

## Infestations of flea species on small, wild mammals in the provinces of Aydın and Manisa in the Aegean Region, Turkey\*

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**Abstract:** This study was carried out to determine flea species infesting small, wild rodents and insectivorous wild mammals of the Aegean Region in Turkey. A total of 52 small, wild mammals, comprising one insectivorous and four rodent species, namely *Crocidura suaveolens*, *Mus macedonicus*, *Apodemus flavicollis*, *Microtus levis*, and *Apodemus witherbyi*, were captured. Fleas were collected, preserved in 70% alcohol, and labelled for identification in the field. In the laboratory, they were cleared in 10% KOH and mounted with Hoyer's medium. The fleas were identified as *Stenoponia tripectinata* (Tiraboschi, 1902) from *Mus macedonicus* (12.8%) and *Nosopsyllus fasciatus* (Bosc, 1800) from *M. macedonicus* (2.5%) and also from *M. levis* (100%). One out of the 5 *C. suaveolens* was infested by *S. tripectinata*. Two species of fleas were found on 8 of the 47 rodents and one of the 5 insectivorous mammals was infested by *S. tripectinata*. The flea species and their hosts should be further investigated for zoonotic pathogens.

**Key words:** Aegean Region, flea, wild small mammals

Flea species have a large host spectrum. These arthropods suck the blood of the hosts, cause irritation, and transmit microbial diseases among them, including *Rickettsia* spp., *Anaplasma* spp., *Ehrlichia* spp., *Bartonella* spp., *Coxiella burnetii*, and *Yersinia pestis* (1–5).

More than a quarter of the world's mammals are rats and mice. Over 1000 species have been identified, living in many parts of the world (6).

Seven species of small mammals, namely *Apodemus mystacinus*, *A. sylvaticus*, *Crocidura* sp., *Meriones blackleri*, *Microtus* sp., *Rattus norvegicus*, and *R. rattus*, have previously been reported from the Aegean Region of Turkey. As for flea infestations on those animals, *Stenoponia tripectinata* (Tiraboschi, 1902) and *Ceratophyllus* spp. were reported from *Meriones* and *Citellus*, respectively, in Turkey (7). Furthermore, the species in the genera *Ceratophyllus* and *Ctenophthalmus* (Gliridae) have been reported from fat dormouse and gliridae species in Lithuania (8). It was also reported that *Stenoponia tripectinata* and *Xenopsylla cheopis* were common on hosts such as the rat, mole, and Muridae in the Afrotropical region, European countries, Turkey, and Russia, whereas *Hystrihopsylla talpae* was

rarely found feeding on shrews (7,9–11). Few studies have been performed on the fleas on small, wild mammals in Turkey. The objective of the present study was to investigate flea species infesting this animal group in the Aegean Region.

All the rodents and insectivores examined for ectoparasites were collected (Project no: TÜBİTAK, 115O281) between November 2015 and March 2016. Permits for capture were issued by the Ministry of Forestry and Water Affairs of the Republic of Turkey and the use of the captured animals for research purposes was approved by the Ondokuz Mayıs University Ethics Committee (OMUHADYEK). The rodents and insectivores, 47 rodents (29 male, 18 female) and 5 insectivores (3 male, 2 female), were trapped with baited cage traps in 39 localities in the provinces Aydın and Manisa in the Aegean Region. Fleas were collected from all the body regions of the captured animals and from inside the traps, preserved in 70% alcohol, and labelled for identification. The fleas were cleared in 10% KOH and mounted with Hoyer's medium. The flea species were identified using the previously described characteristics (12–15). The chi-square test was

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used to compare the prevalence of flea species among the rodent and insectivore species.

One insectivore and 4 rodent species, namely the insectivore *Crocidura suaveolens* (lesser white-toothed shrew), *Mus macedonicus* (Macedonian mouse), *Apodemus flavicollis* (yellow-necked mouse), *Microtus levis* (southern vole), and *Apodemus witherbyi* (steppe field mouse), were captured. Most of the animals captured (75%) were *M. macedonicus*. Flea infestations were recorded in 9 of the 52 (17.3%) animals captured (Table). Two species of flea were recorded. Of those, *Stenoponia tripectinata*, characterized by 3 ctenidia, was collected more often from the Macedonian mouse than from the lesser white-toothed shrew. *Nosopsyllus fasciatus* (Bosc, 1800) (Figures 1 and 2) was collected for the first time from the Macedonian mouse and southern vole in Turkey. Infestation rates of the fleas on the rodent and insectivore species varied (Table). There was no difference between the Macedonian mouse and lesser white-toothed

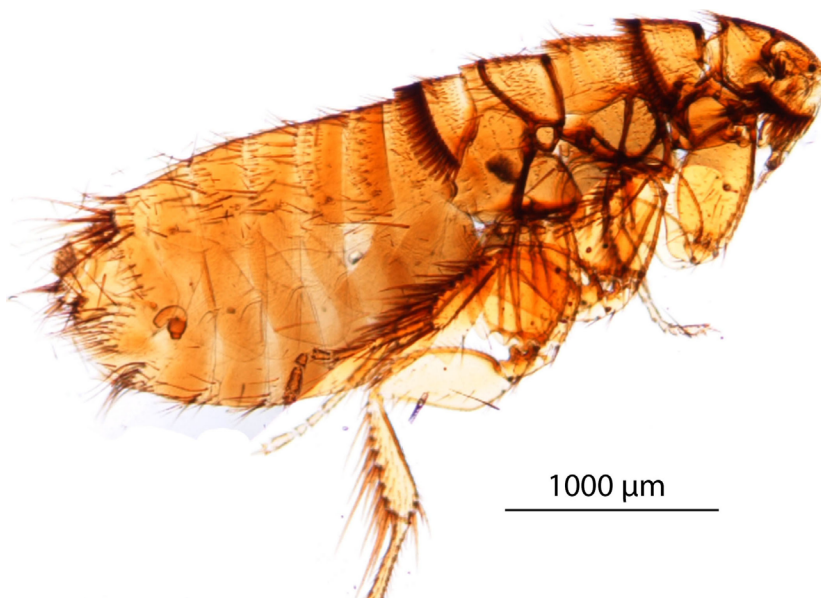
shrew for *S. tripectinata* infestations and no difference in the prevalence of *N. fasciatus* on the Macedonian mouse and southern vole ( $P > 0.05$ ). No flea species were recorded from the yellow-necked mouse or steppe field mouse.

In a previous study (16) conducted on the mite ectoparasites of small wild mammals, eleven species of rodents and insectivores were recorded in the Marmara, Southeast, and Central Anatolia regions of Turkey. In another study (17), seven species of small mammals were collected in the Aegean Region of Turkey. In the present study, one insectivore and 4 rodent species were captured. Most wild rodent species have associated arthropod ectoparasites that are important vectors of pathogens that may cause diseases in humans and domestic animals (1).

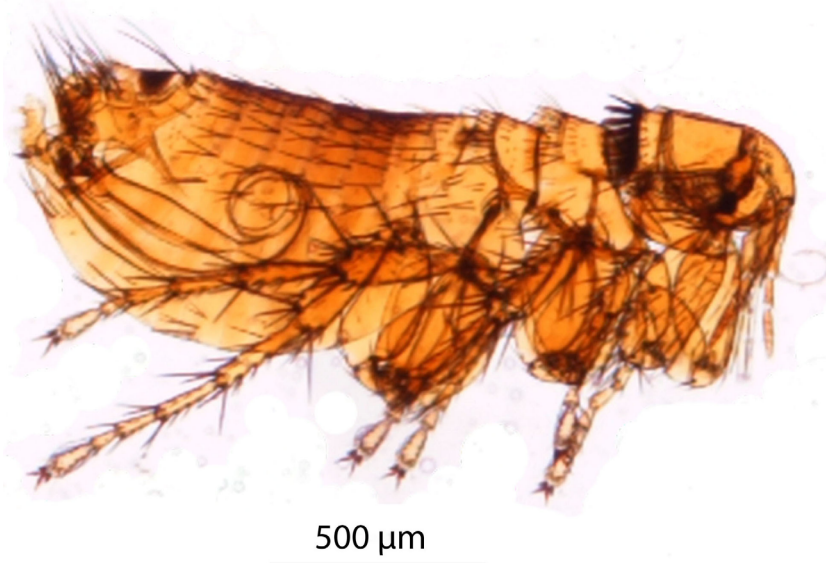
Six flea species associated with one insectivore and 6 rodent species, namely *Anourosorex squamipes*, *A. agrarius*, *Rattus norvegicus*, *R. tanezumi*, *R. nitidus*, *Mus minutus*, and *M. musculus*, were collected in southwest

**Table.** Prevalence of flea species' infestations on small, wild mammals in the Aegean Region of Turkey.

Hosts	Flea species (%)	
	<i>Stenoponia tripectinata</i>	<i>Nosopsyllus fasciatus</i>
<i>Mus macedonicus</i>	5/39 (12.8)	1/39 (2.5)
<i>Microtus levis</i>	0/2 (0.0)	2/2 (100)
<i>Crocidura suaveolens</i>	1/5 (20)	0/5 (0.0)
<i>Apodemus flavicollis</i>	0/5 (0.0)	0/5 (0.0)
<i>Apodemus witherbyi</i>	0/1 (0.0)	0/1 (0.0)



**Figure 1.** *Stenoponia tripectinata* (female).



**Figure 2.** *Nosopsyllus fasciatus* (male).

China (18). In that study, the percentage of Asian mole shrews infested by fleas was 13.3%. In another study, 17 species of fleas were recorded from small mammals in Poland (19). Infestations by *Stenoponia tripectinata* were also reported from Gerbillidae in Turkey, Greece, Italy, France, and the Iberian Peninsula (7,12,20). In the present study, 17.3% of small, wild mammals were infested with fleas and two flea species were recorded for the first time from *M. macedonicus*, *M. levis*, and *Crociodura suaveolens* in Turkey. Infestations by *Nosopsyllus fasciatus* were detected on the Macedonian mouse and southern vole and *S. tripectinata* was mainly found on the Macedonian

mouse and less frequently on the lesser white-toothed shrew. Few studies have been done on zoonotic diseases from rats and mice in Turkey (21,22). Based on the results of this study, *S. tripectinata* and *N. fasciatus* and their hosts should be investigated for zoonotic pathogens such as *C. burnetii*, *Ehrlichia* spp., *Rickettsia* spp., and *Y. pestis* in the Aegean Region of Turkey.

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