

17. 24. DEUTONYMPHAL DIMORPHISM IN THE GENUS *HERICIA* (ASTIGMATA : ALGOPHAGIDAE)

N.J. Fashing

Department of Biology, College of William and Mary, Williamsburg, Virginia 23185, U.S.A.

INTRODUCTION

In their book "Systematik und Ökologie der Tyroglyphiden Mitteleuropas", Türk and Türk (1957) described a new species, *Hericia paradoxa*, based on a deutonymph collected from the bark of birch trees near Erlangen, Germany. The etymology of the species reflects the fact that its systematic position posed a paradox. The habitat and the configuration of the apodemes were characteristic of the genus *Hericia*, but, unlike *Hericia*, the sucker plate was extremely reduced and the pretarsi short.

The present study answers Türk and Türk's paradox by describing deutonymphal dimorphism in a new species of *Hericia* that inhabits the sap-flux (= slime flux) of oak trees in the eastern United States. The deutonymph of Türk and Türk was a non-phoretic morph; a morph that has lost most of the attributes associated with dispersal.

MATERIALS AND METHODS

Specimens of *Hericia* were collected from sap-flux on oak trees (*Quercus*) near Williamsburg, Virginia, during the month of June. Deutonymphs were examined using both phase contrast and Hoffman modulation contrast microscopy as well as scanning electron microscopy (SEM). Mensural data were collected on the idiosomal length and width of the two morphs as well as on a number of characters associated with phoresy. In an attempt to determine the host used for dispersal, insects associated with sap-flux were collected and examined for deutonymphs. Deutonymphs were found on one adult nitidulid beetle, and specimens of this species in the National Museum of Natural History, Smithsonian Institution, were then examined for deutonymphs to corroborate the association.

RESULTS

The collected samples contained all instars of a new species of the genus *Hericia*, among which were two distinct deutonymphal morphs (Fig.1). Although the morphs do not differ significantly in regard to idiosomal size, there are extensive differences in characters

Table 1. Comparative measurements between morph 1 and morph 2. Means given in micrometers; sample size = 10.

	Morph 1	Morph 2	Probability (t-test)
IDIOSOMA			
Length	270.3	265.6	0.6100
Width	161.4	163.4	0.6300
GNATHOSOMA			
Distance Recessed	22.2	9.2	0.0001
Solenidion	5.1	14.2	0.0001
LEG I			
Length minus pretarsus	77.4	101.7	0.0001
Distance Recessed	47.0	28.5	0.0001
Solenidion ω_1	9.7	11.3	0.0230
Solenidion ω_3	11.5	15.8	0.0001
Solenidion φ	11.4	30.3	0.0001
Seta <i>d</i>	36.1	52.1	0.0001
LEG II			
Length minus pretarsus	76.1	103.1	0.0001
Distance Recessed	40.3	27.1	0.0004
Solenidion ω_1	10.4	12.8	0.0009
Solenidion φ	10.8	22.2	0.0001
Seta <i>d</i>	36.3	55.7	0.0001
LEG III			
Length minus pretarsus	56.8	64.2	0.0001
Pretarsus	11.2	27.3	0.0001
Seta <i>d</i>	71.6	115.2	0.0001
LEG IV			
Length minus pretarsus	57.7	64.2	0.0530
Pretarsus	11.2	28.3	0.0001
Seta <i>d</i>	73.7	118.9	0.0001

associated with phoretic behavior (Table 1). One morph (hereafter referred to as morph 1) is lacking or deficient in such characters (Fig. 1a), and the other (hereafter referred to as morph 2) is a typical migratory, entomophilous form, highly adapted for locating and attaching to a host for phoresy (Fig. 1b). The gnathosoma of morph 1 is recessed, with short solenidia that terminate well short of the idiosomal margin (Figs. 2a, 2b)¹, whereas that of morph 2 is more distally located with long solenidia projecting to and

¹Figures 2 - 5 on Plates XIX - XXII.

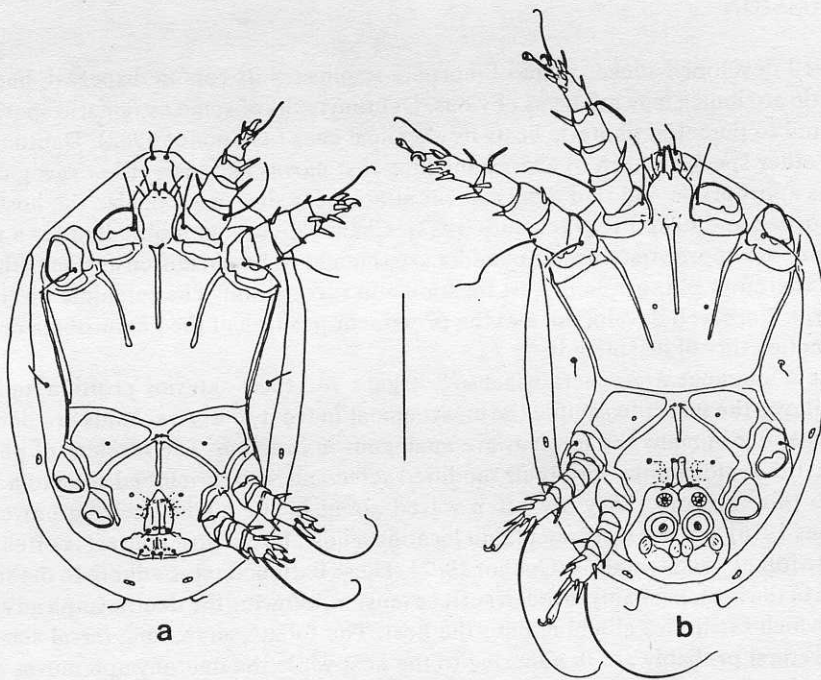


Figure 1. Ventral view of deutonymphs - a - morph 1, b - morph 2. Bar = 100 micrometers.

sometimes beyond the margin of the idiosoma (Figs. 2c, 2d). The anal attachment organ (sucker plate) of morph 2 is well developed with anterior and medial suckers as well as lateral and posterior conoidal setae (Fig. 1b, 3b). In contrast, the anal organ of morph 1 is greatly reduced and devoid of suckers and conoidal setae, the only remnants of which are two pairs of small posterior hairlike setae (homologs of the conoidal setae of morph 1), a pair of anterior vestigial alveoli (homologs of the anterior suckers) and two pairs of medial vestigial alveoli (homologs of the medial suckers) (Figs. 1a, 3a).

The legs of morph 2 are longer than those of morph 1. Legs I and II also originate closer to the idiosomal margin (Fig. 1, Table 1), so that the legs extend much further beyond the idiosoma than those of morph 1 (Fig. 1). The legs of morph 2 also have longer solenidia and tarsal setae *d* than those of morph 1 (Table 1). In addition, seta *e* on tarsi I and II of morph 2 is long and apically expanded (foliate) (Fig. 4b), whereas their homologs on morph 1 are short and unmodified (Fig. 4a). And finally, morph 1 has short pretarsi on legs III and IV, whereas those pretarsi on morph 2 are considerably longer (Fig. 5, Table 1).

Examination of insects collected at sap-flux in the study area produced only one with deutonymphs, an adult of *Glischrochilus obtusus* (Say, 1835) (Coleoptera: Nitidulidae). Examination of museum specimens of *G. obtusus* yielded over 100 deutonymphs, all of which were morph 2.

DISCUSSION

The well developed sucker plate of morph 2 implicates its role in dispersal, but other phoretic attributes may not be as obvious. Deutonymphs of some astigmatid species are attracted to potential phoretic hosts by chemical cues (OConnor 1982). Deutonymphs of yet other species attach to almost anything that moves and then either recognize the host as appropriate and find a permanent attachment site, or recognize the host as inappropriate and drop off (OConnor 1982). Chemical cues undoubtedly play a role in selecting the appropriate host. Solenidia are thought to be chemosensory sensillae and would therefore play a role in host location and recognition. The solenidia on the legs of morph 2 are well developed, and the prominent position of the gnathosoma enhance the functionality of its solenidia.

Insect antennae are generally sensory organs and their anterior position and flexibility allows the insect to sample the environment in front of it. Arachnids are devoid of antennae, but in many the forelegs are analogous in function. The forelegs of phoretic astigmatid deutonymphs with their modified setae and well developed solenidia would fit into this category. They are often waved about in the air in questing movements (Hughes 1976) and are instrumental in locating a host. Initial host contact is often made with the foliate tarsal setae (OConnor 1982). These flattened setae adhere to the smooth cuticle of the host, probably through surface tension, allowing the deutonymph an anchor point which facilitates climbing onto the host. The foliate setae, long tarsal setae and long pretarsi probably aid in adhering to the host while the deutonymph moves about, hunting for a permanent, usually protected, site where it attaches via its sucker plate.

Morph 1, on the other hand, lacks characters that would implicate a role in dispersal. That it is non-phoretic is also attested to by the fact that although over 80% of the deutonymphs found in sap-flux were of this form, none were collected on beetles.

Production of sap-flux by a tree may recur each summer for a number of years, thereby providing a seasonal but predictable habitat. Adaption to this habitat has led to the evolution of deutonymphal dimorphism. One form of deutonymph serves as a dispersal agent for colonization and outcrossing among populations (trees), and it is probable that the other remains on the original tree to await the next year's sap-flux.

An analogous strategy has evolved in the genus *Chaetodactylus*, species of which are cleptoparasites in the nests of megachilid bees (OConnor 1982). Megachilids nest in cavities in wood and the same cavities can presumably be used for several nesting seasons. Two types of deutonymphs are formed. One is of the migratory entomophilous type and is phoretic on the bees, whereas the other is non-phoretic and remains in the bee nest where it overwinters and infests any new nest built in the cavity during the next nesting season (Fain 1966).

The non-phoretic deutonymphs of *Chaetodactylus* and *Hericia* do, however, differ. In *Chaetodactylus* they are of the "inert", immobile type with extremely reduced legs (Fain 1966). Although the non-phoretic deutonymphs of *Hericia* have shorter legs than the phoretic deutonymphs, their legs are well developed and functional. In fact, these deutonymphs are quite active. This is adaptive since trees normally produce sap-flux only during late spring and early summer. Protonymphs ecdyse into deutonymphs in the sap-

flux and it is necessary for the non-phoretic deutonymphs to move into recesses in the tree bark to avoid exposure and desiccation when the production of sap-flux ceases.

SUMMARY

Members of the genus *Hericia* inhabit sap-flux on trees. A new species from the eastern United States has been found to have a dimorphic deutonymphal (hypopal) instar; both morphs are active and concurrent in populations. One morph has attributes associated with locating and attaching to a host for phoresy and the other is lacking or deficient in such attributes. Production of sap-flux by a tree may recur each summer for a number of years, thereby providing a seasonal but predictable habitat. The phoretic morph serves as a dispersal agent for colonization of trees with new areas of sap-flux as well as for outcrossing among populations, and the non-phoretic morph remains on the original tree to await the next year's sap-flux.

ACKNOWLEDGEMENTS

Special appreciation goes to Dr. Gisela Fashing, Virginia Department of Health, for critically reading the manuscript, and to Jewel Thomas, College of William and Mary, for preparation of the plates.

REFERENCES

- Fain A., 1966. *Bull. Ann. Soc. R. Entomol. Belg.* 102: 251- 261.
- Hughes A.M., 1976. *The mites of stored food and houses.* Min. Agric. Fish. Food London, Techn. Bull. 9, 400 pp.
- O'Connor B.M., 1982. *Ann. Rev. Entomol.* 27: 385-409.
- Türk E., Türk F., 1957. In: Stammer H.J. (Ed.), *Beiträge zur Systematik und Ökologie mitteleuropäischer Acarina.* Akademische Verlagsgesellschaft, Leipzig, Vol. 1, Part 1, pp. 3-231.

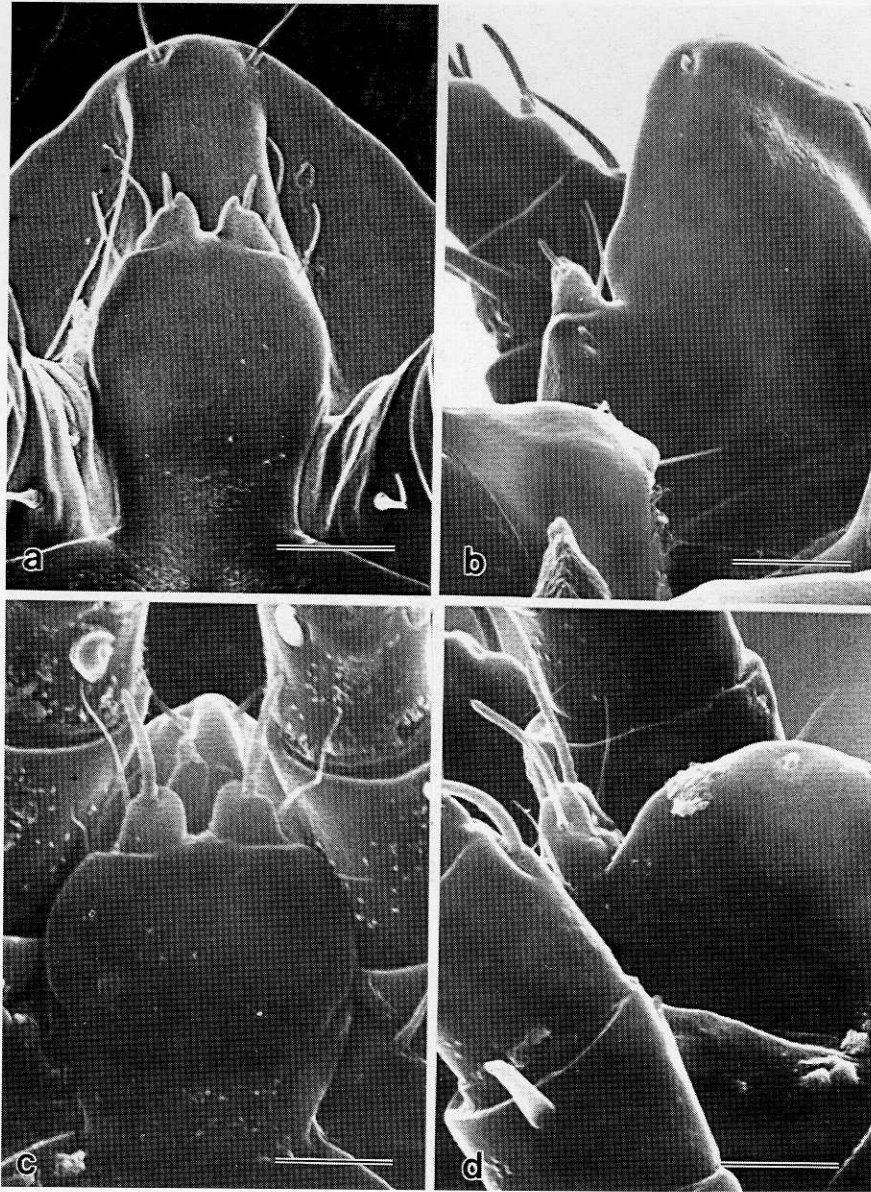


Figure 2. Gnathosoma. a - ventral view of morph 1, b - lateral view of morph 1, c - ventral view of morph 2, d - lateral view of morph 2. Bar = 10 micrometers.

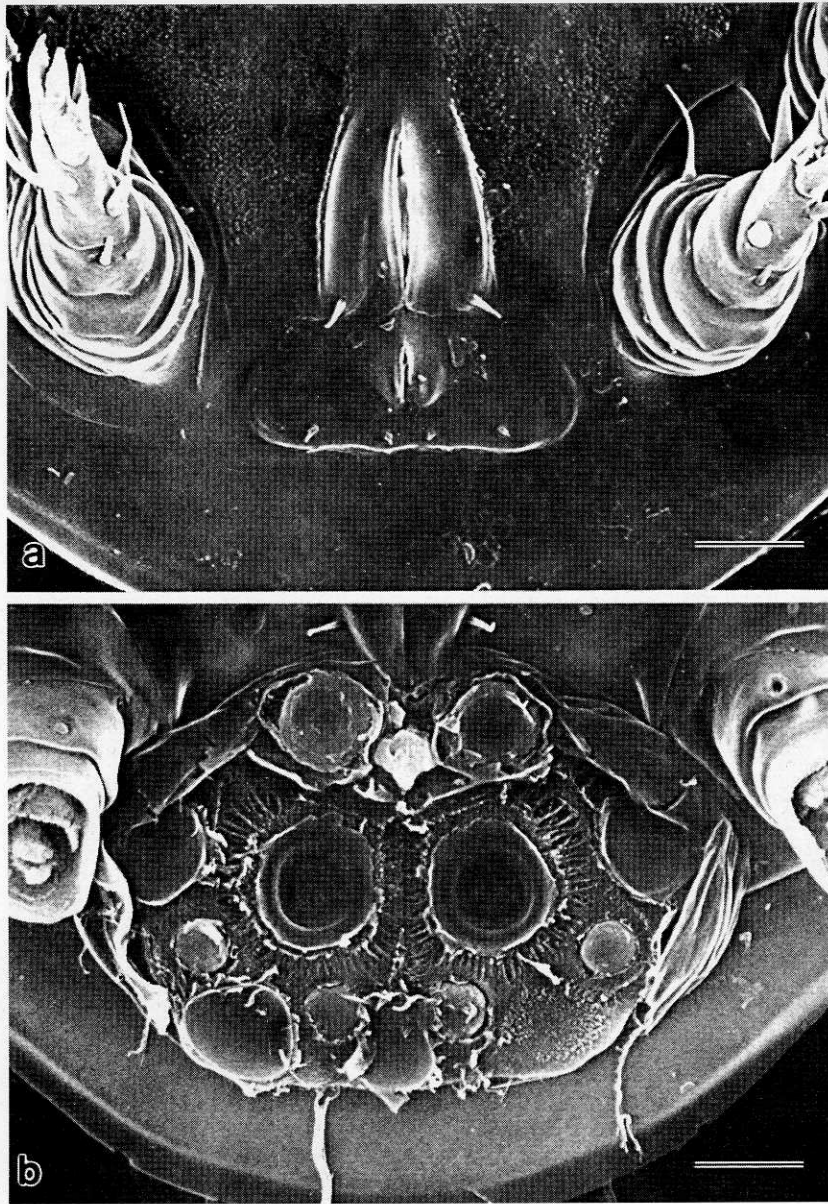


Figure 3. Anal attachment organ. a - morph 1, b - morph 2. Bar = 10 micrometers.

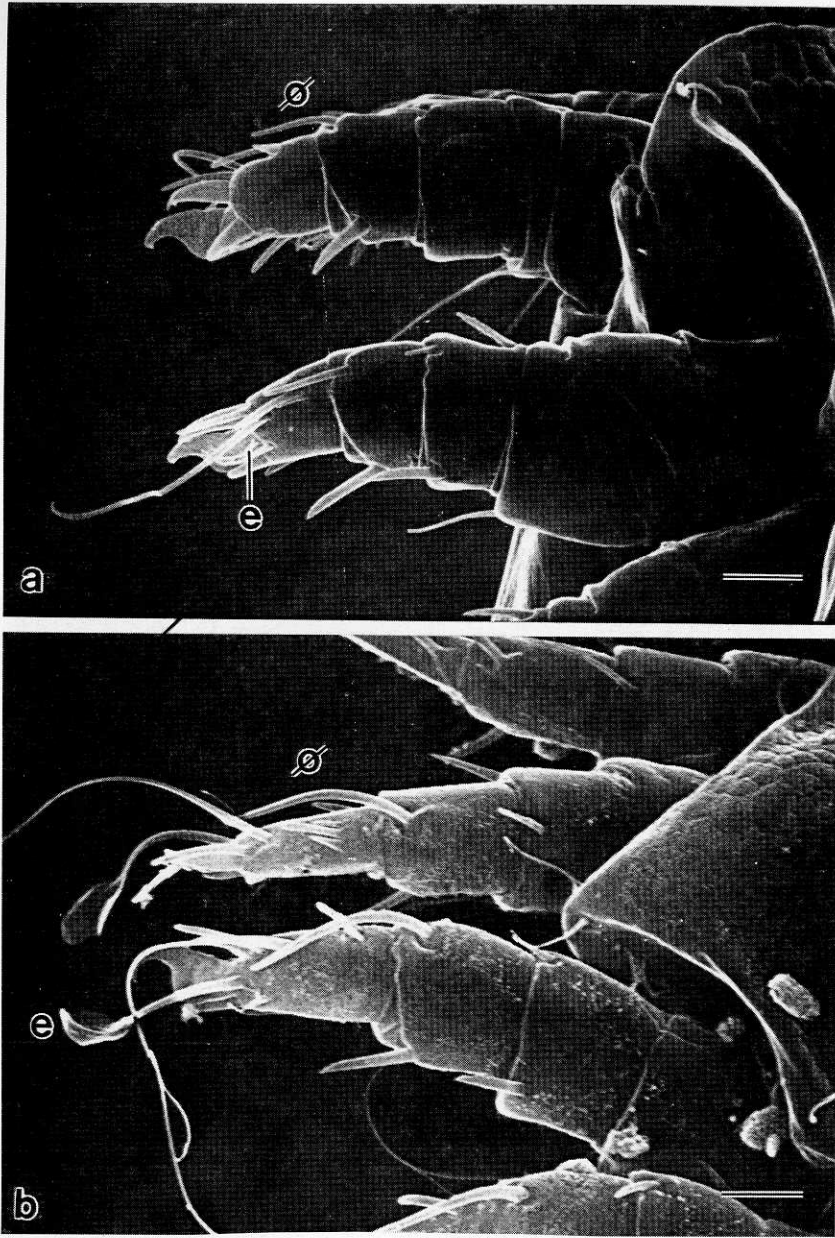


Figure 4. Postaxial and preaxial views of leg I. a - morph 1, b - morph 2. Bar = 10 micrometers.

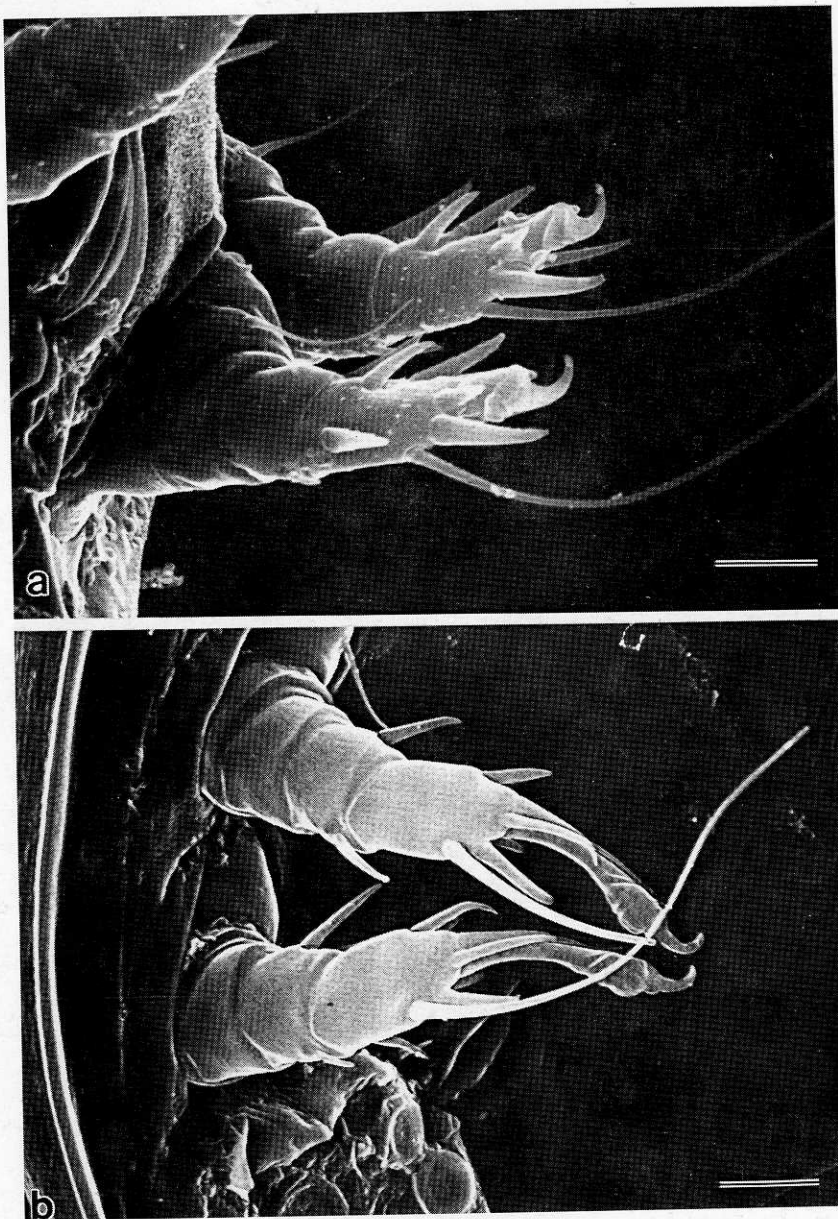


Figure 5. Legs III and IV. a - morph 1, preaxial view, b - morph 2, postaxial view (tarsal setae *d* broken off). Bar = 10 micrometers.