

Review Article

THE STUDY OF POPULATION AND COLONY INTERRELATION OF ANACANTHROTHERMES TURKESTANICUS (ISOPTERA: HODOTERMITIDAE) IN KHOREZM OASIS

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Abstract

The families of common insects quite adequately present ecological functions and considered as the unit of population by many specialists. In termite families two generations are present – royal (king) pair and its numerous descendants. Because of the duration of the multiplication period the individuals of different casts from one mound belong to one generation and are ---- in relation to each other, but the ones simultaneously flying out from neighboring mounds of different ages can belong to different generations, which always takes place in long-term existing populations. The termites from closely located mounds (3, 4, 5, 6) don't usually display mutual hostility. The *A. turkestanicus* termites live not only in single families, but also unite into the whole colonies. In the closely located several termites there is only one king and queen.

Keywords: termites, Isoptera, colony, *Anacanthotermes turkestanicus*, caste system, dyes.

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INTRODUCTION

Termites are recognized as insects that interact with the natural and urban ecosystem in the most complex way (Fontes, 1995). With approximately 3,105 described species in the world (Krishna et al., 2013), of the registered 2 species in Uzbekistan (Abdullaev et al., 2002). The termite family Kalotermitidae Froggatt 1897 is composed of nearly 500 extant species worldwide (Casalla et al., 2016a, b; Ghesini & Marini, 2013; Ghesini et al., 2014; Krishna et al., 2013; Scheffrahn, 2014; Scheffrahn, 2018; Scheffrahn & Postle, 2013; Scheffrahn et al., 2018a). Combined, the Neotropical and Nearctic Regions account for one hundred fifty-eight species (Casalla et al., 2016a, b; Krishna et al., 2013; Scheffrahn, 2014; Scheffrahn, 2018; Scheffrahn & Postle, 2013) or about one-fourth of all New World termite species. The natural and urban territories of Uzbekistan are populated by two termite species *A. turkestanicus* and *A. ahngerianus* (Anacanthotermes, Hodotermitidae), are considered urban pests. This problem is particularly serious in the southern Aral region of Uzbekistan (Abdullaev et al., 2019).

The population of organisms that breed by syngensis presents from one side the community of individuals, connected with cross-breeding ties and interrelations of parents and offspring (Dobzhansky, 1971) and from the other side it is an ecological unit, interacting with other elements of biocenosis. The family as a single whole undergo the impact of ecological factors and effects the other elements of biocenosis. Almost all contemporary specialists admit the family of common insects and not individuals as the elementary unit of their population. Intra-family and inter-family relations are especially investigated in details for ants (Zaharov, 1973), termites (Shatov, 1974) and the number of web-footed birds (Kipyatkov, 1991).

The series of additional forage nests, populated mainly with foragers originates in termite reapers around the main

mounds. In some of them later on additional sexual individuals may appear, and sometimes the main part of the family can move in such kind of nest (Shatov, 1974). Identification of mound system belonging to one colony was carried out by combining the individuals taken from different mounds and foraging mud channels. At that the worker and soldier termites display an aggressive reaction to the smell of individuals from other families. At the absence of mutual aggressiveness among individuals they are considered to belong to code colony or family (Elizarov & Sinitsina 1968). The smell of termite family has a complex origin, but the main component is released by sternal glands and has a genetic nature (Soldatova 1972). Among worker individuals of *A. ahngerianus* of one natural population, taken from quite remote from each other families, the aggressive reaction sometimes doesn't appear.

MATERIALS AND METHODS

Field observations were conducted in the historical monuments of Ichan Kala. The climate of the region is affected by the Kyzylkum and Karakum deserts. The winter here is relatively cold: the average January temperature ranges from -80C in the north to -20C in the south. Summer is long and hot here, the average July temperature is 28-300C (Kurbanniyozov, 1996).

3-amino-7dimethylamino-2 methylphenazine hydrochloride C15H17N4Cl – red and C20H20N3OCl chloride – blue dyes specially used for dyeing termites, special plastic bottles, thermometer and others. The study of different interrelations among mounds of *Anacanthotermes turkestanicus* termite species was carried out in the experimental fields in Shavat and Khiva regions and in laboratory conditions according to the methods of Elizarova, Sinitsin (1968). 8 termite mounds, which were 100 meters far from each other, were selected in the field and marked (Fig. 1).

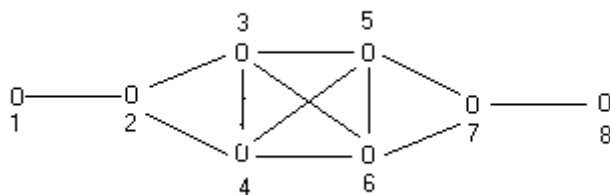


Fig. 1. Lay out of experimental site at “Shaih bobo”, Khiva district

To study the relations within the family of worker termites brought from marked termite mounds, in order to differentiate them they were watered with 1% water solution of $C_{15}H_{17}N_4Cl$

– red and $C_{20}H_{20}N_3OCl$ blue dyes or dyed based on feeding dye-soaked filter paper. (Fig. 2).



Fig. 2. $C_{15}H_{17}N_4Cl$ – red and $C_{20}H_{20}N_3OCl$ chloride – blue

The special attention was paid to the fact that these dyes are harmless and have the ability to remain in the tissues for one month. The worker termites that belonged to different families were placed into special plastic bottles. The termites’ attitude was observed in these plastic bottles. They were kept in the dark room where the temperature was 23 °C and air relative humidity was 33 %. The experiment was conducted in 7 directions and 28 variants ($H_{1\pm 2}, \dots, H_{1\pm 8}; H_{2\pm 3}, \dots, H_{2\pm 8}; H_{3\pm 4}, \dots, H_{3\pm 8}; H_{4\pm 5}, \dots, H_{4\pm 8}; H_{5\pm 6}, \dots, H_{5\pm 8}; H_{6\pm 7}, H_{6\pm 8}; H_{7\pm 8}$). The interrelations of the worker termites delivered from Shavat and Khiva districts were observed based on the abovementioned methods ($H_1 \times S_1 \dots S_8$), ($H_2 \times S_2 \dots S_8$), ($H_8 \times S_1 \dots S_8$). The determination of interrelations in the termite families in field conditions was carried out based on the methods of Belyaeva, Zhuzhikov, Zolotaryov (1969). From 8 termite mounds the collected termite individuals from families 3 and 6 were dyed with blue and red color. To assure the

sufficient absorption of dyes into termite tissues, the termites were kept in laboratory for three days. In a week’s time the dyed termites from the third and sixth family were set free into the termite mounds number 1 and eight. The study on interrelations in termite mounds was conducted through the search of dyed termites in mound chambers.

RESULTS

According to the results of the research on interrelation of 8 termite mounds which were located 100 meters far away from each other (Fig. 3), it was observed that the workers from mound 1 were in friendly relations with those in mound 2 ($H_1 \pm H_2$), but with the workers of other termite family they were aggressive ($H_1 \times H_3, H_1 \times 4, H_1 \times H_5, H_1 \times H_6$), especially the workers in mounds 7-8 ($H_1 \times H_7$ and $H_1 \times H_8$) were extremely aggressive (Table 1).



Fig. 2. Experimental site at “Shaih bobo”, Khiva district

Table 1. Interaction of different termite mounds

Termite mounds	H ₁	H ₂	H ₃	H ₄	H ₅	H ₆	H ₇	H ₈
H ₁	x	Δ	•	•	•	•	•	•
H ₂	Δ	x	Δ	Δ	•	•	•	•

H ₃	•	Δ	x	Δ	Δ	Δ	•	•
H ₄	•	Δ	Δ	x	Δ	Δ	•	•
H ₅	•	•	Δ	Δ	x	Δ	Δ	•
H ₆	•	•	Δ	Δ	Δ	x	Δ	•
H ₇	•	•	•	•	Δ	Δ	x	Δ

Aggressive relations - •

friendly relations-Δ

According to the results of the Table 1 it was observed that the workers of 2±3±4; 3±4±5±6; 5±6±7; 7±8 mounds were behaving friendly whereas in mounds 2 x 5 x 8 x 1 x 7 the workers of the family were behaving aggressively. When studying the interrelation of the worker termites brought from different sites (Shavat and Khiva districts) it was observed that the aggressiveness was very strong, in this kind of relations strong worker termites did bite hard the stomach, neck, legs and other parts of the body of two stranger worker termites and even tore them apart. When studying the interrelation of termite families in 8 selected mounds in field conditions, the worker termites delivered from mounds 3 and 6 and specially dyed were set free into the mounds 1 and 8. It was observed that these termites were found in chambers of mounds 4-5-7 and not in 1-8

DISCUSSION

The termites can simultaneously collect forage from different places into one mound. Usually the places of forage collection are located at small distance from the mound, but sometimes termites bring forage from distances of 70 m and even more (Zhuzhikov 1979). In some cases the forage from one heap was found not in one, but in two or three mounds. This information proves the fact that termite mounds located close to each other are "relatives". In the research we have conducted it became clear that as the distance between mounds gets more than 100 meters, the level of aggressiveness increases. This can be especially seen in mounds 1 and 8. Yet, in the mounds located to each other in less than 100 meters distance, the situation of friendly relation was observed.

Therefore, it might be that several termite mounds belong to one generation because when a new non-visible mound and some others close by were opened, the real queen was not found. It can be concluded that the mounds 3, 4, 5, 6 given in the table were in friendly relations and that these mounds were connected to each other with chambers which proves that they were relatives. If we take into consideration the sensitiveness of the termites to sounds, it should be recorded that when starting to open and look at one mound, the real queen termite is able to move from one mound into the other through the chambers. Besides, in the upper chambers of mounds 3-4-5-6 living in friendly relations the termite eggs were found at the same time but in the other mounds at this exact time new eggs were not found. In termite mounds 3-4-5-6 one-day or three-day eggs were found at the same time which means that the eggs produced by real queen are distributed into these mounds and that worker termites carry them.

In addition, the results of the research show that *A. turkestanicus* termites live not only with single families, but also unite into a whole colony, in the boundaries of which the movement of dyed termites is observed. The dyed termites of one mound can easily move over to the neighboring mound. Mutual aggressive behavior of *A. turkestanicus* termites from distant mounds shows that the termites distinguish very well the individuals of their own or other families by specific smell. The termites from closely located mounds don't usually display hostility.

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