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

BY Stephen E. HUGHES * and Wm. B. NUTTING *

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.


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.

* Zoology Department, Univ. Mass. Amherst, MA 01003 U.S.A.

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

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. Aedegus 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*.

<table>
<thead>
<tr>
<th>Stage</th>
<th>N</th>
<th>Measurements ($μm$ ± s.d.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male*</td>
<td>10</td>
<td>length</td>
</tr>
<tr>
<td></td>
<td></td>
<td>width</td>
</tr>
<tr>
<td>Gnathosoma</td>
<td></td>
<td>12.67 ± 14.8</td>
</tr>
<tr>
<td>Podosoma</td>
<td></td>
<td>36.24 ± 1.25</td>
</tr>
<tr>
<td>Opisthosoma</td>
<td>45.89 ± 8.24</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>94.8 ± 14.8</td>
</tr>
<tr>
<td>Female</td>
<td>20</td>
<td>length</td>
</tr>
<tr>
<td></td>
<td></td>
<td>width</td>
</tr>
<tr>
<td>Gnathosoma</td>
<td></td>
<td>15.42 ± 0.31</td>
</tr>
<tr>
<td>Podosoma</td>
<td></td>
<td>42.35 ± 1.05</td>
</tr>
<tr>
<td>Opisthosoma</td>
<td>74.31 ± 9.41</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>121.75 ± 16.87</td>
</tr>
<tr>
<td>Ovum*</td>
<td>9</td>
<td>length</td>
</tr>
<tr>
<td></td>
<td></td>
<td>width</td>
</tr>
<tr>
<td>Larva*</td>
<td>9</td>
<td>50.0 ± 3.9</td>
</tr>
<tr>
<td>Protonymph</td>
<td>75.62 ± 4.46</td>
<td></td>
</tr>
<tr>
<td>Nymph</td>
<td>16</td>
<td>102.95 ± 25.93</td>
</tr>
</tbody>
</table>

* Weighted standard deviation using:

\[
\sqrt{\frac{(Nx ox^2 + Ny oy^2)}{(Nx + Ny - 2)}}
\]

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. Horse-shoe-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

![Diagram](image.png)

**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 para-
type specimens will be sent to: The Acarology Institute in Columbus, Ohio; the National Mu-

■ Host: Mite specimens obtained from labora-
try maintained individuals of Onychomys leu-
cogaster (WIED-NEWVIED, 1844). These obtained from Washington State through Dr. G. E. COS-
GROVE, 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 dia-
tema 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 con-
generics could then be descriptively specified as Demodex longissimus in tarsal glands of Carolia perspicillata (DESCH et al., 1972). Such proce-
dures would be advantageous in the ongoing assessment of the validity of using these para-
sites to determine the patterns of demodicid and host (mammalian) phylogeny (see NUTTING and DESCH, 1979).
ACKNOWLEDGMENTS

Thanks to Dr. G. C. COSGROVE, National Laboratories, Oak Ridge, Tenn., in whose laboratory this new species was discovered, for sending us mouse specimens used in this study. Margaret NUTTING provided the drawings and technical help for which we are grateful. Thanks, also, to Dr. C. E. DESCH who confirmed and roughed out figures 10 through 13.

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LITERATURE CITED

DESCH (C.), NUTTING (W.) and LUKOSCHUS (F.), 1972. — Parasitic mites of Surinam VII: Demodex longissimus n. sp. from Carolia perspicillata and D. molossi n. sp. from Molossus molossus (Demodidae; Trombidiformes); Meibomian complex inhabitants of neotropical bats (Chiroptera). — Acarologia, 14: 35-53.


NUTTING (W.), SATTERFIELD (L.) and COSGROVE (G.), 1973. — Demodex sp. infesting tongue, esophagus, and oral cavity of Onychomys leucogaster, the grasshopper mouse. — J. Parasit., 59: 893-896.