

Polymely of feeding appendages in *Tegenaria atrica* (Araneae: Agelenidae)

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Summary

Two interesting cases of polymely of the chelicerae were obtained after using thermal shocks in the form of temperatures of 14 and 32°C acting alternately on spider embryos in the first 10 days of development. An analysis of histological sections made by the paraffin method and stained with haematoxylin and eosin demonstrated changes in the neuromerism of the central nervous system.

Introduction

The chelicerae are the first, comparatively short, pair of cephalic appendages in spiders. They consist of only two joints: the large cylindrical basal joint and the terminal one developed in the form of a claw with the opening of the poison gland. This pair of appendages is innervated by the syncerebrum, which is believed by some arachnologists to have formed as a result of fusion of the protocerebrum and deutocerebrum (Babu & Barth, 1984; Legendre, 1959). As demonstrated by many years' teratological studies of *Tegenaria atrica* C. L. Koch embryos, the chelicerae, like other prosomal appendages, are subject to various developmental anomalies (Jacuński, 1984; Jacuński *et al.*, 2002, 2004). Most frequently these anomalies occur in the structure of the basal joint. However, the shape and size of the claw may also change relatively rarely. These deformities impede food ingestion but are of no major significance for the overall structure of the fore part of the spider's body. Serious complications in the body morphology occur only in the case of absence of the chelicerae or of the presence of an accessory one, which can be caused by disturbances in the metamerism of the germ band. The effects of these anomalies are perceivable in the anatomical structure and architectonics of internal organs, particularly in the structure of the nervous system.

Deformities of this type, in particular polymely, occur very rarely, but two interesting cases of this anomaly were obtained by using thermal shocks.

Material and methods

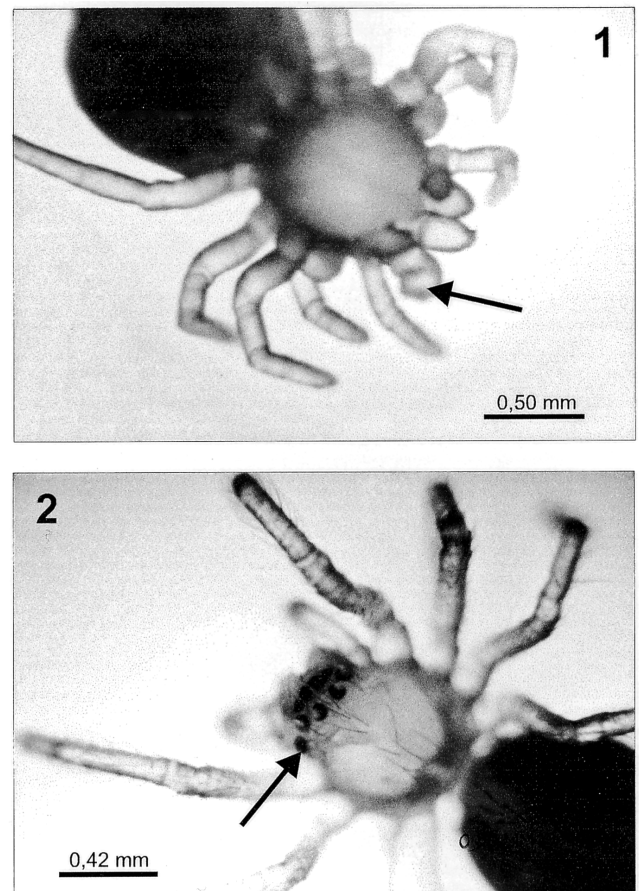
The experimental material were *Tegenaria atrica* individuals. The particular developmental stages of this spider species have been defined according to the nomenclature adopted by Vachon (1957). Larvae with polymely of the feeding appendages were obtained by exposing the embryos to temperatures above and below the optimum for development of that spider species, namely 32 and 14°C. The temperature was changed every 12 h. From the moment of appearance of the first

metameres of the prosoma the embryos were incubated at a temperature of 23°C. After the emergence of larvae the teratological material was inspected, individuals with anomaly of the cheliceral joint were selected, and the structure of their nervous system was studied. Histological sections were made by the paraffin method (Zawistowski, 1984) and stained with haematoxylin and eosin.

Results

In the first individual there were three chelicerae side by side on the front edge of the prosoma. The appendage on the left of the mouth opening was recognised as accessory on account of its size and shape (Fig. 1, arrow). It was slightly longer and the distal part of its basal joint distinctly differed in shape from the basal joints of the two remaining chelicerae. The basal joint was dilated in its distal part and had two small claws. In the nymph I stage the claws adopted the shape and size appropriate for that spider species. On the dorsal side of the prosoma there was, besides the normal set of eyes, one accessory eye (Fig. 2, arrow).

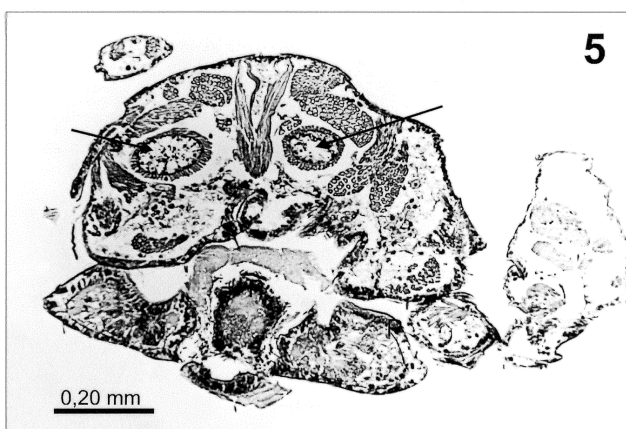
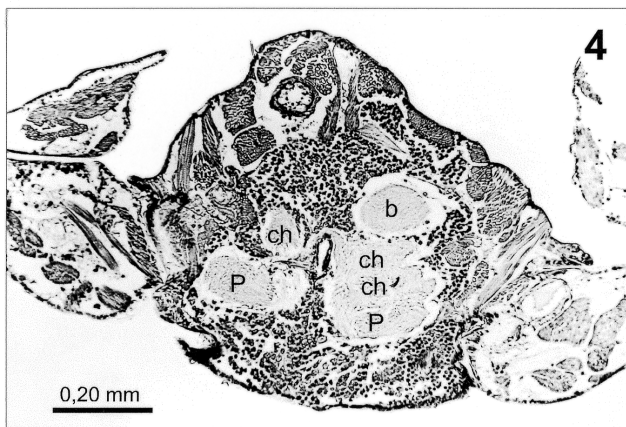
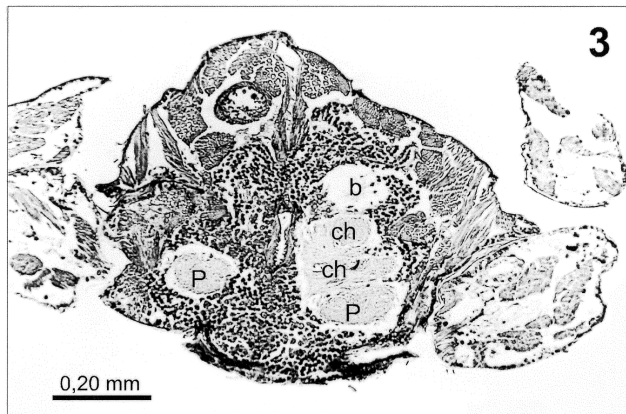
An analysis of a series of histological sections of the fore part of the prosoma showed changes in the metameric structure of the nervous mass. It was clearly asymmetrical, with its left part (right side in the figures) shifted towards the fore part of the body (Fig. 3). On the



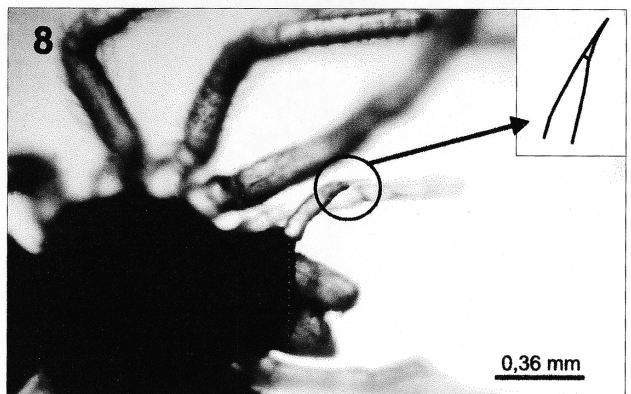
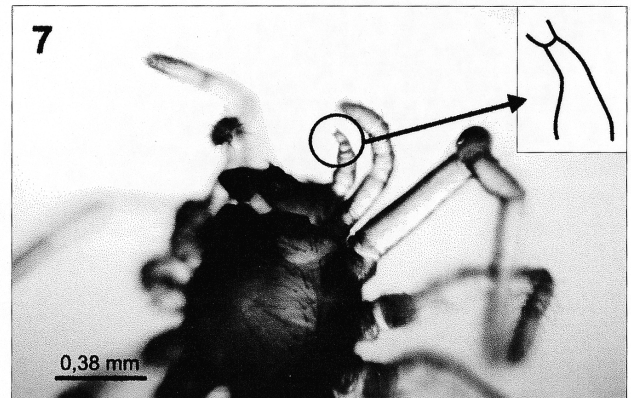
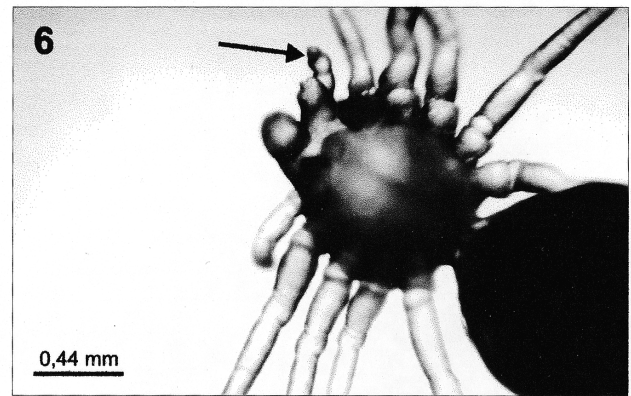
Figs. 1–2: *Tegenaria atrica* individual with supernumerary chelicera. **1** Larva (ventral view); **2** Nymph I with accessory eye (dorsal view).

right side of the oesophagus (on the figure), besides the ganglion innervating the pedipalpus (p) and the developing upper part of the brain (b), there were two large cheliceral ganglia (ch, ch'). As demonstrated by the analysis of histological sections, from one of them ran two nerves towards the accessory chelicera (Fig. 4). In none of the sections, however, was a third, accessory poison gland found (Fig. 5).

The other case was an extremely rare case of polymely of the feeding appendages. The spider had an accessory appendage on the dorsal side above the left chelicera. It



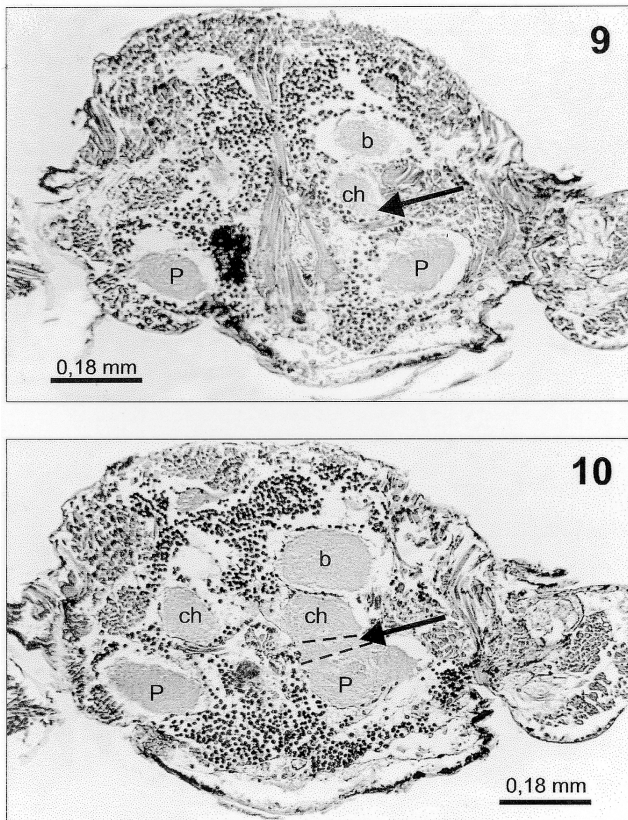
Figs. 3–5: Cross-sections (anterior views) through fore part of prosoma of *Tegenaria atrica* (same animal as shown in Figs. 1–2). **3, 4** Fore part of nervous mass: b=brain, ch=cheliceral ganglion, ch'=supernumerary cheliceral ganglion, p=pedipalpal ganglion; **5** Front of prosoma with two poison glands (arrowed).



Figs. 6–8: *Tegenaria atrica* with supernumerary appendage. **6** Larva (ventral view); **7** Nymph I (ventral view); **8** Nymph II (dorsal view). Claws at end of appendage shown in inset in Figs. 7 & 8.

was slender, comparatively long and was devoid of joints but was constricted in some places, which resulted in the formation of several minor rings on its surface (Fig. 6, arrow). In the nymph I stage two small structures resembling spines developed at the tip of this appendage (Fig. 7). In the following nymphal stage only a large arched claw was observed on the unjointed basal part of the appendage (Fig. 8). This appendage lying on the edge of the prosoma curved leftwards and eventually resembled a two-jointed chelicera in structure.

The structure of the central nervous system was also investigated in this case, particularly the part of the brain innervating the feeding appendages situated on the left of the oesophagus. It was found that under the cheliceral ganglion (ch) there was an accessory nervous mass (Fig. 9, arrow). An analysis of further histological



Figs. 9–10: Cross-sections (anterior views) through fore part of nervous mass of *Tegenaria atrica* (same animal as shown in Figs. 6–8): b=brain, ch=cheliceral ganglion, p=pedipalpal ganglion; arrows indicate accessory nervous mass.

sections showed a pronounced enlargement of that ganglion, so that it touched the pedipalpal ganglion (p) (Fig. 10). Except for these changes the remaining part of the nervous system was undisturbed.

Discussion

Anatomical studies of monsters with polymely of feeding appendages have confirmed earlier reports of disturbances in the morphology and architectonics of the supraoesophageal part of their nervous system (brain). The direct causes of those changes are to be sought in morphogenetic disturbances occurring in embryogeny in the course of the development of metameres on the germ band. The formation of a larger number of complete metameres or their halves (right or left) induced by the incubation of embryos at temperatures differing from the optimum for the given spider species results in an increase in the number of appendages and of the corresponding ganglia in the central nervous system. That, however, does not always result in the development of other accessory structures, such as poison glands, which were absent in both cases of polymely described.

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