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POSSIBLE FUNCTION OF CEPHALIC OUTGROWTHS OF SUCKING LICE (ANOPLURA) PARASITIC ON TREE SHREWS (TUPAIIDAE)

Abstract. Speculation is made upon the significance of cephalic outgrowths in *Sathrax durus* and *Docophthirus acinetus,* 2 species of sucking lice (Anoplura) normally parasitic on tree shrews (Tupaiidae). An infestation of *S. durus* on a small laboratory colony of *Tupaia glis* provided lice for study. While the cephalic interspine spacing on *S. durus* could feasibly allow these spines to interlock with host underfur hairs, use in directly gripping host epidermis seems a more plausible function. No host fur was definitely trapped between spines, but attached fragments of host epidermis were common. Although *D. acinetus* specimens were not available for study, the larger cephalic protuberances on this species suggest that interlocking with host hairs is a distinct possibility. The protection of flexible joints is considered an unlikely function of these outgrowths.

With the exception of members of the family Echinophthiriidae, few sucking lice possess prominent cephalic outgrowths. Some echinophthiriid lice may use cephalic scales (modified setae) and thoracic and abdominal scales, when present, to trap air to form a plastron for respiratory gas exchange when their pinniped and mustelid hosts submerge (Murray & Nicholls, 1965, Aust. J. Zool. **13:** 437–54; Murray, Smith & Soucek, 1965, Aust. J. Zool. **13:** 761–71; Askew, 1973, *Parasitic insects,* Heinemann Educational Books, London, 316 p.; Hinton, 1976, p. 43–78, *In:* Cheng, ed., *Marine insects,* North-Holland Publishing Co., Amsterdam; Murray, 1976, p. 79–96, *In:* Cheng, ed., *Marine insects,* North-Holland Publishing Co., Amsterdam). However, the function of cephalic protuberances on other sucking lice is more open to speculation. It may be significant that the 2 species of sucking lice normally parasitic on tree shrews (Tupaiidae) both possess such outgrowths. These lice,

FIG. 1. Scanning electron micrograph of the ventral aspect of the head of an adult ♂ *Sathrax durus* louse. Bar = 50 μm.

TABLE 1. Mean measurements of *Tupaia glis* host hair diameters and of distances between *Sathrax durus* cephalic spines.

		$\bar{x} \pm$ SD (μm)	n
Host			
Guard hair diam.		57.8 ± 16.3	100
Underfur hair diam.		20.0 ± 4.0	100
Lice			
Dist. betw. adjacent cephalic spines	Adult ♀	20.3 ± 2.4	100
	Adult ♂	19.4 ± 2.6	87
	3rd instars	15.8 ± 3.7	25
Min. dist. betw. adjacent lateral & medial cephalic spine rows	Adult ♀	25.3 ± 2.0	40
	Adult ♂	27.0 ± 2.6	20
	3rd instars	22.3 ± 1.4	6
Min. dist. betw. medial cepahlic spine rows	Adult ♀	27.0 ± 2.9	20
	Adult ♂	23.1 ± 0.9	10
	3rd instars	28.0 ± 8.7	3

both belonging to the Polyplacidae, are *Docophthirus acinetus* Waterston, parasitic on *Anathana ellioti,* and *Sathrax durus* Johnson, a parasite of *Tupaia glis. Docophthirus acinetus* possesses backwardly directed processes on the ventral surfaces of the head and 1st antennal segments (Waterston, 1923, Bull. Entomol. Res. **14:** 99–102), and *S. durus* has similar but smaller and more numerous processes ventrally on the head and 1st and 2nd antennal segments (Johnson, 1964, Misc. Pub. Entomol. Soc. Am. **4:** 68–102) (Fig. 1). An opportunity to study the latter association was afforded when a shipment of *T. glis* infested with lice was received at Vanderbilt University Division of Animal Care (Quarantine Section) from West Malaysia in November 1982.

Lice were collected by visually examining the pelage of 9 adult tree shrews under general anesthesia; lice were removed with microforceps and stored in 70% ethyl alcohol. Host hair samples were also taken and stored in a similar manner. Distances between adjacent pairs of cephalic spine tips on preserved lice were measured using a light microscope fitted with a calibrated eyepiece graticule. In addition, the spacing between the closest spine tips of each of the 4 longitudinal spine rows (Fig. 1) was recorded, i.e., lateral to medial on each side and medial to medial. Host hair diameters were also measured.

A total of 33 lice (20 adult females, 10 adult males, and three 3rd-instar nymphs) was collected and examined. Host hair samples were distinctly divisible into guard hairs with smooth surfaces and more numerous underfur hairs that are annulated with irregular projections.

Measurements of spacing between louse cephalic spines and of host hair diameters are shown in Table 1. These data reveal that adult female *S. durus* lice could trap host underfur hairs between adjacent cephalic spines to facilitate host attachment but that adult males and 3rd instars could interlock with proportionately fewer of these hairs. If minimum spine row spacings are considered, then adults and 3rd instars could trap host underfur (hairs could be aligned along these rows and this could additionally prevent hairs from interfering with the mouthparts during feeding). Despite these possibilities and the presence of irregularities on surfaces of underfur hairs that would facilitate interlocking, no host hairs were unequivocally trapped between these spines on preserved lice; on 1 occasion a hair appeared to be trapped but this hair was also held by a tarsal claw and could have been held in place solely by this appendage. Conversely, fragments of host epidermis were found attached to spines on most of the lice examined. (These fragments often impaired measurements.) It therefore seems likely that these spines are used to lock directly into the host integument. If this is the case, the significance of the row formations of the spines is unclear and could be related to feeding dynamics. Third instars had spines reduced to stubs, and it is difficult to visualize these interlocking with host fur. Since *S. durus* spines are not contiguous at their bases and do not cover any flexible joints, a function in protecting vital joints, as proposed by Marshall (1980, p. 79–87, *In:* Traub & Starcke, eds., *Fleas,* A.A. Balkema, Rotterdam) for the combs of ectoparasitic insects, seems unlikely.

The cephalic protuberances of *D. acinetus,* which was unavailable for study, are larger, less numerous, and have greater interspine spacing than those of *S. durus.* Waterston (1923, loc. cit.), in his original description of *D. acinetus,* referred to these protuberances as "anchoring processes," and it is distinctly possible that their normal function is to interlock with host hairs.

It would be interesting to elucidate the function of the cephalic processes that are present on a few other Anoplura, e.g., *Microphthirus uncinatus* (Ferris) (Enderleinellidae), *Ctenophthirus cercomydis* Ferris (Polyplacidae), and some species belonging to the genera *Hoplopleura* (Hoplopleuridae), *Eulinognathus* (Polyplacidae), and *Linognathus* (Linognathidae).

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