# 10. Parasitic Acarina of the Mammals[25]

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## INTRODUCTION

THIS PAPER is an account of parasitic acarines collected from mammals on Pulau Tioman, 18 March to 27 April, 1962. Detailed collection data are not given; the topography of Pulau Tioman, and the ecology of the island mammals, have already been described (Bullock and Medway, this *Bulletin*, p. 1, and Medway, this *Bulletin*, p. 9).

In all, over 160 mammals were searched for parasites under ether anaesthesia. The body and fur were examined for ticks and laelapid mites, and the ear lobes for cheyletid mites. Chiggers (larval trombiculid mites) were sought in the following sites: —ears, muzzle, axillae, belly, and perineum. Only two animals were killed, and their nasal cavities opened and examined for intranasal chiggers after the method of Audy and Nadchatram (1957). All parasites were collected with the aid of a low-power dissecting microscope or hand lens, and all were preserved in 70 per cent alcohol. Specimen host skins were kept for identification. Some mammals were examined for certain parasites, and not for others. Thus in the tables only the actual number of animals examined for the relevant family of acarines is given. The infestations are given in broad terms in Table 1, and in detail in Tables 2–4. The remainder of this contribution consists of a commentary in amplification of these Tables.

Our individual contributions to the paper have been complementary. The mites were collected, and their hosts registered and identified by C. K. N. and B. L. Lim. C. K. N. also identified some of the chiggers. M. N., having identified and recorded the ticks, and much of the other material (including most of the chiggers), collated the data. R. D. identified the remainder of the material and edited the final manuscript. In addition to Mr. B. L. Lim, we are also grateful to the following, who aided in the collection — Mr. J. A. Bullock and Lord Medway (University of Malaya), and Dr. F. L. Dunn, (Institute for Medical Research, Kuala Lumpur). To Mr. Lim Kee Chong of the Institute for Medical Research we are grateful for technical assistance.

## MESOSTIGMATA

### LAELAPIDAE

*Principal references:* Strandtmann and Wharton (1958); Drummond and Baker (1960); Keegan et al. (1960); Grokhovskaya and Nguyen Xuan Hoe (1961); Baker et al. (1962); Domrow (1962a); Strandtmann and Mitchell (1963).

A summary of the infestation data is given in Table 2. In all, six genera and eleven species were collected.

**Hystrichonyssus turneri** Keegan et al.

Numerous specimens from *Atherurus macrourus*. The type series came from the same host on the mainland.

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TABLE 1

Broad acarine infestation data for mammals, P. Tioman

| Host Species | Laelapidae | Spinturnicidae | Argasidae | Ixodidae | Cheyletidae | Trombiculidae | Listrophoridae |
|---|---|---|---|---|---|---|---|
| Insectivora: | | | | | | | |
| *Crocidura malavana* | .. | .. | .. | * | .. | * | .. |
| *Hylomys suillus* | .. | .. | .. | * | .. | * | .. |
| Dermoptera: | | | | | | | |
| *Cynocephalus variegatus* | .. | .. | .. | .. | .. | .. | .. |
| Chiroptera: | | | | | | | |
| *Pteropus hypomelanos* | * | .. | .. | .. | .. | .. | .. |
| *Cynopterus brachyotis* | .. | .. | .. | .. | .. | .. | .. |
| *Eonycteris spelaea* | .. | * | * | .. | .. | .. | .. |
| *Rhinolophus* | .. | .. | .. | .. | .. | .. | .. |
| Primates: | | | | | | | |
| *Tupaia glis* | * | .. | .. | * | .. | * | .. |
| Rodentia: | | | | | | | |
| Muridae | | | | | | | |
| *Rattus* sp. *tiomanicus* | * | .. | .. | * | .. | * | .. |
| *Rattus exulans* | * | .. | .. | * | .. | * | .. |
| *Rattus cremoriventer* | * | .. | .. | * | .. | * | .. |
| *Rattus sabanus* | * | .. | .. | * | .. | * | .. |
| *Rattus surifer* | * | .. | .. | * | .. | * | * |
| Sciuridae | | | | | | | |
| *Callosciurus notatus* | .. | .. | .. | * | .. | * | .. |
| *Callosciurus nigrovittatus* | .. | .. | .. | * | * | * | .. |
| *Sundasciurus tenuis* | * | .. | .. | * | .. | * | .. |
| *Lariscus insignis* | .. | .. | .. | * | * | * | .. |
| *Iomys horsfieldi* | .. | .. | .. | * | .. | .. | .. |
| *Ratufa bicolor* | .. | .. | .. | .. | .. | .. | .. |
| *Petaurista petaurista* | .. | .. | .. | .. | .. | .. | .. |
| Hystricidae: | | | | | | | |
| *Atherurus macrourus* | * | .. | .. | * | .. | .. | .. |
| Artiodactyla: | | | | | | | |
| *Tragulus napu* | .. | .. | .. | * | .. | * | .. |

**Neolaelaps spinosa** (Berlese)

A dozen specimens from *Pteropus hypomelanos*. This species is common on *Pteropus* spp. from Ceylon to northern Australia, and is often associated with the nycteribiid flies on these bats (Domrow, 1961).

**Echinonyssus nasutus** Hirst

Not uncommon on *Tupaia glis;* known from the same host on the mainland and in Vietnam. The type host is *Tupaia picta,* from Sarawak (G. O. Evans, *in litt.*). The single specimens from *Rattus exulans* and *R. surifer* may be regarded as strays or even bench contaminants.

**Haemolaelaps gallinarii** Grokhovskaya and Nguyen Xuan Hoe

Numerous specimens from one *Sundasciurus tenuis*. This species was originally described from Vietnam and has since been redescribed as *H. audyi* by Baker et al. (1962) from *S. tenuis* from Malaya, and a variety of other hosts, principally squirrels, from Sarawak, Sabah, Palawan and elsewhere in the Philippines.

**Laelaps nuttalli** Hirst

Collected on *Rattus* sp. *tiomanicus, R. exulans* and *R. sabanus*. This species is virtually cosmopolitan, and has been found on many rats, including *Rattus rattus* and *R. norvegicus*.

**Laelaps flagellifer** Domrow

Common on *Rattus surifer*. This species was described from *R. rajah* on the mainland, but relationships within the *rajah-surifer* complex are unsettled (but see Hill, 1960).

**Laelaps echidninus** Berlese

One specimen from *Rattus* sp. *tiomanicus*. This species is virtually cosmopolitan (but see Domrow, 1962c) and found on many rats, including *Rattus rattus* and *R. norvegicus*.

**Laelaps** spp.

Three further species of this genus were taken on P. Tioman. One, from *Rattus cremoriventer,* is either *L. turkestanicus* Lange or *L. hongaiensis* Grokhovskaya and Nguyen Xuan Hoe, if these species are distinct. The other two, one of which is very close to *L. sanguisugus* Vitzthum, were both common on *R. surifer,* and also recorded once on *R. sabanus*.

**Longolaelaps whartoni** Drummond and Baker

Common on *Rattus surifer;* described from *R. rajah* on the mainland.

SPINTURNICIDAE

*Principle reference:* Rudnick (1960).

**Meristaspis** sp.

Eight specimens from three of four *Eonycteris spelaea* examined.

**Ancystropus** sp.

Nineteen specimens from three of four *Eonycteris spelaea* examined.

TABLE 2

Mesostigmata infestation data for mammals, P. Tioman

(The first number indicates the number of animals parasitised, the second the number of parasites found)

| Host Species | animals examined | *Hystrichonyssus turneri* | *Neoliaelaps spinosa* | *Echinonyssus pasutus* | *Haemolaelaps gaffkmanii* | *Laelaps nuttalli* | *Laelaps flageltifer* | *Laelaps echidninus* | *Laelaps* sp. | *Laelaps* sp. | *Laelaps* sp. | *Longolaelaps whartoni* | *Merisiaspis* sp. | *Ancystropus* sp. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Pteropus hypomelanos* .. | 3 | .. | 1/12 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| *Eonycteris spelaea* .. | 5 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 3/8 | 3/19 |
| *Tupaia glis* .. | 26 | .. | .. | 3/4 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| *Rattus* sp. *tiomanicus* .. | 14 | .. | .. | .. | .. | 3/9 | .. | 1/1 | .. | .. | .. | .. | .. | .. |
| *Rattus exulans* .. | 2 | .. | .. | 1/1 | .. | 2/33 | .. | .. | .. | .. | .. | .. | .. | .. |
| *Rattus cremoriventer* .. | 1 | .. | .. | .. | .. | .. | .. | .. | 1/5 | .. | .. | .. | .. | .. |
| *Rattus sabanus* .. | 2 | .. | .. | .. | .. | 1/25 | .. | .. | .. | 1/13 | 1/4 | .. | .. | .. |
| *Rattus surifer* .. | 17 | .. | .. | 1/1 | .. | .. | 6/109 | .. | .. | 13/252 | 12/109 | 7/217 | .. | .. |
| *Sundasciurus tenuis* .. | 2 | .. | .. | .. | 1/120 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| *Atherurus macrourus* .. | 2 | 2/32 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |

## METASTIGMATA

*Principal references:* Kohls (1957); Audy *et al.* (1960); Anastos (1950).

Two families of ticks, represented by four genera and six species, were taken. A summary of the infestation data is given in Table 3. The identification of Malayan ticks in their immature stages is often impossible at present, but wherever possible, the immature stages collected have been compared with specimens obtained during the rearing of known species in the laboratory.

### Argasidae

**Ornithodoros** sp.

Twenty larvae on two *Eonycteris spelaea*. These are probably *O. batuensis* Hirst, the only species known from the mainland. It was originally described from Batu Caves, and has since been recorded from a variety of bats, both Microchiroptera and Megachiroptera, including *E. spelaea*.

### Ixodidae

**Ixodes granulatus** Supino

Collected on twelve host species. It is a common tick of rodents on the mainland of Malaya, and is the only species known to parasitise rats, squirrels and shrews in all its active stages — larva, nymph and adult. *I. granulatus* is medically significant, because Russian spring-summer encephalitis virus has frequently been isolated from it.

**Haemaphysalis atheruri** Hoogstraal et al.

This species was taken on three occasions on *Tragulus napu*, and is known from *T. javanicus* on the mainland. One nymph, probably belonging to this species, was taken on *Tupaia glis*. This tick, in small numbers, seems to be host-specific for *Tragulus* in the adult stage. The larvae and nymphs have been taken from rodents.

**Haemaphysalis atheruri** Hoogstraal et al.

Both specimens of the brush-tailed porcupine, *Atherurus macrourus*, examined were infested with this species. It is the only known host on the mainland.

**Haemaphysalis** sp.

At least one other species is represented in the collection by immature stages only, collected from *Rattus* sp. *tiomanicus* and *R. sabanus*, but these cannot yet be determined. Forest rats are major hosts of immature *Haemaphysalis* ticks in Malaya.

**Amblyomma helvolum** Koch

One female specimen on a dead log near the beach, and one nymph on *Rattus sabanus*. In addition, three *R.* sp. *tiomanicus* bore a total of four larvae which appear close to *A. helvolum*, although we hesitate to confirm this diagnosis at present. The natural hosts of *A. helvolum* in all its active stages are typically snakes and lizards, the water monitor (*Varanus salvator*) being one of the common hosts. On several occasions, *A. helvolum* has been found crawling on, but not attached to, man.

TABLE 3

Tick infestation data for mammals, P. Tioman
(Records with asterisks are based on tentative diagnoses)
N=nymph, L=larva

| Host Species | animals examined | *Ornithodoros* sp. | *Ixodes granulatus* | *Haemaphysalis traguli* | *Haemaphysalis atheruri* | *Haemaphysalis* sp. | *Amblyomma helvolum* |
|---|---|---|---|---|---|---|---|
| *Crocidura malayana* .. .. .. | 3 | .. | 3/11N, 5L | .. | .. | .. | .. |
| *Hylomys suillus* .. .. .. | 1 | .. | 1/2L | .. | .. | .. | .. |
| *Eonycteris spelaea* .. .. .. | 5 | 2/20L | .. | .. | .. | .. | .. |
| *Tupaia glis* .. .. .. | 35 | .. | 1/1♀ | 1/N* | .. | .. | .. |
| *Rattus* sp. *tiomanicus* .. .. .. | 55 | .. | 7/3♀, 6N, 16L | .. | .. | 1/1N | 3/4L* |
| *Rattus exulans* .. .. .. | 6 | .. | 2/1♂, 2♀, 1N | .. | .. | .. | .. |
| *Rattus cremoriventer* .. .. .. | 4 | .. | 2/1♂, 6♀ | .. | .. | .. | .. |
| *Rattus sabanus* .. .. .. | 8 | .. | .. | .. | .. | 2/1N, 8L | 1/1N |
| *Rattus surifer* .. .. .. | 17 | .. | 1/6♀ | .. | .. | .. | .. |
| *Callosciurus notatus* .. .. .. | 9 | .. | 1/1♀ | .. | .. | .. | .. |
| *Callosciurus nigrovittatus* .. .. | 5 | .. | 2/2♀ | .. | .. | .. | .. |
| *Sundasciurus tenuis* .. .. .. | 4 | .. | 1/2♀ | .. | .. | .. | .. |
| *Lariscus insignis* .. .. .. | 5 | .. | 1/1♂, 1♀ | .. | .. | .. | .. |
| *Iomys horsfieldi* .. .. .. | 4 | .. | 1/1♀ | .. | .. | .. | .. |
| *Atherurus macrourus* .. .. .. | 2 | .. | .. | .. | 2/12♂, 2♀, 36N, 7L | .. | .. |
| *Tragulus napu* .. .. .. | 4 | .. | .. | 3/3♂, 1♀, 1N | .. | .. | .. |

## PROSTIGMATA

### CHEYLETIDAE

*Principal reference:* Baker (1949).

**Cheyletus** sp.

Seven females from one *Callosciurus nigrovittatus*.

**Chelonotus selenirhynchus** Berlese

Eighteen females from one *Lariscus insignis*. This aberrant and monotypic genus is common on many squirrels in the Malaysian subregion (Domrow, 1960).

### TROMBICULIDAE

*Principle references:* Womersley (1952); Audy (1956); Audy and Nadchatram (1957); Traub (1960); Domrow (1962b); Nadchatram and Domrow (1964).

A total of nine genera and 21 species of chiggers were collected from 77 of 114 animals examined, and a summary of the infestation data is given in Table 4. By any standards this is a rich collection, considering approximately 140 species are known from Malaysia as a whole, where most of them are found in primary rain-forest. Audy (1956) and Domrow (1962c) have noted that chiggers show little or no host-specificity, but rather a varying degree of habitat-specificity. Audy also suggests that habitat-specificity may give the appearance of host-specificity. The highest number of species of chiggers found on a single host specimen in Malaya (*Rattus bowersi*) is eighteen.

*Leptotrombidium deliense* was the most common chigger found on *Rattus* sp. *tiomanicus*, which has a very wide ecological range (see Medway on Mammals, earlier). The occurrence of this mite even on rats trapped in houses is unusual, as the common house rat on the mainland (*Rattus r. diardi*) is free of *L. deliense* although commonly infested with *Ascoschoengastia indica*.

The following animals (numbers examined in parenthesis) were found to harbour no chiggers — *Cynocephalus variegatus* (2), *Iomys horsfieldi* (4), *Petaurista petaurista* (2), *Ratufa bicolor* (1), *Atherurus macrourus* (2), *Rattus cremoriventer* (1), and all the bats, comprising thirteen specimens of four species.

**Leptotrombidium deliense** (Walch)

Collected from ten of the twelve host species examined, and by far the commonest chigger on the island. *Tupaia glis*, *Rattus* sp. *tiomanicus*, *Rattus sabanus*, *Lariscus insignis* and *Tragulus napu* were its major hosts. Its habitat could therefore range from cultivation, *belukar* and forest fringe, to deep primary rain-forest. It is an established vector of scrub typhus in the Asiatic-Pacific region.

**Leptotrombidium langati** (Audy and Womersley)

Collected from *Hylomys suillus*, *Tupaia glis*, *Callosciurus notatus*, and *Lariscus insignis*. The occurrence of this species in primary rain-forest on P. Tioman substantiates its authors' claim that it is a very deep forest chigger. On the mainland, it is primarily a parasite of forest rats (especially *Rattus mulleri* and *Rattus bowersi*), tree shrews, ground squirrels, and sometimes tree squirrels. Morphologically, it is closely related to *L. deliense*.

**Leptotrombidium bodense** (Gunther)

Collected from *Lariscus insignis* and *Tragulus napu*. An uncommon species, easily mistaken for *L. deliense*. Mouse-deer (*Tragulus* spp.), particularly, and squirrels appear to be its major hosts.

**Leptotrombidium arenicola** Traub

Found on *Tupaia glis*, *Rattus* sp. *tiomanicus* and *Rattus exulans*. The former is a new host record. One infested *T. glis* was trapped in neglected land between a coconut plantation and a vegetable garden at sea level, and the other in a rice-field 100–150 ft. above sea level. The natural habitat of *L. arenicola* is of epidemiological interest, as this species is a suspected vector of scrub typhus in Malaya (I.M.R. Annual Report, 1960). This species seems to be restricted to open, sandy, coastal areas, and was originally recorded from several islands. A more recent record is from *Rattus* sp. *jalorensis* on Pulau Langkawi. It is again a species closely related to *L. deliense*.

**Leptotrombidium muridia** (Womersley)

Only one specimen taken, on *Lariscus insignis*. This rare species was described from a single specimen from Malaya, and has since been collected in small numbers on forest rats.

**Leptotrombidium** sp.

Again, a single specimen taken on *Lariscus insignis*, mixed with other species of *Leptotrombidium*. It is possibly a new species near *L. keukenschrijveri* (Walch).

**Siseca rara** (Walch)

Six specimens obtained from three *Tupaia glis*. On the mainland, this species has been collected from insectivores, snakes, skinks (*Mabuia multifasciata*), and rodents. A closely related species, *S. subrara* Audy, infests pill-millipedes (*Sphaeropaeus globus-magicus*). Very few trombiculids indeed parasitise hosts other than vertebrates.

**Eutrombicula wichmanni** (Oudemans)

Eighteen specimens collected from two *Tupaia glis*. This wide-spread species has a wide range of hosts, including reptiles, birds and mammals. A scrub-itch chigger, it causes severe irritation to man, and is well known to Malay village folk by the name of *tungau*.

**Ascoschoengastia indica** (Hirst)

Found on one of three *Callosciurus notatus* infested with chiggers. This is the commonest chigger on house rats on the mainland. It also occurs in oil palm estates on *Rattus* sp. *jalorensis*, together with *Leptotrombidium deliense*, and all active stages of its life history (larva, nymph and adult) have been recovered from the nests of *Rattus* sp. *jalorensis* in oil palms. Other species of this genus are also known to breed in the nests of their hosts.

**Ascoschoengastia audyi** (Womersley)

Quite common on *Callosciurus notatus* and *C. nigrovittatus;* the pattern of infestation is similar to that on the mainland.

**Ascoshoengastia roluis** (Traub and Audy)

A few specimens of this uncommon species on one *Callosciurus tenuis*. It was originally described from Borneo.

**Ascoshoengastia calcar** Nadchatram and Domrow

This species, like the preceding three, belongs to the subgenus *Laurentella* Audy. Eight specimens were recovered from the two *Rattus surifer* examined for nasal mites. It has been taken in relatively large numbers in the nasal cavities of a variety of forest rats, mixed with species of *Doloisia*, see below.

**Susa labuanensis** (Womersley)

One specimen taken on *Rattus sabanus*. This rare species has not been recorded since the type series from Labuan, Borneo. Very little is known of the biology of this genus (Audy and Nadchatram, 1960).

**Walchiella impar** (Gunther)

Collected from *Rattus* sp. *tiomanicus*. This species is usually found mixed with the next species, *W. oudemansi*, to which it is closely related. It is relatively common on the mainland.

**Walchiella oudemansi** (Walch)

Collected from *Rattus* sp. *tiomanicus*, *R. sabanus* and *Lariscus insignis*. This is a common species on a variety of rodents and some insectivores in scrub, and secondary and primary rain-forest in Malaya.

**Helenicula mutabilis** (Gater)

Several specimens taken from *Rattus sabanus*. This is a fairly common species on a variety of rodents in lalang, scrub and secondary rain-forest in Malaya, where it is markedly seasonal in occurrence.

**Doloisia browningi** (Audy and Nadchatram)

Two *Rattus surifer* were examined for nasal mites, and yielded nineteen specimens. The larvae of this, and the following three species (as well as *Ascoschoengastia calcar*), live exclusively in the intranasal cavities of ground-dwelling forest rats. Their preferred site of attachment is to the walls of the chambers lateral to the nasoturbinal bones. The authors give a summary of infestation data of the Malayan species of the genus. Over 20 species in all have been described. Both rats examined carried larvae of all four species of *Doloisia* as well as *Ascoschoengastia calcar*.

**Doloisia brachypus** (Audy and Nadchatram)

Nineteen specimens of this species were collected from both the *Rattus surifer*. This is the commonest intranasal chigger on the mainland.

**Doloisia intermedia** (Audy and Nadchatram)

Twenty-four specimens of this fairly common species were taken on both the *Rattus surifer*.

**Doloisia domrowi** (Audy and Nadchatram)

Only three specimens of this common species were collected from both *Rattus surifer*.

**Gahrliepia fletcheri** Gater

Recorded from *Rattus* sp. *tiomanicus* and *R. sabanus*. This is the only member of the subfamily Gahrliepiinae to be taken on P. Tioman, although over 25 species are known from Malaya. As many of the animals in the present survey were not examined completely, the group may be more common than our records indicate, as members of this subfamily are minute, and usually attach singly or in very small clusters. On the mainland, it is a common species in primary and secondary rain-forest. The type host and locality are the house rats, *Rattus r. diardi*, Kuala Lumpur, but this rat has not again yielded this species during intensive post-war studies.

TABLE 4

Chigger infestation data for mammals, P. Tioman

As several hundred, or even thousand, specimens of some chiggers were present, only their relative abundance is indicated here. The common species were sorted under a dissecting binocular microscope. Hosts marked with a single + were occasionally, those with two commonly, and those with three heavily, infested with the chigger in question.

| Host Species | exam. infest. | *Leptotrombidium deliense* | *Leptotrombidium langati* | *Lepototrombidium bodense* | *Leptotrombidium arenicola* | *Leptotrombidium murlidia* | *Leptotrombidium* sp. | *Siseca rara* | *Eutrombicula wichmanni* | *Ascoschoengastia indica* | *Ascoschoengastia audyi* | *Ascoschoengastia roluis* | *Ascoschoengastia calcar* | *Susa labuanesis* | *Walchiella impar* | *Walchiella oudemansi* | *Helenioula mutabilis* | *Doloisia browningi* | *Doloisia brachypus* | *Doloisia intermedia* | *Doloisia domrowi* | *Gahrliepia fletcheri* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Crocidura malayana* .. | 2/1 | + | | | | | | | | | | | | | | | | | | | | ++ |
| *Hylomys suillus* .. | 1/1 | + | +++ | | | | | | | | | | | | | | | | | | | ++ |
| *Tupaia glis* .. .. | 34/25 | ++ | +++ | | + | | | + | + | | | | | | | | | | | | | + |
| *Rattus* sp. *tiomanicus* .. | 27/23 | +++ | | | ++ | | | | | | | | | | + | ++ | | | | | | |
| *Rattus exulans* .. | 5/2 | | | | + | | | | | | | | | | | | | | | | | |
| *Rattus sabanus* .. | 10/7 | ++ | | | | | | | | | | | | + | | ++ | + | | | | | + |
| *Rattus surifer* .. | 11(2)/2* | | | | | | | | | | | | + | | | | | + | + | + | + | |
| *Callosciurus notatus* .. | 7/3 | + | + | | | | | | | + | + | | | | | | | | | | | |
| *C. nigrovittatus* .. | 5/4 | + | | | | | | | | | ++ | | | | | | | | | | | |
| *Sundasciurus tenuis* .. | 4/3 | + | | | | | | | | | | + | | | | | | | | | | |
| *Lariscus insignis* .. | 5/4 | ++ | ++ | + | | + | + | | | | | | | | | + | | | | | | |
| *Tragulus napu* .. | 2/2 | +++ | | ++ | | | | | | | | | | | | | | | | | | |

*In all, eleven specimens were examined for ear and body chiggers with negative results. Two were examined for internasal chiggers, and both were infested.

## ASTIGMATA

### LISTROPHORIDAE

*Principal reference:* Domrow (1958).

**Listrophoroides sp.**

Ten specimens from one *Rattus surifer*.

## DISCUSSION

The mite material described above is typical of the Malayan mainland, with few exceptions. It is noteworthy that *Dermacentor auratus* Supino and *Amblyomma testudinarium* Koch, common parasites in their immature stages of a wide range of small mammals, were absent in the island collection. This may be correlated with the absence on the island of wild pigs which are the common hosts of the adult ticks. The larvae of the latter species often attack man, their bites causing severe irritation and skin reaction which persist for several weeks or months.

A total of nine genera and 21 species of chiggers were collected on Pulau Tioman. In terms of species the chiggers were the most abundant parasites recorded; all except one species (*Susa labuanensis*) have been recorded on the mainland. The same, in general, is the case with the species of the other six families. Six species of *Leptotrombidium* were taken on the island, five of them infesting the ground squirrel, *Lariscus insignis*. The genus *Leptotrombidium* is of particular interest because some of its members are established vectors of scrub typhus (tsutsugamushi disease) in the Orient and the Pacific. The absence of *L. akamushi*, one of the best known vectors of scrub typhus, is noteworthy. Nor have previous collections from other islands off the Malayan mainland (Pulau Jarak, P. Berhala, P. Langkawi, and the Sembilan islands — including P. Rumbia and P. Pankor), yielded this species. On mainland Malaya, *L. akamushi* is confined to scrub and lalang (*Imperata cylindrica*) wasteland[26], and this would suggest that *L. akamushi* is an introduced species, while *L. deliense* is probably native to Malaya.

The absence of *Ascoschoengastia indica* on *Rattus* sp. *tiomanicus*, which is found in houses and coconut plantation, among other ecological habitats, is also of interest. This species is the commonest chigger on the house rat (*Rattus r. diardi*) on the mainland. Also, all stages of *A. indica* have been found in the nests of *Rattus* sp. *jalorensis* in oil palm.

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