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ON THE CONCEPTS OF *PARONANA* WOMERSLEY (1939) AND *PARASALINA* SALMON (1944) (COLLEMBOLA : ENTOMOBRYIDAE : PARONELLINAE) FROM NEWZEALAND

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INTRODUCTION

The genus *Paronana* was established by WOMERSLEY (1939) with the type-species *Paronella bidenticulata* Carpenter, 1925. WOMERSLEY (1939) diagnosed the new genus and redescribed the type-species on the basis of a single specimen collected from Belgrave, Victoria. SALMON (1941) added six species to the genus and and at the same time redescribed *Panonana bidenticulata* (Carpenter, 1925) from a paralectotype in the Canterbury Museum. SALMON (1965) erected a new genus *viz.*, *Parasalina* and transferred three species which he had previously described under *Paronana* to his new genus and simultaneously added two new sub-species and one species to it. From these species SALMON (1941) described some setae as scales. The present investigator found in the lectotype of *P. bidenticulata* (Carpenter, 1925) and other species, described by SALMON (1941), that these are in fact short, ciliated setae and do not conform to any type of scales found in the scaled genera under Paronellinae and are similar to those which occur in *Salina*, a well known member of scaleless Cremastocephalini. However, SALMON (1944) changed his earlier contention and commented, "that the structures occurring in those species placed in the genus *Paronana* Wom. and *Glacialoca* Salm. which previously I had regarded as scales, are not true scales but flattened ciliated setae..... There are, therefore, no scaled species of Paronellinae occurring in New Zealand". Thus, SALMON (1944) erected his new genus *Parasalina* on the character that his

new genus is not clothed with scales in contrast to *Paronana* Wom. which is scaled. However, examination of the single specimen from Belgrave, Victoria (*vide*, photomicrograph on Pl. II, G) on which WOMERSLEY (1939) based the redescription of *Paronana bidenticulata* (Carpenter, 1925) revealed that the specimen is a member of the genus *Pseudoparonella* and two "scale like lobes" mentioned by WOMERSLEY (1939) are actually the sockets of dorsal spiny appendages and is clothed with distinct pseudoscales (Fig. 9, A-N). Nvertheless, WOMERSLEY (1939) in erecting his new genus *Paronana* had definitely and specifically fixed "Genotype *Paronella bidenticulata* Carpenter 1925", although his specimen was different. Thus the oldest available generic name for the species *bidenticulata* of Carpenter (1925) other than *Paronella* is *Paronana*. Examination of the lectotype of *Paronella bidenticulata* Carpenter (1925) shows that the species has a chaetal clothing similar to the species of *Parasalina* described by SALMON and it does not possess any scale on body. Moreover, its all other features are similar to *Parasalina* Salmon (1944). Thus the genus *Paronana* Womersley, 1939 is to be conserved with the type-species *Paronella bidenticulata* Carpenter, 1925 (originally designated by WOMERSLEY, 1939) [Article 68 (a) of the Code] and as it has natural priority over *Parasalina* Salmon 1944 (Article 23 of the Code). *Parasalina* Salmon, 1944, at least in part, is, therefore, a junior synonym of *Paronana*. The original diagnosis of the genus *Paronana*, given by WOMERSLEY (1939), is now modified on the basis of the lectotype of the type-species, *viz.*, *Paronella bidenticulata* Carpenter (1925) (=*Paronana bidenticulata*) and other species, added by SALMON (1941, 1944) to this genus. SALMON (1964) in his "An index to the Collembola" again considered the genus *Paronana* as scaled and he (SALMON, 1964) placed the species like *bidenticulata* (Carpenter, 1925), *karoriensis* (Salmon, 1937), *maculosa* (Salmon, 1937), *pigmenta* Salmon (1941) under the genus contradicting his earlier comment of 1944 that no scaled species occur in New Zealand. To emphsise, it must again be stated that examination of the paratypes and other

representative collections of the species of *Paronana* and *Parasalina* from New Zealand described by SALMON (1941, 1944) along with the lectotype of *Paronella bidenticulata* Carpenter (1925) confirms that all such species are without clothing of scales on body. Although, SALMON (1964) fixed *Paronana dorsanota* Salmon (1941) as the type-species of his new genus *Parasalina* which does not possess dental scale appendage, in diagnosis of *Parasalina* he (SALMON, 1944, 1964), however, clearly mentioned that "at junction with mucro are ventrally, one or two scale-like plates". *Paronana dorsanota* Salmon (1941) is the only species under the genus *Paronana* which is without dental scale appendage although it possesses all other characteristics as that of the other species of the genus. Thus the name *Parasalina* Salmon (1944) is to be retained as a sub-generic name for this species of *Paronana* without dental scale appendage and also for convenience in taxonomic placement ; the diagnosis of *Parasalina* given by SALMON (1944) is now modified. The species *viz.*, *Parasalina dorsanota sufflava* (Salmon, 1941), *Parasalina tasmasecta boldensis* Salmon (1944), *Parasalina pilosa* Salmon (1944) which were treated by SALMON (1964) under *Parasalina* are now transferred to *Paronana* as all of them possess distinct dental scale appendage and are without any investment of scales.

UCHIDA (1943) described a new genus *Salinella* (now a subjective synonym of *Akabosia* Konoshita, 1919) with the type-species of *S. konoshitai* from Japan. This author found apparently before the journal is issued out that the genus *Salinella* is preoccupied by *Salinella* Frenzel, 1891 in Mesozoa. UCHIDA (1943), therefore, proposed a new name *Parasalina* for his *Salinella* and issued some correction slips which were pasted over *Salinella* in some of the copies of his publication. This correction unfortunately was not carried out in all the copies as evident from the records in the Biological Abstracts. A question has arisen, therefore, whether the *nom. nov. Parasalina* Uchida, 1943 pro *Salinella* Uchida, 1943 has priority over that of *Parasalina* Salmon, 1944. As only some of the copies in circulation carried this correction,

while others did not, the name *Parasalina* Uchida, therefore, fails to fulfil the criteria of publication and is not available in the meaning of the Code (Articles 8 and 9). Therefore, *Parasalina* Uchida pro *Salinella* Uchida, 1943 has neither any status nor priority over *Parasalina* Salmon and the latter is to be conserved as the available, valid name.

I. Taxonomic Account

Paronana Womersley, 1939 (New status)

Paronana Womersley, 1939, *Primitive Insects of South Australia, Adelaide*, 322 pp. (*nec. S. Str.*) ; Salmon, 1941, *Trans. Roy. Soc., N. Z.*, 70 : 398-407 ; 1964, *Bull. Roy. Soc., N. Z.*, (7) 1 : 103-144 ; 1964b, *Bull. Roy. Soc., N.Z.*, (7) 2 : 145-644 ; 1965, *Bull. Roy. Soc., N. Z.*, (7) 3 : 645-651.

Redefinition : Body facies large ; antennae usually twice the total length of head and body ; not clothed with scales, clothing of body as that of *Salina* involving microchaetae which may be darker and little flattened but not comparable with scales even those of *Parachaetoceras* ; obliquely truncated ciliated macrochaetae (brush setae) present ; frontal spines absent ; ocelli eight on each side ; tibiotarsi divided ; unguis little curved with paired inner teeth located near the middle of the inner margin, unpaired inner distal and external basolateral teeth prominent ; unguiculus lanceolate ; tenent hairs clavate, dentes long, slightly taper distally, not crenulated and annulated ; each dentes armed with a row of distinct simple spines ; dorsally near base of mucrones 2-3 stout, spiny, ciliated appendages present ; dental scale appendage present or absent.

Type-species : *Paronella bidenticulata* Carpenter, 1925, fixed by Womersley (1939).

Interrelationships : *Paronana* is related to *Parachaetoceras* Salmon, a member of the tribe Callyntrurini, but distinctly differs from it in the absence of lanceolate scales and long, outstanding, stiff macrochaetae on antennal segments and legs. It is also related to *Glacialoca* Salmon in the general

organisation of body but is distinct from it in the nature of attachment of mucro to dentes (apically attached *vs.* ventrally attached in *Glacialoca*) and nature of dental spines (simple spines *vs.* foliate, ciliated spines in *Glacialoca*). Further, no ventral dental spiny appendage occur in *Paronana*. *Paronana* also resembles to *Pseudosalina* Mitra, 1973 in the presence of larger number of macrochaetae on head and body. Presence of a transverse row of macrochaetac anteromedially on Abd. IV is a characteristic feature of the genus (*vs.* 2+2 in *Pseudosalina*). The genus appears to have a distant connection with entomobryomorpha. This is indicated by the fact that in *Paronana* (*Paronana*) *pilosa* (Salmon) the structure of mucro is somewhat close to entomobryomorph genera (Fig. 6, D). In addition, the dentes in this species taper considerably distally (Fig. 6, A ; Pl. III, C) suggesting further its affinity with entomobryomorphs and its less specialisation than any other species of this genus. This species, even though possesses a distinct dental scale appendage, a feature restricted only to some of the genera under Paronellinae, nevertheless its entomobryomorph body-facies in addition to the characters, mentioned above, serves as a definite link between entomobryomorph and paronelline genera supporting Christiansen's (1958) contention that *Homidia* (a genus having a row of distinct dental spines as *Paronana*) is somewhat distantly connected with Paronellinae. In cephalic chaetotaxy, *Paronana* is more evolved than its closely related genera under Cremastocephalini.

Distribution : Members of *Paronana* are endemic to New Zealand ; its endemism and abundance in New Zealand, a temperate country, indicates its low range of adaptation. It is interesting to note that New Zealand is the only temperate country which has such specialised and endemic representatives of Paronallinae. *Paronana* (*Paronana*) *tasmasecta*, recorded from Tasman Glacier, goes to prove its adaptibility even to very cold climatic conditions.

II. KEY TO THE SUBGENERA OF *PARONANA*

Single dental scale appendage present ventrally on each dentes, either

simple or superficially or deeply lobed* or crenulated at apex ... Subgenus : *Paronana*

Dental scale appendage absent ... Subgenus : *Parasalina*

Subgenus : **Paronana** Womersley, 1939. New Status

Paronana Womersley, 1939, *Primitive insects of South Australia, Adelaide.* 322 pp. (*nec, S. Str.*)
Panasalina Salmon, 1944, *Rec. Dom. Mus., Wellington,* 1 (2) : 123-182. New Synonymy (in part).

Type-species : *Paronella bidenticulata* Carpenter, 1925.

III. KEY TO THE SPECIES AND SUB-SPECIES

The author had an opportunity to examine series of specimens of *Paronana* (*Paronana*) *karoriensis* (Salmon, 1937) and *Paronana* (*Paronana*) *maculosa* (Salmon, 1937) and the paratypes of other species and subspecies, described by SALMON (1941, 1944), mounted on slides. It is noted that while *P.* (*P.*) *karoriensis* exhibits constancy in colour pattern, *P.* (*P.*) *maculosa* exhibits striking intrapopulation variation in colour pattern as observed in the species of *Salina* (MITRA, 1973), *Pseudosalina* (MITRA, 1974) and *Dicranocentroides* (MITRA, 1975). Much constancy is encountered in the nature of dental scale appendage and no intrapopulation variation could be detected for this structure. The dimension of mucrones and the nature of mucronal teeth vary strikingly within the same population of a species as observed in *P.* (*P.*) *karoriensis* and *P.* (*P.*) *maculosa.* In *P.* (*P.*) *pilosa* the dentes considerably tend to taper distally which is not seen in any other species of this subgenus.

On the basis of the characters, discussed above, following species and sub-species are recognised in this study and a key is given in aid of their identification. Probable cases of synonymy of the species and subspecies, which are known primarily on the basis of colour patterning, are also discussed.

*CARPENTER (1925) and SALMON (1941, 1944, 1964) considered such deeply lobed dental scale appendage as multiple scale appendages.

1	Dentes distinctly tapering distally; dental scale appendage simple; devoid of dark pigmented patches	*P. (P.) pilosa*
	Dentes not tapering appreciably distally; dental scale appendage simple or crenulated; dark or lightly pigmented ...	2
2	Head, thorax, Abds. I, II dorsally entirely pigmented with deep blue black pigment, other segments devoid of such pigment; colour pattern seldom variable ...	*P. (P.) bidenticulata*
	a Dental scale appendage lobed or crenulated ...	*P. (P.) bidenticulata bidenticulata*
	b. Dental scale appendage simple ...	*P. (P.) bidenticulata karoriensias*
	Head, thorax and all abdominal segments with variable patches and streaks of pigment of various shades; forms without any trace of pigment not of rare occurrence (cf. *sufflava*)	*P. (P.) maculosa*
	a Dental scale appendage lobed or cranulated	*P. (P) maculosa tasmasecta* [? Synonyms : *P. (P.) tasmasecta boldensis*; *P. (P.) sufflava*]
	b. Dental scale appendage simple ...	*P. (P.) maculosa maculosa* [Synonym : *P. (P.) pigmenta*]

IV. DESCRIPTIONS OF THE SPECIES

Paronana (Paronana) bidenticulata bidenticulata (Carpenter, 1925). New Status.

1925. *Paronella bidenticulata* Carpenter, *Manchester Museum Publ.*, 89 (28) : 1-16.

1941. *Paronana bidenticulata* Salmon, *Trans. Roy. Soc., N. Z.*, 70 : 282-431 ;nec, *Paronana bidenticulata* sensa Womersley, 1939, *Primitive Insects of South Anstralia, Adelaide*, pp. 320.

Material : Lectotype of *Paronana bidenticulata* (Carpenter) : Mounted on a slide from Manchester University Museum, Manchester ; label on the slide reads as "*Paronella bidenticulata* Carp. ; Rakaia Gorge, Canterb., N. Z., Nov. 1913, T. Hall Coll."

Colouration : Blue-black pigment on Ths. II, III, Abds, I, II, III (Pl. II, A) ; Abds. IV and V pale, without darker pigment dorso-medially ; Abd. IV laterally and posteriorly with faint bluish pigment ; colour pattern similar to *P. karoriensis*

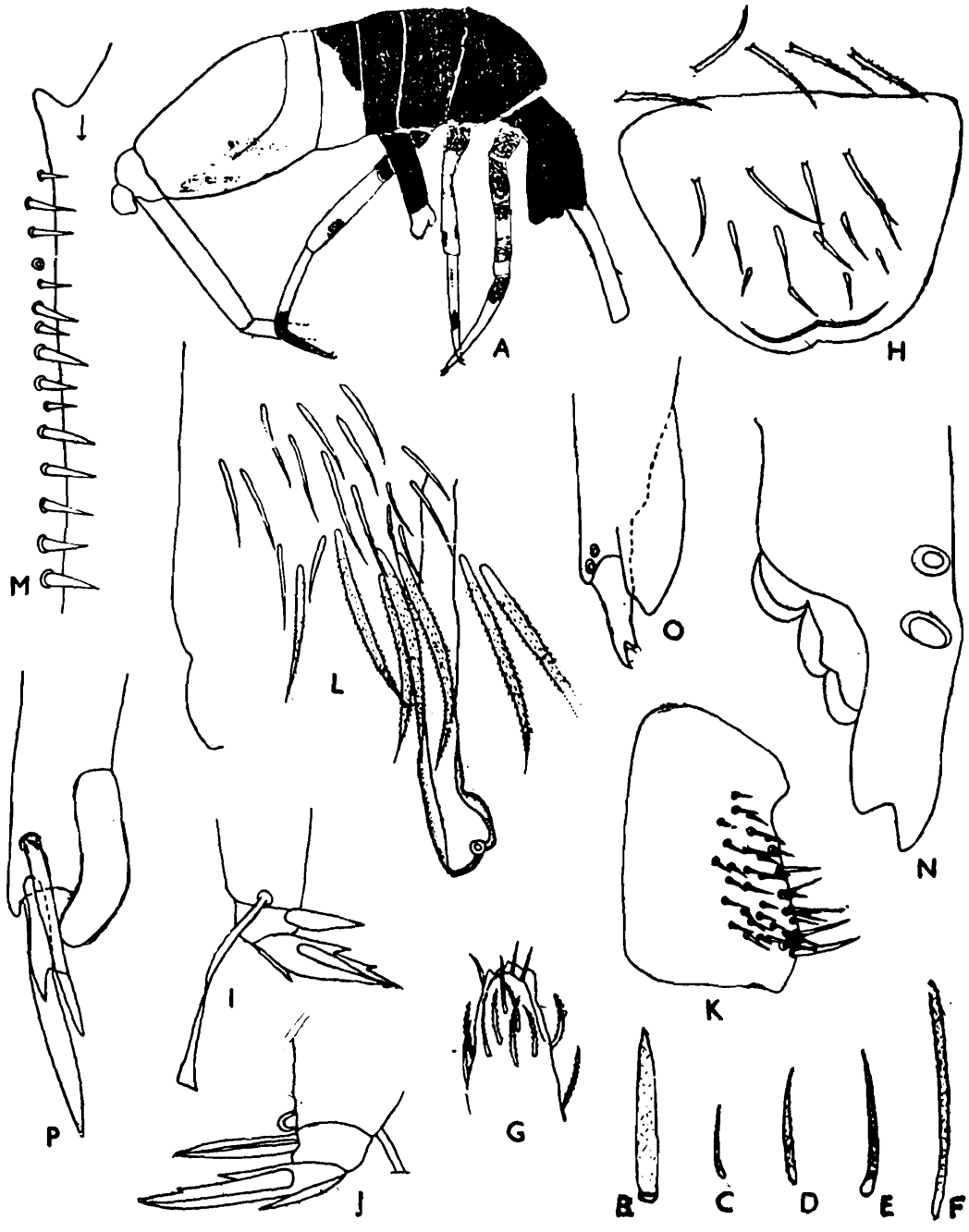

Fig. 1. *Paronana* (*Paronana*) *bidenticulata karoricnsis* (Salmon). A, profile showing colour pattern. B, a dental spine. C, a microchaeta from body. D, a microchaeta from subdorsal region of head. E, a microchaeta from Abd. IV. F, a macrochaeta from "Collar". G, apex of Ant. IV. H, labral chaetotaxy. I, foot-complex of leg I. J, foot-complex of leg III. K, trochanteral organ. L, chaetotaxy of the anterior face of ventral tube. M, proximal portion of dentes showing arrangement of spines. O,P, mucrodens complex. *Paronana* (*Paronana*) *bidenticulata bidenticulata* (Carpenter). N, mucrodens complex from lectotype.

(Salmon) ; anterior part of tibiotarsus near its segmentation pigmented.

Clothing : Clothed with microchaetae and obliquely truncated, ciliated macrochaetae most of which cast off ; obliquely truncated macrochaetae (as ascertained from sockets) present on Ths. II, III, Abds. I, II, III ; acuminate macrochaetae in a transverse row medially on Abd. IV ; femora and tibiotarsi with acuminate, slender setae ; Abds. V and VI posteriorly with short, blunt somewhat broad ciliated setae ; dentes clothed with acuminate ciliated setae.

Chaetotaxy : Polychaetoic ; but the chaetotaxy could not be studied in detail from the lectotype, mounted on a slide.

Head : Lacking in the lectotype.

Thorax : Tibiotarsi clearly divided ; unguis large, little curved apically, paired inner and unpaired distal teeth moderately developed ; unguiculus lanceolate : tenent hair long ; clavate ; trochanteral organ could not be seen in the mounted specimen.

Abdomen : Abd. IV conspicuously long and at least $5\frac{1}{2}$ times longer than Abd. III ; ventral tube with 5 macrochaetae anteriorly on anterior face, general surface of anterior face and posterior face with microchaetae ; rami of retinaculum each with 4 teeth, corpus with a median seta ; furcula long, relative length index of manubrium : mucrodens = 23:44 ; dentes with a single inner row of spines which transit distally into stiff spiny setae ; mucro broad bidentate, dental scale appendage trilobed at apex (Fig. 1, N) ; sockets of dental spiny appendages distinctly visible near the base of mucrones.

Length (excluding head and appendages) : 2.6 mm.

Type-specimens : Lectotype (examined) in the Manchester University Museum, Manchester, England ; singe paralectotype, as mentioned by SALMON (1941), in the Canterbury Museum, New Zealand.

Type-locality : Near Mount Algidus, Rakaia Gorge, Canterbury, New Zealand.

Comments : *Paronana bidenticulata bidenticulata* (Carpenter 1925) is characterised by the presence of dark blue-black pigment on head, Th. II and Abd. I, thick, broad mucrones and lobed dental scale appendage. *Paronana karoriensis* (Salmon, 1937), also from New Zealand, resembles perfectly to the above mentioned species in colour pattern. However, *P. karoriensis*, as has been observed, is always with simple dental scale appendage. With such difference it is felt pertinent to consider *P. karoricnsis* (Salmon) as the sub-species of *P. bidenticulata.*

Some specimens identified by Prof. Salmon as *Parasalina bidenticulata* (Carpenter) were available for study from the South Australian Museum, Adelaide (PI. II, F ; Fig. 8, D). These specimens, however, have no similarity with *Paronana* (*P.*) *bidenticulata bidenticulata* (Carpenter, 1925) and they appear closer to *Paronana* (*Paronana*) *maculosa maculosa* (Salmon, 1937) than any other species so far known under this sub-genus.

Paronana (Paronana) bidenticulata karoriensis (Salmon, 1937)

New Status

1937. *Salina karoriensis* Salmon, *Trans. Roy. Soc,, N. Z.*, 67 : 352-358.

1941. *Paronana karoriensis* Salmon, *Trans. Roy. Soc. N. Z.*, 70 : 398-407.

Material : 1 paratype Slide No. N. Z. 3/200 (Dominion Museum, N. Z.), labelled as "*Parasalina karoriensis*, Loc. Awahuri, Palm. Nth. In debris under Kowhai trees, 17/12/39, Coll. J. T. Salmon, Det. J. T. Salmon. Mounted Euparal (P. type)" ; 8 exs., Vöge Hown, Wellington, New Zealand, 7.10. 1968, R. G. Ordish coll. (ex. mixed grasses) ; 20 exs., Wellington, 24.5.1969, R. G. Ordish coll. (ex. grass and fern).

Colour pattern similar to the principal form, tibiotarsi dark pigmented (PI. I, A ; Fig. 1, A) ; relative length index of Ants. I : II = 26 : 34 ; body clothed with microchaetae similar to those which occur in *Salina* (PI. I, C, E ; Fig. 1, C, D, E) ; Ants. I, II with a few outstanding, stiff and dark

macrochaetae in addition to normal ciliated acuminate setae ; Ant. IV at apex with an inconspicuous sense-knob and with a few smooth setae (Fig. 1, G) ; prelabral setae 4, ciliated,

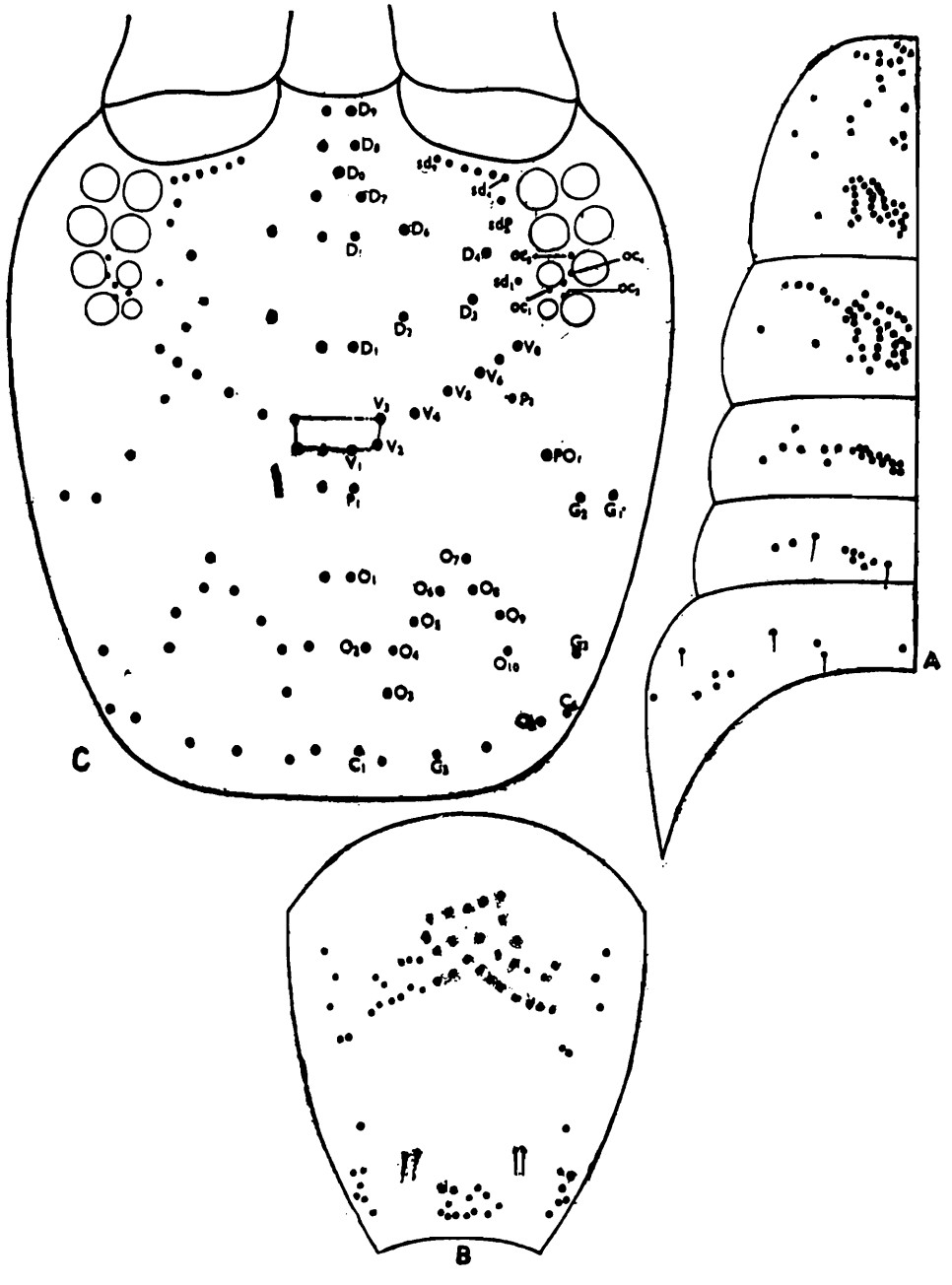

Fig. 2. *Paronana* (*Paronana*) *bidenticulata karoriensis* (Salmon). A, Chaetotaxy of Ths. II, III, Abds. I,II, III. B, chaetotaxy of Abd. IV. C, cephalic chaetotaxy.

labral setae 5, 5, 4, smooth, labrum near anterior margin with a distinct transverse thickening (Fig. 1, H) ; Ths. II : III= 21 : 13 ; unguis moderately curved with paired inner teeth located at middle of the inner margin and a distal conspicuous inner unpaired tooth, external basolateral teeth well

developed ; unguiculi lanceolate ; tenent hair long, clavate (Fig. 1, I, J) ; trochanteral organ with *c.* 38 spiny setae (Fig. 1, K) ; relative length index of Abds. I : II : III : IV : V : VI = 11 : 9 : 7 : 38 : 8 : 3 ; ventral tube long, anteriorly on anterior face with 5+5 macrochaetae, rest of the anterior face and posterior face clothed with acuminate microchaetae (Fig. 1, L) ; relative length index of manubrium : mucrodens = 28 : 38 ; dentes slightly taper distally, each with a single row of simple spines (Fig. 1, M ; PI. 1, D) ; mucro slender bidentate, the teeth little curved upward, dental scale appendage will developed, simple (i. e., not crenulated at apex) (Fig. 1, O, P) ; two dorsal dental spiny appendages present.

CHAETOTAXY

Head : Vertex with V_1-8, all macrochaetae, V_1, V_2 on each side located almost in a straight line and joining them with V_3 on each side yields a trapezeum or a rectangle ; dorsal region with D_0+D_{1-9}, all macrochaetae ; subdorsal region usually represented by microchaetae (sd_{1-9}) ; ocular region has 5 microchaetae (oc_{1-5}) ; postocular region with a macrochaeta (PO_1) ; parietal region represented by 1 macrochaeta only (P_1), p_2 usually represented by a microchaeta ; occipital region represented by O_{1-10}, all macrochaetae, arranged in a characteristic manner ; cervical region represented by 6 macrochaetae (C_{1-6}) ; genal region represented by 3 macrochaetae on each side (C_{1-3}) (Fig. 2,C).

Body : Number of macrochaetae on each tergite ranges as follows : Ths. II (30-52), III (20-42) ; Abds. I (18-20), II (8), III (7) ; Abd. IV medially with a transverse row of macrochaetae varying from 19-20 on either side (Fig. 2 A, B).

Length : (excluding appendage) : 3. 2 mm.

Type-specimens : Holotype mounted on a Slide No. 3/199 and paratype, Slide No. 3/200 (examined) are deposited in the collection of the Dominion Museum, Wellington, New Zealand.

Comments : *P. (P.) bidenticulata karoriensis* differs from the principal form in the possession of simple dental scale appendage.

Paronana (Paronana) maculosa maculosa (Salmon, 1937).
New Status

1937. *Salina karoriensis* var. *maculosa* Salmon, *Trans. Roy. Soc. N. Z.*, 67 : 352-358.
1941. *Paronana maculosa* Salmon, *Roy. Soc. N. Z*, 70 : 398-407.
1941. *Paronana pigmenta* Salmon, *Trans. Roy. Soc., N. Z.*, 70 : 398-407. ? Synonym.

Material : 1 paratype, Slide No. N. Z. 3/46 (Dominion Museum, New Zealand) labelled as "*Parasalins maculosa*, Loc.

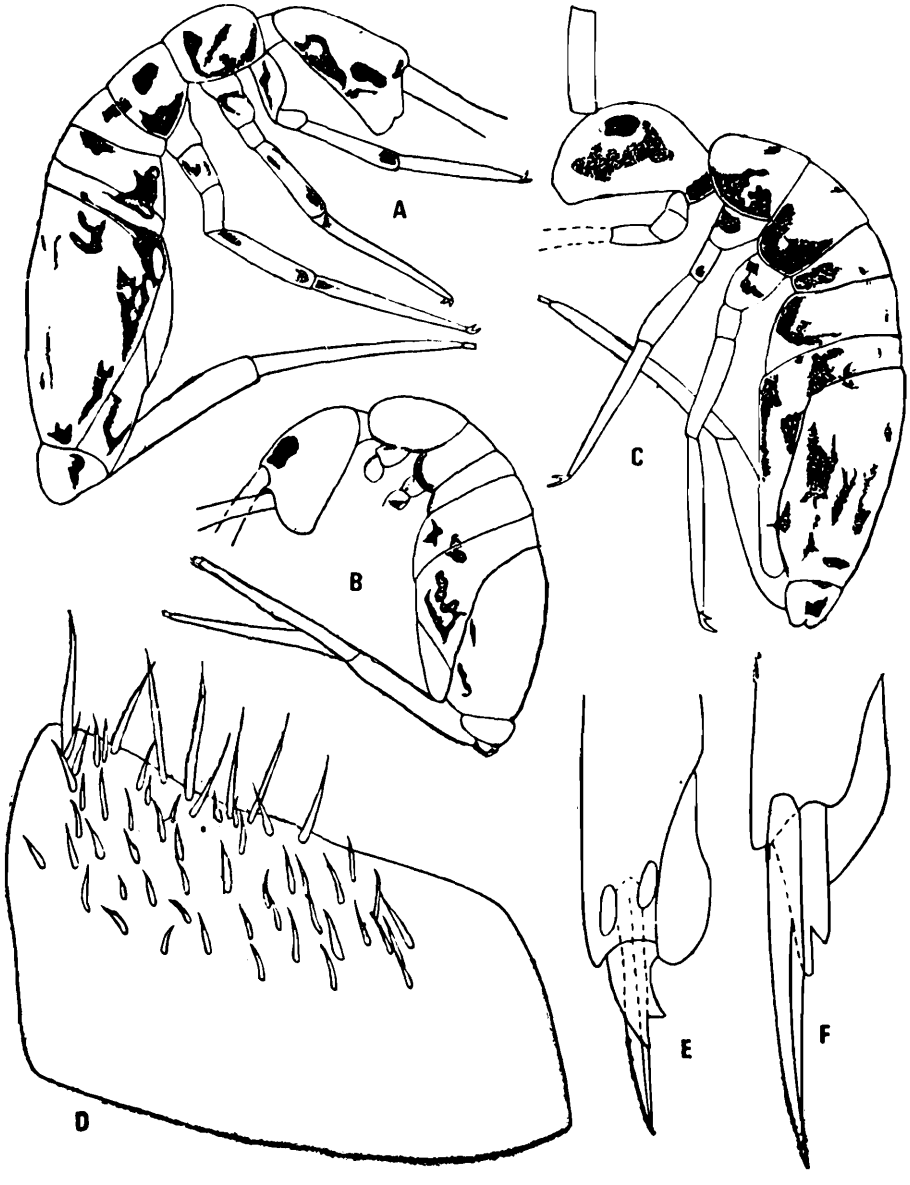

Fig. 3. *Paronana* (*Paronana*) *maculosa maculosa* (Salmon). A-C, profile showing variation in pigment patterning. D, trochanternal organ. E, F, mucrodens complex.

Karori, in soil in garden, coll. J. T. Salmon. Det. J. T.

Salmon. Mounted Euparal (P. type)" ; 5 exs., Wellington, 24.5.1969, exs grass and fern. R. G. Ordish, coll., S. K. Mitra det. ; 1 paratype Slide No. N. Z. 3/932 (Dominion Museum, N. Z.), labelled as "*Parasalina pigmenta*, Loc. Tnatapere, South land. In old log in bush, 8/1/1940, coll. J. T. Salmon.

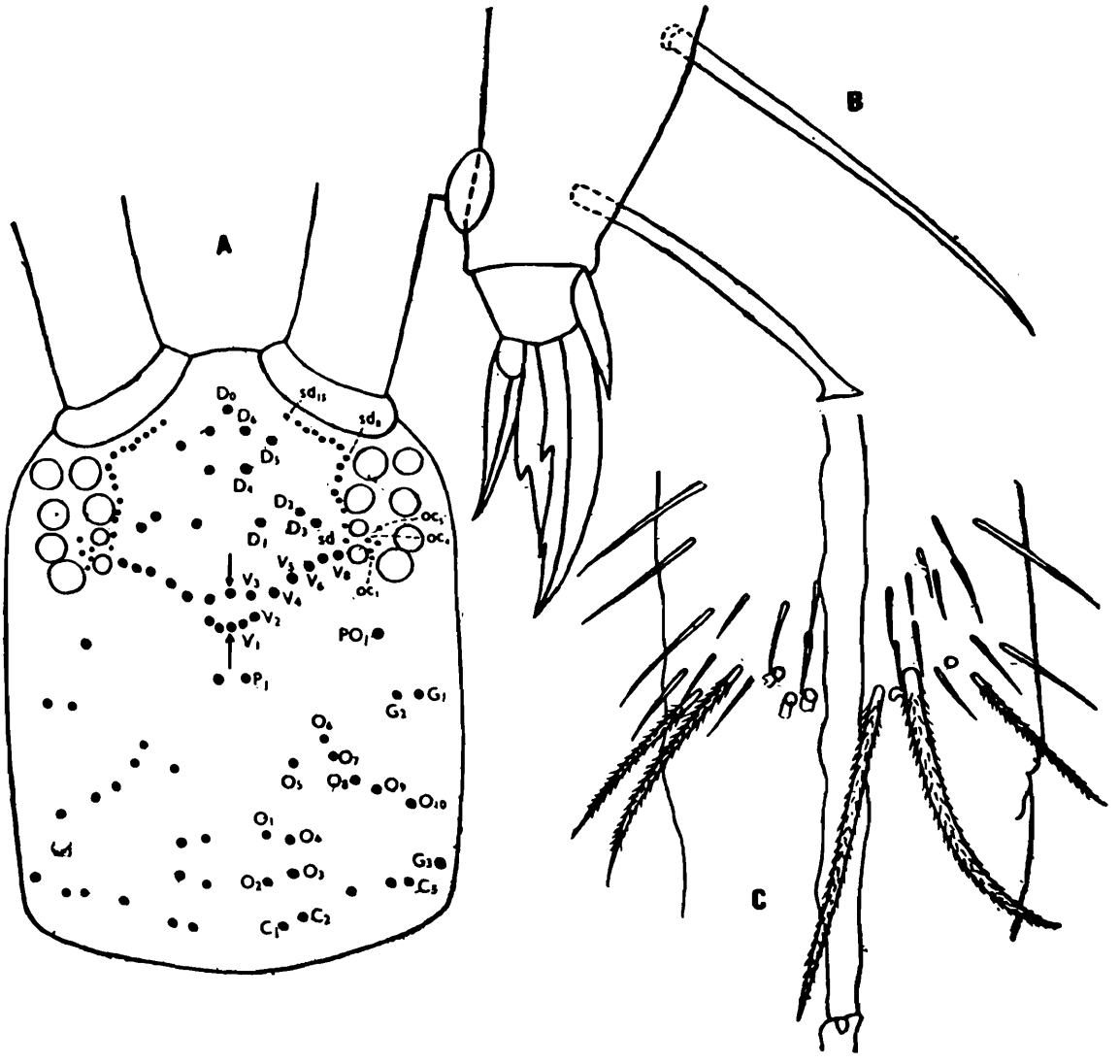

Fig. 4. *Paronana* (*Paronana*) *maculosa maculosa* (Salmon). A, cephalic chaetotaxy. B, foot-complex from leg III.

Det. J. T. Salmon. Mounted Euparal (P. type)" ; 1 ex. mounted on a slide from South Australian Museum, Adelaide, No. Nil, slide bears two labels : (a) reads as "Collembola, *Pseudopuronella bidenticulata* (Carp.), Loc. amongst taraire (?) leaves, Waiheke Is., Auckland, N. Z., 14/1/33, E. D. P. Det. H. Womersley ; (b) reads as "Insecta, *Paraslina dorsanota* subsp. *sufflava* Det. J. T. Salmon" ; 1 ex. mounted on a slide from South Australian Museum, Adelaide, Microslide No. 1, labelled as "*Parasalina bidenticulata* (Carp.), Loc. Cleddau,

2,500, beaten from *Danthonia cunninghamensis*, coll. J. T. Salmon, 17/12/1944, MNT. P. N. A. Det. J. T. Salmon, 1945" ; 1 ex. mounted on a slide, No. Nil, from South Australian Museum, Adelaide, labelled as "Collembola, *Pseudoparonella bidenticulata* Carp., Loc. Belgrave. VIC., 1/38,

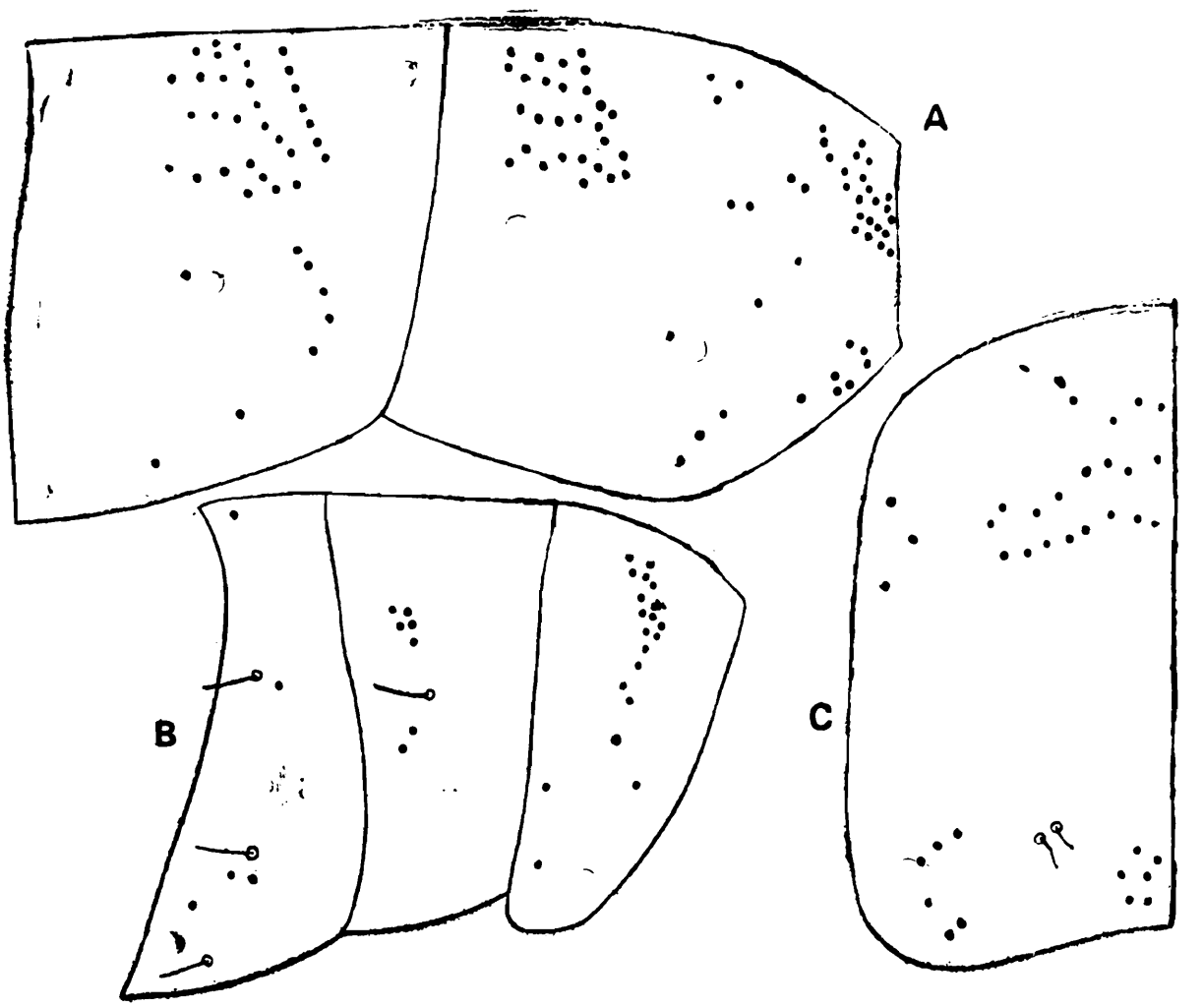

Fig. 5. *Paronana* (*Paronana*) *maculosa maculosa* (Salmon). Chaetotaxy of Ths. II, III (A), Abds. I, II, III (B), IV (C).

O. W. T. Det. H. Womersley" [The specimen is a member of *Pseudoparonella*. Womersley (1939) misidentified the specimen and published it as *Paronana bidenticulata* (Carpenter, 1925)].

In general colour pattern of the species variable and forms with reduced pigmented patches also not rare in the examples examined (Fig. 4, A-C ; Pl. II, B, C, F) ; ground colour pale yellow with variable violet to blue-black patches often suffused with reddish brown pigment inregularly distributed

laterally on head, thoracic and abdominal segments, some smaller streaks dorsally on these segments also noted in some examples ; coxae, subcoxae, femora and tibotarsi with or without such pigmented patches.

Body clothed with microchaetae and obliquely truncated ciliated macrochaetae ("brush setae") ; femora and tibiotarsi with acuminate slender setae.

Ocelli 8+8, G and H reduced ; Ant. 1 only retained in examples exemined ; prelabral setae 4, ciliated, labral setae 5, 5, 4 smooth ; frontal spines absent ; Ths. II : III=16 : 10 ; unguis with paired inner basal and distal unpaired teeth, external basal teeth prominent ; unguiculus lanceolate, non-dentate ; tibiotarsal lobe prominent ; tenent hairs clavate, well developed (Fig. 5, B) ; trochanteral organ with *c.* 54 spine-like setae (Fig. 4, D) ; relative length index of Abds. I : II : III : IV : V+VI=7 : 9 : 6 : 38 : 7 ; ventral tube long, anteriorly on anterior face with 5+5 macrochaetae, rest of the anterior face with acuminate microchaetae ; relative length index of manubrium : dentes=29 : 42 ; dentes slightly taper distally, each with a characteristic row of simple spines ; mucrones straight or little curved upward, bidentate, apical tooth larger than anteapical tooth ; dental spiny appendage represented by a single large, stout spine-like seta ; dental scale appendage simple (Fig. 4, E, F).

CHAETOTAXY :

Head : General plan similar to *P.* (*P.*) *bidenticulata karoriensis* but differs from it in the presence of 2 additional macrochaetae at the middle of vertex and reduction of dorsal (cf. D_7, D_8, D_9 of *P. bidenticulata karoriensis*) and cervical macrochaetae (C_{1-5}) ; subdorsal setae represented by sd_{1-5} (Fig. 5, A).

Body : Polychaetoic ; chaetotaxy of Ths. II, III/Abds, I, II, III, IV=72 (29, anteriorly ; 10, medially ; 23, on anterior margin ; 10, on lateral region), 40/20, 8, 6, 37, 25+1 distributed anteriorly in three apparent distinct rows and 12 posteriorly) ; lasiotrichia present as 2+2 (Abds. II, IV) and as 3+3 on Abd. III (Fig. 5, A-C).

Length (excluding appendages) : 2.5 mm.

Type-specimens : Holotype, mounted on a slide and paratype, Slide No. N.Z.3/932 (examined) remain deposited in the collection of the Dominion Museum, New Zealand.

Comments : *Paronana* (*Paronana*) *maculosa maculosa* differs from the preceding species and subspecies in the possession of dark, variable blue-black patches on the thoracic and abdominal segments, in the chaetotaxy of head and body and from *P. P. tasmasecta, s. str.* in the possession of simple dental scale appendage.

Paronana (Paronana) maculosa tasmasecta Salmon, 1941.
New Status

1941. *Paronana tasmasecta* Salmon, *Trans. Roy. Soc., N. Z.*, 70 : 398-407.

1941. *Paronana suffiava* Salmon, *Ibid.* ? Synonym.

1944. *Parasalina tasmasecta* Salmon, *Rec. Dom. Mus.*, 1 : 123-182 ; 1964, *Bull. Roy. Soc., N. Z.*, (7) : 546.

1944, 1964. *Parasalina tasmasecta boldensis* Salmon, *Ibid.* ? Synonym.

1944, 1964. *Parasalina dorsanota sufflava* Salmon, *Ibid.*

Material : 1 paratype, Slide No. N.Z. 3/885 (Dominion Museum, N. Z.), labelled as "*Parasalina tasmasecta*, Loc. Tasman Glacier, under stones. On terminal moraine, 31/12/1939, coll. J. T. Salmon. Mounted xylol-balsam (P. type)" ; 1 paratype, Slide No. N. Z. 3/1541 (Dominion Museum, N. Z.) labelled as "*Paronana tasmasecta boldensis*, Loc. Bold peak 3000', under log in beech forest, 11/2/1943, coll. J. T. Salmon, Det. J. T. Salmon. Mounted Diaphane (Paratype)" ; 1 paratype, Slide No. N. Z. 3/931 (Dominion Musenm, N. Z.) labelled as "*Parasalina snfflava*, Loc. Bench Island, Dunedin, 17/12/1938, coll. Prof. Marpels. Det. J. T. Salmon. Mounted Euparal."

Paronana (*Paronana*) *maculosa tasmasecta* differs from the principal form in the dental scale appendage being crenulated at apex (Fig. 8, (A—E) ; species like *P.* (*P.*) *sufflava* and subspecies, *viz.*, *P.* (*P.*) *iasmasecta boldensis* do not differ significantly from *P.* (*P.*) *maculosa tasmasecta* except in the details of colour pattern which is extremely

variable as seen in *P.* (*P.*) *maculosa maculosa* ; variation of length and colour pattern according to altitudinal difference is frequent in insects, specially in Collembola. These forms agree in all respect in other morphological details. Further studies on chaetotaxy are required to establish their actual relationship which could not be undertaken for non-availability of a lcohol-preserved specimens. Chaetotaxy as far as could be noted from specimens, mounted on slides, conform to the general pattern of chaetotaxy of *Paronana*.

Paronana (Paronana) pilosa (Salmon, 1944)
New Combination

1944 *Parasalina pilosa* **Salmon**, *Rec. Dom. Mus., N. Z.*, **1** (2) : 123-182 ; 1964, *Bull. Roy. Soc., N. Z.*, (7) : 546.

Material : 1 paratype, Slide No. N. Z. 3/1435 (Dominion Museum, N. Z.) labelled as "*Parasalina pilosa*, Loc. Kennedy's Bush, Ch'. ch'., Beaten off Manuka, 4/3/1943, coll. J. T. Salman. Det. J. T. Salmon. Mounted Diaphane (paratype)".

General ground-colour of body ochre-yellow ; no dark pigmented patches except a frontal patch in between two antennal bases (Pl. II, E ; Fig. 7, A). General clothing of body involves microchaetae, clusters of obliquely truncated ciliated macrochaetae ("brush setae") present on thoracic and first three abdominal segment, rest of the abdominal segments with acuminate flexed macrochaetae. Exact chaetotaxy of head and body though could not be studied for non-availability of alcohol-preserved specimens, nevertheless, the species is polychaetoic like other members of this genus ; unguis slightly curved with paired inner basal teeth located at middle and single unpaired inner basal tooth, external basal teeth well developed, unguiculus lanceolate, non-dentate, tibiotarsal lobe overhanging the base of unguiculus well developed ; tenent hairs long, clavate (Fig. 7, B) ; SALMON (1944) notiaed an additional "much smaller tooth" at half way between this (= "a single strong tooth at two thirds", also seen and illustrated by the present author) and the claw tip.

But in his figure (Pl. 62, Fig. 158), the "much smaller tooth" as refered by him, appears stronger than the "strong tooth

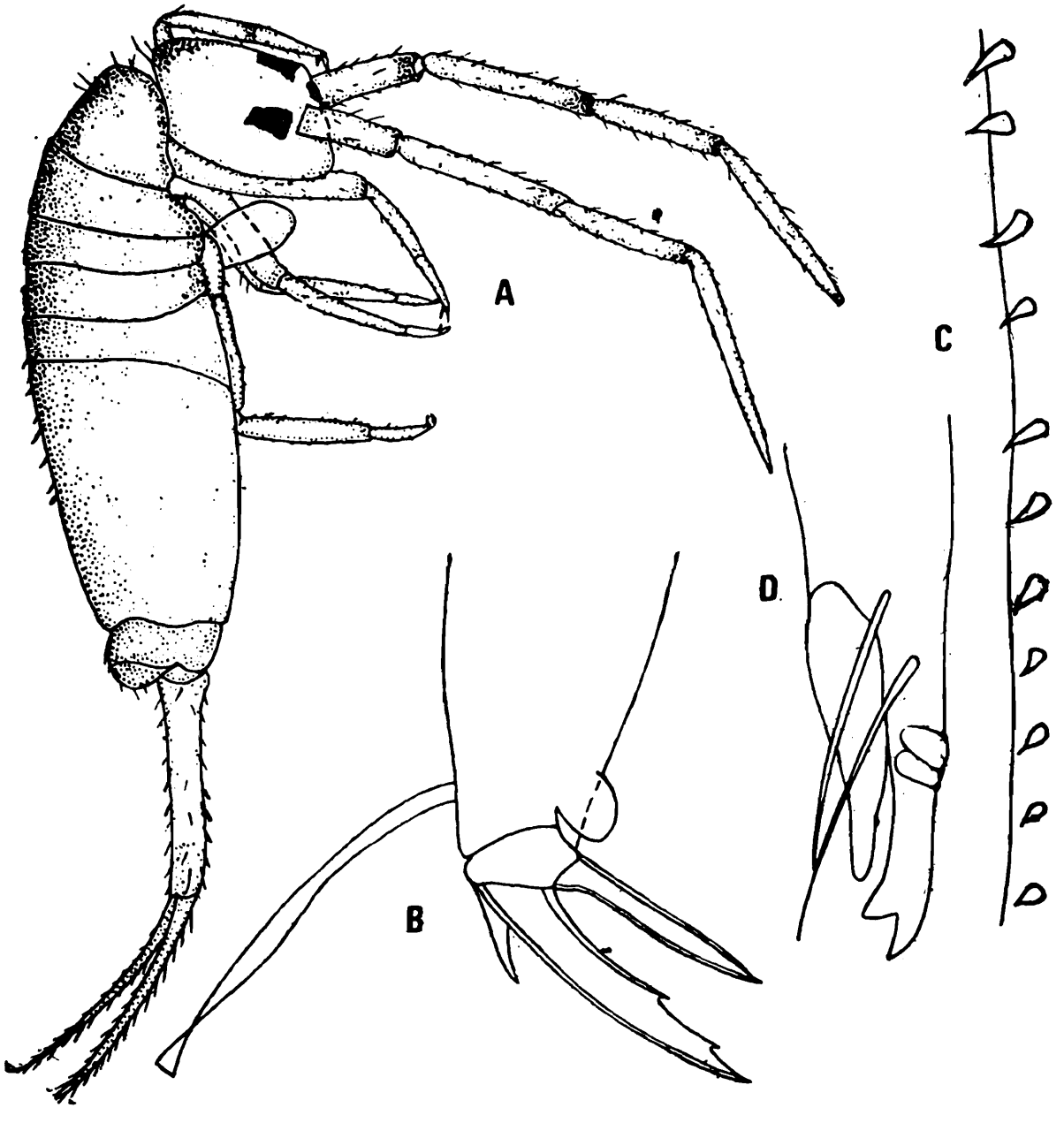

Fig. 6. *Paronana* (*Paronana*) *pilosa* (Salmon). A, profile (Paratype). B, footcomplex from leg III. C, arrangement of spines on dentes. D, mucrodens complex.

at two-thirds" of unguis ; this smaller unpaired tooth, however, was not noticed in the paratype examined by the author ; ventral tube well developed ; dentes considerably taper distally (cf. Entomobryomorpha), a unique character of the species (Pl. 3, C) ; dentes with a row of simple spines (Fig. 7, C), mucrones bidentate, dental scale appendage simple, closely apposed to dentes along most of its length (Fig. 7, D).

Type-specimens ; Holotype, mounted on a slide and paratype, Slide No. N. Z.3/1435 (examined) remain deposited in the collection of Dominion Museum, New Zealand.

Comments : *Paronana* (*Paronana*) *pilosa* (Salmon) is a unique species of the genus in having gradually tapering dentes with a dental scale appendage, entomobryiform body facies and mucrones not to be seen in any other species of this genus. Such characters in this species serve as a definite link between entomobryomorph and paronelline genera.

Sub-genus : **Parasalina** Salmon, 1944. New Status.

Parasalina Salmon, 1944, *Rec. Dom. Mus.*, **1** (2) : 123-182 ; 1964, *Bull. Roy. Soc., N. Z.*, (7) **1** : 103-144.

Redefinition : Dental scale appendage absent ; other features same as given under *Paronana*.

Type-species : *Paronana dorsanota* Salmon, 1941, fixed by Salmon, 1964.

Paronana (Parasalina) dorsanota Salmon, 1941. New Status

1941. *Paronana dorsanota* Salmon, *Trans. Roy. Soc., N. Z.*, **70** : 398-407.

1944. *Parasalina dorsonta* Salmon, *Rec. Dom. Mus., Wellington*, **1**(2) : 123-182 ; 1964, *Bull. Roy. Soc., N.* Z., (7) **2** : 145-644.

1944. *Parasalana dorsanota intermedia* Salmon, *ibid.* New Synonymy.

Material : 1 paratype of *Paronana* (*Parasalina*) *dorsanota* Salmon, Slide No. N. Z. 3/880, details as mentioned above under material of the genus. 1 paratype of *Paronana* (*Parasalina*) *dorsanota intermedia* (Salmon), Slide No. N. Z. 3/1582, details as mentioned above under material of the genus.

Colouration : Ground colour yellowish brown, with dirty brown pigment dorsomedially on Ths. II, III and Abds. I to VI, which unite to from a continuous longitudinal band ; such pigment present as spots laterally on Ths. II, III, Abds. I, II III, but somewhat in the from of a unifrom lateral patch on Abd. IV , pigment also present on general surface of Abds. V and VI ; antennae and legs with dark brown pigment, pigment intense anteriorly on each antennal segment and on

the margins of appendages, Ants. III and IV dark purple ; furcula without pigment (Pl. III, A, B).

Clothing : Body clothed with slender, thin microchaetae and flexed macrochaetae ; macrochaetae on Ths. II, III and

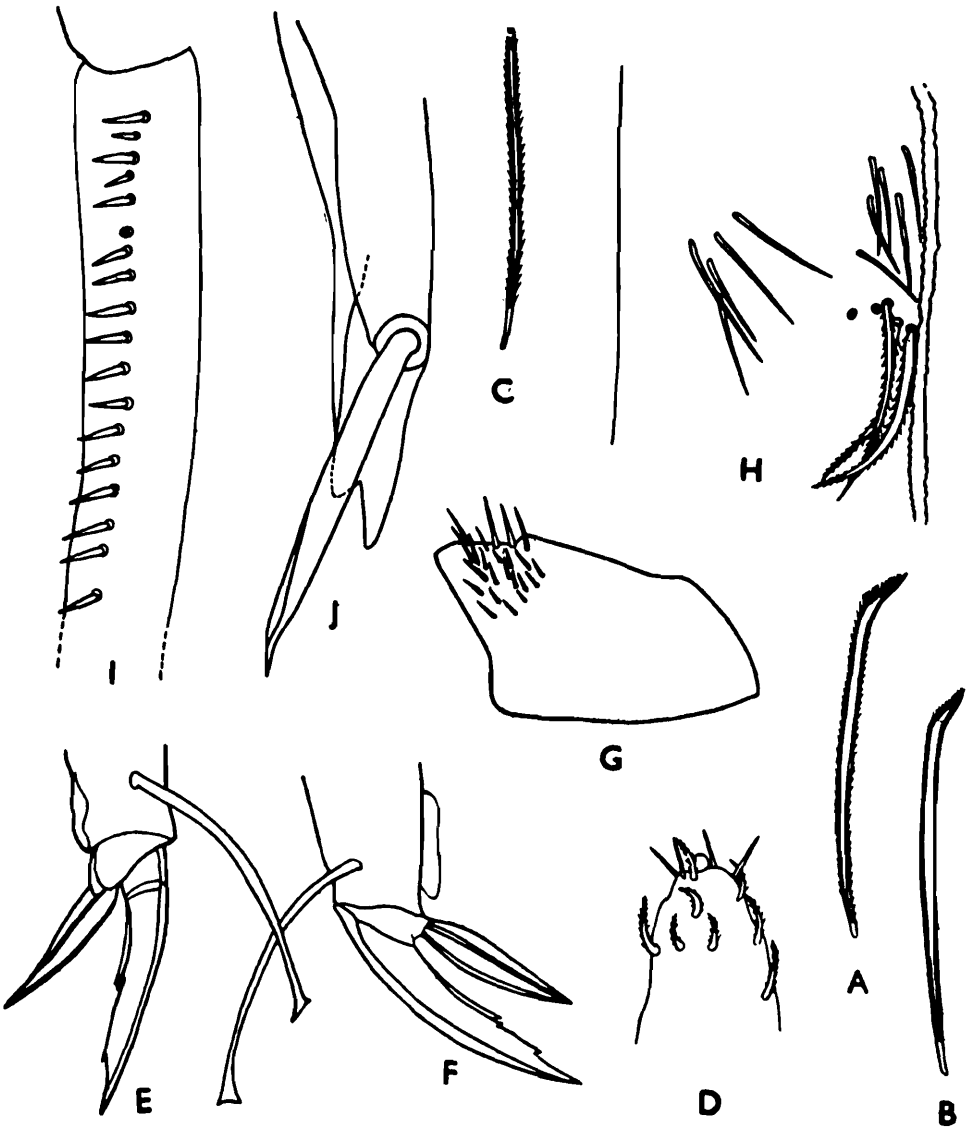

Fig. 7. *Parasalina* (*Parasalina*) *dorsanota* Salmon. A, B, flexed macrochaetee from thorax. C, a flexed macrochaeta from Abd. IV. D, apex of Ant. IV. E, foot-complex of leg I. F, footcomplex ef leg III. G, trochanteral organ. H, Chaetotaxy of anterior race of ventral tube. I, a portion of centes showing arrangement of spines. J, mucrodens complex (All drawn from Paratype).

Abds. I, II obliquely truncated, ciliated, those present on Abds. IV, V broadly acuminate (Fig. 7, A-C) ; antennae and legs clothed with slender acuminate setae interspersed with certain outstanding long setae, Ants. III and IV, in

addition, with certain apparently smooth setae ; furcula clothed with short, slender, acuminate setae.

Head : Pear-shaped when viewed from above : frontal spines absent ; eight ocelli on each side in dark ocellar field,

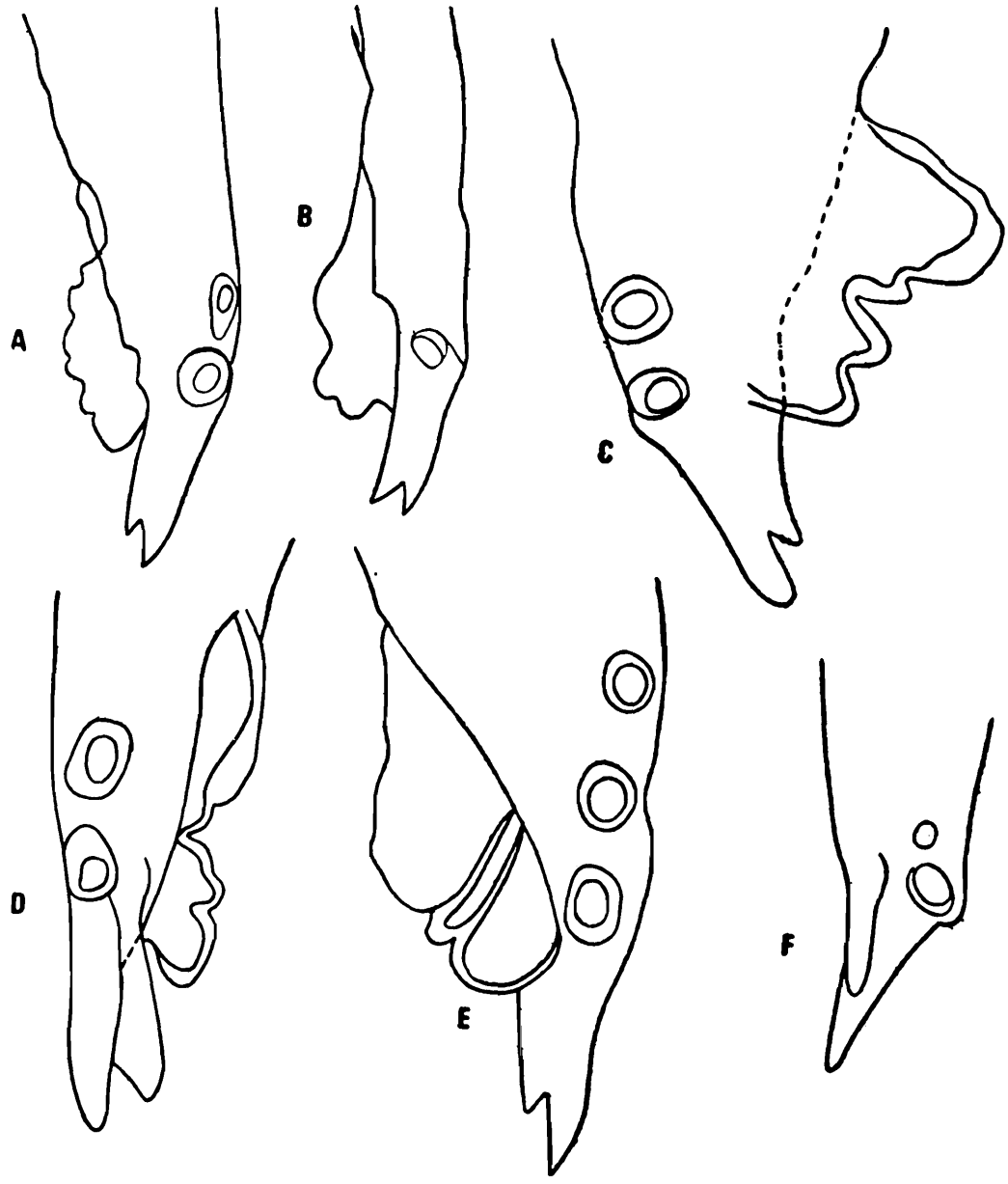

Fig. 8. Mucrodens complex in *Paronana*. A,B, *Paronana* (*Paronana*) *sufflava*. C, *Paronana* (*Paronana*) *tasmasecta*. D, *Paronana* (*Paronana*) *masculosa maculosa* (from a specimen in South Australian Museum, Adelaide ; det. Salmon as *Parasalina bidenticulata*). E, *Paronana* (*Paronana*) *tasmasecta boldensis*. F, *Paronana* (*Parasalina*) *dorsanota intermedia* (from Paratype).

each group arranged in two longitudinal parallel rows ; antennae *c.* twice the length of head and body, relative length index of Ants. I : II : III : IV = 21 : 31 : 21 : 51 ; Ant. IV

with an apical sense-knob guarded with a few apparently smooth setae (Fig. 7, D) ; prelabral setae, 4, ciliated, labral setae 5, 5, 4.

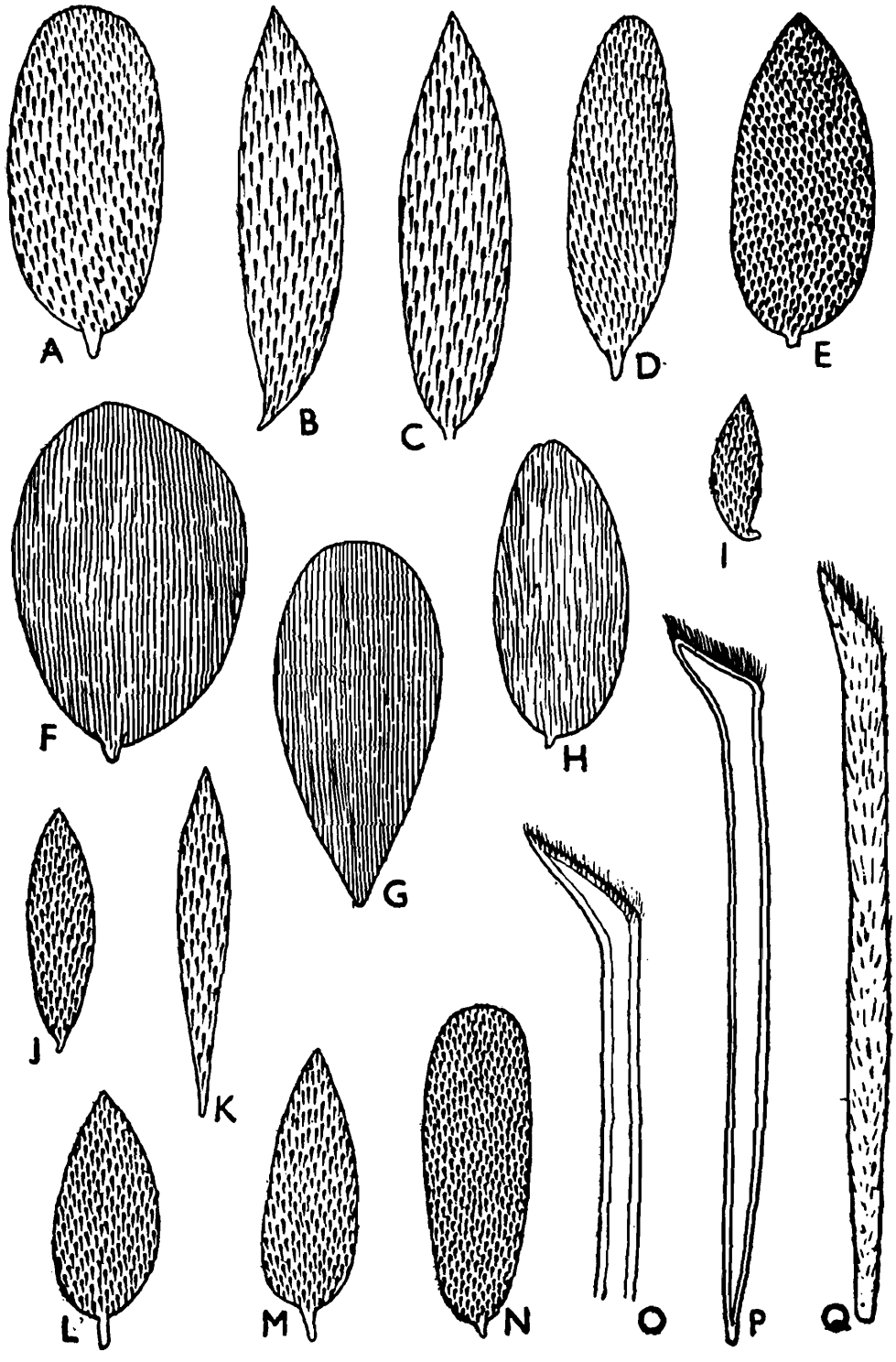

Fig. 9. Typical clothing in *Pseudoparonella*. A-N, Pseudosales. O-Q, flexed "brush setae".

Thorax : Relative length index of Ths. II : III = 13.9 ; unguis with paired inner basal teeth located near the middle of the inner margin, single unpaired distal tooth sub-apically

located and quite exaggerated ; unguiculi lanceolate, non-dentate ; tenent hair well developed, minutely ciliated, clavate (Fig. 7, E, F) ; trochanteral organ with *c.* 22 short spines (Fig. 8, G).

Abdomen : Relative length index of Abds. I : II ; III : IV : V : VI = 5 : 6 : 3 : 34 : 5 : 2 ; ventral tube long with protrusible vesicles retracted ; 5+5 macrochaetae anteriorly on the anterior face of ventral tube, the rest of the anterior and posterior faces with slender microchaetae only (Fig. 7, H) ; relative length index of manibrium : mucrodens = 81 : 112, dentes slightly taper distally ; each dentes with a row of simple spines which gradually transit into stiff ciliated setae distally (Fig. 7, I) ; mucro bidentate ; dental spiny appendage single, ciliated on margins ; dental scale appendage absent (Fig. 7, J).

Length (excluding antennae and furca) : 2.4 mm.

Type-specimens : Holotype (Slide No. 3/875) and paratype (Slide No. 3/880, examined) are in the Dominion Museum, Wellington, New Zealand.

Type-locality : Mount Cargill, Dunedin, New Zealand. SALMON (1941) did not select any type-locality and the author takes this opportunity to select the above-mentioned place as the type-locality.

Comments : Parasalina is a monotypic sub-genus consisting of the species *Paronana* (*Parasalina*) *dorsanota* and its one sub-species *intermedia*. The sub-species was erected by SALMON (1944) only on the basis of slight difference in colour pattern which is frequent in the genera under Paronellinae. In other morphological details the sub-species is similar to the principal form. Short antennae in the sub-species appears to be due to their imperfect regeneration. In fact the paratype examined, shows deformed antennae (Pl. III, B). The sub-species is considered here as a synonym of the principal form.

Interrelationships : *Parasalina* is apparently close to *Paronellides* in the nature of mucrones and in thea bsence of dental scale appendage but differs from it in the presence of

distinct dental spines. The subgenus can be differentiated from *Glacialoca* Salmon in the nature of dental spines and in the presence of dental spiny appendage dorsally at apex of dentes.

Distribution : The type-species of the sub-genus is known from Dunedin and Otago in New Zealand and appears to be an endemite of this country.

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SUMMARY

In this study the confusions existing on the concepts of *Paronana* Womersley and *Parasalina* Salmon are resolved on the basis of the exsmination of type-specimens of the type-species and other species known under these taxa. Detailed studies reveal that *Parasalina* Salm. should be considered as a subgenus of *Paronana* Wom. and the latter is widely different from *Pseudoparonella* Handschin. Keys to the subgenera, species and subspecies are provided on the basis of newly evaluated characters.

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