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AZADIRACHTIN AFFECTS GROWTH AND SURVIVAL OF THE MOLE-CRICKET *GRYLLOTALPA GRYLLOTALPA* (ORTHOPTERA: GRYLLOTALPIDAE)

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Abstract

Antifeedant and molt disruption effects of 0.3% azadirachtin applied one per week for four weeks were evaluated for the mole cricket *Gryllotalpa gryllotalpa*, in laboratory tests. The highest concentration of formulated product (5 ml extract/50 ml distilled water/25g crushed corn seeds) resulted in 98% mortality. Crickets surviving treatment grew more slowly and tunneled less compared to their untreated counterparts.

Key words: Mole cricket, azadirachtin, mortality, antifeedant

INTRODUCTION

Pests reduce crops yield, carry diseases that affect plants, man, animals, damage food and other stored products. Although synthetic organic pesticides appeared to provide a solution to the problems of pest control, it has become apparent that repeated application of pesticides can be an inadequate method of control. Excessive reliance pesticides have been accompanied by the development of pest resistance and problems of environmental pollution. Thus, there is a continuing need for new pesticides which have different modes of action and improved effectiveness and safety over those currently in use. Thus, they may serve as replacements for compound whose usefulness becomes limited because of the development of resistant strains of pests or because of their undesirable persistence or toxicological characteristics.

It has been speculated for many years that plant resistance to insects attack is largely due to chemical factors (Brues, 1946; Dethier, 1954). Large number of compounds having diverse biological effects on insects (i.e killing, attracting, repelling, morphogenetic, feeding deterrent, growth inhibition and sterilizing effects) have been isolated and identified from plants which are relatively free from insect attack. A recent reference on the bioactive agents from plants is now available (Hedin, 1985, Shaaya *et*

al, 1991, Regnault-Roger *et al*, 1993, Huang *et al*, 1998, Isman, 2000,).

Mole cricket is a subterranean insect that causes damage to the cultivated vegetable crops by feeding on their roots. Control of mole cricket becomes a major problem due to the lack of an effective biological control system. This paper describes the effects of neem plant leave extracts on feeding, growth and metamorphosis on *G. gryllotalpa*. These methods, in combination with the proper use of pesticides, may limit mole cricket damage and significantly reduce its population on the cultivated area.

MATERIALS AND METHODS

Collection and maintenance of mole cricket: Nymphs and adults of mole cricket were collected by using pit-fall traps and digging from the soil with a shovel at Abu-Rawash, Kafr-Hakim, Giza Governorate and Kom-Hamada, Beheira Governorate during the period of insects activity (March-October). Captured specimens were immediately confined in tin containers (20 cm x 15 cm). Each container was filled partially with sterilized clay sandy moist soil and slices of potato were offered as a food.

Source of extract: Neem leaf extract (*Azadirachtin indica*) under commercial name trifolio from Germany containing 0.3% azadirchtin was used in the present investigation.

Bioassay techniques: The crushed corn seed was treated by a graded increase of 0.3% azadirachtin as follows: 0, 0.25, 0.5, 0.75, 1, 2, 3, 4,and 5ml of the azadirachtin was added to 50 ml distilled water and mixed with 25g of the crushed corn seed for each treatment. Twenty crickets (5th instar) were assigned to each treatment. Nymphs were held individually in plastic cups, (10 cm x 8 cm), and 5 g of azadirachtin treated crushed corn seeds was applied to each nymph as food material. The active ingredient per 5g of the prepared bait was shown in Table 1.

The control group received the same volume of water without azadirachtin. Crickets were removed from cups and weighed weekly. Mortality of individuals was recorded after 1,2,3 and 4 weeks. Observations on the molting behavior and feeding of the crickets under investigation were recorded.

Table 1. Azadirchtin concentrations tested against 5th instar nymphs of mole cricket.

Formulation volume (ml)	Active ingredient (AI)	AI/ 5 g bait
0	0	0
0.25	0.00075	0.00015
0.5	0.0015	0.0003
0.75	0.00225	0.00045
1	0.003	0.0006
2	0.006	0.0012
3	0.009	0.0018
4	0.012	0.0024
5	0.015	0.003

RESULTS AND DISCUSSION

Certain plant oils widely used as fragrances and flavors in the perfume and food industries have long been reputed to repel insects. Recent investigations confirm that some plant essential oils not only repel insects, but have contact and fumigant insecticidal actions against specific pests and fungicidial action against some important plant pathogens (Isman, 2000).

The application of neem products to food plants of insect aims at two different strategies:1) neem products are useful for crop protection because of their antifeedant activity, 2) ingestion of parts of contaminated plants may reduce the insect population due to the destructive influence of neem on growth, metamorphosis reproduction and activity of insects (Jacobson, 1988). In the present study the effect of the neem leaves extract on the mole cricket 5th nymphal instar was studied. Data presented in Table 2 indicate the mortality percentages resulted from the treatment insect food by azadirachtin. The mortality was remarkably increased with time and the highest mortality percent was occurred after four weeks from treatment at all different concentration. The mortality was increased with increasing the azadirachtin concentration on the bit and reached 98% at the highest concentration (5-ml), Fig.1. These results are in agreement with the results that reported by Kreutzweiser *et al*, (2000) in which the commercial neem formulation significantly affects the aquatic insect community structure. Similarly, Jacobson (1986) found that very high mortality rates appear after application via treated food by using baits contaminated with neem products.

Table 2. Mean percent mortality of mole cricket induced by different concentrations of Azadirachtin.

Concentrations (ml)	Mortality %			
	1st week	2nd week	3rd week	4th week
Control	0	0	0	0
0.25	0.5	3	10.5	10
0.5	1.5	5	20	17.5
0.75	2	7.5	19.5	22.5
1	2.1	5	24.5	35
2	2.5	9.5	22.5	47.5
3	2.4	10	24	47.5
4	2.8	10.5	29.5	62.5
5	3	10	32.5	62.5
Mean	1.8	6.7	20.3	38.13

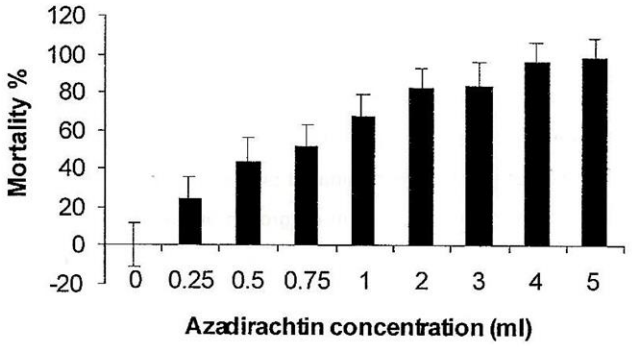

Fig. 1. Total mortality percentages (%) in mole cricket 5th nymphal instar treated by azadirachtin at graded levels after four weeks.

In the present study the effect of azadirachtin on the growth of the mole cricket nymphs was studied. Data indicate that, the average nymphal weight of crickets surviving treatment was significantly decreased than that of the untreated control, Table 3. After four weeks from the initiation of treatment, the nymphs were completely died under high azadirachtin concentration (5ml).

Table 3. Mole cricket nymphs weight reduction as a result of azadirachtin treatment

Concentration (ml)	Insect weight/mg			
	1st week	2nd week	3rd week	4th week
0	390	420	455	470
0.25	390	400	405	405
0.5	388	398	408	403
0.75	385	390	393	393
1	381	389	375	260
2	380	363	280	251
3	380	270	263	248
4	378	255	241	0
5	375	245	165	0
Mean	383	377.8	331.7	270

The antifeedant effect of azadirachtin was observed, Figure.2 indicates the differences in nymphs weight after four week from the beginning of azadirachtin treatment. Correspondingly limited tunneling and feeding activities by treated crickets were also observed. Numerous records exist of antifeedant of neem derivatives on insects of different orders (Jacobson, 1986; Koul, 1999).

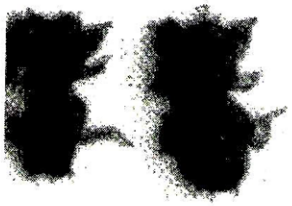

Fig. 2. The antifeedant effect of azadirachtin on the 5th nymphal instar of mole cricket: right side is the control, left side is azadirachtin treated insect

In the present study the effect of azadirachtin on the metamorphosis in mole cricket was observed. When 5 ml azadirachtin was applied to the bait and introduced to the nymphs for four weeks, the mole cricket nymphs failed in molting, Fig 3. Small formed nymph of G. *gryllotapa* can molt after treatment with neem leave extract, after molting the resulted nymphs show an abnormal shape. This result is in agreement with those of Monthean and Potter 1992 and also with Braman, (1993) who observed the

antifeedant and molt disruption effects on the nymphal mole crickets, *Scapteriscus vicinus* treated once per week for 3 weeks with 0.3% azadirachtin.

Fig.3 *G. gryllotalpa* nymph failed to molt after treatment with neem leaves extract.

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تاثير مستخلص نبات النيم على نمو و بقائية حشرة الحفار *Gryllotalpa gryllotalpa*

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تم استخدام المستحضر التجاري Trifolio لمستخلص اوراق نبات النييم بتركيز ٠,٣ ٪ ضد العمر الحوري الخامس للحفار *G. gryllotalpa* بتركيزات مختلفة من المستحضر وذلك باضافة كل تركيز في ٥٠سم ماء وخلطها مع الذرة المجروش ويقدم كغداء للحشرات أدى ذلك إلى وجود تفاوت في نسبة الموت داخل هذا العمر. أثناء العمل كان يتم وزن الحوريات المعاملة ومقارنتها بالحوريات غير المعاملة وكانت تظهر هذه المقارنات فروق معنوية بين اوزان الحوريات. وجد ايضا ان لنبات النيم تأثير علي قدرة الحشرات علي التشكل وتطورها من عمر لآخر، اما الحوريات التي نجحت في الانسلاخ اعطت حوريات مشوهة مما يفقدها القدرة علي القيام بوظائفها الحيوية.