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Scientific Research Into The Creation Of A New Generation Of Food-Baits Against Termites Introduction

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Abstract

The article provides the results of scientific research on the development of a new generation of food-baits in the system of control of termites of the genus Anacanthotermes.

Keywords: termites, feed, food substrate, chemicals, carbohydrates, attractants.

Introduction

Nowadays, there have been significant changes in the structure, composition and number of bio-polluting organisms in buildings and structures due to the growth of anthropogenic factors around the world. In particular, due to the excellent adaptability properties of termites, it leads to their entry from natural habitats into urban areas. Damage from termites is extremely high, especially in densely populated countries with relatively hot climates. Accordingly, it is important to develop modern control methods to control the number of termites in areas with strong anthropogenic pressure [3; 4].

Throughout the world, attention is being paid to the use of termites in order to avoid the treatment of wooden equipment of buildings and structures with toxic drugs through the rational application of the biological properties of termites. In this regard, the measures are being taken, such as the use of molecular-genetic methods in the differentiation of termite species, the study of intestinal symbionts, the development of methods of control using juvenile hormones that control the process of metamorphosis in these insects [8; 9; 10].

It should be noted that today termites are a pest that causes unprecedented damage in Central Asian countries, including most parts of the country, causing severe damage to residential

buildings, historical and cultural monuments, wooden construction materials. In Uzbekistan, the Turkestan termite Anacanthotermes (Anacanthotermes turkestanicus Jacobs, 1904) and the Great Trans-Caspian termite (A. ahngerianus Jacobs, 1904) have been identified, they are currently causing serious damage to wooden structures and other materials in the territory of our country, residential buildings, historical and cultural monuments and strategic objects [8].

Despite a number of measures being taken today to manage the number of termite populations, their range is expanding. Historical monuments, dwellings and buildings made of traditional wooden planks are particularly hard hit by termites. According to the latest data, termite damage has been recorded in more than 15,000 households in the country [3; 4; 8; 9]. At the same time, the damage to historical monuments and buildings is also of great concern.

Yet the biological and ecological characteristics of termites have been studied in some regions of the country, methods and means of preventing and eradicating them have been developed at different times, it is noted that termites occupy more space, and that existing control tools are not effective enough. Therefore, given that the lifestyle of the termites of the Anacanthotermes generation has not been fully studied, the proposed methods and tools are not effective enough, or the proposed basic chemicals have been withdrawn from production due to strong adverse effects on humans, warm-blooded animals and the environment, in the fight against termites, there is also a need to develop new methods of rational use of environmentally friendly, improved, highly effective new feeds and other means of control in the world market, because they can be both an effective and cost-effective tool in an integrated system of termite control [9].

Given the growing threat of termites in the country, after 2000 the Republic of Uzbekistan paid attention to this problem at the national level, and in accordance with the Resolution of the Cabinet of Ministers of February 2, 2012, No 27, the Republican Center for Termite Control was established at the Institute of Zoology. One of the priorities of the center is the production of poisonous food-baits against termites and pesticides, as well as the development ofrecommendations and guidelines for the fight against termites in collaboration with scientists from the Institute of Zoology. In response, a method of preparation of insecticides against termites was developed, on the technology of application against termites, "Cylindrical container" - UZ № SAP01243 (02.08.2013) and "Device for eradication of termites of the genus Anacantothermes" - UZ № FAP00954 14.06.2013) received a patent for a utility model, as well as a patent for the invention № IAP 05832 "Method of preparation of insecticides against termites" dated May 8, 2019 was gained and the patent-based feed-bait is widely used in termite control systems.

However, in the hot climate of Uzbekistan, there are some shortcomings in the use and effectiveness of this feed-baits. We know that termites of the genus Anacanthotermes are characterized by a constant tendency to moisture, and the attractiveness of this feed-baits depends

on the fact that it retains its moisture, requiring constant spraying with water at hot air temperatures. Even if termites eat at least 25% of the food-baits, the efficiency will increase to 85-90%, but the problem is that in most cases the termites will not be able to find food. Therefore, in order to improve the toxic feed-baits in use today, there is a need to increase the attractiveness of the feed-baits, including the addition of flavoring and moisture-retaining additives in a form that prevents the development of harmful microflora during long-term storage. It is necessary to develop the packaging and ensure the convenience of delivery of feed-baits. This leads to an increase in the biological efficiency and duration of exposure of the feed-baits, which in turn plays an important practical role in the control of termites of the genus Anacanthotermes. In view of the above, a number of research studies have been conducted in this regard.

MATERIALS AND METHODS

Experiments of laboratory

As a biomaterial (termites of different layers)for laboratory research, indeed, mainly imago, soldier and working termite classes of different ages were imported from the Republic of Karakalpakstan, Khorezm, Syrdarya and Jizzakh regions in 2018-2020. Furthermore, a termite nest was brought from the Shibili ota shrine in Kegeyli district of the Republic of Karakalpakstan and was installed in an artificial termite nest. The research was conducted at the Institute of Zoology, Academy of Sciences of the Republic of Uzbekistan, in the laboratory of the "Theoretical foundations of entomophagous ecology and biomethods" and in the State Unitary Enterprise "Republican Center for Termite Control" at the Institute.

Researches were carried out on the development of food-baits that attract termites, taste better and are repellent and killing (termitocid).These researches on the detection of prophylactic, ie antiseptic substances against termites were carried out in the laboratory on the basis of methods N.M. Trushenkova (1962), N.B. Belyaeva (2004) [7; 2].

Also, the study of the properties of the action of antimicrobial and thermocidal agents was carried out on the basis of generally accepted methods [2; 5; 6; 7].

In order to do this:

Determination of the effectiveness of chemicals in field experiments.

For the detection of thermocidal substances in field experiments, 50 m^2 area of termite-bearing lands were selected as stationary plots from the territory of Shibiliy ota shrine in Kegeyli district of the Republic of Karakalpakstan and from the territory of Khiva collective farm in Khiva district of Khorezm region.

The use of poisonous baits against termites was based on the Amburgey [1] method. Installation of toxic feed-baits on buildings damaged by termites was carried out as follows. First,

termite infestations were identified, and then anti-termite baits were installed on the roof and walls of the building.

Approximately 2 m^2 of termite nests were selected under natural conditions. The perimeter of the nest was dug in a circle at a depth of 40 cm. Chemicals were added to the excavation site, and prepared toxic food-baits and control samples were placed around the perimeter of the termite nest, along the corridors of the chamber. The termites' mud-plastering process of food was observed.

Development and testing of a new form of food-baits against termites.

Chemicals were added to the core of the prepared new sample of feed-baits in the laboratory: aqueous solutions of different concentrations of Emamectin benzoate 5% water-soaked granule (0.002-0.0025%), Imidacloprid 70% water-soaked granule (0.002-0.0025%)), Acetamiprid 20% water-soaked powder (0.0025-0.003%) were soaked in the core of cardboard feed-baits and installed in termite-affected households to study their biological effectiveness against termites. Also, in order to determine the attractive properties of termites, an aqueous 0.2% solution of 20% $C_{12}H_{22}O_{11}$ sucrose, and a 0.3% aqueous solution of vanillin $C_8H_8O_3$ were soaked in the bulk of the cardboard pieces and the attractive properties of termites were studied. Pieces of cardboard in the experiment were installed in termite-infested areas (homes).

The research was carried out in the natural areas of Bukhara region, Karavulbozor district, Imam Bukhari mahalla, close to the territory of citizens, around the territory of the substation "Turon", where termite nests are commonly distributed.

The selected termite nests were numbered and special pits measuring 40-45 cm in length, 20-25 cm in width and 35-40 cm in depth were dug around each termite nest. The test items were placed in the excavated pits in a state of soaking in the newly constructed feed-baits (specially prepared cardboard pieces with a length of 12×4×2 cm) (Figure 2.3.4). In the first case, the thermocides and attractants, which were soaked in separate pieces of cardboard, were placed in termite nests. In the second case: the main part of the cardboard piece wassoaked with the attractant substances andthe core part of the cardboard piece was soaked with the thermocidal substances. The top of the pits where the substances were installed was tightly sealed with a plastic cover, a thick cloth, and soil. The pre-experimental weights of the forages installed in the termite nests were measured, and on the 15th, 30th, and 60th days after the experiment, the net weights remaining after the termites had been consumed were removed from the mud covered by the termites. In this way, the results obtained on the formation of mud and consumption of the termites on the cardboard pieces were recorded and analyzed after the experiment (Fig. 1).

Figure 1. New food-bait against termites, which is soaked in new drugs and attractants. A- View of the food-bait; B-Installation of food-bait in termite nests in field conditions; C- Installation of food-bait in termite-affected households.

SCIENTIFIC RESULTS

Study of biological efficacy of a new food-bait against termites, which is soaked in new drugs and attractants in the field conditions. To do this, the goal is to develop a design of a new generation of "Antitermit" food-bait in a new form. A new form of food-bait in the fight against termites was prepared as a model under laboratory conditions (Fig. 2).

The corpus offood-bait is made of prestressed corrugated paper and weighs 5 g; The weight of the food soaked in a mixture of a chemical substance attached to the core of the food-bait with glue is 5 g. The total mass is 20 g. (Figure 3). The food-baits are rectangular in shape, with dimensions of 140 × 40 × 10 mm, with a core of 120 × 20 × 10mm. The food soaked in chemical matter is impregnated inside.

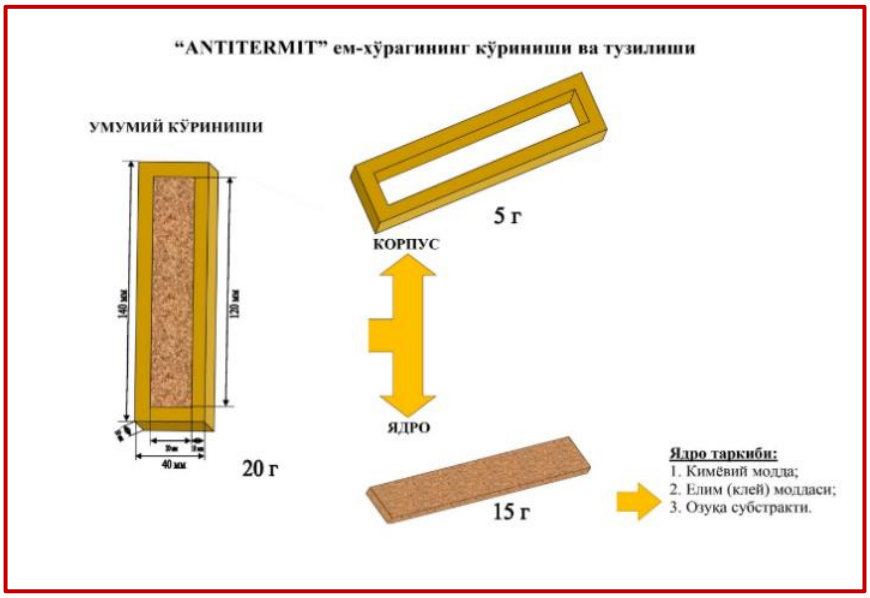

Figure 2. New food-bait against termites

To study the biological efficacy of the new food-baits, they were tested in termite nests under natural conditions and in termite-infested households. Also, the first test of termite nests was carried out in the border area of the substation "Turon" of Imam Bukhari Farm, Karavulbozor city, Karavulbozor district of Bukhara region (Figure 3.4.).

Figure 3. The border area of the substation “Turon” of Imam Bukhari Farm, Karavulbozor city, Karavulbozor district, Bukhara region, where the experimental work was carried out

Aqueous solutions of different chemical concentrations including Emamectin benzoate 5% water-soaked granule, Imidacloprid 70% water-soaked granule, Acetamiprid 20% water-soaked powder were soaked in the core of the new sample of food-bait. In addition, dry cardboard and soaked cardboard as a standard were installed in termite nests to determine their biological effectiveness as well as their attractiveness.

Experiment №1

In the first experiment, food baits soaked in thermocidal matters were installed separately, food baits soaked inattractantmatters were installed separately. In this case, 5 pieces were installed on one side of the nests in termite nests 1,2,3,4,5,6,10 (Table 1).

Table 1. Food-bait consumption of termites, when baits were soaked in thermocidaland attractant matters

Number of the nest	Experimented matters	Weight of food-baits before the experiment	Weight of food-baits when termites consumed them after the experiment (days)					
			15		30		60	
			(g)	(%)	(g)	(%)	(g)	(%)

		(g)						
Termite nest №1	Emamectin benzoate	20	1,2	16	7,0	35	11,0	55
	Sucrose	20	4,4	22	9,0	45	14,8	74
Termite nest №2	Imidacloprid	20	3,0	15	7,6	38	10,0	50
	Sucrose	20	4,0	20	8,0	40	14,0	70
Termite nest №3	Acetamiprid	20	2,4	12	6,0	30	9,6	48
	Sucrose	20	5,5	28	9,2	46	15,6	78
Termite nest №4	Emamectin benzoate	20	3,0	15	2,0	30	9,0	45
	Termite extracts	20	4,0	20	7,0	35	12,0	60
Termite nest №5	Imidacloprid	20	2,6	13	6,0	30	10,4	52
	Termite extracts	20	5,0	25	8,0	40	13,0	65
Termite nest №6	Acetamiprid	20	2,0	10	5,0	25	9,0	45
	Termite extracts	20	4,4	22	6,6	33	11,0	55
Termite nest №14	Dry cardboard piece (control)	20	2,0	10	4,0	20	7,0	35
Termite nest №15	Soaked cardboard piece (control)	20	5,6	28	8,0	40	11,0	55

Note: The experiments were conducted in the natural habitats of termites in their nests

Experiment №2

In the second experiment, food-baits impregnated with attractants on the main part of the cardboard piece and thermocidal substances on the core part of the cardboard piece were installed in termite cells 7, 8, 9 (Table 2). The top of the pits where the substances were installed was tightly sealed with a plastic cover, thick cloth and soil.

Table 2.Food-bait consumption of termites, when baits were soaked in thermocidaland attractant matterstogether

Number of the nest	Experimented matters	Weight of food-baits before the experiment (g)	Weight of food-baits when termites consumed them after the experiment (days)					
			15		30		60	
			(g)	(%)	(g)	(%)	(g)	(%)
Termite nest №7	Emamectin benzoate + Sucrose	20	5,0	25	8,8	44	14,8	74
Termite nest №8	Imidacloprid +Sucrose	20	5,6	28	8,0	40	15	75
Termite nest №9	Acetomiprid + Sucrose	20	4,6	23	7,6	38	14,0	70
Termite nest №11	Emamectin benzoate + Termite extracts	20	4,0	20	7,0	35	11,6	58
Termite nest №12	Imidacloprid + Termite extracts	20	4,4	22	8,0	40	12,4	62
Termite nest №13	Acetomiprid + Termite extracts	20	5,0	25	9,6	48	13,2	66
Termite nest №14	Dry cardboard piece (control)	20	2,0	10	4,0	0	7,0	35
Termite nest №15	Soaked cardboard piece (control)	20	5,6	28	8,0	40	11,0	55

Note: The experiments were conducted in the natural habitats of termites in their nests

The pre-experimental weights of the food-baits installed in the termite nests were measured, and on the 15th, 30th, and 60th days after the experiment, they were removed from thesite and cleaned of termite'smud, and the net weight left over from termite consumption was measured. The mass consumed by the termites was calculated by subtracting the net post-experimental (in days) from the pre-experimental weight of the food baits.

According to the results of the first experiment, the consumption of food-baits soaked in attractant matters by termites for 60 days decreased in the following order: Sucrose (70-78%)> Termite extract (60-65%)>Soaked cardboard (55%)> Dry cardboard (35 %) (Table 2).

Consumption of chemical-impregnated food-baits by termites decreased in the following order: Emamectin benzoate> (45-55%)> Imidacloprid (50-52%)> Acetamiprid (45-48%)>Soaked cardboard (55%)> Dry cardboard (36%) (Table 2).

In the second experiment, thermocytes and attractants-impregnated food-baits by termites decreased in the following order:

Imidacloprid + Sucrose (75%)> Emamectin benzoate + Sucrose (74%)> Acetamiprid + Sucrose (70%)> Imidacloprid + Termite Extract (62%)> Emamectin Benzoate + Termite Extract (58%)>Soaked Cardboard (55%) > Dry cardboard (36%) (Table 3).

Figure 4. Installation of cardboard paper soaked in termitocytes and attractants in termite nests and consumption of cardboard paper wrapped in mud by termites: A-Experimental place; B-15 days after the experiment; 30 days after the experiment; C- 60 days after the experiment.

Indeed, according to the results of the study of the biological effectiveness of food-baits soaked in new drugs and attractants against termites: Sucrose had the highest attraction, ie 70-78% when soaked in individual food-baits; when ingested in combination with drugs, it showed 70-74% attraction. Imidacloprid (55% consumed) and Emomectin benzoate (50-52% consumed) were noted as chemicals with low repellent properties. However, it has been suggested that they can be used as an effective means of mitigating termite damage in natural habitats and in structures damaged by them.

In order to improve the transportation and packaging of food-baits in the system of termite control, a new form of food-bait “Antitermite” was modernized and LLC “Design and Technological

Center for Agricultural Machinery" was commissioned to create equipment for the production of this feed for large-scale production.

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