

Microdispids mites of Turkmenistan and their ecological groups

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Abstract. This study presents the results of research on the ecology of microdispids mites in Turkmenistan. In particular, 8 species of microdispids mites were found in the soil and anthills. The importance of these mites in the decomposition of plant residues and in soil-forming processes is shown. Data on seasonal changes in the abundance and vertical distribution of microdispids mites in irrigated soils are presented. The phoretic relationship of microdispids mites with ants has been proven. Mushrooms adapted to grow in anthills serve as food for microdispids mites. The importance of anthills is indicated as a special place for shelter and a center of mass reproduction of mites, therefore, as a specific biotope in arid conditions.

1 Introduction

In world science, 127 species of free-living microdispids are known. Microdispids mites are widely distributed in soil layers and ant nests [4-15, 17-18]. Microdispids mites are most adapted to living in the soils of arid areas. Some types of mites from the group of heterostigmata forreze by attaching to the body of ants in soil spaces [1, 2 ,3]. But these ecological relationships of microdispids mites with insects are zoochoric and are not parasitic.

Studies on the ecology of mites, in particular, on the zoochoric relationships of microdispids with ants in the arid conditions of Turkmenistan, have not been carried out and remain a little-studied part of the soil zoology of our country.

2 Material and metods

In 2009-2019 we carried out field observations and collection of material in the Amudarya and Murgab oases, in the mountains of Kugitang, Kopetdag and in the South-Eastern Karakum. Soil samples were taken in a volume of 1 dm^3 , and the processing of the material was carried out by the Berlese-Thulgren method. Mites were removed from the soil and other substrates using a thermoeklector [16].

A total of 550 soil samples from various landscapes were analyzed, as well as samples of soil under cotton and rotting plant residues, food stocks contained in ant nests were collected and processed. Of these, 17300 exemplars mites were extracted and fixed in ethyl alcohol.

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Also, in order to collect mites, 3000 ants belonging to 27 species were examined under a stereomicroscope. In total, 1200 exemplars of mites were found on the body of ants. When processing the material, before pouring it into the preparation, mites were transferred from alcohol to 5-10% KOH, where they were clarified. Mites were stored in a solution of 70-80% ethyl alcohol and 1-2% glycerol. To determine the species composition of mites using a stereomicroscope, they were mounted in Faure-Berlese liquid and 760 micropreparations were prepared. Further morphological studies of mites transferred to a permanent micropreparation were carried out using the MBI-3 microscope and Biolam.

3 Discussion

As a result of many years of research in the fauna of Turkmenistan, we have identified 8 species of mites of the family Microdispidae (Acari: Prostigmata, Heterostigmatina). 6 of them were described by us as new species for the world zoological science [7, 18].

We have identified two ecological groups of the species of microdispid mites:

Soil-dwelling microdispids: Species of *Premicrodispus reductus* Khaustov et Chydyrov, 2010, first was described in Turkmenistan. We found the mite in the soil under cotton in the Akdepe etrap. Ordinary species. In subsequent studies, this species was identified in the soil of Liman Kuyalnik near the Black Sea in Ukraine [8]. The species *Premicrodispus incisus* Khaustov et Chydyrov, 2010, was first described in Turkmenistan. It lives on the soil under alfalfa and cotton, we found it in the village of Kul-Aryk, Chardzhev etrap. Ordinary species. In subsequent studies, this species was identified in the soil of Liman Kuyalnik near the Black Sea in Ukraine [8]. The species *Premicrodispus paradoxus* Khaustov et Chydyrov, 2010, was first described in Turkmenistan. We found a mite on the soil under a stone in the Darayi Dere gorge in Mount Kugitang. Also, this type of mite was found by us on the soil under cotton in the village of Kul-Aryk, Chardzhev etrap, and in the village of Odey, Deinau etrap. Ordinary species. The type of mite in other regions was not identified. Species *Premicrodispus obtusisetosus* Khaustov et Chydyrov, 2010, first described in Turkmenistan. We found this species on sandy soil in the vicinity of the city of Balkanabat. Rare species. This type of mite has not yet been identified in other zoogeographic zones.

Myrmecophilic microdispids: Mite *Cesarodispus minutus* Sevastianov, 1981. The species was first discovered in Ukraine on the soddy ant *Tetramorium caespitum* Linnaeus, 1758. Scientists identified this type of mite in Russia in the nest of the yellow earth ant *Lasius flavus* Fabricius, 1782. Also, acarologists found a mite in Iran on expanded-thoracic ant *Temnothorax sp.* [10, 14]. The mite *Cesarodispus minutus* was also found by us in the South-Eastern Karakum, in the Aydere gorge and in the village of Khodjagala in the Western Kopetdag in the nest and on the body of the black-brown earth ant *Tapinoma simrothi* Krausse, 1911, the steppe runner *Cataglyphus aenescens* Nylander, 1849, the brilliant phaeton *Cataglyphus cinnamomea* Karawajew, 1909 and the dune reaper ant *Messor excursions* Ruzsky, 1905. *Cesarodispus minutus* is attached to the chest and abdomen of the ant during forresia. We found individuals of this species on the soil in the agrobiocenoses of the Amudarya and Murghab oases. The species is often found on the soil of irrigated fields in cultivated landscapes. We have studied the seasonal dynamics of their numbers in the soil under cotton. Places of distribution of the species Ukraine, Turkmenistan, Russia and Iran. *Premicrodispus dzumaevi* Sevastianov et Chydyrov, 1991 was first described in Turkmenistan. We found the species in the nest of *Tapinoma simrothi* and *Messor excursions* ants in Repetek, in the Aydere gorge and in the village of Khojagala in the mountains of the Western Kopetdag, in the gorges of Darayi Dere and Khojagaravul in the mountains of Kugitang. Individuals of these species are often found in ant nests in early spring and autumn; during forresia, they attach to the chest and abdomen of the ant. This type of mites lives on the soil in the agrobiocenoses of the Amudarya and Murgab oases.

Repeated inter-row cultivation and subsequent irrigation of cotton fields throughout the summer lead to non-uniform changes in the number of microdispids mites. On fig. 1 (a, b) shows data on seasonal changes in the abundance of *Cesarodispus minutus* and *Premicrodispus dzumaevi* (Sayat region, 2018) and (Chardzhev region, 2019). As can be seen from fig. 1, the abundance of *Cesarodispus minutus* and *Premicrodispus dzumaevi* is not the same, and it changes in different months of the year. For example, their numbers are very low in June and July, but high from August to October. The high number of individuals of the species in autumn is associated, firstly, with their mass reproduction, and secondly, with the cessation of inter-row tillage and irrigation of cotton fields.

In populations of species belonging to the Microdispidae family, females predominate in the soil during the growing season of cotton. Males appear for a short period, the larval stage is short, so the larvae are extremely rare and few in the samples.

The vertical distribution of microdispids mites differs depending on the depth of the soil layer (Fig. 2; a, b. Deinau etrap, 2018). As can be seen from fig. 2, on the arable soil layer (0-30 cm), the abundance of *Cesarodispus minutus* and *Premicrodispus dzumaevi* is very high. According to our observations, these species accumulate in large numbers in the soil at a depth of 30 cm, where a decaying layer of last year's cotton litter is often found. In addition to participating in the decomposition of organic residues, they improve the aeration of the soil for agricultural crops and thus are a necessary link in the general circulation of substances. In arid conditions, low humidity is usually preserved in the soil and therefore earthworms are rare, and therefore the soil Acari and Collembola prevail in number, i.e., there is a change in species habitats.

Mites hibernate in the soil layer at a depth of up to 40 cm from the surface. They tolerate soil freezing well and become active during thaws.

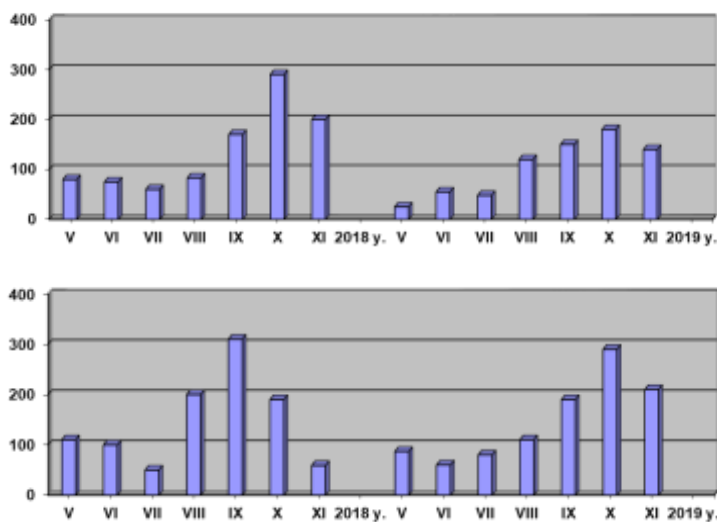


Fig. 1. Seasonal changes in abundance a) *Premicrodispus dzumaevi* b) *Cesarodispus minutus* in the soil of cotton fields at a depth of 0-10 sm.

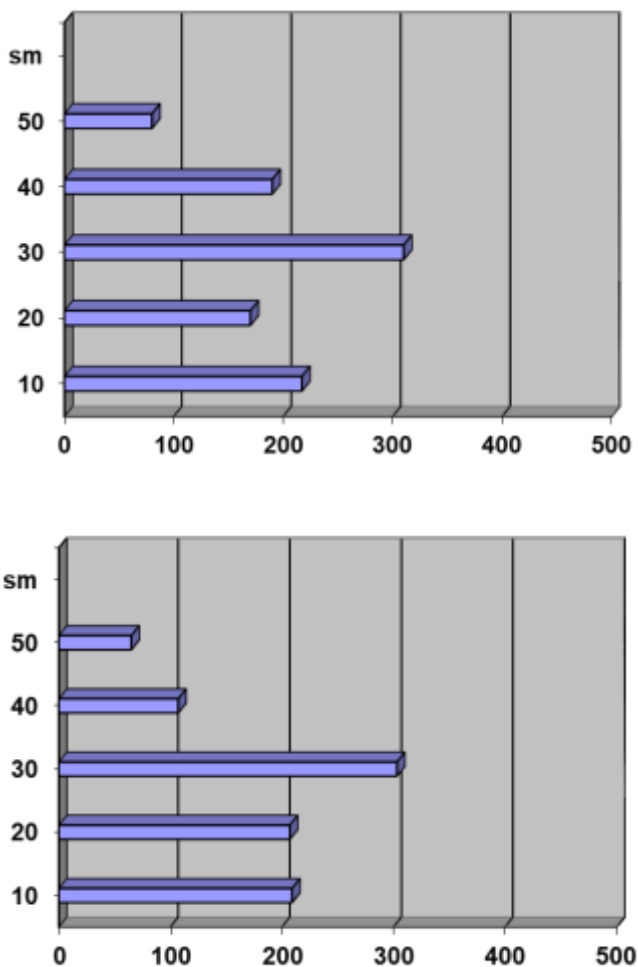


Fig. 2. Vertical placement and average abundance.
a) *Premicrodispus dzumaevi*, b) *Cesarodispus minutus* in soil under cotton in Deinau etrap in October, 2018.

Cochlodispus csibiae Mahunka, 1981 species was found by us in the South-Eastern Karakum and Amuderya oases in in the nest and on the body of the ants: *Messor excursions*, *Cataglyphus aenescens*, *Cataglyphus pallida* Mayr, 1877 and *Pheidole pallidula* Nylander, 1848. Ordinary species in the soil of agrobiosenoses. This type of mite attaches to the chest and abdomen of the ant during forresia. Places of distribution of the species are Hungary, Egypt, Iraq and Turkmenistan. *Premicrodispus heterocaudatus* Khaustov et Chydyrov, 2010. We found the mite on the body and in the nest of *Catoglyphus pallida* in the village of Avchy, Sayat etrap. This species was first described in Turkmenistan. We found a mite on the soil under cotton in the village of Arap, Akdepe etrap and in the village of Megedzhik, Koytendag etrap. Numerous view. The mite species was not found in other regions.

A complex of microdispids mite species have adapted to living in the soil and myrmecophilia i.e. to live in ant nests. The favorable microclimate of ant nests creates conditions for mites to live and breed in them. Microdispids mites have well-defined sexual dimorphism. Males differ sharply from females in external structure. In the course of

ontogenesis at the stage of puberty in male mites, the oral organ of the gnathosoma is greatly reduced and a pair of sensitive organs, the so-called solenidia, develops in its remaining part from above. Thus, from an evolutionary point of view, during the ontogenesis of microdispids mites, the function of the oral organ of the gnathosoma is replaced by the function of touch. Gnathosomal solenidia of microdispids mites are one of the important organs for males when searching for females during sexual reproduction. In microdispids mites, normal sexual reproduction alternates with parthenogenesis.

Specific inhabitants of ant nests are mite species: *Cesarodispus minutus*, *Cochlodispus csibiae*, *Premicrodispus dzumaevi* and *Premicrodispus heterocaudatus*.

4 Finding

Most species of myrmecophilic mites are saprophages, so they are found in anthills that feed on animal corpses and plant seeds. Mushrooms adapted to grow in anthills serve as food for microdispids mites. Anthills form breeding grounds for mites. Ants, being in biocenotic relationships with mites, are involved in the distribution of soil-dwelling microdispids mites. According to our observations, the phoric associations of microdispids mites with ants lead to their active distribution in the soils of various landscapes.

In the soil depths, microdispids mites are often found in places of accumulation of organic residues of plant origin, where they feed on the mycelium of saprobiont soil fungi. In the soils of agrobiocenoses, mites, due to their miniature body size, strength of covers and high fertility, maintain a high number of individuals. In addition, microdispids mites form separate populations in the soil in combination with other soil-dwelling mites. In turn, microdispids mites can be victims of predatory soil arthropods. Thus, they are one of the links in the food chain of soil organisms in nature. Mites of these groups have adapted to living in various ecological conditions of our country, while constituting the necessary proportion of the animal population of the Earth's biosphere.

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