

Three new *Protura* from Western Caucasus

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Received: 3 Aug. 1993

Accepted for publication: 22 Sep. 1993

SZEPTYCKI A. 1993. Three new *Protura* from Western Caucasus. Acta zool. cracov., 36(1): 29-43.

Abstract. *Acerentulus setosus* sp. n. (similar to *A. xerophilus*, *silvanus* and *apuliacus*), *Eosentomon solarzi* sp. n. (of "*transitorium*" group) from Krasnodarskii Kray (Russia), and *Acerentomon granulatum* sp. n. (similar to *A. rostratum* and *skuhravyi*) from Abkhazia (Georgia) are described.

Key words: *Protura*, *Acerentulus*, *Acerentomon*, *Eosentomon*, taxonomy, South Russia, Asian Georgia.

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The *Protura* of the Caucasus Mts and surrounding areas are completely unknown. The only record from this area is that in a paper of MARTYNOV (1913) and concerns *Acerentomon* sp.

The present paper is based on the materials kindly given me by Dr Krzysztof SOLARZ of the Silesian Academy of Medicine in Katowice and by Dr Mikhail POTAPOV of the Pedagogical University in Moscow. This last material contains also a rich collection of the *Acerellidae* from the Caucasus Mts – it will be elaborated later.

I am very glad to express my very cordial thanks to both my friends for these materials.

All material is preserved in the collections of the Institute of Systematics and Evolution of Animals of the Polish Academy of Sciences, Kraków, Poland.

Acerentulus setosus sp.n.

(Figs 1-19)

D i a g n o s i s . The new species belongs to the "*confinis*" group, according to NOSEK (1973). It belongs (together with *A. xerophilus* SZEPTYCKI, 1979 and *A. silvanus* SZEPTYCKI, 1991) to the species with long, parallel-sided sensilla *b'* on the foretarsus, a full

set of *P* setae on urotergite VII, and composed pores on urosternite VI (SZEPTYCKI 1979; 1991). Both species mentioned are much larger than the new one and their body setae are distinctly shorter. An additional character of the new species (hitherto not described from any species of *Acerentulus*) is the presence of a doubled pore on urotergite XII.

In the shape of the pseudoculus, foretarsal morphology and porotaxy of urosternite VI it is also similar to *A. apuliacus* RUSEK & STUMPP, 1988 (RUSEK & STUMPP 1988), from which it differs in the chaetotaxy of urotergite VII (in *apuliacus* seta *P3a* absents).

Description. Head setae long, additional seta absents. Sensory setae billet-like. Pseudoculus shortened, with long lever, PR 15-19. Filamento disostegno with indistinctly trilobed posterior dilation, short, CF 4-5. Sensillae of maxillary palp long, slender, lateral shorter than ventral. Tuft of labial palp with three branches, sensilla slender, long.

Main setae on nota long, *P1a*, *P2a*, and *P5* rounded, short. Length ratio of *P1* : *P2* on mesonotum as 1 : 1-1.1 (in larvae 1 : 1.2-1.3). Seta *P4a* on mesonotum, *A2* on thoracic sterna and *M2* on prosternum billet-like. Thoracic sterna with no pores.

Foretarsus with long sensilla *a*, reaching level of *e*; *b* of medium length, passing beyond level of $\gamma 3$, subequal to *c*; *d* shorter than *a*, passing beyond level of $\alpha 5$. Sensillae *a* and *a'* thicker than others. Length formula of foretarsal sensillae: $t1 = t3 < g = a' = b' = c' < c = e < b < d = f = t2 < a$. Seta $\beta 1$ shorter than $\delta 4$. BS 0.3-0.35, TR 3-3.5, EU 0.1-0.2.

Chaetotaxy of abdomen of common *Acerentulus* - type (SZEPTYCKI 1991). Urotergite I with no *P1a*; *P2a* of same shape as *P1a* on nota; *A5* billet-like. Urotergites II - VI with no setae *P1a* and *P3a*; accessory setae billet-like. Urotergite VII with 3+3 anterior setae (*A2*, *A4*, *A5*); setae *P1a*, *P2a* and *P3a* present; accessory setae short and thin, hair-like.

Accessory setae on urosternites I-VI shorter than that on tergites, on VII as long as those on tergite. Urosternite VII with no seta *Pc*. Connecting line on urosternites IV-VI absent. Porotaxy formula of urosternite I-VII / 0 / 0 / 0 / 1 + 1 / 1 + 1 / *n* + *n* / 1 /. Urosternite VI of females with 2+2 pores, of males with 3+2. Pore on urosternite VII situated near its hind margin.

Urotergite and urosternite VIII with one or two rows of fine, hardly visible granules. Comb VIII with straight hind margin, composed of 8-12 slender teeth. Seta *1a* on urotergite IX subequal to seta *1*, on X shorter than it. Urotergite XI with 3 + 3 setae. Urotergite XII with pair of median pores; hind margin setae very short and thin. Urosternite XI with 3 + 3 setae.

Squama genitalis ♀ with short distal prolongation of stylus and short, stumpy acrostylus. Penis with 6 + 6 setae.

Maturi juniores unknown, larva II with no larval seta on urosternite XII. The development of chaetotaxy seems to be the same as in the other species of this genus (SZEPTYCKI 1991).

Body dimensions (in μm)

	imago	larva II	larva I
head	111-125	ca 87	ca 78
pseudoculus	6-7	ca 6	ca 4
filamento di sostegno	23-30	ca 16	ca 15
mesonotal <i>P1</i>	34-42	ca 15	ca 11
mesonotal <i>P2</i>	38-45	ca 19	ca 13
foretarsus	79-83	ca 50	ca 43
claw	23-25	15-18	?
empodial appendage	2-3	ca 2	?
maximum body length	1 170	620	530
No. of specimens studied	10	2	1

Chaetal variability – not observed.

Remarks. In the new species the pattern of porotaxy on urosternites seems to be stable, but on urosternite VI it differs between males (2+3 pores) and females (2+2 pores). A similar case of sexual dimorphism was observed in the genus *Gracilentulus* TUXEN, 1963 (SZEPTYCKI, 1993). Maybe, it exists in other species of *Acerentulus* with composed pores, too.

Holotype σ (nr 4532) Russia, Krasnodarskii Kray, Sochi, Dragomys Dendropark (=Arboretum), rotten wood from a hollow in a pine - tree, 12 I 1989, leg. K. SOLARZ.

Paratypes: as holotype, 2 σ , 7 φ .

Other material studied: 2 larvae II, 1 larva I, as holotype.

Derivatio nominis: named after its very long body setae.

Acerentomon granulatum sp. n.

(Figs 20-42)

Diagnosis. The new species most resembles to *A. rostratum* IONESCU, 1951 (NOSEK 1973) and *A. skuhavyi* RUSEK, 1965 (RUSEK 1965; SZEPTYCKI 1980). It is most similar to both of them in its very long rostrum, the distinct basal dilation of maxillary palp, and some details of foretarsus morphology (relatively thick and short sensilla *a*, thick sensilla *b*, short *t2* etc.). With *skuhavyi* it shares also the presence of an additional head seta (according to fig. 5,2 in IONESCU 1951, this seta is lacking in *rostratum*), the shape of the pseudoculus, slightly developed pleural combs and peculiar chaetotaxy of urosternites VIII and IX. To *rostratum* it is similar in the very strong granulation of abdominal segment VIII and the shape of comb VIII. It differs from *rostratum* in the shape of pseudoculus (which in *rostratum* is round), the chaetotaxy of urosternites VIII and IX (4/2 and 4 in *rostratum*) and in a smaller number of teeth in comb VIII (in *granulatum* about 40 against about 60 in *rostratum*). From *skuhavyi* it differs in the much stronger granulation of abdominal segment VIII, in the shape of comb VIII (in *skuhavyi* only till 25 teeth), strong teeth of the hind margin of urotergite and urosternite XII, and in some details of ventral porotaxy.

Description. Head setae short, additional seta present. Rostrum slender, very long, LR about 2.7. Foremargin of head capsula smooth. Pseudoculus distinctly elongated, with short lever, PR about 14.5. Filamento di sostegno short, with distinctly dilated hind part, about 1.5 times length of pseudoculus, CF about 10. Sensillae of maxillary palp equal, thin, with distinct basal dilations. Sensilla of labial palp lancet-shaped.

Setae on nota short, chaetotaxy normal, all accessory setae of normal shape. Length ratio of $P1 : P1a : P2$ on mesonotum as 1.3 : 1 : 2.3. Seta $P5$ on meso- and metanotum as small, conical sensilla evidently longer on meso- than on metanotum. Setae $A1$ and $A2$ on prosternum of equal length. Pronotum and prosternum with no pores; mesonotum with 2 + 2 pores (l and al); metanotum with 1 + 1 pore (l). Meso- and metasternum with group of 3 pores anteriorly to level of seta M .

Foretarsal sensilla a thicker than c , reaching level of $t2$, b short and thick, sword-shaped, reaching level of $\beta4$; other sensillae of exterior and interior side thin, long, parallel-sided. Dorsal sensillae of normal shape, $t2$ relatively short (about 1.5 length of $t1$). Length formula of sensillae: $t1 < t3 < t2 < b = a' = c' < e = g < a = c = d = f$. Claw with no teeth, seta s very long. BS about 0.6, TR about 3.5, EU about 0.1.

Chaetotaxy of abdominal segments as in Table I, urotergite VII with seta x . Accessory setae on segments I - VII much shorter than principal ones, thin, of normal shape. Urotergite I only with pore psm , II - VII with 3 + 3 pores (psm , psl and al). Pleural combs slightly developed, line on pleurite VI with no teeth (only with irregular crenulation); on pleurite VII teeth absent, only one large round grain near pore al present. Porotaxy of urosternites I - III unknown. Urosternites IV and V with single pore situated in middle of sternite; VI and VII with group composed of 3 pores situated medially, near anterior margin of sternite, and 2 + 2 (on VI) or 3 + 3 (on VII) single pores situated laterally.

Urotergite VIII with one irregular row of dense, strong, spine-shaped granules. Pore psm with no surrounding teeth. Comb VIII elongated, with more than 35 slender, long teeth. Hind margin of pleurite VIII with 4 distinct teeth. Urosternite VIII with two rows of granules similar to that on tergite. Seta $1a$ situated in row with setae 1 and 2 . Hind margin of sternite smooth. Pores absent.

Seta $1a$ on urotergite IX shorter than seta 1 ; urotergite XI with 3+3 setae. Hind margin of urotergites IX-XI smooth, that of XII with 6 irregular teeth. Urotergites IX-XI with no pores, XII with single, anteromedial pore. Urosternite IX with 3+2 setae, seta $1a$ asymmetrically presents. Hind margin of urosternites IX-XI smooth, that of XII with 7 irregular teeth. Urosternites IX-XI with no pores, XII with two anterolateral pores.

Squama genitalis ♀ with relatively short, pointed acrostyli; male unknown.

Body dimensions of holotype (in μm): head 194, rostrum 72, pseudoculus 13, filamento di sostegno 19, mesonotal $P1$ 29, $P1a$ 22, $P2$ 51, foretarsus 138, claw 38, empodial appendage 4, body length of not quite stretched specimen about 1 700.

Holotype ♀ (nr 4506): Georgia, coastal region of Abkhazia, Myuserskii reserve, 6 VII 1985, leg. E. TARBA.

Only holotype is known.

Derivatio nominis: named after the striking granulation of abdominal segment VIII.

Table I

Chaetotaxy of *Acerentomon granulatum* sp. n.

	composition of setae	formula
Dorsal		
Th. I	1 2	4
Th. II	M A2 A3 A4	10
	P1 P1a P2 P2a P3 P3a P4 P5	16
Th. III	M A2 A3 A4 A5	10
	P1 P1a P2 P2a P3 P3a P4 P5	16
Abd. I	Ac A1 A2 A3	7
	P1 P1a P2 P2a P3 P3a P4	14
Abd. II-VI	A1 A2 A3 A4 A5	10
	P1 P1a P2 P2a P3 P3a P4 P5	16
Abd. VII	A1 A2 A3 A4 A5 + x	12
	Pc P1 P1a P2 P2a P3 P3a P4 P4a P5	19
Abd. VIII	A1 A2 A3 A5	8
	Pc P1 P1a P2 P2a P3 P3a P5	15
Abd. IX	1 1a 2 2a 3 3a 4	14
Abd. X	1 2 2a 3 4	10
Abd. XI	1 3 4	6
Abd. XII		9
Ventral		
Th. I	A1 A2 M1 M2	4 + 4
	P1 P2 P3	6
Th. II	Ac A2 A3 M	5 + 2
	P2 P3	4
Th. III	Ac A2 A3 A4 M	7 + 2
	P2 P3	4
Abd. I	Ac A1	3
	P1 P1	4
Abd. II-III	Ac A1 A2	5
	Pc P1a P2	5
Abd. IV-VI	Ac A1 A2	5
	P1 P1a P2 P3	8
Abd. VII	Ac A1 A2	5
	Pc P1 P1a P2 P3	9
Abd. VIII	1 1a 2	6
Abd. IX	1 1a ^{**} 2	6
Abd. X	1 2	4
Abd. XI		6
Abd. XII		6

* individual abnormality?

** in single specimen studied this seta is asymmetrically absent

Remarks. The porotaxy of the genus *Acerentomon* has not been studied till now. According to an unpublished observations, the groups of pores on thoracic sterna and near anterior margin of urosternites VI and VII exist in many species. The presence of pores situated anterolaterally on urosternite VII seems to be characteristic of the new species. In the nearest species, *A. skuhravyi*, they are absent.

***Eosentomon solarzi* sp. n.**

(Figs 43-61)

Diagnosis. According to its head chaetotaxy the new species belongs to the "transitorium" group of SZEPTYCKI (1986). From all the species of this group described so far it differs in relatively long seta *P2a* on the nota and in filiform foretarsal sensilla *f1*.

In the short squama genitalis ♀, filiform sensilla *f1* and the position of seta *P1a* on urotergite VII it resembles *E. gisini* NOSEK, 1967 (NOSEK, 1974) and *E. pinkyae* ARBEA-POLITE, 1990 (ARBEA-POLITE 1990). From both of them it differs in the chaetotaxy of urotergite VI (in both species seta *A3* exists), from *E. pinkyae* also in the absence of the anterior additional seta on the head and in the shape of the basal seta of leg III (in *pinkyae* it is spine-like) (neither of the characters mentioned was studied in *E. gisini*).

Description. Head setae short, slightly differentiated, subposterior seta 1.4-1.7 x as long as posterior. Anterior additional seta absent, posterior present. Pseudoculus small, with distinct inner structure, PR 10-16. Labral seta present, rostral seta simple, subequal to subrostral. Sensillae of maxillary palp short, lateral sensilla shorter and thicker than dorsal.

Setae on nota slightly diversified, *P1a* situated posteriorly to line *P1-P2*, subequal to *P1*, *P2a* subequal to *P3a*. Length ratio of *P1 : P1a : P2* on mesonotum as 0.9-1.2 : 1 : 1.3-1.7. Tracheal camerae slender, with indistinct basal dilation, variable in length.

Foretarsal sensilla *a* longer than half of *c*; *b* shorter than *a'*; *d* long, reaching level of *t3*; *e* and *g* equal, with spatulate dilation longer than half of sensilla length; *f1* as long as *g*, filiform; position of *t1* variable, mostly halfway between $\alpha 3$ and $\alpha 3'$; *a'* longer than *t2*, reaching level of $\alpha 4$; *t2* and *b'2* equal, filiform; *b'1* absents; *c'* situated on line $\alpha 6 - \delta 5$, short and thin; seta $\delta 4'$ distal to level of $\delta 4$. BS 0.8-0.9, TR 4.3-5.0, EU 0.8-0.9.

Empodial appendage of legs II and III short; basal seta of leg III of normal shape.

Chaetotaxy formula of abdomen:

I	II-III	IV-V	VI	VII	VIII	IX-X	XI	XII
$\frac{4}{12}$	$\frac{10}{14^*}$	$\frac{10}{16}$	$\frac{8^{**}}{16}$	$\frac{6^{***}}{16}$	$\frac{0}{15}$	8	8	$\frac{6}{8}$
$\frac{4}{4}$	$\frac{6}{4}$	$\frac{6}{10}$	$\frac{6}{10}$	$\frac{6}{10}$	$\frac{0}{7}$	4	8	$\frac{8}{4}$

*lack of *P4a*, **lack of *A3*, ***lack of *A1* and *A3*

Formula of setae of urotergite I: 3, 1, 2. Seta *P1a* on urotergites I-VI same length as *P1*, on VII short, situated posteriorly to level of *P2*, passing hind margin of tergite; *P2a* on urotergites II-VI as *P1a*, situated halfway between *P1* and *P2*, on urotergite VII as on preceding tergites, shorter than main setae; *P1a'* on urotergite VIII long, with distinct basal dilation, in normal position. Dorsal setae on urotergite XI about half length of setae on urotergite X. Seta *1* on urosternite X subequal to seta 2.

Antecostae thin, with small, indistinct central lobe. Laterostigmata II-IV large, with no inner structure. Lateral sclerotisation of urosternite VIII absent. Urotergite XII with pair of central pores.

Squama genitalis ♀ long, with distinct head and "beak" more or less perpendicular to medial line. Penis with short basiphallar setae.

Dimensions (in µm)

	imago	mat.jun.	larva 2	larva 1
head	101-141	103-116	91-109	87-91
pseudoculus	8-11	about 7	6-7	about 5
subpost. head seta	11-13	9-10	7-9	about 7
posterior head seta	7-9	6-8	6-7	5-6
mesonotal seta <i>P1</i>	14-17	12-13	9-11	about 8
mesonotal seta <i>P1a</i>	13-16	11-12	9-10	7-8
mesonotal seta	22-26	about 17	13-15	10-12
foretarsus	73-79	about 70	60-64	55-56
claw	15-18	13-15	12-13	about 12
empodial appendage	12-15	10-11	9-11	about 9
maximum body length	1250	?	850	720
No. of sp-ns studied	25	2	10	2

Postembryonic development of chaetotaxy as in other species of the genus.

Chaetal variability. Imagines (25 specimens). 6 specimens with some abnormalities: on urotergite VI asymmetrical lack of *P4a* and *P5*, seta *A4* very near *P4*; symmetrical lack of *A1* and *A3* on urotergite VI, asymmetrical lack of *A3* on V; asymmetrical lack of *A1* on urotergite III and asymmetrical presence of *A3* on VI; asymmetrical lack of *A1* on urotergite V and VI; asymmetrical lack of *A5* on urotergite VII and asymmetrical duplication of seta 2 on urosternite VIII; asymmetrical lack of *A4* on urotergite VI and asymmetrical presence of seta *1a* on urosternite X; asymmetrical presence of *A3* on urotergite VI and asymmetrical duplication of *P1a* on urosternite VI. 4 specimens with single abnormalities: asymmetrical lack of *A1* on urotergite II, symmetrical (1 s-n) and asymmetrical (1 s-n) presence of *A3* on urotergite VI, seta *1a* asymmetrical situated anteriorly to seta 2 on urosternite VIII.

Maturi juniores (2 sp-ns). In one specimen symmetrical lack of *A3* on urotergite II.

Larvae II (10 sp-ns) and **larvae I** (2 sp-ns) – chaetal variability not observed.

Holotype ♀ (nr 4507). Russia, Krasnodarskii Kray, Sochi, Dragomys Dendropark (=Arboretum), rotten wood from a hollow in a pine-tree, 12 I 1989, leg. K. SOLARZ.

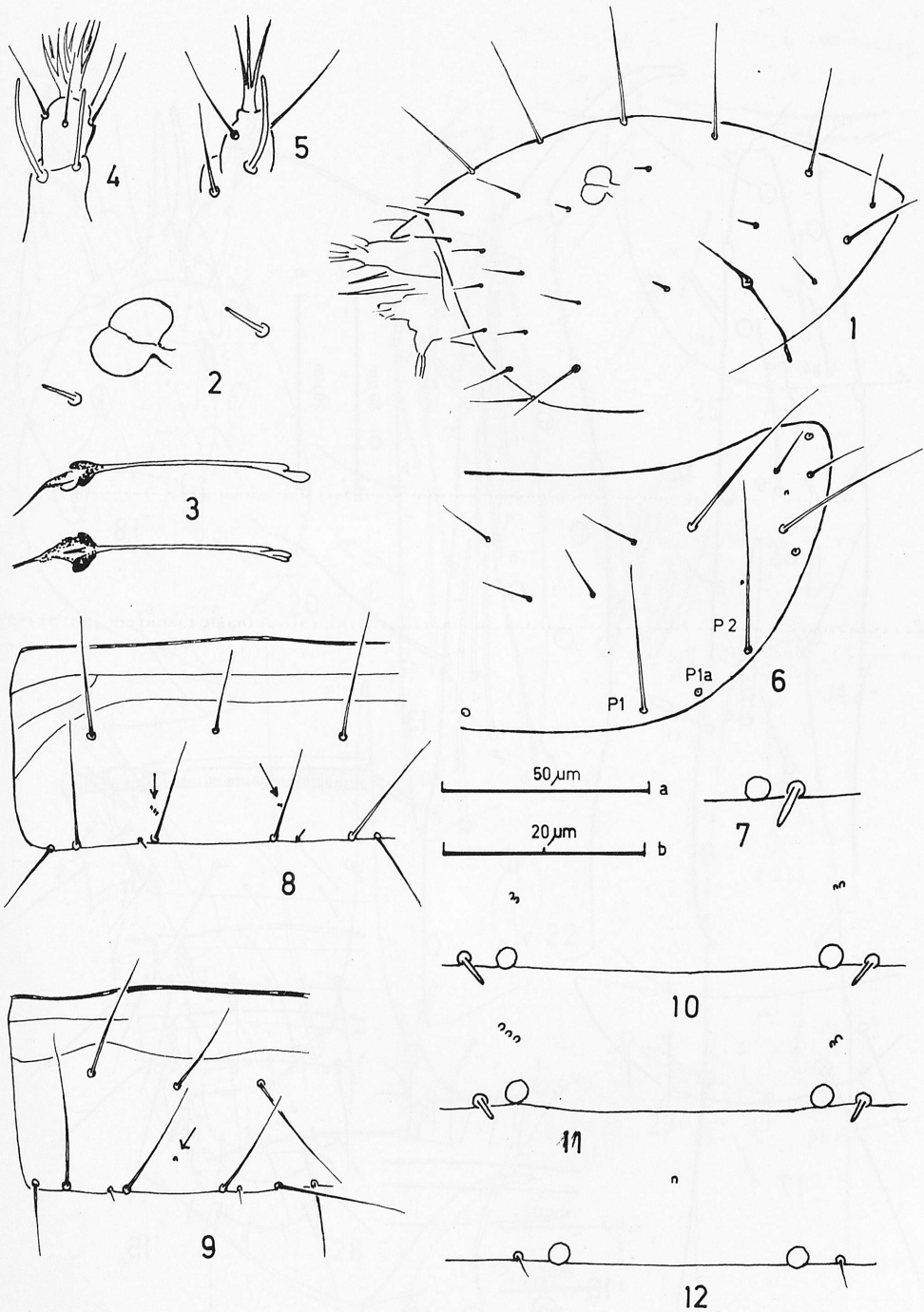
Paratypes: as holotype, 11 ♀, 13 ♂.

Other material: as holotype, 2 maturi juniores, 10 larvae II, 2 larvae I.

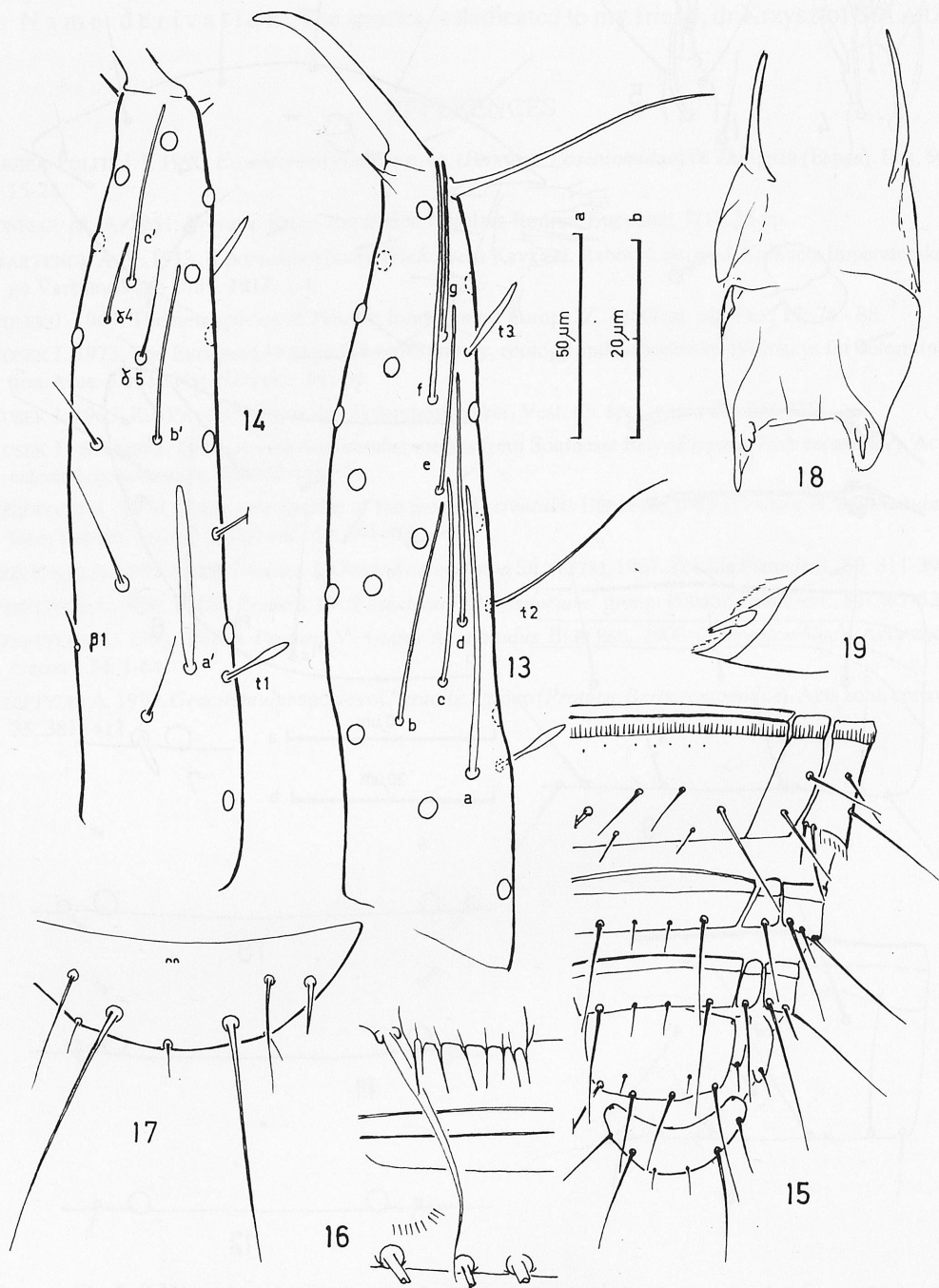
Name derivation. The species is dedicated to my friend, dr Krzysztof SOLARZ.

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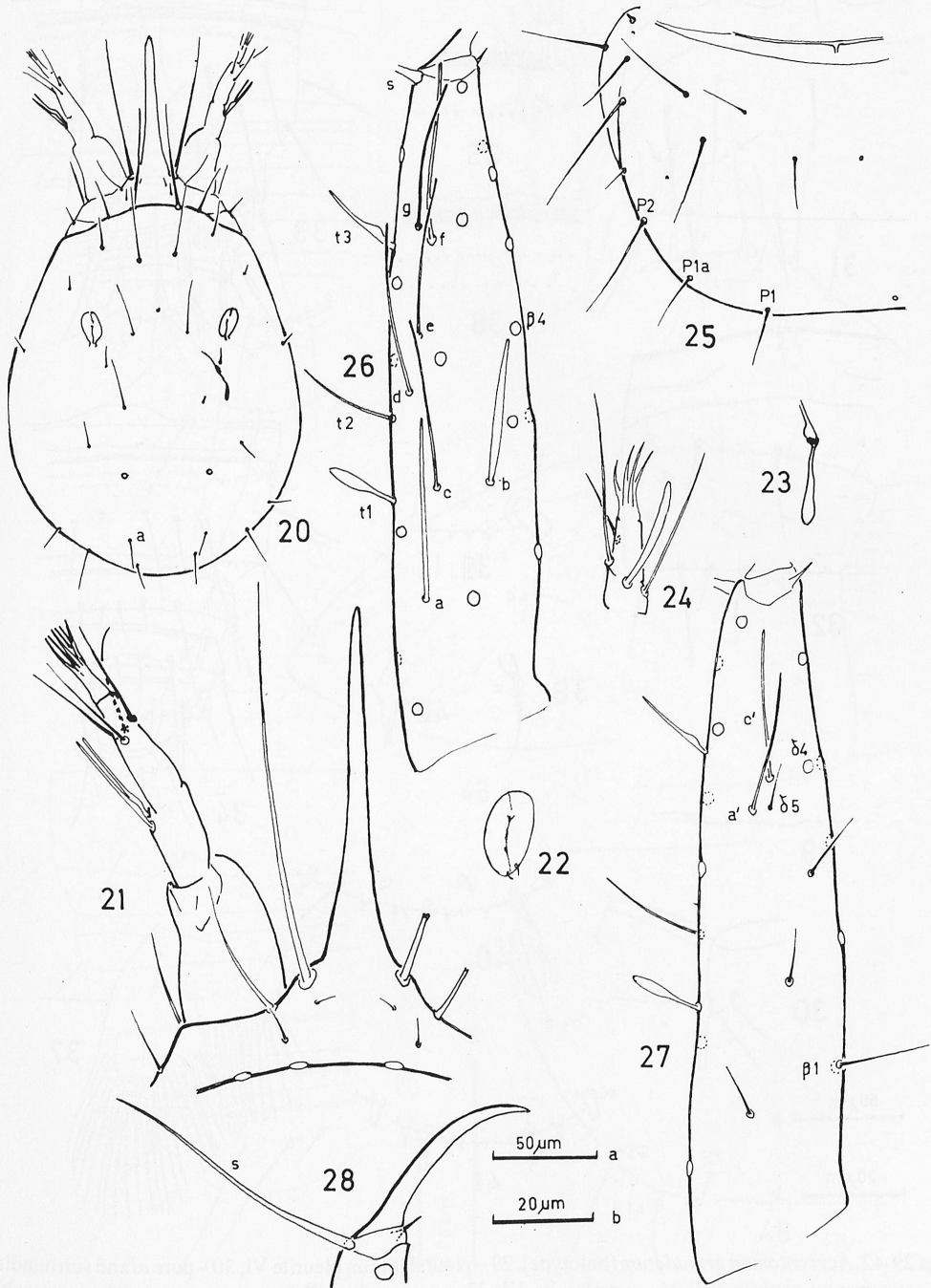
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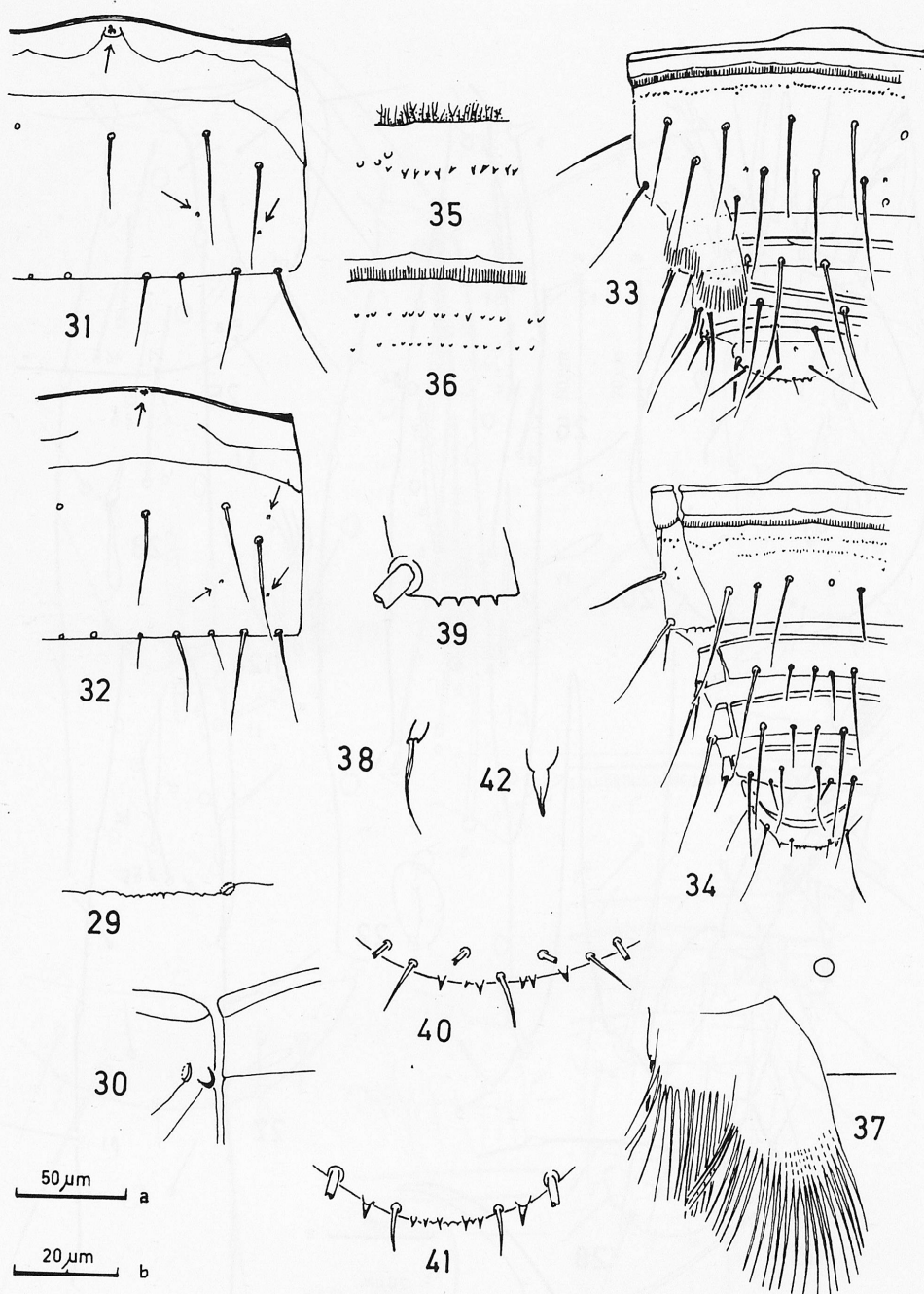
Figs 1-12. *Acerentulus setosus*. 1 – head (paratype 4553); 2 – pseudoculus (paratype 4553); 3 – filamento di sostegno (paratype 4553); 4 – maxillary palp (paratype 4553); 5 – labial palp (paratype 4553); 6 – mesonotum (holotype); 7 – accessory seta *P2a* on urotergite VI (holotype); 8 – urosternite VI (holotype); 9 – urosternite VII (arrows – pores) (holotype); 10 – hind margin of urosternite VI of female (paratype 4557); 11 – hind margin of urosternite VI of male (holotype); 12 – hind margin of urosternite VII of male (holotype). (1, 6, 8, 9 – magnification a, others – b).



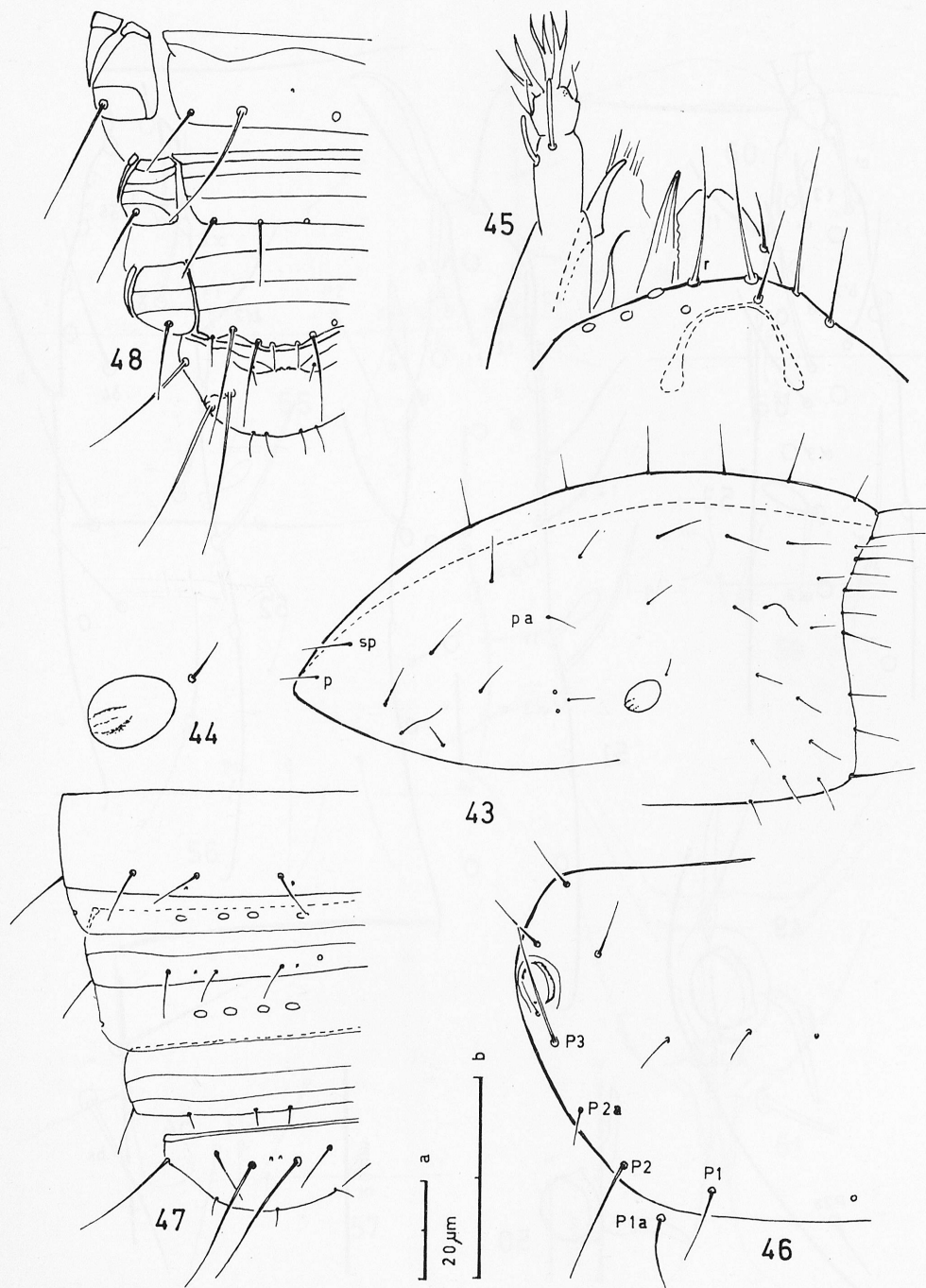
Figs 13-19. *Acerentulus setosus*. 13 – foretarsus, exterior view (paratype 4554); 14 – ditto, interior view (paratype 4554); 15 – urosternites VIII-XII (holotype); 16 – comb VIII and lateral portion of urotergite IX (paratype 4553); 17 – urotergite XII (holotype); 18 – squama genitalis ♀ (paratype 4557); 19 – distal prolongation of squama genitalis and acrostylus, lateral view (paratype 4555). (15 – magnification a, others - b).



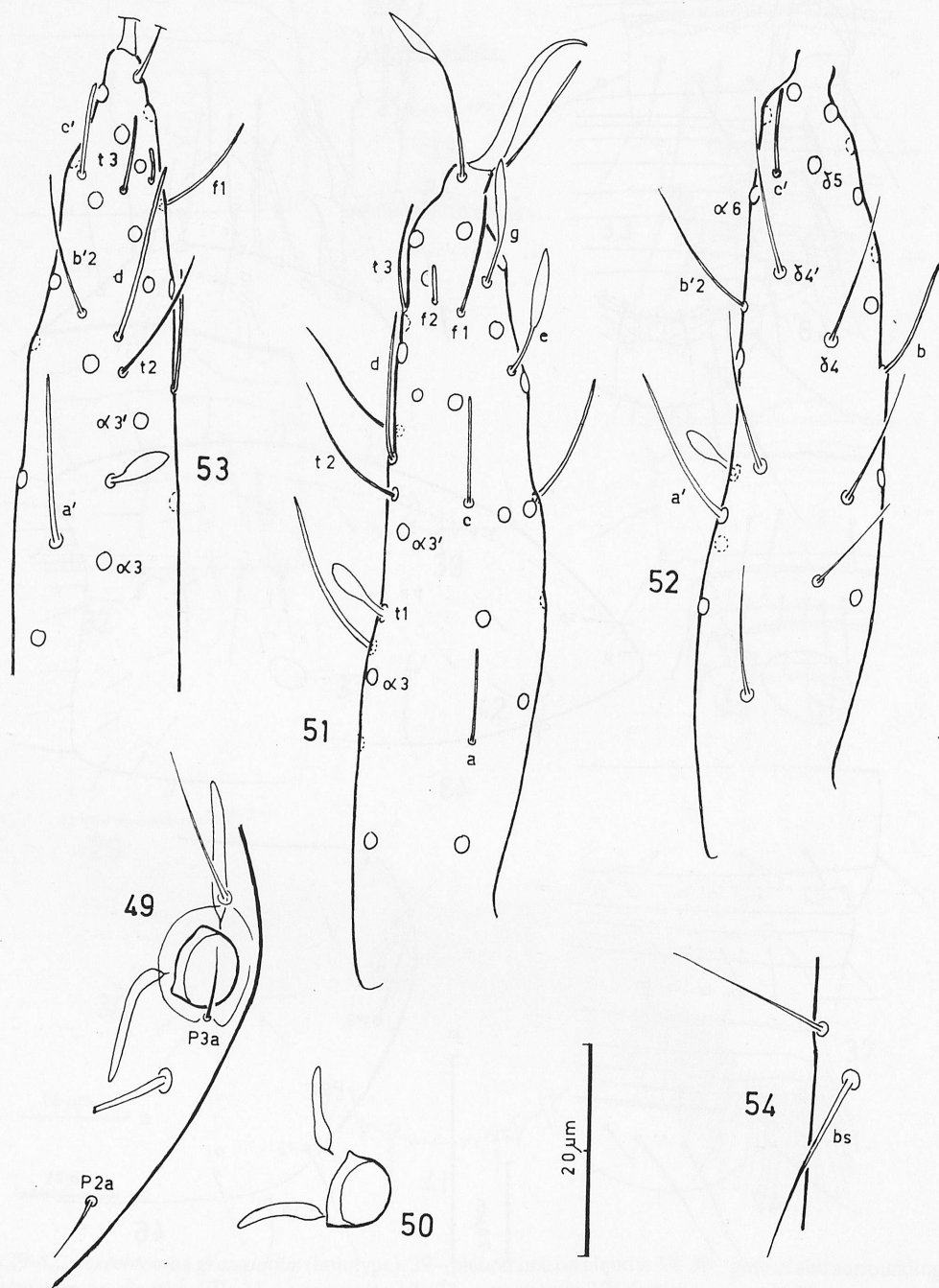
Figs 20-28. *Acerentomon granulatum* (holotype). 20 – head (a – additional seta); 21 – rostrum and maxillary palp; 22 – pseudoculus; 23 – filamento di sostegno; 24 – labial palp; 25 – mesonotum; 26 – foretarsus, exterior view; 27 – ditto, interior view; 28 – claw (21-23 – magnification b, others – a).



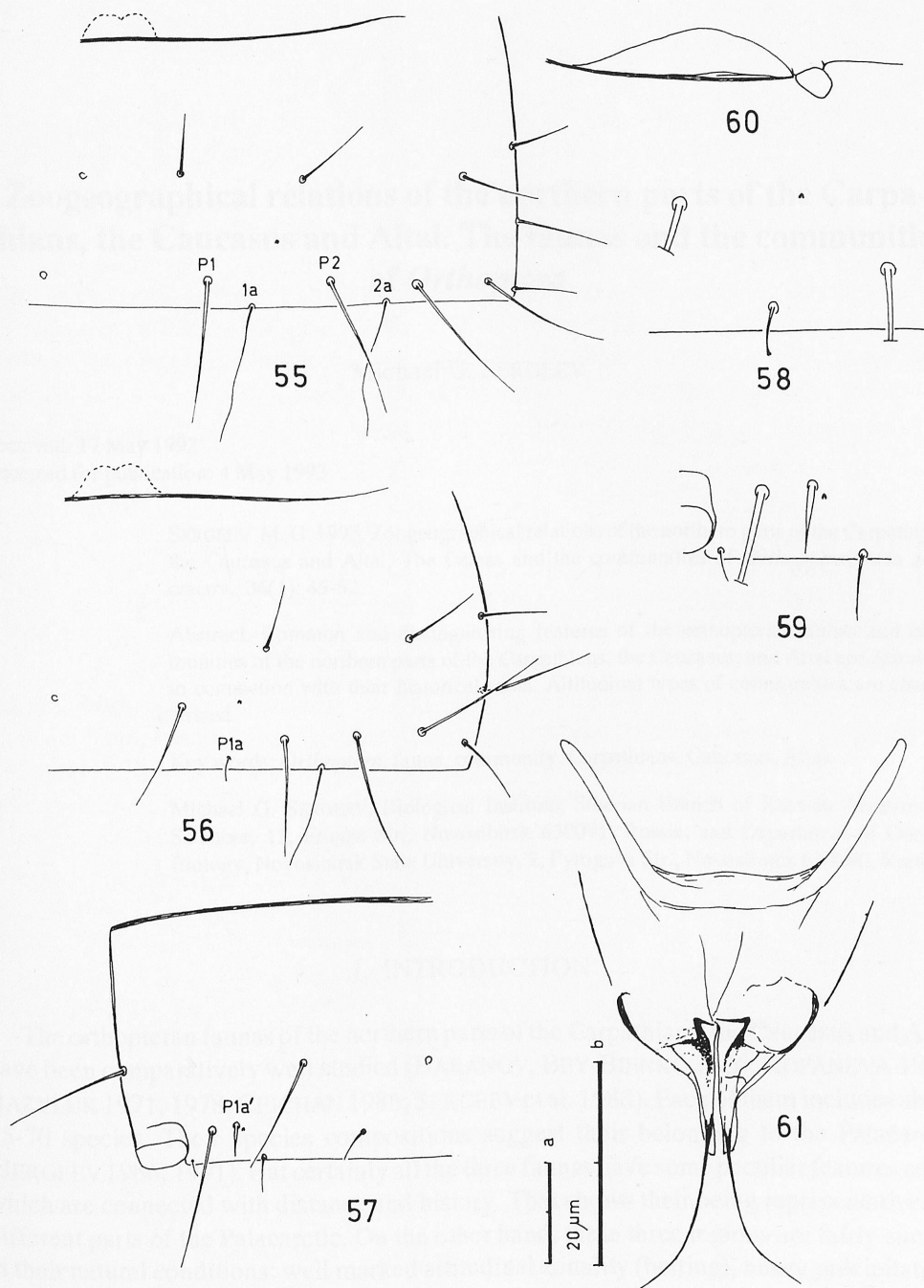
Figs 29-42. *Acerentomon granulatum* (holotype). 29 – pleural line on pleurite VI; 30 – pore *al* and surrounding structure on pleurite VII; 31 – urosternite VI; 32 – urosternite VII (arrows – pores); 33 – urotergites VIII-XII; 34 – urosternites VIII-XI; 35 – granulation of lateral portion of urotergite VIII; 36 – granulation of medial part of urosternite VIII; 37 – comb VIII; 38 – seta *p2a* on urotergite VIII ("comb seta"); 39 – hind margin of pleurite VIII; 40 – hind margin of urotergite XII; 41 – hind margin of urosternite XII; 42 – acrostylus (31-34 – magnification a, others – b).



Figs 43-48. *Eosentomon solarzi*. 43 – head (pa – posterior additional seta, sp – subposterior seta, p – posterior seta) (paratype 4528); 44 – pseudoculus (paratype 4528); 45 – anterior part of head, dorsal side (r – rostral seta) (holotype); 46 – mesonotum (holotype); 47 – urotergites X-XII (holotype); 48 – urosternites IX-X (holotype). (44,45 – magnification b, others – a).



Figs 49-54. *Eosentomon solarzi*. 49 and 50 – tracheal camerae, paratype 4516 (49) and paratype 4516 (50); 51 – foretarsus, exterior view (holotype); 52 – foretarsus, interior view (holotype); 53 – distal part of foretarsus, dorsal view (paratype 4523); 54 – basal seta (bs) of leg III (holotype).



Figs 55-61. *Eosentomon solarzi*. 55 – urotergite VI (holotype); 56 – urotergite VII (holotype); 57 – urotergite VIII (holotype); 58 – seta *P1a* on urotergite VII (holotype); 59 – seta *P1a'* on urotergite VIII (holotype); 60 – laterostigma III (holotype); 61 – squama genitalis ♀ (holotype). (55-57 – magnification a, others – b).

