

The first record of Canadian Protura.

With systematic notes on *Acerentulus*.

By
S. L. Tuxen.

Through the courtesy of Dr. Marie Hammer, of Strødam, Denmark, I have had the opportunity of studying a collection of Protura from northern Canada made by her in 1948 and now forwarded to the Zoological Museum of Copenhagen. The material consists of well over a hundred individuals of the genus *Acerentulus* and one immature specimen of the genus *Eosentomon*. The *Acerentulus* specimens belong to two hitherto undescribed species which I describe below; however, in order to decide whether they were in fact new I had to investigate some of the species already known of this genus. Dr. F. Bonet, Mexico, sent me specimens of *A. tropicum* Bon., Dr. K. H. Forsslund, Stockholm, the four specimens of *A. trågårdhi* Jon. already examined by Condé, Dr. Grace Glance, Washington, Ewing's five species, and Dr. H. Gisin, Genève, three of his own determinations from Switzerland. The Carlsberg Fund enabled me to examine the types of Berlese and Silvestri which will be treated in separate papers. To the direction of the Carlsberg Fund, to the above colleagues, and to Mr. N. D. Riley, British Museum (Nat. Hist.), who corrected the language I tender my warmest thanks.

Acerentulus canadensis n. sp.

Length of body in adult about 0.9 mm. Length and breadth of head 150 μ and 100 μ . Length of foretarsus 75 μ , of claw 30 μ , TR = 2.5. Length of middle and hind tarsus 30 μ , their claws 20 μ .

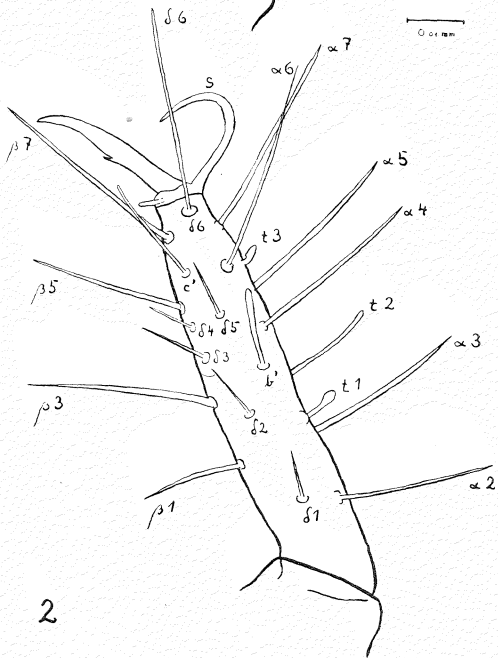
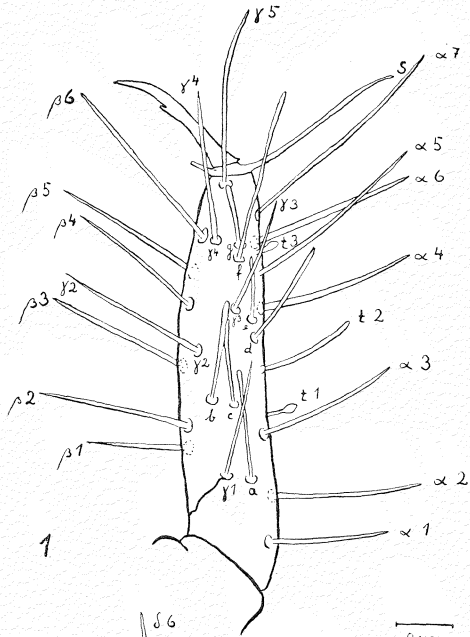
The foretarsus. Condé was the first to realize the systematic importance of the sensillae on the foretarsus which since 1945 he has figured and numbered in every species he has described, and later authors have followed him. Mostly seven sensillae are present on the exterior (posterior) surface of the tarsus, two to three on the interior (anterior) surface, and three dorsally. They were numbered by Condé a—g, a'—c', and t 1—3, respectively. It may, however, sometimes be difficult to distinguish between the setae and the sensillae, and I here propose, therefore, a system for numbering the setae as well. In all species of *Acerentulus* hitherto seen by me (15) the number and position of these setae have been identical. I illustrate the system on a foretarsus of *A. danicus* Condé (figs. 1—2) for direct comparison with the figures 24—25 in my paper from 1949.

The foretarsus is nearly cylindrical, but may be looked upon as foursided. Dorsally a zigzag row of seven setae, called α 1—7, surrounds the three dorsal sensillae t 1—3. Ventrally a zigzag row also of seven setae, called β 1—7. Exteriorly a zigzag row of five setae, γ 1—5, surrounds the seven sensillae a—g. And interiorly an irregular row of six setae, δ 1—6, surrounds the sensillae a'—c'; δ 1—4 is an oblique row of mostly very fine setae. The four setae α 7, γ 5, β 7, and δ 6 are long and form a ring round the praetarsus carrying the claw, the empodium, and the usually s-shaped seta called by Condé s and shown by him to belong to the praetarsus.

This only apparently complicated system of numbering in fact enables us to find and "determine" the sensillae in whatever position the tarsus is fixed on the slide.

In *Acerentulus canadensis* n. sp. the position of the sensillae is shown in figs. 3—5, the last figure showing the tarsus directly from above in which position the sen-

Figs. 1—2: *Acerentulus danicus* Condé. Foretarsus in exterior and interior view.



sillae on both sides are seen. It also shows that t 1—3 do not form a row, but t 1 and t 3 lie nearer the interior side of the tarsus, t 2 near the exterior side. This

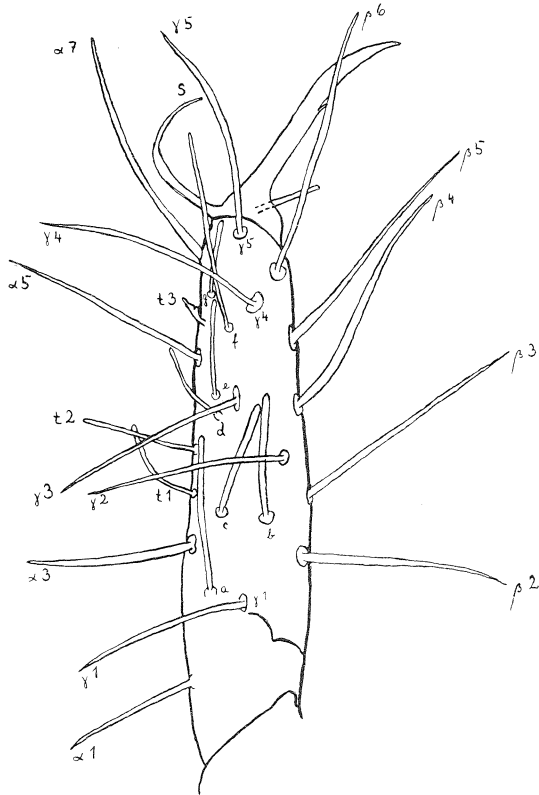
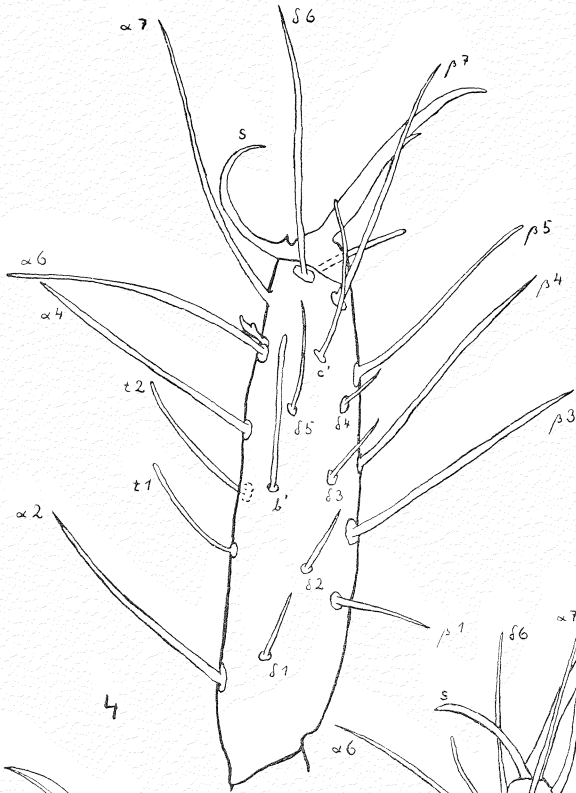


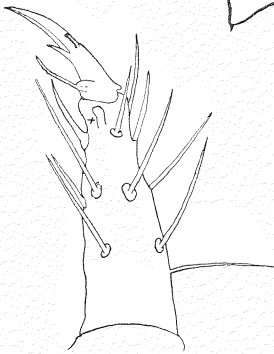
Fig. 3: *Acerentulus canadensis* n. sp. Foretarsus in exterior view.

fact often is useful in determining the orientation of a tarsus on a slide. t 1 is fairly broad and long, gently bowed, not clavate. t 2 is thinner, straight and a little longer. t 3 is short and lanceolate. The length and posi-

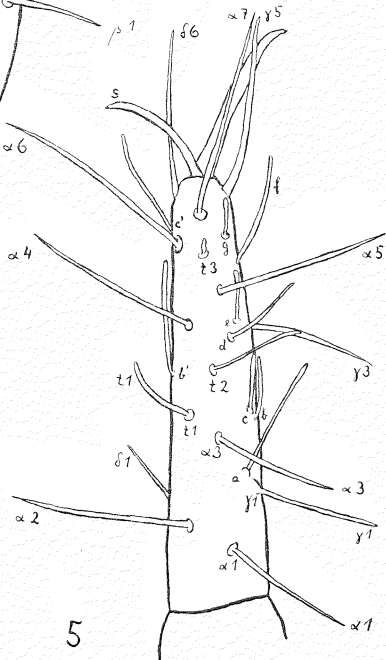
Figs. 4—6: *Acerentulus canadensis* n. sp. Figs. 4—5: Foretarsus in interior view and from above. Fig. 6: Middletarsus, exterior view.



4



6



5

tion of a—g are shown in fig. 3; characteristics: b and c equal in length, d and e near each other, f extremely long, surpassing the tarsus, g short. On the interior side b' and c' are long, a' is missing.

Middle and hind tarsus (fig. 6). Empodium more than half the length of the claw, claw with a large inner tooth which is always clearly visible, and a smaller one at the side of this, only seen "en face". On the inner side of the tarsus near the praetarsus a curious organ

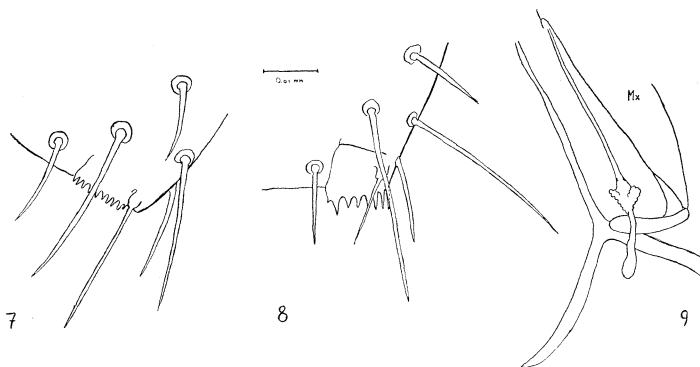


Fig. 7: *Acerentulus canadensis* n. sp. Comb of VIIIth abd. segment. — Fig. 8: *Acerentulus aureitarsus* Ewing, the same. — Fig. 9: *Acerentulus canadensis* n. sp. Filamento di sostegno.

is found, like a lid or a cave, of uncertain structure (x in the figure).

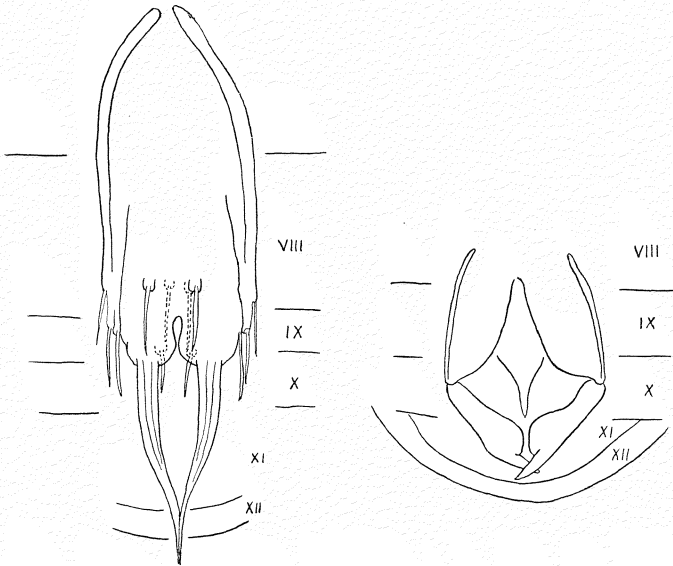
Comb of VIIIth abdominal segment (fig. 7). This comb looks very different in the species known to me and may prove a valuable distinguishing character. It consists in the present species of about 10 small equal-sized teeth.

The genitalia (figs. 10—11) may also prove of specific value though I have not been able to find distinguishing characters in them. Condé since 1947 has used their shape in distinguishing species of *Eosentomon*.

"Filamento di sostegno" of the maxilla (I use

Berlese's term of 1909) is figured in fig. 9. It is unbranched and the part behind the dilatation relatively short compared with e. g. *danicus* Condé (Tuxen 1952).

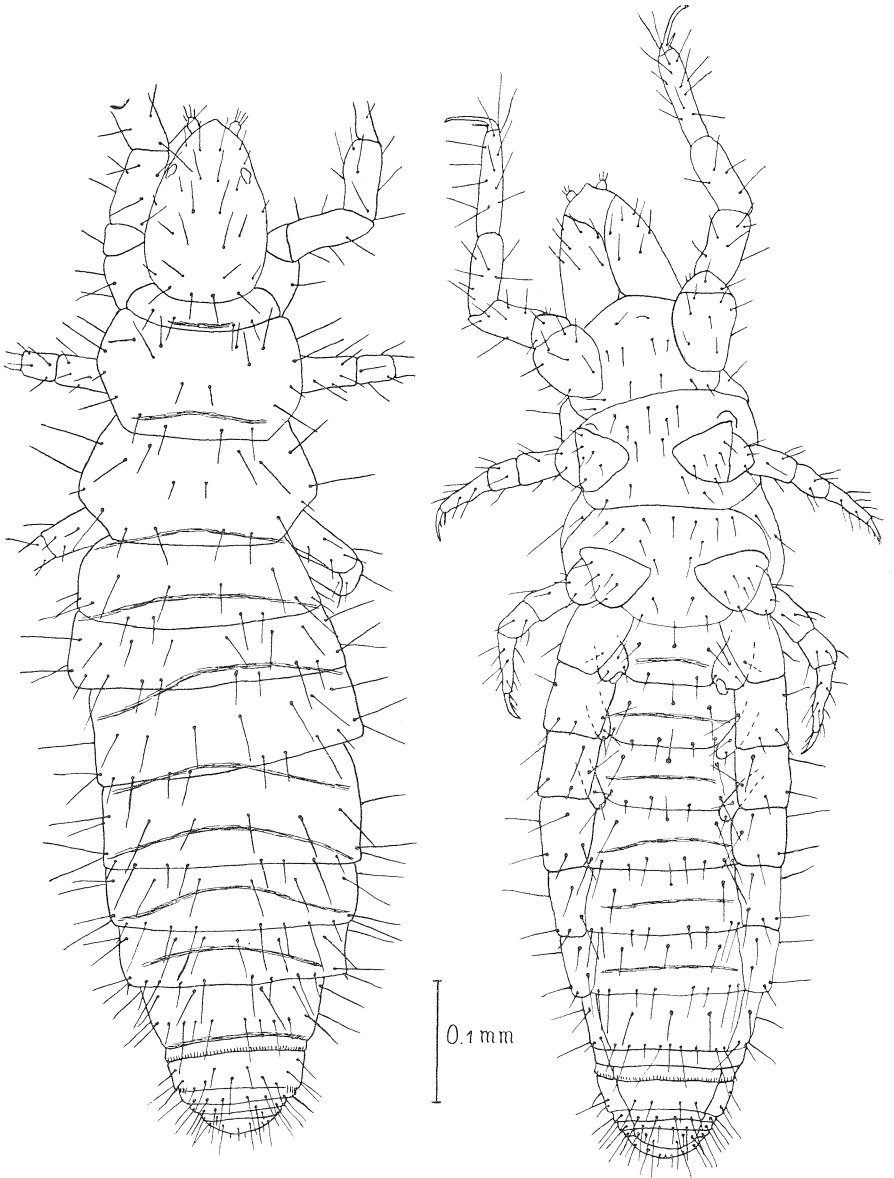
Chaetotaxy (figs. 12—13). The most outstanding feature in the chaetotaxy is the large size of the fine accessory setae in the posterior rows of the segments (1a,



Figs. 10—11: *Acerentulus canadensis* n. sp. Male and female genitalia.

2a) according to my numbering in 1949, fig. 19 p. 27); in most species known to me these setae are quite small, about one fourth of the principal setae, but in *canadensis* they are on all segments more than half the length of the principal ones, 1a often nearly as long as 1.

	Th. I	II	III	Abd. I	II-III	IV-VI	VII	VIII	IX	X	XI	XII
t	4	$\frac{6}{12}$	$\frac{6}{12}$	$\frac{4}{10}$	$\frac{8}{12}$	$\frac{8}{12}$	$\frac{6}{12}$	$\frac{4}{11}$	8	6	4	5
s	12	11	15	$\frac{3}{2}$	$\frac{3}{5}$	$\frac{3}{8}$	$\frac{3}{9}$	$\frac{4}{0}$	4	4	6	6
pl				1	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{1}$	1	1	1	



Figs. 12—13: *Acerentulus canadensis* n. sp. Dorsal and ventral chaetotaxy.

As in all known species of *Acerentulus* there is a certain variation in the chaetotaxy among specimens which must belong to the same species. In this case I have compared 14 specimens. In three of them the central seta in the posterior row of sternite VII ("s VII p c") was missing, in two of them five setae were found on sVIII. I should think that an even or uneven number of setae on these sterna would be good specific characters, but one must have a rather large material to avoid errors due to such individual variation.

Praelarvae and "larvae 1" (with 9 abdominal segments) are not found. In "larva 2" (with 10 abdominal segments) the anterior row on the abdominal terga is wanting as well as $\bar{1}_a$. In the matus junior (with 12 abdominal segments) likewise $\bar{1}_a$ in the abdominal terga is wanting, and also $\bar{3}$. The male praeimago is identical with the adult.

Holotype. ♀ Richardson Mountains, Canada, 25. 6. 1948; on the slide seen from the dorsal side. On the same slide another ♀ seen from the ventral side, a ♂, a ♂ praeimago, a matus junior, and a "larva 2". All drawings were made from specimens on this slide. The holotype and most of the material belong to the Zoological Museum of Copenhagen, some specimens, however, are being presented to U. S. National Museum, Washington, and to the Zoological Museum, Toronto.

For the characters distinguishing the species from the other species of *Acerentulus*, see the systematic chapter. It comes nearest to *aureitarsus* Ewing (a mounted specimen lent me by Dr. Grace Glance), the foretarsus of which is nearly identical with that of *canadensis*, but *aureitarsus* differs in the length of the accessory setae on the abdominal terga (quite small in *aureitarsus*), the chaetotaxy of sVIII ($\frac{4}{2}$ in *aureitarsus*), in tVI which has only six setae in the anterior row in *aureitarsus* (but this of course may be individual), in sVII where \bar{c} is wanting

in *aureitarsus* (also possibly an individual variation), and in the shape of the comb (fig. 8), in which in *aureitarsus* the innermost tooth is broad and with a small accessory tooth, the comb consisting of about seven teeth of which the central ones are smaller than the outer teeth.

Localities and biotopes. Most of the specimens were found at Reindeer Station, northern Canada ($68^{\circ} 42' \text{ N. } 134^{\circ} 08' \text{ W.}$), June 9th to 13th, 1948, at about 130 m above sea level, in moist localities with moss, *Cladonia*, *Empetrum*, cowberries and *Betula nana*, in Berlese samples. Some specimens including the type were found at Richardson Mountains, $68^{\circ} 24' \text{ N. } 135^{\circ} 37' \text{ W.}$, June 25th, 1948, in drier localities with *Dryas* etc. at about 600 m above sea level, also in Berlese-samples. All collected by Dr. Marie Hammer. For a description of the localities vide Hammer 1952 p. 9—15.

***Acerentulus condéi* n. sp.**

The other species of *Acerentulus*, which is also new to science, and which I propose to name after Dr. B. Condé, Nancy, the discoverer of the most important specific criterium in Protura, the sensillae of the foretarsus, is only represented by six specimens. It resembles in many respects *Ac. canadensis*, but is easily distinguished from it in the samples by the clavate, not setiform, t1 of the foretarsus. Other distinguishing characters are the shape of the comb and the chaetotaxy, especially of sVIII.

Length of body in adult about 0.8 mm, length and breadth of head 140μ and 90μ . Length of foretarsus 95μ , of claw 38μ , $\text{TR} = 2.5$.

Foretarsus. The specimens are mounted so awkwardly, that the foretarsus could not be drawn from the exterior side, but more oblique (fig. 14). Still from a comparison with fig. 5 the very close resemblance in size, shape and position of the sensillae to *canadensis* will be

seen, the only difference being found in the shape of t1 which here is distinctly clavate (as in *Ac. danicus*, figs. 1—2).

The comb of abd. VIII (fig. 15) possesses about 7 long teeth.

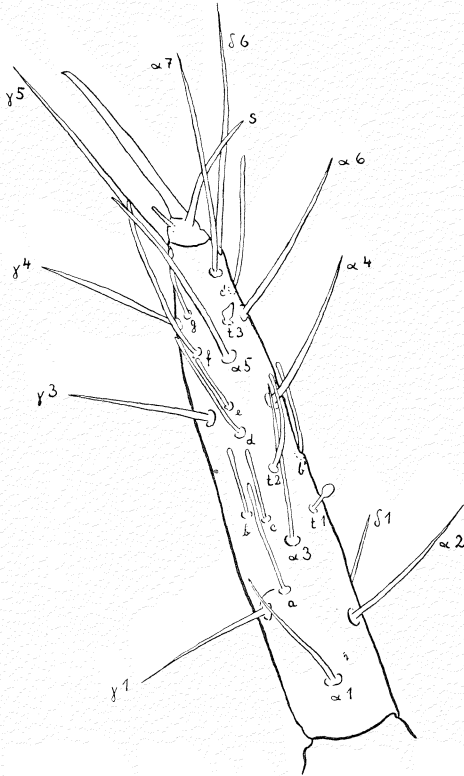


Fig. 14: *Acerentulus condéi* n. sp. Foretarsus obliquely from above.

Chaetotaxy (figs. 17—18). The fine accessory setae on the posterior rows of tergites and sternites are very small, about one fourth of the principal ones. Two setae in posterior row of sVIII; this row is entirely missing in *canadensis*. Otherwise as in *canadensis*.

Holotype. ♂ Richardson Mountains, northern Canada, $68^{\circ} 24' N.$ $135^{\circ} 37' W.$, 25. 6. 1948, on the slide seen from the dorsal side. On the same slide a maturus

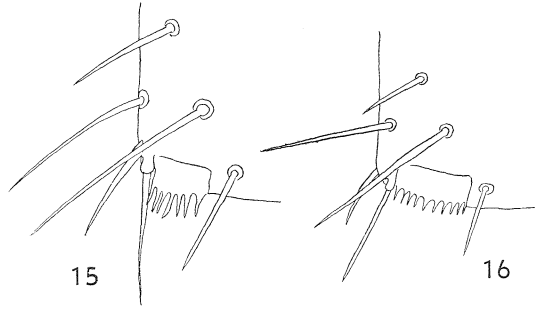
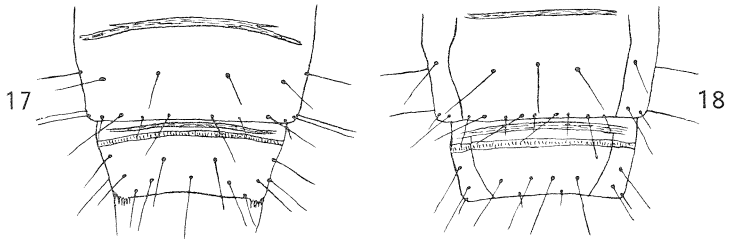


Fig. 15: *Acerentulus condéi* n. sp. Comb of VIIIth abd. segment. — Fig. 16: *Acerentulus danicus* Condé, the same.

junior. On another slide three "larvae 2" (one in moulting) and one maturus junior. All six specimens are from the same sample. Both slides belong to the Zoological Museum, Copenhagen. Nothing is known as to biotope.



Figs. 17—18: *Acerentulus condéi* n. sp. Dorsal and ventral chaetotaxy of VIIth—VIIIth abd. segments.

For the characters distinguishing *condéi* from the other *Acerentulus* species see the systematic chapter. It comes nearest to *danicus* Condé the sensillae of the foretarsus being in complete agreement; it differs, however in the chaetotaxy of sternite and tergite of abd. VIII (s_0^4 , t_{11}^2 in *danicus*; in my paper of 1949 I have given $\frac{2}{9}$, as I

had not reckoned the two setae outside the comb), and in the shape of the comb (fig. 16).

Eosentomon sp.

Finally one specimen of the genus *Eosentomon* was secured at Reindeer Station, Canada, June 9th, 1948, moist soil with lichens. It is, however, a "larva 2" (ten abdominal segments) and therefore indeterminable.

Systematic notes on *Acerentulus*.

In his catalogue of 1950 Rosas Costa mentions 30 species and 5 subspecies of *Acerentulus*. Of these *A. aubertoti* Condé must be deleted (Tuxen 1949) being a prae-larva of an unknown species, whereas since then *A. confinis aureus* Jon. has come to be regarded as an independent species by Condé (1950 p. 2), 7 new species and one subspecies have been described by Condé and da Cunha, and *Acerentomon delamareï* Condé was shown by its author to be an *Acerentulus* (Condé 1949 p. 9). Accordingly 38 species and 5 subspecies of *Acerentulus* are known at present. The distinguishing characters of the two new species from the species already known will be given below, but first I should like to give reasons for deleting two of them, *A. americanus* Hilton and *A. insignis* Condé (= *trågårdhi* Jon.), and I may say already now, that a study of Berlese's types revealed that *A. cephalotes* Berl. is nothing but a ♂ praeimago of *A. confinis* Berl. which will be shown in a later paper.

Acerentulus americanus Hilton was described by Hilton (1943 p. 20); the description is, however, very incomplete and may fit many species, and the drawings are very sketchy. Prof. W. A. Hilton, Claremont, California, on request very kindly told me that he did not possess specimens of the species any more, but that some specimens might be in the U. S. Nat. Mus., Washington. Dr. Grace Gance, however, tells me that this is not the case, and so it will forever be impossible to characterize the species, which, therefore, should be deleted from the catalogues.

Acerentulus trågårdhi Jon. was described by Jonescu (1937 p. 110) on five specimens from Uppland, Sweden. In 1946 Condé investigated the four specimens present in Statens Skogsforskningsinstitut, Stockholm, and realized that two of them belonged to the species *insignis* Condé (1945) and the two others were indeterminate. I have now seen the four specimens in question and am able to say with certainty that also the other two specimens belong to *insignis* Condé, which is very well characterized by the extremely long and basally broad sensilla b on the foretarsus. By means of the above mentioned numbering system of the hairs I was able to find this sensilla b also in the specimens with "orientation défectueuse" of the foretarsus on the slides. There is, of course, the possibility that the fifth specimen which was not seen by Condé and is not in Stockholm, might belong to another species, but as the four specimens belong to one species the probability of the fifth being different is slight; unfortunately Dr. M. A. Jonescu in Bukarest has not answered my letters as to the whereabouts of this specimen. Yet I think it is safe to state that *Acerentulus trågårdhi* Jon. 1937 = *insignis* Condé 1945, and though the description of the former is most insufficient it has priority over *insignis*.

There remain 35 species of *Acerentulus*. From the literature it seems possible to group these species into three groups according to the sensillae t 1—3 on the foretarsus, viz. 1° with t 1 clavate, 2° with t 1 long, thickly filiform and gently bowed, and 3° those in which we have no knowledge of the sensillae of the foretarsus. The last group contains a great number of species, but I have had the opportunity of seeing types of Berlese's and Silvestri's species (the description of which will be published in the nearest future) and paratypes of Ewing's and Bonet's species as well as specimens of *remyi* Condé v. *filisensillatus* Gisin, so I am able to reduce the number of species in this group considerably.

1°. Foretarsus known and t 1 clavate. To this group belong 19 species, viz.

<i>berberus</i> Condé 1948	<i>confinis</i> Berl. 1908
<i>bicolor</i> Ewing 1921	<i>cunhai</i> Condé 1950
<i>caldarius</i> Condé 1945	<i>danicus</i> Condé 1947
<i>catalamus</i> Condé 1951	<i>floridanus</i> Ewing 1924

<i>gerezianus</i> da Cunha 1952	<i>populeus</i> da Cunha 1952
<i>gracilis</i> Berl. 1908	<i>seabrai</i> da Cunha 1952
<i>kenyanus</i> Condé 1948	<i>trägårdhi</i> Jon. 1937 =
<i>ladeiroi</i> da Cunha 1950	<i>insignis</i> Condé 1945
<i>meridianus</i> Condé 1945	<i>travassosi</i> Silv. 1938
<i>paulinoi</i> da Cunha 1952	<i>tropicum</i> Bonet 1942

To this group belongs also the new species *condéi* from Canada, distinguished from the other species by the mutual position, size and form of the sensillae b-g of the foretarsus (very often for instance c and d are near together, d and e far from each other), the relation claw: tarsus (TR) of the foretarsus, the chaetotaxy of abd. VII and VIII, sternites and tergites, and the number and shape of the teeth in the comb of abd. VIII.

2°. Foretarsus known, t1 long, thickly filiform and gently bowed. To this group belong 7 species, viz.

<i>aureitarsus</i> Ewing 1940	<i>remyi</i> Condé 1944
<i>barberi</i> Ewing 1921	<i>tiarneus</i> Berl. 1908
<i>delamarei</i> Condé 1946	<i>tristani</i> Silv. 1938
<i>oculatus</i> Ewing 1921	

To this group belongs also the new species *canadensis* from Canada, distinguishable from the other species by the length of the empodium, the position and size of the sensillae, especially d and e, and the tarsal ratio, TR, of the foretarsus, the chaetotaxy of sternites and tergites of abd. VII and VIII, and the shape of the comb of abd. VIII. From *tiarneus* and *remyi* also by the "filamento di sostegno" which in these two species has an appendix in the form of a bunch of grapes.

3°. Foretarsus unknown. To this group belong 9 species, viz.

<i>aureus</i> Jon. 1930	<i>occidentalis</i> Wom. 1932
<i>australiensis</i> Wom. 1932	<i>sexspinatus</i> Wom. 1936
<i>capensis</i> Wom. 1932	<i>tillyardi</i> Wom. 1932
<i>macecephalus</i> Jon. 1933	<i>westraliensis</i> Wom. 1932
<i>muscorum</i> Jon. 1930	

The distinguishing characters for the two new species must be sought in the tarsal ratio, TR, of the fore-

tarsus and the sternal and tergal chaetotaxy of abd. VIII, but with every reservation for the variability of these two characters.

Summary.

Two new species are described, the first Protura known from Canada. A system is proposed for numbering and thus identifying the setae on the foretarsus. *Acerentulus americanus* Hilton, *insignis* Condé and *cephalotes* Berl. are proposed to be deleted from the catalogues for different reasons and the species known till now arranged after the sensillae t1—3 on the foretarsus.

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