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***Ceratophysella macrocantha* Stach, 1946 (Collembola, Hypogastruridae): a redescription of a forgotten species from the Alps**

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Abstract: *Ceratophysella macrocantha* Stach, 1946 is redescribed on the basis of a syntype specimen from the Austrian Alps which is here designated as the lectotype. This species has the chaetotaxy of the type B and an empodium with a long filament. It is closely related to nine species/forms, two of which, *C. attenuata* Gisin, 1960 nec Cassagnau, 1959 from the Swiss Alps and *C. recta* Cassagnau, 1959 from the Pyrenees, are most similar.

Keywords: Taxonomy - springtails - Europe.

INTRODUCTION

Ceratophysella Börner, 1932 is one of the most species-rich genera within the family Hypogastruridae. Unfortunately, some of the 138 species currently listed by Bellinger *et al.* (2019) are insufficiently known and there are doubts concerning their taxonomic status. One of these is *Ceratophysella macrocantha* Stach, 1946. This characteristic species, with a large body size and long anal spines, has been described by Stach (1946) on the basis of two specimens collected by Dr Herbert Franz in the Austrian Alps. This species has not been recorded ever since, and as a consequence our knowledge of its morphology is exclusively based on the original description. Unfortunately, Stach did not provide comprehensive information on chaetotaxy and some other morphological details, and therefore this species name, a possible synonym of *Ceratophysella scotica* (Carpenter & Evans, 1899), was not included in the most recent identification key of Palearctic Hypogastruridae (Thibaud *et al.*, 2004). An examination of the only syntype that remains in the collection of the Institute of Systematics and Evolution of Animals, PAS, Cracow, Poland (according to Wanda M. Weiner the second syntype is lost) allowed to redescribe *C. macrocantha*, designate a lectotype and discuss the taxonomic position of this species.

MATERIAL AND METHODS

The lectotype of *C. macrocantha* was cleared in Nesbitt's fluid (chloral hydrate, concentrated hydrochloric acid,

distilled water), slide-mounted in a mixed medium (distilled water, gum arabic, glycerol, chloral hydrate), and studied using a Nikon Eclipse E600 phase contrast microscope. Figures were drawn using a camera lucida. Terminology in the description follows that given in Babenko *et al.* (1994) and Thibaud *et al.* (2004).

TAXONOMIC PART

***Ceratophysella macrocantha* Stach, 1946**

Figs 1-8

Type material: Female lectotype, designated here, previously in alcohol, now mounted on permanent slide, deposited in the Institute of Systematics and Evolution of Animals, PAS, Cracow, Poland; Styrian Alps, Buchau, east ridge, about 850 m asl., in beech forest on the south slope; 21 October 1941; leg. H. Franz.

Diagnosis: Body size large. Tegumental granulation fine and uniform. Chaetotaxy of the type B, setae p₃ on abdominal tergum IV absent. Antennal segment IV with trilobed apical vesicle, 7 cylindrical sensilla and about 18 slightly modified sensilla in ventral field. Eversible sac between antennal segments III and IV weakly developed. Head of maxilla with lamella 1 protruding beyond the teeth and broadened at the tip. Outer maxillary lobe with two sublobal hairs. Empodial appendage with apical filament reaching tip of claw. Dens with 7 unmodified setae, mucro slender, spoon-like at tip, with low outer lamella. Anal spines long colourless.

Redescription: Body length 2.4 mm. Colour (in alcohol) mostly dark blue, ventrally paler. Tegumental granulation fine and uniform, 27 granules between widely spaced macrosetae p_1 on abdominal tergum V (Fig. 6).

Arrangement of setae on head typical for the genus, spine-like setae absent. Dorsal chaetotaxy of type B (Figs 5-6). Thoracic tergum II with setae m_3 and m_4 present, setae a_2 similar to a_3 . Setae p_1 on abdominal tergum IV developed as macrosetae, p_2 as microsetae, setae p_3 absent, additional setae m_2 present. Abdominal tergum V with long a-setae, setae p_2 present. Differentiation of dorsal setae into micro- and macrosetae distinct. Setae long (ratio p_3 macrosetae on abdominal tergum II/inner edge of claws III = 1.7), straight, pointed at tips and slightly serrate. Body sensilla (s) relatively long, but mostly shorter than macrosetae (only on abdominal tergum V slightly longer). Microsensilla (ms) on thoracic tergum II present (Fig. 5). Subcoxae I, II, III with 1, 2, 3 setae, respectively.

Antennal segment IV with trilobed apical vesicle, subapical organite (or), microsensillum (ms), 7 (2 lateral, 5 dorsal) cylindrical, subequal sensilla and about 18 thin, slightly curved and blunt-tipped sensilla in ventral field (Fig. 1 and Stach, 1946: pl. II, fig. 1). Antennal segment III organ with two long (lateral) and two short (internal) curved sensilla (Fig. 1). Microsensillum on antennal segment III present. Eversible sac between antennal segments III and IV present but weakly developed. Antennal segment I with 7 setae.

Ocelli: 8 + 8. Postantennal organ 2.6 times as large as single ocellus; the former with four lobes, its anterior pair larger than posterior pair. Accessory boss present (Fig. 2).

Labrum with 5, 5, 4 setae; 4 prelabrals present. Maxillary head (not well visible) as in Figs 3 and 4. Lamella 1 broadened at tip, protruding beyond teeth. Outer maxillary lobe with two sublobal hairs. Labium hardly visible.

Tibiotarsi I, II, III with 19, 19, 18 setae, respectively. Tenent hairs a little shorter than inner edge of claws, pointed. Claws with inner tooth and a pair of lateral teeth. Empodial appendage with broad lamelliform base and filiform apex reaching tip of claw (Fig. 7).

Ventral tube with 4 + 4 setae. Furca well developed. Ratio dens + mucro/inner edge of claw III = 2.2, ratio dens/mucro = 2.1. Dens with uniform fine granules and 7 unmodified dorsal setae (basal macroseta slightly exceeding half of dens length). Mucro slender, spoon-like at tip, with low but distinct outer lamella (Fig. 8). Retinaculum with 4 + 4 teeth.

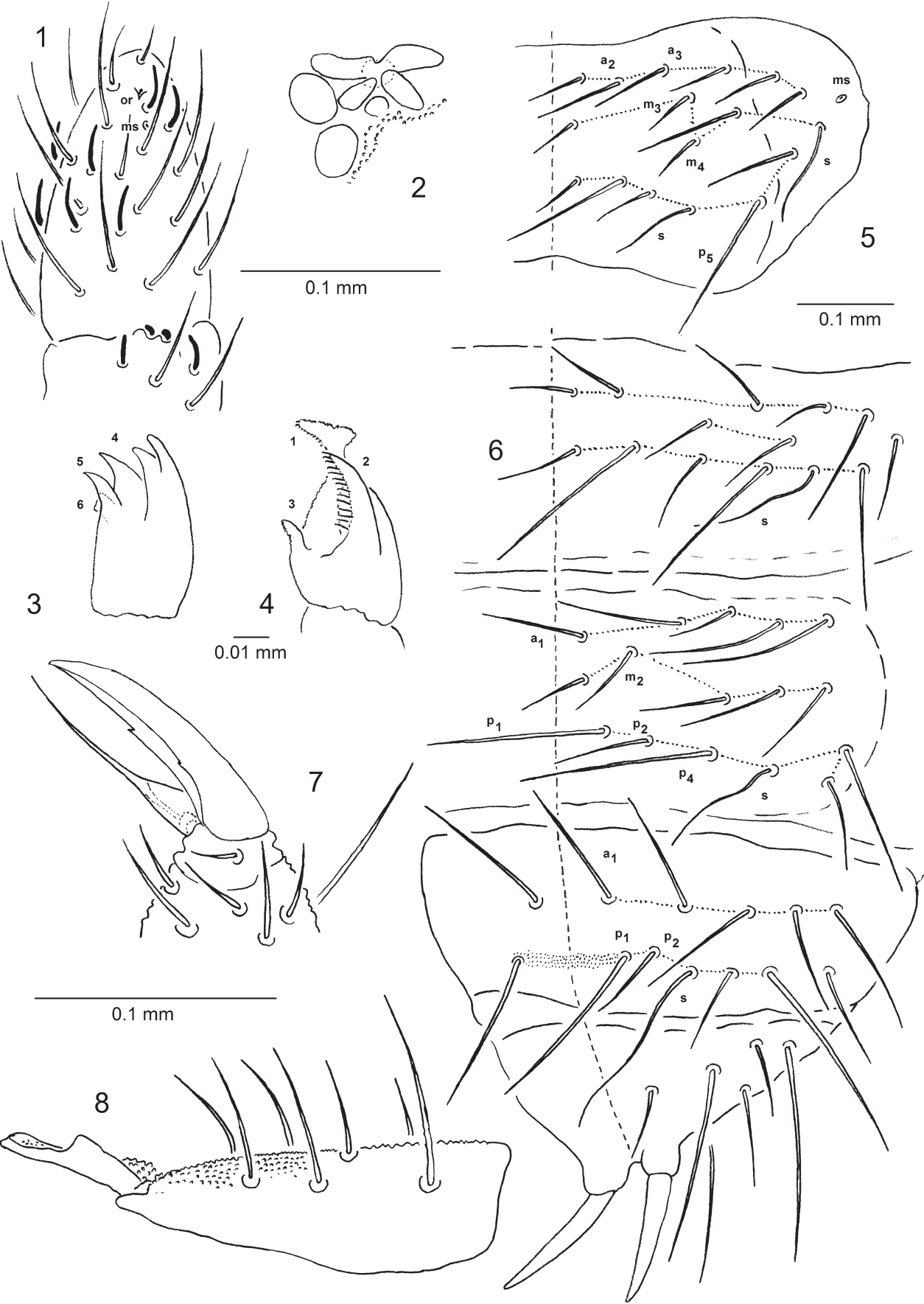
Anal spines long (1.4 times as long as inner edge of claws III), slightly curved, situated on basal papillae, unpigmented (Fig. 6).

Remarks: *Ceratophysella macrocantha*, having chaetotaxy of the type B and an empodium with a long filament, is similar to six European species/forms of the *armata* group: *C. attenuata* Gisin, 1960 nec Cassagnau, 1959 (Swiss Alps, from cave), *C. lawrencei* Gisin, 1963 (Alps, Appenines, Carpathians), *C. penicilifer* Cassagnau, 1964 (France - Massif Central), *C. recta* Cassagnau, 1959 (Pyrenees), *C. scotica* (Carpenter & Evans, 1899) (Belarus, Germany, Great Britain, Ireland, Norway, Poland, Ukraine) and *C. tergilobata* (Cassagnau, 1954) (Mediterranean), and also to three Asian species: *C. empodialis* Babenko *et al.*, 1994 (Russia - Far East), *C. liguladorsi* Lee, 1974 (Korea, China, Russia - Southern Sachalin, Indonesia) and *C. paraliguladorsi* Nguyen, 2001 (Vietnam) (see Gisin, 1960; Babenko *et al.*, 1994; Thibaud *et al.*, 2004; Nguyen, 2001; Skarżyński, 2006).

Ceratophysella tergilobata, *C. liguladorsi* and *C. paraliguladorsi* can be easily distinguished from *C. macrocantha* by the presence of a characteristic medial spine-like integumentary projection between the bases of setae p_1 on abdominal tergum V. Easy to distinguish are also *C. lawrencei* and *C. scotica* (integument with fields of coarse granules), *C. penicilifer* (six setae on dens, filament of empodium split into three or four branches) and *C. empodialis* (boat-like mucro as typical for the genus).

Closest to *C. macrocantha* (probably conspecific) seem to be *C. recta* and *C. attenuata*. Both differ from the species redescribed here in subtle characters. The first of the above-mentioned has a simple apical vesicle on antennal segment IV, the filament of the empodium $\frac{3}{4}$ the length of the inner edge of the leg claws, the mucro is almost without an outer lamella and the tenent hairs on the tibiotarsi are clearly longer than the claws. *Ceratophysella attenuata*, of which I examined four specimens (3 females, 1 male on one slide labelled by Gisin: *Ceratophysella attenuata*, Fikenloch, cave near Jochpass, canton Obwald, central Switzerland, 2450 m asl., 18.08.1959, leg. M.M. Aellen, Roth and Strinati, deposited at the Muséum d'histoire naturelle in Geneva, Switzerland), differs from *C. macrocantha* by a shorter filament of the empodium ($\frac{3}{4}$ the length of the inner edge of the claws), by a lower outer lamella on the mucro and by characters which can be the result of evolution in an isolated cave system: very long macrosetae (ratio p_3

Figs 1-8. *Ceratophysella macrocantha* Stach, 1946. (1) Chaetotaxy of antennal segments III and IV, dorsal side. (2) Postantennal organ and adjacent ocelli. (3) Maxillary head, dorsal side. (4) Maxillary head, ventral side. (5) Chaetotaxy of thoracic tergum II. (6) Chaetotaxy of abdominal terga III-VI. (7) Claw III with empodial appendage. (8) Dens and mucro of furca. Scale lines: 1-2; 3-4; 5-6; 7-8 to same scale. Abbreviations: or - subapical organite on antennal segment IV; ms - microsensillum; a_1 , a_2 , a_3 - setae of a-row; m_2 , m_3 , m_4 - setae of m-row; p_1 , p_2 , p_4 - setae of p-row; s - body sensilla; 1, 2, 3, 4, 5, 6 - maxillary lamellae. The longitudinal axis of the body is indicated by a broken line. ►



on abdominal tergum II/inner edge of claws III = 2.5), slightly enlarged and modified postantennal organ (ratio postantennal organ/nearest ocellus = 3, presence of a single small finger-like papilla on one of the four primary lobes) and reduced body pigmentation (only blue-black spots present). To clarify taxonomic relations between these three species/forms further research based on more extensive material is needed.

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