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THE LAELAPTINE MITES OF THE ECHINOLAELAPS COMPLEX FROM THE SOUTHWEST PACIFIC AREA[1]

(Acarina: Mesostigmata)

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Abstract: *Echinolaelaps* is considered a subgenus of *Laelaps*, family Laelaptidae. Five new species are described: 1) *Laelaps* (*Echinolaelaps*) *sedlaeki* from New Guinea and Borneo, type host *Rattus ruber*; 2) *L.* (*E.*) *barbarae* from New Guinea, type host *Pogonomys* sp.; 3) *L.* (*E.*) *aingworthae* from Thailand, Vietnam and Borneo, type host *Rattus niviventer*; 4) *L.* (*E.*) *sinuatus* from New Guinea, type host *Melomys levipes*; and 5) *L.* (*E.*) *wilsoni* from New Guinea, type host *Melomys levipes*. A new name, *mercedeae* is proposed for *E. grandis* Delfinado (preoccupied by *Laelaps grandis* Hirst). Males are described for the first time for *mercedeae*, *insignis* Delfinado, and *traubi* Domrow; new locality and host records are presented for *echidninus* Berlese, *sanguisugus* Vitzthum, *sculpturatus* Vitzthum, and *ornatus* Delfinado. The synonymy of *echidninus* is briefly discussed. Several species exhibited geographic races. Keys to ♂♂ and ♀♀ are presented.

The extensive collecting program of the Entomology Department of Bishop Museum during the past three years has resulted in a very large collection of ectoparasitic mites. Numerous genera and families are represented but only the laelaptine *Echinolaelaps* complex is considered in this paper. There are sufficient numbers of mites of each species for a fine problem in numerical taxonomy but .we have proceeded along conventional taxonomic routes, depending largely upon subjective and intuitive reasoning.

The "Southwest Pacific Area" mentioned in the title includes the Philippine Islands, Vietnam, Thailand, Malay Peninsula, Sumatra, Java, Borneo, and New Guinea.

Probably less than half of the material is mounted on slides but samples from every host and locality collected were mounted and studied. The unmounted material is stored at Bishop Museum in 70% alcohol. Type specimens are in Bishop Museum and duplicates are in the U. S. National Museum.

We are indebted to the many field collectors who had a part in supplying such a wealth of material including Major John E. Scanlon, Chief, Entomology Dept., SEATO Medical Research Laboratory, Bangkok, Thailand, and to David H. Johnson of the U. S. National Museum and Hobart M. Van Deusen of the American Museum of Natural History

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for host determinations; to Miss Carol Nakashige of the Bishop Museum, Entomology Dept. for her careful typing and editing of the manuscript (but whatever errors appear are ours, not hers), and to Miss Sharon Shannon who prepared most of the illustrations accompanying this paper. But especially are we indebted to Miss Hatsuko Arakaki for her unfailing pleasant disposition and her invaluable assistance in preparing the many hundreds of slides.

Genus **Laelaps**

Subgenus **Echinolaelaps** Ewing, 1929

Generotype: *Laelaps echidninus* Berlese, 1887.
Macrolaelaps Ewing, 1929: 185 (type: *Laelaps sanguisugus* Vitzthum).
Camerolaelaps Fonseca, 1960: 17 (type: *Laelaps yauondensis* Taufflieb & Mouchet).

Furman and Tipton (1961) state in their fine paper on parasitic Laelaptinae of Venezuela, "...as information accrues about various taxa one occasionally observes that groups initially appearing very distinct tend to lose their identity...". This is certainly applicable to the generic taxa closely related to *Laelaps*. It then becomes a question of whether to abandon the generic names of very closely related groups or to draw up finer, and perhaps less meaningful, definitions. We have decided that since generic names already exist, it is perhaps best to retain these and show their affinities by reducing them to subgeneric rank. This has the advantage of showing relationships although it is, at best, a cumbersome method.

The genus *Laelaps*, sensu latus, could be defined as those parasitic laelaptines which have 4 pairs of setae on the genitoventral shield. By this definition, the taxa *Longolaelaps*, *Tur*, *Echinolaelaps*, *Tricholaelaps*, *Mysolaelaps* and *Laelaps* sensu strictu would be included. Of this complex, only *Echinolaelaps*, *Mysolaelaps*, *Tricholaelaps*, and some species of *Tur*, are longer than one millimeter. *Mysolaelaps* can be recognized by the minute dorsal setae; *Tricholaelaps* by the lack of coxal spiniform setae and the presence of long dorsal and ventral setae; *Echinolaelaps* by the presence of coxal spiniform setae, at least in the female; and those species of *Tur* longer than one millimeter, by the anal and genitoventral shields being fused. For a definition of those species of *Tur* less than one millimeter long see Fonseca (1959). *Longolaelaps* is distinguished by its elongate body shape and the presence of a transversely striated presternal area. For an excellent review of the subfamily Laelaptinae and a definition of the genus *Laelaps* sensu strictu see Tipton (1960).

A fuller definition of *Laelaps*, subgenus *Echinolaelaps* Ewing, 1929 is as follows. Dorsal plate covering most of dorsum; setae long and slender, never short and thorn-like. Peritreme always in a narrow plate which is more or less broadened depending on the species. Peritremal plate extends posteriorly from the stigma for approximately the diameter of the stigma. *Female*: Sternal plate approximately as long as wide, or if not, then the epigynial plate is enlarged and in juxtaposition with the anal plate. *Male*: Not distinguishable from *Laelaps* sensu strictu except for size. The holoventral plate is undivided and widely expanded behind coxa IV. It bears 9–10 pairs of setae, occasionally with 1–6 smaller, accessory setae on the margins of the expanded portion behind coxae IV. Spermatodactyl long, blade-like, scimitar shaped. Chaetotaxy generally similar to that of ♀ except on

coxae. The coxal setae of the ♂ are nearly always piliform, and if not, the ♂ spiniforms are not as heavy as those of the ♀. *Immature forms*: Generally resemble the ♀ in gnathosomal and cheliceral features and the ♂ in chaetotaxy; except for size, indistinguishable from *Laelaps* s. s.

The key to species which follows does not include some of the names listed under *Echinolaelaps* by Strandtmann and Wharton (1958) either because they have been removed to other genera or subgenera, or have been synonymized with other species.

Echinolaelaps aragonensis (Fonseca) has been removed to *Tur* (see Tipton 1960: 287).

Echinolaelaps berlesei (Fonseca) is considered a synonym of *echidninus*. Consequently *Echinolaelaps flavioi* Tipton: 288, proposed as a new name for *Laelaps berlesei* Fonseca which was preoccupied by *Laelaps berlesei* G. & R. Canestrini, is also a synonym of *echidninus*.

Echinolaelaps pallidus (Tragardh) is considered a synonym of *echidninus*. Ferris had indicated this in 1932: 117 and it is here accepted.

Echinolaelaps vansomereni (Hirst) has been returned to *Laelaps* sensu strictu. (see Tipton, 1960: 284).

Key to the species of Echinolaelaps (based on ♀♀)

1. Metapodal plates always clearly smaller than coxa IV. Epigynial plate variable...2
   Metapodal plates very large, approximating coxa IV in size. Epigynial plate large and very close to anal plate 21
2 (1). Posterior margin of genitoventral plate concave and fitting closely around anterior margin of anal plate 3
   Posterior margin of genitoventral plate straight or convex; if concave, separated from anal plate by at least the diameter of anal pore or not conforming closely to anterior margin of anal plate. If apparently closely fitting the anal plate, which may occur due to mounting, then the dorsal setae are short and fail to overlap and sternal setae 1 barely reaching base of sternal setae 2 8
3 (2). Sternal plate distinctly longer than wide, with a strong, bilobate posterior production that reaches to the posterior margin of coxa III. Coxae I with converging internal apodemes. Ventrals very stout and frequently on individual platelets 4
   Sternal plate square or slightly longer than wide. Posterior bilobate production not so pronounced and extending to, or only slightly beyond, middle of coxa III. Coxae I without apodemes 5
4 (3). Epigynial plate greatly expanded, distance between setae GV3 distinctly greater than distance between setae GV2. Adanal setae reaching base of postanal seta ..... **sculpturatus**
   Distance between GV3 not much greater than between GV2. Adanal setae short, originating posterior to anal pore and not reaching base of postanal seta ..... **mercedeae**
5 (3). Larger and more robust mites (1200–1450 μ). Sternal plate more than 300 μ long and always longer than wide. Tritosternum less than its width in front

of the sternal plate 6

Smaller and more delicate mites (900–1200 μ). Sternal plate always less than 300 μ long and may be wider than long. Tritosternum more than its width in front of the sternal plate 7

6 (5). Average length, 1350 μ; sternal plate averages 350 μ long × 325 μ wide; nonsclerotized portion of venter with the usual 3 pairs of long paraventrals and 9–10 pairs of shorter, stiff, rather broad, ventrals. Pilus dentilis straight, slender, not knobbed ..... **sedlaceki**

Average length, 1225 μ; sternal plate averages 343 μ long × 292 μ wide. Venter with only 4–5 pairs of smaller ventrals in addition to the 3 pairs of longer paraventrals. Pilus long, slender, slightly swollen medially and with an apical knob which is flexed and appendiculate..... **ornatus**

7 (5). Pilus dentilis knobbed and bent at apex. Coxae II and III with spiniforms. Adanal setae extending well beyond base of postanal seta ..... **echidninus**

Pilus bent at tip but not knobbed. Only coxa I with a spiniform seta. Adanals barely reaching base of postanal seta ..... **praomyia**

8 (2). Dorsal setae clearly overlapping. Sternal setae overlap by 1/3 or more (if short and barely overlapping, then only coxa I, or only coxae III with a spiniform)..... 9

Dorsal setae weak, slender, not reaching base of succeeding setae. Bluntly rounded spiniforms on coxae I–III. (Epigynial plate greatly expanded and may occasionally be very close to the anal plate)..... **barbarae**

9 (8). Coxae II or III with spiniforms. No ventral spiniform on femur I. Sternal setae overlapping by 1/3 or more. Tectum a thin membrane with an indefinite anterior border 10

Coxa I with 2 spiniforms; all other coxal setae piliform. Femur I with a ventral spiniform. Sternal setae barely overlapping. Ventral setae few and long-piliform. Tectum said to be 4-lobed ..... **boultoni**

10 (9). Sternal plate about as long as wide 11

Sternal plate about 2/3 as long as wide 22

11 (10). Epigynial plate markedly expanded and distinctly concave on posterior margin. Setae GV3 much farther apart than GV2; GV1 not as far apart as GV4..... 12

Epigynial plate not widely expanded although posterior margin may be concave; GV2 and GV3 about equally far apart. Distance between genital setae (GV1) as great or greater than distance between setae GV4. Adanal setae always reaching beyond base of postanal seta 14

12 (11). Trochanter I with a ventral spiniform (which is shorter but nearly as thick as apical spiniform of coxa I). Adanal setae not reaching base of postanal seta ..... **traubi**

Trochanter I without a spiniform. Adanals surpassing base of postanal seta..... 13

13 (12). Sternal plate as wide as long. Setae of the epigynial plate more than 200 μ long..... **muricola**

Sternal plate wider than long. Epigynial setae about 150 μ long ..... **wittei**

14 (11). Distance between setae GV4 greater than distance between adanal setae 15

Distance between GV4 about the same as distance between adanals 20

15 (14). Dorsal subterminal setae surpassing margin of dorsal plate. Apical seta of

coxa I spiniform 16
Dorsal subterminals very short, not reaching posterior margin of dorsal plate. Apical seta of coxa I piliform. (Internal rostral setae and capitular setae equal) ..... **insignis**

16 (15). Adanals surpassing base of postanal by 1/3 or more their length 17
Adanals barely reaching base of postanal seta ..... **grandis**

17 (16). Distance between GV4 about the same as width of anal plate. Adanals extending beyond base of postanal seta by no more than 1/3 their length 18
Distance between GV4 less than width of anal plate. Adanal setae surpassing base of postanal seta by 1/2 or more their length 19

18 (17). Both setae of coxa I thick and strong but the proximal is tapered to a fine point. Anterior margin of sternal plate straight. Setae GV4 not quite as far apart as GV1. Anal plate roundly oval. Pilus dentilis swollen medially and slightly sigmoid. 1250–1350 μ ..... **aingworthae**
Both setae of coxa I blunt spiniforms. Anterior margin of sternal plate convex. GV4 a bit wider apart than GV1. Anal plate with sides produced. Pilus dentilis straight and narrow basally and with a large inflated and reflexed tip. 1060–1160 μ ..... **delta**

19 (17). Posterior margin of sternal plate straight or slightly concave ..... **giganteus**
Posterior margin of sternal plate with a bilobate, median projection ..... **sanguisugus**

20 (14). Epigynial plate linguiform; with 30–60 pairs of stiff, short setae on unsclerotized portion of venter. Distal seta on coxa I and posterior seta on coxa II spiniform. Trochanter I with a ventral spiniform ..... **bakeri**
Epigynial plate flask-shaped; with 15–20 pairs of stiff but not especially short, ventral setae. Distal seta on coxa I and posterior seta on coxa II piliform. Anal plate elongated ..... **hapaloti**

21 (1). Sternal seta I not reaching posterior margin of sternal plate. Peritreme reaching anterior margin of coxa I. Coxal seta IV small spiniform; both coxal setae I spiniform ..... **ugandanus**
Sternal seta I longer, surpassing posterior margin of sternal plate. Peritreme extending only to anterior margin of coxa II. Coxal seta IV small and piliform ..... **yaoundensis**
(On the basis of the large metapodal plate, Fonseca (Acarologia **2**: 17, 1960) made this the genotype of a new genus *Camerolaelaps*).

22 (10). Posterior margin of genitoventral plate straight. Anal plate with anterior margin also straight and conforming to the genitoventral plate. Anal pore near middle of plate, the adanal setae arising opposite middle of pore. Both of coxal setae I sharply pointed spiniforms ..... **wilsoni**
Posterior margin of genitoventral plate concave. Anal plate rounded; pore near anterior margin; adanal setae inserted posterior to pore and not reaching postanal seta. All coxal setae except for posterior seta of coxa III slender piliform ..... **sinuatus**

Key to known males of Echinolaelaps

1. All coxal setae tapering to fine points although posterior seta of coxa III may

be short and stout 2
Coxa III always with posterior blunt-tipped spiniform seta 4
2 (1). Ventral portion of holoventral plate with 5–7 pairs of setae. Adanal setae about 1/2 length of postanal seta 3
Ventral portion of holoventral plate with approximately 16 pairs of setae. Adanal setae as long as postanal setae ..... **yaoundensis**
3 (2). Average idiosomal length 930 μ. Tarsi II and III bearing one or more heavy setae with blunt tips. Longest seta on tarsus IV not more than 1/3 longer than ambulacrum. Length-width ratio of tarsus I about 3.8 : 1 ..... **sedlaceki**
Average idiosomal length 880 μ. Tarsi I and II may have one or more heavy setae, however all setae tapering to fine points. Longest seta on tarsus IV nearly 2× as long as ambulacrum. Length-width ratio of tarsus I about 4.4 : 1 ..... **echidninus**
4 (1). Only coxa III with blunt spiniform seta; all other coxal setae tapering to a fine point although they may be stout 5
Coxae II and III or I, II and III with blunt spiniform setae 9
5 (4). Distal setae of tarsi II and III stout and recurved. Adanal setae not extending to base of postanal seta. Dorsal subterminal setae about 1/3 as long as dorsal terminal setae. Internal posterior rostral setae about the same size as anterior rostral setae and extending only halfway to base of capitular setae. Average idiosomal length 800 μ ..... **traubi**
Distal setae of tarsi II and III never greatly recurved. Adanal setae extending to base of postanal seta, or if they do not, then internal posterior rostral setae extending to base of capitular setae 6
6 (5). All setae on tarsi II and III tapering to fine points. Pair of very fine setae situated lateral to tarsal claws protruding from distal end of ambulacral processes of tarsi III and IV. Average idiosomal length 740 μ ..... **wilsoni**
One or more setae on tarsi II and III with blunt tips. Ambulacral processes lacking setae 7
7 (6). Dorsal subterminal setae 1/3 or less length of dorsal terminal setae. Idiosomal length ranging from 655–721 μ ..... **insignis**
Dorsal subterminal setae more than 1/3 length of dorsal terminal setae. Idiosomal length greater than 850 μ 8
8 (7). Adanal setae extending beyond postanal seta. Idiosomal length 910–990 μ ..... **mercedeae**
9 (4). Idiosomal length averages 1300 μ. Adanal setae surpassing base of postanal seta by 1/2 their length. Internal posterior rostral seta very long, surpassing base of capitular setae. Peritreme reaching coxa I. Coxae I–III each with a blunt spiniform seta. Coxa IV with a small, obtusely pointed spiniform seta ..... **sanguisugus**
Idiosomal length averages 900 μ. Adanal setae surpassing postanal seta by 1/3 or less their length. Internal posterior rostral seta not extending to base of gnathosomal seta. Peritreme not extending beyond coxa II ..... **sedlaceki**

Laelaps (Echinolaelaps) echidninus Berlese Fig. 1.

Laelaps echidninus Berl., 1887: fasc. 39.
Laelaps pallidus Tragardh, 1931: 616.
Laelaps berlesei Fonseca, 1938: 104. **New Synonymy.**
Echinolaelaps echidninus subsp. *vitzthumi* Turk, 1950: 71.
Echinolaelaps hirsti Turk, 1950: 71.
Echinolaelaps hirsti subsp. *ceylonicus* Turk, 1950: 72.
Echinolaelaps flavioi Tipton, 1960: 288 (new name for *Laelaps berlesei* Fonseca preoccupied by *Laelaps berlesei* Canestrini).

Female: Averages 1100 μ long. Twenty specimens ranging from 1020–1200 μ. Pilus dentilis straight, slender with knobbed, sharply flexed and appendiculate apex. Sternal plate about as wide as long, averaging 228 μ long on the midline by 215 μ wide at the narrowest point, but length and width may be equal or even a bit wider than long; anterior margin slightly convex, posterior margin slightly produced. Tritosternum originates more than width of its base in front of sternal plate. Epigynial plate nearly always quite similar to the illustration. Adanal setae from 1/2–2/3 as long as postanal seta. Inner basal seta of trochanter I varies from a long piliform, as illustrated, to a shorter and heavier seta but never a distinct spiniform. On trochanter IV, the middle seta of the 3 posterior marginals may be piliform and equal to the 2 adjoining it (as illustrated) but is frequently shorter and heavier than those on either side of it.

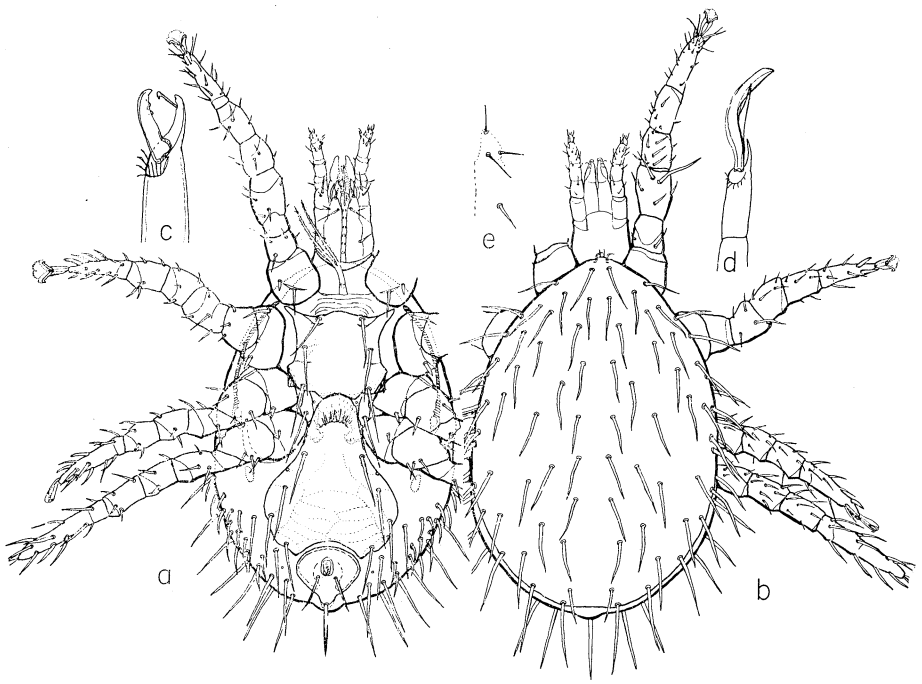

Fig. 1. *Laelaps (Echinolaelaps) echidninus* Berlese, 1887. a, venter of ♀; b, dorsum of ♀; c, chela of ♀; d, spermatodactyl of ♂; e, gnathosomal setae of ♀.

Male: Averages about 880 μ in length. Coxal setae piliform and all tarsal setae tapering to fine points. Peritreme extending anteriorly to middle of coxa II. Holoventral plate bearing 5 pairs of long setae in region between genital and anal setae. All anal setae slender with postanal heavier and about 2× as long as adanals. Dorsal subterminal setae 1/2 as long as terminals. Longest posterior setae very slightly serrated on one side. Length ratio of sickle-shaped spermatodactyl to cheliceral tibia about 4 : 2.75. Capitular seta slightly heavier and almost as long as internal posterior rostral seta.

Immature forms: Can be recognized by the pilus dentilis which is identical to that of the ♀. Coxal spiniforms lacking. Deutonymph averages 986 μ in length and protonymph averages 640 μ.

Remarks: With one exception, the specimens from the various hosts in the 4 regions recorded below do not exhibit any consistent variations. The exception is 3 specimens from *Rattus panglima*, Minagas Point, Philippine Islands, which have all coxal setae piliform.

The identity of *echidninus* remains somewhat of an enigma. Berlese's description and illustrations differ in many respects from the descriptions and illustrations of subsequent authors (Hirst, 1914; Vitzthum, 1926; Bregetova, 1956; Strandtmann & Wharton, 1958). Berlese gives the idiosomal length as 800 μ and his illustrations indicate an angular genitoventral plate, a concave posterior margin on the sternal plate, and a slender, straight, hair-like pilus dentilis. The other authors mentioned have considered *echidninus* to be 900–1200 μ in length with the posterior margin of the sternal plate being straight to convex, and the lateral margins of the genitoventral plate being smoothly rounded or irregular but not angulate. Hirst (1914) and Strandtmann & Wharton (1958) have indicated a slender, knobbed pilus dentilis.

Why has Berlese's name been applied to these mites if they differ so markedly? Probably because the mite Berlese described was a large *Laelaps* with a concave genitoventral plate fitted closely to the anal plate and which occurred on the genus *Rattus*. It would seem logical to assign a mite commonly found on domestic rats and of this general facies to Berlese's species even though it differs in some details. Especially since it is evident that Berlese's illustrations were done in haste and, apparently, were not meant to do more than indicate in a general way what the mite was like. Berlese showed the 2 long, dorsal setae of femur I to be of equal length which is never the case in any species of *Laelaps*; the spiniform of coxa IV is shown to be larger than the spiniforms of coxae I and II in Berlese's illustrations whereas the converse is always true for *Laelaps*; Berlese did not show the marginal setae on coxae II and III although all laelaptids have these setae; the poststigmal plate is not shown and the gnathosoma and tritosternum are only crudely indicated.

Hirst (1913) redescribed the species and presented excellent illustrations of the venter of the ♀ and the pilus dentilis. No doubt he accepted Berlese's name for the mite on the basis of general appearance and the host from which it was taken. We feel confident that an examination of the holotype would confirm Hirst's position and therefore accept Hirst's illustrations as being representative of this species. With this concept in mind, what is the status of the mites called *echidninus* by subsequent authors?

Turk (1950) expressed doubt that *echidninus* Berlese, 1887, *echidninus* Hirst, 1913, and *echidninus* Vitzthum, 1926 are the same. After detailing the discrepancies in the drawings of these authors he came to the surprising conclusion that Berlese's and Vitzthum's species

are conspecific, but that *echidninus* Hirst represents a different species. He further concluded that *Laelaps pallidus* Tragardh, 1931 and *echidninus* Hirst are conspecific and proceeded to assign these to a new species *hirsti*. Apparently on the basis of his examinations of illustrations, Turk proposed the following:

Echinolaelaps echidninus subsp. *echidninus* (Berlese), 1887 (=*Laelaps echidninus* Berl., 1887).

Echinolaelaps echidninus subsp. *vitzthumi* n. subsp. (=*Laelaps echidninus* Vitzthum, 1926).

Echinolaelaps hirsti, n. sp. (=*Laelaps echidninus* Hirst, 1913 & 1914 non Berlese, 1887).

Echinolaelaps hirsti subsp. *ceylonicus* n. subsp.

Echinolaelaps hirsti subsp. *pallidus* n. status (=*Laelaps pallidus* Tragardh, 1931).

We must agree with Zumpt and Till (1958: 264), that the discrepancies found in the illustrations of Berlese, Hirst, and Vitzthum do not warrant such conclusions and that all the specimens considered above are referable to Berlese's *echidninus*.

It should be pointed out that Ferris (1932) had previously suggested that *pallidus* was indistinguishable from *echidninus*.

The subspecies *ceylonicus* was erected in our opinion on untenable characters. Turk failed to point out any significant differences in the ♀♀ of *ceylonicus* and *hirsti* but noted that deutonymphs of *ceylonicus* have "...enormously developed clavate spines on the femur, genu, and tarsus of the second pair of legs...", and that the fixed digit of the chela has 4 recurved teeth, differing in this respect from the ♀. This does not agree with our observations on the nymphs of several species of *Laelaps*. The leg chaetotaxy of the nymphs is invariably less spiniform than in the ♀♀, and the chelae of nymphs and ♀♀ are always remarkably similar. We respectfully suggest that the deutonymphs described by Turk probably belong to a genus other than *Laelaps*.

Laelaps berlesei Fonseca, 1938 was described from 2 specimens (1♀, 1♂) taken from *Galictis vitatta*, a weasel-like carnivore, occurring in Brazil. Professor Fonseca stated that *berlesei* differs from *echidninus* only in the shape and disposition of the genitoventral plate. This plate being wider, with angulous, undulate margins, and touching coxa IV in *berlesei*. Since the description of the female was drawn from a single specimen, and the differences indicated are well within the range of variability found in *echidninus*, we consider *berlesei* Fonseca to be a junior synonym of *echidninus* Berlese. It should also be noted that the grison, *Galictis vitatta*, is not a natural host for laelaptines.

Tipton (1960) proposed the name *Echinolaelaps flavioi* for *Laelaps berlesei* Fonseca, 1938 but since the latter specific name was preoccupied by *Laelaps berlesei* Canestrini, 1882, this name also becomes a junior synonym of *echidninus* Berlese.

Although geographic variants, or subspecies, of *echidninus* will most likely be found to exist, we feel that until more quantitative data are accumulated with respect to the degree of variability within this species, it is best to refrain from making such designations.

DISTRIBUTION: Cosmopolitan in temperate and tropical zones.

THAILAND. Nan: 8, Pan Pha Hang, 30. XI–16. XII. 1961, Kitti Thonglongya, *Rattus rattus*; 4, same data but 1. XII. 1961, *Mus musculus*; 1, same data but 19. XII. 1961, *Tupaia glis*. Chiengmai: 1, Ban Pong, I. 1962, SMRL V–264, *Rattus exulans concolor*; 1, Ban Khi Lek, I. 1962, SMRL V–268, *Bandicota indica*; 7, same data but I. 1962, SMRL 27– & 272

Rattus rattus; 2, same data but I. 1962, SMRL 273 *Rattus exulans*; 3, Ban Pong, Amphoe San Sai, 12–17. II. 1962, SMRL 492–93 & 513 *Rattus exulans concolor*; 1, Ban Khi Lek, Amphoe Mae Taeng, 20. II. 1962, SMRL 527 *Rattus exulans*; 1, same data but 21. II. 1962, SMRL 528 *Bandicota indica*; 2, Ban Pong, Amphoe San Sai, 10. III. 1962, SMRL 596 *Rattus rattus*; 5, Pha Lad., Doi Suthep, 21–30. III. 1962, SMRL 639 & 641 *Rattus niviventer*; 8, same data but 31. III–9. IV. 1962, SMRL 689, 692, 709, 737–38 *Rattus rattus*; 2, Ban Chang Khien, Amphoe Muang, 1. IV. 1962, SMRL 698 *Rattus rattus*. Bankok: 13, 6–17. II. 1962, SMRL 453, 470–71, 475–76, 479–80, 486, & 490 *Rattus norvegicus*; 1, 6. II. 1962, SMRL 454 *Mus musculus*; 2, 8–10. II. 1962, SMRL 458–59 *Rattus rattus*.

VIETNAM. Dalat: 36, 1500 m, 13–14. IX. 1960, C. Yoshimoto & B. Feinstein, ♯ 263–64, 266, 268 *Rattus niviventer champa*, ♯265 & 267 same data, *Rattus rattus molliculus*. Thac Da Tan La: 28, 1450 m, 25. IX. 1960, Yoshimoto & Feinstein, ♯ 297–98 *Rattus niviventer champa*. Ninh Ma: 22, 100 m, 29. XI–2. XII. 1960, Yoshimoto & Feinstein, ♯ 566 & 575 *Rattus rattus molliculus*. Mt. Lang Bian: 6, 2000 m, 22–27. V. 1961, N. Spencer, ♯ 941, *Rattus fulvescens*, & 981 (an undescribed high mountain rat, *Rattus* sp., apparently related to *R. baluensis* of N. Borneo). Khe Sanh: 1, 31. I. 1961, Spencer & Feinstein, ♯ 758, *Rattus niviventer*; 1, same data but 28. I. 1961, ♯ 763 *Rattus niviventer*. Kontum: 1, 630 m, stop 19, 15. V. 1960, R. Leech, ♯ 30 (host ?).

W NEW GUINEA. Vogelkop: 5, Kebar Val. W of Manokwari, 550 m, 4–31. I. 1962, L. & S. Quate, BM–NG 629–30, 640–72, & 716 *Rattus exulans*; 2, same data but BM–NG 631–35 & 718 *Rattus*; 2, same data but BM–NG 721 & 843–44 *Rattus exulans*. Star Mts: 2, Sibil Val., 1245 m, 18. X–8. XI. 1961, L. & S. Quate, BM–NG 115 *Rattus ruber*. Biak I.: 1, Kampung Landbouw, 50–100 m, T. C. Maa, TMP 63 (or 03) *Rattus rattus*.

BOUGAINVILLE: 2, Kieta, 27. XI. 1959, Maa, TMP 1319 & 1322 *Rattus*.

PHILIPPINE IS. Palawan I.: 3, Mt. Mantalingajar, 1200–1450 m, 15. IV. 1962, BBM 1439 & 1443. Minagas Point: 3, Dalawan Bay, Balabac, 21. IV. 1961, M. Thompson & Gonzales, BBM-2569 *Rattus panglima*. (Note: these specimens from Minagas vary from what is generally considered more typical in that the coxal setae all are piliform).

Laelaps (Echinolaelaps) sedlaceki Strandtmann and Mitchell, n. sp. Fig. 2.

Female: Ranges in length from 1240–1440 μ. Twenty specimens averaged 1350 μ. A dark species with many thorn-like ventral setae, strong tarsal setae, greatly expanded genitoventral plate, and a slender, straight or slightly bent pilus dentilis. Dorsal plate covering most of dorsum, with long, overlapping setae; scapular seta prominent; subterminal setae 1/2 as long as terminal setae and surpassing posterior margin of plate which is somewhat truncate. Tritosternum on margin of sternal plate to less than its basal width in front of plate. Sternal plate roughly square, slightly produced posteriorly, convex anteriorly; averages 350 μ long on the mid line × 325 μ wide at the narrowest point; posterolaterally overlapping base of coxa III. Sternal and metasternal setae moderately long; metasternals slightly surpassing base of genital setae. Genitoventral plate roundly to sharply angulate laterally; widest anterior to seta GV3. Soft integument of ventral opisthosoma with 3 long paraventral setae plus 12–15 shorter, broad, stiff ventral setae. Adanal setae about 2/3 as long as postanal but only 1/2 as thick. Peritreme extending to posterior margin of coxa I or beyond. Internal posterior rostral seta more than 2× as long as capitular seta; pilus dentilis straight, or slightly bent at apex, narrow and pointed. All coxal setae strong

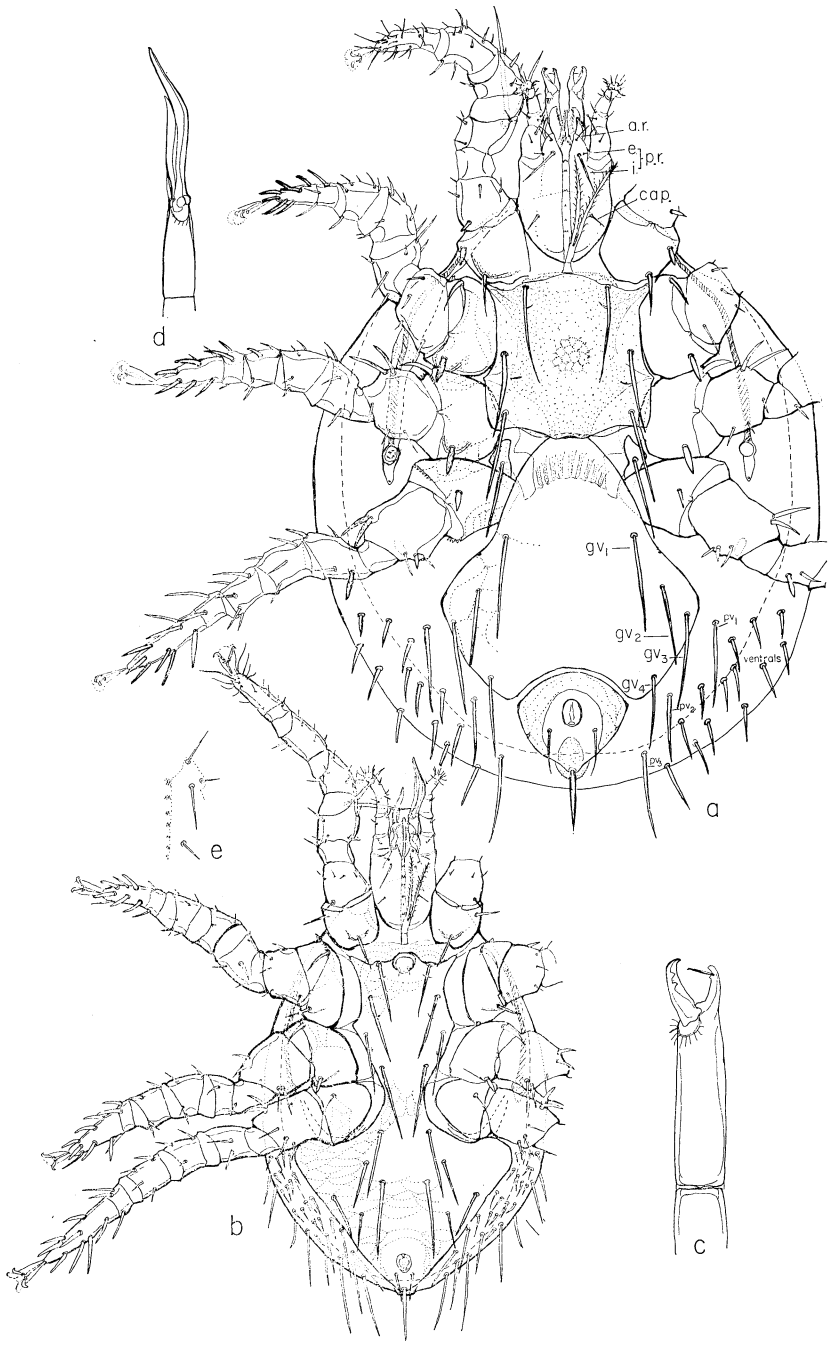

Fig. 2. *Laelaps* (*Echinolaelaps*) *sedlaceki* n. sp. a, venter of ♀; b, venter of ♂; c, chela of ♀; d, spermatodactyl of ♂; e, gnathosomal setae of ♂.

and heavy; basal I and marginals II and III finely tapered. Tarsi II, III, and IV have strong, straight setae, nearly 2× as heavy as those on corresponding tibiae; some setae on tarsi II and III with blunt tips.

Male: Averages 930 μ in length, ranging from 900–946 μ. Spermatodactyl sinuately straight, though it may be somewhat reflexed. Length ratio of spermatodactyl to cheliceral tibia 5.5 : 3. Internal posterior rostral seta only slightly longer than anterior rostral seta and does not quite reach base of capitular seta. Adanal seta more than 1/2 as long as postanal seta. Dorsal subterminals about 1/2 as long as terminals. Peritreme reaching middle of coxa II. Ventral portion of holoventral plate with 5 pairs of long setae and with no accessory setae. Tarsal setae strong; tarsi II and III each with 2 blunt setae apically; longest seta on tarsus IV about 1/3 longer than ambulacral process. Coxal setae variable, from the same hosts and localities are ♂♂ with all coxal setae piliform, while others have spiniforms on coxa II and III.

Immatures: 1 deutonymph measuring 1056 μ in length. Tarsal setae strong as in ♀. Pilus dentilis similar to that of ♀. No coxal spiniforms.

Holotype ♀ (BISHOP 3456), Wau, 1200 m, NE New Guinea, 23. III. 1962, J. H. Sedlacek, on *Rattus ruber* # 246. Also from the same host (No. 246) are 4♀♀ and 1♂. Some 200 additional specimens from Wau, NE New Guinea off *Rattus ruber* are designated as paratypes.

Named for Josef H. Sedlacek, son of Josef Sedlacek of Bishop Museum, who has for two years assisted his father in collecting many fine specimens for the museum at the Bishop Museum field station in Wau.

Remarks: The ♀♀ are similar to *L.* (*E.*) *echidninus* but larger and more robust. The tritosternum arises much closer to the sternal plate and the inner basal seta of trochanter I tends to be more spiniform in *sedlaceki*. Of the 3 posteroapical setae on coxa III, the middle one is always shorter and heavier than the laterals. Males of the 2 species are quite similar. The characters mentioned in the key are possibly the only ones that serve to differentiate the 2 species, and they are unfortunately only relative. We are quite conscious of the possibility that this is only a form of *echidninus* but on the basis of the consistent differences in size in the large series at our disposal we are forced to consider *echidninus* and *sedlaceki* as 2 distinct entities.

The type series is from New Guinea and there is rather close agreement in all specimens of the large series. Specimens from Borneo differ from the type series (and the illustrations) as follows: The lateral margins of the sternal plate are smoothly convex, the inner basal seta of trochanter I is distinctly spiniform, the tritosternum is about its basal width anterior to the sternal plate, and the pilus dentilis is a bit longer. Also the ♀♀ are a bit smaller, averaging 1300 μ. The sternal plate averages 330×315 μ. Apparently the sternal plate is never quite as wide as long in *sedlaceki* whereas in *echidninus* it frequently is.

E. sedlaceki seems to be the predominant form of *Echinolaelaps* in New Guinea and Borneo, according to collection records to date. In New Guinea *E. barbarae* was the only other *Echinolaelaps* found in the same areas and on the same hosts as *sedlaceki*; in Borneo, *E. aingworthae* shared some of the same hosts and localities. *E. echidninus* was not recovered from the same localities as *sedlaceki*.

DISTRIBUTION: New Guinea (NE, NW, SW), Borneo.

NE NEW GUINEA. Wau: 8, 1400 m, 18. VI. 1961, J. H. Sedlacek, Nos. 17, 19 same data ex *R. ruber*, *Rattus verecundus*; 4, 1200 m, 23. VI. 1961, Sedlacek, No. 30, *Rattus ruber*; 4, 1200 m, 15. XII. 1961, Sedlacek, No. 41 'rat'; 63, 29. X–30. XII. 1961, Sedlacek, Nos. 64, 71, 74, 75, 79, 83, 85, 92, 98, 104 *Rattus ruber* and 'rats'; 261, 2. I–23. VI. 1962, Sedlacek, Nos. 126, 138, S–205, S–240, S–243, S–246, S–249, S–250, S–252–254, S–256, S–258, S–272–79, 281–82, 20007, 20010, 20113, 20117, 20139, S–jr–4, S–jr–5, S–jr–7, S–jr–18, S–jr–49, *Rattus ruber*, *Rattus niobe*, and 'rats' S–281 *Rattus exulans*; 24, 18. XII. 1961–2. II. 1962, G. Monteith, Nos. 95, S–185, S–187–88, S–218, *Rattus ruber* and 'rats'; 56, 1070–1670 m, 8. V–13. VI. 1962, H. Clissold, Nos. HC 128, HC 133, HC 138, HC 142, HC 162, HC 184, HC 185, HC 193–97, HC 200, 21273, *Rattus ruber* and 'Grass Rat'; 96, Wau Creek, 5–27. IX. 1962, Clissold, Nos. 20517, 20523, 20525, 20544, 20548, 20562, 20567, 20576, 20577, 20580, 20603, 20618, 'rat' and 'grass rat'; 29, Mooly Creek, 7–24. IX. 1962, Clissold, Nos. 20546, 20552, 20581, 20607, 'rat' and 'grass rat'; 10, Mt. Kaindi, 10. IX. 1962, Clissold, No. 20563, 'grass rat'; 12, Sandy Creek, 30. IX. 1962, Clissold, No. 20628, 'rat'; 11, Kauli Creek, 2. X. 1962, Clissold, No. 20630, 'rat'; 8, Mt. Missim, 7. X. 1962, Clissold, No. 20643, 'grass rat.' Edie Creek: 15, 10 mi. SW Wau, 2000 m, 7–10. X. 1961, Sedlacek, Nos. 55, 60, 62, 'rat'; 12, Wau, 1200 m; 10. II. 1962, Sedlacek, No. S–209, *R. ruber*. Bulolo: 10, 730 m, 13. I. 1962, Clissold, Nos. S–149, S–150. Kassam: 12, 4. IX–1. XI. 1959, H. Van Deusen & T. C. Maa, Nos. TMP 1151, 1166–67, TMP–1202, TMP 1209, 1216–17, R. E. 17047, TMP 120–13–4–E–17051, *Rattus ruber*. Minj: 38, 11–16. IX. 1959, Maa, Nos. TMP 98–99, TMP 104–05, 111–12, 114–21, 148–51, 155–59, 160–82, 184, 185, 199, 236, *Rattus ruber tramitius* & *Rattus* spp. Nondugl: 7, 10–30. IX. 1959, Maa, Nos. TMP 238–78, 381–92, 639, 80, 711–12, 754–56, *Pogonomys* sp.; 8, Nos. TMP 597, 716, 721, *Rattus* sp. Moife: 6, 7–14. X. 1959, Maa, Nos. TMP–848, 993, *Rattus exulans*; 9, 12–15. X. 1959, Maa, Nos. TMP 938, 996, *Rattus* sp. NE Korona Plain: 7, 26 km SE Kainantu, 1680, Maa, Nos. TMP–1028–33, *Rattus* sp. Aiyura: 7, 19–24. X. 1959, Maa, Nos. TMP 1037, 1078, 1093, 1094, 1100, 1108, 1109, *Rattus ruber niger* & *Rattus ruber tramitius*. Akuna: nr. Kainantu, 3, 18. X. 1959, Maa, No. TMP 1058, *Rattus* sp. Kulima: 2, 21. II. 1960, Maa, Nos. TMP 2216–25, *Rattus ruber*.

Manus: 4, Lorengau, 15–29. XII. 1959, Maa, TMP 1626, *Rattus exulans*.

NW NEW GUINEA. Enarotali: 7, 17–29. VII. 1962, Nixon Wilson, BBM–NG 21386, 21421, 21469, *Rattus* sp. Japen I., Dawai River: 14,22–27. X. 1962, Wilson, BBM–NG 21947–49, 21968–71, 21974–82, 22011–14, 22127–30, 'rats.' Star Mts.: 17, Sibil Valley, 1245 m, 18. X–8. XI. 1961, L & S. Quate, Nos. BM–NG 100–14, 117–19, 129, 134, 138–45, 155–64, 166, 179–80, 189, 199, 217, 220, 297 *Rattus ruber* and *Rattus* sp. Bokondini: 43, 40 km N of Baliem Valley, ca. 1300 m, 16–23. XI. 1961, L. & S. Quate, Nos. BM–NG 304–354, *Rattus* sp. Central Mts.: 1, Archibold Lake, 760 m, 26. XI.–3. XII. 1961, L. & S. Quate, BM–NG 446 *Rattus* sp.

SW NEW GUINEA. Eramboe: 3, 2–4. II. 1960, Maa, Nos. TMP 2058, 2149, *Rattus leucopus*. Bomberi: 12, nr. Fak Fak, 3–6. VII. 1959, Maa, Nos. TMP 11, 14, 18, 20, *Rattus rattus*.

BORNEO. Tawau: 1, Cocoa Research Station, 23. VII. 1962, M. Thompson, BBM–BO 10117 *Rattus rajah*; 72, same data, 24–27. IX. 1962, BBM–BO 10291, 10302, 10304, 10305, 10314, 10318, 10321, 10323, *Rattus mülleri* and *Rattus surifer*; 1, same data but 10320–R 5Z, 171, *Rattus whiteheadi*; 1, same data but BBM–BO 265, R52124 *Tupaia minor*.

Laelaps (Echinolaelaps) ornatus Delfinado

Echinolaelaps ornatus Delf., 1960: 100.

A dark, well sclerotized mite. *Female*: 1225 μ long. Sternal plate 343 $\mu \times 292$ μ wide at narrowest point; anterior margin mildly convex, posterior margin with a truncate medial production that clearly extends beyond posterolateral corners of plate. Epigynial plate wide, sharply angulate opposite setae GV3, posterior margin closely conforming to anal plate. Anal plate wider than long, adanals about 1/2 as long as postanal and just reaching its base. Sternal and epigynial setae long, thickened basally, finely attenuated. No more than 4–5 pairs of short ventrals. Dorsal plate covers most of dorsum; setae slender, slightly overlapping; subterminals about 1/2 as long as terminals and reaching margin of plate. Tarsi II and III with 2–3 strong, apically truncate, terminal setae. The ventrobasal seta of trochanter I is very small, blunt spiniform. Delfinado states in the description, "...all coxal setae spiniform", but this is not borne out by her illustrations nor is it true of the 10 specimens before us. Apical I and posterior II and III are spiniform, the others are piliform although marginals II and III are perhaps heavier than in other species. Rostral and capitular setae short, inner rostrals about 2× as long as, and reaching about 1/2 way to base of capitular setae. The pilus is described as "short, pointed apically." It is difficult to see in most of the material we have but one specimen with an extended chelicera exhibits a pilus that is long, slender, weakly swollen medially and flexed, slightly knobbed and appendiculate at the the tip.

Remarks: Except for the discrepancy in the pilus, our specimens agree exactly with Delfinado's characterization, including the sculpturing of the dorsal plate. There is no doubt in our minds that this species is part of the *echidninus-sedlaceki* group. It remains to be seen if the sharply angulate epigynial plate and the small number of ventral setae are constant characters.

Originally described from 5 ♀♀ collected off *Chiropodomys calamianensis* at Puerto Princesa, Palawan, Philippine Islands.

DISTRIBUTION: Philippine Islands.

PHILIPPINE IS.: Brooke's Point, Macagua, Palawan I., 19. IV. 1962, M. Thompson and H. Holtmann, BM2085 (host ?).

Laelaps (Echinolaelaps) sculpturatus Vitzthum Fig. 3.

Laelaps (Laelaps) sculpturatus Vitzth., 1926, Treubia **8**: 64, illus.

Female: 1300 μ long, dark, well sclerotized; sternal plate especially dark. Our specimens conform very closely to Vitzthum's description, differing only by frequently having paraventral and ventral setae on individual platelets. A pair of these seta-bearing platelets occasionally appears to fuse with the epigynial plate, giving false impression of 5 pairs of setae on the plate. Also the coxal spiniforms and the ventral idiosomal setae off the plate are longitudinally striated and a bit more prominent than Vitzthum illustrated them. All the ventral plates (sternal, endopodal and genital) overlap the base of the coxae. The greatest width of the epigynial plate is opposite setae GV3 or just posterior to them. Other species with an expanded plate have the widest point anterior to GV3. The most obvious feature of the species is the bilobate posterior projection of the sternal shield which is very pronounced and reaches the posterior border of coxa III.

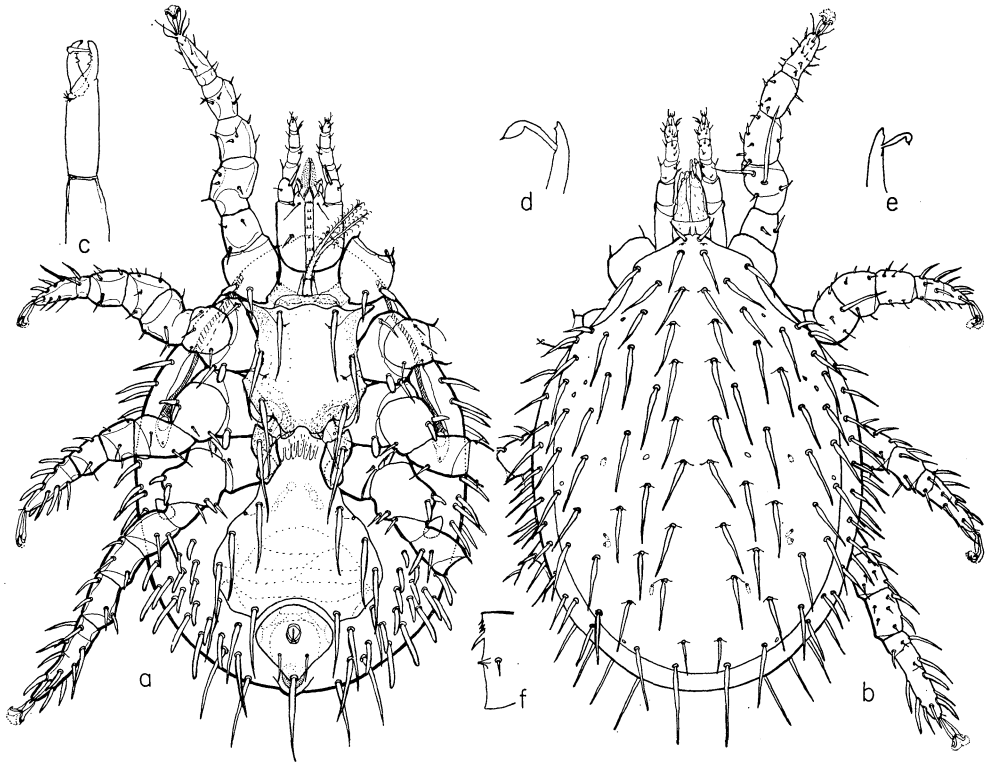

Fig. 3. *Laelaps* (*Echinolaelaps*) *sculpturatus* Vitzthum, 1926. a, venter of ♀ ; b, dorsum of ♀ ; c, chela of ♀ ; d, pilus dentilus of ♀ ; e, pilus dentilus of ♂ ; f, venter of mites right coxa IV.

Male and immatures: Unknown. Originally described from *Rattus whiteheadi* from South Sumatra, near Wai Lima.

The Bishop Museum collection contains specimens bearing the following data.

DISTRIBUTION: Borneo, Sumatra.

N. BORNEO. Tawau: 12, Cocoa Research Station, 230 m, BBM 10320 *Rattus whiteheadi*, M. Thompson; 11, Forest Camp, 5 km WSW Cocoa Research Station, BBM 10109 *Rattus whiteheadi*, Thompson.

Laelaps (**Echinolaelaps**) **mercedeae** Strandtmann and Mitchell, n. name Figs. 4 & 5.

Echinolaelaps grandis Delfinado, 1960: 101 (preoccupied by *Laelaps grandis* Hirst, 1925).

Female: Length of idiosoma, 1500 μ. Specimens before us from the type host and locality (*Rattus panglima*, Philippines) (Fig. 4 a–c) agree very closely with Definado's characterization with the exception that they are a bit larger. Delfinado gave the length of the dorsal plate as 1213 μ; our specimens have a dorsal plate length of 1400 μ.

Specimens from Borneo taken off *Rattus rajah* (fig. 4 d–f) differ slightly from the

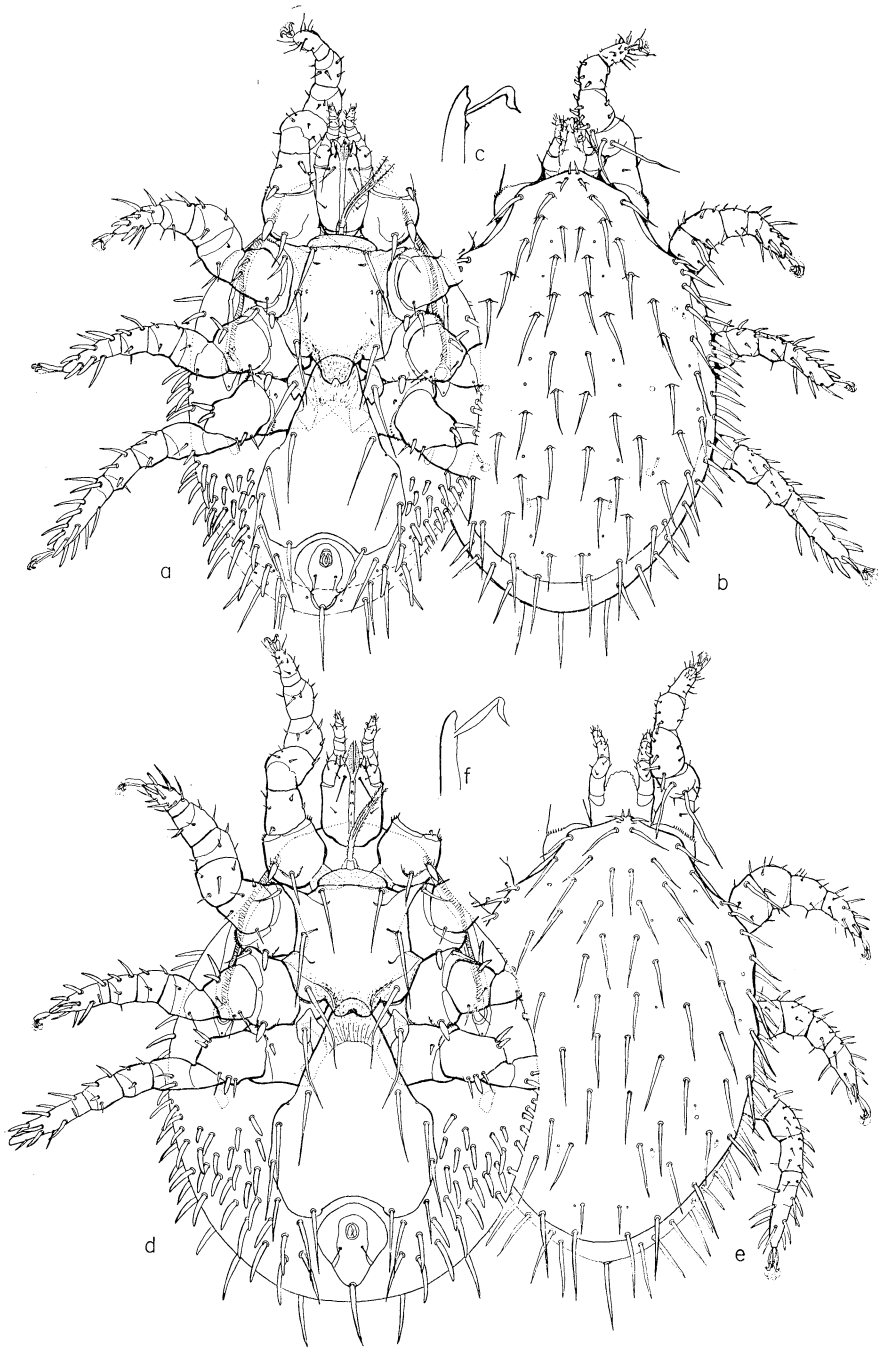

Fig. 4. *Laelaps (Echinolaelaps) mercedeae* n. name. a, venter of ♀ from *Rattus rajah* (note stout setae on trochanter I); b, dorsum of ♀ from *R. rajah*; c, pilus dentilus of ♀ from *R. rajah*; d, venter of ♀ from *Rattus panglima* (cf. setae on trochanter I with a.); e, dorsum of ♀ from *R. panglima.*

Philippine form. The chaetotaxy is generally more robust and the sternal plate is longer with a more prominent posterior production. The inner basal seta of trochanter I is a heavy spiniform. They are also smaller, the length of the idiosoma being 1445 μ; the dorsal plate 1324 μ.

Male: ♂ of this species being described for the first time. Eight specimens average 888 μ in length and 579 in width with ranges of 863–903 and 551–601 μ respectively. Spermatodactyl sinuately straight in some specimens and curved upon itself from 90 to 180° in other specimens. Internal posterior rostral seta about 3× as long as capitular seta and extending to base of capitular seta. Internal posterior rostral seta averages 64 μ in 8 ♂♂ and ranges from 61–67 μ in length. Capitular seta averages 19 μ in length and ranges from 17–22 μ. Nearly always 2 pairs of accessory setae on holoventral plate making 11 pairs exclusive of anal setae. The plate is slightly enlarged, as shown, to accommodate the extra setae. Adanal setae inserted well below posterior margin of anal pore and not surpassing base of postanal seta; less than 1/2 as long as postanal seta. In 8 specimens adanal setae averaged 47 μ with range of 33–54 μ; postanal seta averaged 122 μ with range of 117–129 μ. All coxal setae piliform except posterior seta on coxa III which is spiniform. Pair of long sinuous setae on dorsal surface of femur I with lateral seta being longer than median seta. Distal portion of tarsi II and III with one or more stout setae with blunt rounded tips. Peritreme extending to, or slightly beyond, posterior margin of

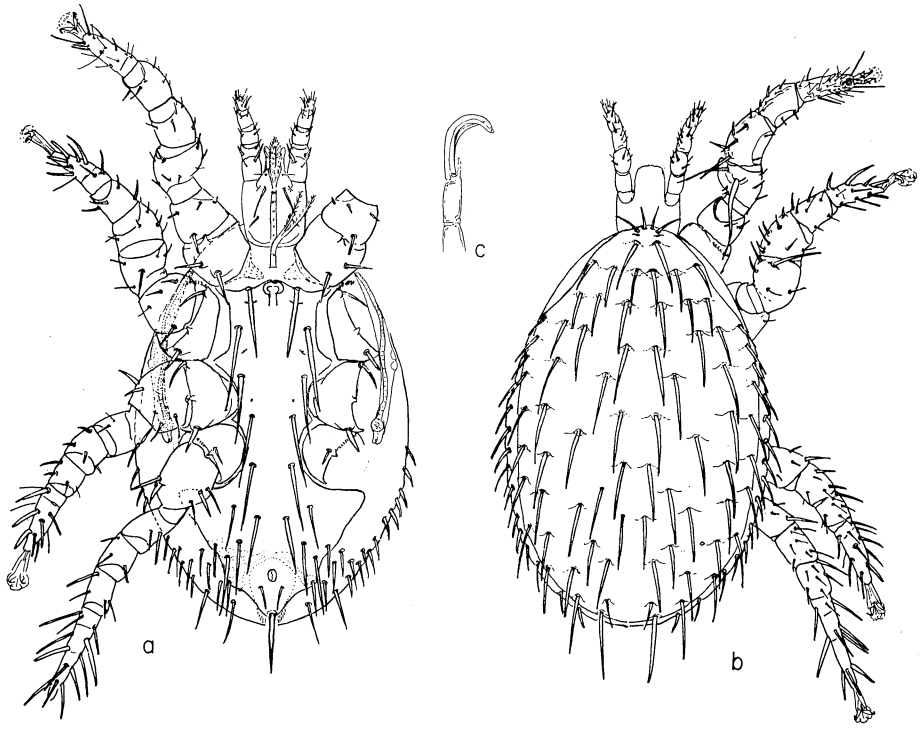

Fig 5. *Laelaps* (*Echinolaelaps*) *mercedeae* n. name. a, venter of ♂; b, dorsum of ♂; c, spermatodactyl of ♂.

coxa I. Dorsal sub-terminal setae about 1/2 as long as dorsal terminal setae. In 8 specimens dorsal sub-terminal setae average 68 μ in length with range of 62–72 μ and dorsal terminal setae average 136 μ with range of 128–148.

The foregoing description of the ♂, and the illustration (fig. 5), is drawn from Philippine material. Three ♂♂ from Borneo taken off *Rattus rajah* are larger, averaging 950 μ; the spermatodactyl is relatively longer and reflexed 180°; the ventrobasal seta of trochanter I is shorter and heavier; and the chaetotaxy is coarser.

Remarks: *Sculpturatus* Vitzthum and *mercedeae* Strandtmann & Mitchell seem to be very closely related. Characters that they share in common are: spiniform ventral setae, converging apodemes from coxae I, coarse setae and heavy spiniforms on coxa II, and the epigynial plate widest at a point posterior to setae GV3 (in all other forms the epigynial plate is widest at a point anterior to setae GV3). *Mercedeae* differs from *sculpturatus* in having a narrower epigynial plate and much shorter adanal setae.

DISTRIBUTION: Borneo, Philippine Islands.

BORNEO. Tawau: 18, Cocoa Research Station, BBM 10028, 10073, 10075 & 10117 *Rattus rajah*, M. Thompson.

PHILIPPINE IS. Palawan: 8, Brooke's Point, Macagua, 28. III–3. IV. 1962, Thompson & H. Holtmann, BBM 544, 770, 1059 & 1283 *Rattus palawanensis*; 28, Brooke's Point, Mantalingajan Range, Pinigisan, 7. IV–14. IV. 1962, Thompson & Holtmann, BBM 1283, 1504, 1506–07, 1519, 1538, 1541, 1606, & 1608 *Rattus panglima*; 11, Mt. Mantalingajan, 1200–1450 m, 11–13. IV. 1962, Thompson & Holtmann, *Rattus panglima.* Malabusog: 1 Tinitian Roxas, 30. IV. 1962, Thompson & Holtman, BBM 2187 *Rattus panglima.* Tarabanan: 4, Concepcion, 73 km N Puerto Princesa, 15. V. 1962, Thompson & Holtmann, BBM 2417 *Rattus panglima.*

Laelaps (Echinolaelaps) barbarae Strandtmann and Mitchell, n, sp. Fig. 6.

Female: Well sclerotized, dark, almost orbicular mite. The ♀ idiosoma varying in length from 1030–1133 μ, averaging 1080. Sternal shield slightly wider than long; average length on mid line 264 μ, average width at narrowest point, 284 μ; posterior margin only slightly produced, anterior margin convex, tritosternum originating at margin. Sternal setae I short, barely reaching 2nd pair, which in turn only slightly surpasses 3rd pair. Epigynial shield greatly expanded, angular, strongly concave on posterior margin where it may or may not fit closely to the anal plate. Anal shield wider than long. Adanal setae much more slender, about 2/3 as long, and barely reaching base of postanal seta. Venter with 10–12 pairs of thorn-like setae in addition to the 3 long paraventrals. Peritremes reach to or slightly beyond posterior edge of coxa I. Peritremal plate strongly produced laterally between legs II and III. Poststigmal plate not quite as wide and a bit longer than stigma. Coxal setae; apical I and posterior II and III cylindrical spiniforms with bluntly rounded apices. Coxal seta IV small, piliform. Leg chaetotaxy not unusual; tarsi II and III each with 3–4 mildly spiniform ventrolateral setae, of which 1 or 2 are apically blunt. Dorsal shield covering body, reflexed ventrally at anterior end displacing vertical setae ventrally; posterior margin rounded. All setae relatively short. Medial setae fail to overlap, the marginal setae are a bit longer. Subterminals barely reaching margin and about 1/2 as long as terminals. Capitular setae subequal to external rostral setae, which are about 1/3

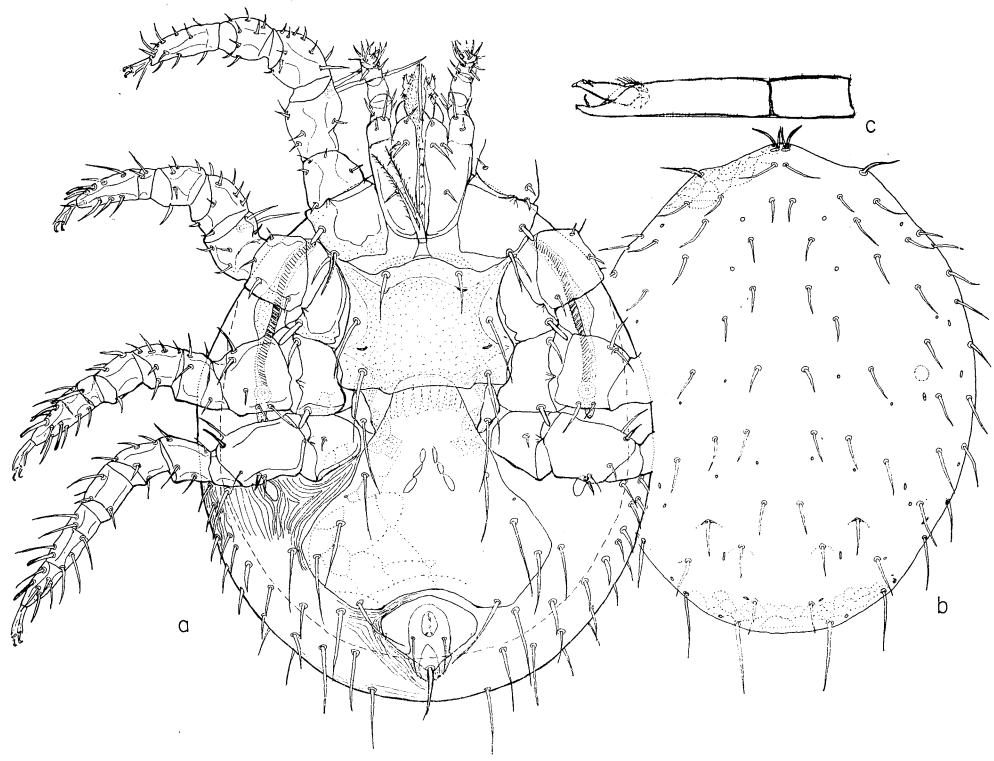

Fig. 6. *Laelaps* (*Echinolaelaps*) *barbarae* n. sp. a, venter of ♀; b, dorsum of ♀; c, chela of ♀.

as long as inner rostrals. Pilus dentilis small, slender, slightly bent.

Male and immature forms: Unknown.

Holotype ♀ (BISHOP 3457) is one of 7 specimens collected at Nondugl, NE New Guinea, 30. IX. 1959, T. C. Maa, on *Pogonomys* sp. ♯ TMP 711–12.

Named for Barbara Mitchell, the wife of the junior author.

Remarks: The 50 odd specimens studied showed few variations. The illustration is drawn from the type series, which has the epigynial plate close to the anal plate. Specimens from other hosts are a few microns smaller and have the epigynial and anal plates separated by as much as the length of the anal pore. Known only from New Guinea. It was recovered a few times from the same hosts as *E. sedlaceki*. The wide body, short sternal and dorsal setae, and shorter inner rostral setae will readily distinguish this species.

DISTRIBUTION: New Guinea (NE, SE).

NE NEW GUINEA. Nondugl: 3, 14–23. IX. 1959, T. C. Maa, TMP 238–278, 281–292, 639–80 *Pogonomys* sp.; 7, 30. IX. 1959, Maa, TMP 711–712 *Pogonomys* sp.; 8, 17. IX. 1959, Maa, TMP 537–545 *Antechinus wilhelmina* and *Rattus niobe*. Wau: 5, 2400 m, 4. I. 1962, J. H. Sedlacek, S–142 *Rattus niobe*; 3, Bulldog Road, 28 mi. S of Wau, 2850 m, 30. V. 1962, Sedlacek, 20127 *Rattus niobe*; 2, 2400 m, 9. I. 1962, G. Monteith, S–141 rat; 10, 2400 m, 10. I. 1962, Monteith, S–145 & 146 *Rattus niobe*; 2, 1200 m, 15. V. 1962, H. Clissold, HC–163

grass rat; 2, Bulldog Road, 27. V. 1962, Clissold, HC–206 *Rattus niobe*; 1, same data, 2700 m, 30. V. 1962, Clissold, HC–224 Forest rat; 4, Edie Creek, 15 mi. SW of Wau, 2200 m, 15. II. 1962, Sedlacek, S–220 *Rattus niobe*. SE NEW GUINEA. S. Highlands: 2, Mt. Giluwe 3650 m, 29. V. 1961, J. L. & M. K. Gressitt, Blunt-nosed, gray-brown rat.

Laelaps (Echinolaelaps) traubi Domrow Fig. 7.

Laelaps traubi Dom., 1962, Acarologia **4** (4) : 517 (♀ illustrated).

A dark mite, rather heavily sclerotized. *Female*: Averages 1050 μ long, varying from 950–1135 μ. Dorsal shield averages 920 μ. Sternal shield longer than wide, average length 260 μ, average width at narrowest point, 208 μ; weakly reticulate medially, strongly produced posteriorly, convex anteriorly. Sternal setae overlapping by about 1/3. Endopodal plates large and seemingly extending under sternal shield. Epigynial shield as illustrated; broadly expanded, the posterior margin concave, but rather short and separated from the anal plate by at least the length of the anal pore (more in fully expanded specimens, less in contracted or poorly mounted specimens). Postanal seta as long as, and a bit heavier than, posterior body setae. Adanal setae inserted at posterior margin of anal pore, weak, not reaching postanal seta. Peritreme not quite reaching coxa I. Poststigmal plate weak, narrow and with a pore at its tip. Venter with 10–13 pairs of thorn-like setae in addition to the 3 long paraventral setae. Dorsal plate broadly elliptic, smaller than the dorsum, posterior margin convex. Dorsal setae subequal, tips overlapping base of following setae. Subterminals not 1/2 as long as terminals and barely reaching margin of shield. Seta of coxa IV is a small spiniform. Ventral spiniforms on trochanters I and IV shorter but nearly as heavy as spiniform of coxa I. Setae of tarsi II–IV longer and 2× as heavy as setae on respective tibiae. Chela rather heavy and in mounted specimens are usually closed; movable arm strongly hooked. Pilus dentilis small and straight.

Male: About 800 μ long, varying from 750–850. Not as dark as ♀. Peritreme barely reaching posterior margin of coxa II. All coxal setae piliform except the posterior of III which is a bluntly pointed spiniform. Sternal setae I not reaching base of sternals 3. Adanal setae less than 1/2 length of postanals and not reaching its base. Posterolateral margins of holoventral plate slightly convex and bearing 1 pair of accessory setae, making 10 pairs of setae on the plate. Dorsal chaetotaxy as in ♀ except for subterminals which are less than 1/3 the length of terminals. Apical 4–5 setae of tarsi II and III very strong and claw-like. Spermatodactyl nearly straight, less than 2× as long as cheliceral tibia; immovable arm weak, short, transparent. Internal posterior rostral seta short, not as long as anterior rostral seta.

Two deutonymphs, each 800 μ long. Adanal setae very short; dorsal subterminals short, not reaching margins of shield; dorsal setae just barely overlapping; tarsal setae heavy, as in ♀; chelae heavy and usually closed.

One protonymph, 667 μ long. With characteristics of deutonymph except for usual differences in the 2 instars, such as divided dorsal shield, shorter peritreme and shorter sternal shield.

Remarks: The ♀ was originally described by Domrow from material collected off *Rattus fulvescens* in Malaya by Robert Traub. The ♂ is here described for the first time. Over 250 specimens, mostly ♀♀, were seen. Specimens from Vietnam and Thailand show

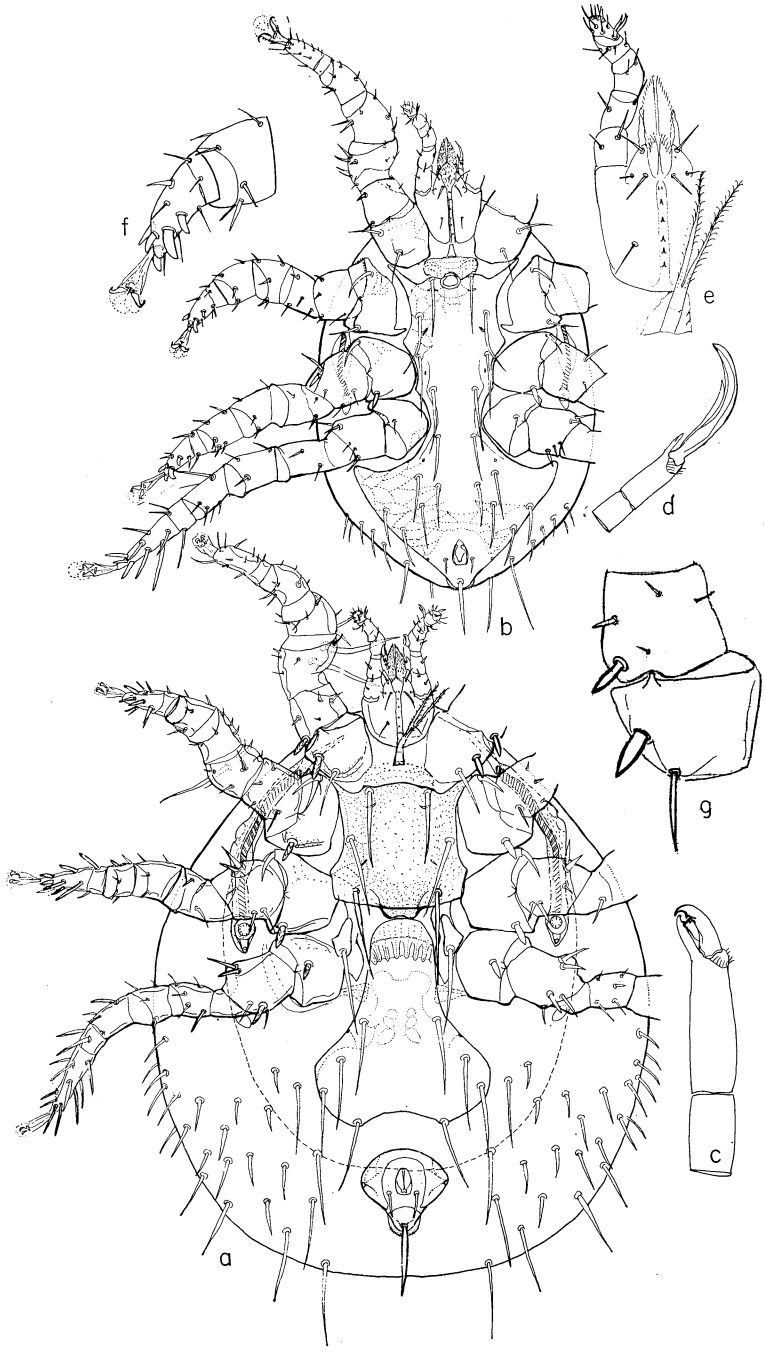

Fig. 7. *Laelaps* (*Echinolaelaps*) *traubi* Domrow, 1962. a, venter of ♀ ; b, venter of ♂ ; c, chela of ♀ ; d, spermatodactyl of ♂ ; e, venter of tritosternum & gnathosoma of ♂ ; f, tarsus II of ♂ ; g, venter of coxa & trochanter I.

no consistent variations and agree closely with the original description.

DISTRIBUTION: Vietnam, Thailand, Malaya.

VIETNAM. Blao: 1, 1700 m, 17. X. 1960, C. Yoshimoto & B. Feinstein, ♯380 *Rattus niviventer champa.* Mt. Lang Bian: 205, 2000 m, 20–27. V. 1961, N. R. Spencer, 910–16, 932–33, 935–37, 940–41, 950–60, 980 *Rattus fulvescens*; 2, same data but 1500 m, 28. V. 1961, ♯985 *Rattus* n. sp. nr. *baluensis*; 1, 1700 m, 29. V. 1961, Spencer, ♯988 *Mus cervicolor annamensis*: 2, 2000 m, 22. V. 1961, Feinstein, ♯938 *Rattus fulvescens.*

THAILAND. Chiengmai Prov.: 3, Doi Pui, higher slope of Doi Suthep, 21. III. 1962, SMRL 636 *Rattus niviventer*; 2, Pah Lad., Doi Suthep, 22. III. 1962, SMRL 644 *Rattus*; 37, same data but 15. III–10. IV. 1962, SMRL 617, 626, 638, 640, 645, 652, 685, 687, 691, 693, 733 & 743 *Rattus niviventer*; 3, Ban Chang Khien, Amphoe Muang, 26. III. 1962, SMRL 649 *Rattus niviventer.*

Laelaps (Echinolaelaps) aingworthae Strandtmann and Mitchell, n. sp. Fig. 8.

Female: Dark, well sclerotized; genitoventral shield slightly expanded; coxae I–III with spiniforms; pilus mildly swollen and sigmoid. Average length 1350 μ, varying from 1300–1400. (A smaller form from Borneo is an exception, averaging 1122 μ). Sternal plate about as long as wide, anterior margin straight, posterior margin with a pronounced bilobate process which extends past middle of coxa III. Sternal setae subequal, 1st pair extending past 2nd sternal pore. Metasternals as long or longer than sternals 3. Epigynial plate smoothly convex, mildly expanded, posterior margin nearly straight; GV4 closer together than GV1 and about as far apart as width of anal plate; 4 nearly parallel lines across widest portion. Separated from the anal plate by about the length of anal pore. Anal plate roundly oval, pore anterior, adanal setae posterior to pore, about 1/2 as thick as postanal and extending about 1/3 past base of postanal. The 3 pairs of paraventral setae about as long as the GV setae, the ventrals are about 1/3 as long and stiff and thorn-like. Dorsal plate conforms to body anteriorly but posteriorly it converges to a broad, truncate tip, leaving a wide band of the dorsum uncovered. Dorsal setae long, strong, overlapping. Subterminals from 1/3–1/2 as long as terminals and surpassing posterior margin of plate. Legs about average, neither unusually long nor unusually stubby. All trochantal setae piliform; tarsus II with 2 blunt setae terminally. On the coxae, apical seta I, posterior II and III are spiniform. The other coxal setae heavy but distinctly not spiniforms. Coxal seta IV small. Peritreme extending a bit past posterior margin of coxa I. Gnathosoma with inner posterior rostrals heavier and much longer than others, nearly reaching capitular. Tritosternum arising more than its width in front of sternal plate.

Male: Averages 950 μ, varying between 890 and 1000. A dark mite, with pronounced reticulations on all shields. Chaetotaxy strong. Spermatodactyl sickle-shaped but may be nearly straight or occasionally may be doubled upon itself. Ratio of length of spermatodactyl to length of cheliceral tibia, about 5 : 3. Internal posterior rostral seta prominent, 3–4× as long as anterior rostral seta and reaching base of capitular seta. Peritreme reaching base of coxa I. Expanded portion of holoventral shield bears 5 pairs of long setae plus 1–3 pairs of small marginal setae. Number of small setae variable and may be lacking. Only posterior seta of coxa III spiniform but setae of coxa I and II stout. Seta of coxa IV smaller and piliform.

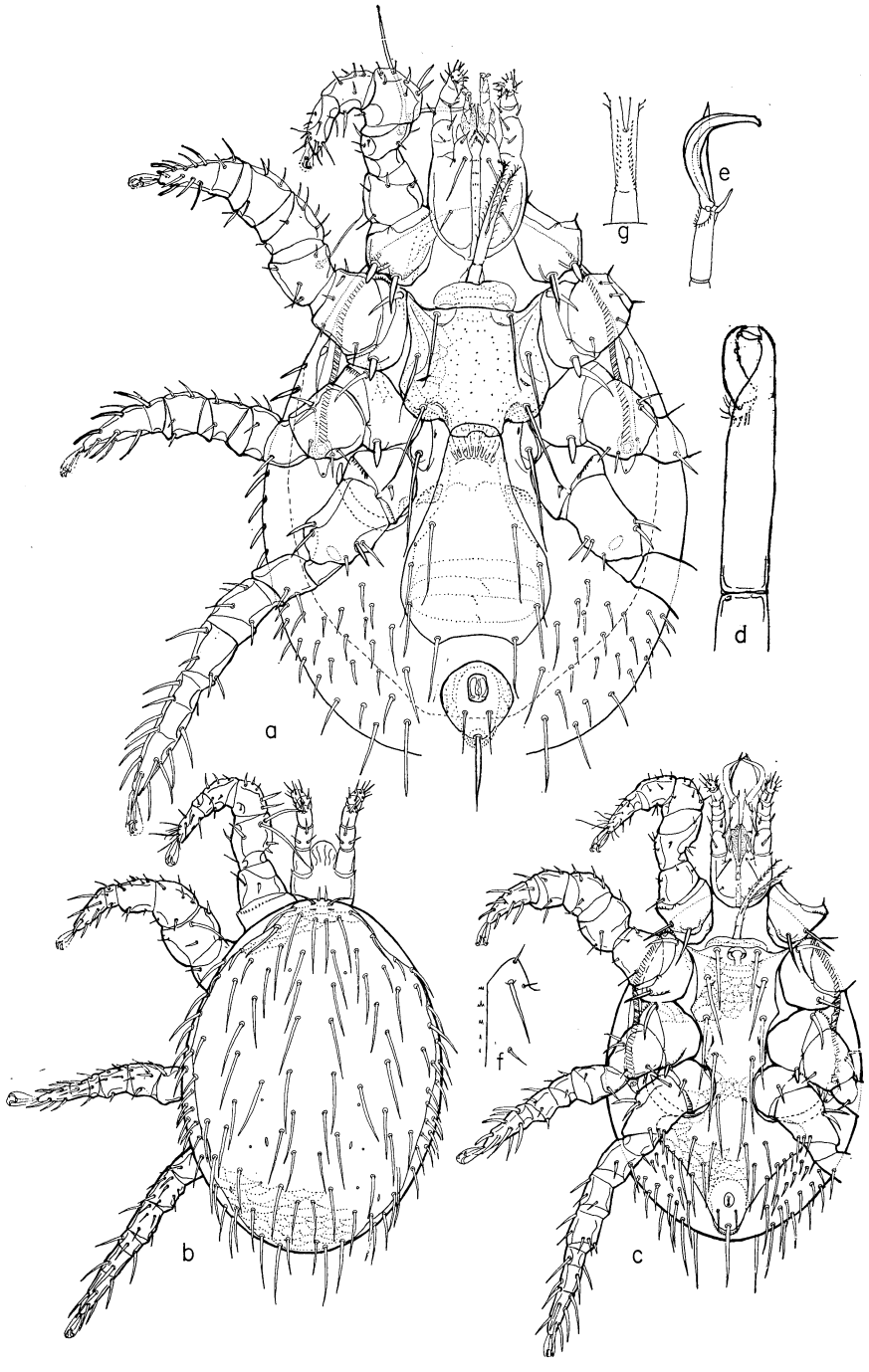

Fig. 8. *Laelaps* (*Echinolaelaps*) *aingworthae* n. sp. a, venter of ♀ ; b, dorsum of ♂ ; c, venter of ♂ ; d, chela of ♀ ; e, spermatodactyl of ♂ ; f, setae on left side of venter of gnathosoma of ♂ ; g, base of tritosternum of ♀.

Deutonymph 984 μ long. Peritreme reaching middle of coxa I. Ventral and dorsal chaetotaxy a bit weaker than in adult. Rostral setae as in adult but internal rostrals a bit shorter, not reaching base of gnathosomal setae. Pilus dentilis as in ♀. Coxal setae as in ♂.

Holotype ♀ (BISHOP 3458), collected off *Rattus niviventer* ♯SMRL 686, Doi Suthep, Pha Lad, Chiengmai Province, Thailand, 19. III–10. IV. 1962.

Named in honor of Professor Helen Aingworth, Northeastern State College, Tahlequah, Oklahoma.

Remarks: Over 300 specimens of this mite were mounted and studied and about that many more remain in alcohol. Of the 300 examined, about 250 were collected from several species of *Rattus* in Vietnam and 27 specimens were from *Rattus niviventer* and *Rattus rajah* collected in Thailand. The type series was chosen from the Thailand material. We could find no differences in either the ♂♂ or the ♀♀ of the material from the two countries. Specimens from *Rattus niviventer* (chosen as the type host) were a few micra smaller than specimens from *Rattus rajah*. The 28 specimens from Borneo, all ♀♀, were identical to the typical series in all respects except size and the relative lengths of the dorsal terminals and subterminals. The body length was 1122 μ with very little variation and the dorsal subterminal setae were about 1/3 as long as the terminals.

In the shape of the sternal and epigynial plates, *aingworthae* is similar to *delta*, *insignis*, and *sanguisugus*. *E. delta* has both setae of coxa I spiniform and the anterior margin of the sternal plate convex; *insignis* has the inner rostral and capitular setae of equal length, all coxal setae piliform, and the posterior projection of the sternal plate shorter and wider; *sanguisugus* has much longer adanal setae, heavier and shorter chelicerae, and the body is much larger.

DISTRIBUTION: Borneo, Thailand, Vietnam.

BORNEO. Tawau: 28, Cocoa Research Station, 250 m, 26–27. IX. 1962, M. Thompson, BBM–BO 10302 & 10314 *Rattus surifer*.

THAILAND. Chiengmai Prov.: 15, Doi Suthep, Pha Lad, 16. III–9. IV. 1962, SMRL 624 & 736 *Rattus rajah*; 4, same data but 16. III. 1962, SMRL 625 *Rattus*; 8, same data but 19. III–10. IV. 1962, SMRL 626, 645, 686 & 743 *Rattus niviventer*.

VIETNAM. Thac Da Tan La: 12, 1550 m, 12. IX. 1960, C. Yoshimoto & B. Feinstein, ♯259 *Rattus rajah koratis*. Di Linh (Djiring): 10, 1500 m, 27. IX–14. X. 1960, Yoshimoto & Feinstein, ♯305 *Rattus rajah koratis*; 53, Ap Hung-Lam, 21 km NW Dilinh, 1100 m, 29. IX–5. X. 1960, Yoshimoto & Feinstein, ♯332 *Rattus rajah koratis*. Blao (Balao): 144, 500–600 m, 16–25. X. 1960, Yoshimoto & Feinstein, ♯371, 382–84, 386–87, 394–97, 411–12, 419–20 *Rattus rajah koratis* & 425 *Rattus rattus molliculus*. Song Trao: 3, 300 m, 7. IX. 1960, Yoshimoto & Feinstein, ♯422 *Rattus rajah koratis*. Mnam: 11, 500 m, 22. XII. 1960, Yoshimoto & Feinstein, ♯632 *Rattus rattus*. Ban Me Thout: 2, 300 m, 25. XII. 1960, Spencer & Feinstein, ♯639 *Rattus* sp. Kontum: 2, 600 m, 3. I. 1961, Spencer & Feinstein, ♯657 *Rattus* sp. Caryu Danar: 3, 17–22. II. 1961, Spencer & Feinstein, ♯823 & 836 *Rattus rajah koratis*; 1, 30 km NW of Kontum, 630 m, stop 34, R. Leech, ♯86 *Rattus rajah*. Pleika: 1, 20 km N, 650 m, 10.V. 1960, L. Quate, ♯6 *Rattus* sp. Phuoc Hai (Phoc Hai): 9, 8. III. 1961, Feinstein, ♯865–66 *Rattus rajah koratis*.

Laelaps (Echinolaelaps) delta Domrow

Laelaps delta Dom., 1962: 515; Acarologia **4** (4): (♀ illus.)

Our material contained no specimens of this species, but it occurs in the area of this paper. It is known from only the ♀, which is between 1067–1155 μ long. Quite similar to *aingworthae* and may eventually prove to be a senior snynonym of that species.

Originally described from Malaya near Kuala Lumpur, off *Chiropodomys gliroides* and *Ratufa bicolor.*

Laelaps (Echinolaelaps) insignis Delfinado Figs. 9 & 10.

Echinolaelaps insignis Delf., 1960: 102 (♀ illus.)

This species is more delicate and less spiniform than others of the subgenus. Two distinct forms, a smaller Philippine form and a larger Borneo form. Females of the Philippine form average 938 μ (880–990) and agree very closely with Delfinado's characterization. Sternal plate square, length and width at narrowest points, 231×231 μ. Sternal setae 1 not quite to base of sternals 3. Epigynial plate very little expanded, smoothly convex laterally, straight to mildly concave between setae GV4. Distance between setae GV4 not as great as between GV1, contrary to Delfinado's description. Dorsal plate broadly elliptic, almost completely covering the dorsum; posterior and lateral setae (except terminals) shorter than the anterior and medial setae; subterminals very small, less than 1/4 length of terminals. Tarsus II with 2 fairly heavy, blunt terminal setae. All coxal setae piliform but posteriors II and III tend toward spiniform. Inner posterior rostral setae and capitular setae equal. Pilus dentilis small, slender, fang-like as figured.

Females of the Borneo form average 1200 μ. The anterior margin of the sternal plate is nearly straight, sternal and metasternal setae longer (sternal setae reaching base of sternal setae 3; sternals 3 reaching base of GV1). Setae GV4 closer together; anal shield not quite so rounded. Of the 3 setae on the apex of trochanter IV the middle seta is the shortest, in the Philippine form it is the longest; inner anterior margin of coxa IV with a distinct tooth (lacking in the Philippine form); the internal rostral and capitular setae equal but shorter than the typical form, dorsal subterminals longer, almost reaching the posterior margin of the plate and about 1/3 as long as the dorsals. Figures a, b, & e show the Philippine form, figures f, g, & h show the Borneo form.

Male of this species being described for the first time. Sixty-four specimens averaging 683 μ in length and 447 μ in width with ranges of 655–721 and 401–470 μ respectively. Spermatodactyl curving to form an angle of approximately 90°. Internal posterior rostral seta about 2× as long as capitular seta and extending to base of capitular seta. With 4 pairs of setae on holoventral shield anterior to constriction of plate between coxae IV, single pair of holoventral setae just anterior to posterior level of coxae IV, always 5 pairs of setae on holoventral shield posterior to level of coxae IV exclusive of anal setae, occasionally one or more pairs of accessory setae on lateral margin of expanded portion of holoventral shield. Adanal setae located posterior to anal opening and slightly more than 1/2 as long as postanal seta. Adanal setae averaging 243 μ in 20♂♂ and ranging from 229–255 μ. Postanal seta averaging 422 μ and ranging from 389–459 μ. All coxal setae piliform except posterior seta on coxa III which is spiniform. Pair of long setae located on dorsal surface of femur I with medial seta being about 2/3 as long as lateral seta. One

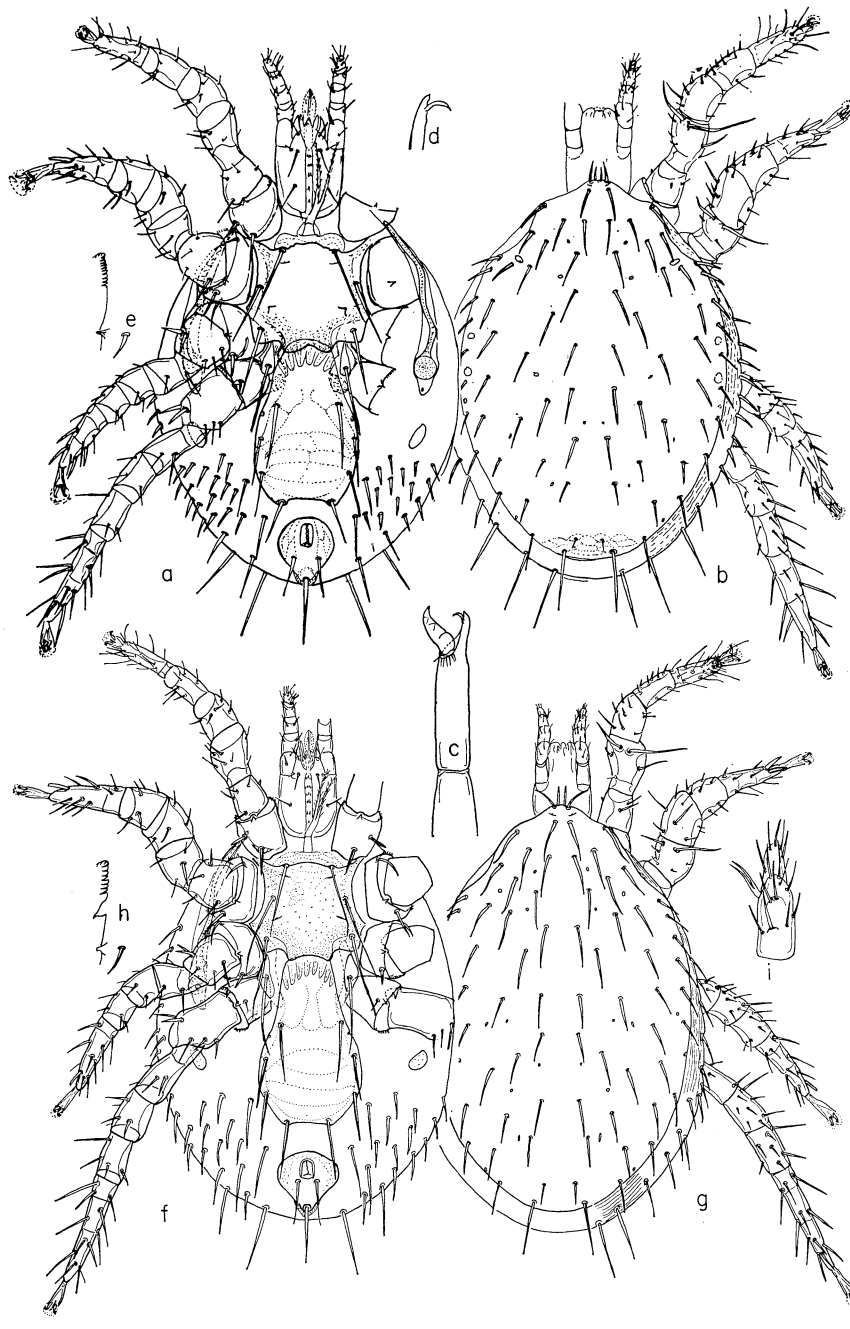

Fig. 9. *Laelaps* (*Echinolaelaps*) *insignis* Delfinado, 1960. a, venter of ♀ from *Rattus panglima*; b, dorsum of ♀ from *R. panglima*; c, chela of ♀; d, pilus dentilus of ♀; e, venter of right coxa IV of ♀ from *R. panglima*; f, venter of ♀ from *Rattus rajah*; g, dorsum of ♀ from *R. rajah*; h, venter of right coxa IV of ♀ from *R. rajah*; i, palp tibia and tarsus of ♀ from *R. rajah*.

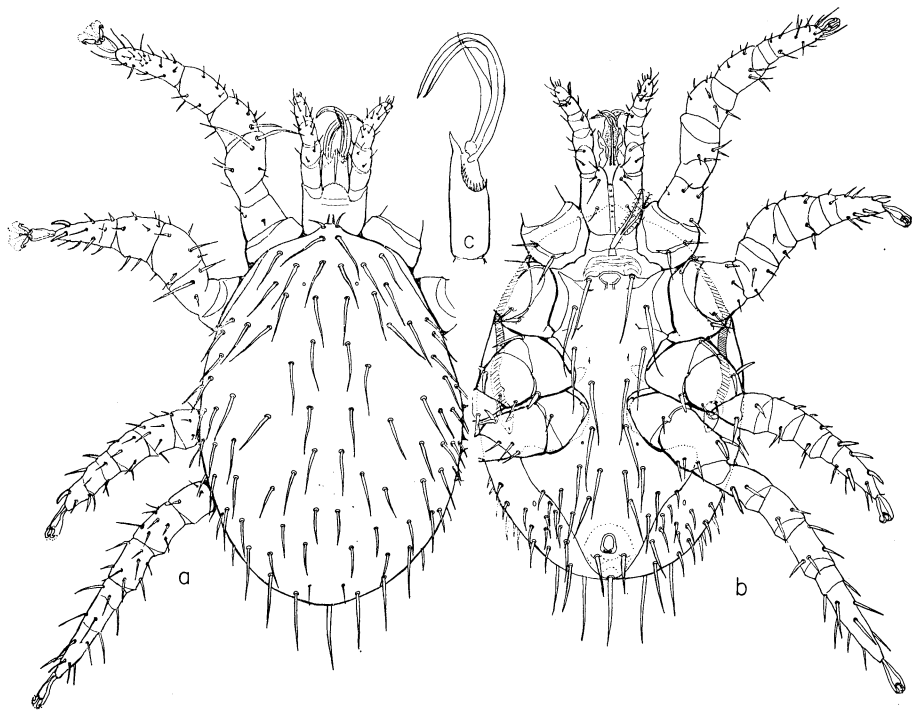

Fig. 10. *Laelaps* (*Echinolaelaps*) *insignis* Delfinado, 1960, ex *Rattus panglima*. a, dorsum of ♂; b, venter of ♂; c, spermatodactyl of ♂.

or more heavy setae near terminal end of tarsi II and III. These setae curved very slightly and with rounded blunt tips. Peritreme extending to, or slightly beyond, level of posterior margin of coxa I. Dorsal terminal setae averaging 432 μ in 20 and ranging from 403–447 μ thus being about the same size as postanal seta. Dorsal subterminals averaging 120 μ and ranging from 109–145 μ. Length ratio of dorsal subterminal to dorsal terminals is 1 : 3.6 for 20 ♂♂.

As in the ♀, ♂♂ from *Rattus rajah* in Borneo are larger than ♂♂ from the Philippines. They averaged 1040 μ long and the setae of the holoventral plate are relatively longer; sternal setae I for example reaches the base of sternal seta 3. Otherwise there are no differences that we could find.

Remarks: Very common in the Philippines, with an apparent strong preference for *Rattus panglima* and *R. palawanensis*, primarily the former. Only one specimen was recovered from a different host (*Rattus exulans*). We could find no differences in the mites from the 2 hosts. Recovered from the same hosts were *Laelaps mercedeae*. The Borneo form, from *Rattus rajah*, was found on the same hosts as *mercedeae* and *sanguisugus*. Although there is a remarkable difference in size between the Borneo and Philippine forms, they are so similar in other respects that we can only conclude that they are the same species.

DISTRIBUTION: Philippine Is., Borneo.

PHILIPPINES. Palawan: 40, Brooke's Point, Macagua, 28. III–4. IV. 1962, M. Thompson & H. Holtmann, BBM 544–45, 703–04, 770, 1059 & 1142 *Rattus palawensis*; 1, same data but 1. IV. 1962, *Rattus exulans*; 158, Mantalingajan Range, Brooke's Point, Pinigisan, elev. 620 m, 1150–1300 m, (elev. not given for majority of specimens), 6–14. IV. 1962, Thompson & Holtmann, BBM 1279, 1282–86, 1415, 1417, 1419, 1427–28, 1430, 1504–07, 1519–21, 1538, 1540–43, 1558, & 1606–08 *Rattus panglima*; 23, Brooke's Point, Macagua, 8–10. IV. 1962, Thompson & Holtmann, BBM 2024–26, 2038 & 2042 *Rattus panglima*; 6, Tinitian Roxas, Malabusog, 30. IV. 1962, Thompson & Holtman, BBM 2187 *Rattus panglima.* Balabac I.: 22, Dalawan Bay, Minagas Point, 21. IV. 1962, Thompson & Holtmann, *Rattus panglima.* Tarabanan: 6, Concepcion, 73 km N of Puerto Princesa, 15. V. 1962, Thompson & Holtmann, BBM 2417 *Rattus panglima.* Busuanga I.: 1, 6 km NE of San Nicholas, 21. V. 1962, Thompson & Holtmann, *Rattus palawanensis.*

BORNEO. Tawau: 19, Cocoa Research Station, 3–23. VII. 1962, Thompson, BBM–BO 10028, 10073, 10075, 10117 *Rattus rajah.*

Laelaps (Echinolaelaps) sanguisugus Vitzthum Fig. 11.

Laelaps (*Laelaps*) *sanguisugus* Vitz., 1926, Treubia **8**: 58 (♂ & ♀ illus.).

A very large species but not unusually dark; with moderate chaetotaxy and moderately sclerotized. As is true also for several other species from the Indonesian area, there seem to be distinct races for the various major regions. We will describe first the characters held in common throughout the area and discuss the variations under "Remarks." The ♀ varies in length from 1510–1780 μ. Sternal plate essentially square, anterior margin convex, posterior margin with a short bilobate production that does not extend farther back than the posterior lateral corners of the plate; sternal setae equal, very long, sternal setae 1 reaching midway between sternal pore 2 and sternal seta 3. Epigynial plate mildly expanded, sides smoothly convex, posterior margin straight, separated from anal plate by more than length of anal pore; seta GV1 longest of the GV setae and reaching base of GV3; seta GV4 closer together than width of anal plate. Anal plate broadly pyriform, anal pore near anterior margin, adanal setae inserted well beyond posterior margin of pore and about 2/3–3/4 as long as postanal seta. Of the coxal setae, apical I and posterior II & III are moderately heavy spiniforms; seta IV is mildly spiniform. Peritreme extends nearly to middle of coxa I. Dorsal plate broadly elliptic, covering nearly all of dorsum, posterior margin convex. Setae of dorsal plate moderately long, clearly overlapping, subterminals surpassing margin of plate and about 1/2 as long as terminals. Inner rostral setae long, reaching base of capitular setae. Chelicerae very strong, greater in diameter than pedipalp; chelate portion forming about 1/4 the total length of the chelicera. Pilus dentilis mildly inflated, flexed at the apex. Legs with moderately heavy and long tarsal setae; all trochantal setae slender piliform. Average length of ♂, 1225 μ, varying from 1150–1260. Expanded portion of holoventral plate with distinctly concave posterolateral margins and bearing 5 pairs of equally long setae posterior to genital setae, frequently with 1 or more smaller marginal setae. Spermatodactyl blade-like, very long, nearly always flexed 180°. Inner rostral setae surpassing base of capitular setae. Chaetotaxy, including coxae, as in ♀.

Remarks: Immature forms unknown. *Sanguisugus* was originally described from specimens taken from "*Mus lepturus*" in Java. In that material, the ♀♀ were 1500–1530 μ

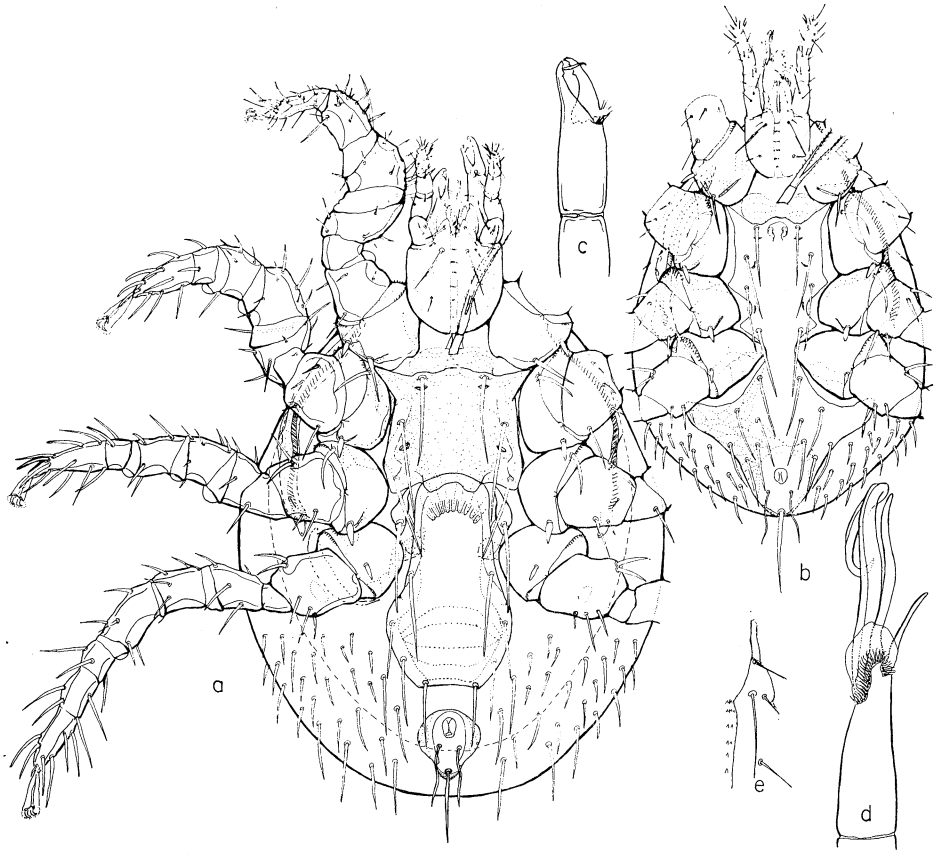

Fig. 11. *Laelaps* (*Echinolaelaps*) *sanguisugus* Vitzthum, 1926. a, venter of ♀; b, venter of ♂; c, chela of ♀; d, spermatodactyl of ♂; e, left ventral side of ♂ gnathosoma.

long, the epigynial plate was wider than the sternal plate, the sternal plate was wider than long, and the tritosternum originated very close to the sternal plate. There were no ♂♂ present in the Borneo material.

There were no consistent differences in the material from Thailand and Vietnam so it will all be considered as a unit. It was recorded from various hosts, including *Rattus rajah.* Females measured 1663–1796 μ, the epigynial plate was wider (400 μ) than the width of the sternal plate, the sternal plate was wider than long, 352×379 μ and the tritosternum originated more than the width of its base from the sternal plate. Males of the Thailand-Vietnam material were 1150–1260 μ and the holoventral plate was more widely expanded and concave posterolaterally.

It is quite possible that *sanguisugus* is the same as the African *Laelaps giganteus* Berlese. The only difference we can find is the posterior margin of the sternal plate, as mentioned in the key. Vitzthum mentioned differences in the relative widths of the epigynial and sternal plates which are differences that we have found to be variable.

DISTRIBUTION: Java, Borneo, Vietnam, Thailand.

N. BORNEO. Tawau: 17, Cocoa Research Station, 3–23. VII. 1962, M. Thompson, BBM–BO 10028, 10073, 10075, & 10117 *Rattus rajah.*

VIETNAM. Thac Datan La: 18, 1500 m, 12. IX. 1960, Yoshimoto & Feinstein, ♯259 *Rattus* sp. Ap Hung-Lam; 9, 21 km NW of Kilinha, 1100 m, 29. IX–5. X. 1960, Yoshimoto & Feinstein, ♯332 *Rattus rajah koratis.* Blao (Balao): 111, 600 m, 16–25. X. 1960, Yoshimoto & Feinstein, ♯371, 382, 384, 386–87, 411–12, 419–20, 423, 426, 632, 729 *Rattus rajah koratis*, 425 *Rattus rattus molliculus*, 383 *Rattus rattus molliculus.* Mnam: 13, 500 m, 22. XII. 1960, Yoshimoto & Feinstein, ♯632 *Rattus rattus.* Lao Bao: 2, 26. I. 1961, Spencer & Feinstein, ♯729 *Rattus* sp. Caryu Danar: 4, 17–21. II. 1961, Spencer & Feinstein, ♯823 & 831 *Rattus rajah koratis.* Khe Sanh: 1, 28. I. 1961, Spencer, ♯735 *Rattus rajah koratis.* Phuoc Hai: 4, 8. III. 1961, Feinstein, ♯865 *Rattus rajah koratis.*

THAILAND. Chiengmai: 10, Pha Lad., Doi Suthep, 16. III–9. IV. 1962, SMRL 624, 627, 686 & 736 *Rattus rajah*; 7, same data but 16. III. 1962, SMRL 625 *Rattus*; 4, same data but 21–27. III. 1962, SMRL 627, 638 & 645 *Rattus niviventer.*

Laelaps (Echinolaelaps) sinuatus Strandtmann and Mitchell, n. sp. Fig. 12.

Female: A dark, heavily sclerotized mite, about 1200 μ long. Chaetotaxy robust but almost no spiniforms. Sternal plate much wider than long; peritreme strongly sinuous. Only the posterior seta of coxa III spiniform.

Female: Length 1235 μ (1170–1300), width 910 μ (845–975). Sternal plate heavily sclerotized, nearly 2× as wide as long; anterior margin slightly produced, with the produced part faintly concave. Posterior margin sharply concave in middle 1/2. Sternal pore I sloping inward; sternal pore II horizontal or nearly so. Metasternal pore vertical. Sternal setae I reaching almost to sternal pore II; sternal setae 2 and 3 longer than 1. Metasternal seta longer than 3rd sternals and reaching beyond base of genital setae. Endopodal plate narrow, reaching from sternal plate to middle of coxa IV and forming a ventral apodeme. Prosternal area small, not sclerotized, with faint, transverse lines. Tritosternum narrow, the slender lacinae extending almost to the corniculi, are closely ciliated, and divide from each other at about 1/3 the distance from base to tip. Genital plate widely expanded behind coxae IV, the sides not quite smooth; concave on the posterior margin. Genital and ventral setae about equal in length but the genital setae not quite so thick. Fourth GV setae a trifle farther apart than the genitals, but not as far apart as the width of the anal plate. Non sclerotized portion of venter with 8–10 pairs of setae; the paraventrals similar in size and shape to the GVs; the ventrals are smaller. Metapodal plate small, narrowly elliptic.

Anal plate roundly triangular, the anal pore near the anterior margin. Adanal setae inserted posterior to caudal margin of pore; slender, not reaching base of postanal and about 2/3 as long as postanal. Peritreme ventral, becoming lateral over coxa II. It is markedly sinuate and lies in a well defined peritremal plate. The dorsal plate covering all but a narrow rim. Setae (38 pairs) subequal and about as long but not as robust as the ventral setae. Subterminals about 1/2 as long as terminals and not extending beyond posterior margin of plate.

Legs moderately long and slender; apical 2 setae of tarsus II light spiniforms. Posterior seta of coxa III is the only coxal spiniform; coxal seta IV very small; anterior marginal seta of coxa II much smaller and more delicate than its homolog on coxa III; proximal

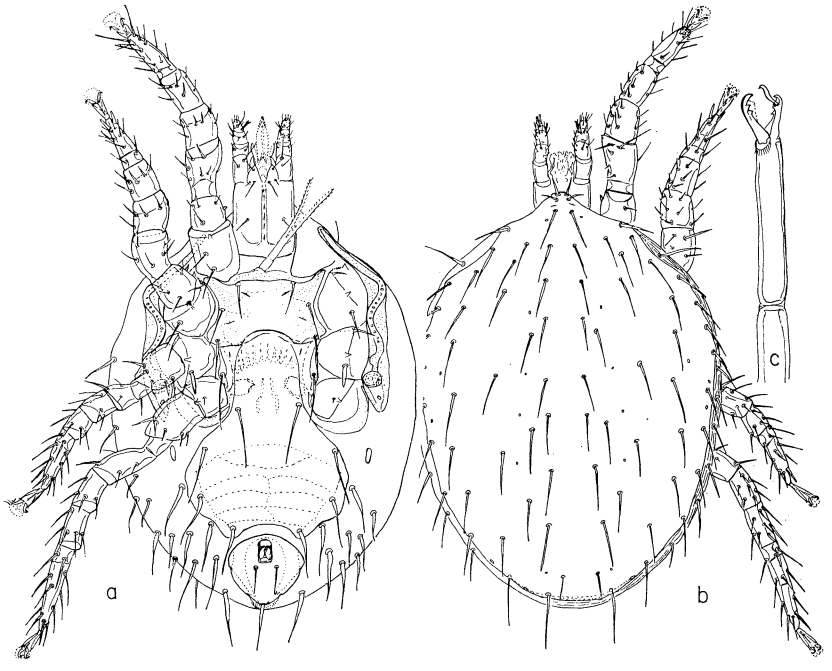

Fig. 12. *Laelaps* (*Echinolaelaps*) *sinuatus* n. sp. a, venter of ♀; b, dorsum of ♀; c, chela of ♀.

seta of coxa I is about 1/4 longer than the distal; both are slender. Deutosternum with 5–7 slender, sharp denticles. Inner posterior rostral seta not reaching more than 1/2 way to base of capitular seta. Epipharynx long, slender, sharp, apparently grooved. Malae internae paddle-like, the inner face ciliated. Tectum, a transparent, loose, many-folded membrane. Chelicera slender. The movable digit longer than the immovable and with a thin, angulate wall opposite the 2 sharp teeth. Immovable digit with 1 or 2 sharp but fragile teeth. Pilus dentilis slightly inflated, mildly sigmoid and terminating in a small ventrally directed point.

Holotype ♀ (BISHOP 3459), Dawai River, Japen I., NW New Guinea, 29. X. 1962, Nixon Wilson, on *Melomys levipes* #BBM–NG 22050. Paratypes: 16♀♀, same data as holotype. An additional 34 paratype ♀♀ are from same host (BBM–NG 22004) and locality as holotype but were collected 25. X. 1962. Not placed in the paratype series are 9 ♀♀ collected at Wau, NE New Guinea, 1400 m, 19. VI. 1961, J. H. Sedlacek, on rat No. 22.

Remarks: The robust appearance, large size, and expanded genitoventral plate militate in favor of placing this mite in *Echinolaelaps* in spite of the short, wide sternal plate.

DISTRIBUTION: New Guinea.

NE NEW GUINEA: 9, Wau, 19. VI. 1961, J. H. Sedlacek, #22 rat. NW NEW GUINEA: 36, Dawai River, Japen I., 25. X. 1962, Nixon Wilson, BBM–NG 22004 *Melomys levipes*; 19, same data but 29. X. 1962, BBM–NG 22050 *Melomys levipes*.

Laelaps (Echinolaelaps) wilsoni Strandtmann and Mitchell, n. sp. Fig. 13.

Female: 21 specimens ranging from 986–1122 μ and averaging 1063 μ. Posterior seta on coxa III blunt spiniform, coxal seta I and posterior coxal seta II piliform but broad as spiniform of coxa III; coxal seta IV minute and piliform. Sternal shield lightly reticulated, wider than long, length-width ratio 1 : 1.4 in 21 paratype ♀♀; anterior margin truncate or slightly convex; posterior margin concavity reaching to level of 3rd pair of sternal setae. Sternal seta I extending beyond base of sternal seta III. First pair of sternal pores slit-like, ca. 23 μ long, slanting posteriorly and medially and lying at angle of ca. 30° in relation to anterior margin of shield. Second pair of pores "V"-shaped with arms of "V" diverging widely; base of "V" directed towards lateral margin of shield, metasternal pores slit-like, off the plate. A pronounced arc-shaped reticulation originates near base of "V" and extends to lateral margin of sternal shield.

Metasternal seta situated on plate at level of juncture of coxae III and extends slightly beyond base of genital seta. Exopodal plate curves around posterior margin of coxa III, terminal portion being closely appressed to genital sclerite. Genitoventral plate somewhat drop-shaped, expanded posterior to coxa IV and broadly reticulated, with truncate posterior margin which closely approximates width of anal plate; separated from anal plate by a narrow band of integument ca. 10 μ wide. Genital setae separated by distance comparable to width of posterior truncate portion of G–V plate. Setae GV2 and GV4 farther apart than genital setae, and positioned so that insertions of GV2 and GV4 demarcate the limits of a rough rectangle with width being slightly greater than length. Setae GV3 farthest apart of GV setae, and inserted at widest point of epigynial shield. Anal plate broadly triangular, corners smoothly rounded, anterior margin slightly longer than sides. Anal pore situated in center of plate with adanal setae ca. 1/2 length of postanal and not reaching to its base. Stigma located on level of posterior margin of coxa III, peritreme extending forward to middle of coxa I. Peritremal plate extending posteriorly to middle of coxa IV, with a small pore near terminal end. Medapodal plates approximate size of stigma and located at level of seta GV2. Internal posterior rostral seta somewhat heavier and ca. 2× length of external posterior rostral seta. Internal posterior rostral seta extending ca. 3/4 distance

Table 1. Distribution of species.

	New Guinea	Borneo	Java	Sumatra	Malaya	Thailand	Vietnam	Philippines
echidninus	×	×	×			×	×	×
sedlaceki n. sp.	×	×						×
ornatus								×
sculpturatus		×		×				
mercedeae n. name		×						×
barbarae n. sp.	×							
traubi					×	×	×	
aingworthae n. sp.		×				×	×	
delta					×			
insignis		×						×
sanguisugus		×	×			×	×	
sinuatus n. sp.	×							
wilsoni n. sp.	×							

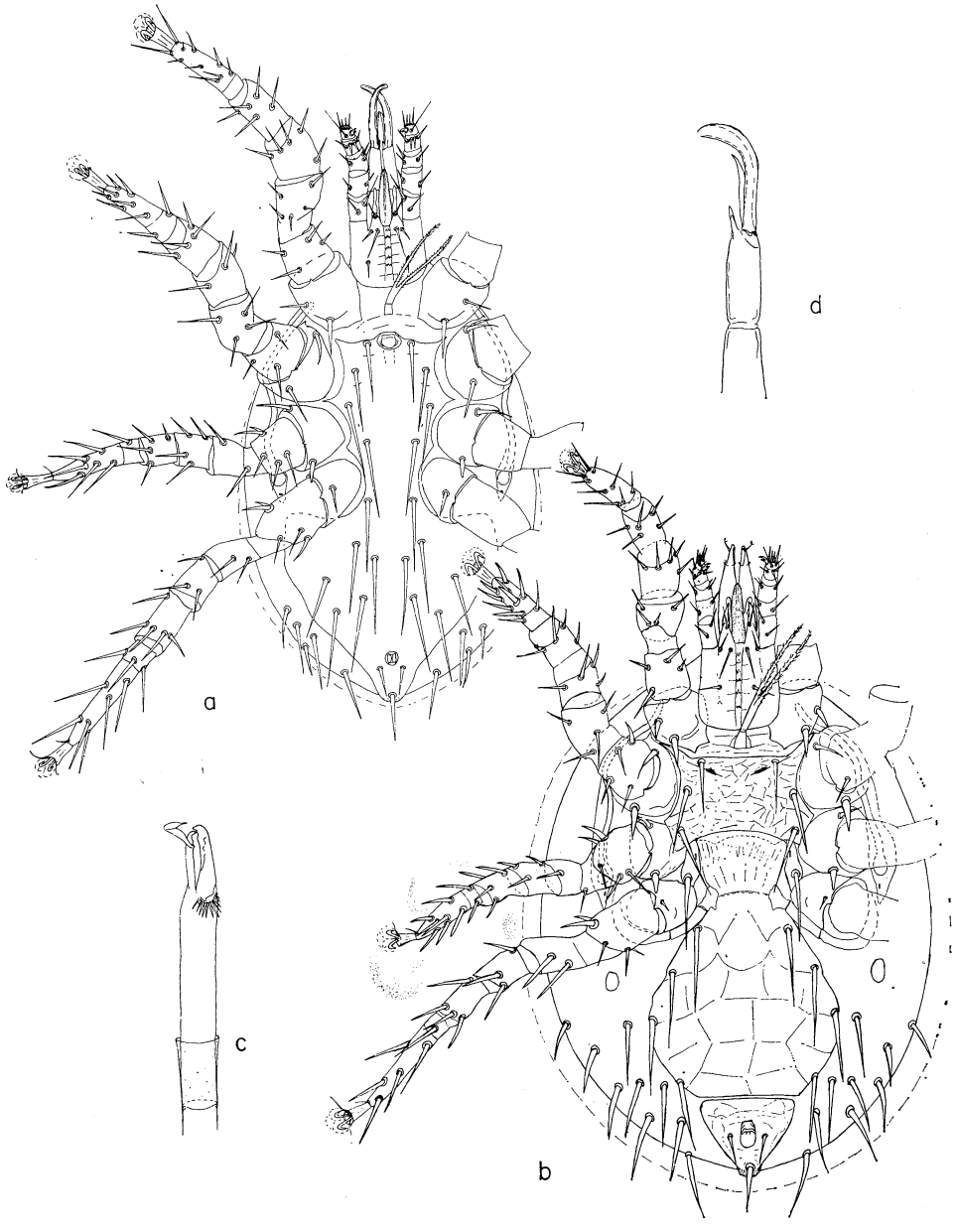

Fig. 13. *Laelaps* (*Echinolaelaps*) *wilsoni* n. sp. a, venter of ♂; b, venter of ♀; c, chela of ♀; d, spermatodactyl of ♂.

to capitular seta and somewhat heavier and ca. 2× length of external posterior rostral seta. Epipharynx only slightly expanded. Pilus dentilis expanded, apical portion looping back on itself and ending in a small teat-like extension which tapers to a fine point. Dorsal plate broadly reticulate. Dorsal setae slender, the subterminals extending a short

Table 2. Host list.

	aingworthae	barbarae	delta	echidninus	insignis	mercedeae	ornatus	sanguisugus	sculpturatus	sedlaceki	sinuatus	traubi	wilsoni
Dasyuridae													
Antechinus wilhelmina		×											
Tupaiidae													
Tupaia glis				×									
Tupaia minor										×			
Sciuridae													
Dremomys rufigenis												×	
Ratufa bicolor			×										
Sciurus culionensis				×									
Muridae													
Bandicota indica				×									
Chiropodomys calamianensis							×						
Chiropodomys gliroides			×										
Melomys levipes											×		×
Mus cervicolor												×	
Mus musculus				×									
Pogonomys sp.		×								×			
Rattus edwardsi												×	
Rattus everetti				×									
Rattus exulans				×	×					×			
Rattus fulvescens												×	
Rattus leucopus										×			
Rattus mindanensis				×									
Rattus mulleri										×			
Rattus niviventer	×			×					×			×	
Rattus niobe		×								×			
Rattus norvegicus				×									
Rattus palawanensis					×	×							
Rattus panglima				×	×	×							
Rattus rajah	×				×	×			×	×			
Rattus rattus	×			×					×				
Rattus ruber				×						×			
Rattus surifer	×									×			
Rattus verecundus										×			
Rattus whiteheadi									×	×			

distance beyond posterior margin of plate.

Seven ♂♂ averaged 741 μ and ranged from 680–774. Posterior coxal seta III blunt and spiniform, all other coxal setae piliform. All setae on tarsi II–IV, tapering to a fine point. Peritreme extending slightly beyond posterior margin of coxa I. Holoventral plate bearing the typical 4 pairs of sternal setae, 1 pair of genital setae and 5 pairs of ventral setae. Adanal setae ca. 1/2 length of postanal seta, and extending to its base. Subterminal dorsal seta more than 1/2 as long as dorsal terminal seta and extending well beyond its base. Internal posterior rostral seta more than 2× as long as external posterior rostral seta and reaching almost to base of capitular seta. Spermatodactyl curving gently toward distal end; tip lies in a plane which forms an angle of 90° with the base. Ratio of spermatodactyl length to cheliceral tibia which bears it is 5.5–4.3 for 6 ♂♂.

Holotype ♀ (BISHOP 3460), 1 of 55 specimens collected at Dawai River, Japen I., NW New Guinea, 25. X. 1962 on *Melomys levipes*, the long-tailed rat No. BBM–NG 22004, by Nixon Wilson.

Named in honor of Dr. Nixon Wilson of Bishop Museum, acarologist and intrepid collector, who sacrificed his health to extend the frontiers of science in the jungles of New Guinea. The latter sacrifice being somewhat compensated for by the extraordinary care extended by the Louisville hospital staff.

Remarks: Both *wilsoni* and *sinuatus* are quite unlike other species of *Echinolaelaps* in the shape of the sternal plate. They are included because of their large size and robust appearance. They are also quite unlike each other, as a glance at the figures will verify. Both were recovered from the same host and localities. No other mites of the *Echinolaelaps* group were associated with them.

DISTRIBUTION: New Guinea.

NE NEW GUINEA: 66, Wau, 19. VI. 1961, J. H. Sedlacek, No. 22 rat. NW NEW GUINEA: Japen I., Dawai River, 25. X. 1962, Nixon Wilson, BBM–NG 22004 *Melomys levipes*; same data but 29. X. 1962, BBM–NG 22050 *Melomy levipes*.

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Addendum

Author and date of publication of *Laelaps* (*Echinolaelaps*) species not mentioned in the text.

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Laelaps (*Echinolaelaps*) *muricola* Tragardh, 1910
Laelaps (*Echinolaelaps*) *praomyia* Taufflieb, 1959
Laelaps (*Echinolaelaps*) *ugandanus* Hirst, 1923
Laelaps (*Echinolaelaps*) *wittei* Cooreman, 1955
Laelaps (*Echinolaelaps*) *yaoundensis* Taufflieb & Mouchet, 1956