DEMODEX LEUCOGASTERI N. SP. FROM *ONYCHOMYS LEUCOGASTER* — WITH NOTES ON ITS BIOLOGY AND HOST PATHOGENESIS

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PARASITE
LIFE CYCLE
DEMODICID

ABSTRACT : A new minute, slender demodicid, *Demodex leucogasteri*, is described in all stages of the life cycle from *Onychomys leucogaster*, the grasshopper mouse. All stages are located in the hair follicles : adult mite at or above sebaceous gland ducts, immatures and ova at or below these ducts. Mites are generally distributed in all body areas but are most common in muzzle and eyelid. The sex ratio (1 : 5.8) indicates arrhenotoky. This species is apparently a typical low grade pathogen — merely harvesting individual cells of the follicular epithelium, causing minor distension and hyperplasia of the follicle and occasional hair loss.

PARASITE
CYCLE DE VIE
DÉMODICIDE

RÉSUMÉ : Une nouvelle espèce de Demodicidae, petite et allongée, *Demodex leucogasteri*, vivant sur *Onychomys leucogaster* est décrite à toutes ses stases. Celles-ci sont localisées dans les follicules pileux : les adultes se tiennent au niveau ou au-dessus des conduits des glandes sébacées, les immatures et les œufs au niveau ou au-dessous de ceux-ci. Les Acariens se rencontrent généralement sur tout le corps, mais sont plus communs dans le museau et la paupière. Le sex ratio (1 : 5,8) montre l'arrhenotoquie. Apparemment, cette espèce joue un rôle pathogène assez faible ; elle détruit des cellules de l'épithélium folliculaire causant des distensions mineures et l'hyperplasie du follicule. Elle cause occasionnellement la perte de poils.

In a study of a short-bodied demodicid, resident in the upper digestive tract of the gasshopper mouse (NUTTING *et al.*, 1973), another, and synhospitalic member of the genus *Demodex* was discovered in the hair follicles of the skin.

A description of this species, *Demodex leucogasteri* is provided, with notes on population structure, locus in the skin complex, incidence and pathogenesis.

MATERIALS AND METHODS

Eight adult specimens (3 male, 5 female) of *Onychomys leucogaster* were scrape examined for the specimens of *Demodex* used in this study. Mites obtained by this method were mounted in Hoyer's medium and examined under phase contrast microscopy. Sections of skin were obtained from two mice (1 male, 1 female) with substantial parasite loads. These were paraffin-embedded, sectioned (8 to 10 μm), stained with hematoxylin

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and eosin, and studied under light and phase contrast miscroscopy.

Special efforts were made to confirm the developmental stage sequence in the life cycle — as standard practice, especially in cases of suspected synhospitaly.

Demodex leucogasteri n. sp.

(All measurements in micrometers)

DESCRIPTION : with characters of the genus. A very slender (all stages) diminutive member of the genus : the largest specimen, a female, measuring 147.0 × 19.8.

■ *Male* (Fig. 1) : Mean body length 94.8. Other measurements (and for below) in Table I. Slender bodies ; podosomal length 10 less than opisthosoma. Annulae of latter prominent (2 in width) : no opisthosomal organ. Tapers posteriorly to rounded point.

Capitulum rectangular, with large (2.9) medially directed supracoxal spines (Fig. 10). Pharynx horseshoe-shaped, open posteriorly. Minute subgnathosomal setae lateral to anterior of pharynx (Fig. 11). Palpal tarsus with 4 spines, longest 1.9.

Podosoma with four pairs of legs ; legs I separated from legs II by a greater distance than other adjacent pairs. Each leg with rigid coxa (= epimeral plate) plus three movable segments, and pair of distally bifid claws with posteriorly directed spur. Solenidion anterior to claws on legs I and II, absent legs III and IV. Epimeral plates meet at midline.

Genital orifice dorsal, a narrow slit 3.5 long in rounded protuberance at level of leg II (Fig. 12). Two pairs dorsal podosomal tubercles equidistant from midline ; anterior pair 6.8 apart posterior to genital slit at level of leg II, and posterior pair 7.3 apart at level between legs III and IV. Aedeagus 15.5 long.

■ *Female* (Fig. 2) : Mean body length 121.8 ; opisthosoma 32 longer than podosoma.

Capitulum and associated structures similar to male, but length about 3 greater and width about 1.5 greater.

Legs and epimeral plates as in male. Dorsal podosomal setae absent.

TABLE . — Measurements (in μm) of stages in the life cycle of *Demodex leucogasteri*.

Stage	N	Measurements ($\bar{x}$ ± sd)	
Male*	10	length	width
Gnathosoma		12.67 ± 14.8	9.93 ± 0.24
Podosoma		36.24 ± 1.25	16.46 ± 0.55
Opisthosoma		45.89 ± 8.24	16.63 ± 0.55
Total		94.8 ± 14.8	
Female	20		
Gnathosoma		15.42 ± 0.31	11.05 ± 0.28
Podosoma		42.35 ± 1.05	17.03 ± 0.47
Opisthosoma		74.31 ± 9.41	18.78 ± 0.58
Total		121.75 ± 16.87	
Ovum*	9	50.0 ± 3.9	17.84 ± 0.54
Larva*	9	56.13 ± 4.2	14.83 ± 0.46
Protonymph	17	75.62 ± 4.46	16.31 ± 0.54
Nymph	16	102.95 ± 25.93	21.86 ± 0.97

* Weighted standard deviation using :

$$\sqrt{(Nx\ \sigma x^2 + Ny\ \sigma y^2) / (Nx + Ny - 2)}$$

Vulva a longitudinal slit, 4.3 long, extending back from level of posterior margin of epimeral plates IV (Fig. 13).

Annuli and terminus of opisthosoma as in male. A small (1.8 long) opisthosomal organ located in posterior one-quarter.

■ *Ovum* (Fig. 3) : Spindle shaped, 50 long, with rounded ends. Width 17.8 at central bulge.

■ *Larva* (Fig. 4) : Elongate, tapered posteriorly ; 56.1 long. Maximum width 14.8 at legs II. Palps two-segmented with tarsal spines. Horseshoe-shaped pharyngeal bulb, open posteriorly. Subgnathosomal setae absent. Supracoxal spines directed medially.

Three pairs of legs without apparent segmentation. Legs end in single trifid claw. Two pairs

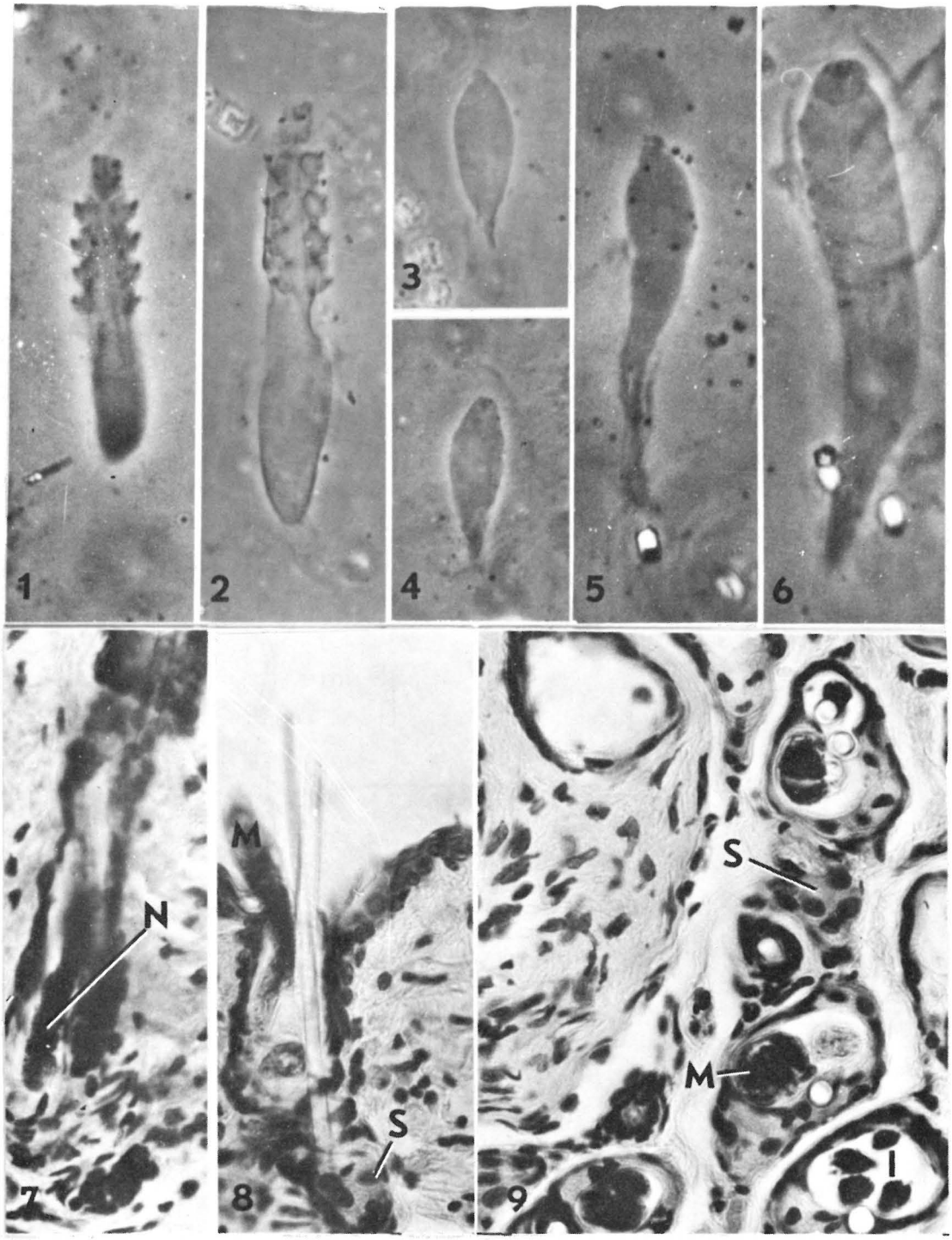

FIG. 1-6. — Photomicrographs of stages in the life cycle of *Demodex leucogasteri*.
1) Male ; 2) Female ; 3) ovum ; 4) larva ; 5) protonymph ; and 6) nymph. (1-4 × 500 ; 5, 6 × 725).

FIG. 7, 8. — Photomicrographs of section of skin (*Onychomys leucogaster*) showing hair follicles in longi-section. Adult female *D. leucogasteri* = M above level of sebaceous gland (= S) ; nymph (= N) undercutting epithelium and deep in hair follicle. Both HaE. (7 × 340 ; 8 × 300).

FIG. 9. — Photomicrograph of skin with hair follicles in x-section showing epidermis (= E) ; adult mite (= M) ; nymphs (= N) ; larvae (= L) ; and sebaceous glands (= S). Note hyperplasia, hair loss and cell destruction to dermis. HaE. (× 700).

epimeral scutes at level legs II and III. Annuli not apparent.

■ *Protonymph* (Fig. 5) : Body similar to larva but larger ; 75.6 long. Maximum width 16.3 at legs II. Gnathosoma and associated structures as larva. Legs each with a pair of trifid claws. Three pairs epimeral scutes, each pair between leg pairs.

■ *Nymph* (Fig. 6) : Body similar to larva ; 103.0 long. Maximum width 21.9 at level between legs III and IV. Gnathosoma and associated structures similar to larva. Four pairs segmented legs, each with pair of trifid claws. Four pairs epimeral scutes, each between leg pairs.

■ *Diagnosis : Demodex leucogasteri* differs markedly from an undescribed, large, stout (♀ *c.* 160 × 46) synhospitalic demodicid reported from the anterior digestive tract (NUTTING *et al.*, 1973). This species has legs evenly spaced in adults as in most rodent demodicids.

In both morphology and habitat *D. leucogasteri* most closely resemble *D. aurati* of the Golden hamster (NUTTING, 1951). *Demodex aurati* is much longer (by 50 μm) and wider (by 5 μm) in all stages except ova, than *D. leucogasteri*. Male anterodorsal podosomal tubercles lie behind genital opening : female genital opening behind open epimera IV in the latter whereas tubercles anterior and epimera closed in *D. aurati*. Both sexes of *D. leucogasteri* have a marked diastema between legs I and II, wanting or weak in *D. aurati*.

■ *Types :* A slide (# 35) with holotype male (black ink ringed) and allotype female (white ink

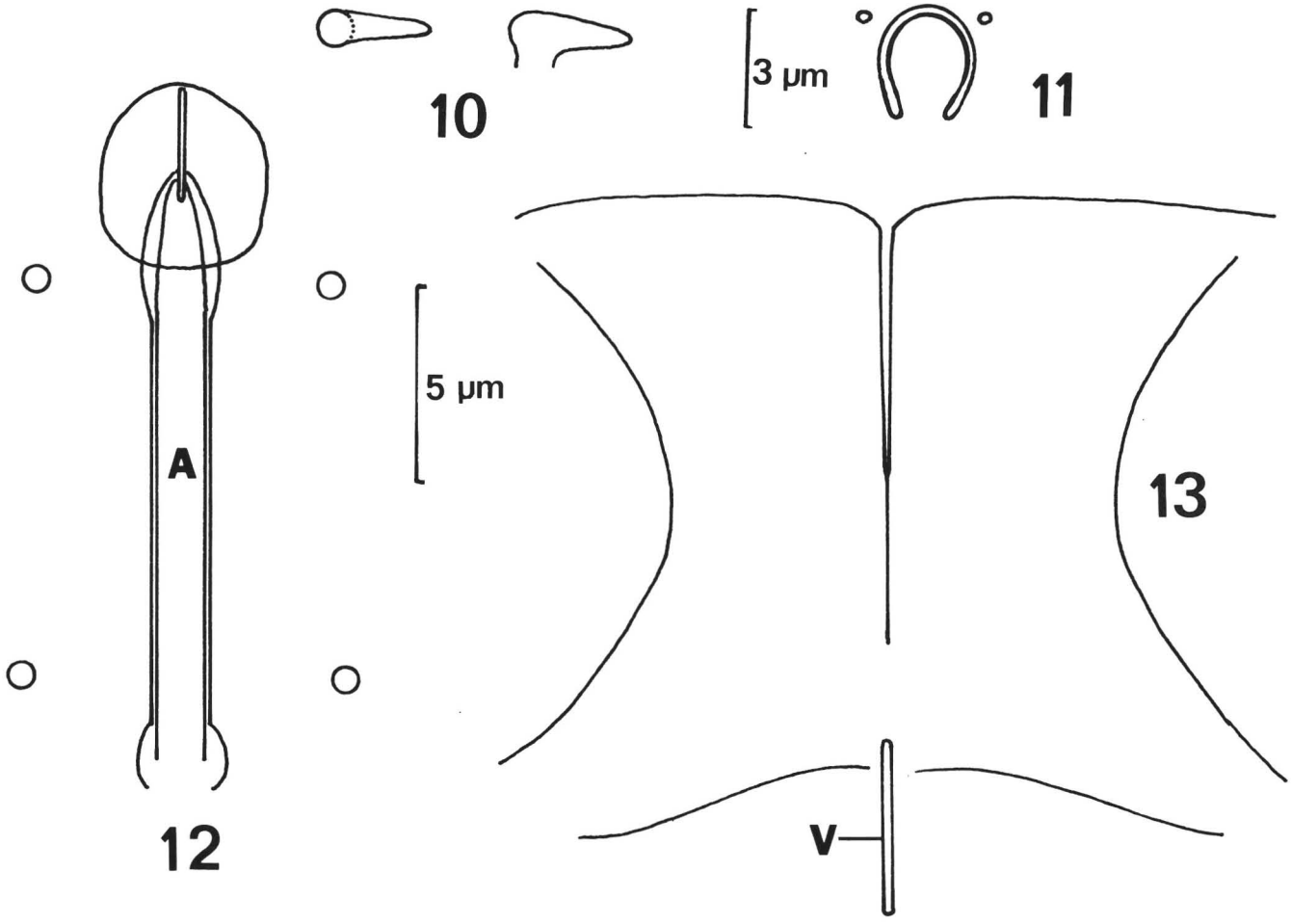

FIG. 10-13. — Critical taxonomic features of *Demodex leucogasteri* (diagrammatic). 10) Lateral and dorsal view of supracoxal seta ; 11) pharyngeal bulb and subgnathosomal setae ; 12) male genitalia (A = aedeagus) ; and 13) female genitalia (V = vulva).

ringed) is retained in the junior authors collection at the University of Massachusetts. Other paratype specimens will be sent to : The Acarology Institute in Columbus, Ohio ; the National Museum, Washington D.C. ; and the British Museum of Natural history, England.

■ *Host :* Mite specimens obtained from laboratory maintained individuals of *Onychomys leucogaster* (WIED-NEWVIED, 1844). These obtained from Washington State through Dr. G. E. COSGROVE, National Laboratories, Oak Ridge, Tenn.

POPULATIONS, INCIDENCE AND LOCI OF INFESTATION

Random counts of stages in the life cycle of *D. leucogasteri* obtained from scrape samples revealed the following : ova 9 ; larvae 9 ; protonymphs 17 ; nymphs 16 ; adult males 11 ; and adult females 64. The sex ratio of 1 : 5.8 (male : female) is suggestive of arrhenotoky.

Scrape examinations of the 8 host specimens showed a mite incidence of 37.5 %. Higher in female hosts, 40 %, than in males, 33.3 %.

Mites were located, in sections, from seven areas of the host body in the following ratios : nape 1 ; axilla 4.6 ; facial 8 ; perianal 9.6 ; muzzle 13 ; and eyelid 44.8. In these and similar sections only immature mites (19 or 17 % of total count) (larva, protonymphs and nymphs) were located deep in the hair follicle below the sebaceous gland (Fig. 7) whereas 35 (30 % total) adults were found above the sebaceous gland. The only ova (4 or 3 % total) were present at the level of the sebaceous gland with 27 (23 % total) immatures and 30 (26 % total) adults at this location. In terms of adult *vs* immatures for location, 100 % of adults were at or above the level of the sebaceous glands and 100 % immatures at or below.

PATHOGENESIS

As with other hair follicle dwelling demodicids, *D. leucogasteri* in all stages except ova, destroys cells of the follicular epithelium (Fig. 9). They also distend the follicular epithelium producing moderate hyperplasia. No host cellular reaction is apparent in the dermis even adjacent to markedly distended follicles or those wherein the mites have penetrated to the dermis (Fig. 9). Neither gross signs of pathogenesis nor changes in host behavior is noted in heavily infested host animals. Hairs are apparently dislodged from follicles housing four or more immature mites.

DISCUSSION AND CONCLUSION

This skin-dwelling species, *D. leucogasteri*, as in other demodicids (NUTTING and DESCH, 1979) seems more diagnostic of the host mammal's phylogenetic position than the upper-digestive tract dwelling demodicid. Also in facets of its biology and low grade pathogenicity it follows rather closely the patterns of other rodent-invading demodicids. Morphologically it is very similar in all stages to *D. aurati* of *Mesocricetus auratus* : sex ratios, implying arrhenotoky, are similar to *Demodex caprae* of *Capra hircus* (LEBEL and DESCH, 1979) ; in stage distribution it also matches *D. aurati* (NUTTING and RAUCH, 1961) ; and for pathogenesis it is nearly identical to *D. aurati*. *Demodex leucogasteri* is, however, the first rodent demodicid to show a marked diastema between legs I and II and one of the few with opisthosomal organs only in adult females.

We suggest that in cases of synhospitaly in host species specific demodicids (as noted in this report) that the most conservative species (*i.e.* that which resides in the hair follicle) be named using the Latin genitive case of the host species designation. More specialized synhospitalic congenerics could then be descriptively specified as *Demodex longissimus* in tarsal glands of *Carollia perspicillata* (DESCH *et al.*, 1972). Such procedures would be advantageous in the ongoing assessment of the validity of using these parasites to determine the patterns of demodicid and host (mammalian) phylogeny (see NUTTING and DESCH, 1979).

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