ANNALES ZOOLOGICI (Warszawa), 2000, 50(3): 347-361

DESCRIPTION OF LARVA OF *PODOTHROMBIUM FILIPES* (C. L. KOCH, 1837) (ACARI: ACTINOTRICHIDA: TROMBIDIIDAE) WITH NOTES ON VARIABILITY, ANOMALY AND THEIR IMPLICATIONS FOR CLASSIFICATION OF *PODOTHROMBIUM* LARVAE

JOANNA MĄKOL

Department of Zoology, Agricultural University of Wrocław, Cybulskiego 20, 50-205 Wrocław, Poland, e-mail: makol@ozi.ar.wroc.pl

Abstract.— A series of larvae of *Podothrombium* reared in laboratory culture was subject to morphometric analysis. Larvae were assigned to *P. filipes* (C. L. Koch, 1837) a species known hitherto only from postlarval instars. An array of anomalies in the chaetotaxy of various body regions was discovered. The results make it possible to re-consider the taxonomic suitability of some characters commonly used in diagnosing larvae of *Podothrombium*.

Key words.— acarology, Parasitengona, Trombidiidae, *Podothrombium*, *Podothrombium filipes*, larvae, variability, anomaly, classification.

INTRODUCTION

Podothrombium Berlese, 1910 comprises 50 nominal species, of which only 2 have been hitherto known from larvae and postlarval stages and as many as 13 are known exclusively from larvae. When classifying larval species of *Podothrombium*, like with other Parasitengona, characters pertaining to the chaetotaxy of idiosoma and legs as well as several metric characters applying to various structures are treated as main diagnostic features. Very little is known about variability of morphological characters, since most larval species have been described based on single (1–4) specimens. In the only two species where more than 10 individuals were examined (*P. exiguum*, in: Fain and Ripka 1998, *P. tymoni*, in: Haitlinger 1994, 1995a), the total number of specimens, which served as a basis for taxonomic description did not exceed 18.

Data on morphological anomalies in Parasitengona larvae are relatively scarce. In his review of abnormalities observed in Parasitengona mites Southcott (1997) listed representatives of 17 species known from larvae. No data concerning the Trombidiidae *sensu* Welbourn (1991) and Zhang (1995) were provided.

The present paper contains the results of morphological studies, carried out on homogenous series of larvae obtained by experimental rearing. The main objective of the study was establishing the variability range of characters, which are commonly used in species descriptions. However, in each larva obtained at least one anomaly was detected. In relation to several characters observed, a question of the border between anomaly and variability and their impact on classification arose.

Despite the fact that the variation observed among the larvae (see below) casts doubt on commonly accepted diagnostic characters, an attempt was made at identifying the adults to species level. Both the female and the other adults collected at the same locality were assigned to *P. filipes* (C. L. Koch, 1837) according to Berlese (1912) and Oudemans (1937).

MATERIALS AND METHODS

The larvae of *P. filipes* were obtained by experimental rearing from a female [SF/1058 – H454/1997] collected together with other conspecifics by the author on the territory of Finland [28.09.97, 6684:207 Nauvo, Koum, Strandbyviken, S-shore, decaying reed on seashore]. The female was kept in a rearing vial filled with the charcoaled Plaster-of-Paris. A small amount of soil and plant debris (previously checked for the presence of eggs) was added in order to vary the surface. The time of collecting confirmed the suggestion that eggs could constitute a diapausing instar in *Podothrombium* (Wohltmann, personal communication; Mąkol, unpublished data). Therefore, after three days of keeping at room temperature, the vial was transferred to the refrigerator and left there for 265 days (till June 22nd, 1998). The lowest temperature recorded inside the refrigerator during that period was: –9.2°C (in the collecting place the coldest period of winter 1997/1998, with the temperature between –8°C and –12°C, was recorded on the turn of January and February).

On the 21st of October, orange-coloured eggs were detected. They were scattered individually all over the sub-

stratum and "wrapped" in a thin soil and debris layer. The female died within a few days after oviposition. After 244 days of chilling, the eggs were transferred to room temperature. The first larvae emerged in July, 22 days after the vial was removed from the refrigerator. The last larva appeared 7 days after the first one. Altogether 26 larvae were obtained. No undeveloped eggs were found. Till the oviposition and after removing from the refrigerator the content of the vial was checked daily, in the remaining period – every 7–10 days.

The material was preserved in 70–75% ethyl alcohol. Specimens that served for light microscope studies were fixed on slides in Faure's fluid after maceration in Nesbitt's fluid. Drawings and measurements were made under Jenaval and Biolar microscopes, respectively. Several specimens (5) were used for scanning electron microscope studies. Photographs of selected morphological structures were taken in SEM LEO 435VP, following drying at critical point (Balzers CPD 010) and gold-coating (Edwards Scancoat Six, Pirani 501).

The terminology applying to morphological structures was adopted after Mąkol and Wohltmann (2000). In selection of the characters set subject to discussion I followed Fain and Ripka (1998), Feider (1968), Haitlinger (1994, 1995a, 1995b), Thor (1930), Robaux (1977), Robaux and Schiess (1982), Zhang and Jensen (1995), Zhang and Xin (1989).

In case of leg chaetotaxy both right and left legs were taken into account. Poorly visible details or structures damaged during preparation were excluded from the analysis.

All measurements are given in micrometers (μm). The larvae of *P. filipes* originating from laboratory culture are in author's collection.

DESCRIPTION OF LARVA OF *Podothrombium filipes* (C. L. KOCH, 1837)

The morphometric data and data on leg chaetotaxy of studied specimens as well as the list of anomalies and/or variations observed are given in Tables 1, 2 and 3 respectively.

Gnathosoma. Body in life orange with red eye-spots. Habitus as in Fig. 1. Subcapitular setae (*bs*) branched (Figs 2, 13), the branches show a considerable variation; they are very distinct in some specimens and barely visible in others. *fch* = 1–0. Cheliceral blade slightly curved, with one small tooth-like process in the distal end of internal edge of blade. Setae *cs* short, acicular. The pedipalp formula varies from fP_ρ = 0-B-B-BBN-4B3ζ3ω to fP_ρ = 0-B-B-BBN-4B3ζ2ω and comprises one slightly barbed seta on palpfemur and palpgenu, three setae on palptibia, one of which, placed closely to palptibial claw is probably a specialized seta and nine to ten setae on palptarsus (Fig. 3). Palptibial claw single. Ventral seta on PaTa with two relatively well developed barbs (Fig. 3).

Aspidosoma. Scutum pentagonal in outline, with well marked anterior process. AM setae with relatively fine branches (Fig. 4). Distinct setulae on AL and PL setae. Sensillae (S) with very tiny branches (Fig. 5), the latter being invisible in light microscope because of their size. Two pairs of eyes at the level of posterior edge of scutum, each pair situated on the oval sclerite and slightly protruded above the idiosoma surface (Fig. 6). Anterior lens similar in size to the posterior one but less protruded than the latter.

Opisthosoma. The cuticle on surface of opisthosoma forms distinct tubercles with wave-shaped folds between them. All setae (except for those on scutellum) covered with barbs and placed on tubercle-like platelets, which are slightly bigger and more asymmetrical than those covering the surface of opisthosoma (Fig. 7). Dorsal setae arranged in distinctly separated rows. The border between C and D rows well marked (Figs 1, 11). The total number of setae in rows C and D (including two setae on scutellum) not stable, ranges from 18 to 23 in various specimens. The total number of setae in formula *f*D: 40 – 48. From 12 to 18 setae in *f*V formula. The shafts of ventral setae slightly thinner than on dorsal side of idiosoma, also covered with barbs (Figs 7, 12). The lowest value of NDV: 56, the highest: 65. Uropore surrounded with membraneous valves.

Podosoma. *fst* = 0-0-B. A pair of sternalae is bound to occur at the level of Cx III (see Remarks and Fig. 8). Urstigma elongated, situated between Cx I and Cx II (Fig. 9). *fcx* = NBB-B-B (supracoxala included in the formula; see also Discussion).

Leg segmentation formula: 6-6-6. For leg chaetotaxy: see Table 2 and Figs 14–16.

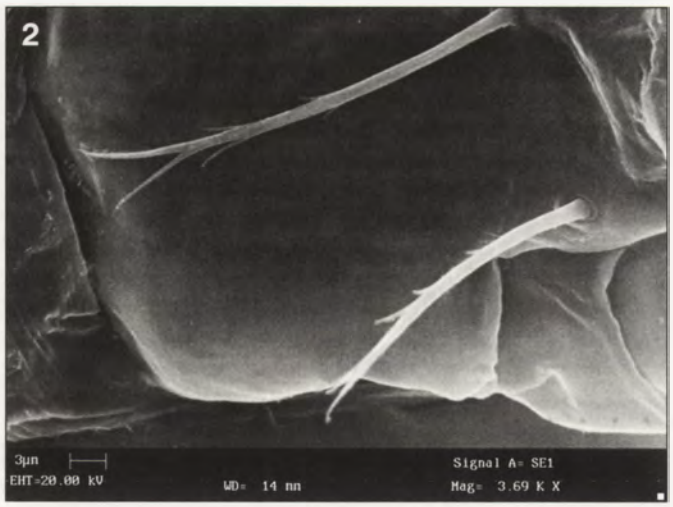
Remarks. Among the characters studied in the series of larvae obtained by experimental rearing there are several which call for special attention. This applies mostly to characters, which display symptoms of teratology.

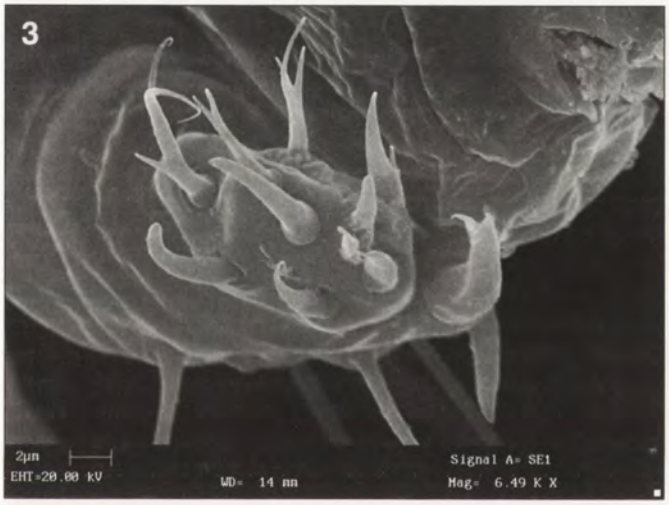
The observed anomalies within the scutum involve only AL setae and consist in their duplication (Figs 17–21).

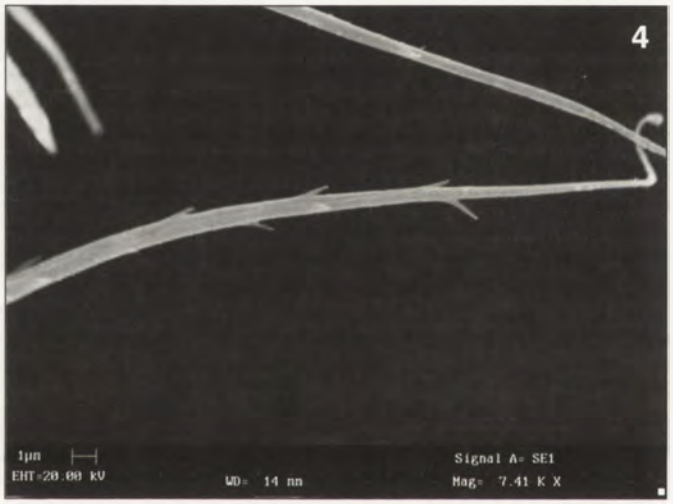
In each of the examined specimens there are either no sternalae at the level of Cx III, or there is only one sternala (Fig. 8). In the whole series there are no specimens with two developed sternalae.

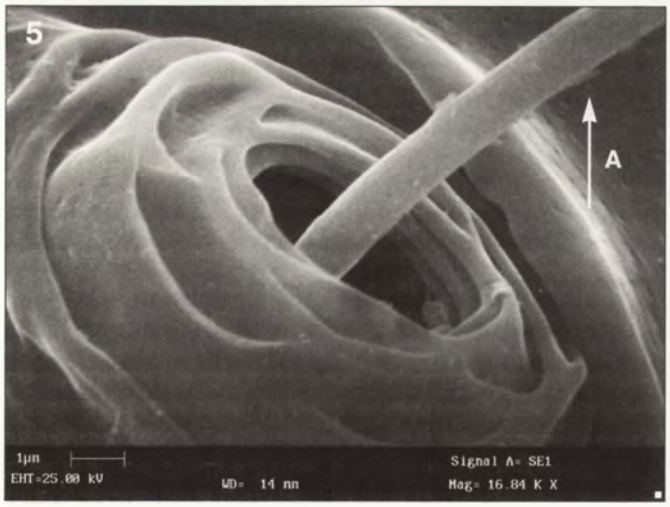
The lack of seta on Cx II involves specimens in which only one coxa is devoid of setae, while on the other coxa of the second pair there is one seta.

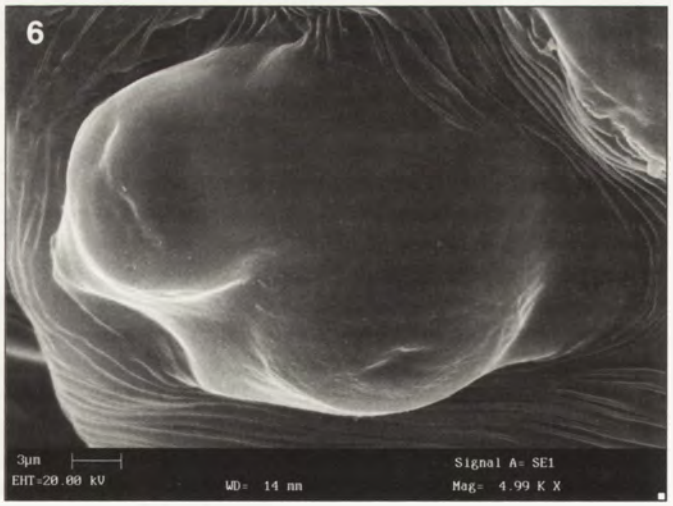
The variation in the number of normal and specialized setae is observed also on various leg segments (see Tables 2–3 and Figs 22–46). An especially wide variation involves the number of solenidia as well as the way of their development on Ta I and Ta II (Figs 22–31). In as many as 17 specimens out of 21, the state of solenidia differs between the left and right Ta I. Very often (in 19 cases out of 42) the solenidion located closer to the base of Ta I is partly divided; in no case is there any division of the solenidion located closer to the terminal part of Ta I. In one case one solenidion on Ta I is partly divided, while the other two are undivided, in two cases the only solenidion is divided; in all the remaining cases (16) the division involves one of the two solenidia. A divided, single solenidion is observed in one case on Ta II (Fig. 30). Also in one case a solenidion instead of n seta is present on Fe I.



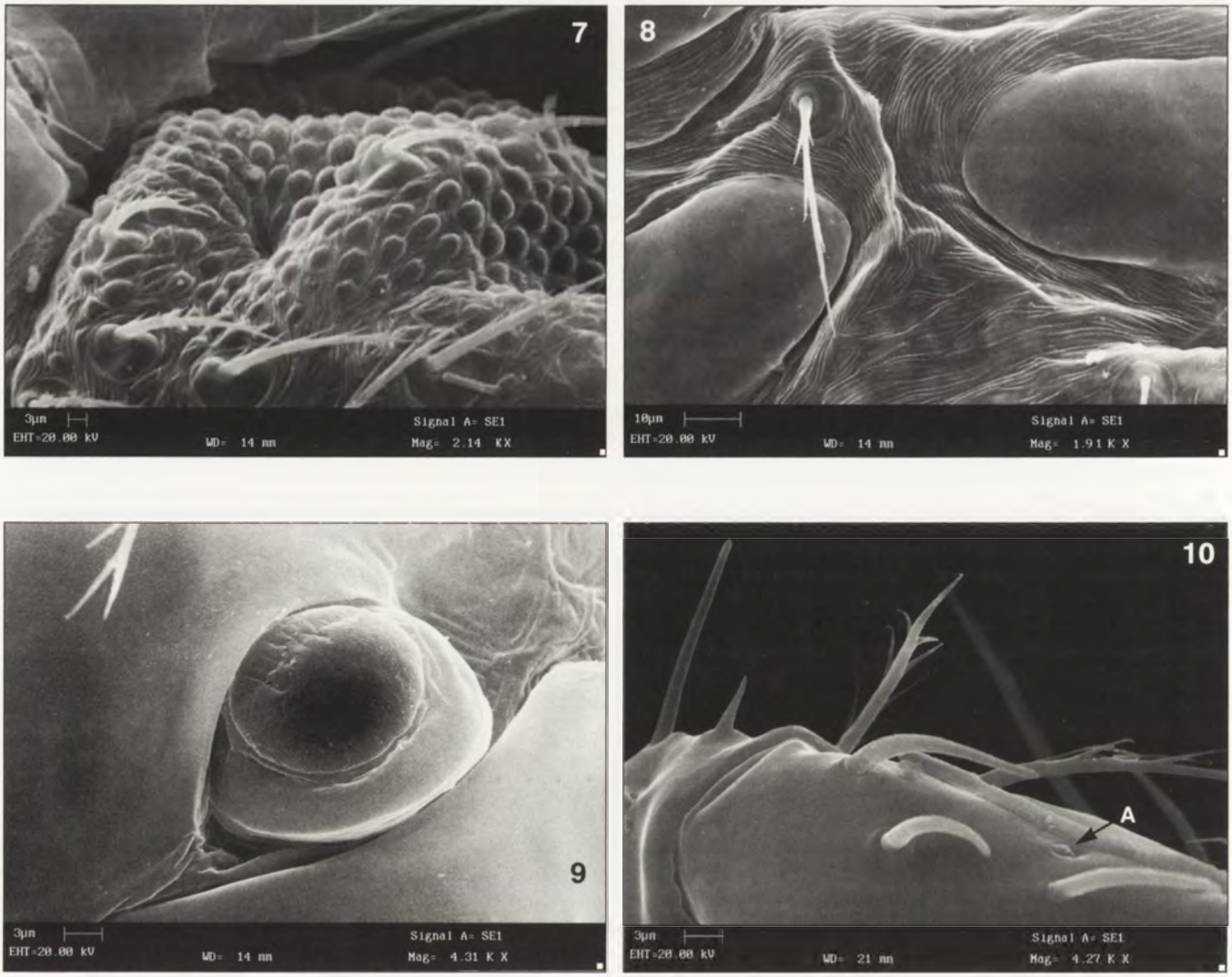








Figures 1–6. *P. filipes*, larva, SEM photographs. (1) dorsum, general view, (2) subcapitular setae, (3) distal end of palp, (4) AM seta, (5) base of S seta (A – setula), (6) eye.



Figures 7–10. *P. filipes*, larva, SEM photographs. (7) surface of opisthosoma on ventral side of the body, (8) sternala, (9) urstigma, (10) tarsus I (A – position of not developed famulus).

There is no famulus on Ta I, however the position of not developed seta is indicated by small tubercle placed in the integument alveolus (Fig. 10). Famulus on Ta II shows a varied distribution in relation to solenidia on Ta II (Figs 27–31). In one case a famulus is observed also on one of tarsi III.

Only leg segments Tr II, Tr III, Fe III and Ti II display no variation in the number and quality of setae.

DISCUSSION

Larvae originating from the laboratory culture, examination of which induced me to attempt a broader discussion of larvae of *Podothrombium*, displayed characters which should be regarded as teratological. The observed deviations from the normal character states, not found in other Parasitengona larvae (e.g. *Trombidium holosericeum*, see Mąkol and Wohltmann 2000) involved most probably those characters whose ontogenetic development was affected by improper temperature. However, the present state of knowledge does not allow a univocal decision to what extent such anomalies can occur when incubation takes place under natural conditions. In this light very important point was an attempt to estimate the variability of characters and to indicate possible "inaccuracies" which may be associated with describing new taxa on the basis of single specimens.

In his computer based cladistic analysis of Trombidiidae, Zhang (1995) took into account the characters of larvae representing four described and one undescribed species assigned to *Podothrombium*. The characters listed included the presence of a nude posterior seta on palptibia (as opposed to a barbed one), the ventral seta on palptarsus with many barbs (as opposed to seta "with reduced barbs or without barbs"), the presence of a nude sensilla (as opposed to a barbed one) and the presence of 5 normal setae on femur II (as opposed to 4 normal setae). The results of my analysis provide a basis for verification of states of characters adop-

Character	Sample size	Mean	Minimum	Maximum	Standard deviation	Coefficient of variation
L	21	410.20	374.85	448.35	21.632	5.27
W	21	265.30	242.55	286.65	13.332	5.03
L_W	21	1.55	1.42	1.64	0.056	3.61
AA	13	30.92	25.74	35.64	2.974	9.62
AW	14	84.86	79.20	89.10	3.547	4.18
PW	19	97.96	91.08	106.92	4.346	4.44
SB	20	48.31	43.56	53.46	2.601	5.38
ASB	19	77.85	69.30	85.14	4.017	5.16
PSB	19	41.79	37.62	49.50	2.944	7.04
AP	22	31.95	27.72	37.62	2.885	9.03
AM	16	48.76	41.58	55.44	3.533	7.25
AL	29	62.68	47.52	77.22	6.986	11.15
PL	24	61.96	45.54	75.24	6.488	10.47
S	13	100.37	95.04	106.92	3.738	3.72
MA	16	55.07	45.54	63.36	5.020	9.12
HS	13	41.12	35.64	45.54	3.629	8.83
LSS	15	65.34	55.44	73.26	4.850	7.42
SL	20	50.89	45.54	57.42	2.951	5.80
SS	20	40.00	35.64	49.50	3.495	8.74
Cx_I	37	74.87	65.34	83.16	5.214	6.96
Tr_I	40	35.05	29.70	43.56	2.660	7.59
Fe_I	39	75.75	63.36	85.14	5.311	7.01
Ge_I	39	36.25	31.68	41.58	2.655	7.32
Ti_I	37	56.83	47.52	63.36	3.457	6.08
Ta_I	42	97.82	87.12	104.94	3.738	3.82
LEG_I	27	376.05	356.4	394.02	10.913	2.90
Cx_II	42	80.24	65.34	91.08	6.063	7.56
Tr_II	35	34.28	29.70	39.60	2.576	7.51
Fe_II	30	66.53	59.40	73.26	3.807	5.72
Ge_II	35	31.03	27.72	36.66	2.109	6.80
Ti_II	41	51.24	45.54	61.38	3.042	5.94
Ta_II	42	86.88	77.22	97.02	4.267	4.91
LEG_II	23	350.68	320.76	378.18	13.263	3.78
Cx_III	37	76.20	69.30	81.18	3.287	4.31
Tr_III	37	36.42	29.70	45.54	3.243	8.90
Fe_III	29	74.22	67.32	81.18	3.246	4.37
Ge_III	29	34.00	29.70	39.60	1.985	5.84
Ti_III	30	61.25	49.50	67.32	3.160	5.16
Ta_III	38	91.08	81.18	99.00	4.269	4.69
LEG_III	15	373.16	356.40	388.08	9.069	2.43
IP	8	1097.17	1057.30	1160.30	34.357	3.13

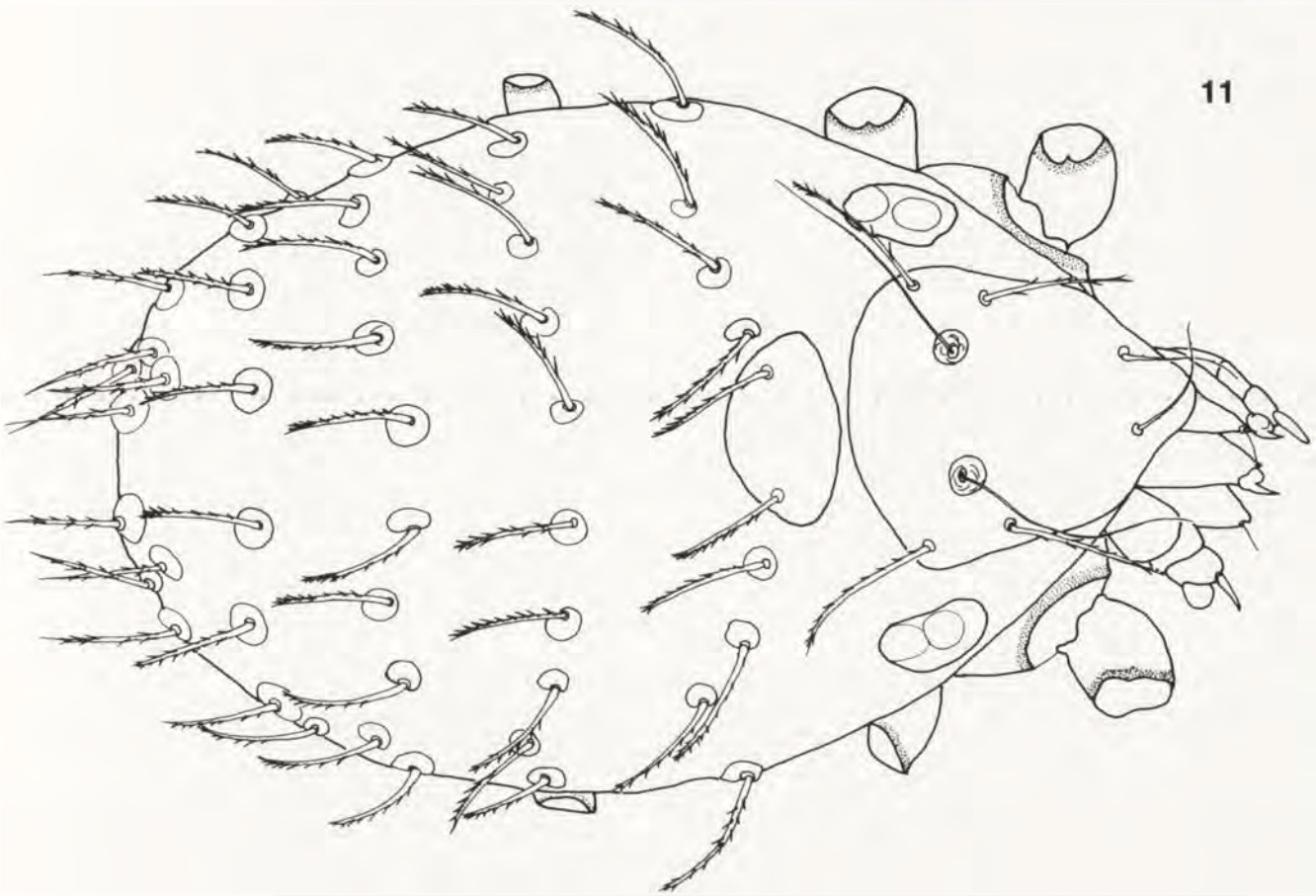
Table 1. Morphometric data on larvae of *P. filipes*.

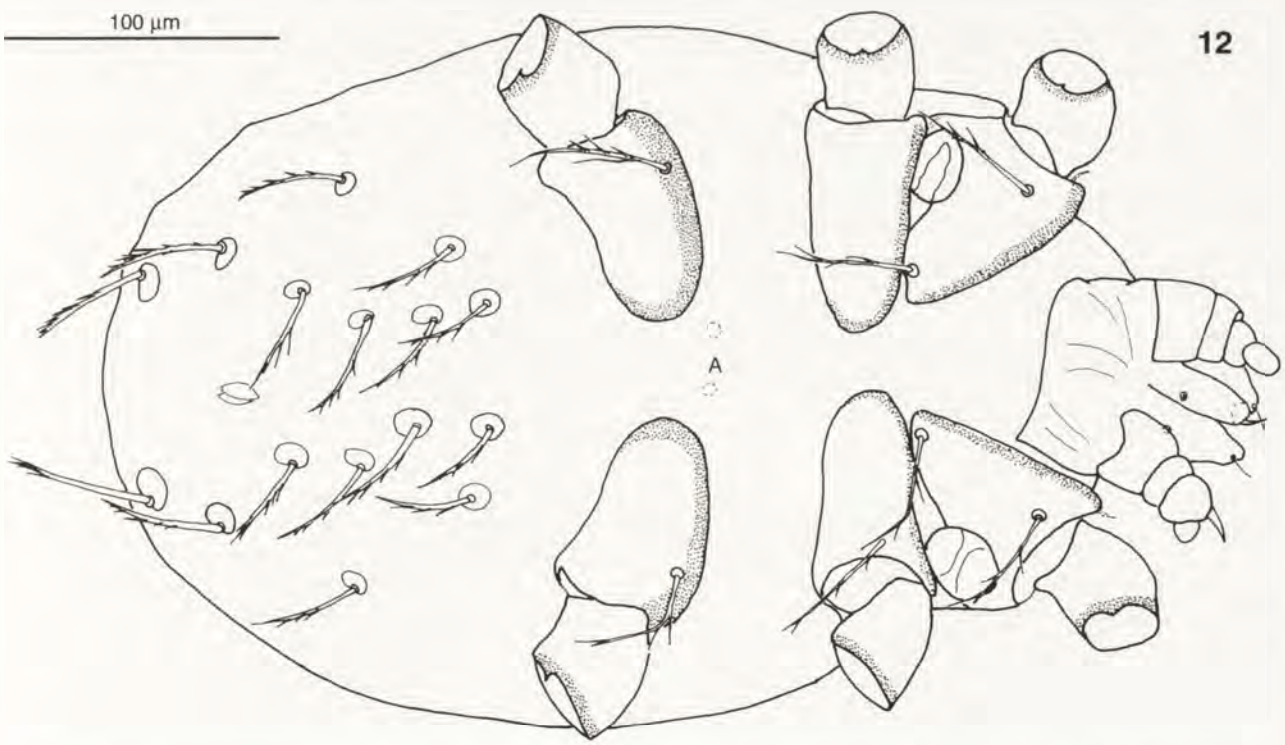
Leg segments	Setae	Leg I	Leg II	Leg III
Tr	n	1–2	1	1
Fe	n	4–6	3–4	4
	θ	0–1	0	0
Ge	n	3–5	2–3	3–4
	σ	2–4	1	1
	κ	1	1	0
Ti	n	5–6	5	5–6
	φ	2	2	0–1
	κ	1	0	0
Ta	n	25–30	17–24	17–21
	ζ	6–8*	0–1	0
	ω	1–3	1–2	0
	ε	0	1	0–1

Table 2. Leg chaetotaxy of larvae of *P. filipes*. * dorsal eupathidium not included

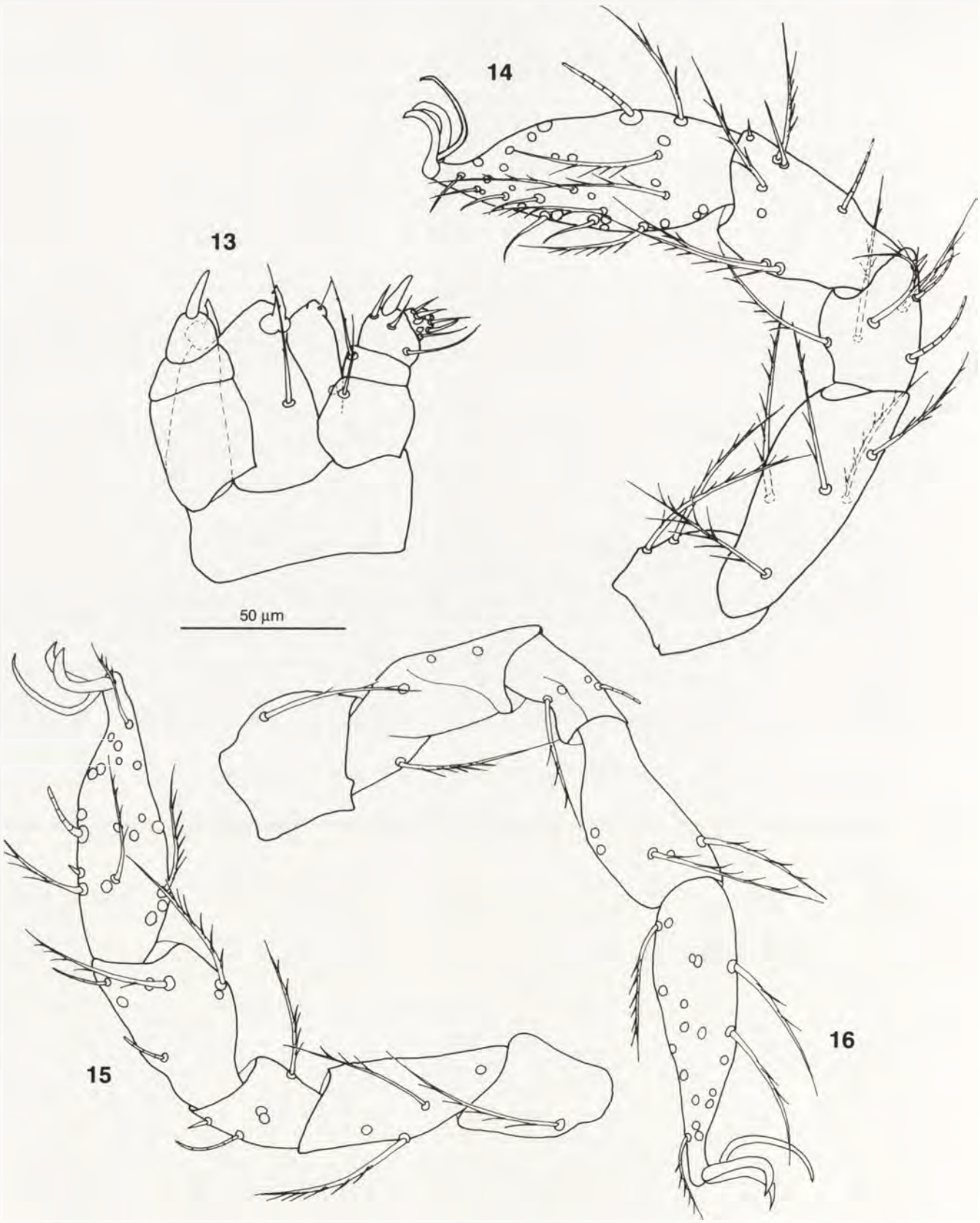
Character (anomaly/variation)	Number of cases	% of cases studied
Duplicated AL seta	9	41
Number of setae in row C on dorsal body side (excl. two setae on scutellum): 10 setae (a), 9 setae (b), 8 setae (c), 7 setae (d)	(a) 8 (b) 2 (c) 5 (d) 5	(a) 40 (b) 10 (c) 25 (d) 25
Lack of seta on one of Cx II	2	5
Lack of sternalae (a) or the presence of only one sternala (b)	(a) 17 (b) 2	(a) 89 (b) 11
Presence of 1 (a) or 2 (b) n setae on Tr I	(a) 37 (b) 1	(a) 97 (b) 3
Presence of 4 (a), 5 (b) or 6 (c) n setae on Fe I	(a) 2 (b) 33 (c) 1	(a) 5 (b) 92 (c) 3
Presence of solenidion and 4 n setae (instead of 5 n setae) on Fe I	1	3
Presence of 3 (a) or 4 (c) n setae on Fe II	(a) 1 (b) 39	(a) 2 (b) 98
Presence of 3 (a), 4 (b) or 5 (c) n setae on Ge I	(a) 6 (b) 27 (c) 4	(a) 16 (b) 73 (c) 11
Presence of 2 (a), 3 (b) or 4 (c) solenidia on Ge I	(a) 22 (b) 13 (c) 1	(a) 61 (b) 36 (c) 3
Presence of 2 (a) or 3 (b) n setae on Ge II	(a) 1 (b) 39	(a) 3 (b) 97
Presence of 3 (a) or 4 (b) n setae on Ge III	(a) 28 (b) 3	(a) 90 (b) 10
Presence of 5 (a) or 6 (b) n setae on Ti I	(a) 38 (b) 2	(a) 95 (b) 5
Presence of 5 (a) or 6 (b) n setae on Ti III	(a) 35 (b) 1	(a) 97 (b) 3
Presence of solenidion on Ti III	5	14
Presence of 1 (a), 2 (b) or 3 (c) solenidia on Ta I	(a) 6 (b) 25 (c) 11	(a) 14 (b) 60 (c) 26
Presence (a) or lack (b) of dorsal eupathidium on Ta I	(a) 26 (b) 5	(a) 84 (b) 16
Presence of 1 (a) or 2 (b) solenidia on Ta II	(a) 3 (b) 39	(a) 7 (b) 93

Table 3. Anomalies and/or variations observed in larvae of *P. filipes*.

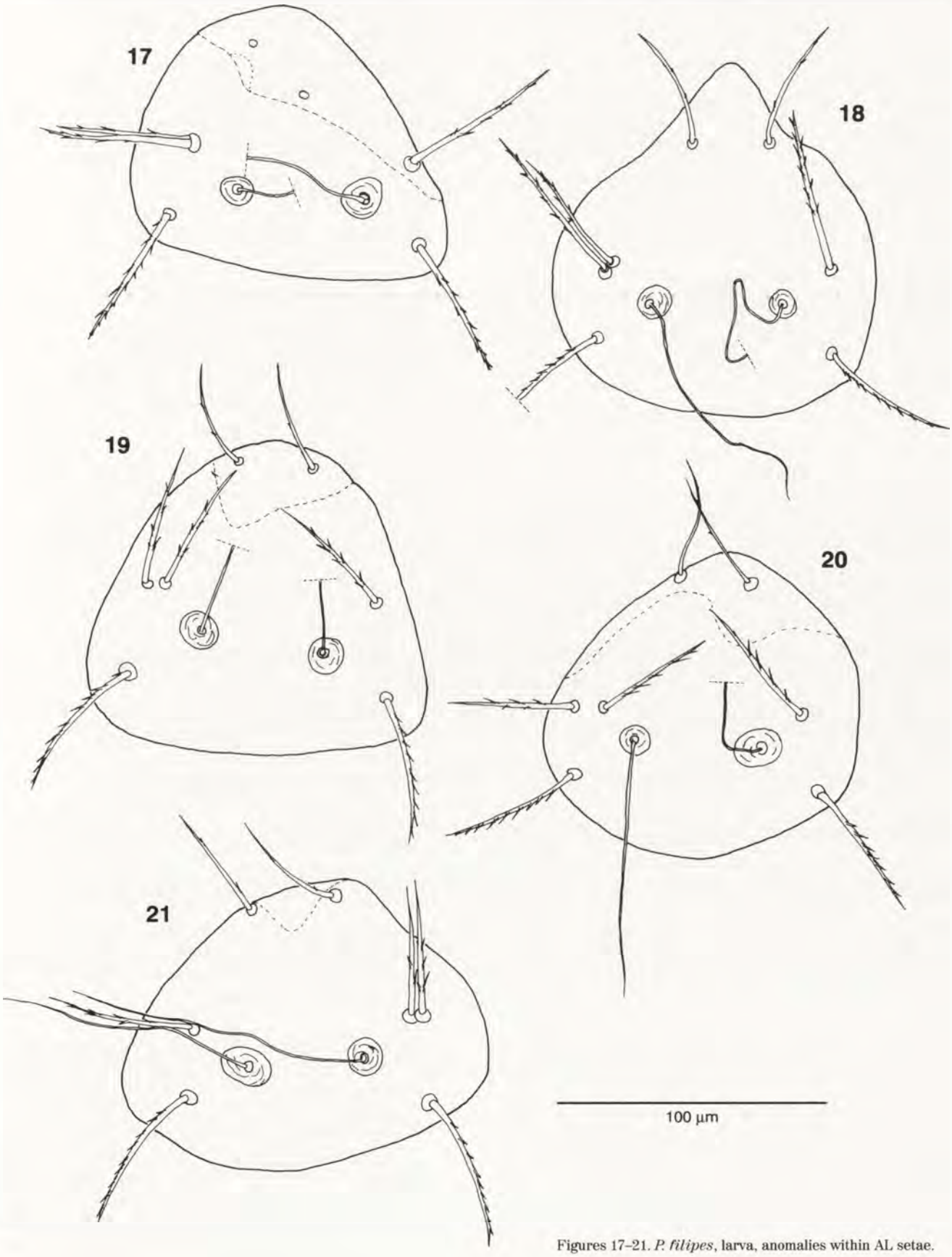




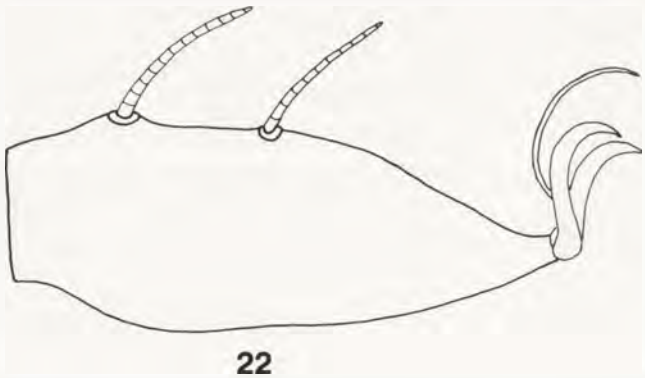
Figures 11–12. *P. filipes*, larva. (11) dorsal view, (12) ventral view (A – position of not developed sternalae marked with dots).

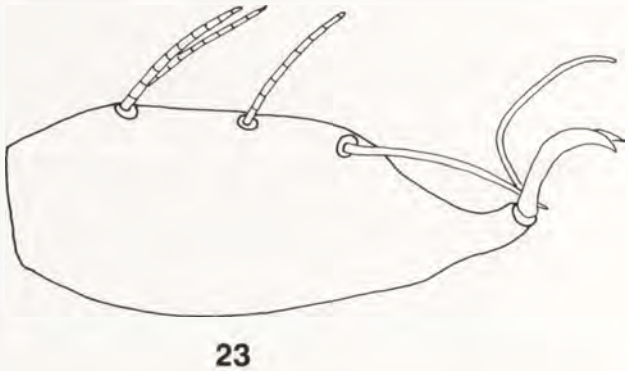


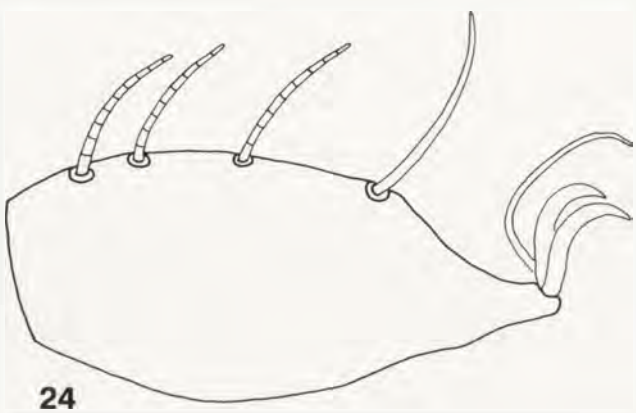
Figures 13–16. *P. filipes*. (13) gnathosoma, (14) leg I (trochanter – tarsus), (15) leg II (trochanter – tarsus), (16) leg III (trochanter – tarsus).

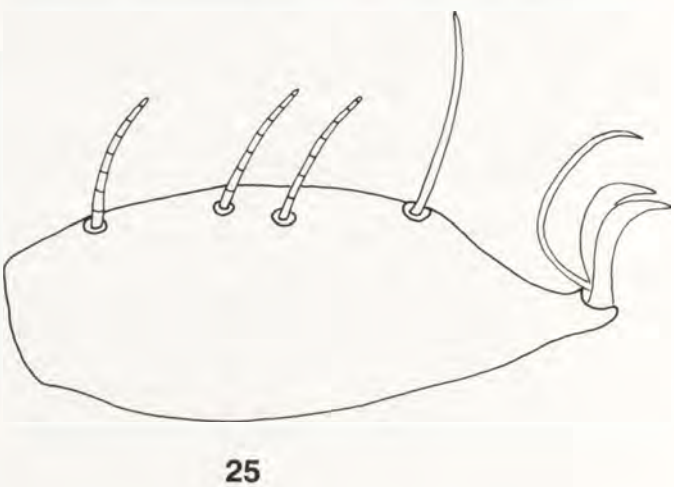


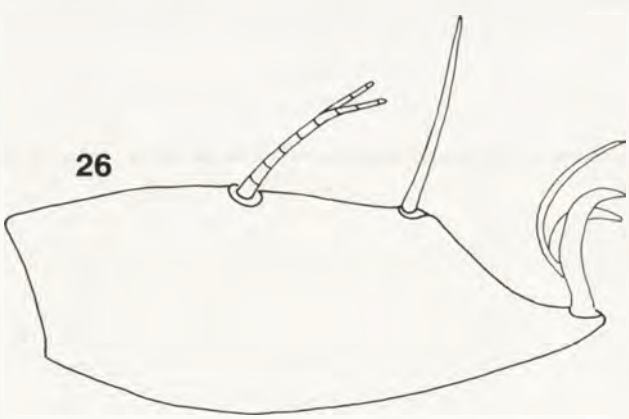
Figures 17–21. *P. filipes*, larva, anomalies within AL setae.

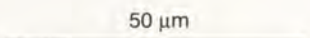












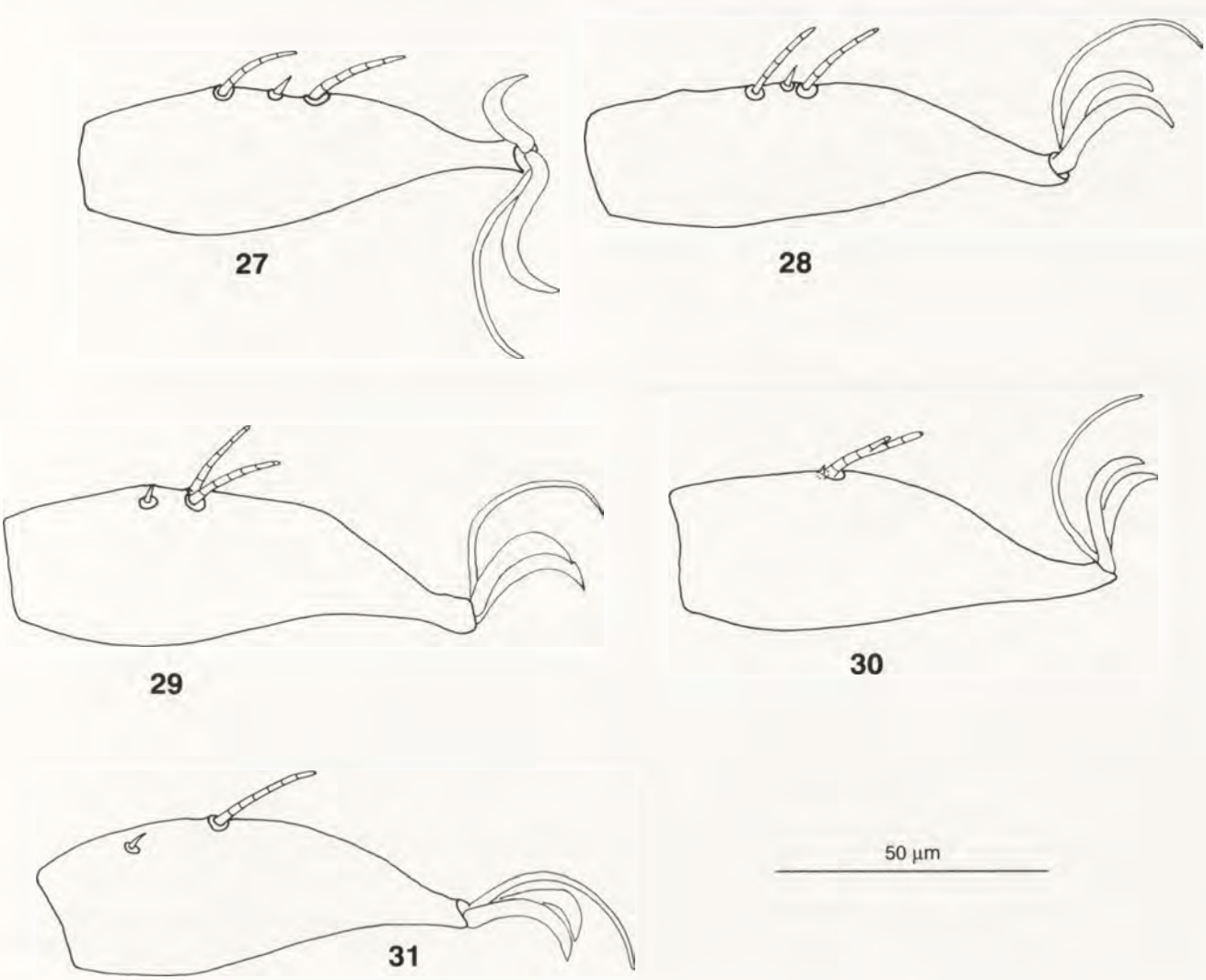
Figures 22–26. *P. filipes*, larva, variation and/or anomaly in the presence, number and position of solenidia and dorsal eupathidium on tarsus I (other setae not marked).

ted for larvae of *Podothrombium*, which may affect the picture of relationships within the Trombidiidae proposed by Zhang (1995).

The results of morphometric analysis of a homogenous series of specimens make it also possible to estimate the applicability of at least some of the metric characters commonly used in the process of diagnosing and describing species of the genus *Podothrombium*, based on larval stages.

The basic measurements of the body such as L and W (not L and W *sensu* Southcott 1986) depend on the degree of filling of alimentary tract of the larvae and as a rule are not included in species characteristics. Stating L and W values may be informative only with respect to freshly emerged larvae, which have not started their parasitic phase.

Among metric characters of particular diagnostic value may be those that display a relatively narrow variation (the value of CV = 5). The analysis of the model series allows, for example, to include in such characters not only values of AW, PW, S, Ta I, Ta II, Cx III, Fe III, Ta III, the total length of leg I, II and III, but also IP. However, some of these

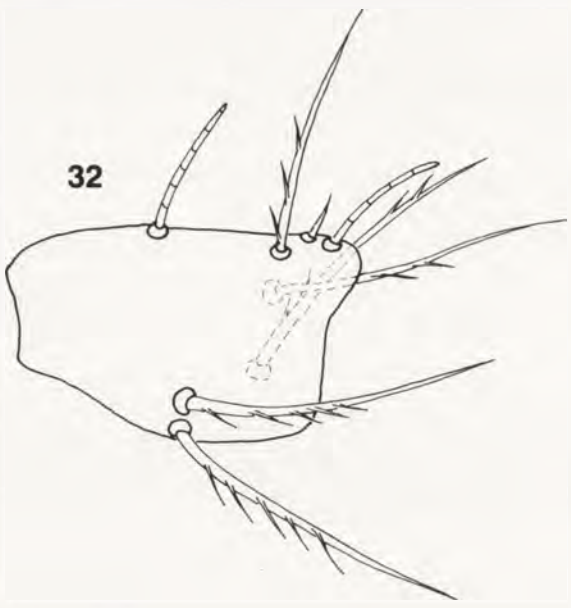


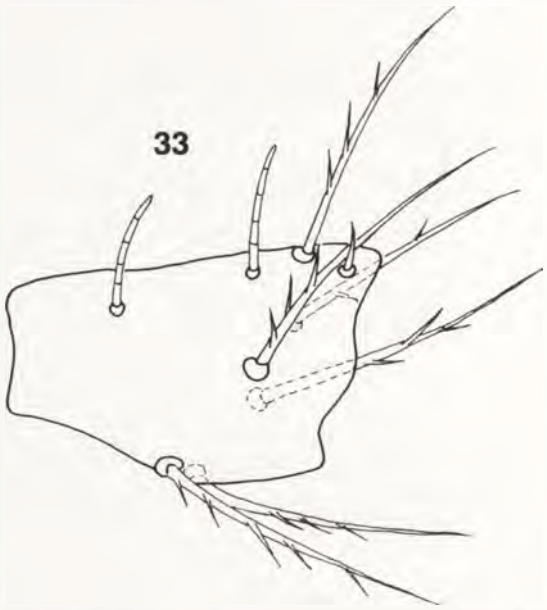
Figures 27–31. P. filipes, larva, variation and/or anomaly in the presence, number and position of famulus and solenidia on tarsus II (other setae not marked).

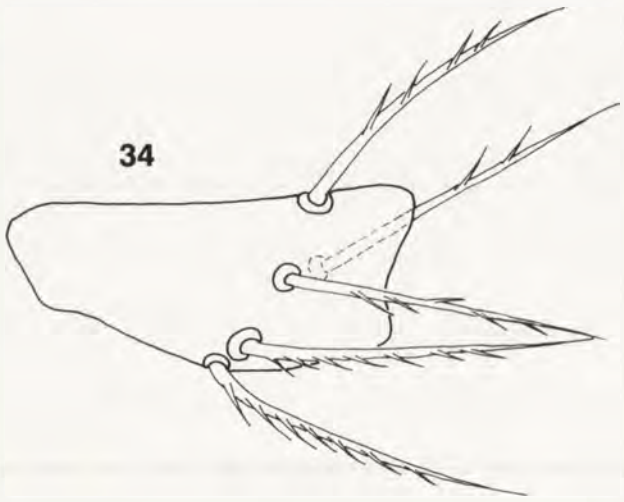
characters (e.g. leg measurements) clearly loose their diagnostic value when their ranges overlap.

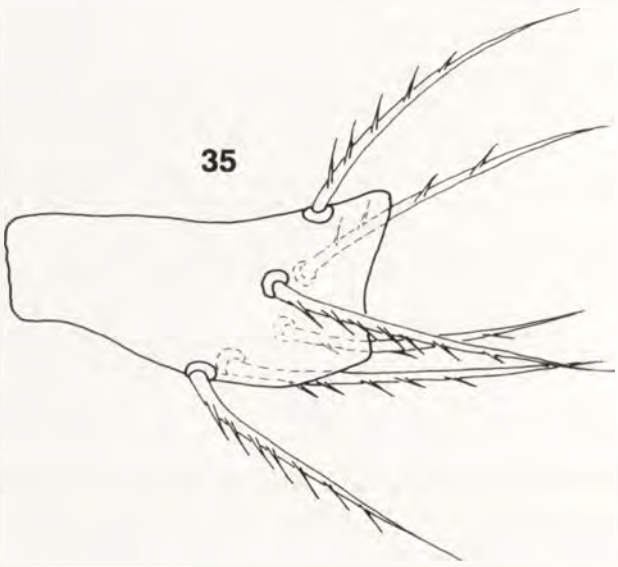
Gnathosoma. The shape of subcapitular setae (hypostomalae) is similar in all the hitherto described species of *Podothrombium*. These setae are simple and vary from nude or nearly so (within one species) to setulose. Moreover, the state of the character is difficult to evaluate in light microscope, therefore it should not be treated as diagnostic unless scanning microscopy becomes routinely applied. The number of setae on palptarsus seems to be a specific character but, like the previous one, difficult to interpret while being observed only in the light microscope.

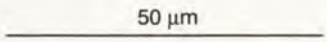
Aspidosoma. The main diagnostic characters within aspidosoma and applied in descriptions of species – members of *Podothrombium* include the structure of AM, AL, PL and S setae as well as metric values of characters located within scutum. AM setae are covered with fine setulae in most known species (see Fain and Ripka 1998, Haitlinger 1994, 1995a, 1995b, Thor 1930, Robaux 1977, Robaux and Schiess 1982, Zhang and Xin 1989). In *P. crassicristatum* and *P. sylvicolum* the setae are reported to be smooth (Feider 1968, Zhang and Jensen 1995). The same setae have not been characterized in the original description of *P. dariae* (Haitlinger 1995b), however it follows from the figure that they are smooth. The condition of the type specimen does not allow verifying this statement. In his description of *P. verae*, Haitlinger (1995b) states that in the only specimen (type) AM setae are smooth, but because of the condition of the slide it is again difficult to ascertain if they are really smooth or, like in many other species, bear very fine branches. AL and PL setae in all the species are covered by setulae. Only in *P. crassicristatum* according to Feider (1968) they are devoid of branches. Haitlinger (1995b) reports that AL in *P. verae* are smooth while the examination of the type specimen revealed very fine branches, barely visible in light microscope. S setae in all the original descriptions are characterized as smooth. In the examined series I found the presence of very fine



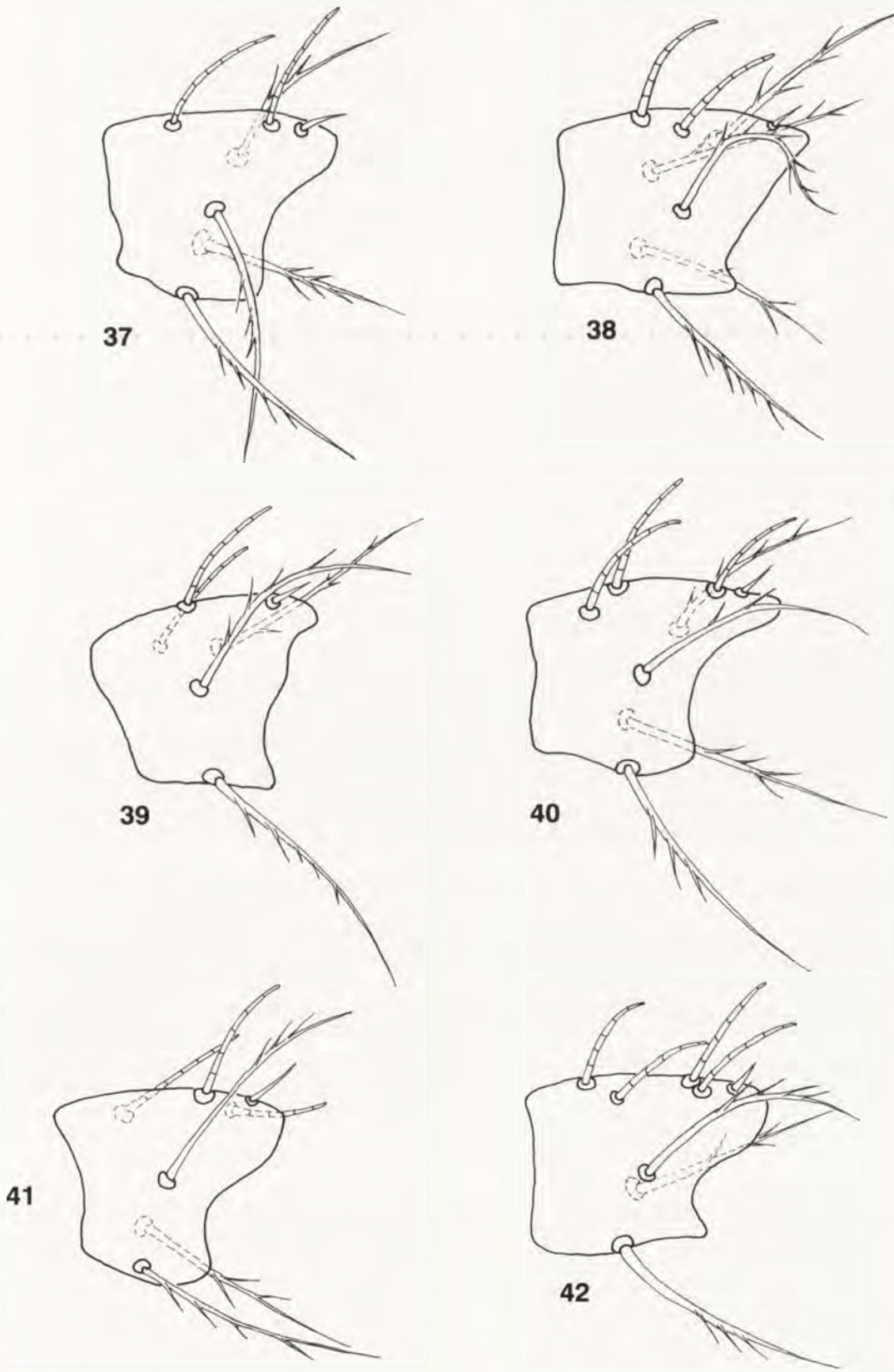




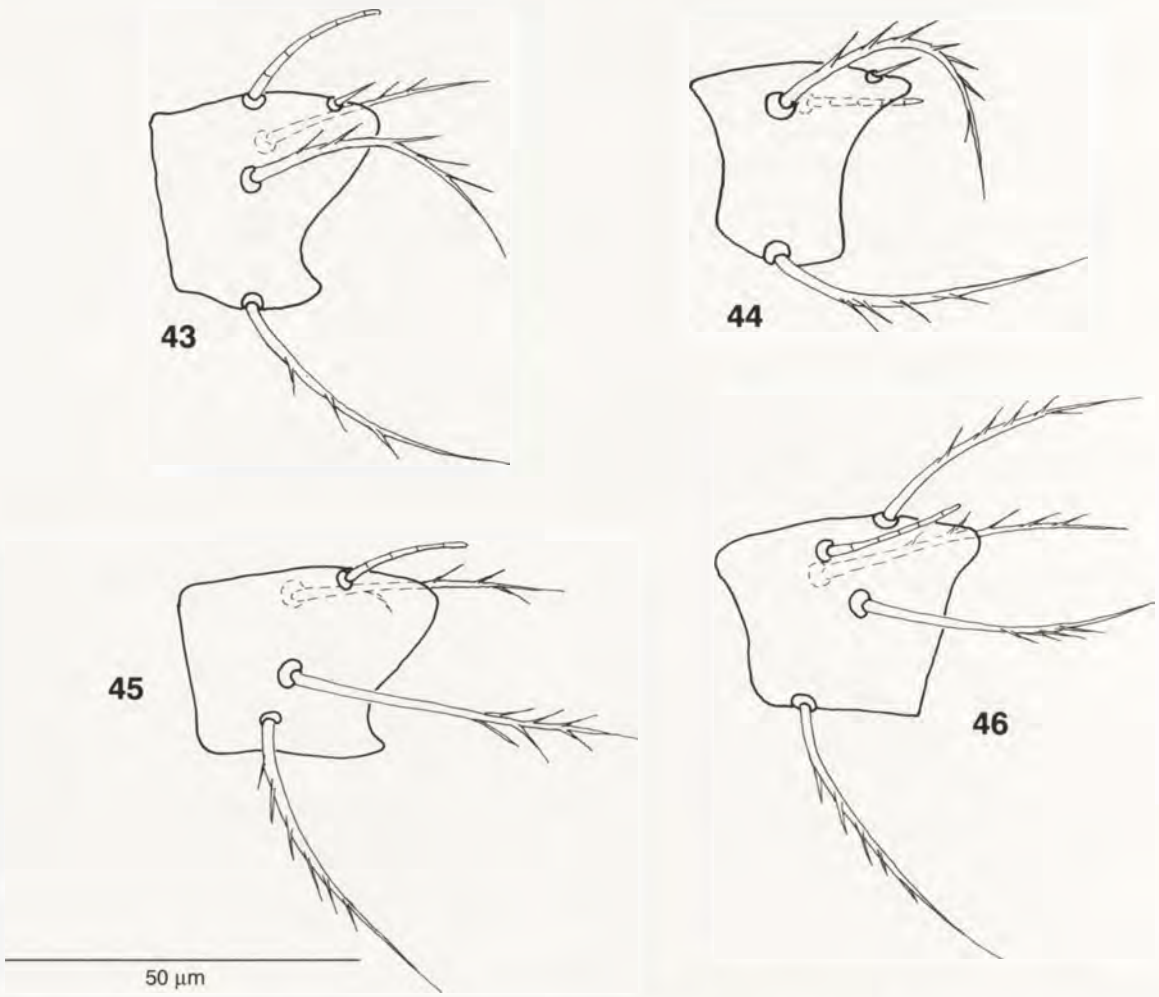




Figures 32–36. *P. filipes*, larva. (32–33) variation and/or anomaly in the chaetotaxy of tibia I, (34–36) variation and/or anomaly in the chaetotaxy of tibia III.



Figures 37–42. *P. filipes*, larva, variation and/or anomaly in the chaetotaxy of genu I.



Figures 43–46. *P. filipes*, larva. (43–44) variation and/or anomaly in the chaetotaxy of genu II, (45-46) variation in the chaetotaxy of genu III.

branches on these setae. Such branches are likely to be present also in other members of the genus, but unless SEM is routinely applied, it is difficult to confirm this hypothesis. The postulated common use of SEM cannot, however, include only single specimens since this might lead to dangerous results i.e. overestimation of individual instead of inter-specific differences.

According to Robaux (1977) who studied variation of metric characters of the scutum of *P. shellhammeri*, in most cases it did not exceed 10%, and only in relation to PL it was over 20%. My studies partly confirm this thesis. The highest variation (>10%) of length was displayed by setae AL and PL (Tab. 1).

Opisthosoma. The number of setae forming the first row (C) on the dorsal side, at the level of scutellum, is regarded by some authors as a diagnostic character. According to Fain and Ripka (1998) two groups can de distinguished among all the species described up to date. In some the border between the first (C) and the second (D) rows of dorsal setae is clear, in others setae located on the sides of scutellum are arranged in a way that precludes a precise determination of the border between the rows. All indicates that the arrangement of these setae is not affected by the degree of filling of alimentary tract, and their moving apart as a result of extension of the integument may only slightly modify their location at the level of scutellum. Thus, the division into groups should be reflected in the key, as proposed by Fain and Ripka (1998). In case of the second group the total number of setae in the irregular accumulation around the scutellum (including setae on scutellum) should be stated.

Podosoma. On coxa I, besides two barbed setae, there is one very short and smooth seta called supracoxala. Only few authors (Robaux 1977, Robaux and Schiess 1982, Zhang and Xin 1989) pay attention to its presence. It does not seem, however, to have a diagnostic value. The adopted formula of coxal chaetotaxy in larvae of *Podothrombium*, considering supracoxala, is thus *f*Cx = NBB-B-B. Zhang (1995) mentions the presence of one seta on Cx II among characters typical of larvae of *Podothrombium*. Actually, in the examined series the number of setae on Cx II varies which results in an unstable formula *f*Cx. In the previous papers only Robaux and

Schiess (1982) pointed to an instability of the number of setae on the coxa of *P. piriforme* (*P. piriformis*), but this pertained to the third pair of these segments.

Zhang (1995) distinguished genera whose members had 5 n setae on Fe II (among others *Podothrombium*) and genera in which on Fe II there were 4 n setae. Actually, only in *P. piriforme* there are 5 n setae on Fe II, while the remaining species are reported to have 4 setae. The obtained results pertaining to the variability of chaetotaxy of various leg segments show that such characters as: the number of setae on femora, genua and tibiae should be treated with special care unless more extensive material of particular taxa is examined. For the time being these characters do not constitute a sufficient background for species differentiation.

Robaux and Schiess (1982) pointed to the variation in the number of specialized setae on the tarsi of *P. piriforme*, contrary to a high stability of chaetotaxy of the remaining leg segments. Actually, the state of solenidia on Ta I was also regarded as one of the characters deciding about the species identity. Among the hitherto described species, in four on Ta I there are 2 solenidia, in nine – 1 solenidion. The state of solenidia is unknown in *P. svalbardense* Oudemans (in: Thor 1930), while in one species – *P. rigobertae* Haitlinger, 1995b (known as one specimen) – 3 solenidia are present. The character is especially varied within the examined series of individuals. Probably the states with 3 solenidia on Ta I develop as a result of a complete division of the first solenidion (located closer to Ta basis) at early ontogenetic stages.

In a tentative key for larvae of *Podothrombium* proposed by Fain and Ripka (1998) IP was treated as an auxiliary character. Again, like with other metric features, it is difficult to evaluate the character when particular taxa are known from single specimens only. Anyway, the character tends to exhibit a variability range of ca. 10% mean value. That is why in the majority of hitherto described species the character is very likely to overlap with the respective data for at least one other species, when studied in more numerous specimens.

For the time being the larva of *P. filipes* can be placed in the group of species with markedly separated C and D rows of setae (as in *P. paucisetarum* Zhang and Xin, 1989, *P. tymoni* Haitlinger, 1994, *P. proti* Haitlinger, 1994, *P. verae* Haitlinger, 1995b, *P. dariae* Haitlinger, 1995b, *P. tersonderi* Haitlinger, 1995b, *P. pannonicum* Fain and Ripka, 1998 and *P. exiguum* Fain and Ripka, 1998).

Because of the observed variability of purportedly informative characters and the great paucity of material of most members of *Podothrombium*, I will refrain from proposing a key to larvae until more material is examined.

Acknowledgements

This work was supported by the grant in aid of research (No 109/GW, Agricultural University of Wrocław, Poland). I wish to express my gratitude to Prof. Dr. Ryszard Haitlinger for the loan of type specimens. Special thanks are due to Dr. Pekka T. Lehtinen for making the trip to Finnish Archipelago possible and to Mr. Veikko Rinne for his help in obtaining the data on temperature distribution in the collecting site. I am very grateful to Dr. Andreas Wohltmann for helpful discussion and comments on the manuscript.

References

Berlese, A. 1912. Trombidiidae. Prospetto dei generi e delle specie finora noti. Redia 8: 1–291. *In:* A. Berlese, Complete Acarological Works, Vol. IV, No 18, 1977.

Fain, A. and G. Ripka 1998. Two new larval Trombidiidae of the genus *Podothrombium* Berlese, 1910 (Acari: Prostigmata) from Hungary. Bulletin de l'Institut royal des sciences naturelles de Belgique, Entomologie, 68: 71–78.

Feider, Z. 1968. La larve et la nymphe de *Podothrombium crassicristatum* (Podothrombiidae, Acariformes). Acarologia, 10, 1: 29–43.

Haitlinger, R. 1994. Two new species of the genus *Podothrombium* Berlese 1910 (Acari, Prostigmata, Trombidiidae) from Austria and Italy. Linzer biologische Beiträge, 26/1: 531–538.

Haitlinger, R. 1995a. *Podothrombium tymoni* Haitlinger, 1994 i *P. proti* Haitlinger, 1994 (Acari, Prostigmata, Trombidiidae) dwa nowe gatunki roztoczy dla fauny Polski. Przegląd Zoologiczny, 1–2: 91–94.

Haitlinger, R. 1995b. New larval mite species of the genus *Podothrombium* Berlese, 1919 [sic!] (Acari, Prostigmata, Trombidiidae) and *Lassenia* Newell, 1957 (Prostigmata, Tanaupodidae) from Poland. Wiadomości Parazytologiczne, 41, 4: 463–474.

Mąkol, J. and A. Wohltmann 2000. A redescription of *Trombidium holosericeum* (Linnaeus, 1758) (Acari: Actinotrichida: Trombidioidea) with characteristics of all active instars and notes on taxonomy and biology. Annales Zoologici (Warszawa), 50, 1: 67–91.

Oudemans, A. 1937. Kritisch Historisch Overzicht der Acarologie. 3, C-G, E.J. Brill, Leiden, 799–3379.

Robaux, P. 1977. Observation sur quelque Actinedida (=Prostigmates) du Sol d'Amérique du Nord. VIII. Sur deux formes larvaires de Trombidioidea (Acari). Acarologia, 18, 4: 651–667.

Robaux, P. and T. Schiess 1982. Une nouvelle forme larvaire de Trombidion du Parc National Suisse: *Podothrombium piriformis* n.sp. (Acarina-Trombidiidae). Acarologia, 23, 3: 239–244.

Southcott, R. V. 1986. Studies on the Taxonomy and Biology of the Subfamily Trombidiinae (Acarina: Trombidiidae) with a Critical Revision of the Genera. Australian Journal of Zoology, Suppl. Ser. No. 123: 1–116.

Southcott, R. V. 1997. Dysmelia and other developmental abnormalities in Prostigmatid mites (Acari). International Journal of Acarology, 23, 2: 93–102.

Thor, S. 1930. Beiträge zur Kenntnis der Invertebraten Fauna von Svalbard. Skrifter om Svalbard og Ishavet, 27: 104–107.

Welbourn, W. C. 1991. Phylogenetic studies of the terrestrial Parasitengona, pp. 163–170. *In*: F. Dušbabek and V. Bukva (eds.). Modern Acarology, Vol. 2. Academia, Prague and SPB Academic Publishing bv, The Hague.

Zhang, Z. Q. 1995. A cladistic analysis of Trombidiidae (Acari: Parasitengona): congruence of larval and adult character sets. Canadian Journal of Zoology, 73: 96–103.

Zhang, Z. Q. and A. Jensen 1995. The adult and larva of a new species of *Podothrombium* (Acari: Trombidiidae) associated with aphids in Oregon. International Journal of Acarology, 21, 1: 3–9.

Zhang, Z. Q. and J. L. Xin 1989. A new species of larva of *Podothrombium* Berlese, 1910 parasitic on aphids from China (Acariformes: Trombidiidae) [in Chinese with English abstract]. Acta Zootaxonomica Sinica, 14, 2: 169–173.

Received: June 5, 2000
Accepted: July 30, 2000

Corresponding Editor: D. Iwan
Issue Editor: D. Iwan