



SPECIES COMPOSITION AND BIOECOLOGICAL CHARACTERISTICS OF ANTS IN THE KHOREZM OASIS

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Abstract

The ant fauna of the Khorezm Oasis comprises eurybiontic, desert, and synanthropic species adapted to the region's extreme continental climate. The species composition is primarily represented by the genera *Messor*, *Camponotus*, *Cataglyphis*, *Lasius*, and *Tapinoma*, whose bioecological characteristics enable them to survive under conditions of hot, dry summers and cold winters. Ants construct complex underground passage systems and contribute to soil mixing and enrichment with humus, nitrogen, and phosphorus, which is particularly important for the irrigated agricultural lands of Khorezm. Ants construct nests in soil, beneath stones, and inside or on decaying tree trunks, particularly species associated with woody substrates. Some species construct nests from dry branches, forming cone-shaped structures that extend above the soil surface. Underground nests may contain highly complex, multi-chambered systems. In some forest-dwelling ants, nests consist of an underground labyrinth and an above-ground dome, with branched passages extending to depths of 1–3 m, where the colonies overwinter. Ants feed on a wide variety of insects, plant seeds, flower nectar, and honeydew produced by aphids and scale insects. Many species maintain food resources, including insects and fungi, within or around their nests. Certain ant species, such as forest ants, provide ecological benefits by reducing populations of pest insects. The present study characterizes the species composition and major bioecological groups of ants occurring in the Khorezm Oasis and discusses their ecological significance under arid and intensively cultivated environmental conditions.

Keywords: Ants, Formicidae, Khorezm Oasis, species composition, bioecology, eurybiontic species, desert species, synanthropic species, *Messor*, *Camponotus*, *Cataglyphis*, *Lasius*, *Tapinoma*.



1. Introduction

Ants (Formicidae) are a family of insects belonging to the order Hymenoptera. Their first and second abdominal segments are narrowed and form a petiole connecting the abdomen with the thorax. Ants possess relatively large heads and strongly developed mandibles adapted for biting and chewing. They are highly social insects that live in organized colonies. An ant colony may consist of several thousand or even millions of individuals. A colony generally includes thousands of workers, numerous winged males, and one or several queens. Males appear primarily during the reproductive period and usually die after mating. Worker ants are reproductively undeveloped females responsible for maintaining the colony. Queens emerge during the reproductive period and, after mating, shed their wings and begin laying eggs. Some queens may live for up to 20 years. Worker ants perform a variety of functions, including collecting and distributing food, protecting the nest, acting as soldiers, and storing liquid food reserves in specialized workers commonly referred to as repletes.

The regulation of polymorphism in ants is associated with several factors, including differences in egg size produced by females, larval development, and the physiological condition and behavior of worker ants responsible for feeding larvae. The coordinated functioning of an ant colony depends substantially on the exchange of nutrients and glandular secretions among colony members, a process known as trophallaxis. Chemical communication between reproductive females and workers is also of major importance. Pheromones play a particularly important role in regulating colony organization and behavior. Some ant colonies establish and defend specific foraging areas. Certain species form supercolonies that integrate several nests or colonies. Members of such colonies may exchange individuals and food resources and jointly defend their territories.

Ants construct nests in soil, beneath stones, and in or on decaying tree trunks, particularly in species associated with woody substrates. Some species construct nests from dry branches, with the upper structure extending above the ground in a cone-like form. Underground nests can be highly complex and consist of numerous chambers. In some forest ants, the nest comprises an underground labyrinth and an



above-ground dome. The underground portion may contain an extensive network of branching passages reaching depths of 1–3 m, where the ants overwinter, whereas brood development occurs in the upper part of the nest. Some tropical ants construct nests by stitching or joining leaves together. Nomadic or army ants occurring in tropical regions may not construct permanent nests.

Ants feed on a broad range of food resources, including various insects, plant seeds, flower nectar, and honeydew secreted by aphids and scale insects. Many species maintain insect or fungal food resources associated with their nests. Some ant species lack their own worker caste and obtain workers by raiding colonies of other species. Several species, including forest ants, can provide substantial ecological benefits by suppressing populations of pest insects.

Approximately 100 ant species have been reported from the fauna of Central Asia. In desert ecosystems, Cataglyphis species may feed on small pest insects, seeds of wild plants, and nectar, whereas other desert and steppe ants primarily consume plant seeds. The black garden ant, Lasius niger, frequently feeds on the sugary honeydew produced by aphids and may protect aphids from predatory insects, potentially causing negative effects in agricultural systems. The yellow pharaoh ant, which is commonly found in human dwellings, is considered a household pest because it feeds on sweet and fatty food products.

2. Ant Fauna of the Khorezm Oasis

The ant fauna of the Khorezm Oasis includes eurybiontic, desert, and synanthropic species adapted to an extreme continental climate. The species composition is dominated by representatives of the genera Messor, Camponotus, Cataglyphis, Lasius, and Tapinoma. Their bioecological characteristics enable them to survive under conditions of hot, dry summers and cold winters.

Several major ecological groups can be distinguished in the Lower Amu Darya region.



2.1. Harvester Ants (Messor spp.)

A representative species is *Messor intermedius*. These ants collect and store seeds of desert and meadow plants and consequently play an important role in seed dispersal, a process known as myrmecochory.

2.2. Running Ants (Cataglyphis spp.)

This group includes species such as *Cataglyphis aenescens*. These ants are characterized by a high tolerance to heat and may remain active during the hottest hours of the day. They feed predominantly on dead insects and therefore exhibit zoonecrophagous feeding behavior.

2.3. Carpenter or Wood-Nesting Ants (Camponotus spp.)

Representative species include *Camponotus xerxes* and *Camponotus turcestanicus*. These ants construct nests in old wood, tree stumps, and beneath bark in tugai forests. They frequently maintain associations with aphids and may collect honeydew produced by them.

2.4. Lasius and Formica

This group includes the black garden ant (*Lasius niger*) and the meadow ant (*Formica pratensis*). These species are commonly associated with agroecosystems, the margins of water bodies, and cultivated landscapes. They may establish mutualistic relationships with sap-sucking insects, particularly aphids.

2.5. Tapinoma spp.

Synanthropic species such as *Tapinoma simrothi* are frequently encountered near human settlements and agricultural lands. Their distribution reflects their capacity to exploit habitats strongly influenced by human activity.

3. Bioecological Characteristics

The bioecology of ants in the Khorezm Oasis is characterized by pronounced seasonal activity. During winter, approximately from November to March, colonies



enter a deep diapause in underground nests. Activity resumes in spring, with foraging and general colony activity increasing substantially. Activity reaches its highest-level during May and June, whereas it temporarily decreases during the extreme summer heat of July and August.

Most species demonstrate considerable ecological flexibility. Zoonecrophagous and polyphagous species are particularly prominent in the oasis. These ants not only actively forage for animal food resources but also collect honeydew produced by sap-sucking insects.

Ants construct complex underground passage systems that contribute to soil mixing. Through their burrowing and nesting activities, they redistribute soil particles and contribute to the enrichment of soil with humus, nitrogen, and phosphorus. This ecological function is particularly important for the irrigated agricultural lands of the Khorezm region.

Ants therefore play multiple roles within oasis ecosystems. They participate in nutrient cycling, soil modification, seed dispersal, interactions with herbivorous insects, and the regulation of insect populations. Their ecological activities can consequently influence both natural and agricultural ecosystems.

4. Effects of Agricultural Intensification

Intensive agriculture and the widespread application of pesticides may lead to a simplification of ant species composition. Specialized psammophilous species associated with cultivated and disturbed soils may decline or disappear from intensively ploughed areas. At the same time, the abundance of synanthropic species and species associated with weeds may increase.

Such changes indicate that agricultural intensification can modify the structure of ant communities in the Khorezm Oasis. Changes in land use, soil disturbance, irrigation practices, and pesticide application may consequently affect the distribution and abundance of different ecological groups.



5. Conclusions

The ant fauna of the Khorezm Oasis represents a diverse assemblage of eurybiontic, desert, and synanthropic species adapted to the region's extreme continental climate. Representatives of *Messor*, *Camponotus*, *Cataglyphis*, *Lasius*, and *Tapinoma* constitute important components of the regional ant fauna.

The major ecological groups include seed-collecting harvester ants, heat-tolerant running ants, wood-associated ants, meadow and garden ants, and synanthropic species. Their ecological characteristics demonstrate adaptations to seasonal temperature fluctuations, arid conditions, and human-modified habitats.

Ants also perform important ecosystem functions through soil mixing, nutrient redistribution, seed dispersal, interactions with aphids and other insects, and the suppression of some pest populations. However, intensive cultivation and pesticide use may reduce the diversity of specialized ant species while favoring synanthropic and disturbance-tolerant taxa.

Consequently, the conservation of suitable habitats and the reduction of excessive anthropogenic pressure are important for maintaining the ecological diversity and functional role of ants in the Khorezm Oasis.

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