DEMODEX ZALOPHI SP. NOV. (ACARI : DEMODICIDAE) FROM *ZALOPHUS CALIFORNIANUS*, THE CALIFORNIA SEA LION

BY

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ABSTRACT

Demodex zalophi sp. nov. from the california sea lion (*Zalophus californianus*) is described. It is a moderate-sized elongate member of the genus which resides in the hair follicle. Epithelial destruction and undercutting near the mouthparts indicate cytophagy : thickened keratin near podosoma and opisthosoma suggests induced hyperkeratinization possibly by strong leg claws.

The discovery of one female and four males of *D. zalophi* invested by a single sheath of keratin and a 1 : 3.2 sex ratio indicates arrhenotoky. *D. zalophi* was recovered from the skin of sea lions (Pinnipedia) in captivity in California, Texas and Australia. It is the first demodicid to be described from a marine mammal.

RÉSUMÉ

Demodex zalophi sp. nov. de l'otarie californienne (*Zalophus californianus*) est décrite. De taille moyenne et allongé, elle vit dans le follicule du poil. La destruction épithéliale et les coupures près des parties bucales indiquent une cytophagie ; la kératine épaissie près du podosoma et de l'opisthosoma suggère une hyperkératinisation venant probablement des fortes griffes des pattes.

La découverte d'une femelle et de quatre males de *D. zalophi* recouverts d'une simple couche de kératine et une proportion sexuelle de 1 : 3.2 indiquent une arrhénotoquie. *D. zalophi* a été prélevé sur la peau d'otaries (Pinnipèdes) en captivité en Californie, au Texas et en Australie c'est le premier demodicide décrit d'un mammifère marin.

INTRODUCTION

Demodicids from the California sea lion, *Zalophus californianus* (Lesson, 1828) have been known since 1969 (KENNEY) with additional reports by DAILEY (1974) and SWEENEY (1974.) The description of this species has been delayed by difficulty in separating specimens from host tissue as well as the discovery by one of us (MDD) of a synhospitalic species residing on this same host.

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The new species of *Demodex* is described with a brief account of its life history and habitat. Information is also provided on habitat destruction, mite activity, and site of infestation This is the first demodicid to be described from a marine mammal.

Materials and methods

Segments of infested skin were biopsied from two sea lions, one each from Sea World, San Diego, California and Six Flags Park, Arlington, Texas. Upon scrape examination demodicid specimens were obtained in very small numbers. However, paraffin sections of this skin at 8-10 μm, stained with Hematoxylin and Eosin, revealed a large, deeply imbedded population of these mites. Other segments of formalin preserved skin were digested with 10 % KOH at 80°C for two days. Sampling revealed that although many mites were present they were tightly packed (3 to 50 mites per packet) in thick keratin. Attempts to tease them loose failed so various concentrations, temperatures and time spans of digestion with trypsin, pepsin, and prolase were attempted. Long term (8 to 10 days at 20°C) digestion in 5 % pepsin proved the most effective.

Additionnal specimens were obtained from a captive *Z. californianus* in Australia. These had been digested from the skin utilizing standard pepsin procedure techniques. Descriptions of all stages were based on 20 specimens. All measurements in micrometers unless otherwise indicated.

Demodex zalophi sp. nov.
(Figure 1-10)

Description : Adult male (Figure 1) : Mean body measurements 201.9 × 29 (Table 1 and values for all stages). Opisthosomal length 4.5 × greatest width. Legs 3 segmented, long, evenly spaced, two trifid claws each, and solenidia in I and II. Pharynx horseshoe-shaped, subgnathosomal tubercles laterad near anterior margin, (Figure 9) and supracoxal spines minute with oval base and conical spine (Figure 8). Gnathosoma nearly square (ventral view).

Genital orifice non-operculate, slightly behind circular small anterior tubercles, posterior tubercles similar shape in line midway laterad of penis. Penis with arrowhead-shaped tip and non-bulbous base (Figure 7).

No opisthosomal organ.

Adult female (Figure 2) : Mean body measurements 257.5 × 33.4. Opisthosomal length 5 × width, and 3 × podosomal length. Gnathosomal and leg structures as in male. No podosomal tubercles. Podosomal dorsum flared so legs less prominent from dorsal aspect.

Vulva a simple longitudinal midventral slit anterior in line with posterior leg bases, and without posterior coxal (IV) sutures (Figure 10).

Opisthosomal organ 2-branched, on short (1.5) stalk opening 55 from opisthosomal terminus Anterior arm nearly equal to posterior arm.

Ovum (Figure 3) : Overall spindle-shaped, anterior rounded with thickened plate, posterior more acuminate, length 85.1 and width (at mid-point) 25.4.

Larva (Figure 4) : Fusiform, 119.4 by 24.4 with 3 pairs conical legs each with 2 bifid claws. Two (?) pairs weak hemicircular ventral scutes. Palps prominent. Pharynx but no subgnathosomal setae.

Table 1. Means and standard deviations for 20 specimens of each stage and sex of Demodex zalophi. All measurements in micrometers.

	Male	Female
Gnathosoma		
Length	19.6± .37	22.2± .47
Width	17.0± .29	19.5± .39
Podosoma		
Length	52.1± 1.58	59.5± 3.02
Width	29.0± 1.24	32.3± .76
Opisthosoma		
Length	130.2± 10.0	174.6± 22.30
Width	28.8± .91	33.4± 1.67
Total Length	201.9± 15.6	257.5± 29.44
Aedeagus	22.3± .76	
Vulva*		9.41*± .10

	Ovum	Larva	Protonymph	Nymph
Length	85.1± 3.39	119.4± 8.19	171.0± 19.52	237.3±42.25
Width	25.4± .42	24.4± .62	27.1± 1.15	32.7± 1.40

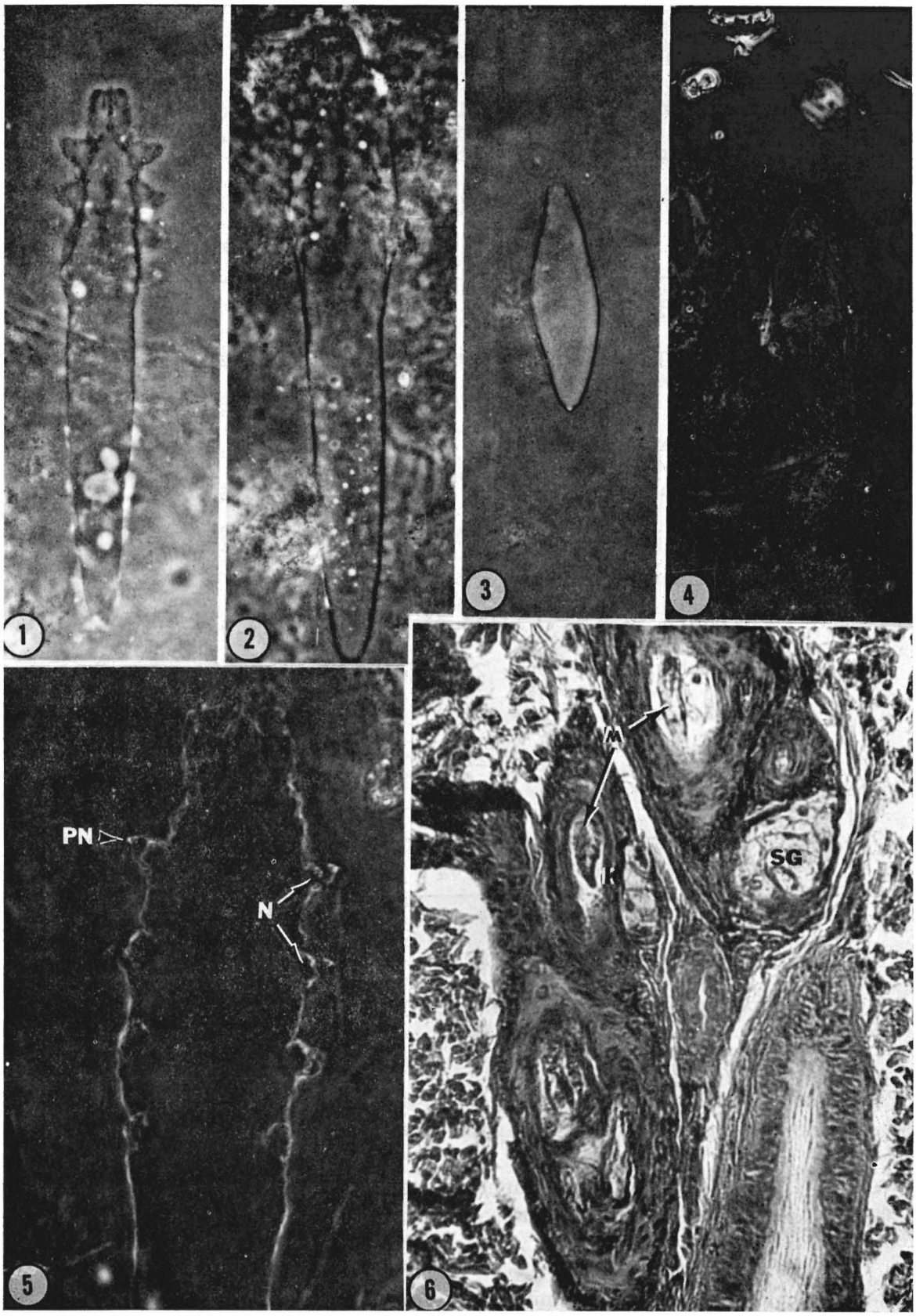
*pseudo - opening (chitin below vulva): actual opening 5
Fig. 10.

PROTONYMPH : Much as larva except larger (171.0 × 27.1), 3 pairs small but thickened ventral scutes, and leg-claws trifid. Note nymph within protonymphal exoskeleton, (Figure 5).

NYMPH : General shape as protonymph but larger (237.3 × 32.7). Four pairs stub-like legs each with 2 pairs trifid claws. Four pairs ventral scutes, pair II mammiform, others as protonymph.

DIAGNOSIS : This species is most similar to *D. canis* (See Desch and Nutting, 1978) but differs in :

1. opisthosoma of both sexes is more than 3 × the podosomal length (close to 2 × in *D. canis*).



FIGS. 1-5. — Photomicrographs of specimens of *Demodex zalophi*. 1) adult male, × 450 ; 2) adult female, × 450 ; 3) ovum, × 450 ; 4) larva, × 450 ; and 5) anterior of nymph developing within protonymph, × 875. In last, PN = protonymphal leg ; N = nymphal leg.

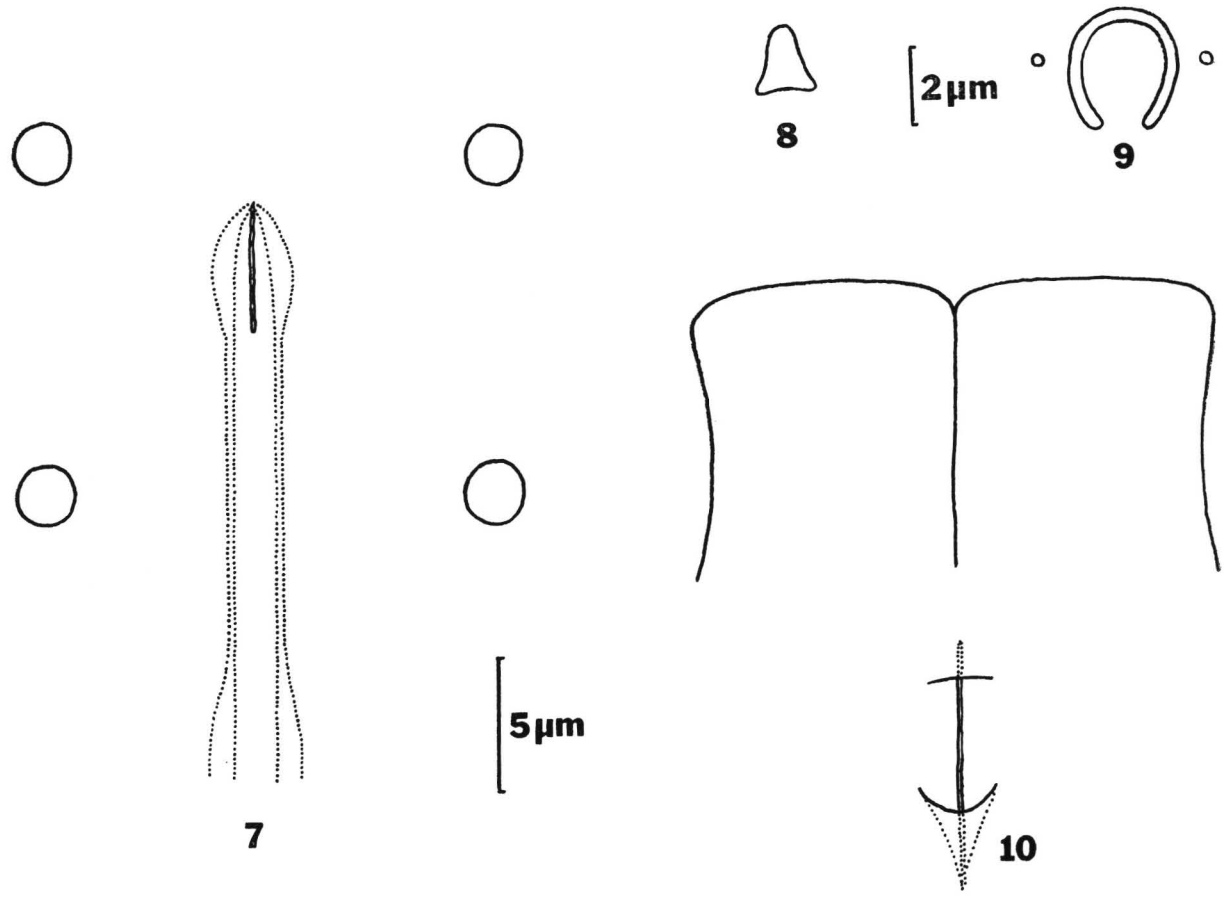
FIG. 6. — Section of skin of *Zalophus californianus* showing segments of mites (M) in hair follicle (note thickened keratin (K) and sebaceous gland (SG), × 275.

2. ova slightly attenuate posteriorly and with anterior thickened plate (more attenuated and without anterior thickened plate in *D. canis*).

3. all immature stages 20+ shorter in *D. zalophi*.

4. genitalia fronted by open coxal plates in female *D. zalophi* vs sutured in *D. canis*. Male *D. zalophi* with circular podosomal tubercles vs peanut-shaped in *D. canis*.

TYPE SPECIMENS : Slide # 34 in the collection of W.B. Nutting as a holotype male (white-ringed) and allotype female (black-ringed). Other paratype specimens will be sent to the National Museum of Natural History, Washington, D.C. the British Museum (Natural History) London, England, and the Acarology Laboratory, Columbus, Ohio.



FIGS. 7-10. — *Demodex zalophi*. 7) penis ; 8) supracoxal spine ; 9) pharynx with subgnathosomal tubercles ; 10) vulva.

HOST : Parasitic on *Zalophus californianus* (Lesson, 1828).

POPULATIONS : Random counts of 312 unsheathed specimens produced a population stage distribution of 33 ova ; 10 larvae ; 5 protonymphs ; 43 nymphs ; 53 adult males, and 168 adult females. The egg to adult female ratio is thus 1 : 5 and sex ratio 1 : 3.2 (male : female). One large single-sheathed group of specimens, the population of one hair follicle, was found to contain a single female and four males (presumably progeny). This and the sex ratio suggest another case of arrhenotoky.

Life cycle and habitat : All stages of the life cycle are found in the hair follicle usually above the duct of the sebaceous gland, although adults were accasionally in the sebaceous gland. Adult and immature mites have their mouthparts closely apposed to the follicular epithelium : cell destruction and undercutting indicates feeding. Distally, for adults, and especially in the area of the podosoma the epithelium is coated with thick (4 to 12,) keratin (Figure 6) which usually remains after KOH digestions as a tough sheath investing the mites. Because adjacent non-parasitized follicles are not thus keratinized, we believe that the large spurred claws may induce keratinization by abrasion.

Locus on host : Specimens obtained from the captive sea lions in California were located only around the genitalia, and flippers. In these two areas (especially the flippers) marked pathogenesis occurred with a similar appearance to pustular demodectic mange in the dog (*Canis familiaris*). This last occasioned by *Demodex canis* associated with *Staphylococcus albus*.

In conclusion : This is the first demodicid reported from any marine mammal. This introduces several new features to the problem of demodicid survival and transference between host animals. It also provides some hope that these mites because of their solid host species specificity and multiple species synhospitaly (see Nutting, 1979) may be used as adjunct descriminators, (biological tags) in (pinniped) phylogeny. The similarity between this pinniped species and *D. canis* of the fissipeds makes plausible the use of demodicids as phylogenetic markers for all mammals.

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