

**TARSONEMOIDES LIMBATUS NOV. SPEC., AND THE
SYSTEMATIC POSITION OF THE TARSONEMIDA
(ACARIDA)**

by

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With 10 text-figures

In the course of my investigations in the field of comparative acarid morphology (Van der Hammen, 1961, 1963, 1964, 1964a, 1965, 1966, 1968, 1968a, 1968b, 1968c, 1969, 1969a, 1970, 1970a, 1970b), I have paid attention to various groups of mites, viz., all orders of Anactinotrichida, except Ixodida (apart from a small paper on the palp); and all orders of Actinotrichida, except Tarsonemida and Acaridida. One of the most important gaps is now constituted by the Tarsonemida, of which the systematic position has been controversial, although recent authors generally classified the group with the Trombidiformes or Prostigmata. Published data on the morphology, notwithstanding the fact that very important studies have recently appeared (e.g. Beer, 1954; Cross, 1965; Karafiat, 1959; Krczal, 1959; Schaarschmidt, 1959; Suski, 1966, 1967, 1968), are difficult to compare with data known from other groups of mites. It is evident that, in view of the need of a satisfactory classification and a complete morphology of the mites, a reinvestigation of the Tarsonemida, with special attention to homologies, now has some priority.

The present paper is my first orientation in the group. I have simply chosen a species of which I had numerous materials. In many characters, this species appeared to be an average representative. It will be important to return to the group for the study of a more primitive species (e.g. a species of Pyemotidae). This study, however, must form part of my program of continued morphological investigation.

The group of the Tarsonemida (generally named Tarsonemini or Heterostigmata) consists of the families Pyemotidae, Scutacaridae, Tarsonemidae, and Podapolipidae. Originally, several authors recognized relationships of the group with Oribatida and Acaridida; as mentioned above, the opinion now prevails that relationships are with the Actinedida (Trombidiformes or Prostigmata). As a result of the present study, however, the Tarsonemida are

considered one of the four separate orders constituting the superorder Actinotrichida.

The present paper consists of a detailed description prepared according to the methods applied in my preceding morphological studies. Figured structures are orientated according to the principles explained in my *Glyptolaspis* paper (Van der Hammen, 1964a: 38-40). I have made use of the terminology developed in my preceding studies, and which is based on the work of Grandjean.

The description is followed by remarks on subjects of general interest, by materials for a glossary, by an alphabetic list of abbreviations, by a summary, and by a list of references.

***Tarsonemoides limbatus* nov. spec.**

Locality and materials. — Near Rû de Gally, Parc de Versailles, Versailles, France, 22 November 1961; in wet moss in alder-marsh near brooklet (samples 61P74, 75), and in moss under trees at a distance of about 10 m from the same brooklet (sample 61P76): hundreds of female specimens (holotype in sample 61P75). The species was more numerous in the two samples collected near the brooklet than in the single sample collected at a distance.

Measurements. — Length of the female (after eight specimens) 0.195-0.225 mm (average 0.200); breadth 0.130-0.140 (average 0.135). Measurements of the specimen after which the greater part of the figures have been prepared: length 0.195 mm, breadth 0.140. The differences in length are mainly caused by differences in the degree of extension; an extended female is represented in fig. 6.

Habitus and colour. — The species has the usual habitus of a Tarsonemid mite, with rather broadly oval outline and convex dorsal surface. The colour is very light yellowish brown, sometimes nearly whitish.

Tegument. — The cuticle is rather hard. When studied on a carbon block, its surface appears to be highly polished.

Subdivision of the body. — The gnathosoma is movably attached to the idiosoma; it can be extended in forward direction. The idiosoma is subdivided into stethosoma (i.e. prosoma without gnathosoma) and opisthosoma. These parts are dorsally separated by the disjugal furrow (fig. 4: *dj*); this furrow, however, is covered by the posterior prodorsal limb (figs. 3, 4: *ppl*). Legs II and III are separated by a large sejugal interval (fig. 6C: *sej*) which is often folded, so that the sejugal furrow is covered. The region posteriorly of disjugal and sejugal furrows is generally named hysterosoma; this region, however, is no tagma but an artificial subdivision. I refer to my

papers dealing with the soma terminology (Van der Hammen, 1968c: 407-408; 1969: 196).

Prodorsum. — The dorsal surface of the stethosoma is named prodorsum, a term introduced by Grandjean (1939: 19); it extends from the rostrum to the posterior prodorsal limb and the disjugal furrow. It presents two pairs of setae: the rostral setae (figs. 1, 3, 4: *pr*; their homology with the rostral setae of the Actinotrichida is uncertain) and the posterior prodorsal setae (figs. 1, 3, 4: *pi*; homology uncertain). The third pair of prodorsal setae, the bothridials (figs. 2, 3, 4: *pb*), has developed a lateral position and is covered by the posterior prodorsal limb. In primitive Actinotrichida, the number of prodorsal setae is six pairs; consequently, Tarsonemidae have lost three pairs (one of these is still present in a number of Pyemotidae).

The rostrum presents anteriorly and laterally a rostral limb. Posteriorly and laterally, the prodorsum has developed a posterior prodorsal limb which is especially well developed in the posterolateral part. The stigmata have a lateral position, and will be dealt with below.

Dorsal and lateral aspect of opisthosoma. — The opisthosoma (figs. 1, 3) consists of five segments which are probably homologous with the anterior five segments of the primitive Actinotrichida. This homology is based on the presence of three pairs of cupules (*ia*, *im*, *ip*), which take the place of the segmentally arranged lyrifissures. The segments are named here *SC*, *SD*, *SE*, *SF*, *SH* (the corresponding segments in the primitive Actinotrichida are named *C*, *D*, *E*, *F*, *H*). When segment *SC* is indeed homologous with *C*, it consists of a fusion of the segments VII and VIII (cf. Van der Hammen, 1969, 1970).

Segment *SC* is laterally and posteriorly bordered by a large limb which, in a retracted opisthosoma, covers the greater part of segment *SD*. An extended specimen is represented in fig. 6A, B; in that condition, the greater part of *SD* is not covered. Segments *SD* and *SE* are posteriorly bordered by a small limb.

Segment *SC* presents two pairs of setae (*pc*₁ and *pc*₂), segment *SD* no setae (in Tarsonemidae it generally presents one pair *pd*₁), segment *SE* two pairs (*pe*₁ and *pe*₂), segment *SF* two pairs (*pf*₁ and *pf*₂), and segment *SH* one pair (*ph*₁).

Segment *SH* (fig. 5A, B) represents the posterior opisthosomatic segment. It has the shape of a tubercle or a cone, dorsally covered by the posterior limb of *SF*, ventrally by a large limb covering the genital orifice. The two limbs together constitute a secondary genital orifice. When this orifice is opened, segment *SH* is easily visible. Apart from the pair of setae

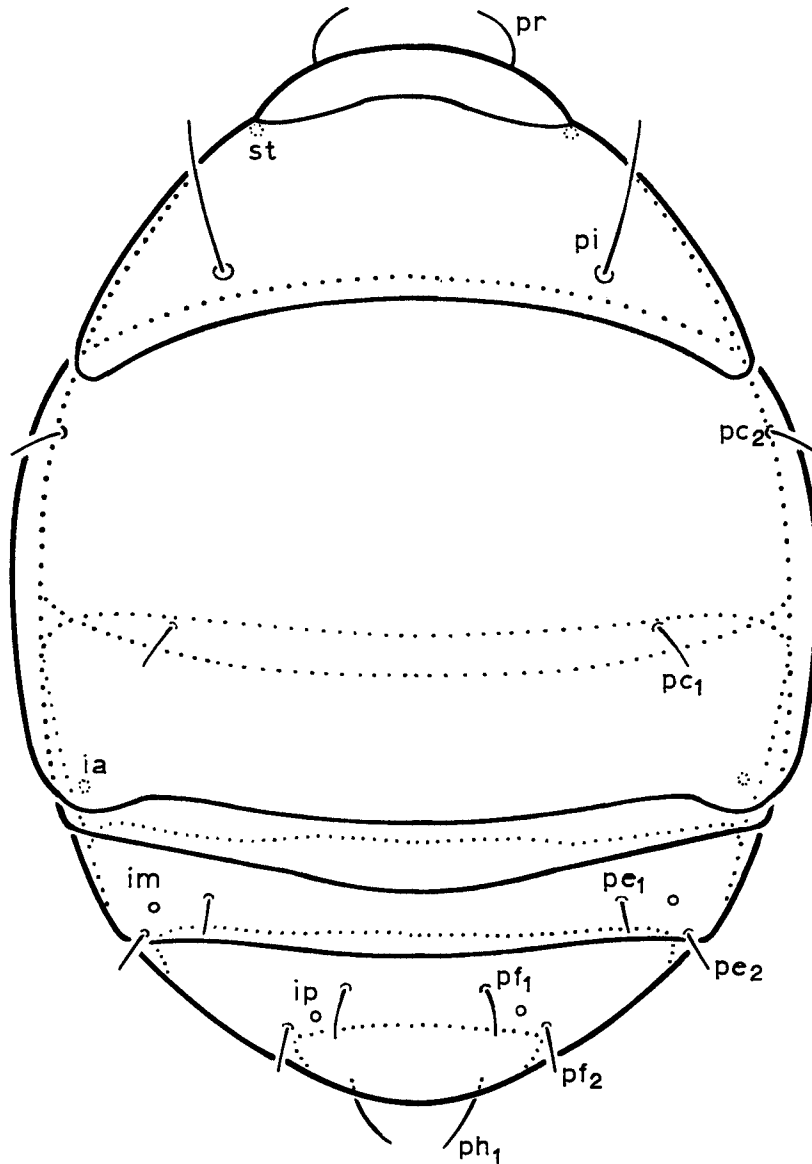


Fig. 1. *Tarsonemoides limbatus* nov. spec., dorsal view of female; $\times 737$.

ph_1 , *SH* presents a uropore (*u.p*), with a median terminal position. This uropore is easily visible when the segment is studied in posterior view. The uropore takes the place of the anal orifice, because the gut is ending blindly; it is the orifice of an excretory canal.

Genital region. — As mentioned above, the genital orifice is covered by a ventral limb. Together with the posterior limb of segment *SF*, this limb constitutes a secondary genital orifice. This orifice is terminal; it can be widely opened (cf. figs. 3, 5).

Ventral region of opisthosoma. — The ventral region posteriorly of the legs is occupied by a large limb which is posteriorly indented by a median notch; possibly it represents a fusion of two limbs. Especially in the posterior and lateral part, it is very thin and transparent.

Coxisternal region. — This region comprises the four epimeres, the sejugal interval, and the apodemes (cf. fig. 2). The terminology used here is based on the fundamental study of the podosomal ectoskeleton by Grandjean (1952). An epimere is the coxisternal region of one leg-bearing segment. In *Tarsonemoides limbatus* each epimere presents one pair of epimeric setae; these are indicated respectively as 1a, 2a, 3a, and 4a (just as in other Actinotrichid mites). Legs II and III are separated by a large interval; this is the sejugal interval. Apodemes are internal lamellae or ridges, which form part of the chitinous ectoskeleton. They are named here respectively: apodeme 1, apodeme 2, sejugal apodeme, apodeme 3, and apodeme 4 (the transverse ones); and anterior and posterior sternal apodemes (the median ones).

As mentioned above, the sejugal interval can be folded. In a folded condition, the region of the sejugal apodeme is covered by the posterior part of the sejugal interval. The folded condition is represented in fig. 2, the extended in fig. 6C.

The disposition of the epimeric setae, and the extent of the apodemes, which probably represent characters of specific value, are represented in figs. 2 and 6C.

Lateral region of podosoma. — The lateral region of the podosoma (figs. 3, 4) is partly covered by the lateral parts of the posterior prodorsal limb and the limb of segment *SC*. I could not discover laterocoxal setae; these are either absent or too small to be distinguished with a normal microscope. As mentioned above, the bothridial seta or sensillus (which is originally one of the prodorsal setae) is inserted laterally, on either side of the podosoma; it presents a pyriform head which is covered with rough, raised points. The bothridium is cup-shaped and well-developed. The pair of stigmata is situated laterally, just under the place where the lateral parts of rostral and posterior prodorsal limbs meet (cf. figs. 6C, D: *st*).

There is an extremely small podocephalic canal (fig. 7C, D: *cpc*) running from the dorsal part of the coxal region of leg I to the dorsal surface of

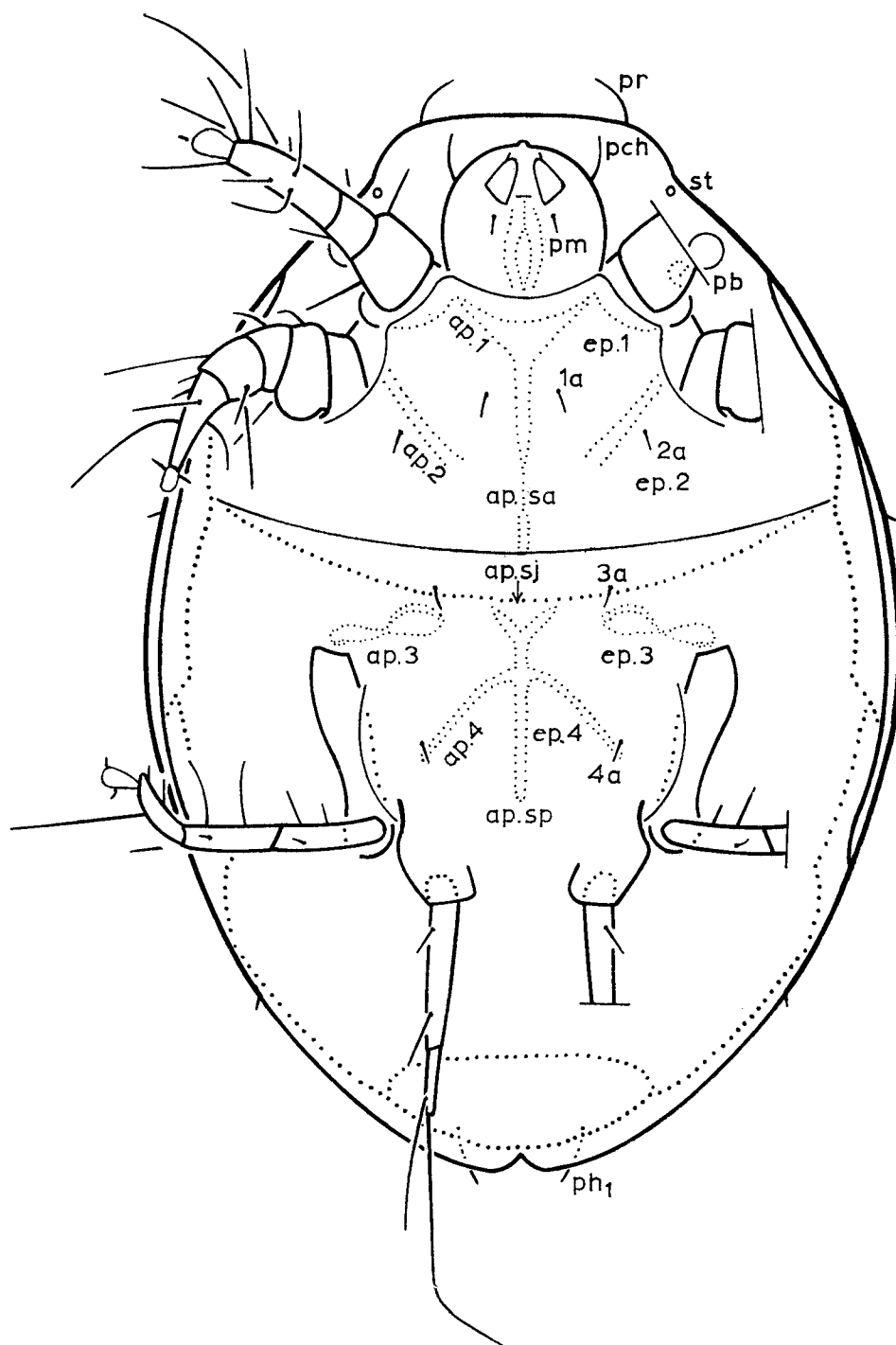


Fig. 2. *Tarsonemoides limbatus* nov. spec., ventral view of female; $\times 737$.

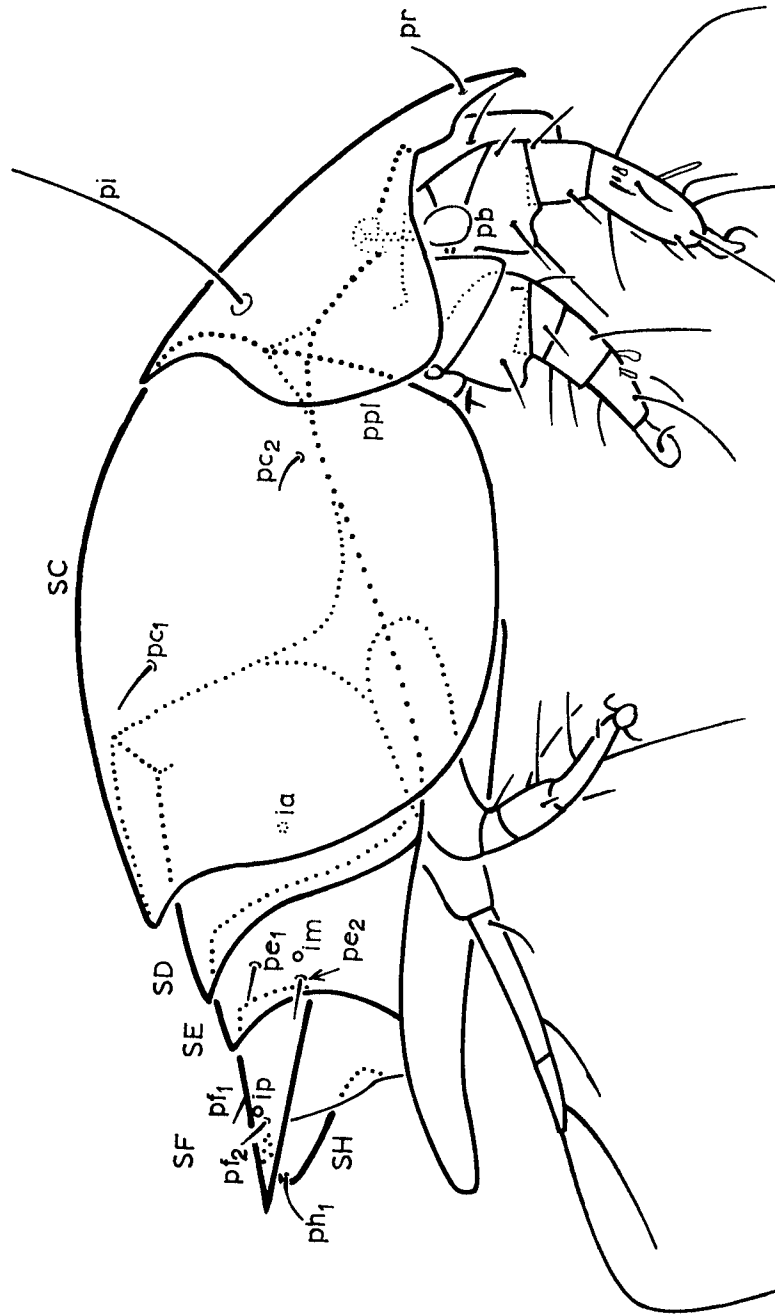


Fig. 3. *Tarsonemoides limbatus* nov. spec., lateral view of female (secondary genital orifice opened); X 737.

the infracapitulum just in front of the line of attachment (*at*) of the tegulum (TG). I could discover the orifices of two glands (*og*₁ and *og*₂). The canal is very difficult to study in detail. I believe that in the present species it is external, i.e. a taenidium. An introduction to the morphology of the podo-

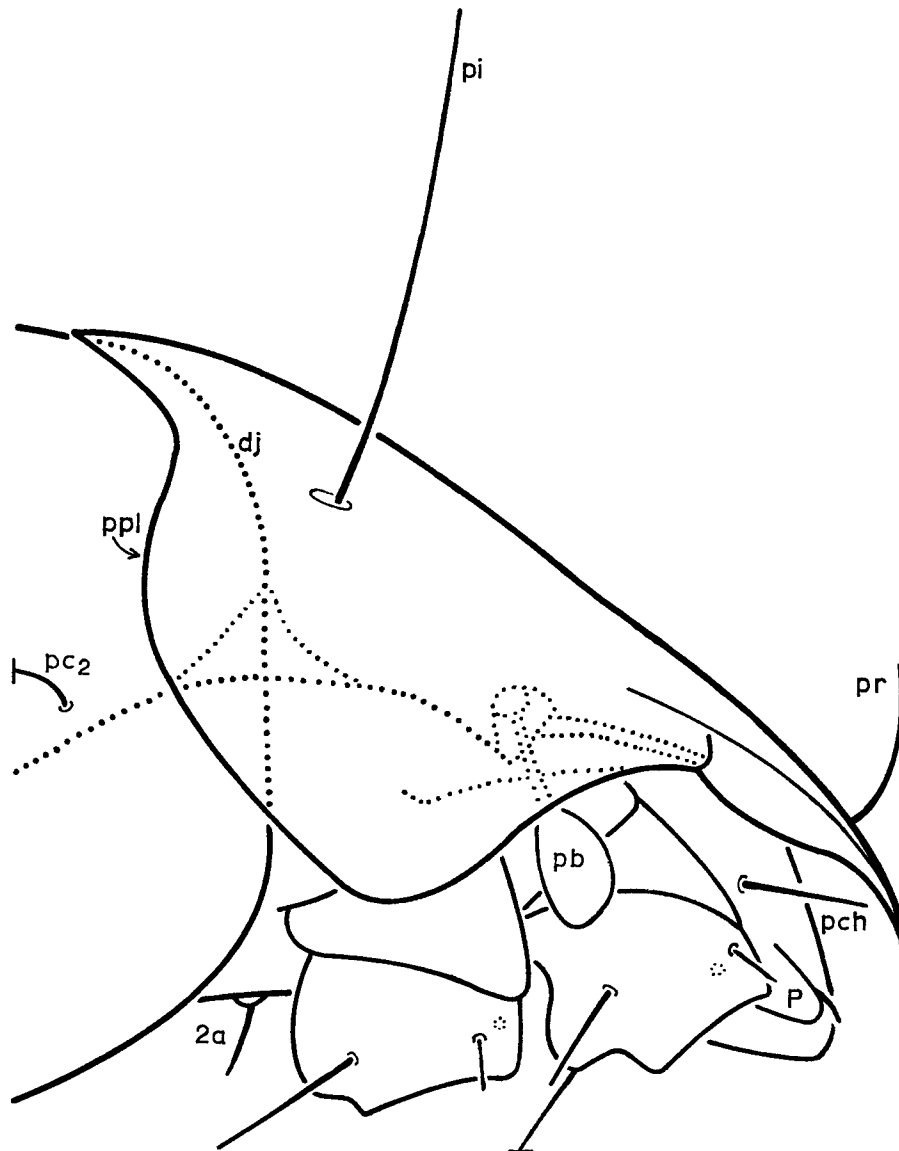


Fig. 4. *Tarsonemoides limbatus* nov. spec., female; lateral view of the anterior part;
 × 1415.

cephalic canal is published in my study of the gnathosoma of *Hermannia convexa* (cf. Van der Hammen, 1968: 19-22, 29-30).

Gnathosoma. — The gnathosoma has been subject to complicated coalescences. The cheliceral frame consists of a tegulum only (fig. 6 C, D: *TG*), extending from the rostral base to the infracapitulum, where it is attached according to the line *at*. In most mites, the chelicerae are attached to the

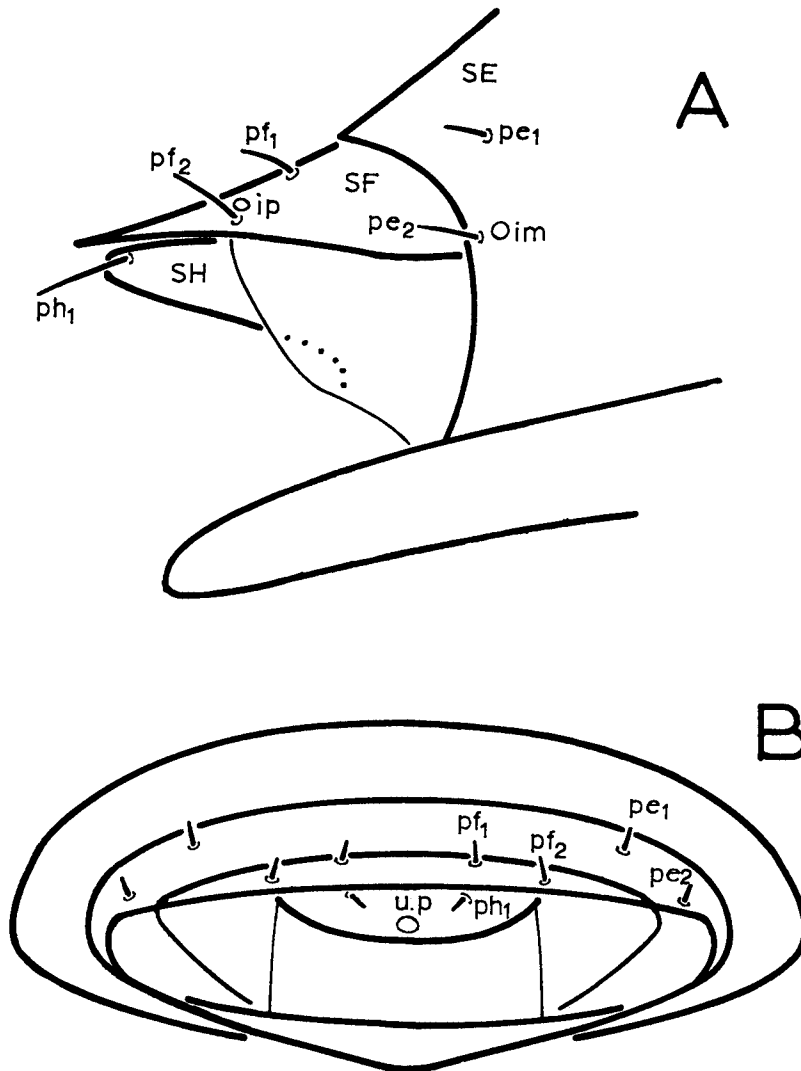


Fig. 5. *Tarsonemoides limbatus* nov. spec., posterior part of opisthosoma of female; A, lateral view; B, posterior view; A, $\times 1415$; B, $\times 737$.

tegulum by means of cheliceral sheaths (cf. Van der Hammen, 1968). In Tarsonemida, the stylets (which are considered homologous with the chelicerae) are situated inside the infracapitulum. This exceptional position can only be explained by the following hypothesis. The stylets represent the apotele (or movable jaw) of the chelicerae. They present indeed two basal knobs (cf. fig. 7B) to which the two tendons (t_s and t_i) of the apotele are probably attached. The remaining part of the chelicerae (trochanter and principal cheliceral segment) has apparently coalesced with the dorsal surface of the infracapitulum, i.e. with the cervix (in the same way as the appendages of some Actinotrichid prelarvae coalesce with the ventral surface of the body). The dorsal surface of the infracapitulum of the Tarsonemidae presents indeed one pair of setae which is unknown from the infracapitulum of other orders of Actinotrichida. In some Pyemotidae there are even two pairs of dorsal setae; these certainly represent the cheliceral setae *cha* and *chb*. In comparison with the Pyemotidae, the paraxial seta has disappeared (this possibly represents *cha*, although it is more advanced). Because of the uncertain homology, the setae of the Tarsonemidae have received here the notation *pch* (those of the Pyemotidae could be indicated as *pch'* and *pch''*).

The ventral surface of the infracapitulum (fig. 7A) presents one pair of infracapitular setae. It is unknown whether this pair is homologous with the *a*, *m*, or *h* setae of other Actinotrichida; because it occupies more or less the position of the *m* setae, it is indicated as *pm*.

The pharynx has a relatively exceptionally heavy wall; it has apparently developed into a highly specialized suctorial organ.

The palp is very small. Apparently, it consists of three segments. Segments 2 and 3 present vestiges of setae; segment 3, moreover, a distinct dorsal, subterminal seta. The last-mentioned seta is birefringent when studied in polarized light; consequently it represents no solenidion, but an ordinary seta. Laterocoxal setae (*e*) are not visible; these, however, are present in Pyemotidae (they are named postpalpal setae by Cross, 1965).

Legs. — The terminology of the leg segments is based on the various types of articulation (cf. Van der Hammen, 1966, 1970b). In the present case it is especially important to discover the articulation trochanter/femur, which is bivalent. The application of my methods of interpretation results in the following terminology. Leg I consists of trochanter, femur, genu, tibio-tarsus and apotele. Leg II consists of trochanter, femur, genu, tibia, tarsus, and apotele. Leg III consists of trochanter, femorogenu, tibia, tarsus, and apotele. Leg IV consists of segment 1, segment 2, and segment 3 (homologies uncertain). This terminology corresponds in general lines with that of

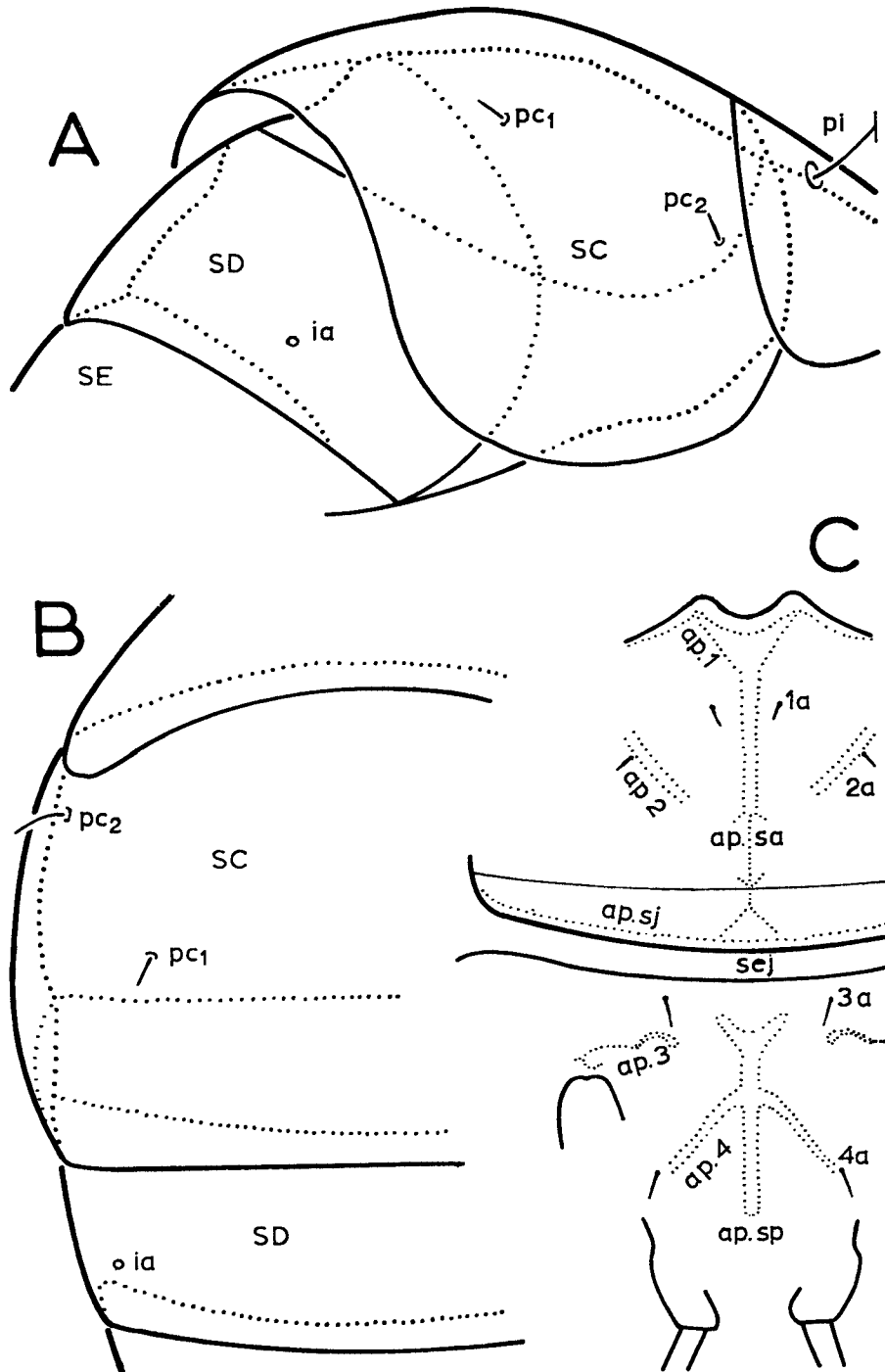


Fig. 6. *Tarsonemoides limbatus* nov. spec., median part of idiosoma of extended female; A, lateral view (slightly oblique from posteriorly); B, dorsal view; C, ventral view; A-C, $\times 737$.

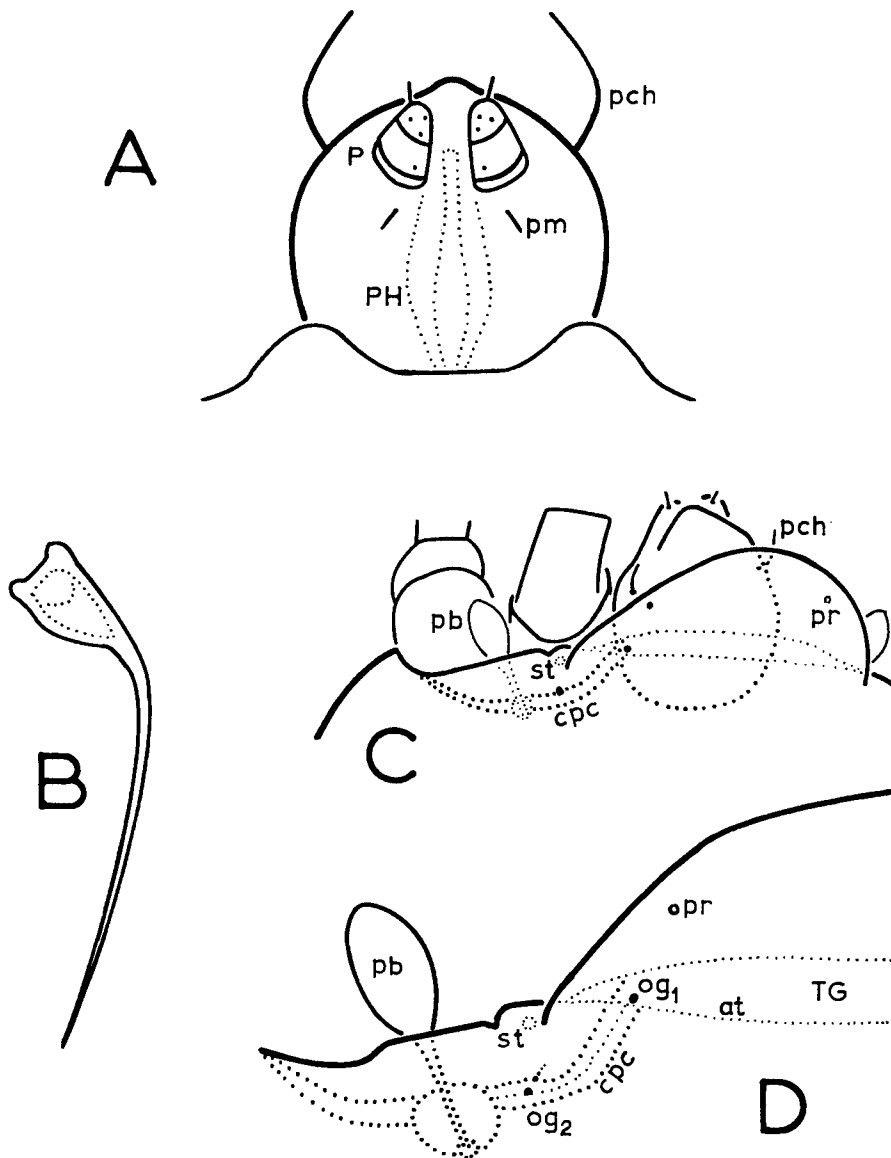


Fig. 7. *Tarsonemoides limbatus* nov. spec., female; A, ventral view of gnathosoma; B, lateral (antiaxial) view of right stylet; C, dorsal (slightly oblique) view of left podocephalic canal and adjacent parts; D, detail of fig. 7C; A, D, $\times 1415$; B, $\times 2625$; C, $\times 737$.

Schaarschmidt (1959) and Suski (1966, 1967, 1968), but differs from that of Cross (1965). These authors, however, do not recognize the apotele as a separate segment.

Several attempts have been made to introduce a system of notation for the study of chaetotaxy in Tarsonemida. These systems present two difficulties. (1) they do not distinguish between solenidia and setae; and (2) they do not take account of the systems existing in other groups of mites.

In the present description an attempt is made to base the study of leg chaetotaxy in Tarsonemida on the methods applied in my studies on other groups of mites, which methods are based on the fundamental investigations by Grandjean.

Tibiotarsus I and tarsus II present solenidia, i.e. hollow sensory organs (often with internal striation), without basal bulb. Solenidia have no internal core of actinopilin, and are easily recognizable in polarized light because of the absence of birefringency.

Tibiotarsus I presents three solenidia, viz., two on the tibial part and one on the tarsal part. Tarsus II presents one solenidium. In Actinotrichid mites the solenidia are indicated with the following Greek letters: θ (femur), σ (genu), φ (tibia), ω (tarsus). In the present case we have φ_1 , φ_2 , and ω_1 , on tibiotarsus I, and ω_1 on tarsus II (there are no solenidia on femur and genu).

The setae of the leg segments are primitively arranged in verticils of seven. A complete verticil consists of one unpaired dorsal seta (d), two pairs of laterals (ld and lv), and one pair of ventrals (v). In case one of the ld or lv setae is exactly lateral, it is indicated as l . However, complete verticils are rare, even in primitive mites. In Tarsonemida the number of setae is reduced. Complete verticils do not exist, and often the setae have apparently moved to slightly different positions. The notation applied to the setae of the present species is exclusively topographic, without paying attention to homologies.

Setae of the anterior and posterior surface of the leg are distinguished by the addition of prime (') and second ("). The notation of the setae of femur, genu, and tibia is followed by an abbreviation of the name of the segment (F , G , T respectively); those of the tarsus are not followed by an abbreviation. This notation could not be completely applied to leg IV, which has received a different notation.

There is a special series of abbreviations for the setae of the Actinotrichid tarsus. However, there is not yet sufficient evidence to apply these to the tarsus of the Tarsonemida. It is not impossible that d and ld_1' of leg I represent the fastigials (ft), ld_2' and ld_2'' the tectals (tc).

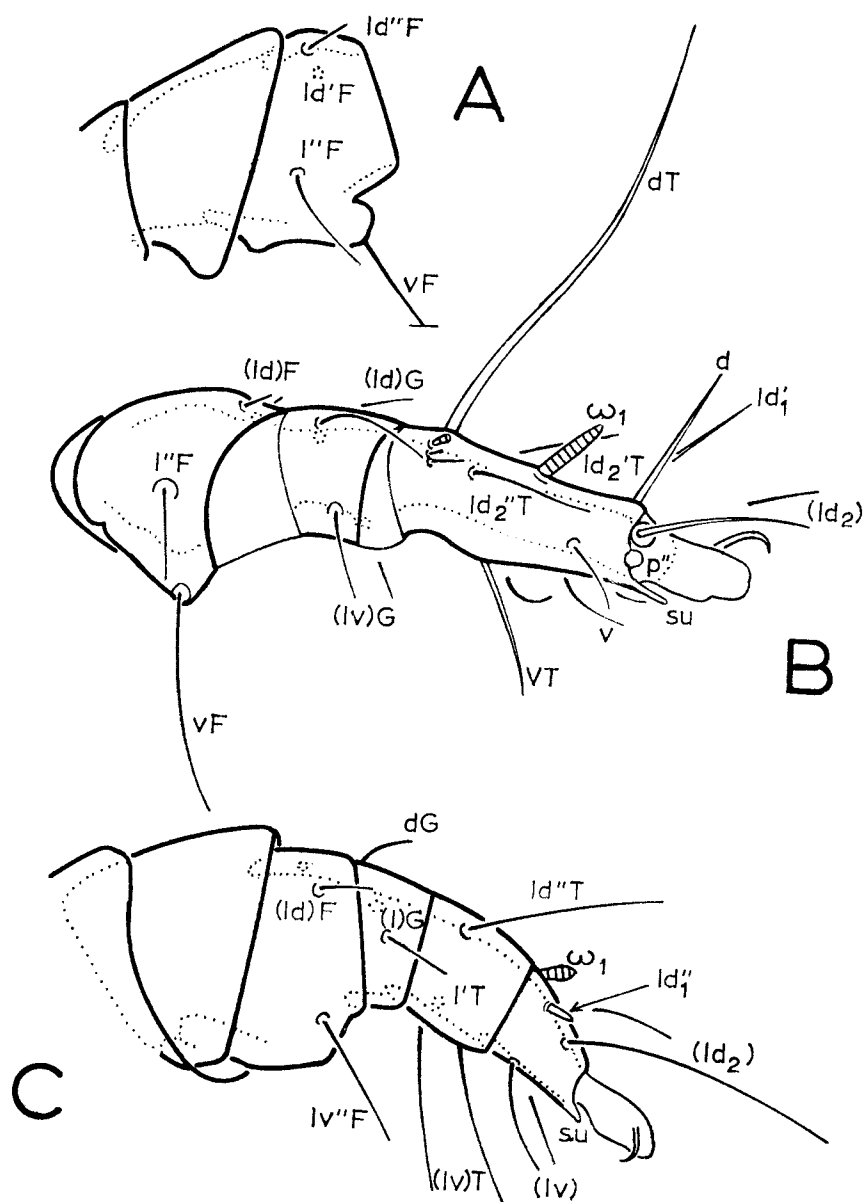


Fig. 8. *Tarsonemoides limbatus* nov. spec., female; A, lateral (antiaxial) view of trochanter and femur of right leg I; B, lateral (antiaxial) view of right leg I (trochanter nearly invisible; leg completely extended); C, lateral (antiaxial) view of right leg II; A-C, $\times .415$.

The notation of setae and solenidia of the legs of the present species is summarized in table 1.

Leg chaetotaxy can also be expressed in formulae. The formulae of the solenidia are the following. I [2-1]; II 0-1; III 0-0; IV 0.

The formulae of the setae are the following (the apotele is included as a segment and the claws are counted as setae). I 0-4-4-[6-8]-1 (this means: trochanter without setae; femur with four; genu with four; tibia with six, and tarsus with eight (but both segments fused); apotele with one claw); II 0-3-3-4-6-2; III 0-[1-3]-4-5-2; IV 0-2-2.

TABLE 1

The notation of setae and solenidia of the legs
of *Tarsonemoides limbatus* nov. spec.

	I		II		III	IV
femur	ld'F	ld''F lv'F	ld'F	ld''F lv''F	vF	lv ₁ '
genu	ld'G	ld''G lv'G	dG l'G	l''G	lv'G	ld''G lv''G
tibia	dT	ld ₁ ''T ld ₂ ''T lv ₁ 'T φ ₁	ld''T	lv''T	ld'T	ld''T ld''T
tarsus	ld ₁ '	d ld ₂ '' su lv ₁ ' v ω ₁	ld ₁ '' ld ₂ '' su lv' ω ₁	ld' lv ₁ ' lv ₂ '	su lv ₁ ''	lv' t

Legs I and II are represented in fig. 8, legs III and IV in fig. 10; details of leg I in fig. 9. The ventral terminal seta *su* of tarsus I-III is a spine. In the case of tarsus I, I discovered a pair of small, lateral, terminal structures, indicated as *p'* and *p''*; I do not know whether these represent indeed the proral setae of other Actinotrichida (they are not counted as setae in the formulae). I could not discover a famulus.

Legs I, II and III present a pulvillus; leg I has one claw (but leg I of the larvae of Tarsonemida apparently has two claws), legs II and III each have two claws. Leg IV presents a terminal seta *t* of which the homology is uncertain.

Development. — Among the materials studied here, I discovered females



Fig. 9. *Tarsonemoides limbatus* nov. spec., tibiotarsus and apotele of right leg I of female; A, ventral and partly frontal view of distal part; B, lateral (antiaxial) view; A, B, $\times 2625$.

Fig. 10. *Tarsonemoides limbatus* nov. spec., female; A, lateral (antiaxial) and partly dorsal view of left leg III; B, lateral (antiaxial) view of left leg IV; A, B, $\times 1415$.

is sometimes mentioned in literature) appears to be uncertain. It will be very important to rear a representative of the group.

Relationship and diagnostic characters. — The species is classified here with the genus *Tarsonemoides* because of the presence of a distinct rostral limb.

Because of the presence of $\varphi_2\text{I}$, and because of the relative size of $\omega_1\text{I}$, and the shape and size of $ld_1''\text{II}$, the species is related to *Tarsonemoides ellipticus* Schaarschmidt (1959). From this species it differs by the larger size and the relatively greater breadth, by a different degree of development of the coxisternal apodemes (they are distinctly broader), and a different disposition of the epimeric setae.

The species is especially characterized by the absence of pd_1 (not known from literature), and the considerable development of the dorsal and ventral limbs. A comparable extension of the limb of segment SC, and of the ventral limb has previously not been described. As mentioned above, the absence of pd_1 is probably connected with the considerable development of the limb of SC.

REMARKS

REMARK 1. THE SEGMENTATION OF THE OPISTHOSOMA IN TARSONEMIDA

As mentioned above, in the section on the dorsal and lateral aspect of the opisthosoma, the number of opisthosomatic segments is supposed here to be five, the first consisting of a fusion of VII and VIII. Consequently, the posterior segment, containing the uropore, would represent segment XII.

The smallest number of segments known from Oribatida and Actinedida is thirteen. However, according to data published by Knülle (1959: fig. 26), segment *H* (= XII) borders also the anal orifice in the larva of *Acarus siro* L. (Acaridida). Consequently, the Tarsonemida would have the same number of segments as the larvae of Acaridida. This conclusion, however, is founded on the hypothesis that the cupules of the Tarsonemida are indeed the three anteriors *ia*, *im*, and *ip*. In order to underline the hypothetical character of the present interpretation, the abbreviations of segments and setae are not exactly the same as in Oribatida and Actinedida, but preceded by another letter. Instead of *C* (for the first opisthosomatic segment) I have used the abbreviation SC and instead of c_1 (a seta of *C*) I have used pc_1 , etc.

REMARK 2. POSITION AND HOMOLGY OF THE STIGMATA IN TARSONEMIDA

In the present species, the single pair of stigmata has a lateral position, just under the place where the lateral parts of rostral and posterior prodorsal

limb meet. The stigmata are directed laterally. In ventral view they appear to be situated just in front of leg I, and laterally of its coxal region.

At first sight, it appears difficult to insert this type of stigmata in the provisional classification of respiratory organs in mites, recently published by me (Van der Hammen, 1968a: 273-274). On the one hand, the absence of stigmata and tracheae in males reminds of an origin from glands (just as in some species with genital tracheae in the females only); on the other hand, Cross (1965: fig. 5) distinctly figures the stigmata of the Pyemotidae as associated with apodemes. This would mean that in Tarsonemida the stigmata belong to group 3a of my provisional classification, and that in Tarsonemidae they have secondarily been removed because of the formation of lateral tecta and limbs. A reinvestigation of the stigmata in Pyemotidae will be very important.

REMARK 3. THE SECONDARY POSITION AND THE PARTIAL COALESCENCE OF THE CHELICERAE IN TARSONEMIDA

A survey of the literature on the Tarsonemid gnathosoma creates the impression that most authors (if not all) have not understood the importance of the strange position of the pair of stylets inside the infracapitulum, and of the presence of one or two pairs of dorsal infracapitular setae.

As mentioned above, in the description of the gnathosoma, both characters lead unavoidably to the conclusion that the greater part of the chelicerae (trochanter and principal cheliceral segment) have coalesced with the cervix, whilst the movable jaw (the apotele) has developed a secondary position inside the infracapitulum. The Tarsonemid cervix now indeed presents one or two cheliceral setae (*pch*, respectively *pch'* and *pch''*), whilst the tegulum is not attached to cheliceral sheaths, but constitutes an uninterrupted membrane between base of rostrum and infracapitulum. Apparently, the present condition is a unique character of the Tarsonemida.

However, it should be remarked here that data published by Krczal (1959: 406, fig. 10) suggest that in Pyemotidae the chelicerae are still dorsally of the cervix; the stylets are apparently situated between the cervix (?) and a dorsal structure possibly representing another part of the chelicerae.

REMARK 4. THE TERMINOLOGY OF THE LEG SEGMENTS IN TARSONEMIDA

The terminology of the leg segments is based mainly on the types of articulation (cf. Van der Hammen, 1966, 1970b); besides, attention is paid to the sequence of the segments and to leg chaetotaxy, e.g. the presence of special types of sensory organs (solenidia). These criteria together lead

to homologization of the segments. In the case of the Tarsonemid female, this way of approach is thwarted by the fusion of several segments. These fusions, however, are not found in the male. Consequently, a comparison of females and males in the case where both sexes are known, easily leads to a solution.

The question arises whether we can indeed speak of homology in the case of similar types of articulation, etc. in different orders of mites. This appears indeed highly probable (although not completely certain; it remains a hypothesis) because the type of articulation is connected with number and position of the tendons.

REMARK 5. THE NOTATION OF THE SETAE OF THE TARSONEMID LEGS

As mentioned above, in the section on the legs, the notation of the setae of the leg segment is derived from that of a primitive verticil of seven setae (d , ld' , ld'' , lv' , lv'' , v' , v''). The unpaired dorsal seta d is subject to regression: it is often absent. I do not think that d is present in Tarsonemida. Nevertheless I have used the indication d in the case of setae with (secondarily) an exactly dorsal position. Probably this concerns ld setae. However, a more definite notation of the setae should be based on a comparative study of several species of all families of Tarsonemida.

REMARK 6. THE TAXONOMIC VALUE OF THE PRIMITIVE NUMBER OF CLAWS, AND THE IMPORTANCE OF A CLEAR DISTINCTION BETWEEN PULVILLI AND EMPODIA

Primitively the ambulacra of all Tarsonemid legs present two claws and a pulvillus (in the family Tarsonemidae the adult leg I presents one claw and a pulvillus, whilst two claws and a pulvillus are present in the larva). In Oribatida and Actinedida the ambulacra present primitively three claws (in Actinedida the central claw is often replaced by an empodium). The legs of many Acaridida present one claw and a pulvillus. Two claws and a pulvillus appears to be the primitive condition of the ambulacrum of Anactinotrichida.

In literature, pulvilli and empodia are often confused. There exists, however, a very important difference between them. Empodia are homologous with central claws; empodia and central claws take each others place in the course of postembryonic ontogeny or in related species. Pulvilli are structures consisting of a ventral cushion and of membranes connected with the tarsus. A pulvillus envelops the apotele, but is morphologically no part of it; it belongs to the tarsus, and could possibly be considered an oncofysis (cf. Van der Hammen, 1968: 13). It may be remarked here that, according to this definition, the so-called pulvillus of the nymph of *Cymbaeremaeus*

cymba (Nicolet) (cf. Willmann, 1931: 335; Grandjean, 1954: 437) possibly is no pulvillus but a different structure, situated ventrally of the central claw.

The presence of a pulvillus appears to be a character of great taxonomic value. The possession of ambulacra with primitively two claws and a pulvillus removes the Tarsonemida from Oribatida and Actinedida.

REMARK 7. SYSTEMATIC POSITION AND RELATIONSHIP OF THE TARSONEMIDA

The presence of ambulacra with primitively two claws and a pulvillus, the small number of opisthosomatic segments (*SC-SH*) and the presence of a single pair of stethosomatic stigmata, constitute characters which remove the Tarsonemida from Actinedida and Oribatida. The Tarsonemid ambulacrum reminds of that of many Acaridida because of its pulvillus, whilst the number of opisthosomatic segments apparently is the larval number of Acaridida (as far as known). The shape of some Tarsonemid solenidia reminds of that of several Acaridida. It is not impossible that a distant relationship exists between the two groups. They are, however, distinctly separated by the presence of stethosomatic stigmata and the absence of a latero-abdominal gland, etc. in Tarsonemida. A further comparison of the two groups will certainly be very interesting. Evidently, the Tarsonemida constitute a separate order of the Actinotrichida, beside Oribatida, Actinedida, and Acaridida.

GLOSSARY

Because the present paper contains many terms which had not been used before in literature on Tarsonemida, the following alphabetically arranged glossary has been prepared. It is a contribution to a more complete glossary, which can only be composed after similar studies of other families of the order. It introduces comparative acarid morphology into the field of descriptive studies of Tarsonemida. It is hoped that it will advance the use of an exact and uniform terminology.

ACTINOPILIN. — Anisotropic element of the central core of a seta; it is strongly birefringent, optically uniaxial, heterogeneous, with radial structure; in a transverse section of a seta, the optic axis is everywhere a radius of the circle of section.

AMBULACRUM. — The terminal part of a leg, in regular contact with the substratum. It is here considered a functional unit (its function is ambulatory), consisting of apotele (basal piece with claw(s) and/or empodium) and pulvillus (a structure belonging to the tarsus).

ANTERIOR FACE OF AN APPENDAGE. — Applied here to the side of an appendage which is anterior when the legs are extended laterally.

ANTERIOR STERNAL APODEME. — The median apodeme anteriorly of the sejugal apodeme.

ANTIAXIAL. — Applied here to the side of an appendage (and its structures) not facing the idiosoma.

APODEME. — An internal lamella or ridge, which forms part of the chitinous ectoskeleton.

APODEME 1. — The anterior apodeme, adjoining the gnathosoma.

APODEME 2. — The second apodeme when counted from front to back.

APODEME 3. — The apodeme posteriorly of the sejugal apodeme. It is the fourth apodeme when counted from front to back.

APODEME 4. — The posterior apodeme. It is the fifth apodeme when counted from front to back.

APOTELE. — The terminal segment of the appendages. In the case of the legs it is reduced to a basal piece bearing the claws. It is absent in the Actinotrichid palp. The movable jaw is the apotele of the chelicerae.

BOTHRIDIAL SETA. — A specialized seta inserted in a bothridium.

BOTHRIDIUM. — A chitinous, cup-like structure, constituting a cavity in which the bothridial seta is inserted, the walls often present framework.

CERVIX. — The dorsal wall of the infracapitulum.

CHELICERAE. — The anterior pair of appendages, transformed into feeding organs. In Tarsonemida, the greater part of the chelicerae (the trochanter and the principal cheliceral segment with its setae) is coalesced with the cervix. The apotele has developed into a stylet, situated inside the infracapitulum.

CHELICERAL FRAME. — The membrane that constitutes the body wall in the region between rostral base and infracapitulum, and to which originally the chelicerae are movably attached. In Tarsonemida this relation to the chelicerae has disappeared because of the development of stylets inside the infracapitulum.

CHELICERAL SETAE. — The setae originally inserted on the principal cheliceral segment. In Tarsonemida they occur on the cervix, because the greater part of the chelicerae has coalesced with the infracapitulum.

CLAW. — Curved, terminal structure, with basal bulb, homologous with a seta, and inserted on the apotele or terminal segment of the appendages.

COXISTERNAL REGION. — The coxal and the sternal part of one appendage-bearing segment, or of all appendage-bearing segments together. The podosoma as well as the infracapitulum have a coxisternal region.

CUPULE. — A rounded cavity in the cuticle, covered by the epiostracum.

Inwards, the cavity continues into a narrow and usually short canal. A cupule is homologous with a lyrifissure; it often takes its place when the cuticle is soft.

DISJUGAL FURROW. — The dorsal furrow separating prosoma and opisthosoma.

EPIMERE. — The coxisternal region of one prosomatic segment.

EPIMERIC SETAE. — The setae of the coxisternal region, with the exception of the laterocoxal setae.

FAMULUS. — A hollow seta, generally occurring in the dorsal part of tarsus I only. Primitively it has the shape of a small, globular fruit surrounded by bracts, and carried by a relatively thick stem. This shape, however, is rare in mites; generally a famulus in Actinotrichida has the shape of a small, pointed, hollow spine. It can be indentified with certainty by a comparative chaetotaxic study only. A famulus has not yet been recognized in Tarsonemida.

FEMOROGENU. — A compound leg segment, originating from a fusion of femur and genu.

FEMUR. — In Actinotrichida with one femur, it is the second leg-segment, situated between trochanter and genu. The articulation between trochanter and femur is bivalent, that between femur and genu monovalent. The femur of Actinotrichida represents a fusion of two femora (femur 1 and femur 2) (cf. Van der Hammen, 1969: 199).

GENU. — In Actinotrichid mites with one femur, it is the third leg-segment, situated between femur and tibia. Its articulation with both segments is monovalent. Primitively the genu is a segment of normal length; in higher developed Actinotrichida it has developed into a short segment.

GNATHOSOMA. — The composition of mouthparts in mites. It constitutes a part of the body, which secondarily has become mobile; it represents no tagma.

HYSTEOSOMA. — The region posteriorly bordered by disjugal and sejugal furrows (respectively dorsally and ventrally). It represents the opisthosoma together with the posterior part of the podosoma. It is no tagma, but an artificial unit.

IDIOSOMA. — The body without the gnathosoma. It is no tagma, although the presence of idiosoma and gnathosoma is a special character of the mites.

INFRACAPITULAR SETAE. — The epimeric setae of the infracapitulum. In Tarsonemida there is apparently only one pair of infracapitular setae. The other setae which, in Tarsonemida, can be found on the infracapitulum, are the laterocoxal setae of the palp, and (because of coalescence) the chelicerai setae.

INFRACAPITULUM. — The ventral one of the two parts constituting the gnathosoma. It bears the labrum and the pair of palps. It consists of mentum, cervix, and genae, and it contains mouth and pharynx. In Tarsonemida it contains secondarily the chelicerae.

LATEROCOXAL SETAE. — Setae of the coxal region of palp, leg I, and leg II. Among Tarsonemida, laterocoxal setae of the palp occur in Pyemotidae.

LEGS. — The four posterior pairs of appendages with ambulatory function.

LIMB. — A chitinous prolongation or extension of a tectum, without internal cavity. It has a protective function.

LYRIFISSURES. — Fissures in the tegument, often with a central cavity, covered by an uninterrupted epiostracum. Inwards, they continue into a narrow canal. The presence of lyrifissures is a character of the Arachnidea. In some groups of Arachnidea, lyrifissures can be arranged in groups (lyri-form organs). In mites they occur only isolated; the number varies from a few to a great many. Part of the lyrifissures are probably stress-sensitive organs. In Tarsonemida lyrifissures have the shape of cupules.

MOVABLE JAW OF CHELICERAE. — The apotele of the chelicerae, characterized by the presence, at its base, of two tendons: a superior and an inferior.

ONCOPHYSIS. — Membraneous structure starting from, or connected with an arthrodial membrane. Originally, oncophyses were known only from the chelicerae. The pulvillus is supposed here to represent also an oncophysis.

OPISTHOSOMA. — The posterior of the two Arachnid tagmata. Dorsally it is separated from the prosoma by the disjugal furrow.

PALP. — The second pair of appendages with perceptive function.

PARAXIAL. — Applied here to the side of an appendage (and its structures) facing the idiosoma.

PHARYNX. — The anterior part of the gut, functioning as suctorial apparatus. In Tarsonemida its wall is relatively very heavy.

PODOCEPHALIC CANAL. — An open canal (a taenidium), or secondarily an internal tube, running from the coxal region of leg I to the laterodorsal region of the infracapitulum; several glands (probably coxal glands) are debouching into the canal.

POSTERIOR FACE OF AN APPENDAGE. — Applied here to the side of an appendage which is posterior when the legs are extended laterally.

POSTERIOR PRODORSAL LIMB. — The limb extending posteriorly and laterally from the prodorsal sclerite.

POSTERIOR PRODORSAL SETAE. — In Tarsonemida the setae which are inserted in the posterior part of the prodorsum.

POSTERIOR STERNAL APODEME. — The median apodeme posteriorly of the sejugal apodeme.

PRIME ('). — Applied to organs of the anterior face of an appendage.

PRINCIPAL CHELICERAL SEGMENT. — The second segment of a chelicera, bearing the fixed jaw. It represents a fusion of femur, genu, tibia, and tarsus. In Tarsonemida it is coalesced with the infra-capitulum.

PRODORSAL SETAE. — The setae inserted on the prodorsum. In Tarsonemida, one pair of prodorsal setae (i.e. the bothridial setae) are, in the adult stage, inserted laterally, under the lateral part of the posterior prodorsal limb.

PRODORSUM. — The dorsal surface of the stethosoma.

PROSOMA. — The anterior of the two Arachnid tagmata. Dorsally it is separated from the opisthosoma by the disjugal furrow.

PULVILLUS. — A part of the ambulacrum, consisting of a ventral cushion and a membrane enveloping the apotele. Morphologically it is part of the tarsus.

ROSTRAL LIMB. — The limb which, anteriorly and laterally, borders the rostral part of the prodorsum.

ROSTRAL SETAE. — The pair of setae inserted on the rostrum.

ROSTRUM. — The anterior part of the stethosoma which, in Tarsonemida, constitutes a tectum with a (generally large) limb.

SECOND (''). — Applied here to organs of the posterior face of an appendage.

SECONDARY GENITAL ORIFICE. — The orifice between the limb of segment *SF* and the ventral limb. It gives entry into the primary genital orifice which is covered by the ventral limb.

SEJUGAL APODEME. — The apodeme internally corresponding with the sejugal furrow. It is the third apodeme when counted from front to back.

SEJUGAL FURROW. — The furrow in the plane of transverse pseudo-symmetry, between legs II and III.

SEJUGAL INTERVAL. — The interval separating the coxisternal regions of legs II and III.

SENSILLUS. — The bothridial seta.

SETA. — An organ produced by the hypodermis. In Actinotrichida, it consists of a basal bulb, a central core of actinopilin, and an outer layer of chitin.

SOLENIIDION. — A seta-like structure; it is hollow, has no basal bulb, contains no actinopilin, and is often internally transversely striated. It is variable in shape; in Tarsonemida it is often claviform.

STETHOSOMA. — The prosoma without the gnathosoma.

STIGMA. — The external orifice of a trachea.

STYLET. — In Tarsonemida the apotele of the chelicerae, which has developed a specialized shape adapted to piercing. Tarsonemid stylets have developed a secondary position: they are situated inside the infracapitulum.

TAENIDIUM. — Collective noun for open canals at the surface of the body, which are in relation with stigmata, glands, or the mouth.

TAGMA. — A primary subdivision of the body. The two tagmata of the Arachnid body are prosoma and opisthosoma.

TARSUS. — Primarily the subterminal segment of the Arachnid leg. Its articulation with the tibia is monovalent; its articulation with the apotele bivalent.

TECTUM. — An external prolongation of the ectoskeleton, with a protective function; it is more or less laminiiform, and it has an internal cavity. A tectum is often bordered by a limb.

TEGULUM. — The dorsal part of the cheliceral frame, consisting of a membrane extending from the rostral base to the chelicerae. In Tarsonemida it is the only remaining part of the cheliceral frame, because of the coalescence of the greater part of the chelicerae with the cervix; it now extends from the base of the rostrum to the infracapitulum.

TENDON. — A cord or bundle of connective tissue between a muscle or a muscle bundle and its place of insertion. A tendon consists of material resisting lactic acid, whilst muscles are dissolved in this medium.

TIBIA. — Originally the fourth free segment of the Actinotrichid appendage. Its articulations with genu and tarsus are monovalent.

TIBIOTARSUS. — A compound leg segment, originating from a fusion of tibia and tarsus.

TRICHOBOTHRIUM. — The composition of bothridium and bothridial seta (sensillus).

TROCHANTER. — Originally the first free segment of the Actinotrichid appendages. Its articulation with the coxal region is more or less universal; its articulation with the femur is bivalent.

UROPORE. — In Tarsonemida the posterior orifice in the posterior opisthosomatic segment. It takes the place of the anal orifice. Because the gut is ending blindly, it is only the orifice of an excretory canal.

VENTRAL LIMB. — The limb covering the genital orifice. In *Tarsonemoides limbatus* nov. spec., it possibly represents a fusion of two limbs; it extends in this species to the posterior border of the opisthosoma.

VERTICIL. — A whorl of setae of the appendages. It is considered the basic element of leg chaetotaxy. A primitive verticil consists of seven setae: one dorsal, two laterodorsals, two laterals (or lateroventrals), and two ventrals.

LIST OF SYNONYMS

In order to facilitate the use of the present terminology, the following list has been composed of terms occurring in the most important recent literature on Tarsonemida (Beer, 1954; Cross, 1965; Karafiat, 1959; Krczal, 1959; Schaarschmidt, 1959; Suski, 1965, 1966, 1967, 1968; the Polish names from Suski, 1967, however, are not included). The list is composed in the following way. The synonyms are arranged in alphabetic order; they are followed by the name of the author who is regularly using them (between brackets), and by the term which is preferred in the present paper. However, I have made no attempt to include the existing systems of notation of the leg setae.

- Anterior coxal setae III (Suski) — epimeric setae 3a.
- Anterior median apodeme (Beer, Cross) — anterior sternal apodeme.
- Anteromedian apodeme (Suski) — anterior sternal apodeme.
- Anterior pseudostigmatala (Cross) — mediolateral prodorsal setae.
- Anterior ventral plate (Cross) — epimeres 1 + 2.
- Anus (Suski) — uropore.
- Apical teeth of palp (Cross) — vestiges of setae.
- Apodeme I (Beer, Cross, Suski) — apodeme 1.
- Apodeme II (Beer, Cross, Suski) — apodeme 2.
- Apodeme III (Beer, Cross, Suski) — apodeme 3.
- Apodeme IV (Beer, Cross, Suski) — apodeme 4.
- Axillaries I (Cross) — epimeric setae 3b or 3c.
- Axillaries II (Cross) — epimeric setae 4b or 4c.
- Capitulum (Beer) — gnathosoma.
- Capsule (Cross) — infracapitulum.
- Cephalothoracic shield (Beer) — rostral tectum + limb.
- Cheliceral sheaths (Beer) — pharynx.
- Chitinkappe (Krczal) — dorsal part of opisthosomatic segment *SF*.
- Chitinplatte des Gnathosoma (Krczal) — cervix (?).
- Chitinspange des Gnathosoma (Krczal) — ?
- Circumgnathosomal foramen (Cross) — camerostome.
- Clawlike hook replacing palpal teeth (Cross) — dorsal, terminal seta of palp.
- Clypeus (Karafiat, Krczal) — dorsal part of first opisthosomatic segment (*SC*).
- Coxa (Beer, Cross) — trochanter.
- Coxa (Karafiat, Krczal, Schaarschmidt) — epimere.
- Coxa of leg III (Beer) — coxal region (?).
- Coxa of leg IV (Beer) — coxal region (?).
- Coxalleisten (Krczal, Schaarschmidt) — apodemes.

- Coxal setae I (Suski) — epimeric setae 1a.
Coxal setae II (Suski) — epimeric setae 2a.
Dorsals I (Cross) — opisthosomatic setae pc_1 .
Dorsals II (Cross) — opisthosomatic setae pd_1 .
Dorsals III (Cross) — opisthosomatic setae pe_1 .
Dorsals IV (Cross) — opisthosomatic setae pf_1 .
Dorsum of propodosoma (Beer) — prodorsum.
Empodium (Beer) — pulvillus.
Epimere (Karafiat) — apodeme.
Epimere I (Krczal, Schaarschmidt) — apodeme 2.
Epimere II (Krczal, Schaarschmidt) — sejugal apodeme.
Epimere III (Krczal, Schaarschmidt) — apodeme 3.
Epimere IV (Krczal, Schaarschmidt) — apodeme 4.
Epimerit (Karafiat) — apodeme.
Epimerit I (Krczal, Schaarschmidt) — apodeme 1.
Epimerit III (Krczal, Schaarschmidt) — anterior part of posterior sternal apodeme.
Erster hysteromatale Tergit (Krczal) — dorsal part of anterior opisthosomatic segment SC.
Esophageal-pharyngeal pump (Cross) — pharynx.
Esophagus (Cross) — pharynx.
External caudals I (Cross) — opisthosomatic setae ph_2 .
External caudals II (Cross) — opisthosomatic setae ph_3 .
External gnathosomal dorsal (Cross) — cheliceral seta pch'' .
External lumbar setae (Suski) — opisthosomatic setae pe_2 .
External poststernals (Cross) — epimeric setae 4(?).
External presternals (Cross) — epimeric setae 3b or 4a.
External ventrals I (Cross) — epimeric setae 1c.
External ventrals II (Cross) — epimeric setae 2c.
Femorogenu (Cross) — genu.
Femur of leg III (Beer) — femorogenu.
First axillaries (Cross) — epimeric setae 3b or 3c.
First hysterosomal tergum (Cross) — dorsal part of first opisthosomatic segment SC.
Gnathosomal dorsals (Cross) — cheliceral setae.
Gnathosomal ventrals (Cross) — infracapitular setae pm .
Haftlappe (Karafiat, Krczal, Schaarschmidt) — pulvillus.
Hinterer Sternalschild (Karafiat, Krczal, Schaarschmidt) — epimera 3 + 4.
Internal and external pseudostigmatal socket (Cross) — bothridium.
Internal caudals (Cross) — opisthosomatic setae ph_1 .

- Internal gnathosomal dorsals (Cross) — cheliceral seta *pch'*.
 Internal humeral setae (Suski) — opisthosomatic setae *pc*₁.
 Internal presternals (Cross) — epimeric setae 3a.
 Internal poststernals (Cross) — epimeric setae 4b (probably).
 Internal ventrals I (Cross) — epimeric setae 1c.
 Internal ventrals II (Cross) — epimeric setae 2c.
 Laterals I (Cross) — opisthosomatic setae *pc*₂.
 Laterals III (Cross) — opisthosomatic setae *pe*₂.
 Laterals IV (Cross) — opisthosomatic setae *pf*₂.
 Main body suture (Beer) — sejugal furrow.
 Median ventrals I (Cross) — epimeric setae 1b.
 Median ventrals II (Cross) — epimeric setae 2b.
 Opisthosomal venter (Cross) — ventral limb.
 Opisthosomal ventrals (Cross) — ?
 Pit (Suski) — cupule.
 Posterior coxal setae III (Suski) — epimeric setae 4a.
 Posterior marginal apodeme (Cross) — sejugal apodeme.
 Posterior median apodeme (Beer, Cross) — posterior sternal apodeme.
 Posterior pseudostigmata (Cross) — posterior prodorsal setae.
 Posterior ventral plate (Cross) — epimeres 3 + 4.
 Posteromedian apodeme (Suski) — posterior sternal apodeme.
 Postpalpal seta (Cross) — laterocoxal seta (*e*) of palp.
 Pretarsus (Beer) — ambulacrum.
 Propodosomal dorsum (Cross) — prodorsum.
 Propodosomal setae (Cross) — prodorsal setae.
 Propodosomal shield (Suski) — prodorsal shield.
 Propodosomataalschild (Krczal, Schaarschmidt) — prodorsal shield.
 Pseudostigmata (Cross) — bothridial setae.
 Pseudostigmatalorgan (Krczal) — bothridial seta (sensillus).
 Pseudostigmatic organ (Beer) — trichobothrium.
 Pseudostigmatic organ (Suski) — bothridial seta (sensillus).
 Pseudostigmatisches Organ (Karafiat, Schaarschmidt) — bothridial seta (sensillus).
 Rostral shield (Beer) — rostral tectum + limb.
 Sacral setae (Suski) — opisthosomatic setae *pf*₁.
 Scapular setae (Suski) — posterior prodorsal setae.
 Second axillaries (Cross) — epimeric setae 4b or 4c.
 Segment 3 of leg IV (Beer) — segment 2 of leg IV.
 Segment 4 of leg IV (Beer) — segment 3 of leg IV.
 Sensory club (Suski) — claviform solenidion.

Setae (Beer) — setae + solenidia.

Setae axillares 1 (Karafiat, Krczal) — epimeric setae 3b or 3c.

Setae axillares 2 (Karafiat, Krczal) — epimeric setae 4b or 4c.

Setae caudales (Schaarschmidt) — opisthosomatic setae ph_1 .

Setae caudales externae 1 (Karafiat, Krczal) — opisthosomatic setae ph_2 .

Setae caudales externae 2 (Karafiat, Krczal) — opisthosomatic setae ph_3 .

Setae caudales internae (Karafiat, Krczal) — opisthosomatic setae ph_1 .

Setae coxales I (Karafiat, Krczal, Schaarschmidt) — epimeric setae 1a, b, c.

Setae coxales II (Karafiat, Krczal, Schaarschmidt) — epimeric setae 2a, b, c.

Setae dorsales (Karafiat, Krczal, Schaarschmidt) — opisthosomatic setae pd_1 .

Setae humerales externae (Karafiat, Krczal, Schaarschmidt) — opisthosomatic setae pc_2 .

Setae humerales internae (Karafiat, Krczal, Schaarschmidt) — opisthosomatic setae pc_1 .

Setae lumbales externae (Karafiat, Krczal, Schaarschmidt) — opisthosomatic setae pe_2 .

Setae lumbales internae (Karafiat, Krczal, Schaarschmidt) — opisthosomatic setae pe_1 .

Setae poststernales (Karafiat, Krczal) — epimeric setae 4b.

Setae praesternales externae (Karafiat, Krczal, Schaarschmidt) — epimeric setae 3b or 4a.

Setae praesternales internae (Karafiat, Krczal, Schaarschmidt) — epimeric setae 3a.

Setae sacrales (Schaarschmidt) — opisthosomatic setae pf_{1-2} .

Setae sacrales externae (Karafiat, Krczal) — opisthosomatic setae pf_2 .

Setae sacrales internae (Karafiat, Krczal) — opisthosomatic setae pf_1 .

Setae scapularis (Schaarschmidt) — posterior prodorsal setae.

Setae scapulares externae (Krczal) — posterior prodorsal setae.

Setae scapulares internae (Krczal) — mediolateral prodorsal setae.

Setae verticales (Krczal, Schaarschmidt) — rostral setae.

Sinneskolbe (Karafiat, Krczal, Schaarschmidt) — clavate solenidion.

Stechborste (Krczal, Schaarschmidt) — stylet.

Sternum I (Karafiat, Krczal, Schaarschmidt) — anterior sternal apodeme.

Sternum II (Karafiat, Krczal, Schaarschmidt) — posterior sternal apodeme.

Stigmatal openings (Beer, Cross) — stigmata.

Stigmata (Cross) — rostral setae.

Subcheliceral plate (Cross) — cervix (?).

Supracheliceral plate (Cross) — ?

Transverse apodeme (Beer, Suski) — sejugal apodeme.

Trochanter (Cross) — femur.

Trochanter of leg IV (Beer) — segment 1 of leg IV.

Ventrite I (Cross) — epimere 1.

Ventrite II (Cross) — epimere 2.

Vertical setae (Suski) — rostral setae.

Vorderer Sternalschild (Karafiat, Krczal, Schaarschmidt) — epimera 1 + 2.

ALPHABETIC LIST OF ABBREVIATIONS

- | | |
|---|---|
| <i>ap.sa</i> , anterior sternal apodeme. | <i>pc</i> ₁₋₂ , opisthosomatic setae of segment |
| <i>ap.sj</i> , sejugal apodeme. | <i>SE</i> . |
| <i>ap.sp</i> , posterior sternal apodeme. | <i>pf</i> ₁₋₂ , opisthosomatic setae of segment |
| <i>ap. 1</i> , apodeme 1. | <i>SF</i> . |
| <i>ap. 2</i> , apodeme 2. | <i>ph</i> ₁ , opisthosomatic seta of segment <i>SH</i> . |
| <i>ap. 3</i> , apodeme 3. | <i>PH</i> , pharynx. |
| <i>ap. 4</i> , apodeme 4. | <i>pi</i> , posterior prodorsal seta. |
| <i>at</i> , line of attachment of cheliceral frame | <i>pm</i> , infracapitular seta. |
| to infracapitulum. | <i>ppl</i> , posterior prodorsal limb. |
| <i>cpc</i> , podocephalic canal. | <i>pr</i> , rostral seta. |
| <i>d</i> , dorsal seta of appendages. | <i>SC</i> , first opisthosomatic segment. |
| <i>dj</i> , disjugal furrow. | <i>SD</i> , second opisthosomatic segment. |
| <i>ep. 1</i> , epimere 1. | <i>SE</i> , third opisthosomatic segment. |
| <i>ep. 2</i> , epimere 2. | <i>sej</i> , sejugal interval. |
| <i>ep. 3</i> , epimere 3. | <i>SF</i> , fourth opisthosomatic segment. |
| <i>ep. 4</i> , epimere 4. | <i>SH</i> , fifth opisthosomatic segment. |
| <i>F</i> , femur. | <i>st</i> , stigma. |
| <i>G</i> , genu. | <i>su</i> , subunguinal spine of tarsus. |
| <i>ia</i> , anterior cupule. | <i>t</i> , terminal seta of segment 3 of leg IV. |
| <i>im</i> , median cupule. | <i>T</i> , tibia. |
| <i>ip</i> , posterior cupule. | <i>TG</i> , tegulum. |
| <i>l</i> , lateral seta of appendages. | <i>u.p</i> , uropore. |
| <i>ld</i> , laterodorsal seta of appendages. | <i>v</i> , ventral seta of appendages. |
| <i>lv</i> , lateroventral seta of appendages. | <i>φ</i> ₁₋₂ , solenidion of tibia. |
| <i>og</i> ₁₋₂ , orifices of glands debouching into | <i>ω</i> ₁ , solenidion of tarsus. |
| podocephalic canal. | <i>1a</i> , epimeric seta of epimere 1. |
| <i>p</i> , possible homologon of proral seta of | <i>2a</i> , epimeric seta of epimere 2. |
| tarsus. | <i>3a</i> , epimeric seta of epimere 3. |
| <i>P</i> , palp. | <i>4a</i> , epimeric seta of epimere 4. |
| <i>pb</i> , bothridial seta. | ' , " , anterior and posterior (in the case |
| <i>pc</i> ₁₋₂ , opisthosomatic setae of segment | of setae of the appendages). |
| <i>SC</i> . | (), a pair (of setae). |
| <i>pch</i> , cheliceral seta. | |

SUMMARY

In the present paper a detailed description is given of a species of Tarsonemidae, as part of a study of the comparative morphology of mites. Special attention has been paid to the application of the same terminology as used in my previous studies in this field. The introduction of this terminology is facilitated by the preparation of a glossary and a list of synonyms. In a series of remarks, problems of general importance are discussed. The systematic position of the group has been revalued, as part of a revised classification of the mites; this revaluation resulted in the creation of a separate order Tarsonemida of the superorder Actinotrichida, of which the relationship is dis-

cussed. The order Tarsonemida includes the families Pyemotidae, Scutacaridae, Tarsone-
midæ, and Podapolipidae. It is pointed out that the present study should be completed
with a similar study of a relatively primitive species of Pyemotidae.

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