

and long-lived spiders were essentially equal. The small number of cases for *A. aurantia* require large differences in order to be significant, however.

Unless the laboratory imposes conditions significantly unrepresentative of population forces in the natural environment, it would appear that early rapid growth in the two species of orb-weavers occurs at the expense of endurance.

If this relationship is valid, its basis is nevertheless unclear. Portions of broods of insects have been reported to eclose at different times (Rupert, 1949 for example), producing morphologically distinct adults. Our animals appear to hatch at the same time and to be similar except for rate of development.

Poetsch (1963) has observed the hatching of cocoons at two different times for the same species of spider, presumably providing an advantageous distribution of egg-production over time. Our observations, however, apply to a single hatching, although differential maturing might provide similar advantage. In any case, death does not follow egg-laying closely in the long-lived animals.

We did not observe cannibalism among the hatchlings before separation. While cannibalism in the cocoon might account for differences in size, it would not account for length of life.

At the moment, we cannot say which of the two extremes of longevity, if either, are remarkable, whether rapid growth has lethal consequences or slow growth aids in surviving developmental crises such as moulting. We have begun to assemble the records of the webs built by the spiders throughout life, in order to examine the possibility that the short-lived and long-lived animals can be distinguished on other grounds, for instance in thread-production and patterns of movement.

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Observations on the classification of some European chernetid pseudoscorpions

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The aim of the present paper is to point out that lack of critical study and comparison of European and American chernetid pseudoscorpions has led to some serious misunderstandings of their relationships. It is hoped that it will lead to renewed study of many forms and increased cooperation among workers in the field.

The studies upon which the following remarks are based were prompted by some observations by Weygoldt (1970) on the courtship and mating behaviour of certain pseudoscorpions. In particular, Weygoldt puzzled over the similarities in behaviour between *Dinocheirus tumidus* (Banks) and *Dendrochernes morosus* (Banks), and between *Chernes cimicoides* (Fabricius) and *Hesperochernes sanborni* (Hagen), because in each example the first named species was considered to belong to the tribe Chernetini Beier while the second was placed in the tribe Hesperochernetini Beier. As I have pointed out to Dr. Weygoldt (*in litt.*), the former case is easily resolved because the genus *Dinocheirus*, like *Dendrochernes*, has four setae in the cheliceral flagellum and rightfully belongs in the tribe Hesperochernetini. The confusion over *Dinocheirus* emerged after Chamberlin (1929) failed to mention the number of setae in the flagellum of *D. tenoch* Chamberlin, the type species of the genus, and Beier (1932, p. 138) erroneously recorded the number as three, placing *Dinocheirus* into his newly erected tribe Chernetini. Chamberlin corrected this error in 1934 (p. 128) and showed that *Epaphochernes* Beier was a synonym of *Dinocheirus*. Beier (1933, p. 100) accepted the correction, but other European workers evidently were unaware of it (cf. Vachon, 1936).

The second case, regarding *C. cimicoides* and *H. sanborni*, was, however, quite perplexing and I suggested that a comparative morphological study of *Chernes* and *Hesperochernes* might be fruitful. Dr. Weygoldt kindly obliged by sending me four specimens each of *C. cimicoides* and *C. hahni* (L. Koch) to

compare with our native *H. sanborni*. These specimens were dissected, the bodies cleared in potassium hydroxide, all parts cleared in beechwood creosote, and mounted in Canada balsam, as is the custom with most American students of pseudoscorpions (cf. Chamberlin, 1931; Hoff, 1949). Careful microscopic study then revealed the surprising and interesting fact that all but one of the *Chernes* possess *four*, rather than three, setae in the cheliceral flagellum, just as the *Hesperochnes* do! Thus these representatives of *Chernes* appear to be typical representatives of the tribe Hesperochnetini, and the similarity of behaviour to that of *Hesperochnes sanborni* is not so difficult to understand! Further similarities between the *Chernes* and *Hesperochnes* species are numerous and include the nature of the setae and sensilla on the fourth pedal tarsus and the form of the spermathecae in the female.

More recently, I have received from Dr. P. Gabbutt some British chernetid pseudoscorpions, including one male and three females of *Toxochnes panzeri* (C. L. Koch). Again, unexpectedly, careful study of the mounted material revealed *four* setae in the cheliceral flagellum of each specimen. Furthermore, all other features of these animals, including the nature of the setae and sensilla of the fourth tarsus and the form of the spermathecae in the female, are such that, had they been received from anywhere in America, I would without hesitation have placed them in the genus *Dinocheirus*!

It may be pointed out here that counting the number of setae in the cheliceral flagellum in such genera as *Dinocheirus* and *Hesperochnes*, where the number is four, is indeed a difficult job. The two basal setae are short and of about the same size and lie very close together, often against the proximal side of the second seta. Unless the chelicera is oriented correctly, it is very difficult or impossible to distinguish the two. Thus it is best to examine the isolated chelicerae before the cover slip is applied or immediately afterwards, so that they may more easily be manipulated into a favorable position for viewing under high magnification.

The occurrence of four setae in the cheliceral flagellum of some specimens assigned to the genera *Chernes* and *Toxochnes* raises several important problems about the taxonomic relationships of these genera. If four setae are present only occasionally, or

teratologically as Beier suggests (1963, p. 273), then *Chernes* and *Toxochnes* may be viewed as well separated from the North American *Hesperochnes* and *Dinocheirus*. On the other hand, if careful examination reveals that four is the usual number of flagellar setae in specimens of *Chernes* and *Toxochnes*, then a re-evaluation of generic and even specific distinctions will be in order. And if *Chernes* is not fundamentally different from *Hesperochnes* in respect of the flagellar setae, then the distinction between the tribes Chernetini and Hesperochnetini disappears.

Another hidden problem has emerged from my study of some specimens of *Lamprochnes nodosus* (Schrank) obtained from Dr. Gabbutt and from the collection of the British Museum (Natural History). In spite of the opinion of Beier (1932, *et seq.*), it seems clear to me that the genus *Lamprochnes* (at least as represented by these specimens) is very closely related to *Allochnes* and *Pselaphochnes*. These three genera do not differ fundamentally in most of their morphological features; and the differences cited by Beier to separate them at the subfamily level (*Lamprochnetinae* vs. *Chernetinae*) are not as distinct as he has implied (cf. 1963, p. 248-249), because they concern surface features which are probably easily modified in adaptation to different environmental conditions. Specifically:

1) the surfaces of the carapace and the palps of *L. nodosus* may appear almost smooth in comparison with other, heavily granulated forms, but they are in fact distinctly granulated; they differ only in degree of granulation from the examples in *Allochnes* and *Pselaphochnes*.

2) the vestitural setae of *L. nodosus* are for the most part not simple, but finely spinulate terminally and subterminally; they differ from those of *Allochnes* and *Pselaphochnes* only in being longer and thinner and in having smaller spinules.

3) the tactile seta on the fourth (and third) tarsus of *L. nodosus* is located proximad of the middle of the segment, a somewhat unusual situation among the Chernetidae. However, in *L. godfreyi* (Kew), this seta is located near the middle of the segment (Beier, 1963, p. 250) just as in most species of *Pselaphochnes*.

4) the elongated (pseudotactile?) setae at the

distal ends of the fourth (and third) femur and tibia appear at first glance to be unique to *Lamprochernes*. However, in both *Allochernes* and *Pselaphochernes* counterparts can be found, which are, of course, shorter and more heavily denticulate than in *L. nodosus*, (in this respect I have studied specimens of *A. dubius*, *A. peregrinus*, *P. scorpioides*, *P. parvus*, and *P. sp.*).

5) Vachon (1957, p. 394) has mentioned the smooth, longitudinally striate pleural membranes as a characteristic of *Lamprochernes*; but here again, the difference from *Allochernes* and *Pselaphochernes* is only one of degree, for in *L. nodosus* the anterior pleural membranes, back to about the fourth opisthosomal segment, are distinctly *granulo-striate*. Thus the actual differences between the genera seem to be relatively slight and unimportant at a supra-generic level.

On the other hand, there are some striking similarities which positively suggest close relationships among *Lamprochernes*, *Allochernes* and *Pselaphochernes*. These cannot be discussed in detail at this time, but they include the general form and surface ornamentation of the body and appendages, the form and chaetotaxy of the anterior genital operculum of the female, the spermathecae of the female, certain aspects of the male genitalia (cf. Legg, 1971), the occurrence of only three setae in the cheliceral flagellum, and the nature of setae *b*, *sb* and *es* on the cheliceral hand.

A major hindrance to seeing *Lamprochernes* as closely allied to *Allochernes* and *Pselaphochernes* has been the erroneous inclusion in the genus of a number of American forms, first by Beier (1932), then by Hoff (1949; cf. 1958) and recently by myself (1971c). This misidentification was promoted by Chamberlin's (1938) acceptance of the subfamily Lamprochernetinae Beier. However, direct comparison of the English specimens of *L. nodosus* with American specimens of "*L.*" *oblongus* and others has revealed that the two forms are certainly not congeneric! The differences are many, but the most striking are the placement of tactile setae on the tibia of leg IV, the arrangement of the setae on the anterior genital operculum of the female, the form of the spermathecae (two) in the female and some details of the male genitalia. It is obvious that the American specimens represent a distinct genus (which

will be defined in another place) closely related to the other American genera *Lustrochernes*, *Cordylchernes* and *Mesochernes*.

A further result of the confusion between *Lamprochernes* and the unrecognized American genus has been the failure to appreciate the close similarity in both morphology and habits between *Lamprochernes* (*sensu strictu*) and some specimens which have been assigned to the genus *Pycnochernes* Beier (cf. Chamberlin, 1952; Muchmore, 1971b). Indeed, it now appears possible that the genus *Lamprochernes* may have representatives in North America, whether indigenous or introduced remains to be determined. If this is so, then some of my remarks (1971a) about phoresy in American representatives of *Lamprochernes* will require revision.

In addition, it seems quite likely that some species of European pseudoscorpions are presently placed in the wrong genera. In addition to the possibility that *Toxochernes panzeri* belongs in *Dinocheirus*, as mentioned above:

1) The description of *Epaphochernes bouvieri* by Vachon (1936, p. 141; 1938) makes it clear that this species is probably a representative of *Dinocheirus*, of which *Epaphochernes* is a synonym (cf. Beier, 1933, p. 100; Chamberlin, 1934, p. 128). The possession of four setae in the cheliceral flagellum, the nature of the spermathecae of the female, and the distal placement of the tactile seta on the fourth tarsus preclude its being a member of *Pselaphochernes* as Beier (1963) has considered it.

2) As Vachon (1957) has already pointed out, it appears that *Chelifer montigenus* E. Simon does not belong in *Toxochernes* but rather is a *Chernes*. Like other species of *Chernes* this form has no tactile seta on the fourth tarsus, has no tactile setae on the eleventh tergite, and does have spermathecae consisting of long convoluted tubules without terminal sacs.

3) The studies of Legg (1971) indicate that the spermathecae of *Lamprochernes nodosus*, *L. godfreyi*, and *Allochernes wideri* are very similar; there are also considerable similarities among the male genitalia of the three species. This all suggests, of course, either the misplacement of *wideri* in *Allochernes*, the misplacement of *godfreyi* in *Lamprochernes*, or else the very close relationship between

the genera *Lamprochernes* and *Allochernes*.

In any event, I am convinced that restudy of many of the European species would lead to important changes in the taxonomy and a new appreciation of the relationship of those forms.

The net result of the above-mentioned observations is that the genera in the family Chernetidae are left with no defensible organization. A distinction cannot be made with any accuracy between the tribes Chernetini and Hesperochernetini of the subfamily Chernetinae, and the subfamily Lamprochernetinae is seen to have been based on a form closely allied to typical members of the Chernetinae. The difficulty has been, of course, that the distinctions between the suprageneric categories have been based upon insufficient numbers of characters. While it is likely that representatives of most genera have a constant number of setae in the cheliceral flagellum, the character is often very difficult to observe with accuracy. In addition, the placement of the tarsal tactile seta on the proximal part of the segment is unreliable by itself for separating groups of genera in this family. In future, it will be necessary to study all genera thoroughly and carefully in order to find the constellations of characters by which they may be grouped satisfactorily. From the recent work of Legg (1971), it appears that genital characters will turn out to be very important, but such a conclusion is premature until the investigation is extended to additional forms from Europe and elsewhere.

The foregoing remarks are not intended as criticism of any particular individual, for we have all been guilty of accepting statements and ideas without bothering to investigate the facts for ourselves. I wish, rather, to enter a strong plea for a concerted effort on the part of any and all interested workers to reassess the situation and set things straight as quickly as possible. I, myself, will be fully occupied with investigation of American forms, and I hope that someone actually on the scene will undertake the European studies. Satisfactory resolution of the problems will depend upon much hard work and a continuous exchange of information and ideas.

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