# Ectoparasitic mites (Acarina) from small mammals in Central Sweden

By ANDERS EDLER

## 1. Introduction

In 1960—1965 small mammals were collected in several provinces of Central Sweden, viz. Södermanland, Uppland, Västmanland, Värmland, Dalarna, Medelpad, Härjedalen, and Jämtland (Fig. 1). The present paper deals with the ectoparasitic mites taken from these mammals.

The collections were made by working groups from the Department of Animal Ecology at the University of Lund, the Zoological Institute at the University of Uppsala, the Swedish Museum of Natural History in Stockholm, and the Research Institute of National Defence in Stockholm. Collectors were as follows: A. Johnels (21/9—7/10 1960, 7/9—25/9 and 7/11—10/11 1961), W. Berg (8/6—29/8 1960, 15/5—26/5 and 4/9—20/9 1962), G. & P. Brinck and I. Rudebeck (15/7—19/7 1963), G. Brinck, B. Jende and I. Rudebeck (28/6—15/7 1963), T. Håkansson, J. Jansson and L. Wallin (21/4—23/4, 5/8—6/8 and 24/9—25/9 1964), B. Jende and K. Norell (17/7—25/7 1965).

## 2. Material and methods

1,610 small mammals were collected. 311 were infested with all together 1,541 ectoparasitic mites.

Most mammals were collected in live traps. In 1960 two kinds of traps were used, viz. net cage traps (Hansson 1967) and Longworth traps. In 1961 and 1962 only Longworth traps were used, and in 1963, 1964 and 1965 only net cage traps.

The ectoparasites were mostly removed by hand, but in 1961 and 1962 a bag method was used for collecting ticks and fleas (Brinck et al. 1967). A small number of ectoparasitic mites was also recovered.

## 3. Small mammal material

The 1,610 specimens collected represented 14 species (table 1). 1,299 specimens had no ectoparasitic mites.

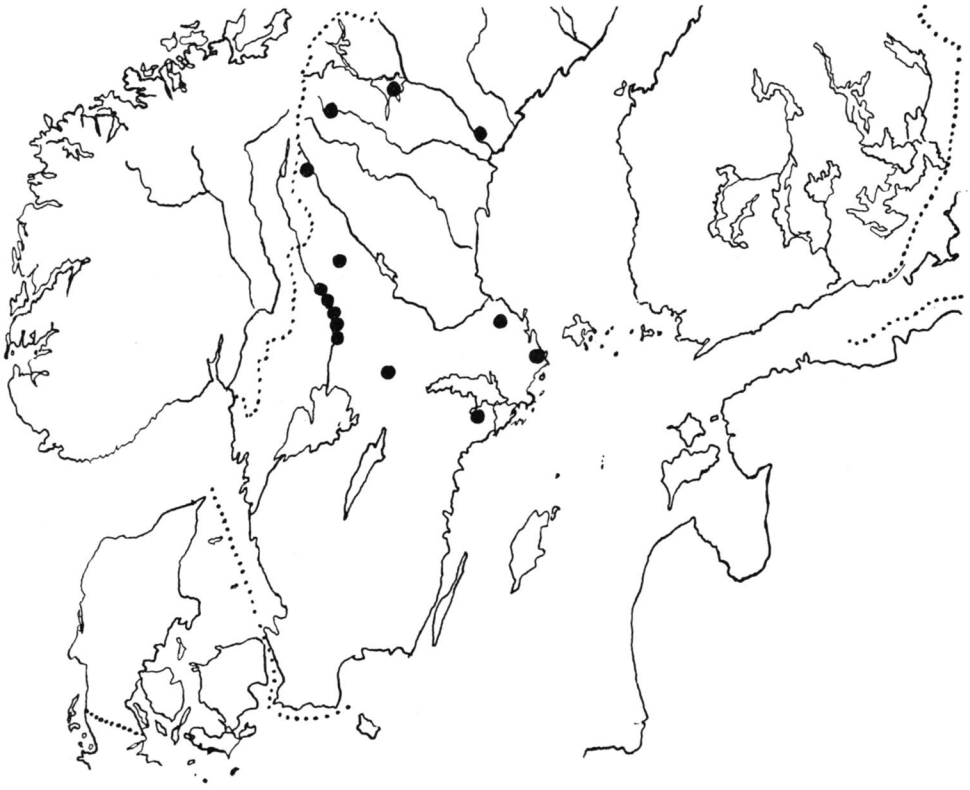

Fig. 1. Map of Southern Scandinavia showing the collecting localities.

## 4. Acarine material

The 1,541 specimens represented 26 species. There were 56 larvae, 14 protonymphs, 97 deutonymphs, 126 males, 1,239 females, and 9 undetermined stages. Their occurrence in the various provinces is shown in table 2 and on the hosts in tables 3 and 4. Seven of the species are new to Sweden (cf. Trägårdh 1910, Willmann 1943 and Edler 1968).

The species are listed below, arranged according to Bregetova (1956). Most of the material belongs to the order Parasitiformes. Three genera (*Pyemotes, Cheyletia* and *Trombicula*) of suborder Trombidiformes were found on a few hosts and are included because of their importance as vectors.

### Suborder *Trombidiformes* Reuter, 1909
### Family *Pyemotidae* Oudemans, 1937

*Pyemotes* sp.

Four specimens from *Sorex araneus*.

*P. ventricosus* Newport, is the causative agent of a form of dermatitis in man. Normally it is an ectoparasite of various insect larvae. The distribution is world-wide. (Cf. Baker and Wharton 1952, Zumpt 1961.)

Table 1. *List of the small mammal species investigated and their numbers from the various provinces.*

| Species | Söderman-land | Uppland | Västman-land | Värmland | Dalarna | Medelpad | Härjedalen | Jämtland | Σ | Specimens with mites |
|---|---|---|---|---|---|---|---|---|---|---|
| *Sorex minutus* L. | — | 9 | 13 | — | — | — | — | — | 22 | 1 |
| *S. araneus* L. | 4 | 170 | 87 | 30 | 26 | — | 18 | 36 | 371 | 32 |
| *Neomys fodiens* Penn. | — | 20 | 3 | 2 | 1 | — | 1 | — | 27 | 7 |
| *Myopus schisticolor* Liljeborg | — | — | — | — | 2 | — | — | — | 2 | 1 |
| *Clethrionomys glareolus* Schreb. | 4 | 286 | 57 | 14 | 48 | 2 | 39 | 36 | 486 | 73 |
| *C. rufocanus* Sundevall | — | — | — | — | 4 | — | — | — | 4 | 4 |
| *Arvicola terrestris* L. | — | 2 | — | — | — | — | — | — | 2 | 1 |
| *Microtus agrestis* L. | 2 | 52 | 64 | 6 | 5 | — | 1 | 18 | 148 | 37 |
| *M. oeconomus* Pall. | — | — | — | — | 7 | — | 3 | — | 10 | 9 |
| *Apodemus flavicollis* Melch. | 16 | 180 | 87 | 1 | — | 3 | — | — | 287 | 79 |
| *A. sylvaticus* L. | 1 | 28 | 131 | 1 | — | — | — | — | 161 | 51 |
| *A.* sp. | — | 5 | 20 | 2 | 3 | — | — | — | 30 | 11 |
| *Rattus norvegicus* Berkenhout | — | 7 | — | — | 1 | — | — | — | 8 | 1 |
| *Mus musculus* L. | — | 21 | 25 | — | — | — | — | 5 | 51 | 3 |
| *Mustela nivalis* L. | — | — | — | 1 | — | — | — | — | 1 | 1 |
| Σ | 27 | 780 | 487 | 57 | 97 | 5 | 62 | 95 | 1,610 | 311 |

## Family *Cheyletidae* Leach, 1814

*Cheyletia* sp.

Specimens from *Clethrionomys glareolus* and *Apodemus sylvaticus*.

The Cheyletidae are free-living predators, but some of them are found more or less regularly in the fur of mammals or the feathers of birds, where they feed on true parasites (Zumpt 1961). Many species are world-wide in distribution (Baker and Wharton 1952).

## Family *Trombiculidae* Ewing, 1929

*Trombicula zachvatkini* Schluger, 1948

Larvae on *Clethrionomys glareolus, Microtus agrestis, Apodemus flavicollis* and *A. sylvaticus*.

Most trombiculids parasitize terrestrial vertebrates, including Man. Particularly the larvae of the genus *Trombicula* are pests of Man in many parts of the world (Baker and Wharton 1952). *T. zachvatkini* is widespread in Europe (Daniel 1959), but has not previously been recorded from Sweden.

## Suborder *Mesostigmata* G. Canestrini, 1819
## Family *Parasitidae* Oudemans, 1902

*Pergamasus crassipes* L., 1758

One female on *Clethrionomys glareolus*.

This is a free-living mite, which is sometimes found in the nests of birds

Table 2. *The numbers of specimens of the mite species in the samples from the various provinces.*

| Species | Södermanland | Uppland | Västmanland | Värmland | Dalarna | Medelpad | Härjedalen | Jämtland | Σ |
|---|---|---|---|---|---|---|---|---|---|
| *Pyemotes* sp. | — | 4 | — | — | — | — | — | — | 4 |
| *Cheyletia* sp. | — | — | — | 1 | 3 | — | 1 | — | 5 |
| *Trombicula zachvatkini* | — | — | 56 | — | — | — | — | — | 56 |
| *Pergamasus crassipes* | — | 1 | — | — | — | — | — | — | 1 |
| *Eugamasus kraepelini* | — | — | — | 1 | — | — | — | — | 1 |
| *E. remberti* | — | — | — | — | 1 | — | — | 1 | 2 |
| *E.* sp. | 1 | — | — | 1 | 13 | — | — | — | 15 |
| *Euryparasitus emarginatus* | 2 | 4 | — | 1 | 1 | — | — | 1 | 9 |
| *Cyrtolaelaps mucronatus* | — | 1 | — | — | 9 | — | 2 | — | 12 |
| *Androlaelaps fahrenholzi* | — | — | — | — | — | — | — | 4 | 4 |
| *Haemolaelaps casalis* | — | — | — | 1 | — | — | — | — | 1 |
| *Eulaelaps stabularis* | 4 | 8 | — | 6 | 22 | — | 2 | 10 | 52 |
| *Laelaps muris* | — | 7 | — | — | — | — | — | — | 7 |
| *L. clethrionomydis* | — | — | — | — | 8 | — | 3 | — | 11 |
| *L. hilaris* | — | 28 | — | 8 | 45 | — | 7 | 99 | 187 |
| *L. agilis* | 38 | 251 | 453 | 55 | 8 | 6 | — | — | 811 |
| *Hyperlaelaps arvalis* | — | 4 | 4 | 2 | 22 | — | — | 4 | 36 |
| *Haemogamasus horridus* | — | 4 | — | 9 | 12 | — | 1 | 1 | 27 |
| *H. nidi* | 6 | 39 | — | 19 | 48 | — | 4 | 4 | 120 |
| *H. nidiformis* | — | — | — | — | 1 | — | — | 1 | 2 |
| *H. hirsutus* | 1 | 14 | — | — | — | — | — | — | 15 |
| *H. ambulans* | — | 1 | — | — | 4 | — | 1 | — | 6 |
| *Hirstionyssus isabellinus* | — | 8 | — | 5 | 35 | — | 29 | 28 | 105 |
| *H. soricis* | — | — | — | — | — | — | 16 | 5 | 21 |
| *H. musculi* | 1 | 5 | 17 | — | 1 | — | 2 | — | 26 |
| Σ | 53 | 379 | 530 | 109 | 233 | 6 | 68 | 158 | 1,536 |

and small mammals and, temporarily, in the fur of mammals. Nordberg (1936) found it in a nest of *Turdus pilaris* L. in Finland, Mrciak and Brander (1965) reported it from *Sciurus vulgaris* L. in Finland, and Mrciak, Daniel and Rosický (1966) found it in nests of *Clethrionomys glareolus* and *Apodemus flavicollis* among others.

*Eugamasus kraepelini* Berlese, 1903

One female on *Clethrionomys glareolus* taken in a forest at an altitude of ca. 150 m.

Known from most parts of Europe (Trägårdh 1931).

*Eugamasus remberti* Berlese, 1912

Two deutonymphs from *Clethrionomys glareolus.*

As deutonymph abundant in the fur of small mammals. As adult free-living. Known from most parts of Europe (Edler 1968, Mrciak and Tovornik 1966).

*Eugamasus* sp.

Deutonymphs from *Sorex araneus, Clethrionomys glareolus* and *Microtus oeconomus.*

Table 3. *The numbers of specimens of the mite species on the hosts investigated.*

| Species | *S. minutus* | *S. araneus* | *N. fodiens* | *M. schisticolor* | *C. glareolus* | *C. rufocanus* | *A. terrestris* | *M. agrestis* | *M. oeconomus* | *A. flavicollis* | *A. sylvaticus* | *A.* sp. | *R. norvegicus* | *M. musculus* | *M. nivalis* | *Larva* (L) | *Protonymph* (N I) | *Deutonymph* (N II) | ♂ | ♀ | Undetermined stages | Σ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Pyemotes* sp. | — | 4 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 4 | 4 |
| *Cheyletia* sp. | — | — | — | — | 4 | — | — | — | — | — | 1 | — | — | — | — | — | — | — | — | — | 5 | 5 |
| *Trombicula zachvatkini* | — | — | — | — | 46 | — | — | 1 | — | 2 | 7 | — | — | — | — | 56 | — | — | — | — | — | 56 |
| *Pergamasus crassipes* | — | — | — | — | 1 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 1 | — | 1 |
| *Eugamasus kraepelini* | — | — | — | — | 1 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 1 | — | 1 |
| *E. remberti* | — | — | — | — | 2 | — | — | — | — | — | — | — | — | — | — | — | — | 2 | — | — | — | 2 |
| *E.* sp. | — | 4 | — | — | 9 | — | — | — | 2 | — | — | — | — | — | — | — | — | 15 | — | — | — | 15 |
| *Parasitidae* non det. | — | 2 | — | — | 2 | — | — | — | — | 1 | — | — | — | — | — | — | — | 5 | — | — | — | 5 |
| *Euryparasitus emarginatus* | — | 3 | — | — | 1 | — | — | 1 | — | 3 | — | — | — | 1 | — | — | — | 9 | — | — | — | 9 |
| *Cyrtolaelaps mucronatus* | — | — | — | — | 7 | 1 | — | 2 | 1 | 1 | — | — | — | — | — | — | — | 12 | — | — | — | 12 |
| *Androlaelaps fahrenholzi* | — | — | — | — | — | — | — | 4 | — | — | — | — | — | — | — | — | 3 | 1 | — | — | — | 4 |
| *Haemolaelaps casalis* | — | 1 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 1 | — | 1 |
| *Eulaelaps stabularis* | — | 6 | 1 | 2 | 27 | — | — | 7 | 1 | 4 | 2 | 1 | — | 1 | — | — | — | — | 2 | 50 | — | 52 |
| *Laelaps muris* | — | — | — | — | — | — | 7 | — | — | — | — | — | — | — | — | — | — | — | 2 | 5 | — | 7 |
| *L. clethrionomydis* | — | — | — | — | 5 | 6 | — | — | — | — | — | — | — | — | — | — | — | — | 2 | 9 | — | 11 |
| *L. hilaris* | — | 1 | — | — | 1 | — | — | 142 | 36 | 3 | — | — | — | 2 | 2 | — | — | — | 4 | 183 | — | 187 |
| *L. agilis* | 2 | 1 | 4 | — | 3 | — | — | 2 | — | 493 | 207 | 99 | — | — | — | — | 9 | 22 | 95 | 685 | — | 811 |
| *Hyperlaelaps arvalis* | — | — | — | — | — | — | — | 16 | 20 | — | — | — | — | — | — | — | — | 1 | 4 | 31 | — | 36 |
| *Haemogamasus horridus* | — | 10 | 3 | 1 | 11 | 1 | — | — | — | 1 | — | — | — | — | — | — | — | 18 | 3 | 6 | — | 27 |
| *H. nidi* | — | 13 | 1 | 2 | 63 | — | — | 10 | 3 | 21 | 3 | 2 | 1 | 1 | — | — | 1 | 5 | 6 | 108 | — | 120 |
| *H. nidiformis* | — | — | — | — | — | — | — | 1 | 1 | — | — | — | — | — | — | — | — | — | — | 2 | — | 2 |
| *H. hirsutus* | — | 1 | 3 | — | 7 | — | — | — | — | 4 | — | — | — | — | — | — | 1 | 7 | 2 | 5 | — | 15 |
| *H. ambulans* | — | — | — | — | 2 | 1 | — | 2 | 1 | — | — | — | — | — | — | — | — | — | — | 6 | — | 6 |
| *Hirstionyssus isabellinus* | — | 3 | 2 | 2 | 48 | 3 | — | 19 | 21 | 1 | — | 1 | — | 4 | 1 | — | — | — | 6 | 99 | — | 105 |
| *H. soricis* | — | 6 | 15 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 21 | — | 21 |
| *H. musculi* | — | 1 | — | — | 1 | — | — | — | 1 | 9 | 12 | 2 | — | — | — | — | — | — | — | 26 | — | 26 |
| Σ | 2 | 56 | 29 | 7 | 241 | 12 | 7 | 207 | 87 | 543 | 232 | 105 | 1 | 9 | 3 | 56 | 14 | 97 | 126 | 1,239 | 9 | 1,541 |

Table 4. *The frequency of some well-represented mite species on the small mammals investigated.*

| Species | *S. minutus* | *S. araneus* | *N. fodiens* | *M. schisticolor* | *C. glareolus* | *C. rufocanus* | *A. terrestris* | *M. agrestis* | *M. oeconomus* | *A. flavicollis* | *A. sylvaticus* | *A. sp.* | *R. norvegicus* | *M. musculus* | *M. nivalis* | Total number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Trombicula zachvatkini* | — | — | — | — | 82.1 | — | — | 1.8 | — | 3.6 | 12.5 | — | — | — | — | 56 |
| *Eulaelaps stabularis* | — | 11.5 | 1.9 | 3.8 | 51.9 | — | — | 13.5 | 1.9 | 7.7 | 3.8 | 1.9 | — | 1.9 | — | 52 |
| *Laelaps hilaris* | — | 0.5 | — | — | 0.5 | — | — | 75.9 | 19.3 | 1.6 | — | — | — | 1.1 | 1.1 | 187 |
| *L. agilis* | 0.2 | 0.1 | 0.5 | — | 0.4 | — | — | 0.2 | — | 60.8 | 25.5 | 12.2 | — | — | — | 811 |
| *Haemogamasus nidi* | — | 10.8 | 0.8 | 1.7 | 52.5 | — | — | 8.3 | 2.5 | 17.5 | 2.5 | 1.7 | 0.8 | 0.8 | — | 120 |
| *Hirstionyssus isabellinus* | — | 2.9 | 1.9 | 1.9 | 45.7 | 2.9 | — | 18.1 | 20.0 | 1.0 | — | 1.0 | — | 3.8 | 1.0 | 105 |
| | | | | | | | | | | | | | | | Σ | 1,331 |

*Parasitidae* non det.

Deutonymphs from *Sorex araneus, Clethrionomys glareolus* and *Apodemus flavicollis.*

## Family *Ascaidae* Oudemans, 1905

*Euryparasitus emarginatus* C. L. Koch, 1839

Deutonymphs on *Sorex araneus, Clethrionomys glareolus, Apodemus flavicollis* and *Mus musculus.*

A free-living predator, often very common in nests of small mammals in nymphal and especially adult stages. Sometimes in the fur of small mammals as nymphs (Mrciak 1959 a, Mrciak and Tovornik 1966). Recorded from Europe and Asia. In Sweden recorded from the Sarek mountains. (Trägårdh 1910, Bregetova 1956, Pirianik 1962).

*Cyrtolaelaps mucronatus* G. & R. Canestrini, 1881

Deutonymphs from *Clethrionomys glareolus, C. rufocanus, Microtus agrestis, M. oeconomus* and *Apodemus flavicollis.*

Recorded from small mammals and their nests, mostly as deutonymphs (Mrciak and Brander 1965, Edler 1968). Observed free-living by Willmann (1941).

## Family *Laelaptidae* Berlese, 1892

*Androlaelaps fahrenholzi* Berlese, 1911

Three protonymphs and one deutonymph on *Microtus agrestis.*

Cosmopolitan, on many different hosts, chiefly on small mammals and in their nests (Mrciak 1959 a, Evans and Till 1966). Important in natural foci of such diseases as tularemia and haemorrhagic fever (Mrciak 1960 a—b).

The species is not previously recorded from Sweden.

*Haemolaelaps casalis* Berlese, 1887

One female on *Sorex araneus.*

Cosmopolitan, mostly found in nests of birds and only rarely in the fur of small mammals (Mrciak 1959 a, Evans and Till 1966).

New to Sweden.

*Eulaelaps stabularis* C. L. Koch, 1836

50 females and 2 males from *Sorex araneus, Neomys fodiens, Myopus schisticolor, Clethrionomys glareolus, Microtus agrestis, M. oeconomus, Apodemus flavicollis, A. sylvaticus* and *Mus musculus.*

Known from many parts of the world. It has a wide ecological amplitude and is found on various host animals and in the nests of most small mammals in Europe (Edler 1968). In the present material 51.9 % were found on *C. glareolus* but only 13.5 % on *M. agrestis* and 7.7 % on *A. flavicollis.* A similar dominance (54.1 %) on *C. glareolus* was reported by Edler (1968) from northern Sweden. In High Tatras, Czechoslovakia, Mrciak (1958 a) found 20.9 % on *C. glareolus,* 40.0 % on *M. agrestis* and 2.6 % on *A. flavi-*

*collis*. From the Western Carpathians in Czechoslovakia Mrciak, Daniel and Rosický (1966) have recorded 38.6 % on *C. glareolus* and 32.9 % on *A. flavicollis*.

This mite can attack Man and may be a vector (Mrciak 1958 b).

*Laelaps muris* Ljungh, 1799

Five females and two males from *Arvicola terrestris*.

Specific to *A. terrestris*. A reservoir of the agent of tularemia (Mrciak and Tovornik 1966). Known from Europe (Evans and Till 1966). It was described from Sweden as early as 1799 under the name *Acarus muris*.

*Laelaps clethrionomydis* Lange, 1955

Only 11 specimens were found, 5 on *Clethrionomys glareolus* and 6 on *C. rufocanus*.

This mite is of interest because of its adaption to particular hosts in different zoogeographical areas. Unfortunately the present material is too small to show such tendencies. In material from northern Sweden Edler (1968) found 533 specimens, 84.1 % of which were collected from *C. rufocanus* and only 9.4 % from *C. glareolus*. The main host on the European continent seems to be *C. glareolus* (Mrciak 1959 a—b, 1960 a, Mrciak and Rosický 1959). *C. rufocanus* is found only in the northernmost part of Europe and Asia from Norway to the coast of the Pacific. In material from this region *L. clethrionomydis* is recorded from both *C. glareolus* and *C. rufocanus* (Bregetova 1965).

*Laelaps hilaris* C. L. Koch, 1836

The species was found on *Sorex araneus, Clethrionomys glareolus, Microtus agrestis, M. oeconomus, Apodemus flavicollis, Mus musculus* and *Mustela minuta*. 75.9 % were taken from *M. agrestis* and 19.3 % from *M. oeconomus*. A similar dominance on *M. agrestis* was recorded by Edler (1968) with 83.0 % and by Mrciak (1959 b) with 77.3 %.

The common hosts are species of *Microtus* and *Pitymys*. The occurrence of *L. hilaris* on other small mammals may be a result of contacts in overlapping ranges of the mammals (Mrciak 1959 a).

*Laelaps agilis* C. L. Koch, 1836

This is the dominating species, representing 52.6 % of the collected mites. It was found on *Sorex minutus, S. araneus, Neomys fodiens, Clethrionomys glareolus, Microtus agrestis, Apodemus flavicollis* and *A. sylvaticus*. 60.8 % of the specimens were found on *A. flavicollis*, 25.5 % on *A. sylvaticus* and 12.2 % on *Apodemus* sp., i.e. *A. flavicollis* and/or *A. sylvaticus*. Thus, 98.5 % on species of *Apodemus*, which are evidently the main hosts. In Ukraina Pirianik (1962) recorded 55.6 % on *A. flavicollis* and 38.1 % on *A. sylvaticus*. In Yugoslavia Mrciak and Tovornik (1966) found 44.8 % and 49.0 % respectively, but in Roumania Mrciak (1960 a) 95.9 % and 3.1 % respectively. In northern Sweden, where *Apodemus*-species are not found, no specimens of *L. agilis* have been found so far (Edler 1968). The northernmost provinces of those referred to in this work, Härjedalen and Jämtland, are north of the boundary for *A. flavicollis*. *L. agilis* was not found there.

Recorded from many parts of Europe. New to Sweden.

*Hyperlaelaps arvalis* Zachvatkin, 1948

The species was found on *Microtus agrestis* and *M. oeconomus.*

According to Mrciak and Brander (1965) the main host in Europe is *M. arvalis* Pallas, though in the U.S.S.R. and Europe *H. arvalis* has adapted itself to a wide range of host species of the genus *Microtus* and *Pitymys* (Mrciak and Tovornik 1966). In northern Sweden Edler (1968) found 84.8 % of the specimens of *H. arvalis* on *M. agrestis,* which was the only species of genus *Microtus* in the area investigated at that time.

## Family *Haemogamasidae* Oudemans, 1926

*Haemogamasus horridus* Michael, 1892

This species was found on *Sorex araneus, Neomys fodiens, Myopus schisticolor, Clethrionomys glareolus, C. rufocanus* and *Apodemus flavicollis.*

Known from various hosts in the U.S.S.R. and Europe (Bregetova 1956) but mainly from the nests (Mrciak and Brander 1965). In the present material 66.7 % were represented as deutonymphs. This agrees with Mrciak (1958 a), and Mrciak and Brander (1965).

New to Sweden.

*Haemogamasus nidi* Michael, 1892

Found on *Sorex araneus, Neomys fodiens, Myopus schisticolor, Clethrionomys glareolus, Microtus agrestis, M. oeconomus, Apodemus flavicollis, A. sylvaticus, Rattus norvegicus* and *Mus musculus.* 52.5 % were found on *C. glareolus.*

Edler (1968) noted the same frequency on the same host in northern Sweden. In Finland Mrciak and Brander (1965) found 82.6 %. Elsewhere in Europe the corresponding values were as follows: in Czechoslovakia 33.8 % and 11.2 %, in Yugoslavia 13.4 % and in Roumania 4.7 % (Rupeš 1965, Mrciak 1958 a, Mrciak and Tovornik 1959, Feider, Solomon and Hamar 1965). In Yugoslavia and Roumania the preferred hosts were *Microtus nivalis* Martins (52.9 %) and *M. arvalis* Pallas (55.6 %), two species not represented in Sweden and northern Finland. In Czechoslovakia, however, *M. agrestis,* was the main host (39.8 %) (Mrciak 1958 a).

Known from most parts of Europe, Japan, the USA and Greenland. It can attack Man and is a vector (Mrciak 1959 a).

*Haemogamasus nidiformis* Bregetova, 1955

Only two specimens were found, one on *Microtus agrestis* and one on *M. oeconomus.*

This mite is only known from four countries, viz. the U.S.S.R., Czechoslovakia, Bulgaria and Sweden (Edler 1968). According to Mrciak (1959 a) it is mainly a mountain species. In Sweden 132 specimens have been collected at altitudes between 400 and 800 m.

*Haemogamasus hirsutus* Berlese, 1889

Found on *Sorex araneus, Neomys fodiens, Clethrionomys glareolus* and *Apodemus flavicollis.*

This mite is found both in the fur, predominantly as nymphs, and in the nests, predominantly as adults, of small mammals (Mrciak and Tovornik 1966). In the present material there are only 15 specimens, 7 adults and 8 nymphs.

The species is known from all parts of Europe and has no specific host. It can be a vector of tick-borne encephalitis (TBE) (Mrciak 1959 a, 1960, Mrciak and Brander 1965).

New to Sweden.

*Haemogamasus ambulans* Thorell, 1872

Found on *Clethrionomys glareolus, C. rufocanus, Microtus agrestis* and *M. oeconomus.*

This mite is mostly found in nests of birds and also in the nests and the fur of small mammals. It is known from Asia, Europe, Greenland and North America (Evans and Till 1966, Edler 1968).

## Family *Liponyssidae* Ewing, 1923

*Hirstionyssus isabellinus* Oudemans, 1913

The species was found on *Sorex araneus, Neomys fodiens, Myopus schisticolor, Clethrionomys glareolus, C. rufocanus, Microtus agrestis, M. oeconomus, Apodemus flavicollis, Mus musculus* and *Mustela nivalis.* 45.7 % of the specimens were found on *C. glareolus,* 2.9 % on *C. rufocanus,* 18.1 % on *M. agrestis* and 20.0 % on *M. oeconomus.*

Edler (1968) recorded 26.1 % from *C. glareolus,* 13.7 % from *C. rufocanus* and 53.8 % from *M. agrestis.* From these results and from previous records (e.g. Pirianik 1962, Mrciak and Brander 1965) *Microtidae* seem to be the main hosts, though *H. isabellinus* is reported in low frequencies from many hosts. It is also found in nests.

Known from many parts of Europe, the U.S.S.R. and North America. Important in natural foci of tularemia (Mrciak 1959 a).

*Hirstionyssus soricis* Turk, 1945

On *Sorex araneus* and *Neomys fodiens.*

According to the literature this mite seems to be rare. It is specific of the *Soricidae* (Bregetova 1956).

New to Sweden.

*Hirstionyssus musculi* Johnston, 1894

Found on *Sorex araneus, Clethrionomys glareolus, Microtus oeconomus, Apodemus flavicollis* and *A. sylvaticus.*

The present material is small, only 26 specimens. Most of them parasitized species of *Apodemus* (*A. flavicollis, A. sylvaticus*). This agrees with the findings of Mrciak and Brander (1965), who state that *H. musculi* is a parasite of the *Muridae* and only rarely occurs on *Microtidae.* In northern Sweden, where there are no *Apodemus,* Edler (1968) found *H. musculi* on *C. glareolus* and *M. agrestis.*

Important as a vector in natural foci of tularemia (Mrciak 1960 b).

Table 5. *Infestation in relation to known age of the hosts and the values of chi-square analysis of infestation in relation to the age.*

| Species | Number of infested hosts | | | Number of mites on the hosts | | | Average mites on the hosts | | | $\chi^2$ | P (Df = 1) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Juveniles | Adults | Σ | Juveniles | Adults | Σ | Juveniles | Adults | On total number | | |
| *Clethrionomys glareolus* | 20 | 52 | 72 | 75 | 165 | 240 | 3.8 | 3.2 | 3.3 | 2.0834 | 0.20—0.10 |
| *Microtus agrestis* ..... | 17 | 20 | 37 | 128 | 79 | 207 | 7.5 | 4.0 | 5.6 | 22.7504 | < 0.0005 |
| *Apodemus flavicollis* .... | 26 | 53 | 79 | 103 | 440 | 543 | 4.0 | 8.3 | 6.9 | 64.1470 | < 0.0005 |
| *A. sylvaticus* ..... | 29 | 18 | 47 | 91 | 127 | 218 | 3.1 | 7.1 | 4.6 | 28.1490 | < 0.0005 |
| These four species together | 92 | 143 | 235 | 397 | 811 | 1,208 | 4.3 | 5.6 | 5.1 | | |

## 5. Infestation in relation to the age of the host animals

The age (juvenile/adult) of most hosts in the material was determined. Four host species were represented of infested specimens, enough to make a statistical analysis possible, viz. *Clethrionomys glareolus, Microtus agrestis, Apodemus flavicollis* and *A. sylvaticus*. In tab. 5 the number of the hosts and mites on juveniles and adults and the average for mites on the hosts respectively are listed. Chi-square analysis of the numbers of mites on the juveniles and the adults showed that there is no difference between juvenile and adult *C. glareolus,* while between juvenile and adult *M. agrestis, A. flavicollis* and *A. sylvaticus* the infestation is significantly different. In *M. agrestis* the juvenile stage is most infested. In *A. flavicollis* and *A. sylvaticus,* however, the adults are most infested.

The nest parasites are of great importance for the ectoparasite fauna on the small mammals. Differences are found between the nests of *Microtus* and those of *Apodemus,* and between the vagility of the adults. Especially the first factor would seem to be important.

## 6. Acknowledgements

The work was carried out at the Department of Animal Ecology, University of Lund, where the material is preserved. The work was supported by grants from the Research Institute of National Defence.

To Professor Per Brinck, head of the department, and to Dr. Milan Mrciak, docent at the Zoological Institute, University of Bratislava, I wish to express my gratitude for valuable advice and criticism.

## 7. Abstract

A total of 1,541 specimens of ectoparasitic mites from small mammals representing 26 species were collected in Central Sweden. Seven species were

new to Sweden. As regards the infestation on juvenile and adult hosts there was no difference in *Clethrionomys glareolus,* while in *Microtus agrestis* the juveniles were most infested, and in *Apodemus flavicollis* and *A. sylvaticus* the adults.

## References


BAKER, E. W. and WHARTON, G. W. 1952. An introduction to acarology. — Macmillan, New York. 465 pp.

BREGETOVA, N. G. 1956. Gamasid mites (Gamasoidea). — Opred. po faune SSSR, izd. Akad. Nauk SSSR 61. (In Russian.) Moscow.

BRINCK, P., JOHNELS, A., LUNDHOLM, B., SVEDMYR, A., VON ZEIPEL, G. and ZETTERBERG, B. 1967. Small mammals in Sweden as hosts of thick-borne encephalitis virus and vagrant ectoparasites. — Oikos 18: 124—134. Copenhagen.

DANIEL, M. 1959. Ein Beitrag zur Kenntnis von Larven der an Kleinsäugern Bulgariens schmarotzenden Samtmilben (Acari: Trombiculidae). — Práce Brněnské základny ČSAV 4: 355—359. Brno.

EDLER, A. 1968. Ectoparasitic mites (Acarina: Parasitiformes) from small mammals from the Tärnasjö and Ammarnäs areas in Swedish Lapland. — Entom. Tidskr. 89: 269—277. Stockholm.

EVANS, G. O. and TILL, W. M. 1966. Studies on the British Dermanyssidae (Acari: Mesostigmata). Part 2. Classification. — Bull. Brit. Mus. (nat. Hist.) Zool. 14: 109—370. London.

FEIDER, Z., SOLOMON, L. and HAMAR, M. 1965. Contributie la studiul parazitofaunei acarienilor de pe mamiferele mici din Republica Socialista Romania. — Comunicari, Universitatea "AL. I. Cuza" IASI: 297—309. Jassy.

HANSSON, L. 1967. Index line catches as a basis of population studies on small mammals. — Oikos 18: 261—276. Copenhagen.

MRCIAK, M. 1958 a. Parasitische Milben (Parasitiformes, Acari) von kleinen Säugetieren der Hohen Tatra. — Zool. Listy 7: 65—86. (In Slovac with German summary.) Brno.

— 1958 b. Mites of the superfamily Gamasoidea from the epidemiological aspect. — Čs. epid., mikrob., immunologie 7: 276—286. (In Slovac with English summary.) Prague.

— 1959 a. Ein Beitrag zur Kenntnis der Milben (Parasitiformes) von Kleinsäugern aus dem Gebiet Bulgariens. — Práce Brněnské základny ČSAV 4: 365—376. Brno.

— 1959 b. Die Milben der Ordnung Parasitiformes (Acarina) der Kleinsäuger des Riesengebirges. — Acta Mus. Nat. Prague 3—4: 170—176. Prague.

— 1960 a. Contribution à la connaisance des Acariens de l'ordre Parasitiformes trouvés sur les petits Mammiferes en Roumanie. — Biologia, Bratislava 15: 498—507. Bratislava.

— 1960 b. Contribution à la connaisance des Acariens de l'ordre Parasitiformes en Albanie. — Čs. parasitologie 7: 133—137. Prague.

MRCIAK, M. and BRANDER, T. 1965. Beitrag zur Kenntnis der Milben (Acarina) einiger Säugetiere in Finnland. — Lounais-Hämeen Luonto 17: 3—13. Forssa.

MRCIAK, M., DANIEL, M. and ROSICKÝ, B. 1966. Parasites and nest inhabitants of small mammals in the western Carpathians. I. Mites of the superfamily Gamasoidea (Parasitiformes). — Acta Fac. Rerum Nat. Univ. Comen. 12 — Zoologia 13: 81—116. Bratislava.

MRCIAK, M. and ROSICKÝ, B. 1959. Über die Beziehungen von Milben (Acari) aus der Ordnung Parasitiformes zu ihren Wirtstieren, namentlich zu Kleinsäugetieren. — Biologia, Bratislava 14: 241—264. (In Slovac with German summary.) Bratislava.

MRCIAK, M. and TOVORNIK, D. 1959. Beitrag zur Kenntnis der Milben (Parasitiformes) auf Kleinsäugern in den Saviner Alpen Jugoslavien. — Čs. parasitologie 6: 179—193. (In Slovac with German summary). Prague.

— 1966. A contribution to the fauna of mites (Acari) from the territory of Slovenia (Yugoslavia). — Acta Fac. Rerum Nat. Univ. Comen. 12 — Zoologia 13: 117—139. Bratislava.

NORDBERG, S. 1936. Biologisch-ökologische Untersuchungen über die Vogelnidicolen. — Acta Zool. Fennica 21: 1—168. Helsingfors.

PIRIANIK, G. I. 1962. Gamasid mites on small mammals from foreststep in Ukraina. — (In Russian.) Kiev. 176 pp.

RUPEŠ, V. 1965. Kurzer Beitrag zum Erkennen der Milben und parasitären Insekten der Nagetiere Apodemus flavicollis und Clethrionomys glareolus aus der Umgebung von Prag. — Acta soc. zool. Bohemoslov. 29: 36—39. Prague.

TRÄGÅRDH, I. 1910. Acariden aus dem Sarekgebirge. — Naturw. Unters. d. Sarekgeb. 4: 375—586. Stockholm.
— 1931. Terrestrial Acarina. — Zool. Faroes 49: 1—69. Copenhagen.
WILLMANN, C. 1941. Die Acari der Höhlen der Balkanhalbinsel. — Stud. allgem. Karstforschg., wiss. Höhlenkd., Eisztforschg. und Nachbargeb. — Biol. Ser. 8: 1—80. Brno.
— 1943. Terrestrische Milben aus Schwedish-Lappland. — Archiv f. Hydrobiologie 40: 208—239. Stuttgart.
ZUMPT, F. 1961. The Arthropod parasites of vertebrates in Africa south of the Sahara. Vol. I. (Chelicerata). — South African Inst. f. Med. Res. Vol. 9. 457 pp. Johannesburg.