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Further records of teratological changes in the Neobisiidae (Arachnida, Pseudoscorpiones)

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Introduction

Traumatic variation occurs with varying frequency in different groups of animals. The abnormal nature of this type of variation is usually obvious, but in some cases it is subtle and may be misleading.

Teratological variation has been elaborately studied and classified by Cappe de Baillon (1927) and Balazuc (1948). The student interested in pursuing this subject further is referred to these works for details and for further references.

Accidental variation may be produced internally through some developmental or hormonal system, although it is usually externally induced. The external stimuli may be mechanical, physical or chemical. In most animals, such variation may be readily identified because the individuals involved either deviate markedly from type, or because the abnormalities involved are asymmetrical. However, in those forms which undergo metamorphosis, injuries at an earlier stage may produce later abnormalities which are not so easily recognised as such (Ćurčić, 1980). For instance, certain types of nymphal injury in pseudoscorpions may produce abnormalities in surface sculpturing, trichobothrial pattern or segmentation of appendages. In most cases, however, the abnormal nature of the variation may be detected by the specialist without much difficulty.

Often pseudoscorpions are found with tergal or sternal abnormalities. For instance, half of a tergite can be missing or fused with an adjacent one of the same or the opposite side, or with the opposite half of the next tergite. Pedder (1965) has listed and classified a number of such abnormalities found in England. Ćurčić (1980) has given a survey of such abnormalities established to date in different species of pseudoscorpions and has described further anomalies in the species of *Neobisium* Chamberlin 1930 and *Roncus* L. Koch 1873.

As far as the representatives of the family Neobisiidae are concerned, tergal and sternal anomalies have been recorded from five species: *Neobisium erythrodactylum* (L. Koch), *N. maritimum* (Leach), *N. muscorum* (Leach), *N. carpaticum* Beier and *Roncus lubricus* L. Koch (Kästner, 1972; Pedder, 1965; Ćurčić, 1980).

The aim of this study is to express in qualitative and quantitative terms the phenomena of traumatic (accidental and teratological) variations of tergal structure in representatives of the Neobisiidae. The analysis, like that of Pedder (1965), has been extended to all postembryonic stages in order to assess the origin and frequency of such anomalies.

Material and Methods

Protonymphs, deutonymphs, tritonymphs and adults (males and females) of two species, *Neobisium carpaticum* Beier and *N. sylvaticum* (C. L. Koch), have been examined.

The abdominal tergites and sternites of fifty specimens of each stage of these two species were dissected and mounted in Swan's fluid (gum chloral medium), with the exception of the protonymphs of *N. sylvaticum* where only 38 were available for study.

Specimens of *N. sylvaticum* were collected during the period May 1973 to May 1980 from the same

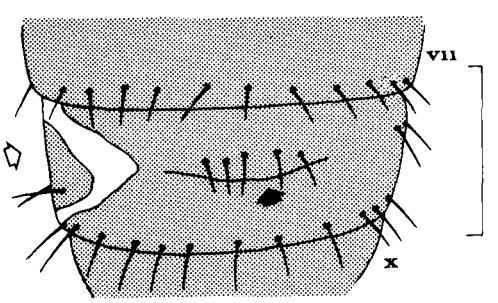

Fig. 1: *Neobisium sylvaticum*. Tergites VII-X, male. Scale line 0.5 mm.

site, on the eastern slopes of Mt Fruška Gora near Sremski Karlovci, Yugoslavia; specimens of *N. carpaticum* were collected during the period May 1973 to September 1980 on the northern slopes of Mt Avala near Belgrade, Yugoslavia.

Results

All the nine anomalies in tergal structure were confined to adults. Details of teratological specimens are as follows:

Neobisium sylvaticum

(a) Male (Fig. 1). Tergites VIII and IX have partially grown together; in the mid-region the division between them is clearly discernible. Apart from this, parts of the left side of both tergites are missing. As a result of this anomaly, the chaetotaxy of tergite VIII is disturbed and the number of chaetae is reduced in relation to the normal values for *N. sylvaticum* (Ćurčić, 1977).

Neobisium carpaticum

(a) Male (Fig. 2A). Part of tergite I on the left side is missing; this area lacks pigmentation.

(b) Male (Fig. 2B). The mid-region of tergite I is missing; this part is without pigmentation.

(c) Male (Fig. 2C). As above.

(d) Male (Fig. 3A). Tergites VII and VIII are partially fused on the right side of the body. In addition, part of each of these tergites on the same side is missing. Despite the presence of this anomaly, the chaetotaxy of both tergites is normal, i.e. it corresponds to that of *N. carpaticum* (Ćurčić, 1977).

(e) Female (Fig. 3B). The mid-region of tergite II, corresponding in size to one-third of the tergite, is missing. This area lacks pigmentation. The number of chaetae on tergite II, however, corresponds to that of normal specimens of *N. carpaticum*; it is only the distribution of these chaetae which is disturbed, since they are concentrated on the lateral sides of the tergite. This deformity has also resulted in an enlargement of the mid-region of tergite III.

(f) Female (Fig. 4A). In this specimen, abnormalities have been established in as many as four successive tergites of the abdomen (V-VIII). Firstly, parts of the left side of tergites V and VI are missing. The deformity of tergite VI is correlated with changes in the chaetal formula, which deviates from the normal values for *N. carpaticum*; the chaetotaxy of tergite V is normal.

An interesting example of teratological variation in the same specimen is found in tergites VII and VIII; these two tergites are partially fused in the mid-region and on the left side. This anomaly results in the disturbance of the chaetotaxy of both tergites. It is of interest to point out that tergite VII is considerably enlarged in its mid-region and narrowed towards the lateral sides, whereas in tergite VIII the situation is reversed.

(g) Female (Fig. 4B). The deformity of tergites VIII-X is manifested by the partial fusion of tergites VIII and IX; this is probably correlated with the increase (duplication) of the number of lateral chaetae on tergite X. Tergites VIII and IX are fused in the mid-region as well as on the right side. The chaetotaxy of these two tergites shows considerable changes, namely, the number of chaetae on tergite

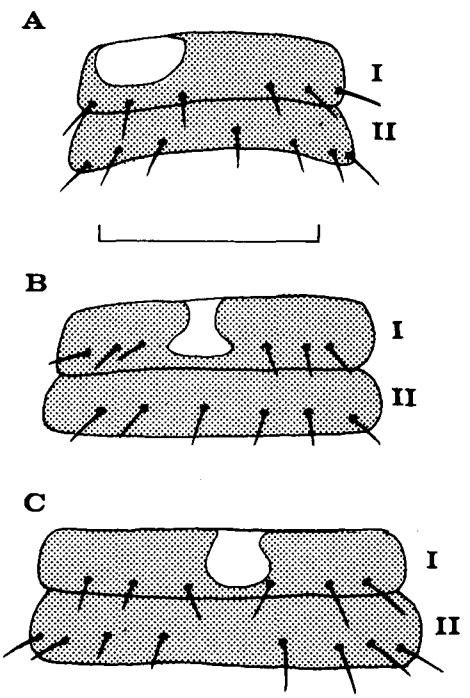

Fig. 2: *Neobisium carpaticum*. **A** – tergites I and II, male; **B** – tergites I and II, male; **C** – tergites I and II, male. Scale line 0.5 mm.

VIII is reduced and their distribition is irregular in relation to normal values for *N. carpaticum* (Ćurčić 1977).

Tergites IX and X of this specimen are partially fused in the mid-region.

(h) Female (Fig. 4C). Tergites IX and X of this specimen are partially fused in the mid-region; this anomaly is correlated with the disturbed distribution of chaetae on tergite IX which are concentrated towards the lateral sides of the tergite; the number of chaetae on this tergite is the same as on the previous tergite.

Discussion

The presence of tergal abnormalities in nearly 2% (i.e. 1.84%) of adults and their virtual absence from nymphal stages suggests that these abnormalities arise as tritonymphs achieve maturity, i.e. at the last moult, as was suggested by Pedder (1965) and Ćurčić (1980).

In *N. sylvaticum* (Fig. 1), partial fusion of two tergites (VIII and IX) has been established, as well as the absence of the left side of both these tergites. If we follow the classification of segmentation anomalies in the Coleoptera (Balazuc, 1948) the deformities in tergal structures may be regarded as symphysomery (segments partially fused together) and partial hemiatrophy, since parts of tergites VIII and IX are clearly missing on the left side.

Judging by the presence and distribution of the two existing chaetae, the separated tergal section on the left side of the same specimen belongs mostly to tergite VIII. The two isolated chaetae on the right side also belong, according to their relative position, to the set of chaetae of tergite VIII.

The examples of *N. carpaticum* (Fig. 2) are less complex: they can be considered partial hemiatrophy which affects the central or left part of tergite I. The number of chaetae is not disturbed by these anomalies, but their distribution is altered in one case (Fig. 2B) in that the chaetae are more concentrated towards the lateral parts of the tergite, which results in the existence of a central region without chaetae.

Accidental variation in another specimen of *N. carpaticum* (Fig. 3A) affects tergites VII and VIII. In this case, we have a combination of partial fusion of the segments on the right side and partial atrophy of both these tergites. Judging by the form of the injury and the configuration of its edge, it seems probable that this anomaly was caused by the effect of some mechanical stimulus (a sting or a bite?) at a subadult stage. This opinion is supported by the fact that, despite significant damage to both tergites, the number and relative position of tergal chaetae are not changed from the normal values in *N. carpaticum* (Ćurčić, 1977).

The following deformity in a female of the same species is found in tergites II and III (Fig. 3B). The mid-region of tergite II is missing, which may be characterised as partial atrophy of the segment; at the same time, the anterior median part of tergite III

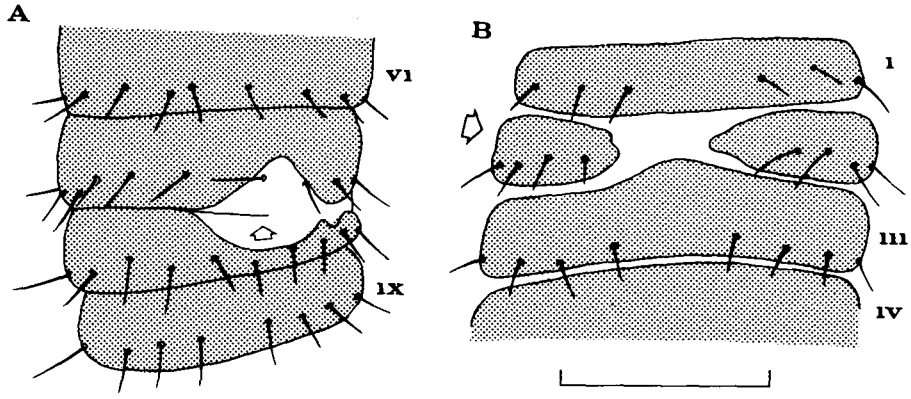

Fig. 3: *Neobisium carpaticum*. **A** – tergites VI-IX, male; **B** – tergites I-IV, female. Scale line 0.5 mm.

is enlarged and thus partially fills the place where the missing part of tergite II would otherwise be. It is noteworthy that the relative position of chaetae on tergite II has been affected by the anomaly, so that the chaetae are concentrated more on the lateral sides of the tergite; on the other hand, the number of these chaetae is normal.

The anomaly in the structure of tergites V-VIII in *N. carpaticum* (Fig. 4A) is more complex: it may be considered a combination of reduction in part of the tergites V and VI (hemimery) and the partial fusion of two segments (symphysomery). As a result of hemimery, the number of chaetae on tergite VI is reduced. Apart from that, the symphysomery of tergites VII and VIII has caused considerable modification in the chaetotaxy: the reduction, the different relative distribution and uneven position of individual chaetae. These phenomena are particularly marked in the mid-region and on the left side, i.e. in the regions of partial fusion of the tergites.

In the female of *N. carpaticum* (Fig. 4B), partial fusion of three tergites (VIII-X) has been established, with tergites VIII and IX fused in two places and tergites IX and X only in one place (in the mid-region). This anomaly seems to be correlated with sweeping changes in the chaetal formula of tergites VIII-X. In addition, it seems that this is a case of partially expressed hemimery (the omission of a segment half), or at least of the reduction of part of sclerite IX on the right side.

In the last example, the female of *N. carpaticum* (Fig. 4C), symphysomery has been established, i.e. partial fusion of tergites IX and X in the mid-region; this phenomenon is correlated with changes in the relative position of chaetae on tergite IX.

One last remark is relevant in this context. Namely, Pedder (1965) has observed that sclerites in the mid-region are more susceptible to aberrations than those towards the extremities. However, the present study has clearly demonstrated that, apart from minor deformities, all more serious tergal anomalies are registered from tergite VII onwards, which means that they are mainly confined to posterior tergites.

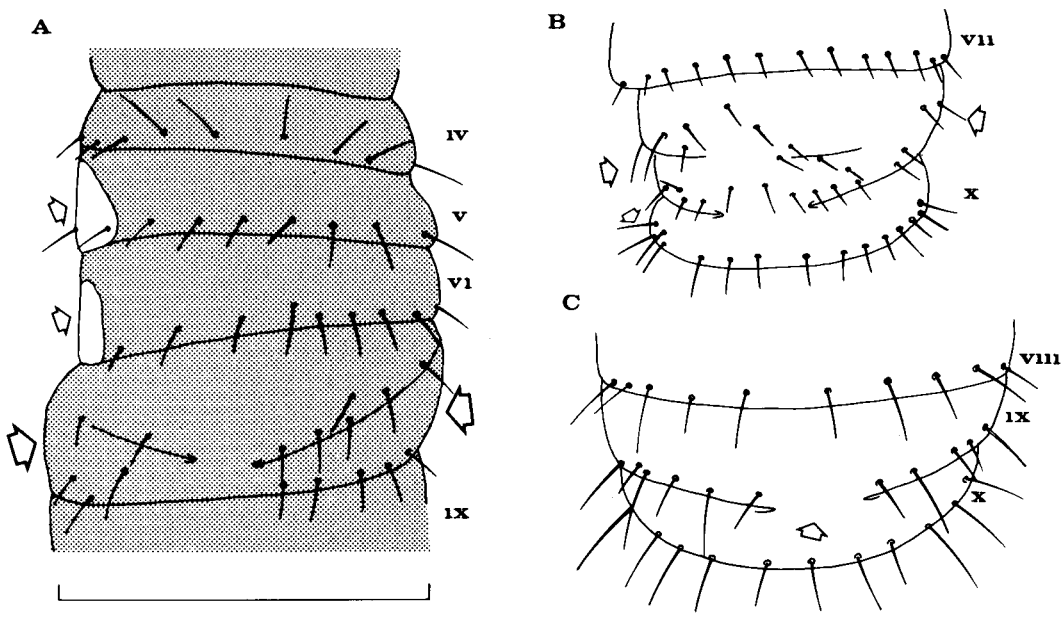

Fig. 4: *Neobisium carpaticum*. **A** – tergites IV-IX, female; **B** – tergites VII-X, female; **C** – tergites VIII-X, female. Scale line 1 mm.

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