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Observations on the male palps of *Micrargus herbigradus* (Bl.) and *M. apertus* (O.P.-C.) (Araneae, Linyphiidae)

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Introduction

In a recent paper Millidge (1975) showed that the common European spider *Micrargus herbigradus* (Bl.) is composed of three closely related species, *Micrargus herbigradus* (Bl.), *M. apertus* (O.P.-C.) and *M. georgescuae* Millidge, only the first two having been recorded from Britain.

For females the separation of *M. herbigradus* and *M. apertus* is based on differences in the vulvae where, for *M. herbigradus*, only a single coil of the seminal duct is visible, whilst two coils are visible in *M. apertus*. A powerful top light is necessary and a positive identification is not always possible without clearing. The separation of males is based mainly on differences in a small process lying within the anterior coil of the embolus. For *M. herbigradus* the process is described by Millidge as being only lightly sclerotised (light in colour), truncated, and rather blunt at the distal end, and associated with a fan-shaped membrane which is difficult to see. The process in *M. apertus* is described as being more highly sclerotised (black in colour), the distal end being distinctly pointed, and the fan-shaped membrane apparently absent.

The process in both species is a very small structure and the spatial relationship between the process and the associated membrane is difficult to resolve using stereoscopic optics. This note describes the results of an examination of these structures, in both *M. herbigradus* and *M. apertus*, using the higher quality optics of a normal compound microscope, and also using the much greater depth of field and the higher resolving power of a scanning electron microscope.

Materials and Methods

Material examined

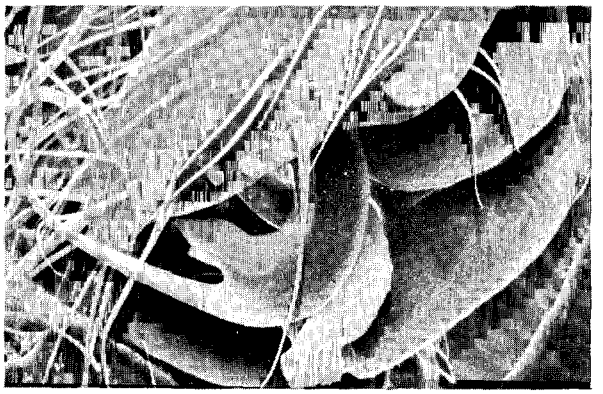
Specimens from a number of sites in Britain have been examined. Most of these were identified before the publication of Millidge's paper and had thus been assigned to *M. herbigradus*. Mr R. B. Coleman kindly made available a large number of specimens amongst which was a single *M. apertus* male. Dr A. F. Millidge and Mr J. R. Parker each kindly supplied a male of *M. apertus*.

Examination using the optical microscope

Specimens were examined using a Vickers M45 compound microscope equipped with Microplan flat-field optics, giving a magnification of x 130. To overcome the disadvantage of the short working distance objective lens, and to prevent convection currents in the alcohol, the specimens were held in a cavity milled into the plane face of a block of transparent plastic. The cavity was almost filled with small glass beads (60 mesh, BDH Ltd), flooded with alcohol and the specimen gently pressed into the beads using a cover slip. Great care was taken to completely exclude air from the cell and to ensure that the palp, in the desired orientation, was almost touching the underside of the cover slip. Illumination was provided by a high-intensity tungsten-halogen source via two fibre optic light guides. Under these conditions the process and the associated membrane could be clearly resolved. Photomicrographs were produced on Polacolor film (Type 108).

Examination in the scanning electron microscope

Specimens were dried in air to remove alcohol, mounted onto the sample stub with Durofix adhesive and sputtered with a conducting film of gold (~30nm.) in an Edwards S150 sputter coater. The sputtering was done in 10 second bursts to minimise undesirable heating of the specimens. They were examined in a Cambridge Instruments S600 Stereoscan using the secondary electron imaging mode of operation and a primary beam voltage of 25kV. Electronmicrographs were produced on Polaroid film (Type 52) at a range of magnifications up to x 1200. Because of the scarcity of the specimens and the irreversibility of the gold treatment only two



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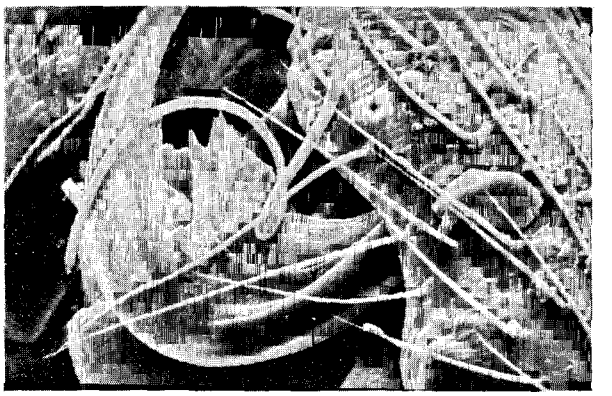

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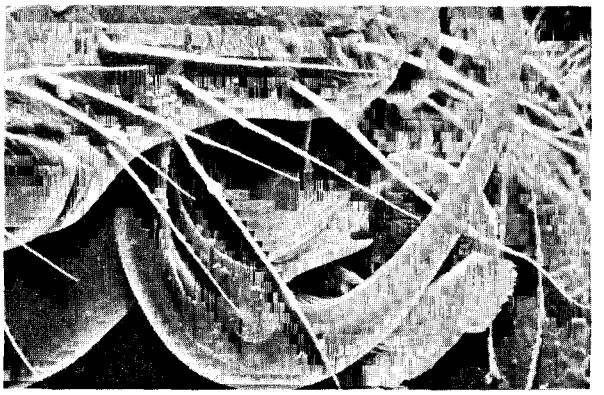

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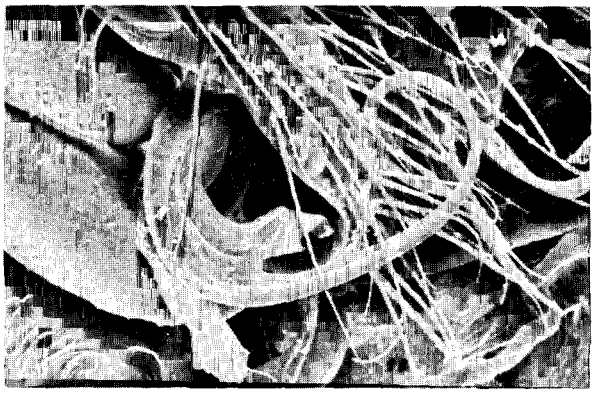

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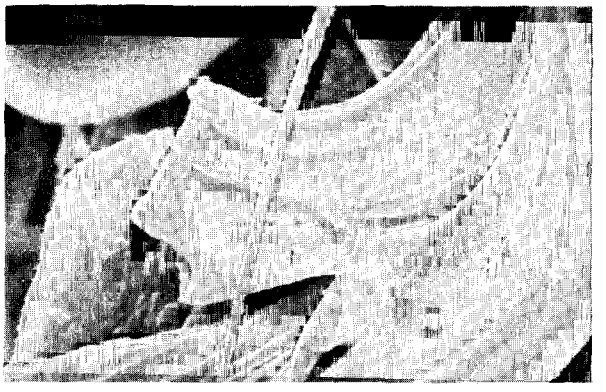

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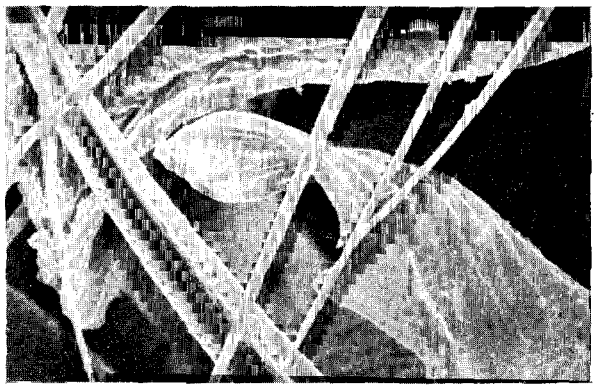

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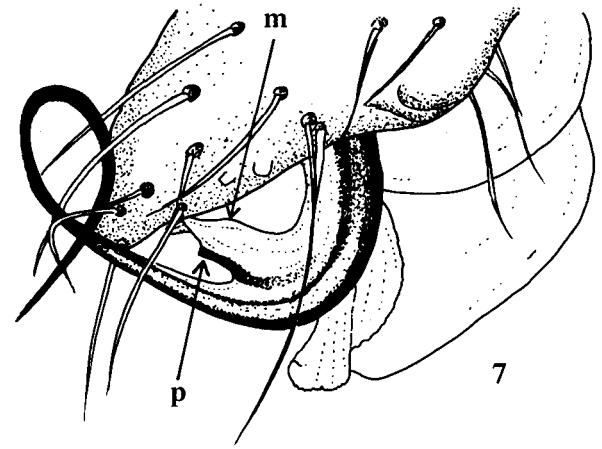
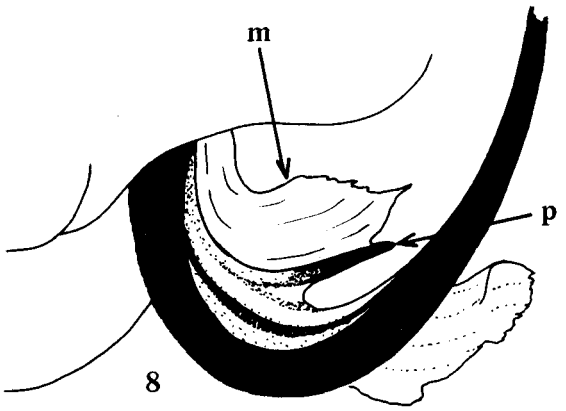
Figs. 1-6: *Micrargus herbigradus* (Bl.) and *M. apertus* (O.P.-C.), male palps. **1** left palp of *herbigradus*, showing process and membrane within coil of embolus (x 215); **2** left palp of *apertus*, showing process and membrane (x 300); **3** right palp of *apertus*, showing finely rounded point of process and serrated leading edge of membrane (x 300); **4** right palp of *herbigradus*, showing slightly pointed process and twisted membrane (x 195); **5** left palp of *herbigradus*, showing membrane folded back on itself (x 855); **6** left palp of *herbigradus*, showing bifurcated tip of membrane (x 780).

examples of *M. apertus* were committed to the microscope and, unfortunately, the orientation of the palps on one of these was such that the process was obscured.

Results

Examination of the specimens in the optical microscope provided a good deal of information. Firstly it enabled a check to be made on the possibility of any distortion of the palps when subsequently examined under the high-vacuum conditions in the electron microscope. No such distortion was apparent and it was concluded that the spatial relationships of the palpal structures visible in the electron micrographs were real. Secondly it allowed the course of the sclerotised process to be followed. A disadvantage of the stereoscan microscope is that it cannot distinguish between heavily sclerotised and transparent structures, because electrons are emitted only from the surface of the specimen. Thirdly it showed that the observations of Millidge were largely correct and that the form of the process was clearly different in the two species. Unfortunately, because the photo-micrographs were in colour and of lower quality than desirable they have not been reproduced here.





Figs. 7-8: *Micrargus herbigradus* (Bl.) and *M. apertus* (O.P.-C.), male palps. 7 drawing of left palp of *herbigradus* shown in Fig. 1; 8 drawing of right palp of *apertus* shown in Fig. 3. Both drawings show the membrane (*m*) and the course of the sclerotised process (*p*).

Figure 1 is an electron micrograph of the left palp of *M. herbigradus*, showing the process and the membrane lying within the coil of the embolus. The structures are identified and the course of the sclerotised process indicated in Fig. 7 which is a drawing of the same palp as in Fig. 1, in the same orientation, the information being obtained from the visual examination in the optical microscope. The process is approximately square-ended and has a distinct kink some 35μm from the distal end. The membrane appears to taper to a point but it is in fact twisted over and the tip is hidden from view by the hairs on the tarsus. Figures 2 and 3 show, respectively, the left and right palps of *M. apertus*. The course of the process is indicated in Fig. 8. In this species the process is straight, does not show the kink present in *M. herbigradus* and tapers to a finely rounded point. However, as in *M. herbigradus*, the process is associated with a membrane but this is shorter and has a serrated leading edge. In both species, the process (as shown by the electron microscope) is actually only the thickened and sclerotised lower margin of the membrane.

The examination of the *M. herbigradus* specimens revealed some variation in the process and in the appearance of the membrane, not only between specimens but also between the palps of a single specimen. Shown in Fig. 4 is an example where the distal end of the process is slightly more pointed than square-ended (cf. Fig. 1), and the long membrane is twisted at right angles and has a sharply pointed end.

The left palp of the same specimen is shown in Fig. 5 and here the membrane is clearly folded back on itself. Figure 6 shows the membrane of another specimen to be twisted through ninety degrees and to have a bifurcated tip. Because the palps of only one specimen of *M. apertus* could be clearly seen in the electron microscope the detailed extent of any variation in the membrane and process is not known with certainty. However, examination of a number of specimens in the optical microscope, at high magnification, indicated that the shape of the process was constant whilst there was some small variation in the shape of the membrane.

It would appear that a further distinction between the two species, in addition to the differences in the process, is that the membrane in *M. herbigradus* is longer, somewhat less broad and often twisted back on itself or folded. The shorter membrane of *M. apertus* makes this folding much less likely.

Acknowledgements

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Reference

MILLIDGE, A. F. 1975: Re-examination of the erigonine spiders *"Micrargus herbigradus"* and *"Pocadicnemis pumila"* (Araneae: Linyphiidae). *Bull.Br.arachnol.Soc.* 3(6): 145-55.