

POSSIBLE SPECIES ISOLATION MECHANISMS IN SOME SCOLOPENDRID CENTIPEDES (CHILOPODA; SCOLOPENDRIDAE)

by

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ABSTRACT

Secondary sexual characters in centipedes are briefly discussed and it is suggested that the spines on the prefemora of the last pair of legs in some scolopendrids are used in specific discrimination prior to mating. The hypothesis is discussed with reference to *Scolopendra* spp. of the eastern Mediterranean, north-east Africa and Arabia.

Where species of *Scolopendra* with virtually identical spinulation on the last legs are sympatric, a large size difference exists between them.

It is suggested that in some genera where the prefemoral spines are absent, speciation may have been inhibited. In the genus *Otostigmus* where spines may be absent or spine patterns are very similar in a number of species other secondary sexual characters have developed.

INTRODUCTION

Centipedes not infrequently exhibit secondary sexual characters. In a number of geophilomorphs the last pair of legs of males are tumescent and more densely setose than they are in females. In male *Pectiniunguis pampeanus* Pereira & Coscaron males have dense fine setae from antennal segment two, females from antennal segment three. In *Pectiniunguis argentinensis* Pereira & Coscaron the antennal setae are shorter in males and there is a dense field of setae on the second antennal segment (Pereira & Coscaron, 1976). In the mecistocephalid genus *Tygarrup* from the Himalayas females lack sternal pore fields.

In a number of *Lithobius* species the tibiae of the 14th and 15th pairs of legs are swollen and may bear a groove posterodorsally which sometimes contains a wart-like outgrowth or ridge. Such modifications have been well described by Eason (1973). Similar structures

are seen on the femur of *Eupolybothrus* spp. Various other lithobiid secondary sexual characters have been reviewed by Lewis (1981).

Differences of the type described above are presumably associated with mating behaviour in which male and female come together head to tail, and the antennae and the last pair of legs are tapped. The morphological adaptations in the males would serve for the females to identify different species and sex.

DIMORPHISM IN SCOLOPENDRIDAE

Sexual dimorphism is also seen in the scolopendromorph family Scolopendridae. In *Scolopendra morsitans* Linnaeus the dorsal side of the prefemur, femur and sometimes the tibia of the last pair of legs is flattened and there is a prominent ridge along each lateral border. In *Otostigmus spinosus* Porat the posterior tergites bear small spines in the female (Lewis, 1982).

In *Otostigmus* (subgenus *Parotostigmus*) from South America and Africa, there is frequently a cylindrical process on the inner side of the prefemur of the last pair of legs in males and in *O. (P.) insignis* Kraepelin males have in addition a large coxopleural process on the 20th pair of legs (figs. 1, 2). Male *O. (P.) caudatus* Brölemann have an almost cylindrical posterior median process on the last tergite (fig. 3).

Some leaf-footed centipedes (*Alipes* spp.) also show a peg-like or cylindrical process on the inner side of the prefemur of the last pair of legs in males.

Neither *Alipes* nor *Parotostigmus* show the usual spined prefemur of the last pair of legs

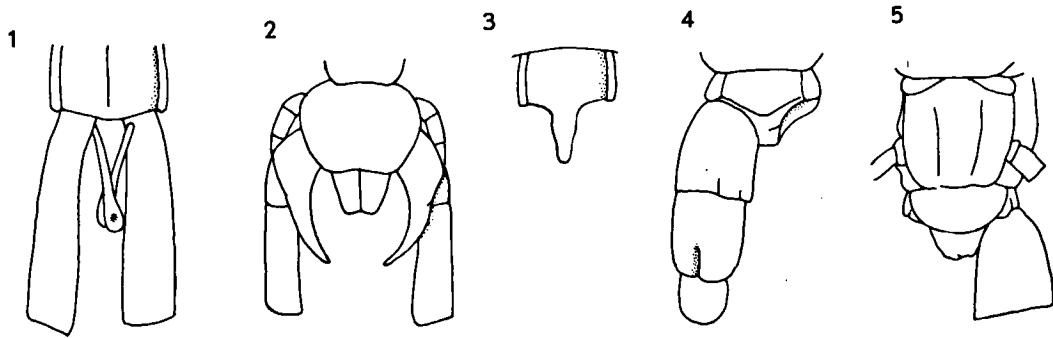


Fig. 1. Dorsal view of tergite 21 and the prefemora of the last pair of legs of *Olostigmus (Parotostigmus) insignis* (after Attems, 1930).

Fig. 2. Ventral view of the terminal segments of the same (after Attems, 1930).

Fig. 3. Tergite 21 of *O. (P.) caudatus* (after Attems, 1930).

Fig. 4. Dorsal view of tergite 21 and left last leg of *Asanada sokotrana* Pocock from Tiptur, India.

Fig. 5. Ventral view of segments 20 and 21 of the same, showing the femur of the left last leg.

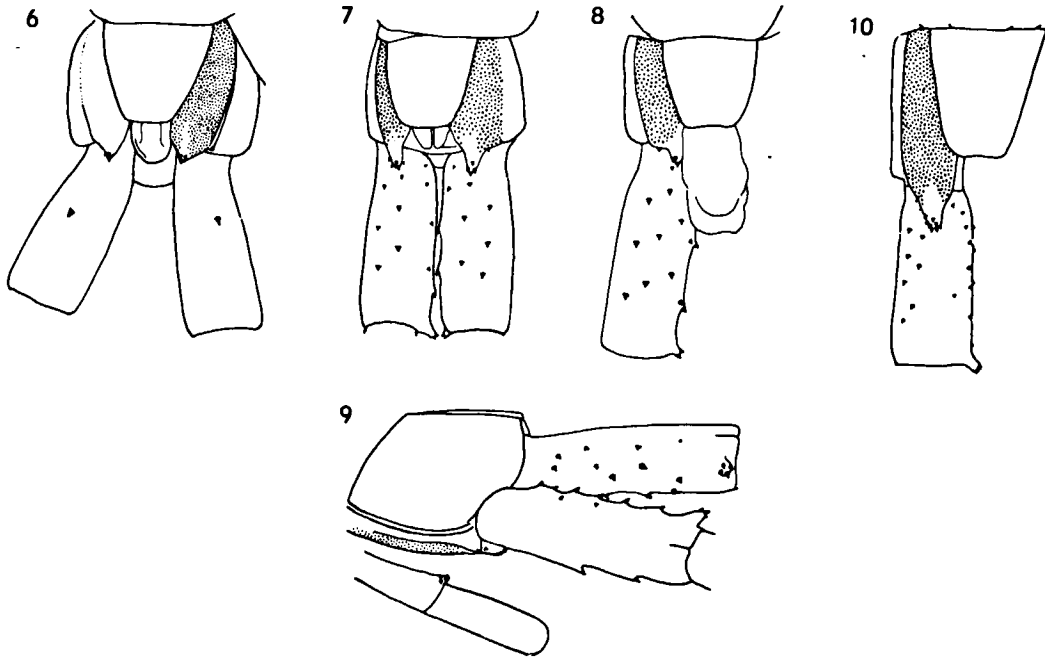


Fig. 6. Ventral view of the terminal segments and prefemora of the last pair of legs of *Scolopendra cingulata*.

Fig. 7. Ventral view of the terminal segments and prefemora of the last pair of legs of *Scolopendra morsitans*.

Fig. 8. Ventral view of the terminal segments and the prefemur of the right last leg of *Scolopendra valida*.

Fig. 9. Dorsolateral view of tergite 21 and the prefemora of the last pair of legs and prefemur and femur of the 20th leg of the same specimen.

Fig. 10. Ventral view of the 21st segment and the prefemur of the left last leg of *Scolopendra dalmatica*.

and the coxopleural process of the last pair of legs tends to be reduced and also lacks spines. The last pair of legs also lacks spines in *Asanada* (figs. 4, 5) and *Arrhabdotus*. Some species of *Cormocephalus* (subgenus *Colobopleurus*) also lack

spines on the prefemur and coxopleural process of the last pair of legs.

Where the prefemur of the last pair of legs bears spines considerable variation is seen within a genus from one species to another.

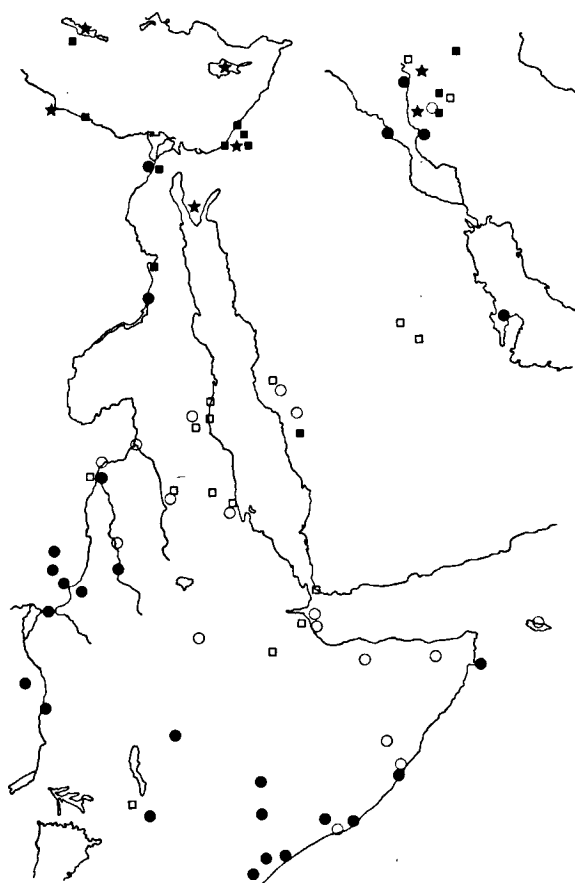
Thus *Scolopendra cingulata* Latreille usually has two ventral spines and four dorsolateral spines (fig. 6 shows a specimen with only one ventral spine on each prefemur). *Scolopendra morsitans* usually has three rows of three spines ventrally and five dorsolateral spines (fig. 7). *Scolopendra valida* Lucas similarly has three rows of three spines ventrally (fig. 8) but there are about ten dorsolateral spines (fig. 9). There are, moreover, spines at the end of the dorsal surface of the prefemora of legs 20, 19 and sometimes 18. In *Scolopendra dalmatica* C. L. Koch there are two rows of 3-5 spines ventrolaterally and 10-18 spines ventromedially and dorsomedially (fig. 10), that is between 30 and 40 spines in all.

The function of these spines has not been explained although a number of observations have been made on the uses of the last pair of legs. Jangi (1961) suggested that the last pair of legs of *Scolopendra* served as posterior antennae. In *Alipes* spp. they act as stridulatory organs and in *Asanada* spp. they are readily autotomised and perform distracting wriggling movements when detached. The autotomised last legs of *Rhysida nuda togoensis* Kraepelin make a squeaking noise (see Lewis, 1981, for details).

The last pair of legs are used in the ritualised meeting reactions of scolopendrids. When two *Scolopendra cingulata* meet, each attempts to grasp the posterior region of the trunk of the other with its last pair of legs (Klingel, 1960); only very occasionally do the animals bite each other. Similar behaviour has been observed in *Cormocephalus anceps anceps* Porat by Brunhuber (1969).

The spines on the prefemur of the last legs are directed backwards and it is therefore unlikely that they are used to facilitate gripping for which they should be directed forward. The most likely explanation of their function is that they are used in specific discrimination prior to mating. If this is the case then one would not expect sympatric species to have the same spine arrangement.

Map 1 shows the distribution of five species of *Scolopendra* in the eastern Mediterranean, north-east Africa and Arabia, namely *S. morsitans*, *S. valida*, *S. cingulata*, *S. canidens*



Map. 1. The distribution of five scolopendrids in north-east Africa, the eastern Mediterranean and Arabia. ● *Scolopendra morsitans*, ○ *S. valida*, ★ *S. cingulata*, ■ *S. canidens*, □ *Trachycormocephalus mirabilis*.

Newport and *Trachycormocephalus mirabilis* Porat which is a species of *Scolopendra* related to the *canidens* group (Lewis, unpublished). In most areas only two or three species occur: *cingulata*, *morsitans* and *canidens* in Egypt, *cingulata* and *canidens* only in Israel, *morsitans*, *valida* and *T. mirabilis* in the central Sudan but only *valida* and *mirabilis* in the eastern Sudan and Ethiopia. Four species occur in the mountainous region of north-east Iraq, namely, *cingulata*, *valida*, *canidens* and *T. mirabilis*. *S. morsitans* occurs in the Euphrates valley and apart from an imprecise locality in southern Ethiopia, it is limited to land below 1000 m throughout the entire area.

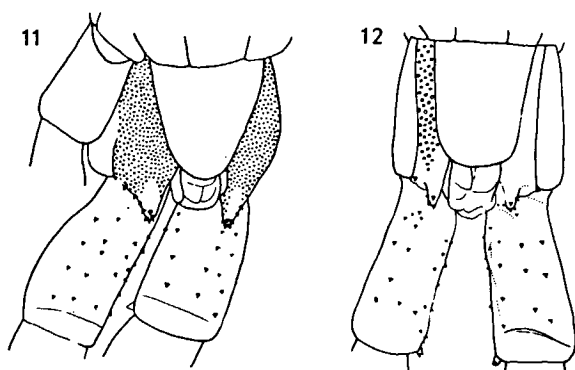
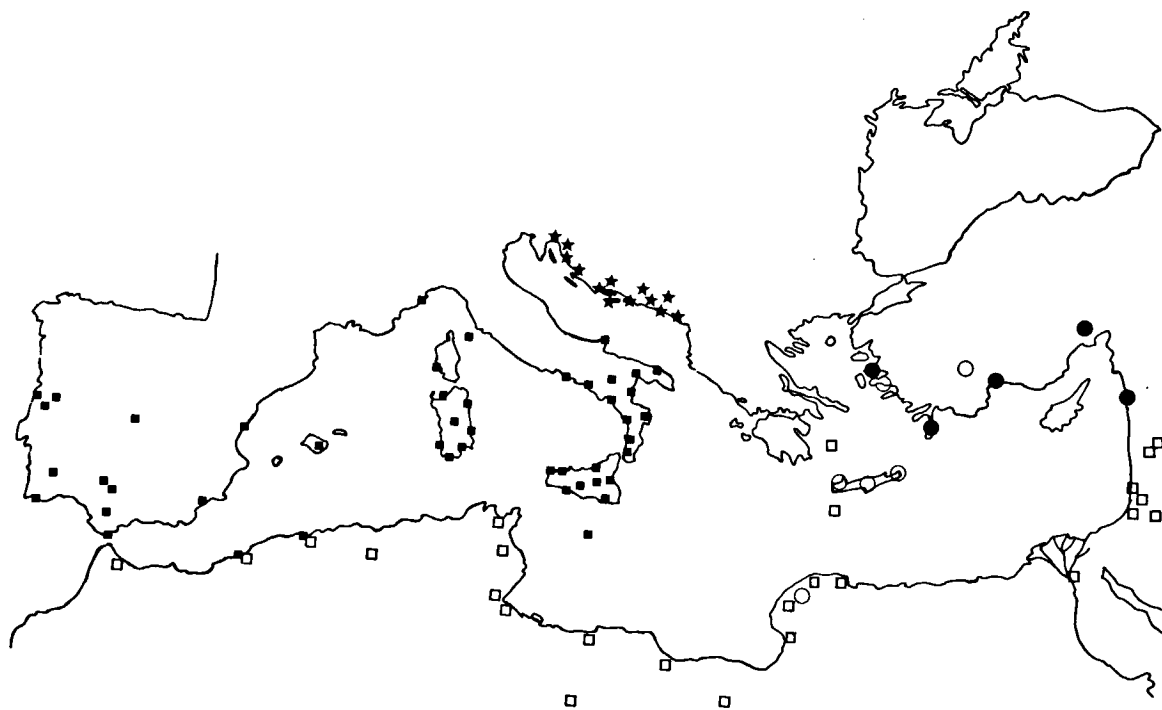


Fig. 11. Ventral view of the terminal segments and the prefemora of the last pair of legs of *Scolopendra canidens*.
Fig. 12. The same for *Trachycormocephalus mirabilis*.

S. canidens and *T. mirabilis* have similar spine patterns on the prefemora of the last pair of legs (figs. 11, 12), but whereas *canidens* has 8-13 (normally 11 or 12) spines on the coxopleural process, *T. mirabilis* normally has 5. These two species are largely allopatric. The other species have spine patterns very distinct from *canidens* and *mirabilis* and from each other.

Map 2 shows Würmli's (1980) data for the distribution of species of the *canidens* group: *Scolopendra clavipes* C. L. Koch, *S. dalmatica*, *S. canidens*, *S. oraniensis* (Lucas) and *S. cretica* Attems. In these species the number and arrangement of the spines on the coxopleural process and prefemur of the last pair of legs is extremely similar. *S. clavipes* is distinguished by the clavate shape of the last leg pair; it is the most distinct of these species. Of the other species the last pair of legs is glabrous in both sexes in *dalmatica* and *canidens* but have long brush-like hairs on tarsus I and II of the last pair of legs in males in *cretica* and *oraniensis*. Neither *dalmatica* or *canidens*, nor *cretica* or *oraniensis* occur together.

I am only aware of two cases in which species with virtually identical last legs are sympatric. These are *Scolopendra morsitans* and what Jangi (1959) came to regard as *Scolopendra amazonica* (Bücherl) and *S. morsitans* and *S. laeta* Haase in Australia. In both cases one of the species pair is much larger than the other: in India the maximum size of *amazonica* is 65 mm and that of *S. morsitans* 113 mm (Jangi, 1955); and in



Map. 2. The distribution of species of the *Scolopendra canidens* group in the Mediterranean region. ■ *S. oraniensis*, □ *S. canidens*, ★ *S. dalmatica*, ○ *S. cretica*, ● *S. clavipes* (based on Würmli, 1980).

Australia adult *S. laeta* measure 31-65 mm, *S. morsitans* 85-127 mm (Koch, 1982). Presumably the considerable difference in size prevents successful pairing.

The genera *Asanada* and *Arrhabdotus* which lack coxopleural spines, prefemoral spines and any form of secondary sexual character on the last pair of legs are of interest. *Asanada* is widely distributed through Africa, India and the Far East but always seems to be represented by one species only in a particular area. *Arrhabdotus* from Borneo is a monospecific genus. It is possible that the absence of spines or other characteristics on the last pair of legs has inhibited speciation, allopatric populations interbreeding when they meet. Where, as in species of the subgenus *Parotostigmus* of the genus *Otostigmus* which also lack spines on the last prefemora, secondary sexual characters have developed in males, more speciation has taken place.

In the genus *Otostigmus* (subgenus *Otostigmus*) a number of species show similar spine patterns on the last pair of legs, namely 3-4 ventrolateral, 2-3 ventromedial, 2-4 medial and 2-3 dorsomedial spines. *Otostigmus* shows, however, considerable variation in the nature of the surface of the sternites and tergites. The sternites may bear wart-like structures and the tergites may be spined or ridged, the ridges bearing small teeth in some species. These modifications are of the posterior segments and could be involved in meeting reactions and sexual behaviour. I find it very difficult to assign specimens of *Otostigmus* from the west Pacific to a particular species and suspect that other workers may have experienced the same difficulty, this being reflected in the large number of species described from single localities. As *Otostigmus* species have spread through the islands of the west Pacific they may have become separated from related forms, thereby eliminating the need for morphological characters serving to separate the species, which would give rise to variation.

CONCLUSION

More evidence is required to support the suggestion made above that various characters of the last pair of legs and in some cases of the sternites and tergites in scolopendrids are important in maintaining the separation of species. Further data are required on the distribution of species together with precise habitat data. More observations are required on ritualised meeting reactions not only between members of the same species but also between closely related species.

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