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# STUDIES ON OPILIOACARIDA (ARACHNIDA) II. REDESCRIPTION OF PARACARUS HEXOPHTHALMUS (REDIKORZEV)

by

**L. VAN DER HAMMEN**

Rijksmuseum van Natuurlijke Historie, Leiden

With 4 text-figures

In the first part of the present series (Van der Hammen, 1966), I estimated the extent of my studies on Opilioacarida at two papers, each paper dealing with a representative of one genus. Since the publication of this first part, however, new material has been placed at my disposal, enabling me to start a revision (to be published in several parts) of nearly all species of the group described up to now. Such a revision is interesting because of two reasons. In the first place Opilioacarida are characterized by a very homogeneous habitus which is in remarkable contrast with the considerable variability of many other characters, in such a way demonstrating the further evolution of a type probably fixed at an early date. In the second place, a thorough knowledge of the group will certainly provide comparative Anactinotrichid morphology with an essential base, primitive representatives being indispensable for a clear comprehension of homologies (Opilioacarida and, to a less extent, Holothyrida are considered here the only primitive representatives of the Anactinotrichida, primitive being interpreted as presenting an important number of primitive characters).

In my preliminary revision of the species of Opilioacarida (Van der Hammen, 1966: 48), I mentioned also the genus *Paracarus* Chamberlin & Mulaik (1942), of which *Opilioacarus hexophthalmus* Redikorzev (1937) from Asiatic Russia is the type-species and single representative. A short diagnosis of this remarkable genus was given by me, which diagnosis was based on the original description and figures by Redikorzev (some characters had been verified by Dr. Nina Bregetova). Recently, however, through the kindness of Dr. Bregetova, I was enabled to examine personally one specimen

of the species, an investigation which appeared to be of considerable interest to our knowledge of the morphology of the group. For this reason it is a pleasure to me to express here my sincere thanks to Dr. Bregetova for her valuable contribution to my study of the Opilioacarida.

The description by Redikorzev (1937: 10-12) is sufficient to recognize the species. It contains some interesting details such as the presence of three pairs of eyes, whilst other important characters are represented in his figures, e.g. the presence of four setae on the principal cheliceral segment, the absence of With's organ, and the presence of a rutellum with six teeth. Some characters, however, are puzzling such as the apparently dorsal position of the stigmata (the series seems, moreover, to have moved up one segment in posterior direction), and the recorded measurements (which are not completely in accordance with the figures, and apparently have been subject of misprints and mistakes in the calculation). Besides, an important number of characters required for the preparation of a diagnosis comparable with that of *Opilioacarus texanus,* were unknown.

For this reason the present redescription has been prepared. It is not complete, partly because I had only one specimen at my disposal (which had, moreover, to be handled with the utmost care), partly because mention is made mainly of differential characters. The study is composed in the following way. After the redescription, a diagnosis is given of the genus *Paracarus*; this is followed in its turn by further remarks of general importance, and by additions and corrections to the glossary published in the first part of the present series. An alphabetic list of abbreviations and a summary will facilitate the use of the paper.

**Paracarus hexophthalmus** (Redikorzev, 1937)

Locality and date. — Dzhungarskij Alatau (Kazakhstan), valley of the river Terekty, August 11-16, 1936.

Material. — One female specimen with extended ovipositor has been studied by me. It is labelled: "Zool. Mus. AN No. 232-1937. 3737. Opiliocarus [sic!] hexophthalmus Redik. det. V. Redikorzev". The label further records in Russian the above-mentioned data on locality and date; V. Shnitnikov is mentioned as collector.

The specimen is no type, because according to Redikorzev (1937: 12) the type-locality is "Semiretshje, Alexander-Bergkette (= Kigizskij Khrebet), Schlucht des Flusses Tujuk". The four type-specimens had been collected in July 1931, also by V. Shnitnikov. The Kirgizskij Khrebet is a mountain range between Kirgizya and Kazakhstan. Dr. Bregetova kindly informed me that the river Tuyuk begins on the northern slope of the

eastern part of the range, i.e. in Kirgizya; it is a very small mountain-stream, tributary of the river Issygaty.

The opisthosoma of the specimen investigated by me was slightly deformed. Two legs (right leg II and left leg IV) are lacking. Parts of the specimen (especially its opisthosoma) are only faintly coloured.

The specimen has been studied in cold, diluted lactic acid (one part of lactic acid and one part of distilled water). This medium (if not warmed) is favourable for the study of Opilioacarida; in the present case the specimen even returned more or less to its original shape. Because of the extended ovipositor, only part of the ventral surface could be studied.

Measurements. — Length (gnathosoma included) of the single female specimen studied by me 2.25 mm; breadth 1.00; ratio length : breadth 2.25. The lengths of the legs (coxae not included) are the following (the ratio leg: length of the body is mentioned between brackets): I 2.74 (1.22); II 1.92 (0.85); III 1.96 (0.87); IV 3.12 (1.39). Further data on measurements of leg segments are given below, in the section on the legs. The sequence of the legs (according to decreasing length) is IV, I, III, II. These measurements are exceptional because *Paracarus hexophthalmus* is the only known Opilioacarid species in which leg IV is longer than leg I.

My results are not completely in agreement with the data mentioned by Redikorzev (1937: 12). He mentions 1.67 mm as total length of the body, 0.75 mm as length of the prosoma. According to his fig. 1, the total length is, however, 3 × the length of the prosoma, which would result in a total length of 2.25 mm, exactly corresponding with the length of the specimen measured by me. As to the lengths of the legs recorded by Redikorzev, part of these are not only different from my own results, but also different from the results obtained by a comparison of his figures. Only the reported length of legs II and IV appear to be correct. The abnormal length of leg I as mentioned in the text (5.07 mm), is apparently partly due to a misprint (it does not correspond with figure and description). Leg III was probably not orientated horizontally when it was measured; its reported length is too small in comparison with my results.

Habitus and colour. — The specimen studied by me has the typical habitus of an Opilioacarid. The pronounced segmentation figured by Redikorzev is not present; possibly this is in connection with the way of preservation or the internal condition of the opisthosoma.

The prosoma presents a bluish lateral and rostral border, transverse bluish stripes at the posterior border and at the level of the transverse

prodorsal furrow, and a median bluish band enclosing a pair of anterior light spots. The eyes are situated in dark eye patches.

The opisthosoma is for the greater part pale; two dorsal segmental borders in front of the anal tubercle are indistinctly bluish; further traces of dorsal bluish stripes at the borders of the opisthosomatic segments are very faint or invisible.

In dorsal view, the chela appears to be blue; a dark blue stripe is present near the distal border of the cheliceral trochanter. Parts of the infracapitulum present dark blue borders. Femur and genu of the palp are light blue with darker stripes. The tibia of the palp is blue, darker in the distal part. The palpal tarsus is dark blue with an antiaxial light spot; it is distinctly differentiated (by its darker colour) from the tibia.

The trochanteres of all legs are pale yellowish. The general colour pattern of femur, genu, and tibia is blue with lighter or darker longitudinal stripes; femur IV is pale with blue stripes. Basi- and telotarsus I-IV are blue (I) or dark blue (II, III, IV) with lighter (distinct or indistinct) lateral stripes; acrotarsi II-IV are lighter than basi- and telotarsi.

Cuticle. — The cuticle is faintly sclerotized and easily deformed, as in other Opilioacarida. The sculpture consists of the usual small cones. According to Redikorzev (1937: 10) the surface of the prodorsum was smooth; the prosoma, however, presents the same type of cones as in the remaining part of the body (the cones are only slightly smaller than those in the anterior dorsal part of the opisthosoma). No sculpture is present on the anal valves.

Prodorsum. — The prodorsum presents the usual furrows: a transverse furrow (*tr*) in the posterior part, and at both sides a groove extending from the eyes to the rounded indentation (*RE*) laterally of the rostrum. The last-mentioned furrow is named here oculorostral groove (fig. 1A: *org*); it is apparently present in all Opilioacarida. The rostrum appears to be rather long. A distinct rostral lobe is not developed in the specimen studied by me.

Three pairs of eyes are present (fig. 1A, C), the additional eye being situated between the usual pair, and slightly higher. The third eye is described and figured by Redikorzev (1937: 11, fig. 1) as considerably smaller. In reality it is, however, nearly as large as the remaining eyes (only slightly smaller). In dorsal view its border is difficult to distinguish because of the dark pigment; only a small light spot in the centre of the eye is visible at first sight in this orientation (cf. fig. 1C).

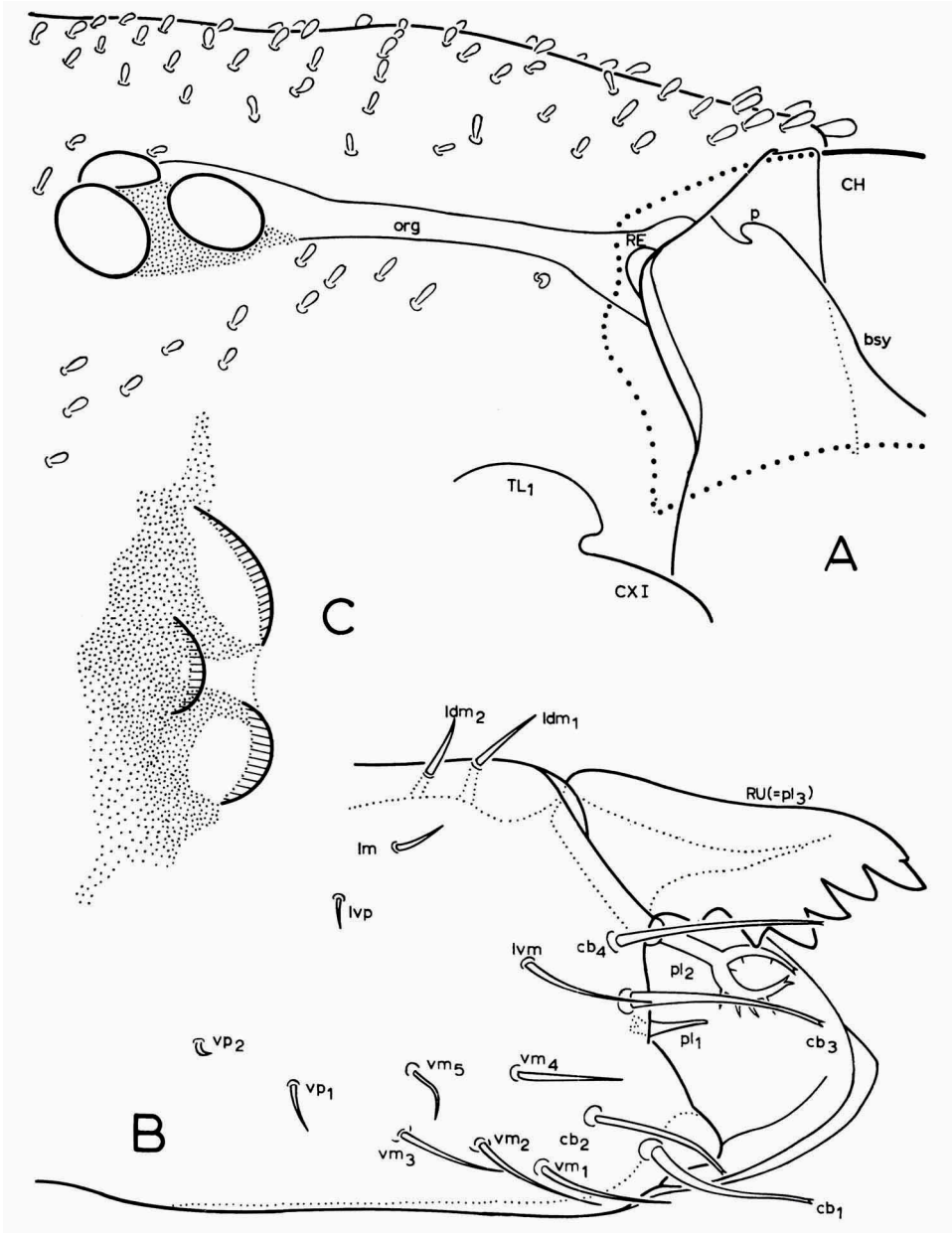


Fig. 1. *Paracarus hexophthalmus* (Redikorzev), female; A, lateral view of frontal part of prosoma and basal part of gnathosoma; B, lateral view of infracapitulum (labrum omitted); C, right group of eyes, viewed obliquely from above; A, × 230; B, C, × 370.

The prodorsum presents numerous papilliform setae, but no lyrifissures. Numerous muscle attachments are present in the same regions as described by me for *Opilioacarus texanus* (Chamberlin & Mulaik) (cf. Van der Hammen, 1966: 12).

Opisthosoma. — As mentioned above, the segmentation is less pronounced than in the specimens described and figured by Redikorzev (1937: 10, fig. 1); the segments, however, are still recognizable by the presence of faint, transverse furrows, and of course by a study of muscle attachments and lyrifissures. The number of opisthosomatic segments is the same as in *Opilioacarus texanus* (cf. Van der Hammen, 1966: 12), viz., 14 (nos. VII-XX). The segments XIX and XX constitute the anal tubercle.

Judging from the original figure (Redikorzev, 1937: fig. 1), the stigmata of *Paracarus hexophthalmus* have a more dorsal position than in other species of Opilioacarida; especially stigmata 3 and 4 are represented rather close to each other. The complete series of stigmata seems, moreover, to have moved up one segment in posterior direction. In reality, however, the stigmata occupy nearly the same position as in *O. texanus* (cf. Van der Hammen, 1966: 16, fig. 1, 3). Redikorzev did not see stigma 1 (probably because of its lateral position); apparently he did also not recognize the true position of stigmata 3 and 4.

With the exception of the anal tubercle, the opisthosoma does not bear setae. The complete disappearance of the setae of segment XVIII (there are about 1-5 setae in species of the genus *Opilioacarus*) is apparently a special character of *Paracarus hexophthalmus*.

There are numerous muscle attachments and lyrifissures. These have not been studied here in all details; they have about the same disposition as in *O. texanus*.

Anal tubercle. — Segment XIX presents numerous papilliform setae (many more than in *O. texanus*) arranged in about three rows. No setae occur on the anal valves (segment XX); as mentioned above, this segment lacks, moreover, the sculpture of small cones.

Genital region. — The specimen represented by Redikorzev (1937: fig. 4) has ten pregenital setae arranged in one row, and fourteen genital setae arranged in two rows (8 + 6). Judging from the condition in *Opilioacarus texanus* (cf. Van der Hammen, 1966: 17), this presence of many pregenital setae and of two rows of genital setae points to the possibility of the specimen being a male.

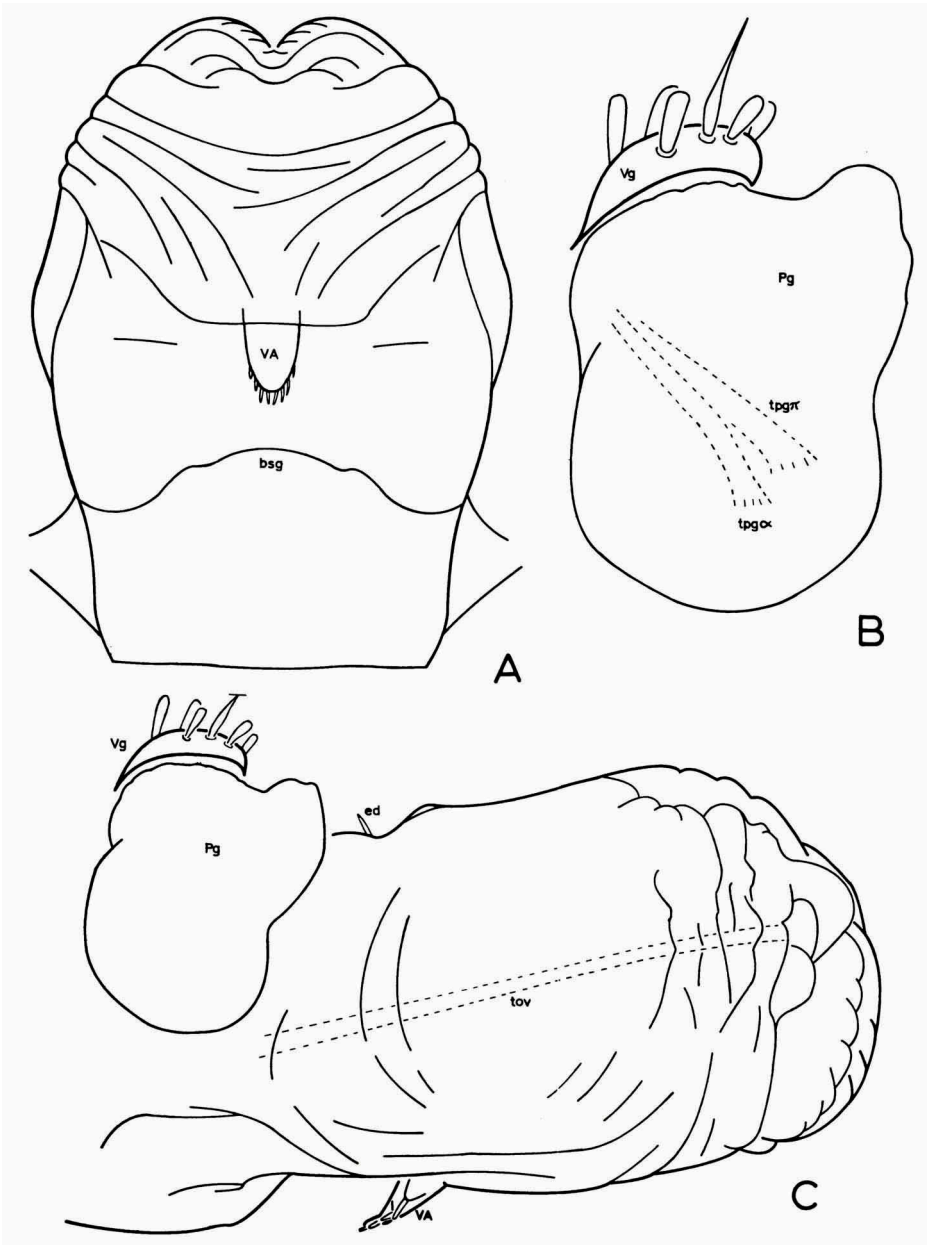


Fig. 2. *Paracarus hexophthalmus* (Redikorzev), female; A, ventral view of extended ovipositor; B, lateral view of right genital verruca with evaginated genital papilla; C, lateral view of extended ovipositor and evaginated genital papilla; A, × 140; B, × 295; C, × 185.

The specimen studied by me is a female with extended ovipositor; this ovipositor is represented in ventral and in lateral orientation in fig. 2A, C. One of the capsules (cf. fig. 2B, C) appeared to be open, with the so-called pregenital sac evaginated. This throws a new light on this mysterious organ. Although we still do not know anything about its function, it is apparently a genital papilla, as was recently already supposed by me (Van der Hammen, 1966: 19, 22, 53); the name genital papilla is now definitely applied to it, whilst the name genital verruca is reserved for the cover (or capsule). Two tendons (*tpgα, tpgπ*) appear to be present inside the papilla. The figured verruca bears five papilliform setae and one composite seta (consisting of a long, narrow tip and a broader base), more or less as in *Opilioacarus texanus*.

The ovipositor is not ternary (ternary is the condition in many Actinotrichida) but faintly binary: two terminal lobes are rather indistinctly differentiated. It will be interesting to compare this condition with the vulva of other Anactinotrichida.

In lateral view, one dorsal spine (fig. 2C: *ed*) appears to be present. In lateral as well as in ventral view, a posteriorly directed ventral apophysis (fig. 2A, C: *VA*) is visible near the base of the ovipositor; this apophysis bears four pairs of hollow setae. I do not know whether these setae, when the ovipositor is retracted, take the position of genital setae.

The eggs, as far as visible by transparency, apparently lack the two apophyses present in *Opilioacarus texanus* (cf. Van der Hammen, 1966: fig. 6A-C); their outline appears to be more or less oval.

Sternal region. — In the single specimen studied by me, this region is covered by the extended ovipositor. No mention of it is made in the original description. Consequently, the number and condition of setae and lyrifissures on sternal verrucae and remaining part of the sternum are unknown. There are two sternapophyses, each with two setae, as in *Opilioacarus*.

Lateral region of podosoma. — The three pedotectal lobes, dorsally of coxae I-III, are also present in *Paracarus hexophthalmus*. They resemble those of *Opilioacarus texanus*.

Gnathosoma. — Part of the cheliceral frame is represented in lateral view in fig. 1A. The cheliceral sheath and the conspicuous border of the synaptic tectum (*bsy*) with its prominent apophysis (*p*) are easily visible.

The cervix has not been studied in the present species, because the single specimen could not be dissected.

The infracapitulum is represented in ventral view in fig. 3, and part of it in lateral view in fig. 1B. Three paralabial setae are present, viz., the small corniculus $pl_1$, a large bifurcate seta $pl_2$ at the place of With's organ, and the rutellum (= $pl_3$). The corniculus is slightly longer than in *Opilio-*

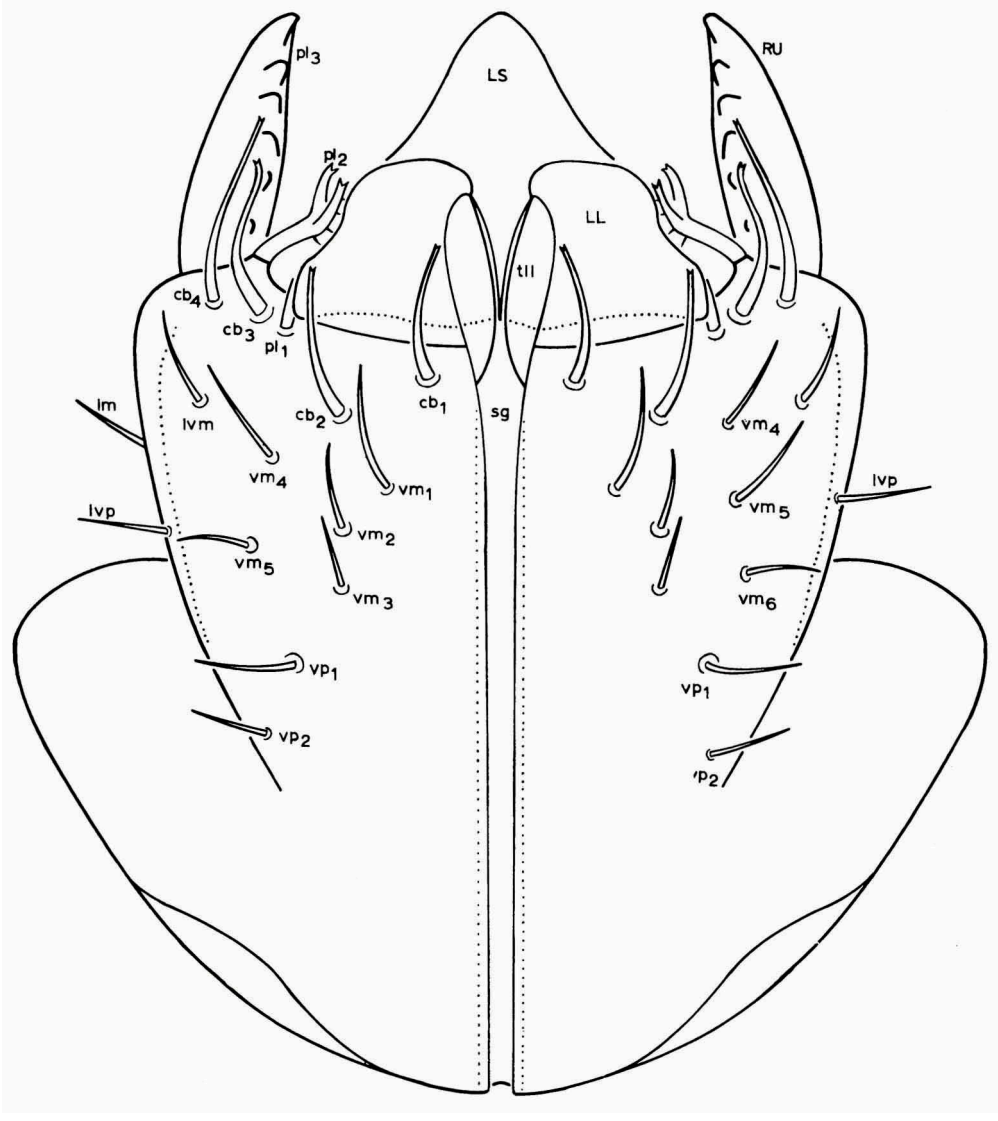


Fig. 3. *Paracarus hexophthalmus* (Redikorzev), female; ventral (oblique) view of infracapitulum (labrum schematized); × 370.

*acarus texanus*. The presence of a bifurcate seta at the place of With's organ is very interesting; it proves that With's organ is indeed a hypertrophied seta, as was recently already supposed by me (Van der Hammen, 1966: 25). The two branches of $pl_2$, especially the ventral one, are beset with barbs. Below, in remark 4, I return to With's organ and the other paralabial setae. The rutellum has six teeth, one more than in *Opilioacarus texanus* (the additional tooth is a small basal one); the remaining teeth are more or less of equal length (in *O. texanus* the proximal tooth is distinctly larger); the terminal tooth has a very small, dorsal denticle. The central core of the rutellum is strongly birefringent; an axial band, however, remains dark in polarized light; extinction is obtained when the stage of the microscope is turned round.

The four pairs of circumbuccal setae ($cb_{1-4}$) are more or less curved; they have a truncate and slightly split tip. There are a great number of median setae, viz., at each side five or six *vm*, one *lvm*, one *lm* (at one side only), and one or two *ldm*. There are two pairs of *vp* and one pair of *lvp*.

The lateral lips habe about the same shape as in *Opilioacarus*. The subcapitular groove is protected in its distal part by a pair of "tecta" (*tll*) which in reality are ventral, paraxial lobes of these lips. The labrum is beset with long, pointed teeth, strikingly longer than those in *Opilioacarus texanus*.

Chelicera. — The cheliceral trochanter (the first free segment) has no setae; the single seta of *O. texanus* is not present. The principal cheliceral segment (segment 2) has four setae, one more than in *O. texanus* (a seta is added posteriorly of the dorsal paraxial one of the last-mentioned species).

Palp. — The palp resembles that of *Opilioacarus texanus* (cf. Van der Hammen, 1966: 34, fig. 14). The trochanter, however, is relatively longer, and the tarsus distinctly shorter; consequently the relation tarsus : tibia is much smaller ($^1/_5$ in *P. hexophthalmus*, $^2/_5$ in *O. texanus*, when the antiaxial surfaces are measured). In the specimen studied by me, tibia and tarsus have not the shape of one segment: the tarsus is distinctly differentiated, because it is slightly bent; this character is not present in the specimen figured by Redikorzev. Just as in *O. texanus*, the paraxial surface is much longer than the antiaxial; consequently, the border between tarsus and tibia (when studied in dorsal or ventral view) is oblique. The tarsal lyrifissures ($i\alpha$ and $i\pi$) are both present. The chaetotaxy of the tarsus is slightly different from that of *O. texanus*. The dorsal area consists of about 18 hollow setae (*ch*). There is no distinctly differentiated paraxial group of leaf-shaped setae; the paralateroventral setae are barbed. The ventral setae are mucronate.

There is a row of four small dorsal "solenidions", and one or two longer dorsal setae that probably also represent "solenidions". One of the composite *sm* setae (*lv''*) is rather long and extends beyond the tip of the palpal claws.

Legs. — As mentioned above, leg IV is longer than leg I; both legs are longer than the body. Legs II and III are shorter than the body. The exceptional length of leg IV is a striking character of the species; it is not met with in other Opilioacarida known to me.

The legs have the same primary and secondary segments as in *O. texanus*; leg I has also no acrotarsus, and no divided tibia. There are slight differences between *P. hexophthalmus* and *O. texanus* as to the relative lengths of the leg segments. Trochanter, femur, and genu of leg I of *P. hexophthalmus* are relatively longer, tibia, basitarsus, and telotarsus I relatively shorter than in *O. texanus*. The acrotarsi of legs II-IV are relatively longer than in *O. texanus*; acrotarsus III, for instance, is half as long as the telotarsus. The lengths of the leg segments (with exception of the coxae) are represented in table 1.

Table 1. — Length in mm of the segments of the legs.

| | leg I | leg II | leg III | leg IV |
|---|---|---|---|---|
| trochanter (trochanter 1 + trochanter 2) | 0.37 | 0.17 | 0.15 + 0.13 | 0.29 + 0.22 |
| femur (basifemur + telofemur) | 0.69 | 0.47 | 0.40 | 0.69 |
| genu | 0.47 | 0.30 | 0.28 | 0.44 |
| tibia | 0.62 | 0.29 | 0.31 | 0.52 |
| basitarsus | 0.26 | 0.35 | 0.36 | 0.57 |
| telotarsus (incl. acrotarsus, pretarsus, and apotele) | 0.33 | 0.34 | 0.33 | 0.39 |
| Total | 2.74 | 1.92 | 1.96 | 3.12 |

The ratio length : breadth of the leg segments is considerably smaller than in other species known to me, i.e. the legs are distinctly broader. This appears already from a comparison of the original figure of the legs of *Paracarus hexophthalmus* (Redikorzev, 1937: fig. 3) with my figures of the legs of *Opilioacarus texanus* (Chamberlin & Mulaik) (cf. Van der Hammen, 1966: fig. 15, 17-19). A comparison of fig. 4 of the present paper with fig. 15 of my 1966 paper, demonstrates that in leg I of *P. hexophthalmus* the segments are relatively about 1.35 (trochanter), 1.5 (genu, tibia), 1.7 (tarsus), and 2 times (femur) as broad as the corresponding segments in *O. texanus*.

All legs present scattered lyrifissures and lyrifissures associated with

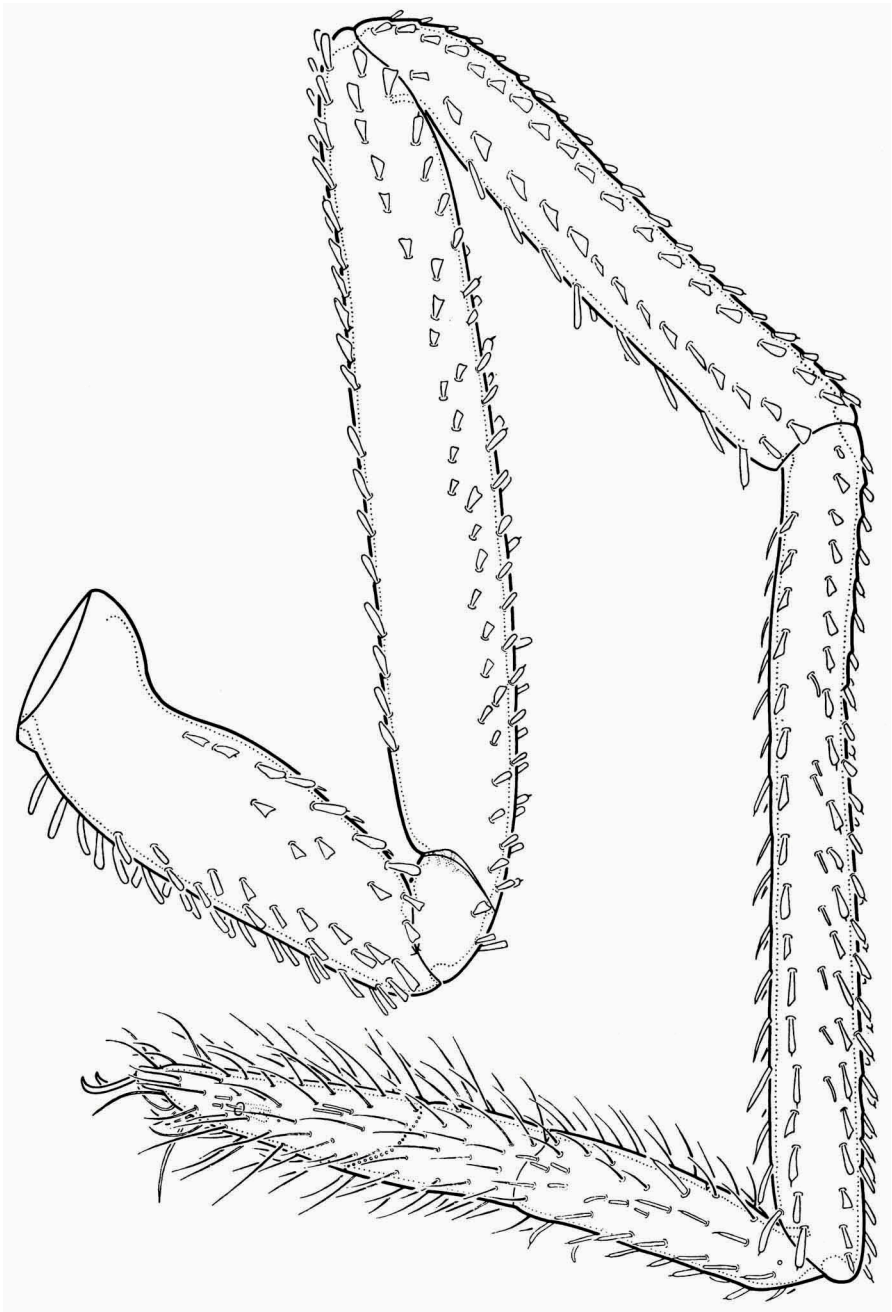

Fig. 4. *Paracarus hexophthalmus* (Redikorzev), female; antiaxial face of right leg I; × 155.

secondary articulations; the articulation between basifemur and telofemur I passes antiaxially and ventrally through a composition of about eight lyrifissures.

Coxae I and II present laterocoxal setae at the same place as in *O. texanus*; these are also mucronate.

Great numbers of setae are present on all legs. Evidently, this concerns a neotrichy (just as in other species of Opilioacarida) which is in connection with the increased length of the legs. All setae are still arranged in distinct rows, sometimes even in distinct verticils. Consequently, there is a linear cosmiotrichy. In remark 3, I return to this interesting question.

Leg I is represented in fig. 4. In comparison with the subadult leg figured for *O. texanus* (cf. Van der Hammen, 1966: fig. 15), there are relatively many more papilliform setae. Tibia I has no secondary articulation; its antiaxial surface presents eight "solenidions". The telotarsal organ resembles that of *O. texanus*; two small "solenidions" are situated in front of it. The smooth (not sculptured) area of the telotarsus is smaller than in *O. texanus*.

Geographical distribution. — The species was originally described from a locality in Kirgizya. It is recorded here apparently for the first time from Kazakhstan. The two localities are separated by a distance of at least 500 km. It is not impossible that the species will prove to occur in several widespread localities in Central Asia. It has the northernmost distribution of all Opilioacarida known (about 42° 30′ to 45° North latitude).

## Diagnostic characters of the genus *Paracarus*

The present redescription demonstrates that the two existing diagnoses of the genus *Paracarus* are insufficient and partly incorrect; they had both been founded on the original description of the type-species. The diagnostic characters mentioned by Chamberlin & Mulaik (1942: 125, 126) are: the presence of three pairs of eyes (one of which is smaller), and the absence of a separate trochanter 2 in legs I and II (this, however, is a character of all Opilioacarida; it was indeed also mentioned by the authors in the same paper for *Opilioacarus texanus*). In a preliminary revision of the species of Opilioacarida, recently published by me (Van der Hammen, 1966: 48-50), I enumerated a number of diagnostic characters, some of which now appear to be incorrect (the prodorsum is not smooth; the segmentation is not pronounced in the specimen studied by me; segment XX is present;

stigmata 3 and 4 have no abnormal position; legs II and III are not as long as or longer than the body).

The observations published in the present paper result in the following revised diagnosis of the genus.

**Paracarus** Chamberlin & Mulaik, 1942

Prosoma and opisthosoma (with the exception of the anal valves) with a sculpture of small cones. Prosoma with a great number of papilliform setae. Three pairs of eyes, the median one only slightly smaller than the remaining eyes. Opisthosoma (with the exception of segment XIX) without setae; segment XIX (the base of the anal tubercle) with many setae; no setae on segment XVIII. Segmental furrows of the opisthosoma faint; they can, however, be also more pronounced. Stigmata with the normal latero-dorsal position. Rutellum with six teeth. A large bifurcate seta ($pl_2$) takes the place of With's organ. There are a great number of infracapitular setae, among which many *vm,* and at each side one or two *ldm* (these numbers, however, are based on the study of one specimen only). Cheliceral trochanter without setae; principal cheliceral segment with four setae. Leg IV longer than leg I; both legs longer than the body. Leg II and III shorter than the body. All legs distinctly broader than in other known genera of Opilioacarida.

Type-species: *Opilioacarus hexophthalmus* Redikorzev, 1937.

## REMARKS

### Remark 1. The systematic position of the Opilioacarida

Recently (Van der Hammen, 1968a), in a series of stray notes on mites, I revaluated the systematic position of the Opilioacarida. I demonstrated that all characters in common between Opilioacarida and Actinotrichida are in fact primitive characters. Because primitive Anactinotrichida were unknown, this list now appears to be misleading. Taking into account that there is a considerable list of characters in common between Opilioacarida and Anactinotrichida, our conclusion should be that Opilioacarida represent the Anactinotrichida with the greatest number of primitive characters. This is an important result, because we have now recognized for the first time a group of primitive Anactinotrichida. This provides us with a base for a new study of comparative morphology. This demonstrates at the same time the relations and fundamental differences between Anactino- and Actino-trichida. New lists of diagnostic characters of the two superorders of mites

and a revised classification are now in press (Van der Hammen, 1968b); I refer to the paper in question.

It will now be interesting to make further comparisons between *Opilioacarus* and one of the primitive Actinotrichida. For that purpose an extensive description of *Pachygnathus dugesi* Grandjean will be prepared after the completion of my series of papers on Opilioacarida.

### Remark 2. The type of segmentation of the Opilioacarid opisthosoma

The opisthosoma of the Opilioacarida is only faintly sclerotized. Apart from the muscle attachments, the borders of the segments are rather indistinctly indicated: there can be transverse bands of coloured pigment grains at the borders, the borders can be slightly constricted, and there can be small, irregular interruptions in the sculpture of the tegument. There are, however, no distinct sclerites separated by intersegmental areas of soft skin: the primitive Arthropod arrangement of tergite, sternite, and lateral pleurites is not met with. Because of this, some doubt has been expressed as to the character of the segmentation: it is sometimes thought to be of secondary origin.

In contradistinction to this, it is my opinion that the type of segmentation met with in Opilioacarida is a very primitive one, more primitive than that presenting dorsal, ventral, and lateral sclerites. A related type is apparently found in some Endeostigmata (e.g. in *Pachygnathus*), and probably also in some Lohmanniidae. It will be very interesting to prepare comparative descriptions of the opisthosoma of representatives of these groups.

### Remark 3. The neotrichy of the Opilioacarid leg

As mentioned above, the legs of the Opilioacarida present a neotrichy which is evidently in connection with the increased length of the legs. All setae, however, are still arranged in distinct rows, sometimes even in distinct verticils. It seems as if the number of verticils has increased. The greater part of the verticils, however, are incomplete, so that it is preferable to speak of a linear cosmiotrichy (cf. Grandjean, 1965: 714-717). A further study must prove whether this cosmiotrichy is idiotaxic.

### Remark 4. On the homology of With's organ and other paralabial setae in Opilioacarida

As mentioned above, the presence in *Paracarus hexophthalmus* of a bifurcate seta $pl_2$ at the place of With's organ is the definite proof that

this organ represents a hypertrophied seta. This homology was recently already suggested by me in my first study on Opilioacarida (Van der Hammen, 1966: 25). Grandjean (1957: 273) remarked that With's organ probably is a second rutellum. I now prefer to consider it a specialized adoral seta, presupposed that the rutellum is also a specialized adoral seta. This means that paralabial and adoral are synonymous.

Although I recently set up the hypothesis (Van der Hammen, 1966: 54) that the circumbuccal setae are homologous with the anterior and adoral setae of other mites, it now appears that this homology should be restricted to the anterior setae *a* (*va, lva* in *Holothyrus*; $va_2$ [1]), *lva* in *Allothyrus*).

Adoral setae present indeed several specialized shapes which can resemble With's organ and rutellum. I point especially to the adoral setae of the Lohmanniidae (cf. Grandjean, 1950: fig. 5B, 6C), which have already some resemblance to With's organ. In some primitive Oribatid mites, adoral setae resemble a primitive rutellum. In *Speleorchestes* (Endeostigmata) on the other hand, a bifurcate seta takes the place of the rutellum (cf. Grandjean 1939: 25). I return to the interesting subject of the adoral setae in my second series of Stray Notes on Acarida (Arachnida).

## Remark 5. On the evolution of the Opilioacarida

Opilioacarida constitute a group with a homogeneous general habitus, probably fixed long ago, which condition is in remarkable contrast with the considerable variability of other characters. They present in this respect a remarkable parallel (the groups are of course not related) to the Oribatid family Lohmanniidae. In this Opilioacarid connection, general habitus refers not only to shape of the body, colour, and presence of eyes and long legs; but also to segmentation, position of the stigmata, general characters of the gnathosoma, etc. The variable characters include: number of eyes, presence or absence of opisthosomatic setae, number of setae on the sternapophyses, measurements (including the length of the legs), various characters of the gnathosoma (especially the number and condition of the infracapitular setae), leg chaetotaxy, presence or absence of a secondary articulation in tibia I, etc.

It will be interesting to investigate whether the combination of a homogeneous habitus and a considerable variability of other characters, is especially found in very old, isolated groups which, at the same time, still constitute

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1) Seta $va_1$ of *Allothyrus constrictus* (cf. Van der Hammen, 1968a, fig. 2A) possibly is an adoral seta, just as the corniculus; *z* is probably a vestige of an adoral seta.

more or less vigorous branches. Apparently this condition especially occurs in taxa which, after having fixed a certain general type, have found within this pattern new ways of evolution.

## Glossary

The following is an addition to the glossary published in my first study on Opilioacarida (Van der Hammen, 1966: 67). It is again divided into two parts: a synonymic list and a list of terms used in the present series of papers. An asterisk (*) preceding a term means that it concerns a correction to a definition or conception occurring in the above-mentioned paper.

### Synonymic list

Cheliceral tectum (Van der Hammen) — tegulum.
* Praetarsus (Redikorzev) — telotarsus.
Pregenital sac (Van der Hammen) — genital papilla.
Rostrum (Grandjean) — cheliceral sheath (coxal region of chelicera).
* Rostrum (With) — tegulum.
* Tarsus (Redikorzev) — basitarsus.

### List of terms to be used in descriptions of Opilioacarid mites

Cheliceral groove. — A longitudinal depression in the dorsal surface of the infracapitulum in which a chelicera can move. Cheliceral grooves start on either side of the capitular saddle (the convex median part of the cervix) and continue on the genae.

*Cheliceral tectum. — See: Synonymic List.

Cosmiotrichy. — A neotrichy in which the setae are placed in a simple and recognizable order. Although the disposition is not arbitrary, this does not mean that the setae can always be homologized.

*Genital papilla. — A papilla, in Opilioacarida laterally of the genital orifice, which can be evaginated (probably by hydrostatic pressure) and invaginated (by means of tendons). In invaginated position it is covered by the genital verruca. There are one pair of genital papillae and verrucae.

*Genital verruca. — A wart-like elevation, functioning as cover of the genital papilla; when it is opened, the genital papilla can be evaginated.

Idiotaxy. — The condition in which the organs (setae, etc.), in a certain neotaxic area, are all susceptible to receive notations because of their position.

Linear cosmiotrichy. — A cosmiotrichy in which the setae are placed in a line.

NEOTRICHY. — The secondary formation of setae, in a certain area, by multiplication of the setae pre-existing in this area.

OCULOROSTRAL GROOVE. — The groove running, at both sides, from the eyes to the rounded prodorsal indentation laterally of the rostrum.

*PREGENITAL SAC. — See: Synonymic List.

TEGULUM. — The dorsal part of the cheliceral frame, extending from the rostrum to the chelicerae (cf. Van der Hammen, 1968: 9).

## CORRECTIONS

In the table on p. 35 of my first paper on Opilioacarida (Van der Hammen, 1966), the terms basi- and telofemur have been interchanged; it is evident that this concerns a misprint. On p. 60 sub (5) of the same paper, mention is made of "the secondary subdivision of the tibia"; this concerns of course only tibia I.

## ALPHABETIC LIST OF ABBREVIATIONS USED IN FIG. 1-4

*bsg*, border of sculptured area of genital region.
*bsy*, border of synaptic tectum.
$cb_{1-4}$, circumbuccal setae.
*CX I*, coxa I.
*CH*, chelicera.
*ed*, dorsal spine of ovipositor.
*Ji*, inferior commissure of mouth.
$ldm_{1-2}$, laterodorsal infracapitular setae.
*LL*, lateral lip
*lm*, lateromedian infracapitular seta.
*LS*, labrum
*lvm*, lateroventral median infracapitular seta.
*lvp*, lateroventral posterior infracapitular seta.
*org*, oculorostral groove.
*p*, laterodorsal prominence of synaptic tectum.
*Pg*, genital papilla.
$pl_{1-3}$, paralabial setae.
*RE*, laterorostral indentation.
*RU*, rutellum.
*sg*, subcapitular groove.
$TL_1$, anterior pedotectal lobe.
*tll*, ventral tectal lobe of lateral lip.
*tov*, tendon of ovipositor.
*tpgα*, *tpgπ*, antiaxial, resp. paraxial tendon of genital papilla.
*VA*, ventral apophysis of ovipositor.
*Vg*, genital verruca.
$vm_{1-6}$, medioventral infracapitular setae.
$vp_{1-2}$, posteroventral infracapitular setae.

## SUMMARY

In the present paper a redescription is given of *Paracarus hexophthalmus* (Redikorzev, 1937), an Opilioacarid from from Kirgizya and Kazakhstan. The paper is part of a morphological study and a revision of all known species of the group. Special attention is paid here to characters omitted or insufficiently described by Redikorzev. The following list is a summary of the main results.

1. The measurements appear to be different from those recorded by Redikorzev probably because of misprints and miscalculations in the original description.

2. There are three pairs of eyes; the additional eye, situated between the usual pair, is only slightly smaller than the remaining eyes. The furrow running in all Opilioacarida from the eyes to the rounded laterorostral indentations is named here oculorostral groove.

3. The number of opisthosomatic segments is fourteen, just as in the genus *Opilioacarus*. The position of the stigmata is different from the original description by Redikorzev; in fact they have the same position as in *Opilioacarus*.

4. Segment XVIII presents no setae. There are numerous setae on segment XIX. The anal valves (segment XX) are glabrous.

5. The genital verruca covers a genital papilla (previously named pregenital sac) which can be evaginated. The terminal part of the ovipositor is not ternary, but faintly binary; it presents one dorsal spine, and one ventral apophysis with four pairs of hollow setae.

6. The infracapitulum presents a large bifurcate seta ($pl_2$) at the place of With's organ; this is considered a definite proof of With's organ being a hypertrophied seta. The rutellum has six teeth, one more than in *Opilioacarus*. Apart from the paralabial setae, there are about sixteen pairs of infracapitular setae, viz., at each side four *cb*, five or six *vm*, one *lvm*, one *lm* (at one side only), one or two *ldm*, two *vp*, and one *lvp*.

7. The cheliceral trochanter has no setae; there are four setae on the principal cheliceral segment.

8. The palpal tarsus presents a dorsal area with about 18 hollow *ch* setae, and four small, and probably two longer, dorsal "solenidions"; there is no paraxial group of leaf-shaped setae, but there are barbed lateroventrals; there are mucronate ventral setae.

9. Leg IV is longer than leg I; both legs are longer than the body. Leg II and III are shorter than the body.

10. In a series of remarks, Opilioacarida are considered an order of the superorder Anactinotrichida.

The type of segmentation of Opilioacarida is considered more primitive than that presenting tergites, sternites, and lateral pleurites.

The neotrichy of the Opilioacarid legs is considered a linear cosmiotrichy.

The paralabial setae of Opilioacarida are homologized with the adoral setae of the Actinotrichida.

Attention is drawn to the remarkable contrast between the homogeneous Opilioacarid habitus on the one hand, and the considerable variability of some characters on the other. For this reason Opilioacarida are regarded here as a still rather vigorous branch of an old, now isolated group.

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