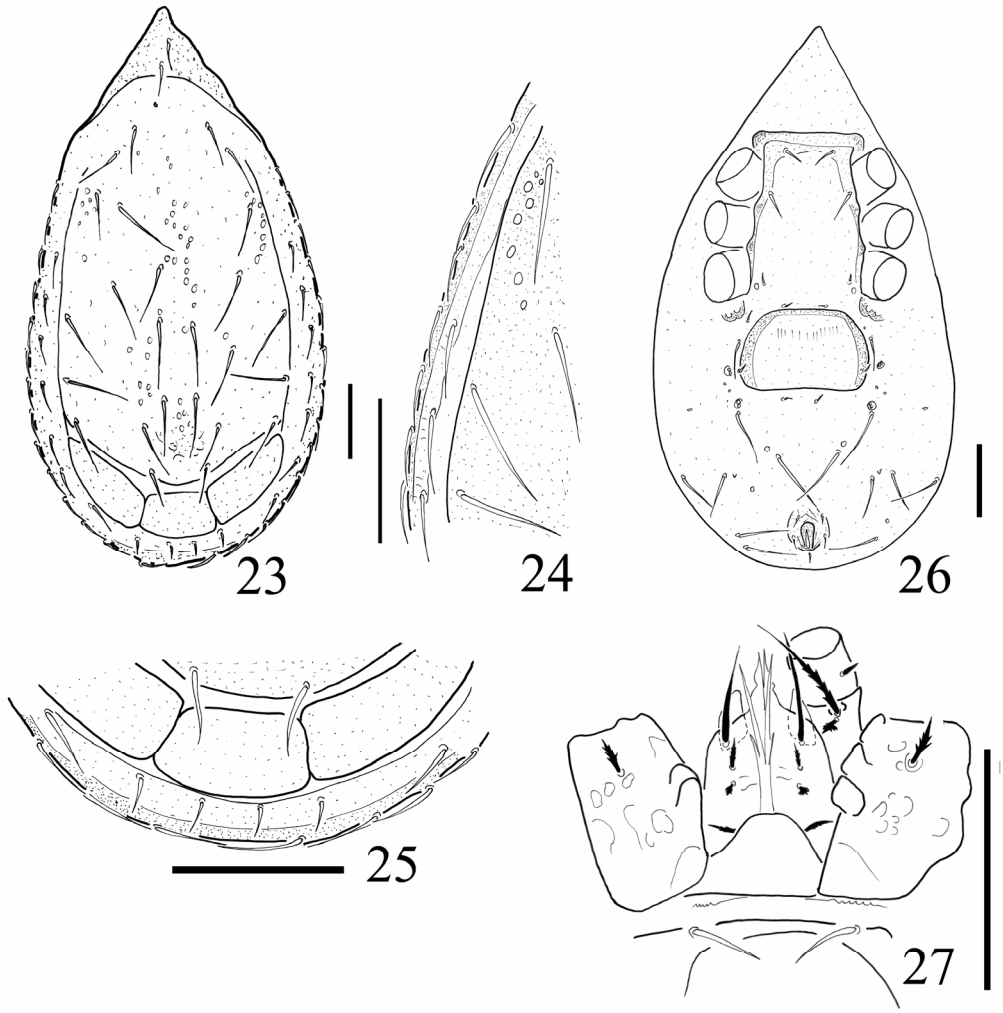
Legs with serrated setae.

Male. Idiosoma pear-like, 650-610 long, 340-310 wide (n=2). Dorsal, postdorsal and marginal shields and setae similar to female. Well sclerotised region can be seen near the posterior margin of dorsal shield (Fig. 28). Ventral side: Position and size of sternal setae similar to female, but StY absent and St3 placed near the central part of coxae 4. Position and size of ventral setae are similar to female. Genital shield can be found near the posterior margin of coxae 4, its shape is oval (Fig. 29).

Etymology. I dedicate the new species to Prof. Dr. Jerzy Błoszyk, the renowned Polish acarologist.



Figures 17–22. *Tetrasejaspis ecuadorensis* n. sp., 17 = dorsal view of female, 18 = marginal and dorsal setae, 19 = ventral view, 20 = lateral view, 21 = postdorsal region of caudal region of male, 22 = sternal and ventral region of male (scale: 100 µm)

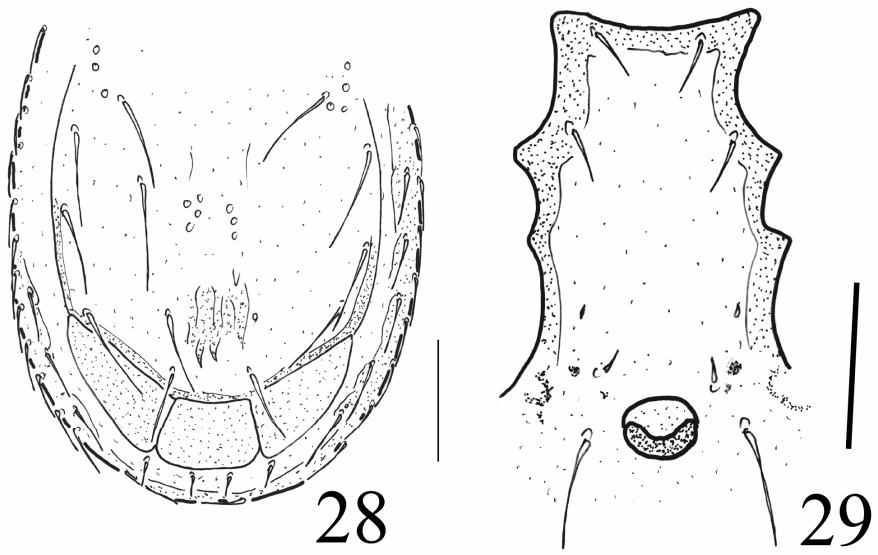


Figures 23–27. *Tetrasejaspis bloszyki* n. sp. female, 23 = dorsal view, 24 = marginal and dorsal setae, 25 = postdorsal shield, 26 = ventral view, 27 = ventral view of gnathosoma (scale: 100 μm)

DISCUSSION

The species of the family Tetrasejaspidae show a typical Neotropical distribution (Fig. 30). Their most northern occurrence is on the southern part of Mexico (Vazquez & Klompen, 2007) and the southernmost record is from Bolivia (Hirschmann, 1973 a). Presumably the species of this family live in most of the counties of Central America and northern South-America, though the occurrences from these regions have not been recorded yet. From the Caribbean region, where several Uropodina mites are listed hitherto no Tetrasejapsid species were mentioned (Błoszyk & Athias-Binche, 1986; Fox, 1948; Huțu, 1977; Kontschán, 2004; Sellnick, 1930, 1963, 1970, 1973).

Tetrasejapsis species can be found in natural vegetations (e.g. cloudy rain forest or paramo) and in disturbed habitats (e.g. coffee or citrus plantations) as well. Most of the *Tetrasejaspis* species occur only in soil and leaf litter, there are no records yet from the canopy.



Figures 28–29. *Tetrasejaspis bloszyki* n. sp. male, 28 = caudal region, 29 = sternal shield (scale: 100 μm)

Key to species (females)

1 (8) Genital shield rectangular
2 (7) Genital shield with ornamentation
3 (4) Ornamentation of genital shield reticulate
T. decui Hutu, 1991
4 (3) Ornamentation of genital shield alveolar
5 (6) Ventral shield with reticulate pattern
T. baloghisimilis Hirschmann, 1973
6 (5) Ventral shield without ornamentation
T. eustructura Hirschmann, 1973
7 (2) Genital shield without ornamentation
T. bloszyki n. sp.
8 (1) Genital shield oval
9 (14) Genital shield with ornamentation
10 (11) Margin of St2 and St3 serrated
T. serrata Hirschmann, 1973
11 (10) Margin of St2 and St3 smooth
12 (13) Alveolar ornamentation on the anterior region of sternal shield
T. alveolaris n. sp.
13 (12) Alveolar pattern on the posterior region of sternal shield
T. ecuadorensis n. sp.
14 (9) Genital shield without ornamentation
15 (16) Genital shield wider than long (3:1)
T. carlosbordoni Hutu, 1991
16 (15) Genital shield as wide as long (1:1)
17 (18) Setae St2 longer than St1
T. dinychoides Sellnick, 1941
18 (17) Setae St2 as long as St1
19 (20) St4 longer than than St3
T. sellnicki Hirschmann, 1973
20 (19) St4 as long as St3
21 (22) St1 and St2 longer than St3 and St4
T. kaszabi Hirschmann, 1973
22 (21) St1 and St2 as long as St3 and St4
T. muranyii Kontschán, 2007

Remarks. T. baloghi is missing from this key, because this species is known only by male. Likewise *T. zicsi* is not included because the adult stage of this species is unknown.

Figure 30. Distribution of *Tetrasejaspis* species in Central and South America

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Faunistical and taxonomical studies on oribatids collected in Albania (Acari: Oribatida), I.

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Abstract. A list of 111 oribatid species collected at several sites in Albania is presented. Four of them (*Carabodes csikii*, *Dissorhina shqipetarica, Chamobates* (*Xiphobates*) *latissimus* and *Scheloribates salebrosus* spp. n.) are new to science. Some notes on rare or little known species are also given. With 25 figures.

INTRODUCTION

A thorough study of the fauna of Balkan Peninsula is important in the knowledge and the genesis of the soil fauna of Hungary and that of the whole Carpathian Basin. Therefore our main goal was to study the pedofauna living in this area.

The initial inclination towards the region began some 100 years ago. Unfortunately, the zoological and botanical "Balkan researches" although supported by the Hungarian Academy of Sciences (HAS) soon came to an end, and for some unknown reasons the gained results were not published, excepting a few (e.g. Frivaldszky I. & Frivaldszky J., 1873, later Csiki, 1922–1940).

On the other hand, soil zoological examinations have not even been started until the late 1950s and any organised, general collecting tours were resumed in the end of the 1970s (collecting work by Balogh, 1956; Loksa, 1960; Gozmány, 1960; Pintér, 1967). However, even these have not brought substantial results, excepting the papers of Balogh (1958 a, b, 1961) in acarology, Pintér (1972, 1978) in malacology and Gozmány (1961, 1997) in lepidopterology. The material collected by Loksa was probably lost.

Other (international and national) soil zoological researches in some countries of this region were organised and started even later (e.g. Bernini *et al.*, 1987; Dubinina *et al.,* 1966; Kunst, 1957, 1959; Jeleva, 1960; Piffl, 1966; Sellnick, 1931; Tarman, 1958, 1959, 1984; Willmann, 1941, etc.). Furthermore, the Romanian acarological researches may also be connected to the basic questions (e.g. Feider & Suciu, 1957; Feider, Vasiliu & Călugăr, 1971; Vasiliu *et al*., 1993)

Especially significant results on the region were presented by the collection activity of Dr. B. Hauser (Musée d'Histoire naturelle, Genève) in Greece, which mite material was studied by the senior author (e.g. Mahunka, 1974, 1977 a, b, 2001) and furthermore the unpublished material collected by the authors also in Greece and in the Greek islands.

A few years ago the scientific staff of the Hungarian Natural History Museum (HNHM) renewed their interest in the region and collecting tours were organised (Fejér *et al.*, 2004), the results of these researches were recently published (Murányi, 2007), and just have finished a very similar series of Transylvanian researches as well (Csuzdi & Pop, 2006; Dányi, 2006; Dányi *et al.*, 2006; Kontschán, 2006; Mahunka, 2006 a, b).

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Numerous data of the above listed publications made it probable or even proved the earlier supposed theory of a fauna migration from south to northward. An example is the species-group of *Epilohmannia gigantea* spreading from Greece to Transylvania, or another, the species-group of *Microzetes hellenicus* definitely occurring from Greece to Northeast Hungary (Nyírség). These facts arose our attention to launch new investigations. The Zoology Research Group of the HAS joined forces with this venture that has also won the pecuniary support of the Hungarian Scientific research Found (OTKA No. 72744).

From the available material first we began to examine the oribatids of Albania. The main reason for this was that the mite fauna of Albania as far as we are aware is very poorly known. On the other hand, besides the researches of the Carpathian Basin this geographical region is intriguing mainly owing to the proximity of the Apennine Peninsula and the western parts of Greece.

It is quite obvious that far more species live in Albania that could be treated within the space of a single contribution. What is more, the number of collected samples awaiting examination several times surpasses the quantity that can be studied presently. So in this paper we give a list of localities, under which 111 identified Oribatida species belonging to 74 genera are given, making reference to the so far known distribution types. Among the species four are new to science. Besides the morphological and taxonomical novelties of the newly described species our knowledge is widened regarding the relationships in the aspects of zoogeography and distribution.

In the identification of the listed and described taxa we used primarily the book of Weigmann (2006), the new and older monograph or semi-monographic works of some authors (e.g. Ghyliarov, 1975; Pérez-Iňigo, 1969). Besides these we used keys partially or wholly elaborating taxa. We chose the lately published works; for example the determination keys of Moritz (1976), Pérez-Iňigo (1993, 1997), Subias and Arillo (2001). We also relied on yet unpublished keys compiled by us.

As our earlier paper, in this one too, we usually follow the system of Marshall *et al*. (1987), based on that of Grandjean's (1954, 1965), with some modifications introduced by Woas (2002), Subías (2004), Weigmann (2006) and Mahunka (2008 in lit.). In the description the morphological terminology of Grandjean (1954 and several publications) was used with some addenda or modifications of the studied groups or organs (e.g. Mahunka & Zombori, 1985; Norton *et al*., 1997; Mahunka & Mahunka-Papp, 2001; Behan-Pelletier, 2000; Behan-Pelletier & Eamer, 2008; Niedbała, 2002) and the before mentioned authors.

LIST OF LOCALITIES

E-1812 Periferi County, Dibre 3 km W of q. e Murres, Shkémb i Skanderbeut, gorge of Lumi i Varoshit (975 m) /cave spring and its outlet, stream Varoshit, limestone walls /41°38.792'+20°11.390'-litter from dead tree trunk, 11. 10. 2005. Leg. D. Murányi.

E-1813: Periferi County, Dibre, 9km N of Cidhne towards Fushé-Lure(1345m) /karstic forest, limestone rocks/ 41°48.892'+20°16.650'-beech litter from rocks, 10. 10. 2005. Leg. D. Murányi.

E-1815: Periferi County, Kukes, 3km N of Arren (29km S of the Shkoder-Kukes road (1322m) /karst plateau, secondary beech forest /41°56.833'+20°16.773'-beech litter, 10. 08. 2005. Leg.: D. Murányi.

E-1817: Montenegro, 1km SW of Spilijani (829m) /in the river and the littoral alders, limestone rocks,karstic forest /42°54.410'+20°20.062'-litter and soil under rocks, 10.12. 2005. Leg.: D. Murányi.

E-1818: Periferi County, Tropoje, W of Ragam, spring of Lumi i Valbones(1434m) /in and around spring/ 42° 24.620'+19°49.366'-beech litter, 10.06. 2005. Leg.: D. Murányi.

E-1920: Periferi County, Elbasan, S of Gurri i Zi, 13 km from the Elbasan junction on the road to Qafa e Shtyllës (900 m) [limestone rocks], 10.04,2006. Leg.: Z. Erőss, Z. Fehér, A. Hunyadi and D. Murányi.

E–1928: Periferi County, Mat, 4 km to Fushë-Lurë from the Peshkopi – Burrel road (1210 m) ,[stream, degraded forest], 13.04.2006. Leg.: Z. Erőss, Z. Fehér, A. Hunyadi and D. Murányi.

E–2005: Saranadë County, Mezopotam, Bistricë River and the riverside pasture, 11.05.2006. Leg.: L. Dányi, J. Kontschán and D. Murányi.

E-2006: Vlorë County, Cikë Mts, pine forest N of the Llogara Pass, 11.05.2006. Leg.: L. Dányi, J. Kontschán and D. Murányi.

E-2008: Vlorë County, Cikë Mts, pine forest N of the Llogara Pass, 11.05.2006. Leg.: L. Dányi, J. Kontschán and D. Murányi.

E-2063: Skrapar County,Tomor Mts, 4 km NW of Terovë, NE of Mt. Çuka Partizan, 24.08.2006. Leg.: Z. Fehér, A. Hunyadi, T. Huszár and D. Murányi.

E-2066: Gramsh County, Tërvol, gorge of the Holta Stream, 26.08.2006. Leg.: Z. Fehér, A. Hunyadi, T. Huszár and D. Murányi.

E-2070: Skrapar County, Tomor Mts, Ujanik, gorge of the Ujanik Stream, 23.08.2006. Leg.: Z. Fehér, A. Hunyadi, T. Huszár and D. Murányi.

E-2072: Skrapar County, Ostrovicë Mts, 4,5 km NE of Turbehovë, gorge of Krishovë Stream, moss from rocks, 23. 08.2006. Leg.: Z. Fehér, A. Hunyadi, T. Huszár and D. Murányi.

LIST OF THE NEWLY IDENTIFIED SPECIES

ENIOCHTONIIDAE Grandjean, 1947

Eniochthonius minutissimus (Berlese, 1903)
Distribution: Cosmopolitan.
Localities: E-1928, E-2063, E-2070.

BRACHYCHTHONIIDAE Thor,1934

Liochthonius alpestris (Forsslund, 1958)
Distribution: Holarctic Region.
Locality: E-2008.

Neobrachychthonius magnus Moritz, 1976
Distribution: Palearctic Region.
Locality: E-2072.

Poecilochthonius spiciger (Berlese, 1910)
Distribution: Holarctic Region and South America.
Localities: E-1929, E-2063, E-2070.

Synchthonius elegans Forsslund, 1957
Distribution: Palelarctic Region.
Locality: E-2063.

SPHAEROCHTHONIIDAE Grandjean, 1947

Sphaerochthonius splendidus (Berlese, 1904)
Distribution: Mediterranean, semicosmopolitan (?).
Locality: E-1813.

EPILOHMANNIIDAE Oudemans, 1923

Epilohmannia cylindrica (Berlese, 1904)
Distribution: Semicosmopolitan (?).
Locality: E-2005.

PHTHIRACARIDAE Perty, 1841

Phthiracarus boreosetosus Jacot, 1930
Distribution: Holarctic Region.
Locality: E-2006.

STEGANACARIDAE Niedbala, 1986

Atropacarus clavigerus (Berlese, 1904)
Distribution: Mediterranean.
Locality: E-2070.

Atropacarus striculus (C. L. Koch, 1835)
Distribution: Semicosopolitan.
Locality: E-1928.

Steganacaris spinosus (Sellnick, 1920)
Distribution: European.
Locality: E-1928.

ORIBOTRITIIDAE Grandjean, 1969

Mesotritia nuda (Berlese, 1887)
Distribution: Holarctic Region.
Locality: E-1928.

EUPHTHIRACARIDAE Jacot, 1930

Acrotritia ardua (C. L. Koch, 1841)
Distribution: Cosmopolitan.
Localities: E-1818, E-2070, E-2072.

Acrotritia hyeroglyphica (Berlese, 1916)
Distribution: Mediterranean.
Localities: E-1818, E-2005.

Euphthiracarus monodactylus (Willmann, 1919)
Distribution: Holarctic Region.
Localities: E-1815, E-1928.

NOTHRIDAE Berlese, 1896

Nothrus anauniensis Canestrini et Fanzago, 1876
Distribution: Cosmopolitan.
Localities: E-1818, E-2070.

Nothrus silvestris Nicolet, 1855
Distribution: Holarctic Region, semicosmopolitan (?).
Locality: E-1928.

CAMISIIDAE Oudemans, 1900

Camiisia biverrucata (C. L. Koch, 1839)
Distribution: Holarctic Region.
Locality: E-1813.

Heminothrus targionii (Berlese, 1885)
Distribution: Holarctic Region.
Locality: E-1812.

NANHERMANNIIDAE Sellnick, 1928

Nanhermannia elegantula Berlese, 1913
Distribution: Palearctic Region.
Locality: E-1928.

Nanhermannia nana (Nicolet, 1855)
Distribution: Cosmopolitan.
Locality: E-1928.

HERMANNIIDAE Sellnick, 1928

Hermannia gibba (C. L. Koch, 1839)
Distribution: Holarctic Region.
Locality: E-1813.

HERMANNIELLIDAE Grandjean, 1934

Hermanniella dolosa Grandjean, 1931
Distribution: Palearctic Region (Southern part).
Locality: E-1813.

GYMNODAMAEIDAE Grandjean, 1954

Aleurodamameus setosus (Berlese, 1883)
Distribution: Palearctic Region (Southern part).
Locality: E-2063.

Gymnodamaeus bicostatus (C. L. Koch, 1835)
Distribution: Holarctic Region.
Locality: E-1813.

DAMAEIDAE Berlese, 1896

Metabelba pulverosa Strenzke, 1953
Distribution: Holarctic Region (?).
Locality: E-1818.

Kunstidamaeus tecticola (Michael, 1888)
Distribution: Europe.
Locality: E-1815.

LICNODAMAEIDAE Grandjean, 1954

Licnodamaeus pulcherrimus (Paoli, 1908)
Distribution: Palearctic Region (southern part).
Localities: E-1813, E-1928, E-1929.

CEPHEIDAE Berlese, 1896

Cepheus cepheiformis (Nicolet, 1855)
Distribution: Holarctic Region.
Locality: E-2008.

Cepheus tuberculosus Strenzke, 1951
Distribution: Europe.
Locality: E-1815.

Eupterotegaeus ornatissimus (Berlese, 1908)
Distribution: Holarctic Region.
Locality: E-1928.

DAMAEOLIDAE Grandjean, 1965

Damaeolus asperatus (Berlese, 1904)
Distribution: Holarctic Region.
Locality: E-2070.

Damaeolus ornatissimus Csiszár, 1962
Distribution: Mediterranean, (Palearctic Region?).
Localities: E-1815, E-2070.

CALEREMAEIDAE Grandjean, 1965

Caleremaeus monilipes (Michael, 1882)
Distribution: Palearctic region (Europe?).
Locality: E-1928.

EREMAEIDAE Oudemans, 1900

Eremaeus hepaticus C. L. Koch, 1835
Distribution: Holarctic Region.
Locality: E-1817.

Eueremaeus oblongus (C. L. Koch, 1835)
Distribution: Holarctic Region.
Localities: E-2070, E-2072.

Eueremaeus valkanovi (Kunst, 1957)
Distribution: Europe, Japan.
Locality: E-1813.

AMERIDAE Bulanova-Zachvatkina, 1957

Amerus troisi (Berlese, 1883)
Distribution: Greece.
Localities: E-1929, E-2070.

ZETORCHESTIDAE Michael, 1898

Zetorchestes phyllosetus Mahunka, 1977
Distribution: Mediterranean.
Locality: E-1813.

LIACARIDAE Sellnick, 1928

Dorycranosus acutus (Pschorn-Walcher, 1951)
Distribution: Palearctic Region (?).
Locality: E-1818.

XENILLIDAE Woolley et Higgins, 1966

Xenillus clypeator Robineau-Desvoidy, 1839
Distribution: Palearctic Region.
Locality: E-2008.

Xenillus tegeocranus (Hermann, 1804)
Distribution: Palearctic Region.
Locality: E-1813.

ASTEGISTIDAE Balogh, 1961

Cultroribula bicultrata (Berlese, 1905)
Distribution: Holarctic Region, (Java?).
Locality: E-1929.

PELOPPIIDAE Balogh, 1943

Ceratoppia bipilis (Hermann, 1804)
Distribution: Holarctic Region.
Localities: E-1818, 2008.

CARABODIDAE C. L. Koch, 1837

Carabodes hungaricus Balogh, 1943
Distribution: Balkan Peninsula (northern part).
Locality: E-2063.

Carabodes csikii sp. n.

Carabodes femoralis (Nicolet, 1855)
Distribution: Europe, (Palearctic Region?).
Localities: E-1928, E-2063.

Carabodes minusculus Berlese, 1925
Distribution: Palearctic Region, USA.
Locality: E-2072.

Carabodes rugosior Berlese, 1916
Distribution: Holarctic Region.
Locality: E-2070.

TECTOCEPHEIDAE Grandjean, 1954

Tectocepheus minor Berlese, 1903
Distribution: Europe (southern part), Palearcrtic and Oriental Regions (?)
Locality: E-1818.

Tectocepheus velatus sarekensis Trägårdh, 1910
Distribution: Cosmopolitan (?).
Localities: E-1812, E-1815, E-1928, E-2063.

Tectocepheus velatus velatus (Michael, 1880)
Distribution: Cosmopolitan (?)
Localities: E-1813, E-2063.

OPPIIDAE Sellnick, 1937

Berniniella bicarinata (Paoli, 1908)
Distribution: Palearctic Region.
Localities: E-1815, E-2005, E-2063, E-2070.

Dissorhina corniculata (Paoli, 1908)
Distribution: East Mediterranean.
Locality: E-1929.

Dissorhina shqipetarica sp. n.

Lauroppia acuminata (Strenzke, 1951)
Distribution: Europe, (Vietnam).
Localities: E-1812, E-1928

Lauroppia fallax (Paoli, 1908)
Distribution: Semicosmopolitan.
Locality: E-2070.

Medioppia beskidyensis (Niemi et Skubala, 1993)
Distribution: Poland.
Locality: E-2008.

Microppia minus (Paoli, 1908)
Distribution: Cosmopolitan.
Localities: E-1920, E-2005, E-2072.

Oppia denticulata (R. et G. Canestrini, 1882)
Distribution: Palearctic Region, (semicosmopolitan?).
Locality: E-2063.

Oppiella nova (Oudemans, 1902)
Distribution: Cosmopolitan (?)
Localities: E-1920, E-1928, E-1929.

Ramusella (*Insculptoppia*) *elliptica* (Berlese, 1908)
Distribution: Holarctic Region (southern parts).
Locality: E-2005.

QUADROPPIIDAE Balogh, 1983

Quadroppia hammerae Minguez, Ruiz et Subías, 1985
Distribution: Semicosmopolitan?.
Locality: E-2008.

Quadroppia monstruosa (Hammer, 1979)
Distribution: Europe, (semicosmopolitan ?).
Localities: E-1812, E-2070.

Quadroppia quadricarinata (Michael, 1885)
Distribution: Holarctic Region.
Locality: E-2008.

AUTOGNETIDAE Grandjean, 1960

Autogneta longilamellata (Michael, 1885)
Distribution: Holarctic Region.
Locality: E-1928.

SUCTOBELBIDAE Jacot, 1938

Allosuctobelba grandis (Paoli, 1908)
Distribution: Holarctic Region.
Locality: E-2063.

Suctobelba altvateri Moritz, 1970
Distribution: Central Europe.
Locality: E-2072.

Suctobelba granulata van der Hammen, 1952
Distribution: Europe.
Localities: E-1815, E-1928.

Suctobelba trigona (Michael, 1888)
Distribution: Palearctic Region.
Locality: E-1928.

Suctobelbella alloenasuta Moritz, 1971
Distribution: Holarctic Region.
Localities: E-1815, E-2063.

Suctobelbella sarekensis (Forsslund, 1941)
Distribution: Holarctic Region.
Localities: E-1928, E-2072.

Suctobelbella subcornigera (Forsslund, 1941)
Distribution: Holarctic Region (semicosmopolitan?)
Locality: E-1815.

Suctobelbella subtrigona (Oudemans, 1916)
Distribution: Holarctic Region (semicosmopolitan?)
Locality: E-2070.

SPINOZETIDAE Balogh, 1972

Spinozetes inexpectatus Piffl, 1966
Distribution: Greece and Albania.
Locality: E-2070.

MICROZETIDAE Grandjean, 1936

Microzetes helleicus Mahunka, 1977
Distribution: Greece and Albania.
Locality: E-2070.

PHENOPELOPIDAE Petrunkevitch, 1955

Eupelops acromios (Hermann, 1804)
Distribution: Palearctic Region.
Localities: E-1812, E-1818.

Eupelops major (Hull, 1914)
Distribution: Holarctic Region (semicosmopolitan?).
Locality: E-1817.

Peloptulus phaenotus (C. L. Koch, 1844)
Distribution: Palearctic Region.
Localities: E-18132, E-1818.

ACHIPTERIIDAE Thor, 1929

Achipteria coleoptrata (Linné, 1958)
Distribution: Holarctic Region.
Localities: E-2008, E-2070.

Parachipteria punctata (Nicolet, 1855)
Distribution: Holarctic Region.
Locality: E-2008.

ORIBATELLIDAE Jacot, 1925

Ophidiotrichus tectus (Michael, 1884)
Distribution: Europe (mostly in southern part).
Locality: E-1929.

Oribatella calcarata (C. L. Koch, 1835)
Distribution: Holarctic Region.
Locality: E-1813.

Oribatella ornata (Coggi, 1900)
Distribution: Europe.
Locality: E-1929.

Oribatella sexdentata Berlese, 1916
Distribution: Holarctic Region.
Locality: E-1928.

Oribatella tenuis Csiszár, 1962
Distribution: Balkan Penninsula.
Locality: E-1928.

Tectoribates proximus (Berlese, 1910)
Distribution: East Mediterranean..
Localities: E-2006, E-2008.

CERATOZETIDAE Jacot, 1925

Euzetes globulus (Nicolet, 1855)
Distribution: Palearctic Region.
Locality: E-1817.

Ceratozetes laticuspidatus Menke, 1964
Distribution: Palearctic Region
Locality: E-2005.

Ceratozetes mediocris (Berlese, 1908)
Distribution: Holarctic Region, Australia.
Locality: E-1815.

Sphaerozetes orbicularis (C. L. Koch, 1835)
Distribution: Holarctic Region.
Locality: E-2008.

Sphaerozetes piriformis (Nicolet, 1855)
Distribution: Palearctic Region.
Locality: E-2063.

CHAMOBATIDAE Thor, 1937

Chamobates (Chamobates) interpositus Pschorn-Walter, 1953
Distribution: Europe.
Localities: E-1812, E-2008.

Chamobates (*Chamobates*) *pusillus* (Berlese, 1895) senssu Mahuka & Mahunka-Papp
Distribution: Palearctic Region.
Locality: E-2006.

Chamobates (*Xiphobates*) *latissimus* sp. n.

Chamobates (*Xiphobates*) *rostratus* Sellnick, 1928.
Distribution: Europe.
Locality: E-1818.

Chamobates (*Xiphobates*) *voigsti* (Oudemans, 1902)
Distribution: Palearctic Region.
Localities: E-1813, E-1928, E-2006, E-2063, E-2072.

Globozetes longipilus Sellnick, 1928
Distribution: Central and South Europe.
Locality: E-2008.

ORIBATULIDAE Thor, 1929

Liebstadia willmanni Miko et Weigmann, 1996
Distribution: Central Europe.
Locality: E-1817.

Lucoppia burrowsi (Michael, 1890)
Distribution: Holarctic Region (southern part).
Locality: E-1818.

Oribatula tibialis (Nicolet, 1855)
Distribution: Holarctic Region.
Localities: E-1813, E-1815.

Eporibatula rauschenensis (Sellnick, 1908)
Distribution: Europe.
Locality: E-1818.

Zygoribatula excavata (Berlese, 1916)
Distribution: Mediterranean.
Localities E-1812, E-2005.

Zygoribatula exilis (Nicolet, 1855)
Distribution: Holarctic Region.
Localities: E-1812, E-2063, E-2072.

Zygoribatula frisiae (Oudemans, 1916)
Distribution: Palearctic Region.
Locality: E-2066.

Zygoribatula glabra (Michael, 1890)
Distribution: Palearctic Region.
Localities: E-1812, E-1818.

SCHELORIBATIDAE Jacot. 1935

Hemileius initialis (Berlese, 1908)
Distribution: Palearctic Region.
Locality: E-2006.

Scheloribates pallidulus (C. L. Koch, 1841)
Distribution: Holarctic Region, (cosmopolitan?).
Locality: E-2005.

Scheloribates salebrosus sp. n.

HAPLOZETIDAE Grandjean, 1936

Peloribates europaeus Willmann, 1935
Distribution: Palearctic Region.
Locality: E-2005.

GALUMNIDAE Jacot, 1925

Galumna tarsipennata Oudemans, 1914
Distribution: Palearctic Region (southern part) and Brasil.
Locality: E-2066.

DESCRIPTIONS OF NEW AND NOTES ON RARE SPECIES

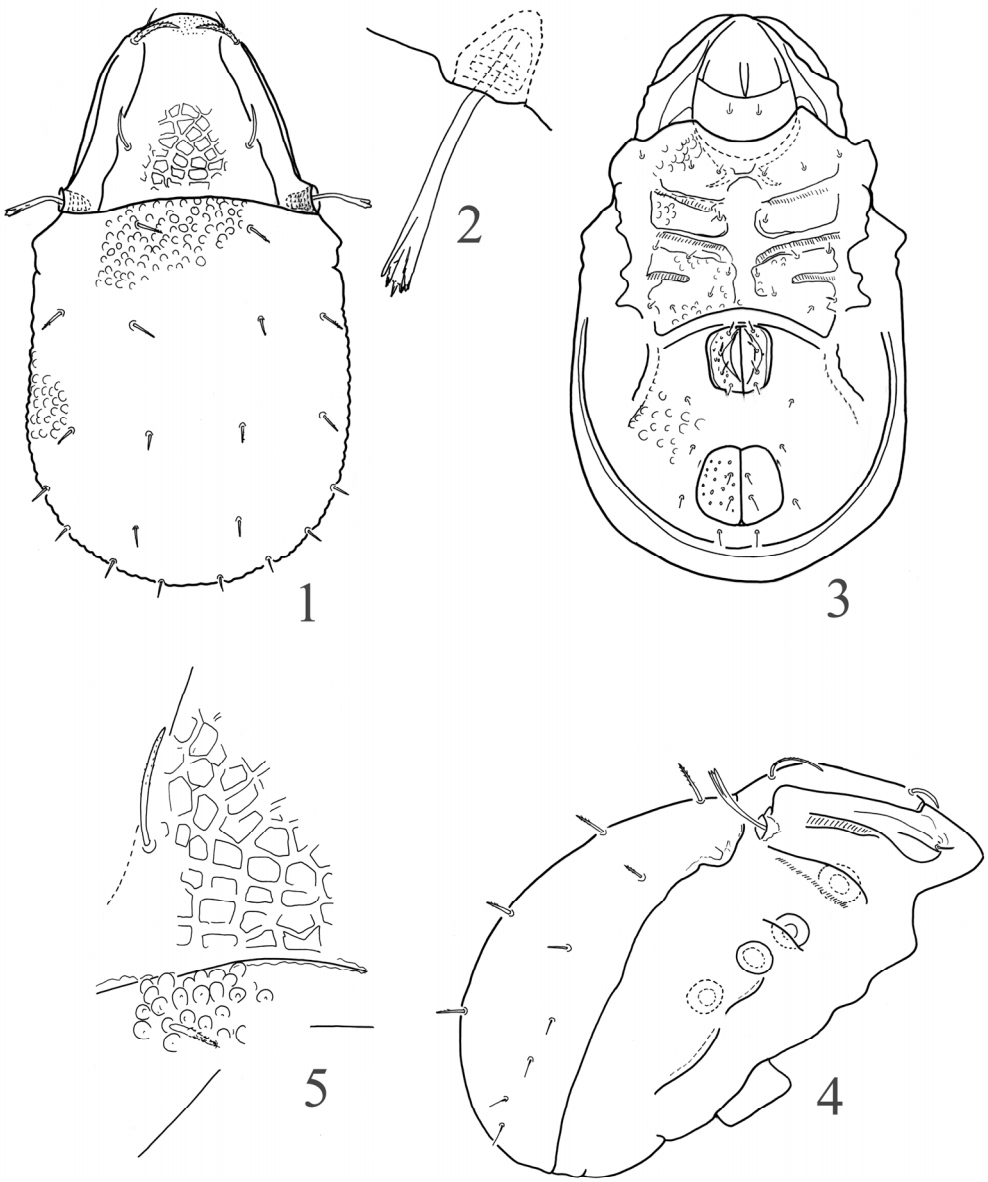
***Carabodes csikii* sp. n.**
(Figs. 1–5, Plate I)

Material examined. Holotype: Albania, Periferi Mat, 4 km to Fushë-Lurë from the Peshkopi – Burrel road (1210 m), [stream, degraded forest], 13.04.2006. Leg.: Z. Erőss, Z. Fehér, A. Hunyadi and D. Murányi. (E-1928). 5 paratypes from the same sample. 1 paratype: 1km SW of Spilijani (829m) /in the river and the littoral alders, limestone rocks, karstic forest /42°54.410' +20°20.062'-litter and soil under rocks, 10.12. 2005. Leg.: D. Murány (E-1817). Holotype (1754-HO-2008) and 5 paratypes (1754-PO-2008): Hungarian Natural History Museum (HNHM), 1 paratype: Muséum d'Histoire naturelle, Genève (MHNG).

Diagnosis. Prodorsum widely rounded, lamellae narrow. Interlamellar surface with polygonal pattern, notogastral surface covered by round tu bercles. Lamellar setae phylliform, interlamellar ones slightly dilated.

Sensillus comparatively long, with divided but narrow head. Ten pairs of erect, short and bacilliform notogastral setae present. Tutorium well sclerotised. Epimeral surface and surface of the ventral plate with large alveoli, genital plates with small irregular, anal plates with larger round alveoli. Four pairs of short genital setae present.

Measurements. Length of body: 351–428 µm, width of body:201–226 µm.



Figures 1–5. *Carabodes csikii* sp. n. 1 = body in dorsral view, 2 = sensillus, 3 = body in ventral view, 4 = body in lateral view, 5 = sculpture of the prodorsal and notogastral surface

Prodorsum. Rostrum convex, widely rounded, its surface finely granulate. Lamellae narrow, their apices cut obliquely, surface mostly smooth. Interlamellar region ornamented by coarse polygonal pattern (Fig. 5). Rostral setae spiniform, smooth, arising on the apical part of tutorium, lamellar setae widest of all, phylliform, roughened. Interlamellar setae located on the interlamellar surface, slightly dilated, curved anteriorly. Sensillus (Fig. 2) comparatively long, its peduncle much longer than the narrow and split head.

Notogaster. Whole surface covered by nearly equally large, round tubercles (Fig. 5). In the middle of them a small alveolus(?) visible. Their dis-

tance varies from each other. Dorsosejugal suture convex. Ten pairs of spiniform, erect notogastral setae present, six pairs in median position longer than the four posterolateral ones. Among the median pairs setae c_2 longer than *la* and *lm,* these setae roughened (Fig. 4), all others in posteromarginal position smooth.

Lateral part of podosoma. A strong tutorium present, without apex (Fig. 4). On the lateral surface some large alveoli also visible.

Ventral parts (Fig. 3). Surface of the epimeral region ornamented by larger, ventral plate by similar but scarcely located alveoli. All epimeral borders and apodema well visible. *Bo. 3* shorter than the others. Epimeral setal formula: 3 – 1 – 3 – 3, all setae simple, spiniform, genito-anal setal formula 4 – 1 – 2 – 3. Genital setae short and simple, arising in longitudinal rows, along the inner margin. Adanal setae varying in length, setae ad_1 slightly longer than the others. Lyrifissures *iad* hardly observable. Along the genital aperture a pair of well observable, directed posteriorly curved lath. The surface of the genital plates with smaller, irregular, anal plates with larger and round foveolae.

Remarks. On the basis of the dorsal sculpture (large alveoli on prodorsum and large, round tubercles on notogaster) and of the long sensillus, the new species is related to *Carabodes manganoi* Bernini, 1976. However, the new species is distinguished from it by the longer and ciliate notogastral setae (much shorter and smooth in *manganoi*) and by the coarse polygonate prodorsal pattern (it composes from rounded fields).

Etymology. We dedicate the new species Dr. Ernő Csiki, one of the best Hungarian coleopterologists, the former director of the Zoological Department of the Hungarian Natural History Museum, and the best Hungarian collector in Albania.

Tectocepheus minor **Berlese, 1903**
(Figs. 6–8)

Diagnosis. Rostral apex with two incisions, located far from each other. Lamellar cusp broad, with outer and inner lateral teeth, small lateral teeth mostly absent. Notogastral setae very short, fusiform. Notogastral margin without median angle. Tectopedia 2-3 with well developed lobe posteriorly. Circumpedal carina long, normally sclerotised and developed. Lyrifissures *iad* in adanal position.

Remarks. All exemplars studied belong to the „*cuspidentatus* Knülle" type.

Dissorhina shqipetarica **sp. n.**
(Figs. 9–11)

Material examined. Holotype: Albania, Skrapar county,Tomor Mts, 4 km NW of Terovë, NE of Mt. Çuka Partizan, 24.08.2006. Leg.: Z. Fehér, A. Hunyadi, T. Huszár and D. Murányi. (E-2063). 7 paratypes from the same sample. Holotype (1755-HO-2008) and 5 paratypes 1755-PO-2008): HNHM, 2 paratypes: MHNG.

Diagnosis. Rostrum tripartite with triangular median apex, bearing rostral setae. One pair of short, well sclerotised basal and one pair of weak lateral costula present. Sensillus long, gradually widened distally, with 6 (5-7) short bristles on its distal end. Postbothridial tubercles present. No essential difference – except the short setae c_2 –in length of notogastral setae. Posterior border (*bo. 4*) of the epimeral region with furrow in which some tubercles. Five pairs of genital setae, except g_4 all arranged in one row.

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

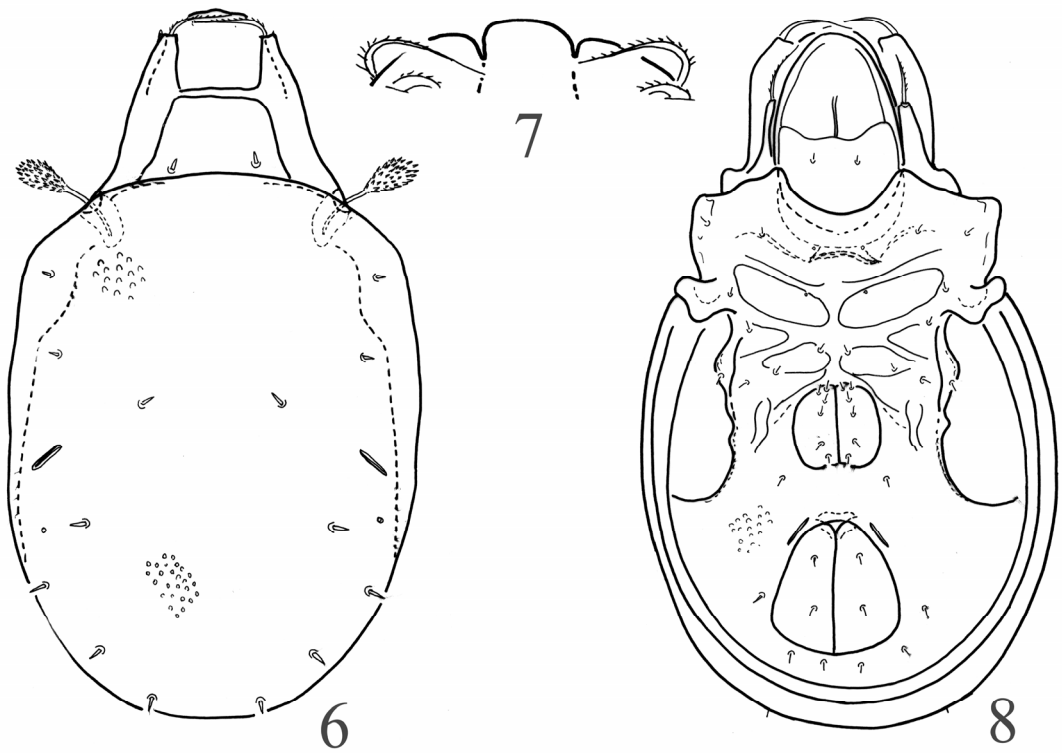
Prodorsum. Rostral apex triangular, hardly protruding from rostral part of prodorsum. Incisure wide, lateral teeth rounded, not shorter than rostral apex. Rostral setae arising on median apex. Prodorsal surface with weak costulae, one pair of short, thick, but narrower ones located basally and a pair of S-shaped, also weak ones laterally. Not one reaching to the insertion of lamellar setae. Some weak maculae and a comparatively large granulate field visible laterally. Ratio of prodorsal setae: *ro* > *exa* > *in* > *le*. Sensillus gradually dilated distally, with rounded distal end bearing 5-6 bristles on its margin (Fig. 9). A pair of well

developed, singular posterobothridial tubercles present.

Notogaster. Anterior part slightly narrowed anteriorly, dorsosejugal suture slightly convex. Ten pairs of comparatively thick and long notogastral setae present, c_2, p_2 and p_3 shorter than the others. Setae *la* and *lm* arising nearly in a transversal line, h_1 bent outwards.

Lateral part of podosoma. Pedotecta I very small, bearing setae *1c*. Some maculae and some granulate areas present in this part, some well sclerotised crests also seen above the legs (Fig. 11)

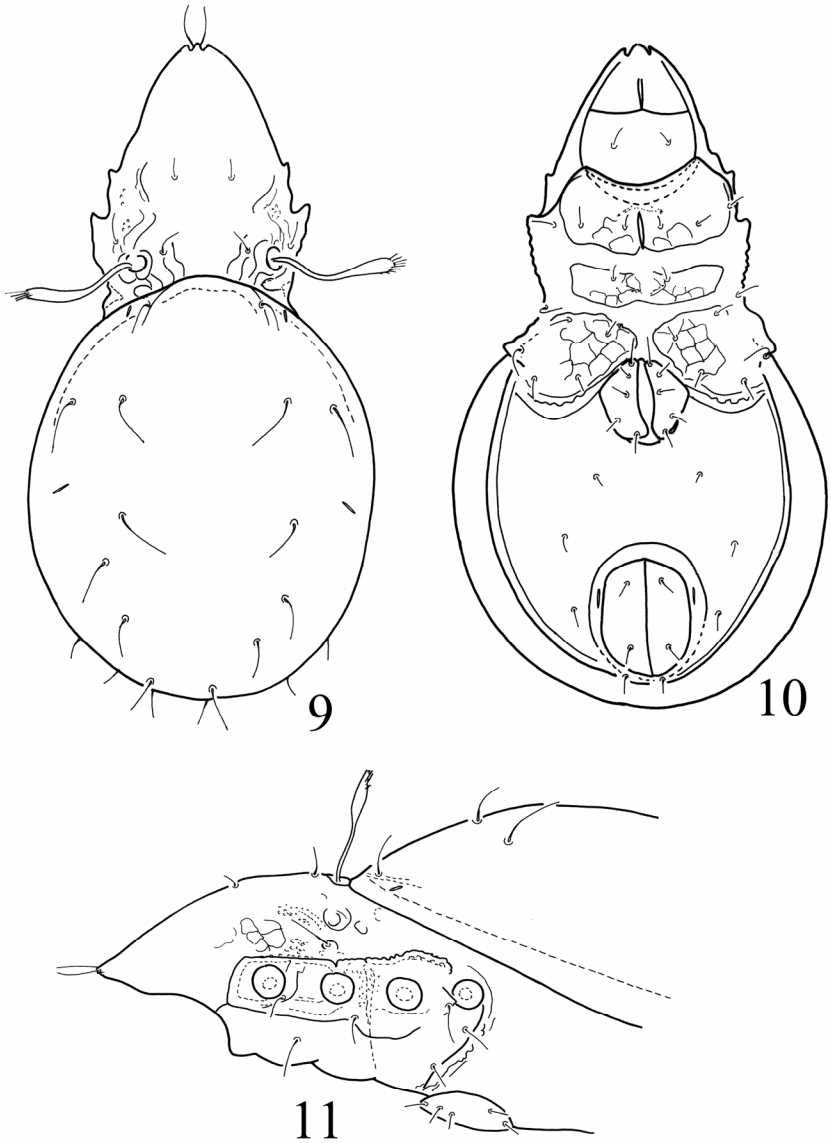
Ventral parts (Fig. 10). Apodemes and epimeral borders mostly weakly developed. *Ap 2* not connected medially and only a short, anterior part of the sternal apodema observable. *Ap. 4* well developed, wide, a pair of posteroepimeral furrow with some tubercles in it also observable. Epimeral surface ornamented by polygonal pattern, epimeral setae short, some of them finely ciliate. All setae in the anogenital region short and simple. Lyrifissures *iad* in adanal position setae ad_1 arising in posteromarginal position.



Figures 6-8. *Tectocepheus minor* Berlese, 1903. 6 = body in dorsal view, 7 = body in ventral view, 8 = rostral part in anterodorsal view

Remarks. The species of the genus *Dissorhina* Hull, 1916 – with some exceptions – are distributed in the East-Mediterranean region spreading there from Central-European territories. Only 1–2 species live in West Europe.

The new species can clearly be characterised by the completely reduced median costula and the bristled distal end of the sensillus. However, the bristles of the new species are much shorter than the known species of the *tricarinatoides* (Dubini-



Figures 9–11. *Dissorhina shqipetarica* sp. n. 9 = body in dorsal view, 10 = body in ventral view, 11 = podosoma in lateral view

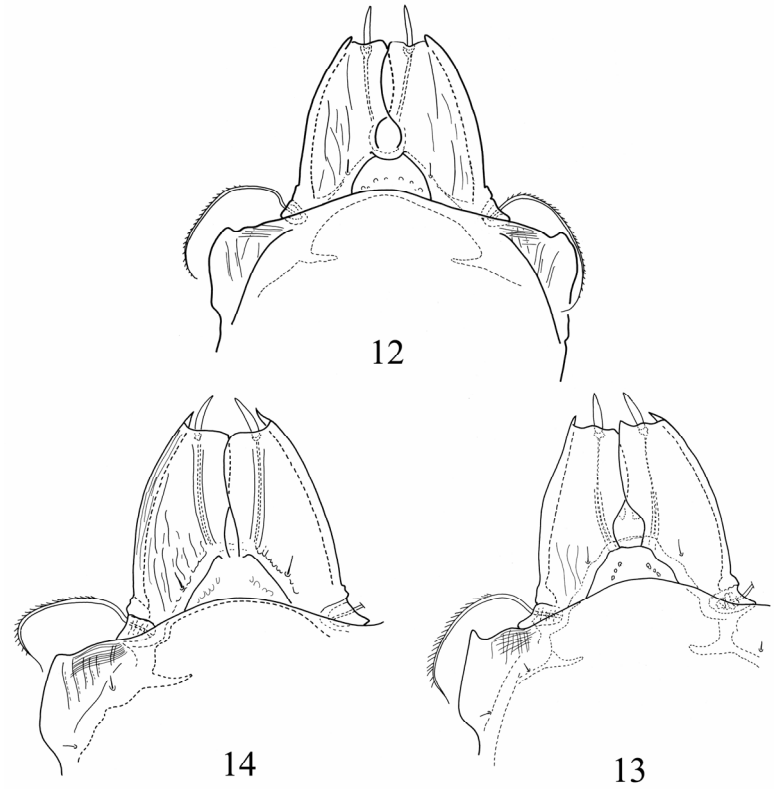
na, 1966) species group. (See the key of Mahunka, 2007).

Etymology. The new species is named on the basis of the historical name of the nation which leaves in this territory, in which the Hungarian zoologists carried on zoological studies nearly hundred years ago.

***Microzetes hellenicus* (Mahunka, 1977)**
(Figs. 12–14)

Remarks. When describing the species Mahunka (1977) placed the species in the alliance of the genus *Nellacarus* Grandjean, 1936 (= *Microzetes* Berlese, 1913), but he did not deal either with the type species or the other relating

species. When studying the fauna of the Bátorliget mire a new closely allied species (*M. raczi* Mahunka, 1991) was discovered (Fig. 14). This time he examined several species known from Greece and the type of *M. baloghi* Jeleva, 1962 described from Bulgaria. These investigations proved that on the basis of the position of lamellar setae and on the ratio of the outer lamellar cusps and the lamellar setae allt these species belong to the *hellenicus* species-group, and that they may easily be separated from the other species group of this genus; *petrocoriensis*-group. The newly discovered specimens (Fig. 12) found in Albania are without doubt identical with *M. hellenicus* (Fig. 13), and this is made probable also by the geographical situation of the country.



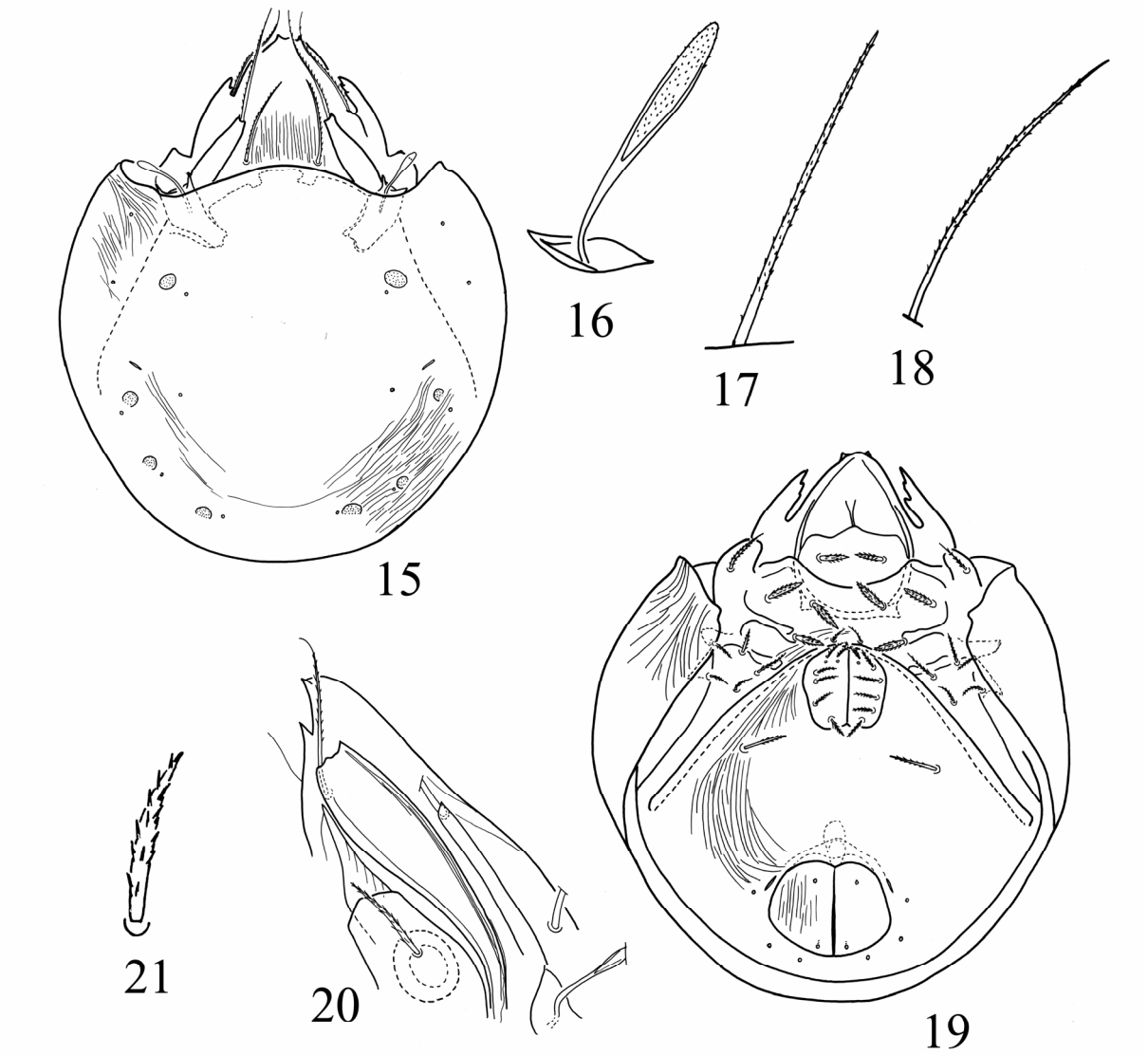
Figures 12–13. *Microzetes hellenicus* Mahunka, 1977. 12 = prodorsum of a paratype, 13 = prodorsum of an exemplar from Albania. **Figure 14.** Prodorsum of *Microzetes raczi* Mahunka, 1991

***Chamobates (Xiphobates) latissimus* sp. n.**
(Figs. 15–21)

Material examined. Holotype: Albania, Skrapar County, Tomor Mts, Ujanik, gorge of the Ujanik Stream, 23.08.2006. Leg.: Z. Fehér, A. Hunyadi, T. Huszár and D. Murányi (E-2070). 2 paratypes from the same sample. Holotype (1756-HO-2008) and 1 paratype (1756-PO-2008) HNHM, 1 paratype MHNG.

Diagnosis. Rostral apex convex with two lateral apices. Lamellae short, their apex sharply poined laterally. Tutorium with 1–2 teeth distally. Sensillus narrow, its head slightly dilated, fusiform. Basal part of interlamellar region, surface of pteromorphae and some other fields of the body finely lineate. Pteromorphae with anterolateral excision. Ten pairs alveoli and four pairs of porose areas present. All setae in epimeral and genital region well bristly, some of them dilated. Setae in anal region minute. All legs tridactylous.

Measurements. Length of body: 488-522 µm, width of body:433-462 µm.



Figures 15–21. *Chamobates* (*X.*) *latissimus* sp. n. 15 = body in dorsal view, 16 = sensillus, 17 = seta *in*, 18 = seta *ro*, 19 = body in ventral view, 20 = podosoma in lateral view, 21 = hypostomal setae

Prodorsum. Rostrum conical, rostral apex rounded medially, with a pair of teeth laterally. Lamellae well developed, with short, but sharply pointed lateral apex. Rostral setae (Fig. 18) setiform, shorter than lamellar ones, both pairs with fine distal end. Interlamellar setae (Fig. 17) much shorter, their distal end blunt. Sensillus (Fig. 16) long, narrow, proclinate, its head longer than peduncle, slightly fusiform, with some minute barbs. Interlamellar region finely lineat (Fig. 15).

Notogaster. Pteromorphae and a part of the notogastral surface ornamented by weak, very characteristic sculpture, consisting of inward bending, mostly parallel lines (Fig. 15). Anterolateral corner of pteromorphae deeply incised. Ten pairs of minute alveoli and four pairs of different areae

porosae present, *Aa* largest of all, all others nearly equal in size and form.

Lateral part of podosoma. Tutorium gradually widened anteriorly, with sharply pointed dorsal apex and mostly 1–2 smaller teeth medially. Rostral setae arising far from apex. Dorsal margin well striate, with parallel lines. Pedotectum long and large, angular distally.

Ventral parts (Fig. 19). Hypostoma with thick, barbed setae *h* (Fig. 21). Epimeral setal formula: 3 – 1 – 3 – 3. All setae well barbed, setae *1a, 1b,* and *3a* dilated fusiform, only setae *2a* much thinner, setiform. All others also strong, well barbed. Circumpedal carina weak, a pair of well sclerotised lath running along the genital aperture posteriorly. Genito-anal setal formula: 6 – 1 – 2 – 3. Setae in genital region strong, spiniform, well barbed, setae in the anal region minute or represented only by their alveoli. Surface of ventral plate also characteristically lineate. Similar sculpture observable also in the anal plates.

Legs. All legs tri-heterodactylous.

Remarks. The new species belongs to the species-group *Ch.* (*X.*) *rastratus* (Hull, 1914). However, the new species is well distinguished from the other species by the very thick hypostomal, epimeral and genital setae, the well sclerotised longitudinal lath and the lineate sculpture on notogaster and ventral regions.

Etymology. Named after the conspicuously broad body.

***Scheloribates salebrosus* sp. n.**
(Figs. 22–25)

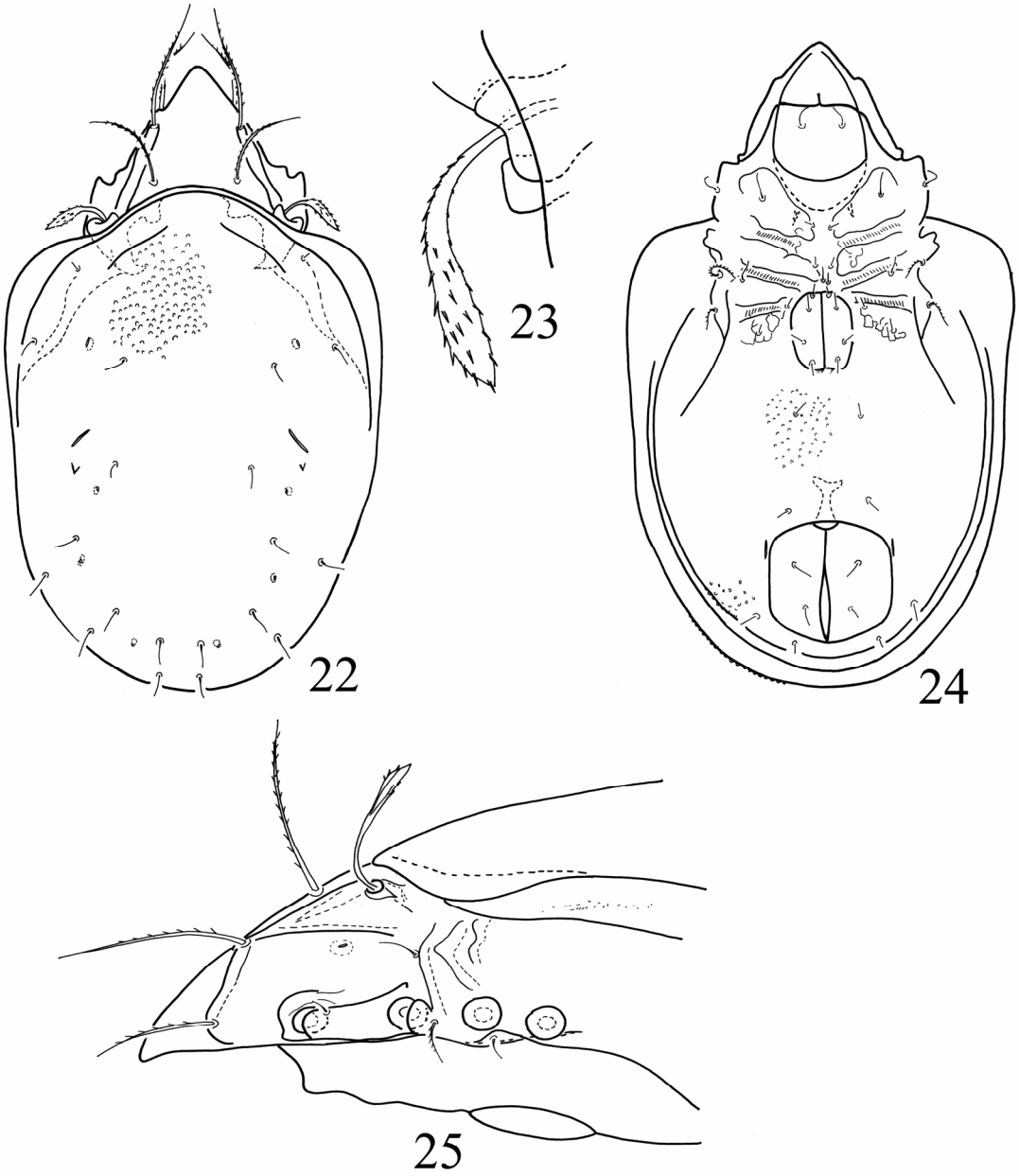
Material examined. Holotype: Albania, Periferi County, Mat, 4 km to Fushë-Lurë from the Peshkopi – Burrel road (1210 m), [stream, degraded forest], 13.04.2006. Leg.: Z. Erőss, Z. Fehér, A. Hunyadi and D. Murányi. (E-1928). 1 paratype from the same sample. Holotype (1757-HO-2008) and 1 paratype (1757-PO-2008): HNHM.

Diagnosis. Rostrum narrowed, conical. All prodorsal setae setiform, ciliate, long. Sensillus lanceolate, rarely ciliate. Surface of the notogaster covered by granules, notogaster with 10 pairs of short and fine setae and 4 pairs of small sacculi. Epimeral borders compose a closed network. Ventral plate finely granulate, surface of genital and anal plates smooth. All legs tridactylous.

Measurements. Length of body: 433–471 µm, width of body:282–308 µm.

Prodorsum. Surface smooth. Rostral part narrowing anteriorly, conical, without sharply pointed apex. Lamellae well developed prelamellae also strong. Ratio of lamellar setae: *ex*< *ro*< *le*< *in*, exobothridial much thinner than the others and smooth. The remaining notogastral setae well ciliate. Sensillus (Fig. 23) lanceolate, directed laterally, its head not longer than peduncle and rarely ciliate.

Notogaster. Dorsosejugal suture convex medially, no depression behind the bothridium, pteromorphae small not protruding anteriorly. Whole surface – excepting an anteromedian band – covered by smaller or bigger granules (cloddy) (Fig. 22) Ten pairs of very thin and short notogastral setae present, setae c_2 much shorter than the others. Four pairs of small sacculi and a pair of conspicuously long lyrifissures (*im*) also observable.



Figures 22–25. *Scheloribates salebrosus* sp. n. 22 = body in dorsal view, 23 = sensillus, 24 = body in ventral view, 25 = podosoma in lateral view

Lateral part of podosoma. Lamella, prelamella and sublamella well developed, prelamella reaching over the insertion of rostral seta (Fig. 25). Sublamella not directed to the bothridium. Exobothridial seta simple, thin. Some well sclerotised ribs observable in the sejugal region. Pedotecta I long and narrow, seta *1c* arising on its dorsal margin. Circumpedal carina short, ending far from the lateral margin of ventral plate.

Ventral parts (Fig. 24). Epimeral borders – excepting *bo.4* – well developed, *bo.2* and *bo. sej.* long, *bo.3* not reaching the genital aperture, *bo.4*

reduced. Sternal border also present. Discidium small, slightly arched, circumpedal carina fine, not reaching the lateral margin of ventral plate. Epimeral setal formula: 3 – 1 – 3 – 3, setae *1c* arising laterally, setae *3c* slightly pilose, setae *4c* located on the lateral margin of the discidium. Most of them short. Surface the ventral plate granulate, granules smaller and sparser than in the notogastral surface. All setae in the genito-anal region also short, their formula: 4 – 1 – 2 – 3. Setae ad_3 arising in preanal position, comparatively far from the anal aperture.

Legs. All legs tri- and heterodactylous.

Remarks. On the basis of the form of pteromorphae and sensillus furthermore owing to the presence and number of the notogastral setae, the new species is well ranging to the nominate subgenus of genus *Scheloribates* Berlese, 1908. The species is unique among the heretofore known species; its notogastral sculpture resembles that of *Sch.* (*Topobates*) *granifer* Grandjean, 1958, although the number of the notogastral setae in the new species is 10.

Etymology. The new species is named after the notogastral sculpture.

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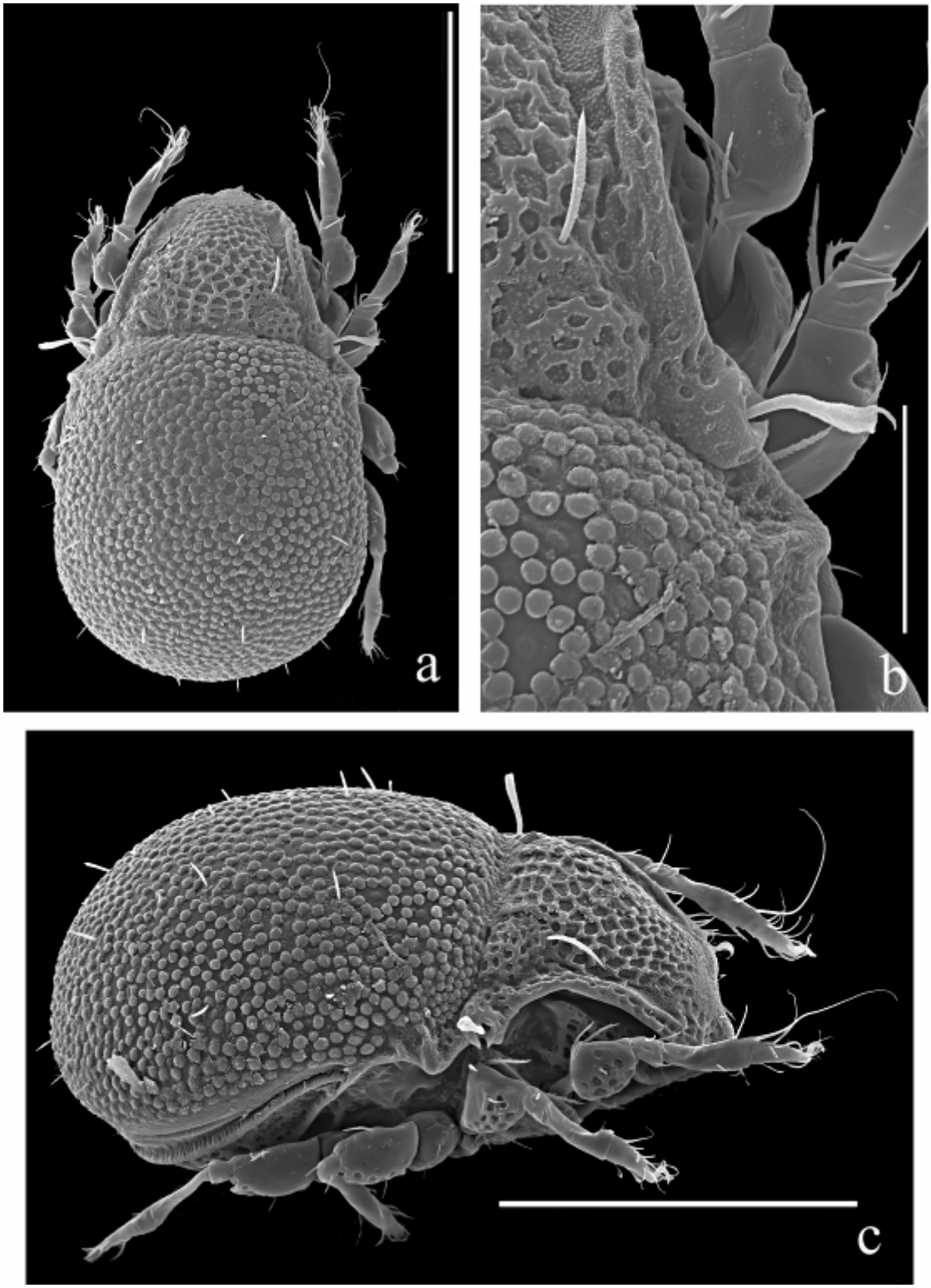

Plate I. SEM micrographs of *Carabodes csikii* sp. nov. a = dorsal view, b = humeral part with the trichobothrium, c = lateral view.

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New records of zerconid mites (Acari: Mesostigmata) from Mts. Papuk, Croatia, with description of *Zercon kontschani* sp. n.

ZS. UJVÁRI[1]

Abstract. Nine zerconid mite species belonging to the genera *Prozercon* Sellnick, 1944 and *Zercon* C. L. Koch, 1839 were collected from Papuk Mts., North Croatia. Eight of them – *Prozercon fimbriatus* (C. L. Koch, 1839); *Prozercon rafalskii* Błaszak, 1971; *Prozercon sellnicki* Halašková, 1963; *Prozercon tragardhi* (Halbert, 1923); *Zercon gurensis* Mihelčič, 1962; *Zercon hungaricus* Sellnick, 1958; *Zercon peltatus* C. L. Koch, 1836; *Zercon spatulatus* C. L. Koch, 1839 – are new to the fauna of Croatia, and one, *Zercon kontschani* sp. nov., proved to be new to science as well.

INTRODUCTION

Members of the family Zerconidae (Acari: Mesostigmata) are soil-inhabiting predatory mites. Representatives of this important component of the soil fauna occur mainly in moss and leaf-litter. The group is represented by 35 genera and more than 300 species worldwide.

Our knowledge on the zerconid mites of the Balkan and especially of the former Yugoslavia is scarce. The first data on mesostigmatid mites of Yugoslavia mentioning one species of Zerconidae (*Zercon triangularis* C. L. Koch, 1836) was published in the middle of the last century (Willman, 1941). Later Košir (1974) reported two new species (*Zercon primus* Košir, 1974 and *Prozercon tuberculatus* Košir, 1974) and mentioned one species (*Zercon plumatopilus* Athias-Henriot, 1961) new to the fauna of the country (from the territory of present-day Macedonia and Slovenia). Recently, Kontschán (2006) described a new species from Kosovo, *Zercon kosovina* Kontschán, 2006, and listed some known ones from Serbia-Montenegro.

The Zerconidae fauna of Croatia has not been studied so far. Herewith I report the occurrence of nine species in several locations of Papuk Mts. One of them represents a new species to science and eight are new to the fauna of Croatia.

MATERIALS AND METHODS

Specimens were cleared in lactic acid and impregnated with glycerin. Preparations were examined using a light microscope; drawings were made with camera lucida. Photos were taken by an Olympus Color View I. digital camera. Mites are stored in alcohol and deposited in the Soil Zoology Collections of the Hungarian Natural History Museum. Specimens were identified according to Błaszak (1974) and Mašan & Fenďa (2004). In the description of the new species, terminology of setea follows Sellnick (1958). Measurements were taken – on the basis of microscopic photos – by Adobe Photoshop CS 8.0, and given in micrometers (µm), presented as mean.

TAXONOMIC RESULTS

Prozercon fimbriatus (C. L. Koch, 1839)
(Fig. 1)

Material examined. E-1860: Croatia, Papuk, Drenovac, streamside, near a small wooden bridge, 21.04.2004. leg. Kontschán, J. (5 ♀); E-1861: Croatia, Papuk, Strmac, from humid forest, 21.04.2004. leg. Kontschán, J. (6 ♀, 1 ♂, 2 deutonymphs); E-1862: Croatia, Papuk, Novo Zvecevo, streamside, near the village, 22.04.2004. leg. Kontschán, J. (2 ♀); E-1863: Croatia, Papuk, Novo Zvecevo, under the pass, 22.04.2004. leg. Kontschán, J. (1 ♀, 1 deutonymph); E-1864: Croatia, Papuk, Drenovac, streamside, near a small

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wooden bridge, 21.04.2004. leg. Kontschán, J. (3 ♀); E-1867: Croatia, Papuk, 7 kms north Kutjevo, streamside, 20.04.2004. leg. Kontschán, J. (4 ♀); E-1878: Croatia, Papuk, Drenovac, near Velikai road, beech forest, 20.04.2004. leg. Kontschán, J. (3 ♀, 3 ♂); E-1881: Croatia, Papuk, 1 km north of Kutjevo, streamside, 20.04.2004. leg. Kontschán, J. (1 ♀); E-1882: Croatia, Papuk, 7 kms north Kutjevo, streamside, 20.04.2004. leg. Kontschán, J. (3 ♀, 1 ♂).

Distribution. Europe.

***Prozercon rafalskii* Blaszak, 1971**
(Fig. 2)

Material examined. E-1860: Croatia, Papuk, Drenovac, streamside, near a small wooden bridge, 21.04.2004. leg. Kontschán, J. (1 ♀); E-1862: Croatia, Papuk, Novo Zvecevo, streamside, near the village, 22.04.2004. leg. Kontschán, J. (1 ♀).

Distribution. Poland, Slovakia, Turkey.

Remarks. Setae S1 with (postero)lateral position to Z1, in this way the mites collected in Croatia differ from the type described from Poland (S1 with anterolateral position to Z1). On the figure of Mašan & Fenďa (2004) S4 1.5 times longer than S3. At the Croatian species S3 and S4 equal in length.

***Prozercon sellnicki* Halašková, 1963**
(Fig. 3.)

Material examined. E-1860: Croatia, Papuk, Drenovac, streamside, near a small wooden bridge, 21.04.2004. leg. Kontschán, J. (1♀).

Distribution. Central Europe.

***Prozercon tragardhi* (Halbert, 1923)**
(Fig. 4)

Material examined. E-1863: Croatia, Papuk, Novo Zvecevo, under the pass, 22.04.2004. leg. Kontschán, J. (1 ♀).

Distribution. From Europe to Turkey.

***Zercon gurensis* Mihelčič, 1962**
(Fig. 5.)

Material examined. E-1860: Croatia, Papuk, Drenovac, streamside, near a small wooden bridge, 21.04.2004. leg. Kontschán, J. (9♀ 2♂ 10 deutonymphs); E-1880: Croatia, Papuk, Kokocak, alder forest, 20.04.2004. leg. Kontschán, J. (1♀ 1 deutonymph)

Distribution. Central Europe.

***Zercon hungaricus* Sellnick, 1958**
(Fig. 6)

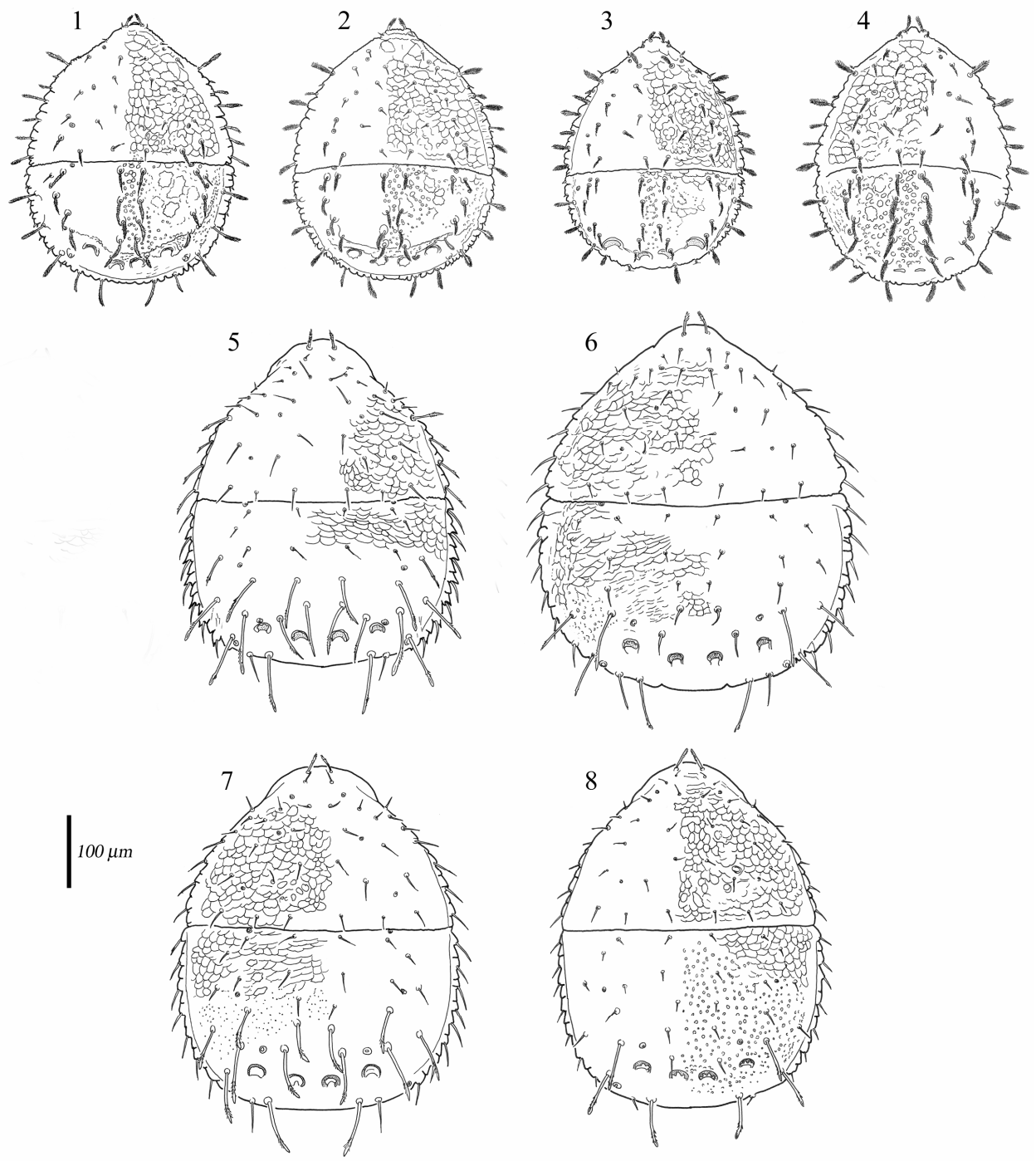
Material examined. E-1863: Croatia, Papuk, Novo Zvecevo, under the pass, 22.04.2004. leg. Kontschán, J. (4 ♀, 3 ♂); E-1864: Croatia, Papuk, Drenovac, streamside, near a small wooden bridge, 21.04.2004. leg. Kontschán, J. (1 deutonymph).

Distribution. Poland, Czech Republic, Austria, Slovakia, Hungary, Romania, Bulgaria, Ukraine.

***Zercon peltatus* C. L. Koch, 1836**
(Fig. 7)

Material examined. E-1861: Croatia, Papuk, Strmac, from humid forest, 21.04.2004. leg. Kontschán, J. (1 ♀); 1864: Croatia, Papuk, Drenovac, streamside, near a small wooden bridge, 21.04. 2004. leg. Kontschán, J. (4 ♀, 10 ♂, 3 deutonymphs); E-1867: Croatia, Papuk, 7 kms north Kutjevo, streamside, 20.04.2004. leg. Kontschán, J. (1 ♀); E-1879: Croatia, Papuk, Strmac, humid forest, 21.04.2004. leg. Kontschán, J. (3 ♀, 5 ♂); E-1881: Croatia, Papuk, 1 kms north Kutjevo, streamside, 20.04.2004. leg. Kontschán, J. (3 ♀, 9 ♂, 1 deutonymph).

Distribution. British Isles, Spain, Germany, Poland, Czech Republic, Austria, Slovakia, Ukraine, Hungary, Romania, Bulgaria.



Figures 1-8. Known species collected in Mts. Papuk (females, dorsal view): 1 = *Prozercon fimbriatus* (C. L. Koch, 1839), 2 = *Prozercon rafalskii* Błaszak, 1971, 3 = *Prozercon sellnicki* Halašková, 1963, 4 = *Prozercon tragardhi* (Halbert, 1923), 5 = *Zercon gurensis* Mihelčič, 1962, 6 = *Zercon hungaricus* Sellnick, 1958, 7 = *Zercon peltatus* C. L. Koch, 1836, 8 = *Zercon spatulatus* C. L. Koch, 1839

***Zercon spatulatus* C. L. Koch, 1839**
(Fig. 8)

Material examined. E-1881: Croatia, Papuk, 1 kms north Kutjevo, streamside, 20.04.2004. leg. Kontschán, J. (1 ♀, 2 ♂, 2 deutonymphs).

Distribution. Europe.

***Zercon kontschani* sp. n.**
(Figs 9-16)

Material examined. Holotype: female, E-1861: Croatia, Papuk, Strmac, from humid forest, 21.04.2004. leg. Kontschán, J. Paratypes: 9 ♀, 10 ♂, 2 deutonymphs, locality same that of the holotype. Other localities: 1862: Croatia, Papuk, Novo Zvecevo, streamside, near the village, 22. 04.2004. leg. Kontschán, J. (8 ♀, 5 ♂, 1 deutonymph); E-1865: Croatia, Papuk, Novo Zvecevo, streamside near village, 22.04.2004. leg. Kontschán, J. (8 ♀, 5 ♂, 1 deutonymph); E-1867: Croatia, Papuk, 7 kms north Kutjevo, streamside, 20.04.2004. leg. Kontschán, J. (1 ♀, 2 ♂); E-1878: Croatia, Papuk, Drenovac, near Velikai road, beech forest, 20.04.2004. leg. Kontschán, J. (6 ♀, 5 ♂); E-1881: Croatia, Papuk, 1 kms north Kutjevo, streamside, 20.04.2004. leg. Kontschán, J. (1,♀).

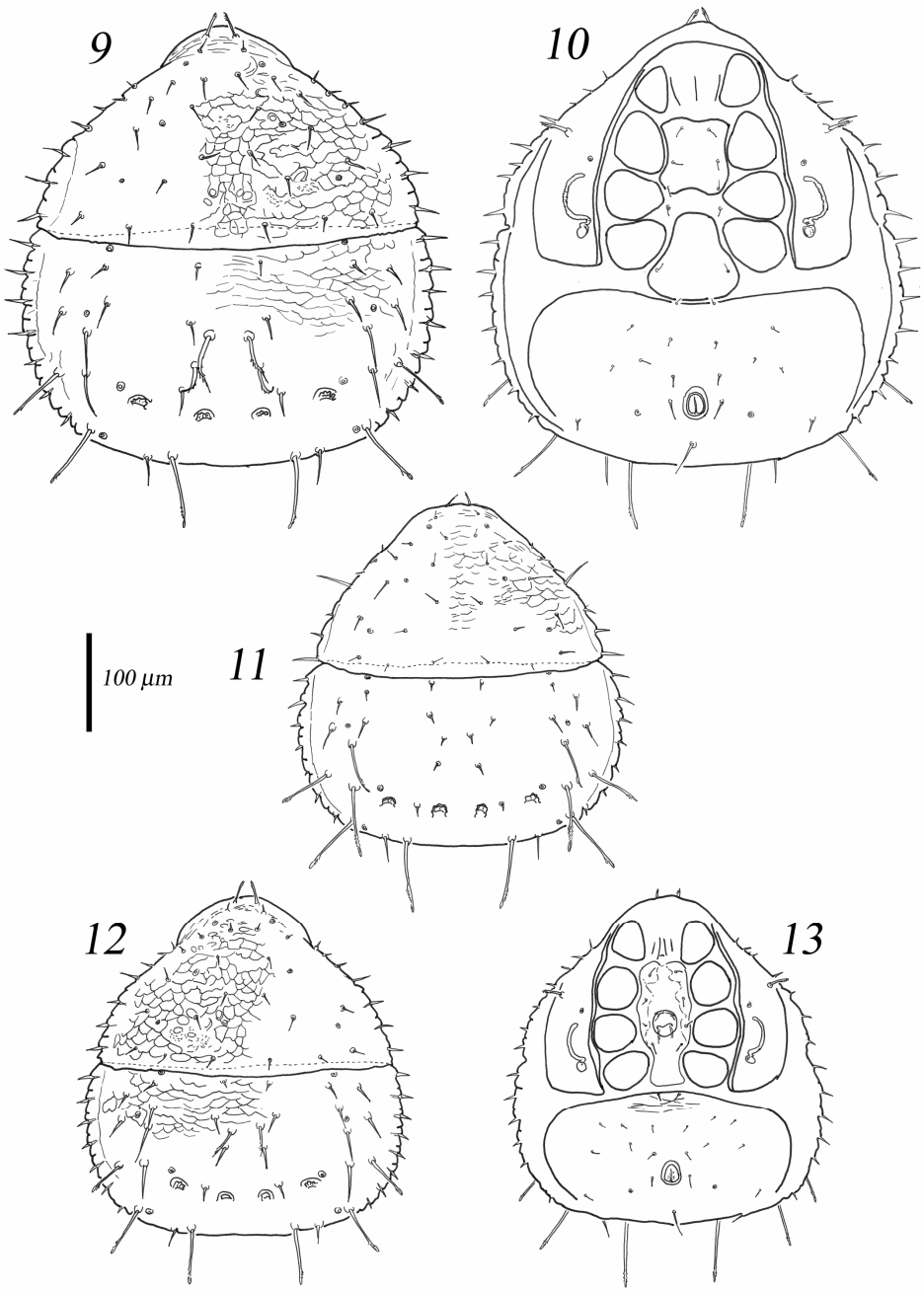
Diagnosis. Podonotal setae short and smooth, except i_1, which barbed. On opisthonotum, setae I_2 with lateral or anterolateral position to I_3, short, smooth. I_{3-4} thickened, elongated, slightly pilose, reaching the following's bases. I_3 3-4 times longer than I_2 (size of these two setae varies, but I_3 always much longer) Setae I_6, S_{3-4} of almost equal size and appearance, long, apically barbed, with hyaline ending. Z_{3-4} medium-sized, smooth. Other opisthonotal setae short, smooth. Marginal R setae thickened, pointed. Dorsal fossae of general size and appearance. Podonotum with irregular pattern; anterior part of opisthonotum with tile-like pattern (disappearing on posterior part).

Description. Female. Length of idiosoma: 450 µm; width: 430 µm.

Dorsal side (Fig. 9). On podonotum, 22 pairs of different setae: i-row with 6, z-row with 2, s-row with 5, p-row with 2, and marginal r-row with 7 pairs of setae. i_1 apically barbed, others short and smooth. Members of r-row thickened, thorn-like. Pores po1 situated on the line connecting the bases of i_2 and s_2, po_2 between i_4 and s_4, in mid-position, po3 under the line connecting the insertions of setae z_1 and s_5, closer to s_5. On opisthonotum, 22 pairs of different setae (Figs. 14-16): I-row with 6, Z-row with 5, S-row with 4, R-row with 7 pairs of setae. I_1 short and smooth. I_2 short, smooth and needle like, situated very close to I_3 with (antero)lateral position to it, and far from I_1. I_2 may vary in length but never thickened or pilose. I_3 elongated, thickened, rarely, finely pilose and reaching far beyond the following's bases. I_4 similar in appearance to I_3, but always shorter and reaching the following's bases. I_5 short (in general longer than I_2) but thickened. I_6 long, apically barbed and terminated with hyaline ending. Z_{1-4} smooth, Z_{1-2} shorter, Z_2 never reaching the following's insertion, Z_{3-4} longer, Z_3 reaching the bases of Z_4. Z_5 short and smooth. S_{1-2} similar to Z_{1-2}. S_{3-4} similar to I_6, but shorter and reaching beyond the margin of idiosoma. Setae of R-row thickened, pointed. Po_1 with anterior position to the insertions of Z_1, Po_2 just under the line connecting Z_2 and S_2 (usually closer to Z_2), Po_3 between I_5 and Z_4 (closer to setae Z_5), Po_4 next to the insertions of S_4 (medially). Dorsal fossae of general size and appearance. Lateral margins of opisthonotum with normal serration. On podonotum, irregular, tile-like pattern. Anterior part of opisthonotum covered with tile-like pattern, posterior 70 % smooth.

The size of setae and the distances between their insertions as in Table 2 (measurements are given as mean, in micrometers).

Ventral side (Fig. 10.). The shape and chaetotaxy of the ventroanal shield is typical for the genus *Zercon*. Anterior margin of ventroanal shield with one pair of setae.



Figures 9-13. *Zercon kontschani* sp. n.: 9 = female, dorsal view, 10 = female, ventral view, 11 = deutonymph, dorsal view, 12 = male, dorsal view, 13 = male, ventral view

Male. Length of idiosoma: 345 µm; width: 320 µm.

Dorsal side (Fig. 12). Chaetotaxy, dorsal cavities, situation of pores and pattern as in female, but I_3-$_4$ shorter, I_4 smooth and reaching only half the distance to the insertions of setae I_5.

The size of setae and the distances between their insertions as in table 3 (measurements are given as mean, in micrometers).

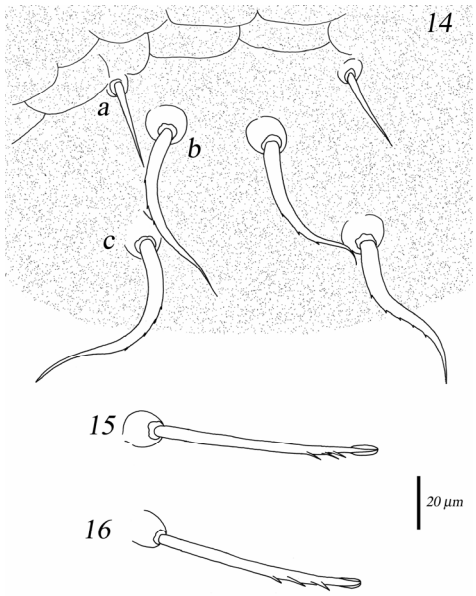
Ventral side (Fig. 12). Typical for the genus *Zercon*, as in female.*Deutonymph* (Fig. 11). Podonotum as in adult stage. On opisthonotum, I_{1-5} short, smooth, needle like. I_2 at equal distance from I_1 and I_3. I_5 situated far from I_4, between medial and lateral dorsal fossae. Setae Z_{3-4} long, apically barbed, with hyaline tips, just as I_6, S_3 and S_4. Other setae, pores and cavities as in adult stage. Podonotum with indistinct irregular pattern, opisthonotum smooth. The size of setae and the distances between their insertions as in table 4 (measurements are given as mean, in micrometers).

Remarks. Setae I_2, I_3 and I_4 variable in length. The following minimum and maximum values have been measured:

I_2: 23-34 µm; I_3: 47-74 µm; I_4: 32- 50 µm

The new species is most similar to *Zercon latissimus* Sellnick, 1944 and *Zercon kosovina* Kontschán, 2006. The females of the three species can be distinguished according to table 1.

Etymology. The new species is dedicated to Dr. Jenő Kontschán, acarologist, who kindly helped me in every aspect of my work.



Figures 14-16. Opisthonotal setae of *Zercon kontschani* sp. n.: 14 = central part of opisthonotum with setae I_{2-4} (a: setae I_2, b: setae I_3, c: setae I_4), 15 = seta I_6, 16 = seta S_4

Table 1. Distinguishing characters of *Z. kontschani* sp. n., *Z. latissimus* and *Z. kosovina*

Zercon kontschani sp. n.	*Zercon latissimus* Sellnick, 1944	*Zercon kosovina* Kontschán, 2006
I_2 short, thin and smooth	I_2 long, thickened, slightly pilose	I_2 short, thin and smooth
I_3 2-3 times longer than I_2	I_2 and I_3 equal in length	I_3 4 times longer than I_2
I_3 1.5 times longer than I_4	I_3 and I_4 equal in length	I_3 and I_4 equal in length
I_5 short, smooth, close to dorsal fossae	I_5 short, slightly pilose, close to dorsal fossae	I_5 long, thickened, smooth, situated laterally to I_4, far from dorsal fossae
S_3 long, apically barbed, reaching beyond the margin of opisthonotum	S_3 long, apically barbed, reaching beyond the margin of opisthonotum	S_3 medium-sized, smooth, not reaching the margin of opisthonotum
Z_2 not reaching the insertions of Z_3	Z_2 reaching beyond the insertions of Z_3	Z_2 not reaching the insertions of Z_3
Setae s_1 absent	Setae s_1 absent	Setae s_1 present

Table 2. Length of opisthonotal setae and longitudinal distances between their bases in *Zercon kontschani* sp. n., female (values in µm)

Setae and intersetal distances	Length or distance	Setae and intersetal distances	Length or distance	Setae and intersetal distances	Length or distance
I_1	14	**Z_1**	19	**S_1**	23
I_1-I_2	56	**Z_1-Z_2**	36	**S_1-S_2**	40
I_2	24	**Z_2**	27	**S_2**	27
I_2-I_3	25	**Z_2-Z_3**	35	**S_2-S_3**	62
I_3	59	**Z_3**	46	**S_3**	63
I_3-I_4	35	**Z_3-Z_4**	45	**S_3-S_4**	70
I_4	33	**Z_4**	43	**S_4**	69
I_4-I_5	31	**Z_4-Z_5**	100		
I_5	26	**Z_5**	33		
I_5-I_6	67				
I_6	74				

Table 3. Length of opisthonotal setae and longitudinal distances between their bases in *Zercon kontschani* sp. n., male (values in µm)

Setae and intersetal distances	Length or distance	Setae and intersetal distances	Length or distance	Setae and intersetal distances	Length or distance
I_1	9	**Z_1**	15	**S_1**	18
I_1-I_2	37	**Z_1-Z_2**	25	**S_1-S_2**	31
I_2	19	**Z_2**	22	**S_2**	22
I_2-I_3	20	**Z_2-Z_3**	24	**S_2-S_3**	44
I_3	31	**Z_3**	34	**S_3**	43
I_3-I_4	19	**Z_3-Z_4**	36	**S_3-S_4**	52
I_4	22	**Z_4**	36	**S_4**	52
I_4-I_5	43	**Z_4-Z_5**	71		
I_5	15	**Z_5**	18		
I_5-I_6	46				
I_6	57				

Table 4. Length of opisthonotal setae and longitudinal distances between their bases in *Zercon kontschani* sp. n., deutonymph (values in µm)

Setae and intersetal distances	Length or distance	Setae and intersetal distances	Length or distance	Setae and intersetal distances	Length or distance
I_1	9	**Z_1**	9	**S_1**	15
I_1-I_2	35	**Z_1-Z_2**	33	**S_1-S_2**	30
I_2	9	**Z_2**	18	**S_2**	25
I_2-I_3	28	**Z_2-Z_3**	27	**S_2-S_3**	49
I_3	10	**Z_3**	52	**S_3**	54
I_3-I_4	29	**Z_3-Z_4**	44	**S_3-S_4**	52
I_4	11	**Z_4**	70	**S_4**	66
I_4-I_5	48	**Z_4-Z_5**	59		
I_5	10	**Z_5**	26		
I_5-I_6	37				
I_6	73				

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Report on the soil zoological expeditions to Ecuador and Colombia between 1986 and 1993

I. List of localities and habitats of "Berlese" samples

A. ZICSI[1] and CS. CSUZDI[2]

Abstract. Complete lists of the sampling localities and habitats of the Hungarian soil zoological expeditions to Ecuador and Colombia between 1986 and 1993 are presented. The lists are organized according to the expedition's dates and apart from the locality some data on the biotopes and sampled substrates are also given.

INTRODUCTION

Between 1986 and 1993 six Hungarian soil zoological expeditions collected earthworms and soil mesofauna samples ("Berlese" samples of different substrates like moss, litter, soil etc.) in Ecuador and Colombia. The participants were in 1986, 1987, 1989 András Zicsi and the late Imre Loksa; in 1988, 1990, 1993 András Zicsi and Csaba Csuzdi. These researches were financially supported by the Hungarian Academy of Sciences. We also enjoyed local assistance from the Pontificia Universidad Católica del Ecuador, Quito, and the Universidad Nacional de Colombia, Palmira.

The expeditions took place during the rainy season, mainly in April and May, and covered most of the Ecuador, from the Colombian to the Peruvian borders, with the exception of some regions in the South-East (Oriente) and the Pacific Coast. Our collectings in Colombia focused on the Southern part, mainly the Cauca Valley.

Detailed results of the earthworm collections have yet been presented (Zicsi, 2007); herewith we summarize the Berlese samples' localities so as to facilitate the further work on these materials. The lists are organized according to the expedition's dates and codes used.

LIST OF LOCALITIES AND HABITATS

Ecuador 1986

Ecu. Berl. 1. – Between Quito and Nono (Prov. Pichincha), 8 km to Nono, 3280 m. – 4. II. 1986. – *Wet grass from the banks of a creek.*

Ecu. Berl. 2. – *Moss from shrubs at the entrance of a gorge hollowed out by a creek.*

Ecu. Berl. 3. – *Moss from the vertical walls of the gorge.*

Ecu. Berl. 4. – *Moss from the stems of shrubs at the gorge entrance.*

Ecu. Berl. 5. – *Detritus from fern stems from about 30 m above the water level of the creek.*

Ecu. Berl. 6. – *Moss from stems of shrubs from about 30 m above creek level.*

Ecu. Berl. 7. – *Detritus from below shrubs about 30 m above the creek.*

Ecu. Berl. 8. Riverbanks of Rio Alamo, 6 km leaving Nono, 2250 m. – 4. II. 1986. – *Moss from a tree stump on the riverbank.*

Ecu. Berl. 9. – *Moss and fern stems from riverside rock.*

Ecu. Berl. 10. – *Forest litter and soil from 10 m above the water level of the river.*

Ecu. Berl. 11. – *Moss hanging from shrubs and tree branches, from about 10 m above the river.*

Ecu. Berl. 12. – *Moss from tree stems, from about 10 m above the river.*

Ecu. Berl. 13. – *Horsetail and moss from forest edge, about 50 m above the river.*

Ecu. Berl. 14. – *Moss hanging from rock at a small waterfall, about 50 m above the river.*

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Ecu. Berl. 15. – *Moss and scale-moss from tree stem, about 60 m above the river.*

Ecu. Berl. 16. Riverbank of Rio Alamo, 3 km leaving Nono, 2750 m. – 4. II. 1986. – *Litter and soil from forest patch.*

Ecu. Berl. 17. – *Debris of decomposing tree stump and moss from near the riverbank.*

Ecu. Berl. 18. – *Grass of grazed pasture, with much couch-grass.*

Ecu. Berl. 19. Pasochoa National Park, 2800-2850 m. – 6. II. 1986. – *Scale-moss hanging from vertical bank of a creek, 3 m above water level.*

Ecu. Berl. 20. – *Litter of dense creeping reed and soil from the bank of the creek (light scarcely at all).*

Ecu. Berl. 21. – *Rock-trough filled with water above creek level, moss hanging from the wall above the trough.*

Ecu. Berl. 22. – *Hillside 150 m above the creek (3000 m); fern stems from shrubby secondary forest.*

Ecu. Berl. 23. – *Mossy litter and soil from below ferns in the shrubby secondary forest.*

Ecu. Berl. 24. – *Sclerophyllous litter and soil of the shrubby secondary forest.*

Ecu. Berl. 25. – *Moss and soil from below closed shrubs of the shrubby secondary forest.*

Ecu. Berl. 26. – *Moss and soil from a small clearing of the shrubby secondary forest.*

Ecu. Berl. 27. – *Cattle pasture, detritus and soil from a fresh grass patch.*

Ecu. Berl. 28. – *Cattle pasture, detritus and soil of relatively dry grass.*

Ecu. Berl. 29. – *End of the fenced part of the park with a small creek. Wet litter of creeping reed growing along the creek.*

Ecu. Berl. 30. – *Wet moss cover of stones lying in the creek.*

Ecu. Berl. 31. – *Moss hanging from tree branches overshadowing the creek.*

Ecu. Berl. 32. – *Thick moss and soil from almost vertical wall.*

Ecu. Berl. 33. – *Litter and soil of very old reeds, about 20 m above the creek.*

Ecu. Berl. 34. – *Litter and soil from below Rubus shrubs on a pasture, about 50 m above the creek.*

Ecu. Berl. 35. Naranhito (Prov. Cotopaxi), on the way to San Francisco de las Pampas, cca 2200 m. – 9. II. 1986. – *Forest patch, litter and soil.*

Ecu. Berl. 36. – *Debris and moss cover of decomposing tree stump.*

Ecu. Berl. 37. – *Moss hanging from tree branches.*

Ecu. Berl. 38. – *1.5 km in the direction of Toachi. Forest patch with many palm trees. Litter and soil.*

Ecu. Berl. 39. – *Debris and moss cover of decomposing tree stump.*

Ecu. Berl. 40. – *Moss from tree stems.*

Ecu. Berl. 41. Galapagos de las Pampas (Prov. Cotopaxi), on the way to San Francisco de las Pampas, cca 2200 m. – 9. II. 1986. – *Wet litter and soil from the bank of a hollow of a creek.*

Ecu. Berl. 42. – *Moss from rock, moistened continuously by a small spring.*

Ecu. Berl. 43. San Francisco de las Pampas (Prov. Cotopaxi), cca 2300 m. – 10. II. 1986. – *Litter and soil from small forest patch among cultivated fields.*

Ecu. Berl. 44. – *Moss hanging from the tree stems.*

Ecu. Berl. 45. – *Epiphyllous moss of palm leaves.*

Ecu. Berl. 46. – *Litter and soil from maize field near the forest patch (last year's fallow).*

Ecu. Berl. 47. – *Soil and detritus of secondary vegetation from the fallow.*

Ecu. Berl. 48. – *Thick moss carpet of the fallow.*

Ecu. Berl. 49. About 4 km from San Francisco de las Pampas in the direction of Toachi. (Prov. Cotopaxi), 2200 m. – 10. II. 1986. – *Litter and soil of the forest patch on the plateau.*

Ecu. Berl. 50. – *Moss hanging from tree stems and braches in the flat forest patch.*

Ecu. Berl. 51. – *Moulder from below the bark of cut tree trunk, in the flat forest patch.*

Ecu. Berl. 52. – *Litter and soil from forest on steep hillside (inclinatio about 50°).*

Ecu. Berl. 53. – *Moss hanging from branches and detritus of Bromelia from steep hillside forest.*

Ecu. Berl. 54. – *Bark and moss from tree trunk lying on flat, clear-cut area.*

Ecu. Berl. 55. – *Grass detritus and soil from flat, clear-cut area.*

Ecu. Berl. 56. Large waterfall near Toachi (Prov. Pichincha), 2000 m. – 10. II. 1986. – *Litter and soil from shrubby forest bordering the waterfall.*

Ecu. Berl. 57. – *Wet moss from rock walls beside the waterfall.*

Ecu. Berl. 58. – *Somewhat drier moss and soil from rock walls, farther from the waterfall.*

Ecu. Berl. 59. – *Decomposing palm leaves, somewhat farther from the waterfall.*

Ecu. Berl. 60. – *Decomposing tree trunk at the foot of rock wall, somewhat farther from the waterfall.*

Ecu. Berl. 61. – *Wet moss from below the waterfall.*

Ecu. Berl. 62. – *Wet litter, moss and roots from beside the foot of the waterfall.*

Ecu. Berl. 63. Pomasqui (Prov. Pichincha), cca 2600 m. – 12. II. 1986. – *Eucalyptus forest, litter and detritus of sparse grass.*

Ecu. Berl. 64. Pululagua crater and its surroundings, „Midad del Mundo" (Prov. Pichincha). – 12. II. 1986. – *Shrubs and ferns on the sides of the crater, litter and soil.*

Ecu. Berl. 65. – *Moss from below of shrubs growing on the sides of the crater.*

Ecu. Berl. 66. – *Grass stems and moss from the sides of the crater.*

Ecu. Berl. 67. – *Eroded hollow in the direction of Midad del Mundo, moss from under bushes growing on the sides of the hollow.*

Ecu. Berl. 68. – *Litter and soil from below the bushes.*

Ecu. Berl. 69. – *Litter and soil from below shrubs on the slopes of another eroded hollow.*

Ecu. Berl. 70. – *Moss from the stems of trees and shrubs on the slopes of this eroded hollow.*

Ecu. Berl. 71. – *Litter and soil from under scattered shrubs on flat area between the eroded hollows.*

Ecu. Berl. 72. – *Litter and soil from below shrubs, on steep walls of an eroded gully.*

Ecu. Berl. 73. Towards Calacali (Prov. Pichincha). – 12. II. 1986. – *Detritus from below thorny vegetation.*

Ecu. Berl. 74. – *Litter and soil from below planted Acacia shrubs.*

Ecu. Berl. 75. Cosanga (Las Caucheras) (Prov. Napo), 2100 m. – 13. II. 1986. – *Relict fragment of primary forest. Litter of large, sclerophyllous trees and soil.*

Ecu. Berl. 76. – *Moss hanging from stems of old trees in relict fragment of primary forest.*

Ecu. Berl. 77. – *Litter, mostly of creeping reed, and soil from the edges of the primary forest.*

Ecu. Berl. 78. – *Grass detritus and soil from clear-cut area.*

Ecu. Berl. 79. – *Decomposing debris and moss cover of tree trunk lying on the clear-cut area.*

Ecu. Berl. 80. Puerto Misahualli (Prov. Napo), 250 m. – 14. II. 1986 – *Litter and soil from secondary forest.*

Ecu. Berl. 81. – *Soil from a large rock (there are huge boulders in the forest).*

Ecu. Berl. 82. – *Moss from the large rock.*

Ecu. Berl. 83. – *Debris of decomposing tree trunk and moss in secondary forest.*

Ecu. Berl. 84. – *About 50m above the level of Rio Napo (300m a.s.l.). Litter and soil of secondary forest.*

Ecu. Berl. 85. – *50m above the level of Rio Napo, pasture with scattered trees, litter and soil.*

Ecu. Berl. 86. – *50m above the level of Rio Napo, decomposing leaves of palm trees.*

Ecu. Berl. 87. In the direction of Mirador, a nameless little streamlet of Rio Napo. – 14. II. 1986. – *Litter and soil from forest bordering the streamlet.*

Ecu. Berl. 88. – *Moss from a fallen tree.*

Ecu. Berl. 89. – *Wet moss from the side of a little spring.*

Ecu. Berl. 90. Puerto Napo (Prov. Napo). 14. II. 1986. – *Litter and soil from patch along a temporary creek.*

Ecu. Berl. 91. – *Moss from tree stems in the creek side forest patch.*

Ecu. Berl. 92. Near Santa Clara (Prov. Pastaza). – 14. II. 1986. – *Litter and soil from primary forest patch.*

Ecu. Berl. 93. – *Debris and moss of decomposing tree trunk in the primary forest patch.*

Ecu. Berl. 94. – *Detritus amassed by the floods of a small creek.*

Ecu. Berl. 95. – *Soil and detritus of grass, after clear-cutting.*

Ecu. Berl. 96. Teniente. Hugo Ortiz (Prov. Pastaza). – 14. II. 1986. – *Litter and soil of primary forest patch.*

Ecu. Berl. 97. – *Moss hanging from trees of the primary forest patch.*

Ecu. Berl. 98. – *Soil and detritus of high grass (of the forest edge).*

Ecu. Berl. 99. Between Puyo and Shell (Prov. Pastaza). – 15. II. 1986. – *Forest fragment on steep hillside (970 m a.s.l.), litter and soil.*

Ecu. Berl. 100. – *Moss from tree stems in the forest fragment.*

Ecu. Berl. 101. – *Detritus of high grass and soil.*

Ecu. Berl. 102. Between Rio Negro and Rio Verde (Prov. Tungurahua), 1270 m. – 15. II. 1986. – *Litter and soil from steep hillside forest patch bordering a creek.*

Ecu. Berl. 103. – *Moss from rocks in the creek side forest patch.*

Ecu. Berl. 104. – *Stony hillside secondary forest clearing, tussocks.*

Ecu. Berl. 105. Near to Baños (Prov. Tungurahua). – 15. II. 1986. – *Very dry area. Litter and soil from below shrubs.*

Ecu. Berl. 106. – *Tussocks and detritus.*

Ecu. Berl. 107. La Avelina (Prov. Cotopaxi), 2840 m. – 15. II. 1986. – *Wet meadow (with Juncus-like plants), soil and detritus.*

Ecu. Berl. 108. – *Pasture, couch-grass.*

Ecu. Berl. 109. – *Litter and soil from below bushes along the banks of a water gully.*

Ecu. Berl. 110. Atapul (Prov. Cotopaxi), between Pujili and Zumbagua, 3600–3800 m. – 16. II. 1986. – *Paramo vegetation. Cushion plants.*

Ecu. Berl. 111. – *Soil and detritus of tussocks of the paramo vegetation.*

Ecu. Berl. 112. – *Litter, moss and soil from under bushes.*

Ecu. Berl. 113. – *Paramo vegetation, 4000-4200 m a.s.l. Small cushion plants.*

Ecu. Berl. 114. – *Cushion plants (taller ones).*

Ecu. Berl. 115. On the way to Pujili, 3400 m. – 16. II. 1986. – *Paramo vegetation. Roadside moss.*

Ecu. Berl. 116. – *Rocky gorge with waterfall. Moss from the side of the waterfall.*

Ecu. Berl. 117. – *Moss from rock wall, about 10 m from the waterfall.*

Ecu. Berl. 118. – *Cushion plants.*

Ecu. Berl. 119. – *Tussocks, detritus and soil.*

Ecu. Berl. 120. On the way to Pujili, flat eroded depression, 3200 m. – 16. II. 1986. – *Wet meadow, detritus and soil.*

Ecu. Berl. 121. – *Small cushion plants from beside streamlet.*

Ecu. Berl. 122. – *Tussocks, detritus and soil.*

Ecu. Berl. 123. – On the way to Pujili, *Pinus radiata* forest plantation (about 40 years old), 2800 m. – 16. II. 1986. – *Mossy litter and soil from below trees*.

Ecu. Berl. 124. – *Tussocks and coniferous litter of sparse forest stand.*

Ecu. Berl. 125. – C*ushion plants from forest clearing.*

Ecu. Berl. 126. 8km leaving Pifo (Prov. Pichincha), 2800 m. – 18. II. 1986. – *Deep hollow (cca 50 m) of temporary creek. Soaking wet moss*.

Ecu. Berl. 127. – *Soil and litter from below bushes of the hollow.*

Ecu. Berl. 128. – *Soil and litter from under dwarf shrubs in the upper third of the hollow.*

Ecu. Berl. 129. – *Soil and litter from below bushes growing above the max. flood level of the hollow.*

Ecu. Berl. 130. – *Moss from the ground, upper third of the hollow.*

Ecu. Berl. 131. Psluguillo, about 20 km leaving Pifo (Prov. Pichincha), 3600m. – 18. II. 18986. – *Canyon of a permanent creek. Moss and detritus from trees, about 5m above the level of the creek.*

Ecu. Berl. 132. – *Moss from stones, on the level of the creek.*

Ecu. Berl. 133. – *Litter and soil from below shrubs bordering the creek.*

Ecu. Berl. 134. – *Moss and detritus from bushes and trees along the creek.*

Ecu. Berl. 135. – *Moss from rocks, cca 30 m above the creek level.*

Ecu. Berl. 136. 6 km leaving Psluguillo (Prov. Pichincha), 3900 m. – 18. II. 1986. – *Wet cushion plants from the flat area os a basin surrounded by heights.*

Ecu. Berl. 137. – *Litter and soil from bushes at the foot of rocks.*

Ecu. Berl. 138. – *Moss from decomposing tree trunk, at the foot of rocks.*

Ecu. Berl. 139. – *Moss from tree stems, some 50 m higher.*

Ecu. Berl. 140. – *Litter and soil from below the trees.*

Ecu. Berl. 141. – *Moss and soil.*

Ecu. Berl. 142. – *Cushion plants.*

Ecu. Berl. 143. – *Tussocks and detritus.*

Ecu. Berl. 144. – *Moss and cushion plants*.

Ecu. Berl. 145. Near Psluguillo (in the direction of Pifo), 3400 m. – 18. II. 1986. – *Dry, paper-like bark of trees bordering a stream.*

Ecu. Berl. 146. – *Scarcely moist moss, from 5 m above the stream level.*

Ecu. Berl. 147. – *Soaking wet cushion plants from beside a streamlet.*

Ecu. Berl. 148. – *Moss and other plants growing on wet soil, from stream level.*

Ecu. Berl. 149. – *Detritus of sedge-like plants and wet soil from the side of a streamlet.*

Ecu. Berl. 150. Near Psluguillo (in the direction of Pifo), 3200 m. – 18. II. 1986. – *Creekside moss, from the creek level.*

Ecu. Berl. 151. – *Litter and soil from below shrubs bordering the creek.*

Ecu. Berl. 152. – *Cushion plants from near the creekside.*

Ecu. Berl. 153. – *Moss from decomposing tree trunk, near the creekside.*

Ecu. Berl. 154. Between Tandapi and Toachi, 15 km to Toachi, stream confluent with Rio Pilatión, 2650 m. – 19. II. 1986. – *Soaking wet moss from the stream level*.

Ecu. Berl. 155. – *Litter and soil from below bushes, growing on stream lev*el.

Ecu. Berl. 156. – *Litter and soil from below bushes, growing cca 30m above the stream level*.

Ecu. Berl. 157. – *Moss and debris of decomposing tree, 30m above stream level.*

Ecu. Berl. 158. – *Soil and decomposing Bromelia leaves, from steep devastated area.*

Ecu. Berl. 159. – *Moss from rocks on the steep devastated area.*

Ecu. Berl. 160. – *Somewhat farther from the stream, forest patch without reeds. Litter and soil*.

Ecu. Berl. 161. – *Litter and soil from forest patch with reeds.*

Ecu. Berl. 162. – *Forest patch, moss and soil from rocks.*

Ecu. Berl. 163. – *Forest patch, epipyllous moss.*

Ecu. Berl. 164. Near Toachi, at junction the old highway of Quito, about 50 m above the level of Rio Pilatión. – 19. II. 1986. – *Shrubby forest patch, 1200 m, litter and soil.*

Ecu. Berl. 165. – *Grass cover succeeding clear-cutting*.

Ecu. Berl. 166. – *Moss from the steep roadside.*

Ecu. Berl. 167. Santo Domingo de los Colorados (Prov. Pichincha). – 20. II. 1986. – L*itter and soil from forest patch.*

Ecu. Berl. 168. – *Grass, succeeding clear-cutting*.

Ecu. Berl. 169. 17 km from Santo Domingo de los Colorados, in the direction of Quininde, 350 m. – 20. II. 1986. – *Plantation of palma africana. Decomposing palm-trunk*.

Ecu. Berl. 170. – *Moss and small plants from live palm stems.*

Ecu. Berl. 171. 15 km from Puerto Quito (Prov. Pichincha). – 20. II. 1986. – *Litter and soil from forest patch.*

Ecu. Berl. 172. – *Decomposing tree trunk debris*.

Ecu. Berl. 173. Puerto Quito (Prov. Pichincha). – 20. II. 1986. – *Moss from riverside (May be inundated by floods)*.

Ecu. Berl. 174. – *Sparse moss from riverside rock, frequently inundated.*

Ecu. Berl. 175. – *Moss from high, riverside wall, above inundation area.*

Ecu. Berl. 176. Leaving Pto. Quito (in the direction of Saloya). – 20. II. 1986. – *Soil and litter from a forest patch in a steep gully.*

Ecu. Berl. 177. – *Debris of decomposing tree.*

Ecu. Berl. 178. Saloya (Prov. Pichincha), 1450 m. – 20. II. 1986. – *Relict fragment of primary forest, litter and soil.*

Ecu. Berl. 179. – *Moss from tree stems in the primary forest.*

Ecu. Berl. 180. – *Debris of decomposing tree stump.*

Ecu. Berl. 181. – *Litter and soil from forest edge with Banana plants.*

Ecu. Berl. 182. Pululagua (Prov. Pichincha). – 21. II. 1986. – *Big excrement heaps of earthworms.*

Ecu. Berl. 183. Ibarra (Prov. Imbabura). – 22. II. 1986. – *Soil and litter from below spiny thicket of shrubs on a plateau above the stream.*

Ecu. Berl. 184. – *Pasture with couch-grass, on the stream level.*

Ecu. Berl. 185. – *Detritus of a bulrush (Typha) patch.*

Ecu. Berl. 186. – *Soil, litter and plants hanging from high streamside wall.*

Ecu. Berl. 187. Cotacachi (Prov. Imbabura), on the banks of Rio Ambi. – 22. II. 1986. – *Pasture with couch-grass.*

Ecu. Berl. 188. – *Soil and detritus of reed.*

Ecu. Berl. 189. – *Soil and litter from below bushes.*

Ecu. Berl. 190. – Palenque (Prov. Los Rios), „Centro Cientifica Rio Palenque", 220 m. – 21. II. 1986. – leg. Tjitte de Vries. – *Soil and litter.*

Ecu. Berl. 191. La Merced (Prov. Pichincha), near the settlement. – 25. II. 1986. – *Moss from below low bushes on devasted hills.*

Ecu. Berl. 192. – *Soil and litter from below taller shrubs.*

Ecu. Berl. 193. – *Tussocks from rock clefts.*

Ecu. Berl. 194. – *Nostoc stems from a shallow depression of a rock.*

Ecu. Berl. 195. – *Grass detritus and soil.*

Ecu. Berl. 196. – *Litter and soil from below bushes growing on the steep walls of a small creek hollow.*

Ecu. Berl. 197. – San Rafael (Prov. Pichincha). – 25. II. 1986. – *Soil and litter from below shrubs, cca 10m above the river level.*

Ecu. Berl. 198. – *Moss from below bushes.*

Ecu. Berl. 199. – *Moist moss from a quarry.*

Ecu. Berl. 200. – Cotopaxi National Park (Prov. Cotopaxi). – 26. II. 1986. – *Paramo, 4200 m a.s.l., cushion plants.*

Ecu. Berl. 201. – *Tussocks and their detritus.*

Ecu. Berl. 202. – *Mossy detritus from below shrubs.*

Ecu. Berl. 203. – *Greybeard lichen from bushes.*

Ecu. Berl. 204. – *Paramo, 4000 m, moss from the banks of a deep water gully.*

Ecu. Berl. 205. – *Soil and litter of dwarf shrubs.*

Ecu. Berl. 206. – *Moss from a steep slope.*

Ecu. Berl. 207. – *Lichens from a grey lichen meadow.*

Ecu. Berl. 208. – *Soil from below lichens.*

Ecu. Berl. 209. – *Thick grey lichen cover from stones.*

Ecu. Berl. 210. – *3900 m, most probably burnt area. Sparse cushion vegetation.*

Ecu. Berl. 211. – *Sparse moss and soil.*

Ecu. Berl. 212. Cotopaxi National Park (Prov. Cotopaxi). Laguna del Limpio, 3850 m a.s.l. – 26. II. 1986. – *Wet vegetation and soil from immediate vicinity pf water surface.*

Ecu. Berl. 213. – *Relatively dry vegetation and soil from somewhat farther.*

Ecu. Berl. 214. – *Plants and soil from depressions temporarily inundated.*

Ecu. Berl. 215. – *Laguna del Limpio, lichens, tussocks and soil from somewhat farther from the water surface.*

Ecu. Berl. 216. – *Paramo, 3750 m a.s.l., moss from shrubs.*

Ecu. Berl. 217. – *Moss, litter and soil from below bushes.*

Ecu. Berl. 218. – *Tussocks from near the stream.*

Ecu. Berl. 219. – *Cushion plants from near the stream.*

Ecu. Berl. 220. Cotopaxi National Park (Prov. Cotopaxi). Plantation of *Pinus radiata*, 3750 m. – 26. II. 1986. – *Thin forest stand, cushion plants from a clearing.*

Ecu. Berl. 221. – *Soil, detritus and tussocks.*

Ecu. Berl. 222. – *Large Boletus mushrooms.*

Ecu. Berl. 223. – *Closed forest stand, mossy soil and litter.*

Ecu. Berl. 224. – *Dried out big tussocks from closed forest stand.*

Ecu. Berl. 225. – *Decomposing tree branches on the ground of closed forest stand.*

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Ecu. Berl. 1. Finca Los Cypreses, near La Merced (Prov. Pichincha), 2800 m. – 1. IV. 1987. – *Moss from the vertical wall of a gorge in a creek valley.*

Ecu. Berl. 2. – *Fern stems and soil.*

Ecu. Berl. 3. – *Plant roots and soil from below Eucalyptus trees an a flat area.*

Ecu. Berl. 4. – *Soil and litter from below old, planted Cupressus trees.*

Ecu. Berl. 5. – *Moss from below stems of old, planted Cupressus trees.*

Ecu. Berl. 6. Quito S. el Pintado (Prov. Pichincha), 2800 m. – 1. IV. 1987. – *Soil and litter from below shrubs growing on the sides of a deep water gully.*

Ecu. Berl. 7. – *Moss and plant detritus from sides of a deep water gully.*

Ecu. Berl. 8. – *Flat, moist area above the water gully. Roots of cough-grass and soil, 0-5 cm depth.*

Ecu. Berl. 9. – *Soil from the smae site, 10-20 cm depth.*

Ecu. Berl. 10. – *Devastated area; soil and litter from below shrubs growing on the edge of a small gorge.*

Ecu. Berl. 11. Pilahuin (Prov. Tungurahua), in the environs, 2900 m. – 2. IV. 1987. – *Steep slope of small hill left out from agricultural cultivation. – Soil and detritus of sparse vegetation.*

Ecu. Berl. 12.– *3100 m. Paramo vegetation. Detritus and roots of grass tussocks*.

Ecu. Berl. 13. – *Cushion-plants.*

Ecu. Berl. 14. – *Moss and soil from steep rock wall.*

Ecu. Berl. 15. Pilahuin – Arenales de Chimborazo (Prov. Tungurahua), 3200 m. – 2. IV. 1987. – *Paramo vegetation, cushion-plants.*

Ecu. Berl. 16. – *Pinus radiata forest, planted after Paramo vegetation.*

Ecu. Berl. 17. Arenales de Chimborazo, Hacienda Cununyacu (Prov. Tungurahua), 3600 m. – 2. IV. 1987. – *Paramo vegetation; detritus of grass and cushion-plants of grazed area.*

Ecu. Berl. 18.– San José de Chimbo, near to the settlement (Prov. Bolivar), 2000 m. – 3. IV. 1987. – *Soil and litter from below shrubs.*

Ecu. Berl. 19. – *Moss from rocks.*

Ecu. Berl. 20. Cashca Totoras (prov. Bolivar), 3000 m. – 3. IV. 1987. – *Rainforest; soil and litter from below thick shrubs.*

Ecu. Berl. 21. – *Rainforest; moss from below shrubs (scarely any light).*

Ecu. Berl. 22. – *Rainforest; moss from tree stems.*

Ecu. Berl. 23. – *Rainforest; soil and decomposing leaves of sclerophyllous trees.*

Ecu. Berl. 24. – *Rainforest; dead Bromelia-stems from trees.*

Ecu. Berl. 25. – *Grass succeeding cut forest.*

Ecu. Berl. 26. – *Soil and litter from below bushes, grown on the forest clearing.*

Ecu. Berl. 27. Chimborazo W. Cruce del Arenal, 4200 m. – 3. IV. 1987. – *Grey lichen covering the ground.*

Ecu. Berl. 28. – *Small flowered cushion-plants.*

Ecu. Berl. 29. – *Soil and litter from below dwarf shrubs.*

Ecu. Berl. 30. – *Grey lichen and plant detritus from below dwarf shrubs.*

Ecu. Berl. 31. 5 km SE, 4300 m. – 3. IV. 1987. – *Soil and litter from below dwarf bushes.*

Ecu. Berl. 32. – *Cushions of small flowered cushion-plant.*

Ecu. Berl. 33. – *Cushions of big flowered cushion-plant.*

Ecu. Berl. 34. 8 km SE, 4200 m. – 3. IV. 1987. – *Lichens from grey lichen field of more than 100 m² extent.*

Ecu. Berl. 35. – *Detritus of dead tussocks.*

Ecu. Berl. 36. Chimborazo SW, Loma Yanausha, 4000 m. – 3. IV. 1987. – *Cushion-plants from grazed area.*

Ecu. Berl. 37. – *Soil and moss from the sides o fan artificial water gully.*

Ecu. Berl. 38. – *Detritus of plants from the bottom of the artificial water gully (in continuous contact with the water).*

Ecu. Berl. 39. In the environments of Juan de Velasco (Prov. Chimborazo), 3200 m. – 4. IV. 1987. – *Soil and litter from shrubby forest fragmentum.*

Ecu. Berl. 40. – *Wet moss from a source, on the edge of a forest patch.*

Ecu. Berl. 41. – *Wet soil and plant detritus from beside the source, on the edge of the forest patch.*

Ecu. Berl. 42. Mal Pote (Prov. Chimborazo), cca 2600 m. – 4. IV. 1987. – *Rainforest patch in a creek valley; soil and litter.*

Ecu. Berl. 43. – *Soil and moss from the ground in the above rainforest patch.*

Ecu. Berl. 44. – *Moss from trees.*

Ecu. Berl. 45. Between Mal Pote and Chagmala, cca 2400 m. – 5. IV. 1987. – *Thick moss from the steep sides of the highway.*

Ecu. Berl. 46. – *Dry, decomposing leaves of Bromelia-stems, from the steep sides of the highway.*

Ecu. Berl. 47. Mal Pote (Prov. Chimborazo), cca 2600 m. – 5. IV. 1987. – *Soil and litter from an extensive but disturbed rainforest.*

Ecu. Berl. 48. – *Moss from trees in the above rainforest.*

Ecu. Berl. 49. Rio Chimbo (Prov. Chimborazo), in the height of San Pablo, cca 2000 m. – 5. IV. 1987. – *Soil and litter from a riverside forest.*

Ecu. Berl. 50. – *Moss from trees in the riveside forest.*

Ecu. Berl. 51. In the environment of Juan de Velasco (Prov. Chimborazo), 2600 m. – 5. IV. 1987. – *Soil and litter from disturbed, grazed forest patch.*

Ecu. Berl. 52. Tandajapa (Prov. Pichincha), 2200 m. – 8. IV. 1987. – *Soil andlitter from rainforest of a creek valley.*

Ecu. Berl. 53. – *Moss from trees in the above rainforest.*

Ecu. Berl. 54. – *Moss from rock in the above rainforest.*

Ecu. Berl. 55. Between Tandajapa and Santa Rosa (Prov. Pichincha), 2000m. – 8. IV. 1987. – *Soil and litter accumulated on the rock rim, in the rainforest of a creek valley.*

Ecu. Berl. 56. – *Moss and scarce soil from the rock wall in the above rainforest.*

Ecu. Berl. 57. On the way from Tandajapa to Nono (Prov. Pichincha), 2500 m. – 8. IV. 1987. – *Rainforest patch in the third creek valley; soil and litter.*

Ecu. Berl. 58. – *Moss from the ground in the above rainforest.*

Ecu. Berl. 59. – *Thick moss and detritus of Orchidea, from the steep sides of the highway.*

Ecu. Berl. 60. Baeza (Prov. Napo), on the left banks of the Rio Papallacta, 2000 m. – 8. IV. 1987. – *Old rainforest on a rocky mountain above the river. Soil and litter.*

Ecu. Berl. 61. – *Debris of lying, decomposing tree trunk in the above rainforest.*

Ecu. Berl. 62. – *Moss and soil interwoven with roots, from rocks in the above rainforest.*

Ecu. Berl. 63. – *Young rainforest on a mountain above the river; soil and litter.*

Ecu. Berl. 64. – *Moss from the ground in the above forest.*

Ecu. Berl. 65. – *Moss from the edges of the forest.*

Ecu. Berl. 66. – *Moss from the sides of Carex-like clumps on a wet, boggy area, with many small springs.*

Ecu. Berl. 67. Between Bermejó and Cosanga (Prov. Napo), 2100 m. – 10. IV. 1987. – *Moss and debris of dead trees in a thinned rainforest.*

Ecu. Berl. 68. – *Moss from below stems of live trees in the thinned rainforest.*

Ecu. Berl. 69. – *Soil and litter from below trees.*

Ecu. Berl. 70. Cosanga, Rio Cosanga (Prov. Napo), 2000 m. – 10. IV. 1987. – *Remnants of a riverside galery forest.*

Ecu. Berl. 71. – *Debris of decomposing tree trunk and moss from the trunk in the riverside galery forest.*

Ecu. Berl. 72. – *Moss from tree stems of the galery forest.*

Ecu. Berl. 73. – *Moss and plant detritus from a wet, swampy area of forest cut.*

Ecu. Berl. 74. Cosanga (Las Caucheras) (Prov. Napo), 2100 m. – 10. IV. 1987. – *Formerly thinned but no burnt rainforest with creeping reeds; soil and litter.*

Ecu. Berl. 75. – *Moss from the foot of an old tree in the above rainforest.*

Ecu. Berl. 76. – *Moss hanging from the branches of trees in the above rainforest.*

Ecu. Berl. 77. – *Cut over area; debris of entirely decomposed roadside tree stump.*

Ecu. Berl. 78. – *Debris of lying, decomposing palm trunk.*

Ecu. Berl. 79. – *Debris of lying, decomposing tree trunks.*

Ecu. Berl. 80. – *Moss from lying, decomposing tree trunks.*

Ecu. Berl. 81. Between Cosanga and Sarayacu (Prov. Napo), 1800 m. – 10. IV. 1987. – *Moss hanging from interwoven twigs of shrubs in a gorge with water run.*

Ecu. Berl. 82. – *Litter from below bushes in a gorge with water run.*

Ecu. Berl. 83. Rio Jondachi, somewhat after leaving Jondachi (Prov. Napo). – 10. IV. 1987. – *Soil and litter from riverside forest.*

Ecu. Berl. 84. – *Soil, roots and scale-moss from rocks on the edge of the riverside forest.*

Ecu. Berl. 85. Pusuno, on the left banks of Rio Pusuno, 300 m. – 11. IV. 1987. – *Soil and litter of rainforest.*

Ecu. Berl. 86. – *Moss from tree stems in the rainforest.*

Ecu. Berl. 87. – *Moss from the steep side of the forest road.*

Ecu. Berl. 88. – *Soil and litter from young (natural) rainforest.*

Ecu. Berl. 89. 4 km from Pusuno to Puerto Misahualli (Prov. Napo). – 11. IV. 1987. – *Orange plantation, litter and soil.*

Ecu. Berl. 90. – 10 km from Pusuno to Puerto Misahualli. – (Prov. Napo). – 11. IV. 1987. – *Moss from stones lying in a stream.*

Ecu. Berl. 91. – *Soil and litter from the forest bordering the stream.*

Ecu. Berl. 92. 5 km from Puerto Misahualli, towards Mirador (Prov. Napo). – 11. IV. 1987. – *Rainforest in a deep gorge; soil and litter.*

Ecu. Berl. 93. – *Debris of mossy tree stump in the deep gorge.*

Ecu. Berl. 94. Rio Anzu near Piatua (Prov. Pastaza). – 11. IV. 1987. – *Soil and litter from riverside galery forest.*

Ecu. Berl. 95. – *Moss hanging from trees, and debris of other plants, from the riverside galery forest.*

Ecu. Berl. 96. – *Cut area, cca 150 m from the river. Soil and detritus of high grass.*

Ecu. Berl. 97. Triunfo (Prov. Pastaza). – 12. IV. 1987. – *Soil and litter from rainforest fragmentum.*

Ecu. Berl. 98. – *Debris and moss from decomposing, lying tree trunk.*

Ecu. Berl. 99. – *Moss from tree stems.*

Ecu. Berl. 100. – *Soil and detritus of grass growing on clear cut area.*

Ecu. Berl. 101. 2 km from Triunfo, towards Pujo (Prov. Pastaza). – 12. IV. 1987. – *Soil and litter from rainforest patch with big bamboos.*

Ecu. Berl. 102. – *Moss from trees in the above rainforest patch.*

Ecu. Berl. 103. – *Decomposing bamboo of the rainforest patch.*

Ecu. Berl. 104. – *Soil and detritus of grass growing on clear cut area.*

Ecu. Berl. 105. Between Mera and Cashurcu (Prov. Pastaza). – 12. IV. 1987. – *Rocky gorge with stream; soil and litter from below bushes.*

Ecu. Berl. 106. – *Moss from trees.*

Ecu. Berl. 107. – *Moss from rocks.*

Ecu. Berl. 108. Pasochoa National Park. – 15. IV. 1987. – *Old, dense creeping reed from about 50 bm above the stream level; Soil and litter (there was scarcely any light on the ground).*

Ecu. Berl. 109. – *Moss from the ground on the edges of the reeds.*

Ecu. Berl. 110. – *Deciduous trees and reed about 100 m above the stream level. Debris of composing tree stump and moss from the stump.*

Ecu. Berl. 111. – *Soil and litter from the same site.*

Ecu. Berl. 112. – *Soil and litter from the steep sides of the stream.*

Ecu. Berl. 113. – *Moss, scale-moss and sparse soil.*

Ecu. Berl. 114. – *Soil and litter from ferny, shrubby forest, about 50 m above the stream level.*

Ecu. Berl. 115. – *Forest skirts; soil and grass detritus from grazed meadow.*

Ecu. Berl. 116. – *Moss from steep sides of carriage-road.*

Ecu. Berl. 117. Antisana volcano (Prov. Napo), along Rio Antisana, 4300 m. – 16. IV. 1987. – *Paramo vegetation; moss and litter from below shrubs.*

Ecu. Berl. 118. – *Cushion-plants; cushion and soil.*

Ecu. Berl. 119. – *Old, decomposing cattle dung (among Paramo-grass).*

Ecu. Berl. 120. – *Small plants and moss from rocks.*

Ecu. Berl. 121. – *Once burnt area (Paramo); grass and mossy soil.*

Ecu. Berl. 122. – *Small plants and moss from rocks in the burnt area.*

Ecu. Berl. 123. – *Grey lichen meadow on a flat area; lichens and moss.*

Ecu. Berl. 124. Antisana volcano (Prov. Napo), at the research-house, 4200 m. – 16. IV. 1987. – *Soil and large cushion-plants on te stream side.*

Ecu. Berl. 125. – *Grass and mossy soil.*

Ecu. Berl. 126. Antisana volcano, road leading W, downwards to Pintag, 3600 m. – 17. IV. 1987. – *Paramo (not burnt); soil and detritus of tussocks.*

Ecu. Berl. 127. – *3600 m. Paramo; cushion-plants.*

Ecu. Berl. 128. – *3000 m.Soil and litter from below shrubs, about 50m above stream level.*

Ecu. Berl. 129. – *3000 m. Moss from horizontal branches of live trees.*

Ecu. Berl. 130. – *3000 m. Soil and litter from below stream-side bushes.*

Ecu. Berl. 131. – *3000 m. Moss from rock; about 5m above the stream.*

Ecu. Berl. 132. – *3000 m. Soil and plant detritus from grazed meadow, somewhat above the stream.*

Ecu. Berl. 133. – *3000 m. Soil from 20-40 cm depth on the above grazed meadow.*

Ecu. Berl. 134. – *3000 m. Soaking wet streamside soil and plants.*

Ecu. Berl. 135. – *2900 m. Soil and litter from below bushes around a source.*

Ecu. Berl. 136. – *2900 m. Moss and scale-moss.*

Ecu. Berl. 137. Pichincha Aguagua volcano (Prov. Pichincha), 4600 m. – 19. IV. 1987. – *Moss and cushion-plants.*

Ecu. Berl. 138. – *4600 m. Lower, dead leaves of a cudweed-like plant.*

Ecu. Berl. 139. – *4600 m. Live and dead parts of a big cush-ion-plant standing isolated.*

Ecu. Berl. 140. – *4500 m. Moss and small plants from the ground.*

Ecu. Berl. 141. – *4500 m. Mass of lower, dead leaves of a plant with violet coloured cluster-like flowers.*

Ecu. Berl. 142. – *3800 m. Cushion-plants; live and dead parts of the cushions.*

Ecu. Berl. 143. – *3800 m. Soil and plant detritus from the bottom of a temporary water gully.*

Ecu. Berl. 144. – *3800 m. Soil and plant detritus from a deepening, in wich water is temporarily gathering.*

Ecu. Berl. 145. – *3800 m. Secondary grazed area. Soil and detritus of tussocks.*

Ecu. Berl. 146. – *3800 m. Paramo; soil and tussocks.*

Ecu. Berl. 147. – *4400 m. Roots and soil from cushion-plants.*

Ecu. Berl. 148. – *4400 m. Upper parts of cushion-plant.*

Ecu. Berl. 149. – *4400 m. Paramo; moss and litter from below shrubs.*

Ecu. Berl. 150. – *4400 m. Paramo; soil and detritus of tussocks.*

Ecu. Berl. 151. – *4000 m. Soil and litter from below bushes on a rock rim os a rock wall of S exposure.*

Ecu. Berl. 152. – *Moss from ground below bushes.*

Ecu. Berl. 153. – *Soil and litter from the edge of the rock rim; grassy patch.*

Ecu. Berl. 154. – *Soil and moss from the edge of the rock rim.*

Ecu. Berl. 155. – *3200 m. Soil and litter from below shrubs around the ruins of a house.*

Ecu. Berl. 156. – *Soil and plants from grazed meadow.*

Ecu. Berl. 157. Quito W. outskirts of the town, 3000 m. – 19. IV. 1987. – *Planted Pinus radiata forest, cca 60 years old.*

Ecu. Berl. 158. Between Perucho and San José de Minas (Prov. Pichincha), about 4 km from Perucho. – 21. IV. 1987. – *Soil and litter from secondary shrubby area (Acacia, Eucalyptus) on the streamside.*

Ecu. Berl. 159. San José de Minas (Prov. Pichincha). – 21. IV. 1987. – *Moist litter of shrubs along a small creek in otherwise dry area.*

Ecu. Berl. 160. – *Continuously moist, wet litter from beside small waterfall.*

Ecu. Berl. 161. – *Moist moss, from beside small creek.*

Ecu. Berl. 162. 5 km from San José de Minas on the way to Otavalo. – 21. IV. 1987. – *Soil and litter from streamside forest patch.*

Ecu. Berl. 163. – *Soil and litter from steep streamside.*

Ecu. Berl. 164. – *Moss from the ground of streamside forest patch.*

Ecu. Berl. 165. – *Hanging moss from a gorge, from about 10m above the stream level.*

Ecu. Berl. 166. – *Wet soil with scale-moss, from cca 10 m above the stream level.*

Ecu. Berl. 167. – *Wet soil and moss from beside source in a deep gorge, about 50 m above the stream level.*

Ecu. Berl. 168. – *Roots and detritus of ferns, from the walls of the deep. gorge.*

Ecu. Berl. 169. – *Moss from the walls of the deep gorge.*

Ecu. Berl. 170. 10 km leaving San José de Minas, on the way to Otavalo. – 21. IV. 1987. – *Thicket of bushes succeeding clear cut forest area, with small creek. Soil and litter.*

Ecu. Berl. 171. – *Soil and moss, in continuous contact with water.*

Ecu. Berl. 172. – *Moss and debris from decomposing tree stump.*

Ecu. Berl. 173. – *Soil, moss and horsetail (Equisetum) from rocks.*

Ecu. Berl. 174. 12 km Leaving San José de Minas, on the way Otavalo. – 21. IV. 1987. – *Thinned rainforest; soil and litter.*

Ecu. Berl. 175. – *Moss and lichens from trees*.

Ecu. Berl. 176. 8 km to Otavalo (coming from San José de Minas) (Prov. Imbabura); *Rainforest patch on steep mountainside; soil and litter.*

Ecu. Berl. 177. – *Moss from the ground.*

Ecu. Berl. 178. 53 km from Otavalo, on the way to Selva Alegre (Prov. Imbabura). – 22. IV. 1987. – *Thinned rainforest; soil and litter.*

Ecu. Berl. 179. – *Decomposing tree stump interwoven with roots.*

Ecu. Berl. 180. – *Moss from rocks.*

Ecu. Berl. 181. – *Soil and litter from forest skirts overgrown with creeping reed.*

Ecu. Berl. 182. – *Soil and detritus from secondary grassy area.*

Ecu. Berl. 183. 47 km from Otavalo, on the way to Selva Alegre (Prov. Imbabura). – 22. IV. 1987. – *Only slightly thinned rainforest; soil and litter.*

Ecu. Berl. 184. – *Debris and moss of decomposing tree stump.*

Ecu. Berl. 185. – *Moss from trees.*

Ecu. Berl. 186. 32 km from Otavalo, on the way to Selva Alegre, 3700 m. – 22. IV. 1987. – *Soil and Litter from below bushes along a small creek.*

Ecu. Berl. 187. – *Moss from the bushes along the small creek.*

Ecu. Berl. 188. – *Debris and moss of decomposing tree trunk.*

Ecu. Berl. 189. – *Soil and small plants of a small clearing among the bushes*.

Ecu. Berl. 190. – *Moss, in continuous contact with the water of the creek.*

Ecu. Berl. 191. – *Wet soil and detritus of a ferny area along the creek (on creek level).*

Ecu. Berl. 192. 30 km from Otavalo, on the way to Selva Alegre, 3900 m. – 22. IV. 1987. – *Paramo vegetation; small plants from among tussocks.*

Ecu. Berl. 193. – *Roots and detritus of tussocks*.

Ecu. Berl. 194. – *Moss and litter from below shrubs.*

Ecu. Berl. 195. – *Loose cushion-plants.*

Ecuador 1988

Ecu. B. 1. Above Quito, 3200-3400 m a.s.l., 46 km leaving Quito to Santo Domingo (Prov. Pichincha). – 21. IV. 1988. - *Moss*

Ecu. B. 2. – *Litter from the same site.*

Ecu. B. 3. – *Soil from 15 cm depth*.

Ecu. B. 4. Between Quito and Santo Domingo (Prov. Pichincha). About 1km from the church. – 21. IV. 1988. – *Moss from the neighbourhood of a rapid.*

Ecu. B. **5**. – *Litter from the same site.*

Ecu. B. **6.** – *Soil from 15 cm depth.*

Ecu. B. 7. Below Olmedo (Prov. Pichincha), meadow with couch-grass. – 23. IV. 1988. – *Upper , grassy level*.

Ecu. B. 8. – *Soil from 15cm depth.*

Ecu. B. 9. Slope of the volcano Cayambe, about 4200 m a.s.l. (Prov. Pichincha). shrubby vegetation. – 23. IV. 1988. – *Moss.*

Ecu. B. 10. – *Grassy, upper level.*

Ecu. B. 11. – *Soil from 15 cm depth.*

Ecu. B. 12. Above the lagoon San Marcos (Prov. Pichincha). – 23. IV. 1988. – *Moss and leaves from branches lying on the ground.*

Ecu. B. 13. – *Moss from the walls of a road-cut.*

Ecu. B. 14. – *Moss-cushion from the slope of the bank.*

Ecu. B. 15. About 71 km from Quito to Santo Domingo (Prov. Pichincha). – 24. IV. 1988. – *Moss from lake-shore, leaving the waterfall*.

Ecu. B. 16. – *Litter from the same site.*

Ecu. B. 17. – *Soil from 15 cm depth.*

Ecu. B. 18. Chunchi, 7km approaching town (Prov. Chimborazo). – 25. IV. 1988. – *Moss.*

Ecu. B. 19. – *Litter from the same spot.*

Ecu. B. 20. 12 km to El Tambo (Prov. Cañar). – 25. IV. 1988. – *Litter from below shrubs.*

Ecu. B. 21. 26 km leaving Cuenca (Prov. Azuay). – 26. IV. 1988. – *On an access road, litter from below shrubs.*

Ecu. B. 22. – *Grass from the smart site.*

Ecu. B. 23. – *Soil from 15 cm depth.*

Ecu. B. 24. 52 km from Cuenca, on the road to Loja (Prov Azuay). 4000 m a.s.l., plateau. – 26. IV. 1988. – *Sphagnum-moss*.

Ecu. B. 25. – *Litter from the same place*.

Ecu. B. 26. – *Soil from 15 cm depth*.

Ecu. B. 27. Leaving Saraguro, 175 km from Cuenca (Prov. Loja). – 26. IV. 1988. – *Moss*.

Ecu. B. 28. – *Litter from the same collecting site.*

Ecu. B. 29. – *Soil from 15 cm depth.*

Ecu. B. 30. 5 km leaving Loja, towards Vilcabamba (Prov. Loja). – 27. IV. 1988. – *Mixed litter, soil and grass*

Ecu. B. 31. 12 km leaving Loja, on the way to Vilcabamba (Prov. Loja). - 27. IV. 1988. – *Moss.*

Ecu. B. 32. – *Litter on the same site.*

Ecu. B. 33. – *Soil from 15 cm depth.*

Ecu. B. 34. 6 km leaving Yangana, to Zumba, valley of a creek (Prov. Loja). – 28. IV. 1988. – *Litter.*

Ecu. B. 34/Ecu. B. – *Moss from the same place.*

Ecu. B. 35. 35 km leaving Loja, on the way to Machala (2km before reaching Catamayo) (Prov. Loja). – 1. V. 1988. – Dry, shrubby area. Litter.

Ecu. B. 36. – *Tussocks on the same spot.*

Ecu. B. 37. 85 km from Loja, leaving Zambi, at the bridge (Prov. Loja). – 1. V. 1988. – *Moss*.

Ecu. B. 38. – *Litter from the same place.*

Ecu. B. 39. – *Soil from a depth of about 15 cm.*

Ecu. B. 40. 11 km leaving Santa Rosa, on the way to Loja (Prov. El Oro). – 2. V. 1988. – *Patch of primary forest; litter.*

Ecu. B. 41. – *Bromelias from the same forest patch.*

Ecu. B. 42. Leaving Pasaje, 54 km from Santa Rosa (Prov. El Oro). – 2. V. 1988. – *Tussocks and tuff.*

Ecu. B. 43. – *Succulent dicotyledons from the same site.*

Ecu. B. 44. Leaving Pasaje, 64 km from Santa Rosa (Prov. El Oro). – 2. V. 1988. – *Dry area, tussocks*.

Ecu. B. 45. – *Soil from 15cm depth.*

Ecu. B. 46. 15 km leaving Santa Isabel (Prov. Azuay). Mountain slope. – 2. V. 1988. – *Moss*.

Ecu. B. 47. – *Litter from the same site.*

Ecu. B. 48. – *Soil from a depth of about 15 cm.*

Ecu. B. 49. Between Giron and Victoria de el Portete (Prov. Azuay). – 2. V. 1988. – *Litter*.

Ecu. B. 50. – *Grass from the same site*.

Ecu. B. 51. – *Soil 15 cm depth.*

Ecu. B. 52. Leaving Chordeleg, 39km from Cuenca (Prov. Azuay). – 3. V. 1988. – *Moss*.

Ecu. B. 53. – *Litter from the same collecting site.*

Ecu. B. 54. (Z/64) 2 km leaving Sigsig (Prov. Azuay). – 3. V. 1988. – *Moss from the slope of bank.*

Ecu. B. 55. – *Litter on the same place.*

Ecu. B. 56. Between El Tambo and Zhud, 84 km from Cuenca (Prov. Cañar). – 4. V. 1988. – *Moss*.

Ecu. B. 57. – *Litter on the same site.*

Ecu. B. 58. – *Soil from 15 cm depth.*

Ecu. B. 59. 52 km from Loja, on the way to Cuenca (Prov. Loja). – 30. IV. 1988. – *Soil from 15cm depth.*

Ecu. B. 60. Leaving Riobamba, near the village Mocha Pata (Prov. Tungurahua). – 4. V. 1988. – *Grassy pasture; lower soil layer.*

Ecu. B. 61. – *Upper soil layer from the same place.*

Ecu. B. 62. Above the lagoon San Marcos, on the slopes of the volcano Cayambe (Prov. Pichincha). – 6. V. 1988. – *Moss from trees.*

Ecu. B. 63. 79 km from Quito, leaving the church, a tan Indian dwelling (Prov. Pichincha). – 7. V. 1988. – *Bromelia*.

Ecu. B. 64. Leaving Borja, to Lago Agrio, cut primary forest patch (Prov. napo). – 9. V. 1988. – *Moss from trees.*

Ecu. B. 65. – *Litter from the same site.*

Ecu. B. 66. – *Tussocks.*

Ecu. B. 67. – *Woody debris.*

Ecu. B. 68. – *Bromelias.*

Ecu. B. 69. – *Soil from 15 cm depth.*

Ecu. B. 70. 3 km leaving Las Palmas, on the way to Lago Agrio (Prov. Napo). – 9. V. 1988. – *Hillside , moss-cushion.*

Ecu. B. 71. – *Litter on the same spot.*

Ecu. B. 72. (Z/86) On the way to Lago Agrio, near the bridge of Rio Marker (Prov. Napo). – 9. V. 1988. – *Moss*.

Ecu. B. 73. Primary forest patch, leaving San Vincente (Prov. Napo). – 10. V. 1988. – *Moss*.

Ecu. B. 74. – *Litter on the same site.*

Ecu. B. 75. – *Soil from 15 cm depth.*

Ecu. B. 76. Leaving Lago Agrio, 8 km towards Dureno (Prov. Napo). – 10. V. 1988. – *Patch of primary forest, litter.*

Ecu. B. 77. – *Cut forest patch on the same place; decomposing wood debris.*

Ecu. B. 78. (Z/87) 25 km leaving Lago Agrio (Prov. Napo). – 10. V. 1988. – *Litter of coffee plantation.*

Ecu. B. 79. – *Litter of nearby primary forest patch.*

Ecu. B. 80. – *Moss of nearby primary forest patch.*

Ecu. B. 81. (Z/88) Primary forest patch, leaving Dureno, on the riverside of Rio Aguarico (Prov. Napo). – 10. V. 1988. – *Litter*.

Ecu. B. 82. Primary forest patch at the second bridge, leaving Dureno (Prov. Napo). – 10. V. 1988. – *Litter*.

Ecu. B. 83. Primary forest patch, 2,5 km on access road, approaching Lago Agrio (Prov. Napo). – 10. V. 1988. – *Litter*.

Ecu. B. 84. 48 km leaving Lago Agrio, towards Quito (Prov. Napo). – 11. V. 1988. – *Moss of primary forest cut.*

Ecu. B. 85. – *Litter from the same site*.

Ecu. B. 86. – *Wood debris*.

Ecu. B. 87. Between Lago Agrio and Quito, 70 km from Lago Agrio (Prov. Napo). – 11. V. 1988. – *Primary forest patch.*

Ecu. B. 88. Between Lago Agrio and Quito, 80 km from lago Agrio, (2 km approaching Reventador) (Prov. Napo). – 11. V. 1988. – *Moss of primary forest.*

Ecu. B. 89. – *Litter on the same spot.*

Ecu. B. 90. 1km leaving Reventador (Prov. Napo). – 11. V. 1988. – *Bromelias from cut primary forest.*

Ecu. B. 91. Above Papallacta, in about a distance of 7 km (Prov. Napo). – 11. V. 1988. – *Moss from a meadow.*

Ecu. B. 92. – *Litter from the same site.*

Ecu. B. 93. – *Soil from 15 cm depth.*

Ecu. B. 94. About 9 km above Papallacta (Prov. Napo). – 11. V. 1988. – *Litter of pachonal.*

Ecu. B. 95. Between Papallacta and Pifo, near the summit (Prov. Napo). – 11. V. 1988. – *Moss*.

Ecu. B. 96. Leaving El Chaupi, on the way to El Refugio finca (Prov. Pichincha). – 13. V. 1988. – *Moss*.

Ecu. B. 97. – *Litter from the same spot.*

Ecu. B. 98. Above El Chaupi on the slope of Illniza, paramo vegetation (Prov. Pichincha). – 13. V. 1988. – *Soil from 15cm depth.*

Ecu. B. 99. – *Cushion-plants from the same site*.

Ecu. B. 100. Some 2 km further higher on the slope of Illniza, on about 4400 m a.s.l. (Prov. Pichincha). – 13. V. 1988. – *Moss from the ground.*

Ecuador 1989

Ecu. B. 1. Before reaching Tinalandia, 550-60 m. a.s.l. (Prov. Pichincha). – 12. IV: 1989. – *Rainforest , moss from solitary tree.*

Ecu. B. 2. Between road-jonction of Santo Domingo and Tinalandia, 550 m a.s.l. (Prov. Pichincha). – 12. IV. 1989. – *Withered palm-leaves.*

Ecu. B. 3. – *Moss from brookside big stones (inundated by floods).*

Ecu. B. 4. – *Litter and soil from under old standard tree (around it bamboo and bananas).*

Ecu. B. 5. Before reaching Tinalandia, 600 m a.s.l. (Prov. Pichincha). – 12. IV. 1989. – *Moss , plant-debris and roots from almost vertical soil-vall.*

Ecu. B. 6. – *Rainforest, steep break-down of about 70°, soil and litter.*

Ecu. B. 7. Leaving Alluriquin, 700 m. a.s.l. (Prov. Pichincha). – 12. IV. 1989. – *Rainforest , litter and soil.*

Ecu. B. 8. – *Bananas, roots and soil.*

Ecu. B. 9. – *Moss from stones.*

Ecu. B. 10. – *Moulding, lying tree trunk, mossy bark.*

Ecu. B. 11. – *Inner, mouldy part of the same trunk.*

Ecu. B. 12. 3 km before Toachi, 900 m. a.s.l. (Prov. Pichincha). – 12. IV. 1989. – *Steep wall beside waterfall, litter and soil.*

Ecu. B. 13. – *Moss and litter from fallen tree trunk.*

Ecu. B. 14. – *Moss and soil from a vertical wall.*

Ecu. B. 15. Pia Santa Rosa, near San Francisco, 2990 m. a.s.l. (Prov. Pichincha). – 13. IV. 1989. – *Couch-grass*

Ecu. B. 16. – *Soil of couch-grass, 10-20 cm depth.*

Ecu. B. 17. – *Moss and soil from the roadside*.

Ecu. B. 18. – *Litter, grass and soil from under bushes.*

Ecu. B. 19. – *Thicket of Rubus, litter and soil.*

Ecu. B. 20. Urbanisation Ludres, 13 km S from Quito, 3100 m. a.s.l. (Prov. Pichincha). – 13. IV. 1989. – *Grass and couch-grass and soil.*

Ecu. B. 21. – *Moss and soil from the side of an irrigation canal.*

Ecu. B. 22. – *Dwarf horsetail. litter and soil from the bushy shore of the irrigation canal.*

Ecu. B. 23. – *Grass with couch-grass, and soil from 10-20 cm depth.*

Ecu. B. 24. Between Pifo and Papallacta, 4100 m. a.s.l. (Prov. Pichincha). – 14. IV. 1989. – *Withered leaves and soil from under dicotyledon plant with big leaves (and lilac flowers).*

Ecu. B. 25. – *Moss from the soil.*

Ecu. B. 26. – *Jumble of dicotyledon, creeping to 2 m height on a tree*.

Ecu. B. 27. – *Felt-like debris from under the same plant*.

Ecu. B. 28. – *Litter and sparse moss from under bushes.*

Ecu. B. 29. – *Thick, dense moss from the stem of bushes.*

Ecu. B. 30. – *Soil, 10-30 cm depth*.

Ecu. B. 31. – *Gallery and excrement of earthworms, 30-40 cm depth*.

Ecu. B. 32. – *Moss from the soil*.

Ecu. B. 33. – *Cushion-plant.*

Ecu. B. 34. – *Fruits (seeds) of Espeletia-like plant.*

Ecu. B. 35. – *Moss from the soil, beside water-course.*

Ecu. B. 36. – *Grass with couch-grass.*

Ecu. B. 37. – *Moss and withered plant-debris from under bushes.*

Ecu. B. 38. – *On 4150 m. a.s.l., moss and low cushion-plants.*

Ecu. B. 39. – *Soil of the sample 38, about 10-15 cm depth.*

Ecu. B. 40. Antisana, eartworm experimental station, 3300 m. a.s.l. (Prov. Pichincha). – 15. IV. 1989. – *Brookside pasture.*

Ecu. B. 41. – *Drying cattle-exrement and soil from under it.*

Ecu. B. 42. – *Close to the brookside, leaves of wild sorrel-like plant and soil.*

Ecu. B. 43. – *Bog in the depression between the brook and the mountain-side, litter and soil.*

Ecu. B. 44. – *Moss and dicotyledon roots from branches of a tree, spanning over the waterfalls of the other book, flowing in here.*

Ecu. B. 45. – *Scale-moss from the vertical wall (not rock), beside the same site.*

Ecu. B. 46. – *Litter and soil from under the bushes of the valley.*

Ecu. B. 47. – *Litter and soil from under trees and bushes, cca 50m above the level of the brook*.

Ecu. B. 48. – *Relatively dry moss from bushes.*

Ecu. B. 49. – *Mossy soil and litter from under dwarf bushes.*

Ecu. B. 50. – *Relatively dry moss and soil from rocks, cca 150m above the level of the brook.*

Ecu. B. 51. Lava-flow of Antisanilla (Prov. Pichincha). – 15. IV. 1989. – *Soil and detritus from among the stone-avalanche.*

Ecu. B. 52. – *Moss from flat, horizontal stones.*

Ecu. B. 53. – *Moss from vertical surface of stones.*

Ecu. B. 54. Rio Guajalito, Las Palmeras, 1850 m a.s.l. (Prov. Pichincha). – 18. IV. 1989. – *„Real" primary forest, litter and upper soil level.*

Ecu. B. 55. – *Soil and roots.*

Ecu. B. 56. – *Loose moss, hanging from trees.*

Ecu. B. 57. – *„Hanging litter" and big, withered, mossy leaves.*

Ecu. B. 58. – *Living, mossy leaves (undergrowht).*

Ecu. B. 59. – *Moss from the riverside (vertical soil-wall).*

Ecu. B. 60. – *Moss from beside the small water-course nearing the river (open area).*

Ecu. B. 61. – *Narrow gorge, secondary rainforest of the valley, litter and soil.*

Ecu. B. 62. – *Above Las Palmeras, 2000 m a.s.l. (Prov. Pichincha). Litter and soil from under fern-trees.*

Ecu. B. 63. – *Moss from under fern-trees*.

Ecu. B. 64. – *Moss from rocky roadside*.

Ecu. B. 65. Chirigoba, 1850 m a.s.l. (Prov. pichincha). – 18. IV. 1989. – *Secondary rainforest, litter and soil.*

Ecu. B. 66. – *Moss, hanging from trees.*

Ecu. B. 67. – *Parts of moulding tree trunk, moss-ferns.*

Ecu. B. 68. – *Moss from roadside rock-wall.*

Ecu. B. 69. About 2km leaving Cayambe, 2700 m a.s.l. (Prov. Pichincha). – 19. IV. 1989. – *Moss from the side of small artifical water-course.*

Ecu. B. 70. – *Litter from under shrubs.*

Ecu. B. 71. – *Deep, natural water-gully, moss from the wall of the gorge.*

Ecu. B. 72. Above Otavalo, leaving Mohanda laguna, 3000 m a.s.l. (Prov. Imbabura). – 19. IV. 1989. – *Litter and soil from under bushes.*

Ecu. B. 73. – *Dwarf horsetail and moss from beside water-gully.*

Ecu. B. 74. – *Moss, lichen and roots from the steep wall.*

Ecu. B. 75. Above Otavalo, 3700 m a.s.l. (Prov. Imbabura). – 19. IV. 1989. – *Moss -forest, litter and soil.*

Ecu. B. 76. – *Moss from a tree.*

Ecu. B. 77. – *Moss from the ground.*

Ecu. B. 78. – *Lichen from the outside trees of the moss-forest.*

Ecu. B. 79. – *Out-over area towards the road; plants with bigger leaves.*

Ecu. B. 80. – *Bushes and shrubs of a flat area; litter and soil.*

Ecu. B. 81. – *Moss and lichen from trees*.

Ecu. B. 82. – *Moss from the ground.*

Ecu. B. 83. – *On 3350 m a.s.l., secondary shrubby area with creeping reed; dark litter and soil.*

Ecu. B. 84. – *On a cut-over area.*

Ecu. B. 85. 30km from Otavalo to Apuela, Otocique, 3250 m a.s.l. (Prov. Imbabura). *Paramo vegetation (burnt a year ago), litter and soil from under shrubs.*

Ecu. B. 86. – *Cushion-plants.*

Ecu. B. 87. - *Tussocks of couch-grass (from non-burnt area).*

Ecu. B. 88. – *On 3300 m a.s.l., thick hrubs, almost no light.*

Ecu. B. 89. – *Plant debris from under open shrubs.*

Ecu. B. 90. – *Soil moss from under open bushes.*

Ecu. B. 91. Tablachupa, 39 km from Otavalo, 3350 m a.s.l., (Prov. Imbabura). – 20. IV. 1989. – *Paramo; detritus, withered grass, quite dark soil from under bushes.*

Ecu. B. 92. – *Tussocks of couch-gras, lichen and some moss among it.*

Ecu. B. 93. – *Between couch-grass tussocks, moss from the open spaces.*

Ecu. B. 94. 53 km from Otavalo, 2850 m a.s.l. (Prov. imbabura). – 20. IV. 1989. – *Litter of bamboo, hanging on roots, without soil.*

Ecu. B. 95. – *Soil and roots from under sample 94.*

Ecu. B. 96. – *Moss, hanging from trees.*

Ecu. B. 97. – *Plant with big leaves (Gunnera sp.).*

Ecu. B. 98. 52 km from Otavalo, 2900 m a.s.l. (Prov. Imbabura). – 20. IV. 1989. – *Small waterfall with mossy vegetation. Moss and soil from rocks.*

Ecu. B. 99. – *Overshaded scale-moss.*

Ecu. B. 100. – *Hanging moss (fern-moss).*

Ecu. B. 101. 50 km from Otavalo, 2950 m a.s.l. (Prov. Imbabura). - 20. IV. 1989. – *Moss , lichen, fern.*

Ecu. B. 102. 43 km from Otavalo, 3200 m a.s.l. (Prov. Imbabura). – 20. IV. 1989. – *Moss -forest (trees with big leaves), litter and soil.*

Ecu. B. 103. – *Moss from the ground.*

Ecu. B. 104. – *Moss from the trees.*

Ecu. B. 105. 10 km from Otavalo to Selva Alegre, 2650 m a.s.l. (Prov. Imbabura). – 21. IV. 1989. – *Shrubby area, below it deep shadow.*

Ecu. B. 106. – *Pasture (with couch-grass).*

Ecu. B. 107. – *Moss from sunlit rocks of the pasture.*

Ecu. B. 108. 28 km from Otavalo to Selva Alegre, 3500 m a.s.l. (Prov. Imbabura). – 21. IV. 1989. – *Paramo; seeds of couch-grass.*

Ecu. B. 109. – *Cushion-plants from the open spaces between couch-grass tussocks.*

Ecu. B. 110. – *Gladiolus-stem.*

Ecu. B. 111. – *Plant debris from under bushes.*

Ecu. B. 112. 26 km from Otavalo to Selva Alegre, 3300 m a.s.l. (Prov. Imbabura). – 21. IV. 1989. – *Litter from under bushes.*

Ecu. B. 113. – *Moss from the shore of a small creek.*

Ecu. B. 114. 16 km from Otavalo to Selva Alegre, 3000 m a.s.l. (Prov. Imbabura). – 21. IV. 1989. – *Litter from under bushes.*

Ecu. B. 115. – *Moss from sunlit rocks of the pasture.*

Ecu. B. 116. Leaving the road-junction to Toachi, to Quito, 2600 m a.s.l. (Prov. Imbabura). – 21. IV. 1989. – *Litter and soil from under dwarf bushes.*

Ecu. B. 117. – *2500 m a.s.l.; litter from under bushes.*

Ecu. B. 118. – *2450 m a.s.l.; litter and soil from under roadside bushes.*

Ecu. B. 119. – *Moss from mountain-side.*

Ecu. B. 120. – *2000 m; litter and soil from under Acacia-trunk.*

Ecu. B. 121. 62 km from Otavalo, before reaching Selva Alegre, at a flooded river, 1700 m a.s.l. (Prov. Imbabura). – 24. IV. 1989. – *Secondary rainforest, steep part (70°); litter and soil.*

Ecu. B. 122. – *Moss from tree branches*.

Ecu. B. 123. – *Scale-moss and moss from rock-wall.*

Ecu. B. 124. – *Shrubby steep area on cut-over forest (cut-over about 3-4 years ago), moss from trees.*

Ecu. B. 125. 56 km from Otavalo, approaching Selva Alegre, 2200 m a.s.l. (Prov. Imbabura). – 24. IV. 1989. – *Rainforest patch, soil and litter.*

Ecu. B. 126. – *Mouldering trunk, mossy parts and bark.*

Ecu. B. 127. – *Moss from the ground.*

Ecu. B. 128. – *Hanging moss from trees.*

Ecu. B. 129. 49 km from Otavalo, on the side of Selva Alegre, 2980 m a.s.l. (Prov. Imbabura). – 24. IV. 1989. – *Steep moss-forest (with sprase trees) beside waterfalls of a creek; soil and litter.*

Ecu. B. 130. – *Moss from steep soil-wall.*

Ecu. B. 131. – *Moss, hanging from trees and shrubs*.

Ecu. B. 132. – *Constantly wet moss from rock-wall beside the waterfalls.*

Ecu. B. 133. Above Junghal, 2150 m a.s.l. (Prov. Carchi). – 25. IV. 1989. - *Artifically irrigated area, grass.*

Ecu. B. 134. – *Plant debris from under bushes.*

Ecu. B. 135. 3 km before reaching El Angel, 2950 m a.s.l. (Prov. Carchi). – 25. IV. 1989. – *Meadow with couch-grass.*

Ecu. B. 136. – *Soil of the meadow with couch-grass.*

Ecu. B. 137. – *Litter from under small bushes.*

Ecu. B. 138. 7km leaving the road-junction of La Libertad, 3300 m a.s.l. (Prov. Carchi). – 25. IV. 1989. – *Litter and soil from under bushes.*

Ecu. B. 139. – *Soil-moss.*

Ecu. B. 140. 10 km leaving La Libertad to Tulcan, 3400 m a.s.l. (Prov. Carchi). – 25. IV. 1989. – *Old quarry, completely overgrown with vegetation; litter and soil from under shrubs.*

Ecu. B. 141. – *Moss and cushion-vegetation.*

Ecu. B. 142. – *Cushion vegetation.*

Ecu. B. 143. – *Fern stems, lichen.*

Ecu. B. 144. 14 km leaving La Libertad, towards Tulcan, 3500 m a.s.l. (Prov. Carchi). – 25. IV. 1989. – *Big bushes and ferns in Espeletia-vegetation; litter and soil.*

Ecu. B. 145. – *Material of moulding tree trunk, and moss from it.*

Ecu. B. 146. – *Moss hanging from bushes, lichen.*

Ecu. B. 147. – *Withered leaves of Espeletia.*

Ecu. B. 148. 13 km leaving La Libertad, towards Tulcan, 3500 m a.s.l. (Prov. Carchi). – 25. IV. 1989. – *Mossy soil.*

Ecu. B. 149. – *Big Graminea tussocks.*

Ecu. B. 150. 13 km leaving La Libertad, towards Tulcan, 3500 m a.s.l. (Prov. Carchi). – 25. IV. 1989. – *Moss level of very wet meadow (artificially inundated).*

Ecu. B. 151. 500 m leaving the road-junction, 2600 m a.s.l. (Prov. Carchi). – 25. IV. 1989. – *Tussocks of dry grass, leaves and litter.*

Ecu. B. 152. – *Dry grass and moss.*

Ecu. B. 153. Leaving the Santa Barbara – Tulcan road-junction, 500 m towards Tulcan, 3200 m a.s.l. (Prov. Carchi). – 26. IV. 1989. – *Remnant patch of moss-forest; soil.*

Ecu. B. 154. – *Moss from the ground.*

Ecu. B. 155. – *Moss from the stems of trees (not hanging); mushrooms among it, too.*

Ecu. B. 156. 34 km from the road-junction to Santa Barbara, 2550 m a.s.l. (Prov. Carchi). – 26. IV. 1989. – *Moss from beside small waterfall.*

Ecu. B. 157. – *Leaves of Gunnera sp. and litter of other plants.*

Ecu. B. 158. 33,5 km from the road-junction os Santa Barbara, 2550 m a.s.l. (Prov. Carchi). – 26. IV. 1989. – *Secondary rainforest, shrubby area; litter and soil.*

Ecu. B. 159. – *Moss from tree stems.*

Ecu. B. 160. – 31 km from the road-junction to Santa Barbara, on the riverside of Rio Chingual, 2480 m a.s.l. (Prov. Carchi). – 26. IV. 1989. – *Riverside rainforest-galery; litter and soil.*

Ecu. B. 161. – *Moss from stem of a very old tree.*

Ecu. B. 162. – *Riverside cut-over area, moss-level of wet meadow, parts of Schoenoplectus-like plant.*

Ecu. B. 163. 15 km from road-junction of Santa Barbara, 2800 m a.s.l. (Prov. Carchi). – 26. IV. 1989. – *Scale-moss from perlite-like wall of the road (overshaded by bushes).*

Ecu. B. 164. 14 km from the road-junction of Santa Barbara, 2900 m a.s.l. (Prov. Carchi). – 26. IV. 1989. – *Secondary rainforest patch; litter and soil.*

Ecu. B. 165. – *Soil-moss from the stem of fern-tree (very thick).*

Ecu. B. 166. – *Moss and lichen from stem and branches of bushes.*

Ecu. B. 167. Below Baños, 500 m after leaving the tunnel, 1500 m a.s.l. (Prov. Tungurahua). – 30. IV. 1989. – *Plant debris and sparse moss from under thick vegetation.*

Ecu. B. 168. – *Moss and small ferns from skirts of the thicket, well exposed to light.*

Ecu. B. 169. – *Moss from open area.*

Ecu. B. 170. Rio Verde, 1450 m a.s.l. (Prov. Tungurahua). – 30. IV. 1989. – *Small, nearly unisturbed rainforest patch beside orange-plantation; litter and soil.*

Ecu. B. 171. – *Carpet-like moss from rock-wall.*

Ecu. B. 172. 5 km from Rio verde towards Puyo, 1430m a.s.l. (Prov. Tungurahua). – 30. IV. 1989. – *Wide rainforest patch; litter and soil.*

Ecu. B. 173. – *Soil-moss (mossy soil, respectively).*

Ecu. B. 174. – *Wet moss from beside small waterfall.*

Ecu. B. 175. 16 km from Puyo, towards Macas, 900 m a.s.l. (Prov. Pastaza). – 1. V. 1989. – *Rainforest patch, beside an open area; litter and soil.*

Ecu. B. 176. – *Litter and roots, from the branching of a big tree, in about 2,5 m height.*

Ecu. B. 177. – *Completely humified mossy tree trunk, lying on the ground.*

Ecu. B. 178. – *Tinder from the same tree trunk.*

Ecu. B. 179. – *Mossy part of a standing tree stem.*

Ecu. B. 180. – *Soil and plant debris from the high (cultivated?) grass of a meadow on cut-over area.*

Ecu. B. 181. 23 km from Puyo, 900 m a.s.l. (Prov. Pastaza). – 1. V. 1989. – *Plant of a pasture, with litter and debris of ferns (water-filtration).*

Ecu. B. 182. – *Mossy soil.*

Ecu. B. 183. 1 km from the road-junction of Cañelas, 870 m a.s.l. (Prov. Pastaza). – 1. V. 1989. – *Steep forest of about 70°; litter and soil.*

Ecu. B. 184. – *Forest on falt area (sparse, secondary).*

Ecu. B. 185. 32 km from Puyo, 900 m a.s.l. (Prov. Pastaza). - 1. V. 1989. – *Secondary rainforest; litter and soil (in the deepening small „pond”).*

Ecu. B. 186. – *Pasture grass.*

Ecu. B. 187. 34 km from Puyo, 950 m a.s.l. (Prov. Pastaza). - 1. V. 1989. – *Secondary rainforest patch; flat area, litter and soil.*

Ecu. B. 188. – *Moss from tree stems.*

Ecu. B. 189. – *Material of humified, lying tree trunk, and moss from it.*

Ecu. B. 190. Between Puyo and Palora, bridge of Madre Tierra, 800 m a.s.l. (Prov. Pastaza). – 2. V. 1989. – *Moss from bark of tree stems.*

Ecu. B. 191. – *Plant debris and litter, mossy soil.*

Ecu. B. 192. – *Mossy debris of reed.*

Ecu. B. 193. *1km from the collecting site 190; wet meadow (with horsetail), plant debris and moss. - 2. V. 1989.*

Ecu. B. 194. – *Thick moss of old tree stem.*

Ecu. B. 195. Leaving Madre Tierra, 1000 m a.s.l. (Prov. Pastaza). - 2. V. 1989. – *„Fenwood”; litter and soil.*

Ecu. B. 196. – *Moulding tree trunk; moss and litter.*

Ecu. B. 197. – *Jumble („fusion”) of a plant and roots.*

Ecu. B. 198. – *Pasture patch beside the „fenwood”; plant debris and soil.*

Ecu. B. 199. Leaving Madre Tierra, 1000 m a.s.l. (Prov. Pastaza). – 2. V. 1989. – *Roadside wet but no fen-like cut-over („forest”) – patch; litter and soil.*

Ecu. B. 200. – *Moss from tree.*

Ecu. B. 201. Leaving Madre Tierra, cca 500 m from the collecting site 199, 850 m a.s.l. (Prov. Pastaza). – 2. V. 1989. – *Young, sparse trees, wet, high „pasture grass”; litter and soil.*

Ecu. B. 202. Some km leaving Triomfo, 980 m a.s.l. (Prov. Pastaza). – 2. V. 1989. – *Sparse trees, between them „pasture grass”; litter and soil from under tree.*

Ecu. B. 203. – *Moss and roots from a tree.*

Ecu. B. 204. – *Detritus of „pasture grass”.*

Ecu. B. 205. – *Drying cattle exrement and soil from under it.*

Ecu. B. 206. 22 km from Puyo, towards Baños, 1100 m a.s.l. (Prov. Pastaza). – 3. V. 1989. – *Gorge with small creek; litter and soil.*

Ecu. B. 207. – *Soil and wet moss from rock (always dripping).*

Ecu. B. 208. – *Dertitus of plants (shrubs) with big leaves, on open area.*

Ecu. B. 209. – *Open area, moss from wall.*

Ecu. B. 210. 31 km from Puyo, towards Baños, 1100 m a.s.l. (Prov. Pastaza). – 3. V. 1989. – *Rainforest patch with rock-wall; litter and soil.*

Ecu. B. 211. – *Moss from trees.*

Ecu. B. 212. – *Dripping moss from rock-wall.*

Ecu. B. 213. – *Very thick, wet moss from roadside wall.*

Ecu. B. 214. At the foot of Cotopaxi, 3500 m a.s.l. (Prov. Cotopaxi). – 3. V. 1989. – *Pesudo-paramo level; withered, dead patch of cushion-like vegetation.*

Ecu. B. 215. – *Litter of withered grass-like plants of a meadow.*

Ecu. B. 216. – *Cushion-like vegetation, litter and soil.*

Ecu. B. 217. – *Thick moss, growing on the litter.*

Ecuador 1990

Ecu. B. 1. Prov. Pichincha. Leaving Nono, 50km from Quito, 2250m. – 19. IV. 1990. – *Moss.*

Ecu. B. 2. – *Litter.*

Ecu. B. 3. – *Soil.*

Ecu. B. 4. – *Bromelia from a tree.*

Ecu. B. 5. Prov. Pichincha. 8km after Santa Rosa, 2400 m. – 19. IV. 1990. – *Moss from fallen logs.*

Ecu. B. 6. – *Bark from fallen logs.*

Ecu. B. 7. – *Bromelia from a tree.*

Ecu. B. 8. – *Leaf litter from a ditch.*

Ecu. B. 9. Prov. Pichincha. Between Santa Rosa and Los Bancos, 2200 m. 19. IV. 1990.– *Leaf litter.*

Ecu. B. 10. – *Soil.*

Ecu. B. 11. Prov. Manabi. Between Sto. Domingo and El Carmen, 10 km from El Carmen 400 m. 20. IV. 1990. – *Leaf litter and coarse woody debris.*

Ecu. B. 12. – *Bromelia.*

Ecu. B. 13. Prov. Manabi. 7 km after Flavio Alfaro 300 m. – 20. IV. 1990. – *Litter from Cocoa plantation*.

Ecu. B. 14. – *Bamboo litter*.

Ecu. B. 15. *Epiphytes from trees*.

Ecu. B. 16. Prov. Manabi. Piedra Azul, 22 km after Flavio Alfaro, 250 m. – 20. IV. 1990. – *Coarse woody debris*.

Ecu. B. 17. Prov. Manabi. Garrapatilla, 7km before San Andres, 100 m. – 21. IV. 1990. – *Moss and epiphytes*.

Ecu. B. 18. Prov. Manabi. 40 km before Jipijapa 350 m. –21. IV. 1990. – *Dry soil.*

Ecu. B. 19. – *Dry leaf litter*.

Ecu. B. 20. Prov. Manabi. 19 km after Manta, toward Portoviejo, cloud-forest, 300 m. – 22. IV. 1990. – *Leaf litter*.

Ecu. B. 21. – *Ceiba pentandra litter*.

Ecu. B. 22. Prov. Manabi. After Calderon toward Quevedo bamboo-forest, 150 m. –22. IV. 1990. – *Litter*.

Ecu. B. 23. – *Pristine forest fragment, litter.*

Ecu. B. 24. Prov. Manabi. Palmita, 20 km from San Miguel, 500 m. – 22. IV. 1990. –

Ecu. B. 25. Prov. Cotopaxi. 20 km leaving El Palmer La Mana. – 750 m. 23. IV. 1990. – *Bromelia*.

Ecu. B. 26. Prov. Cotopaxi. 35 km from La Mana, before El Tingo, pristine forest fragment, 1300 m. – 23. IV. 1990. – *Forest litter*.

Ecu. B. 27. Prov. Cotopaxi. 43 km from La Mana, after El Tingo, 2000 m. – 23. IV. 1990. – *Moss from rocks*.

Ecu. B. 28. – *Moss hanging from trees*.

Ecu. B. 29. Prov. Pichincha. After Lloa, 4100 m.. – 27. IV. 1990. – *Upper soil layer with grass*.

Ecu. B. 30. – *Lower soil layer*.

Ecu. B. 32. – 4050 m, *moss from the road-wall*.

Ecu. B. 33. Prov. Napo. 26 km before Loreto pristine forest, 650m. – 2. V. 1990. – *Leaf litter*.

Ecu. B. 34. – *Soil*.

Ecu. B. 35. Prov. Napo. 7 km leaving Loreto cafe plantation, 500 m. –2. V. 1990. – *Leaf litter*.

Ecu. B. 36. Prov. Napo. Just before Loreto, 580 m. – 2. V. 1990. – *Littef from a hill side*.

Ecu. B. 37. Prov. Napo. 2 km before Loreto, pristine forest, 550 m. – 2. V. 1990. – *Leaf litter.*

Ecu. B. 38. Prov. Napo. 12 km before Loreto, cafe plantation, 450 m. – 2. V. 1990. – *Leaf litter*.

Ecu. B. 39. Prov. Napo. 31 km before Loreto, 1000 m. – 2. V. 1990. – *Litter*.

Ecu. B. 40. Prov. Napo. 35 km. Before Loreto, 1000 m. – 2. V. 1990. – *Coarse woody debris from a lake-shore*.

Ecu. B. 41. Prov. Napo. 41 km before Loreto, 1200 m. – 2. V. 1990. – *Litter*.

Ecu. B. 42. Prov. Napo. 52 km before Loreto, 1200 m. – 2. V. 1990. – *Leaf litter.*

Ecu. B. 43. – *Litter*.

Ecu. B. 44. Prov. Napo. 55 km before Loreto 1220 m. – 2. V. 1990. – *Moss from a fallen log*.

Ecu. B. 45. Prov. Napo. Between Puerto Napo and Ahuano, 9 km from Tena, 500 m. – 3. V. 1990. – *Cocoa and other litter.*

Ecu. B. 46. Prov. Napo. Between Puerto Napo and Ahuano, 18 km from Tena, pristine forest, 430 m. – 3. V. 1990.– *Leaf litter.*

Ecu. B. 48. Prov. Napo. Between Puerto Napo and Ahuano, 27 km from Tena, pristine forest, 430 m. – 3. V. 1990. – *Leaf litter*.

Ecu. B. 49. Prov. Napo. Before San Pedro, 35 km from Tena, pristine forest, 500 m. – 3. V. 1990. – *Litter*.

Ecu. B. 50. Prov. Carchi. Leaving Tufino on the Chiles Volcano, 4300 m. – 8. V. 1990. – *Moss and soil.*

Ecu. B. 51. – 3650 m*, moss and soil.*

Ecu. B. 52. Prov. Imbabura. 15 km from Otavalo juast above the laguna Mojanda, 3800 m, – 9. V. 1990. – *Moss and soil*.

Colombia 1993

C. 4. Before Finca La Sirena, Tenjo, Palmira, on a little path. – 17. IV. 1993.

C. 5. Finca La Sirena, Tenjo, Palmira, Sendero el Mirador 2650 m. – 17. IV. 1993.

C. 14. El Topacio Nat. conservation area 1700 m. – 22. IV. 1993.

C. 16. Before El Topacio Nat. conservation area1400 m. – 22. IV. 1993.

C. 20. Paramo de los Domingues 3650 m. El Cerrito on the shore of a small pond. – 23. IV. 1993.

C. 36. At the gate of Finca La Sirena, Tenjo, Palmira. – 19. IV. 1993.

C. 39. Before Finca La Sirena, Tenjo, Palmira on the bank of a small stream. - 19. IV. 1993.

Ecuador 1993

E. 5. Prov. Cotopaxi. Toward Latacunga at the foot of Cotopaxi Volcano. – 04. V. 1993.

E. 8. Prov. Cotopaxi. Leaving Insivili, paramo, 4150 m. – 04. V. 1993.

E. 14. Prov. Tungurahura. Leaving San Jose de Poalo, 3450 m. – 05. V. 1993.

E. 18. Prov. Tungurahura. Leaving San Jose de Poalo, 3700 m. – 05. V. 1993.

E. 22. Prov. Tungurahura. Laguna Pisayambo, 3700 m. – 06. V. 1993.

E. 24. Prov. Tungurahura. Laguna Pisayambo, 3800 m. – 06. V. 1993.

E. 28. Prov Tungurahura 3km before the Laguna Pisayambo 3800 m, swampy slope. – 06. V. 1993.

E. 34. Prov Tungurahura. Above the Pucara hydroelectric station, 3420 m. – 07. V. 1993.

E. 36. Prov Tungurahura. Above the Pucara hydroelectric station, 3400 m. – 07. V. 1993.

E. 40. Prov Tungurahura. Before Pillaro, Eucaliptus wood on sandy soil, 2700 m. – 07. V. 1993.

E. 41. Prov. Cotopaxi, On the Cotopaxi Volcano, 3350 m. – 08. V. 1993.

E. 42. Prov. Cotopaxi, On the Cotopaxi Volcano, grassy vegetation, 3450 m.

E. 49. Prov. Carchi. Between Mira and El Angel 2900 m. – 12. V. 1993.

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First record of the Zitting Cisticola (*Cisticola juncidis* Rafinesque, 1810) in Hungary

Á. NÉMETH[1] and CS. VADÁSZ[2]

Abstract. On the 18th of July, 2006, one singing male individual of Zitting Cisticola *(Cisticola juncidis)* was observed at Lake Kolon, Central Hungary. It is the first record of this species in Hungary.

A new species was added to the list of the Hungarian avifauna on the 18th of July, 2006, when the first individual of the Zitting Cisticola (*Cisticola juncidis* Rafinesque, 1810) was recorded at Lake Kolon (46º 48'N, 19º 20'E). At a drying swamp meadow (*Molinion coeruleae*) the unmistakable zitting song of a male Zitting Cisticola was heard. Right after the acoustical detection, it was possible to visualize the individual perched on the stands of Purple Moor-grass *(Molinia coerulea)* as well as the Common Reed *(Phragmites australis)*. A digital photo is presented (Figure 1).

All the typical identification characters such as the flesh-colored legs, the yellowish-brown back with contrasting black stripes and the tail feathers with dark subterminal coloring and whitish tips were possible to detect, providing a full positive identification (Baker, 1997; Cramp & Simmons, 1983). When playing-back a species-specific song from a mobile CD-player, the observed individual frequently attacked the source of the sound, and replied to it by singing short songs consisting of 3-4 syllables during the attacking flights.

The genus *Cisticola* contains fifty-one, mainly African species (Monroe *et al*., 1997). Only four species breed in the Palearctic, with the Zitting Cisticola as the only *Cisticola* species breeding in Europe (Baker, 1997). The breeding range of this species covers a huge but patchy area spanning form Southern Europe southwards to South Africa and eastwards to South Asia. The Zitting Cisticola inhabits tall grassland habitats, generally located close to marshy areas.

Due to its large range and large overall population size, the Zitting Cisticola is regarded as 'Lower risk/least concern' by the IUCN (Baillie *et al*., 2004). Although there have not been specific investigations, there is evidence of population increase in the Mediterranean region and expansion of its breeding range, and also short term fluctuations and population declines are reported (Jiquet & Julliard, 2007), which are usually influenced by hard winters.

The Zitting Cisticola is a rare vagrant to North and Central Europe, and has been recorded in countries far away from the breeding areas, e.g. in Denmark (Klein *et al*., 2003), Sweden (Mortensen & Pedersen, 2002), United Kingdom (Sharrock, 1972) and Belgium (Herroelen, 2000). Individuals of this species observed outside the breeding range are usually regarded as spring overshoot. Even the specimen recorded at Lake Kolon can be regarded as an overshoot, but it is worth mentioning that due to the global climate change, it is possible that Zitting Cisticola will sooner or later be a regular visitor to, or even a breeding species in Hungary.

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Figure 1. Zitting Cisticola *(Cisticola juncidis)* at Lake Kolon, Hungary. (Photo János Oláh)

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To the memory of late Dr. Olga Urbanc Berčič
(National Institute of Biology, Ljubjana)

Planktonic rotifers from Lake Cerknica (Slovenia)

K. SCHÖLL[1]

Abstract. The basic hydrobiological conditions as well as the planktonic Rotifer assemblages of the Lake Cerknica (Slovenia) were investigated first time in 2004-2005. 16 taxa were found, most of them are frequent in Central Europe. The preliminary results suggest a pressing need for further research.

The Lake Cerknica (Cerkniško Jezero, Slovenia, N 45º46'02", E 14º22'21") is the largest intermittent karstic lake in Europe. It lies in Slovenia, in the southern part of Cerknica polje, with a catchments area of 475 km^2. The surface of the lake can reach up to 27 km^2, the surface level varies from 546 to 551 meters above sea level. The average yearly precipitation is 1700 mm, 80% of the lake's inflow consist of karst waters, 15% of surface waters (Gaberščik 2003). The planktonic rotifer assemblages of the lake have not been investigated before. The aim of the study was to get the basic information about the rotifer fauna of the lake, besides the ecological and hydrochemical parameters.

METHODS

Samples were taken from 4 characteristic sites in the lake, by filtering 10-10 liters water through a 40-µm mesh-size plankton net. The sampling sites represented characteristically different parts of the lake:

Site 1: *Dolenje Jezero (Lower Lake), bridge of River Stržen*

Site 2: *Gorenje Jezero (Upper Lake), bridge of River Olerh*

Site 3: *Dolenje Jezero, sinking holes*

Site 4: *Zadnji Kraj*

The sampling sites were visited on foot and by boat, respectively (Fig. 1). Samples were collected from the depths of 15-25 cm. After collection they were taken to the laboratory, but also instantly preserved in a 4 % formaldehyde solution. Live specimens were collected to be able to make accurate identifications (Koste, 1978; Segers, 2007) and they were analysed within 4-5 hours. Specimens in the preserved samples were counted in a Sedgewick-Rafter chamber. Besides the collections of rotifers, the physico-chemical parameters were also recorded with a Multiline-P field device on the field: water temperature, pH, conductivity, dissolved oxygen content and oxygen saturation. The water level was low at the time of both investigations.

RESULTS

The physico-chemical parameters measured on the field are summarized in the Table 1. There were marginal differences between the parameters of sampling sites, excluding the site 3, where the lowest conductivity was measured (Tab. 1).

16 rotifer taxa were found, most of them in 2004 (Tab. 3). All species are common in Central Europe. The taxon number and abundance was relatively low, except the site 3, 2004. The taxon-number and diversity were markedly lower, the dominance higher in 2005 than in the year before (Tab. 2). These preliminary results suggest that

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Figure. 1. Rotifer sampling from site 1

the Lake Cerknica has diverse and colorful rotifer assemblages, which call for a further, particular investigation.

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Table 1. Physical-chemical parameters measured on the field

Date	**10. 09. 2004**			**29. 06. 2005**		
Site	**1**	**2**	**3**	**1**	**2**	**4**
Temperature (ºC)	18.6	19.3	18.9	21.5	14.1	21.9
pH	7.4	7.7	8.0	7.9	7.8	7.4
Conductivity (µS/cm)	497	475	339	429	478	478
Oxygen concentration (mg/L)	5.86	14.53	9.13	9.15	8.07	3.61
Oxygen saturation (%)	63.1	166.9	104.3	110.2	84.0	42.6

Table 2. Ecological parameters

Year	**2004**			**2005**		
Site	**1**	**2**	**3**	**1**	**2**	**4**
Taxa S	5	6	9	2	2	3
Individuals 10 L^{-1}	125	120	12750	100	50	100
Dominance D	0,2	0,19	0,34	0,63	0,5	0,38
Shannon H	1,60	1,73	1,42	0,56	0,69	1,04
Evenness	1	0,94	0,46	0,88	1	0,94
Equitability J	1	0,97	0,65	0,81	1	0,95

Table 3. Quantitative data of rotifers (ind./10 L)

Year	**2004**			**2005**		
Lake Cerknica	**1**	**2**	**3**	**1**	**2**	**4**
Brachionus angularis angularis Gosse, 1851	0	0	525	75	0	50
Bdelloidea sp.	25	0	25	0	0	0
Hexarthra mira (Hudson, 1871)	0	0	50	0	0	0
Keratella cochlearis cochlearis (Gosse, 1851)	0	0	1700	25	0	0
K. cochlearis macracantha (Lauterborn, 1900)	0	0	6825	0	0	0
K. quadrata quadrata (O. F. Müller, 1786)	0	0	50	0	0	0
Lepadella ovalis (O. F. Müller, 1786)	0	15	0	0	0	25
L. patella (O. F. Müller, 1773)	0	15	0	0	25	25
Polyarthra dolichoptera Idelson, 1925	0	0	1250	0	0	0
P. longiremis Carlin, 1943	25	15	1825	0	0	0
Scaridium longicaudum (O. F. Müller, 1786)	25	0	0	0	0	0
Squatinella rostrum (Schmarda, 1846)	0	15	0	0	0	0
Synchaeta tremula (O. F. Müller, 1786)	0	30	0	0	0	0
Testudinella patina (Hermann, 1783)	25	0	0	0	0	0
Trichocerca birostris (Minkiewitz, 1900)	25	0	500	0	0	0
Trichotria pocillum (O. F. Müller, 1776)	0	30	0	0	25	0
Total abundance:	125	120	12750	100	50	100

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