Accidental and teratological changes in the family Neobisiidae (Pseudoscorpiones, Arachnida)

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Introduction

Accidental variation in animals is usually externally induced, although it may work internally through some developmental or hormonal system. Such variation is extremely diverse; it may readily be identified because the individuals involved either deviate so markedly from type as to be recognised as freaks, or because the damage or abnormalities involved are asymmetrical.

Pseudoscorpions have been found with segmental anomalies involving the tergites and sternites. For example, there may be partial or total fusion of two segments (symphysomery), the spiral alignment of segment halves (helicomery), the omission of a segment half (hemimery), or a reduction in part of the sclerites (hemiatrophy). Such abnormalities have been described in *Ellingsenius sculpturatus* (Lewis) and *Anatemnus javanus* (Thorell) (With, 1905), *Dactylochelifer latreillei* (Leach) (Hadži, 1930; Gilbert, 1952), *Synsphyronus mimetus* Chamberlin (Chamberlin, 1949), *Horus granulatus* Ellingsen (Beier, 1955) and *Allochernes wideri* (C. L. Koch) (Weygoldt, 1969). Pedder (1965) has described further abnormalities in *D. latreillei* and listed others for *Chthonius tenuis* (L. Koch), *Neobisium maritimum* (Leach), *N. muscorum* (Leach), *Lamprochernes nodosus* (Schrank) and *Allochernes dubius* (O. P.-Cambridge).

A striking anomaly other than aberration in tergal and sternal structure has been reported by Vachon (1947), who recorded a protonymph of *Chelifer cancroides* (Linnaeus) with the right foreleg fused basally with the pedipalp, suggesting the segmentation pattern of the pedipalp. In 1949, Chamberlin reported one of the most unusual anomalies yet observed in pseudoscorpions: in the holotype of *Xenochelifer davidi* Chamberlin, the movable finger of the left chela is greatly reduced, being only half the normal length. The fixed finger is apparently normal.

As far as the family Neobisiidae is concerned, anomalies have been recorded only from three species, *Neobisium erythrodactylum* (L. Koch) (Kästner, 1927), and *N. maritimum* and *N. muscorum* (Pedder, 1965).

The purpose of this paper is firstly, to express in qualitative and quantitative terms the phenomena of accidental and teratological variation in representatives of the Neobisiidae, and secondly, to extend this analysis to all postembryonic stages, as was done by Pedder (1965) in his work on *D. latreillei* and *L. nodosus*, in order to assess the frequency and origin of such aberrations.

Material and methods

All postembryonic stages, protonymphs, deutonymphs, tritonymphs and adults (males and females), of six species, *Neobisium carpaticum* Beier, *N. macrodactylum* (Daday), *N. fuscimanum* (C. L. Koch), *N. cephalonicum* (Daday), *N. sylvaticum* (C. L. Koch) and *Roncus lubricus* L. Koch have been examined.

The chelicerae, pedipalps and walking legs, as well as the cephalothorax and abdomen of twenty

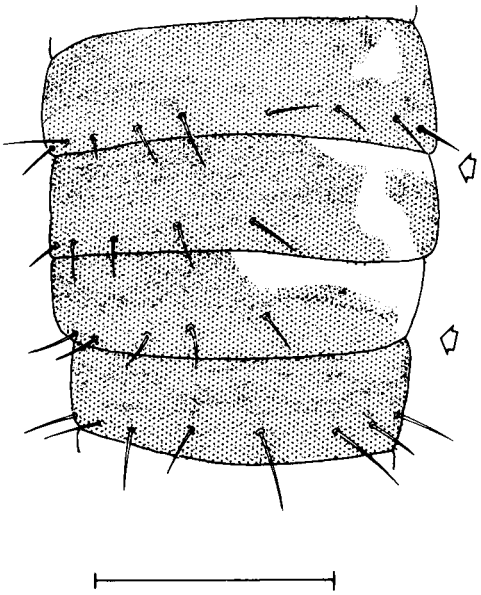

Fig. 1: *Neobisium carpaticum*. Tergites VI-IX, male. Scale line 0.5 mm.

specimens of all stages of these six species were dissected and mounted in Swan's fluid, with the exception of the deutonymphs of *N. macrodactylum* where no specimens were available, and of the protonymphs of *R. lubricus* where only one was available for study.

All specimens were collected during the period May 1975 to May 1977, from the same site, on the northern slopes of Mt Avala near Belgrade, Yugoslavia.

Results

Anomalies have been found in the abdomen, chelicerae, pedipalps and walking legs but not in the cephalothorax of the six species examined. All the eighteen abnormalities were confined to adults with two exceptions; single deutonymphs of each of *N. carpaticum* and *N. sylvaticum.*

Details of teratological specimens are as follows:

Neobisium carpaticum

(a) *Deutonymph.* The flagellum of the left chelicera carries, apart from a row of flagellar setae, a long and smooth accessory seta which is adjacent to the small proximal seta of the flagellar row. This anomaly is possibly correlated with the increased number of setae on the palm of this chelicera where 7 (number

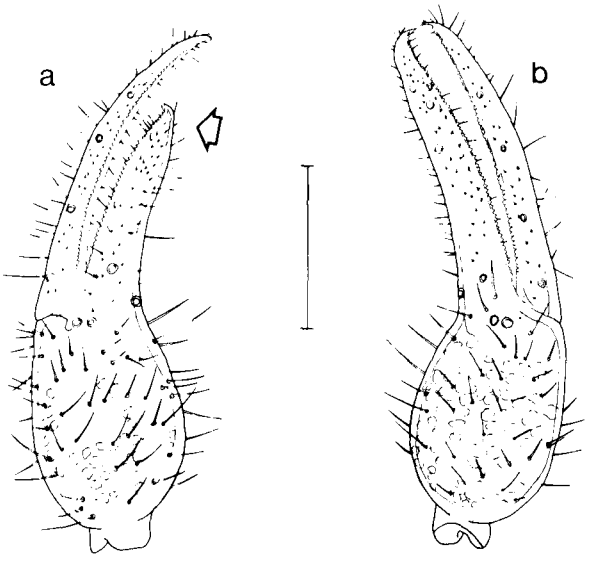

Fig. 2: *Neobisium carpaticum.* (a) Left and (b) right chela of the pedipalps, female. Scale line 0.5 mm.

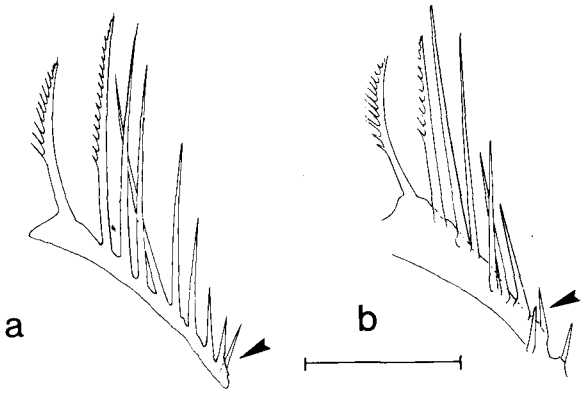

Fig. 3: *Neobisium fuscimanum.* (a, b) Flagella, different females. Scale line 0.1 mm.

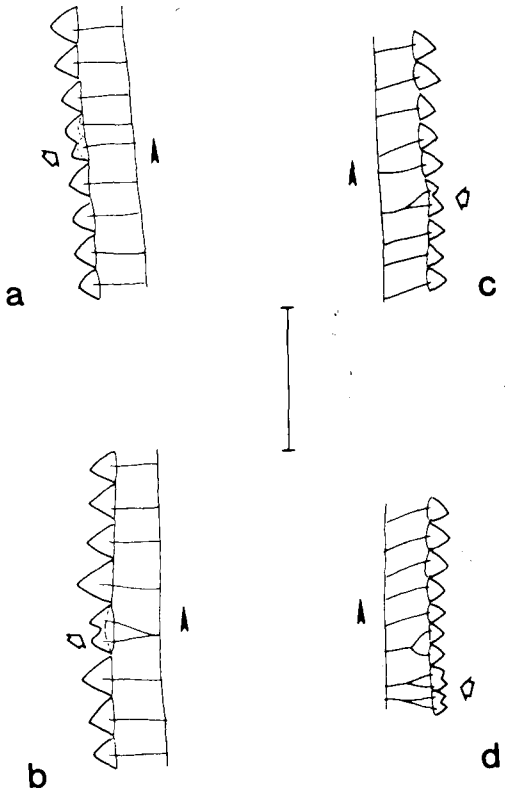

Fig. 4: *Neobisium fuscimanum.* Fixed finger of the chela of the pedipalps. (a) Distal and (b) proximal teeth of female, and (c) distal and (d) proximal teeth of male. Scale line 1 mm.

typical of the tritonymph) instead of 6 setae have been noted.

(b) *Male* (Fig. 1). Parts of the right side of tergites VI-VIII are missing; these regions are not sclerotized (pigmentation lacking) and carry no tergal setae. As a result of this anomaly, the number of setae on tergites VI-VIII is reduced.

(c) *Male.* The mid-region of sternite V is contracted, causing the appearance of a longitudinal sternal suture. The "demi-sternites" each carry 8 and 6 setae respectively.

(d) *Female* (Fig. 2). The fixed finger of the left chela of the pedipalp is greatly reduced (Fig. 2a), being only two-thirds the normal length. Consequently, four distal trichobothria (*ist, est, it* and *et*) are missing and there are also fewer teeth on this finger in comparison to that of the right chela which is normal (Fig. 2b). The movable finger is apparently completely normal (Fig. 2a).

The deformity of the left chela of the pedipalps seems to be correlated with changes in the tergal formula and in some morphometric ratios, which deviate from the values which have been quoted for *N. carpaticum* (Ćurčić, 1977).

Neobisium macrodactylum

(a) *Male.* The mid-region of sternite IV is contracted and with no pigmentation. The "demi-sternites" each carry 8 and 9 setae respectively.

(b) *Male.* On the fixed finger of the left chela of the pedipalps, one tooth is bidentate and has a single tooth canal.

(c) *Male.* On the fixed finger of the left chela of the pedipalps, two adjacent teeth are half the normal size.

(d) *Female.* On the movable finger of the right chela of the pedipalps, two teeth lie side by side, not in sequence.

Neobisium fuscimanum

(a) *Female.* Sternite III is contracted medially; the sternal suture shows no pigmentation. Sternite IV carries a pronounced longitudinal groove, dividing it

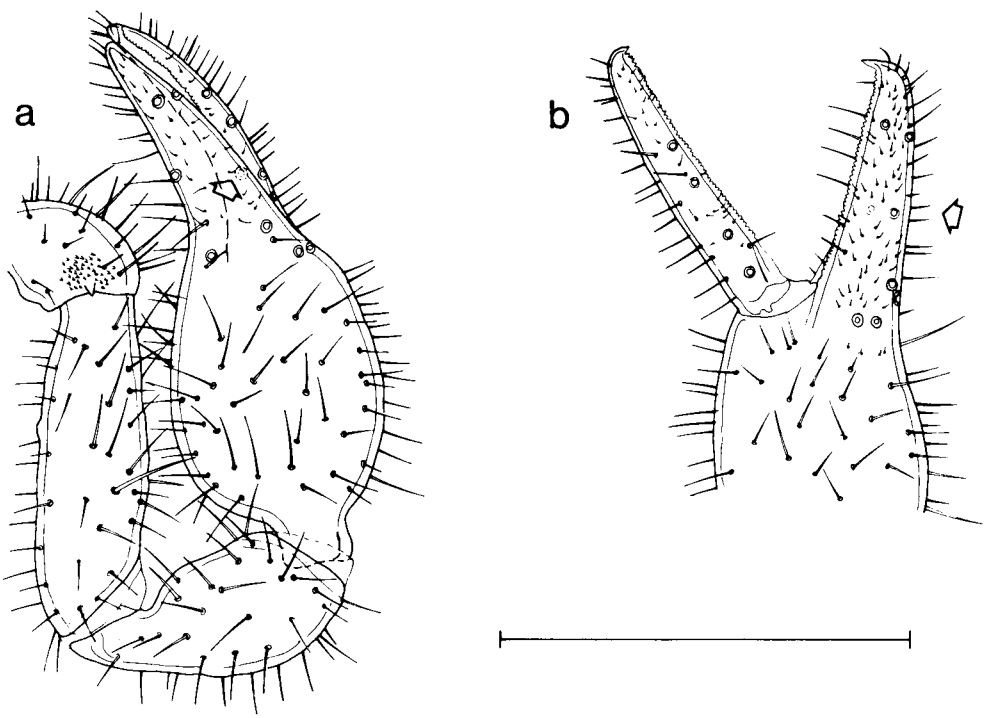

Fig. 5: *Neobisium cephalonicum.* (a) Right pedipalp and (b) left chela of the pedipalps, male. Scale line 1 mm.

into two "demi-sternites"; each of them carries 11 setae.

(b) *Female* (Fig. 3). The deformity of the left flagellum is manifested by the presence of an accessory seta which is adjacent to the row of flagellar setae (Fig. 3a). Such differences have been found in two more females (Fig. 3b). In all these instances, the anomalies have appeared on the left chelicerae, the right chelicerae being normal.

(c) *Female* (Fig. 4). The fixed finger of the left chela of the pedipalp carries a few distal (Fig. 4a) and proximal bidentate teeth (Fig. 4b) fused together, each of them being provided with its own dental canal.

(d) *Male* (Fig. 4c, d). As above.

Neobisium cephalonicum

(a) *Male* (Fig. 5). An interesting case of teratological variation is found in the trichobothrial pattern. In this case, the trichobothrium *isb* is situated in the mid-region of the fixed finger and not in the distal half of the finger (as is usual for *N. cephalonicum*; Fig. 6). Since this anomaly is present in both chelal fingers, the modification of the trichobothrial pattern is therefore symmetrical.

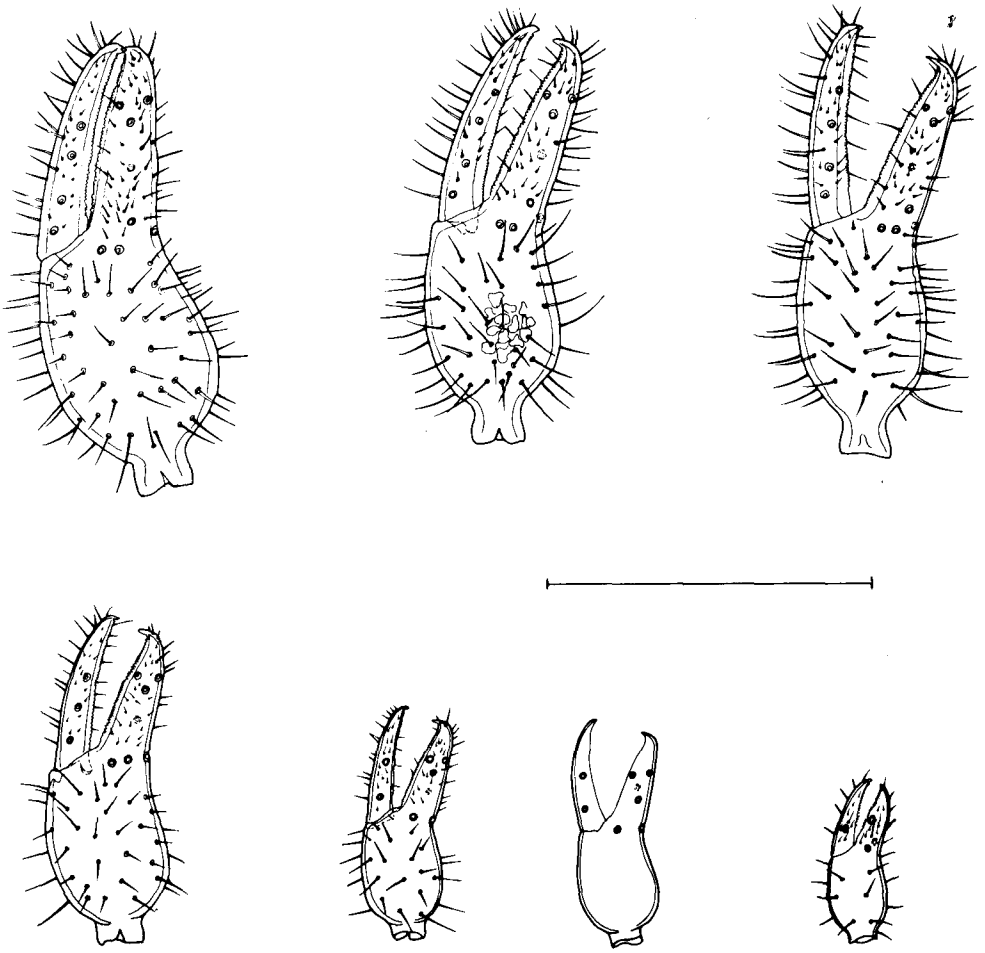

Fig. 6: *Neobisium cephalonicum.* Left chela in the protonymph to adult stages, normal variation. Scale line 1 mm.

Neobisium sylvaticum

(a) *Deutonymph.* On the fixed finger of the left chela of the pedipalps, between the close-set teeth, there is an empty space with no teeth. This empty space corresponds to the length of three teeth of the finger.

(b) *Female* (Fig. 7). One of the most unusual abnormalities yet found in pseudoscorpions has been noted in this specimen. On both third and fourth legs, the basitarsi are narrower and more elongate in relation to the normal condition of this character. On the other hand, telotarsi III and IV are thicker and relatively shorter than usual. This teratological phenomenon is more evident on the tarsi of legs IV (Fig. 7b).

Roncus lubricus

(a) *Male.* On both fingers of the chela of the pedipalps either in their distal or proximal parts, two or three teeth have grown together. This phenomenon has been recorded in three instances.

(b) *Female.* As above.

(c) *Female* (Fig. 8). Tergites III-VI are partially fused on each side (Fig. 8a). Sternites VIII and IX are fused mainly in the mid-region (Fig. 8b).

Discussion

The presence of abnormalities, in all regions except the cephalothorax, in nearly 10% of adults and their virtual absence from nymphs suggests that these aberrations arise at the last moult, as tritonymphs achieve maturity.

Following the classification of teratological variation in the Coleoptera which has been proposed by Balazuc (1948), the anomaly in tergal structure of *N. carpaticum* may be regarded as partial hemiatrophy (Fig. 1) since parts of tergites VI-VIII are clearly missing on the right side.

The example of *R. lubricus* (Fig. 8a) is more complex; it may be considered a combination of hemimery (segment halves omitted), symphysomery (segments partially fused together) and helicomery (spiral alignment of segment halves). The deficiency in the sternal structure of the same specimen may be regarded as combined symphysomery and helicomery (Fig. 8b).

One last remark is relevant in this context. If we assume that the rows of setae are indicative of segmentation, the simplest explanation might be that this is a case of partial polymery (an addition to the normal number of segments) since there are five rows and not the four rows one might expect to be present

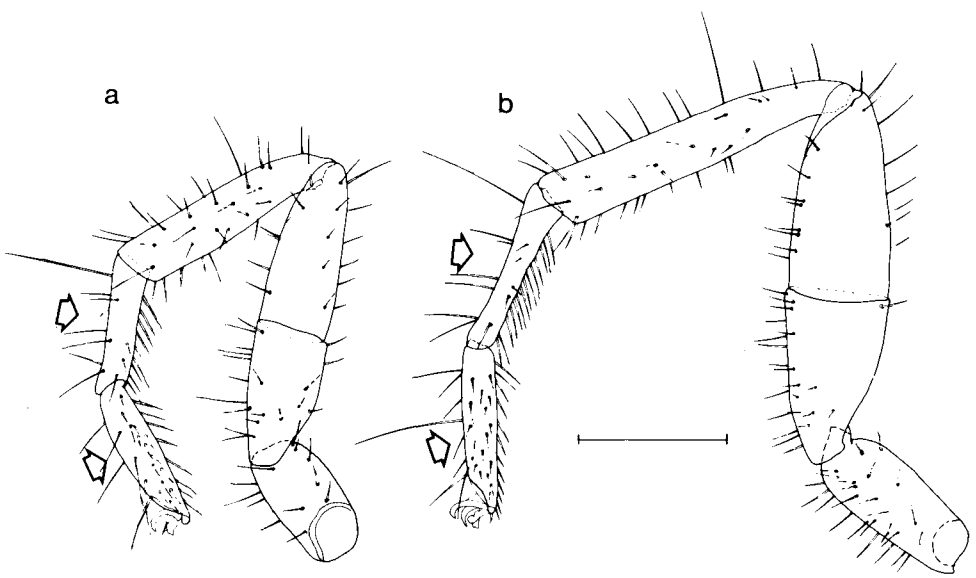

Fig. 7: *Neobisium sylvaticum.* Leg III (a) and IV (b), female. Scale line 0.5 mm.

between tergites III-VI (also three rows and not the two rows that might be expected to occur on sternites VIII-IX). However, the author is of opinion that the anterior complete row of transversely arranged setae on the deficient tergites may be assumed to represent a fusion of two halves of rows of the preceding (tergite III) and the following tergite (tergite IV). This also might be true of the setal pattern on sternites VIII and IX. While we cannot profitably carry the discussion very far until much deeper and more extensive investigations have been made, it may definitely be stated that the use of number of setal rows, although of considerable interest in pseudoscorpion ontogeny and phylogeny, must be carefully guarded in order to avoid fundamental errors.

The observation of Pedder (1965) that sclerites in the mid-region are more susceptible to aberrations than those towards the extremities may be correct as far as the tergites of both *N. carpaticum* and *R. lubricus* are concerned. However, it does not hold completely for sternal anomalies in *R. lubricus* since they are confined to the posterior sternites.

Although the anomalies of the chelicerae have been restricted to the flagellum only, Chamberlin (1962) has elsewhere found that the chaetotaxy of chelicerae also shows some deformities.

Teratological changes (accidental or otherwise) on the pedipalps are extremely diverse. These anomalies may affect the disposition and form of chelal teeth, the trichobothrial pattern as well as the structure of chelal fingers. Some abnormalities are not so easily recognised as such. This is especially true when anomalies involve characters which are normally of taxonomic value in pseudoscorpions – as is the case with the disposition of trichobothria. For instance, certain types of aberration may occur symmetrically, as in *N. cephalonicum* (Fig. 5). In this case, even with such a subtle difference, the abnormal nature of the variation can be detected without much difficulty.

The deformity as noticed in the structure of the hind legs (III and IV) in *N. sylvaticum* is quite striking. The abnormalities examined are symmetrical and comprise both tarsi III and IV. On the present evidence, it is a unique case of anomaly in pseudoscorpions. It is noteworthy that the relative position of tactile setae on these podomeres has not been affected by the anomaly examined.

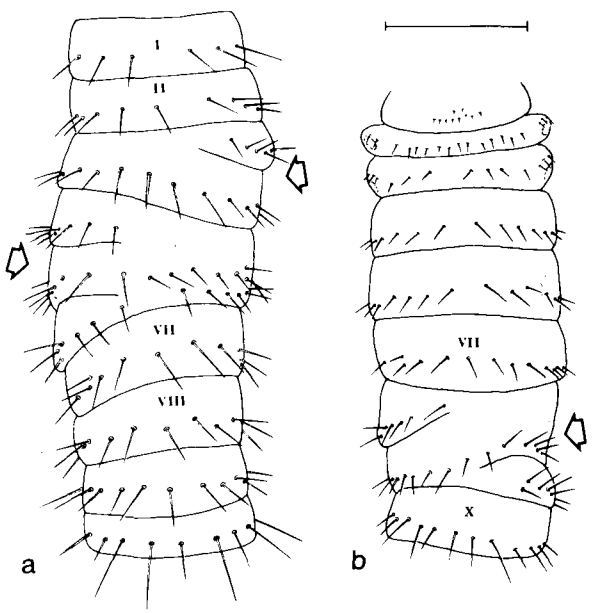

Fig. 8: *Roncus lubricus.* Tergites I-X (a), sternites II-X (b), female. Scale line 0.5 mm.

Acknowledgements

I am very grateful to Dr Peter N. Martinovitch of the Institute of Nuclear Sciences "Boris Kidrič" (Belgrade – Vinča), for his useful and stimulating discussion and for his criticism of the original manuscript.

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