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SOME STUDIES IN CONTROLLING THE PRDATOR IVSECT VESPA *ORIENTALIS* ATTACKING HONEYBEE IN EGYPT.

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ABSTRACT

Different control measurements were tested against the oriental hornet *Vespa orientalis* Fab. in three sites in Quena governorate representing Upper Egypt viz. Abu-Tisht, Quena and Isna during two successive years, The results indicated that the efficiency of using sweep-net as a method of control, the annual mean numbers of captured hornets throughout the study period reached 3844.3, 2566.8 and 2351.9 individuals for the three study sites, respectively.

Of the four tested types of traps, the Ministry of Agriculture trap (MAT) was found to be the most effective one in trapping the hornet, while the hanged trap was the least. The average collected number of hornets / trap/ year reached 2755.8 individuals using MAT comparing with 58.6 individuals for the hanged trap.

Attractiveness of six baits viz. fermented sugar solution, fresh honey, fermented honey, dead bees, fresh fish and animal lung were tested using MAT. Fish bait was superior over all tested baits, while the dead bees bait was the least attractant.

Chemical control methods were tested under laboratory conditions. Two forms of applications viz. spray and poisoned baits were experimented using Lannate 90%, Lannate 20% and Malathion 57%. According to the obtained data Lannate 90% proved the highest efficiency against the hornet when applied either as spray or poisoned baits.

INTRODUCTION

The hony bee has several enenmios that endanger the life of individual bee or damage coiong .vespa oreintalis isdamgerous pest of honey bee in Egypt.

Earliest records of predation of honeybee colonies by species of *Vespa* were made during Roman times (De Jong, 1990). This predation and robbing of honey from hives continues today, and hornets are serious economic problem to beekeepers in the tropical and subtropical areas of the Middle East (Ishay *et al.*, 1968; Muzaffer & Ahmed, 1986; Archer, 1989; Akre&Mayer, 1994). In Egypt, the oriental hornet has become established in regions of Upper Egypt and is a real threat for beekeeping industry (Wafa, 1956; Ibrahim & Mazeed, 1967). The seriousness of the hornet resulted from its sever attack on honeybee colonies when its population reached the peak of activity in late summer and early autumn meanwhile, honeybee activity declined (Wafa & Sharkawi, 1972; Sharma & Raj, 1988; Sihag, 1992 a,b). A

number of procedures were investigated world wide for combating hornets. Among these procedures, killing individual workers (Shah & Shah, 1991), destroying nests (Subbiah & Mahadevan, 1957; Singh, 1962), trapping by using baits (Sharkawi, 1964; Davis *et al.*, 1975; Higo, 1983; Orlov *et al.*, 1988), toxic baits (Wafa *et al.*, 1969; Mishra *et al.*, 1989). Sharma *et al.* (1979) tested different methods either alone or in combination, and concluded that none of the methods could exclusively be relied upon; instead a combination of methods would be useful. Since efficient control program has not been developed, therefore, the purpose of this study is to find and evaluate any possible methods to eliminate or minimize the hazards of the oriental hornet to honeybees.

MATERIALS AND METHODS

Three sites representing Upper Egypt were chosen to carry out this study, Abu-Tisht in the north, Quena in the middle and Isna in the south. The following control measurements were tested throughout two successive years.

3.1. Sweep-net

A sweep-net described by Borrer and Delong (1970) was used for catching hornet workers attacking honeybee colonies. Capturing took place in each study site once a week at two hour intervals from 6.0 a.m. to 8.0 p.m. during spring and summer, and from 6.0 a.m. to 6.0 p.m. during autumn and winter. The monthly data were calculated as mean over weeks throughout the two study years.

3.2. Traps

Efficacy of four types of traps, locally used by beekeepers in ARE, was evaluated for catching hornets. The following traps were tested:

3.2.1. Ministry of Agriculture trap.

The trap is screened wire cage measures 120 X 100 X 100 cm armed with wooden bars (Fig.1.a). The bottom side is about 20 cm apart from the ground with a hole of about 30 cm diameter in the middle. Screened wire cone was fixed on that hole with the narrow end up inside the cage.

3.2.2. Modified trap no. 1.

The trap is more or less as same design as ministry of Agriculture trap but with different measurements i.e. 50 x 50 x 30 cm. (Fig.1.b).

3.2.3. Modified trap no. 2.

The trap consists of two parts (Fig.1.c), the lower is a wooden box measures 50 x 50 x 35 cm, with open bottom side. The topside of the lower part is made of screened wire with a hole of 10 cm diameter in the middle provided by screened wire cone with the narrow end up. The upper part is a screened wire cage measure 50 x 50 x 100 cm.

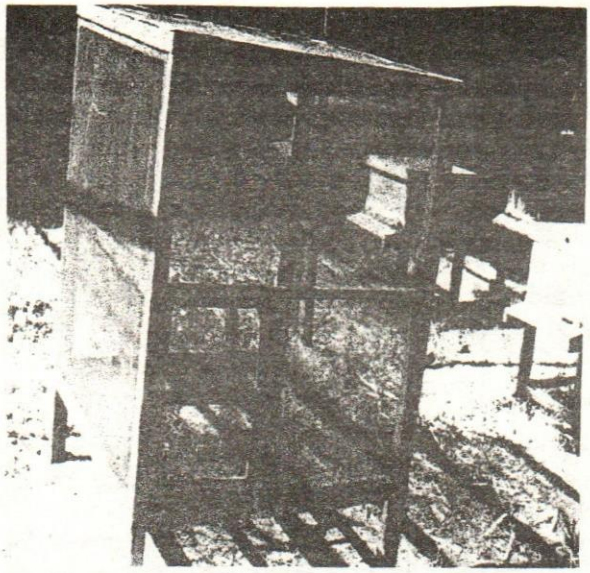


Fig. (1,a): Ministry of Agriculture trap

Fig. (1,b): Modified trap no.1

Fig. (1,c): Modified trap no.2

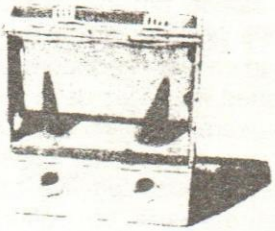


Fig.(1,d): Hanged trap

Fig. (1,a-d): Different types of hornet traps

3.2.4. Hanged trap

The trap is a rectangular box of two parts (Fig.1.d) the lower is wooden box, whereas the front and hind sides of the upper part made of screened wire. Two screened wire cones are fitted to each of the front and hind side of the lower part with the narrow ends inside. Another two cones are fixed between the lower and the upper part with narrow ends up. This trap is hanged on any opposite place in the apiary.

From each type of the previously mentioned traps, four units were located randomly in each site and provided with the same attractant bait. Hornets caught in each trap were counted weekly throughout the two years of the study.

3.3. Attractant baits

The attractiveness of six baits i.e. fermented sugar, fresh honey, dead bees, fresh fish and animal lung were tested using Ministry of Agriculture trap. Three traps each having

100g. of one of the tested baits were placed randomly in different locations in the experimental apiaries of each study site. Numbers of hornets attracted to the given traps were counted once a week from 10.0 a.m. to 4.0 p.m. over a month (October) throughout the two study years.

3.4. Insecticides

Efficacy of three insecticides, Lannate 90%, liquid Lannate 20% and Malathion 57% were tested under laboratory conditions as follows:

3.4.1. Spray

Twenty cm^3 of the manufacturer recommended dose of each of the three insecticides were tested as spray application using hand sprayer on hornets in cages. A wooden cage measure 20 x 20 x 20 cm having both sides of screened wire, was used for caging 20 hornets. Four cages populated with hornets were represented as one treatment of each tested insecticide. Additional group of four cages was left untreated (control). Knocked down hornets were counted five min. subsequent spraying and the numbers of dead hornets were, thereafter, recorded every 15 min. over a period of two hours (Ibrahim and Mazeed, 1967). The mortality percentage was corrected using Abbot's formula (Abbot, 1925).

3.4.2. Poisoned baits

Three doses of each insecticide were tested. Amount of 5, 10 and 15 grams or cm^3 of the tested insecticide was mixed each with equal amount of honey (1 kg.). Amount of 100 gm. of each poisoned bait was provided in petri dishes to the hornets of the observation nest (contains about 400 individuals). The dead hornets were counted every 30-min. over two hours after applications (Wafa *et al.*, 1969) and mortality percentages were calculated.

RESULTS AND DISCUSSIONS

4.1. Sweep-net

Data presented in Table (1) indicate that monthly mean numbers of hornets collected by sweep-net, throughout the two study years, reached its peak in October for all study sites. These data agreed with those of Sharkawi (1964). Numbers of hornets caught during the first year were substantially higher than that of second year. The total mean numbers overall months showed the highest record of 3844.3 individuals for Abu-Tisht site followed by 2566.8 for Quena and 2351.9 for Isna. Sweep-net can be considered as a good method of control since large numbers of hornets were captured using this method. Some other closed methods such as killing the hornets by using palm leaves, stick or swatter were reported by Sharkawi (1964) in Egypt and Akre & Mayer (1994) in Japan, to be useful measures against hornets. These methods are labor intensive and must be used when the hornet become so numerous.

Table (1): Monthly mean numbers of hornets collected with sweep-net from the study sites Abu- Tisht (I), Quena (II), and Isna (III).

Site	Monthly mean numbers of hornets												
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Total
I	0	0	21.6	33.3	50.1	113.8	329.3	686.3	1120.2	1320.8	164.5	4.1	3844.3
II	0	0	17.2	35.2	55.9	90.6	244.5	384.7	624.0	917.2	185.1	12.3	2566.8
III	0	0	17.6	32.8	60.5	111.0	233.2	388.8	641.1	737.8	118.5	10.4	2351.9
Overall mean	0	0	56.4	101.4	166.5	315.4	807.1	1459.9	2385.4	2975.9	468.1	26.8	

4.2. Traps

The numbers of hornets caught by various types of traps are summarized in Table (2). Ministry of Agriculture trap was the most efficient one and caught the highest numbers of hornets in all study sites, followed by modified trap no. 1 and modified trap no. 2. Hanged trap, however, showed the lowest efficacy. The mean total numbers of hornets collected from the three sites using Ministry of Agriculture trap, modified trap no. 1, modified trap no. 2 and hanged trap were 2755.8, 2509.9, 1998.3 and 58.6 individuals/ trap/ year, respectively. This agreed with Ibrahim and Mazeed (1967).

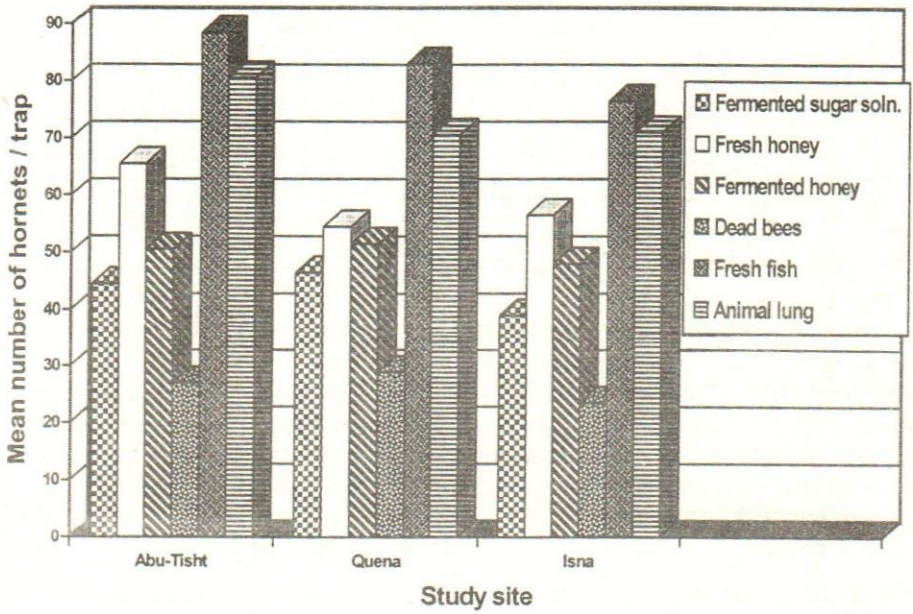
Table (2): Annually mean number of hornets caught by various types of traps in Abu-Tisht (I), Quena (II), and Isna (III).

Traps	Mean number of caught hornets / trap in different study sites			
	I	II	III	MEAN
Ministry of Agric.	3533.6	2851.7	1882.0	2755.8
Modified No.1	3384.6	2334.9	1810.2	2509.9
Modified No. 2	2725.0	1705.0	1564.9	1998.3
Hanged	64.4	74.6	37.0	58.6

4.3. Attractant baits

Results presented in Fig. (2) show that fresh fish bait was more attractive one to the hornets than the other tested attractant baits, while dead bees bait was the least attractant. The tested baits could be arranged according to their attractiveness in descending order as follows: fresh fish > animal lung > fresh honey > fermented honey > fermented sugar > dead bees. The present results agreed with those of Vincent (1988) who conducted a bait preference experiment and found that yellow jackets wasp *Vespula germanica* Fab. preferred tuna fish over meat or liver. Meat baits (fish, beef, ham) were reported as the most effective attractants to the hornets (Akre & Mayer, 1994). Moreover, the present investigations indicated that bees did not attracted to fish or animal lung baits. This support the opinion of Davis *et al.* (1975) and Higo (1983) who stated that traps baited with correct ttractants can provide useful measure against wasps without harming bees.

Fig (2): Number of hornets attracted to different baits in the three study sites



4.4. Insecticides

The efficacy of various insecticides viz. Lannate 90% (A), Lannate 20% (B) and Malathion 57% (C) tested in both forms spray and poisoned bait applications are summarized in Tables (3) and (4).

4.4.1. Spray

Comparing the average mortality percentages obtained by spraying caged hornet with the tested insecticides (Table 3), it can be observed that spraying with A accelerate the hornet mortality. Five minutes after application the mortality percentages for cages treated with A (22.5%) was substantially higher than those treated with B (8.0%) or C (1.25%). Moreover, mortality percentages in cages of A rose to achieve 46.25, 62.5 and 82.5% after 20, 35 and 50 min. of spraying, respectively. Whereas, killing all hornets was accomplished with A after 65 min. of application. In comparison, both B and C caused 100% mortality 125 min. subsequent to spraying.

Table (3): Mortality percentages of different tested insecticides sprayed on the hornet in cages under laboratory conditions

Insecticides	Average mortality % in minutes after application								
	5	20	35	50	65	80	95	110	125
Lannate 90% (A)	22.50	46.25	62.50	82.50	100.00	-	-	-	-
Lannate 20% (B)	8.00	23.00	34.25	46.75	61.75	78.00	89.25	98.00	100.00
Malathion 57% (C)	1.25	8.75	25.00	32.50	50.00	60.00	76.25	90.00	100.00

4.4.2. Poisoned baits

Data in Table (4) show the efficacy of tested insecticides for killing the hornets. Progressive increase of hornet mortality was observed for each tested insecticide with the corresponding increase of its concentration within the bait. Inspecting the observation nests 0.5, 1.0 and 1.5 h. after treatment with bait containing the lowest concentration of A (5 g.) showed mortality of 22.5, 90.0 and 98.5%, respectively. Destroying all individuals within the nest was achieved 2.0, 1.5 and 1.0 h. after using baits containing the lowest (5 g.), moderate (10 g.) and highest (15 g.) concentrations of A. Despite using the highest concentration (15 cc.) of either B or C resulted in 100% mortality, however, more time (2.0 hrs.) was needed. The present results confirmed the observation of Mishra *et al.* (1989) who reported the corresponding decrease in LT_{50} values with the increase of the insecticide concentration of the bait.
The tested insecticides could be arranged according to their efficacy against the oriental hornet as follows:
Lannate 90% > Lannate 20% > Malathion 57%.

Table (4): Mortality percentages of hornets treated with various poisoned baits in observation nests

Bait poisoned with	concentration	Average mortality % in hours after application			
		0.5	1.0	1.5	2.0
Lannate 90% (A)	5 g.	22.5	90.0	98.5	100.0
	10 g.	27.5	99.0	100.0	-
	15 g.	33.5	100.0	-	-
Lannate 20% (B)	5 cc.	7.5	60.0	77.5	90.0
	10 cc.	11.5	67.5	91.0	96.0
	15 cc.	15.0	77.5	95.0	100.0
Malathion 57% (C)	5 cc.	9.0	56.5	84.0	96.5
	10 cc.	12.5	70.0	90.0	97.5
	15 cc.	13.5	86.0	98.5	100.0

The present results suggest the use of the sweep-net for capturing the oriental hornet particularly when its population reaches the peak. Ministry of Agriculture traps can be used for trapping the hornet after they provided with fish or meat attractant bait. Lannate 90% is a good killer for the hornet in both forms of application spray and poisoned baits. These points would be useful when designing integrated pest management against the oriental hornet.

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بعض الدراسات فى مكافحة دبور البلح *Vespa orientalis* Fab. المهاجم لطوائف نحل العسل فى مصر

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فى دراسة أجريت فى ثلاث مناطق بمحافظة قنا بمصر العليا وهى أبو تشت، قنا، وإسنا خلال عامين متتاليين اختبرت طرق مختلفة لمكافحة دبور البلح *Vespa orientalis* Fab. وتضمنت الآتى:

١- استخدام الشبكة اليدوية.

استخدمت الشبكة اليدوية لصيد شغالات الدبور ٣التى تهاجم خلايا النحل مرة فى الأسبوع وذلك كل ساعتين وعلى مدار ١٢ ساعة وسجلت المتوسطات الشهرية لأعداد الدبور خلال عامى الدراسة.

أظهرت النتائج فاعلية هذه الطريقة حيث تم صيد أعداد كبيرة من الدبور بلغ أجمالى متوسطات هذه الأعداد فى عامى الدراسة لمناطق أبو تشت، قنا، إسنا ٣٨٤٤,٣، ٢٥٦٦,٨، ٢٣٥١,٩ فردا على التوالى.

٢- المقارنة بين كفاءة المصائد المختلفة فى مكافحة الدبور.

قيمت كفاءة العديد من المصائد المصنعة محليا فى اصطياد الدبور وهى مصيدة وزارة الزراعة، المصيدة المحسنة رقم ١، المصيدة المحسنة رقم ٢، والمصيدة المعلقة حيث استخدمت أربعة مصائد من كل نوع زودت جميعها بمادة جاذبة واحدة ثم وزعت بطريقة عشوائية فى المناحل المختارة فى مناطق الدراسة وقدرت الأعداد التى تم صيدها أسبوعيا وتم حساب متوسطات الأعداد السنوية التى تم صيدها خلال فترة الدراسة.

أظهرت النتائج أن أفضل المصائد هى مصيدة وزارة الزراعة حيث أن إجمالى متوسط الأعداد السنوية التى جمعت من مناطق الدراسة الثلاثة بلغت٢٧٥٥,٨ فرد/المصيدة يليها مباشرة المصائد المحسنة. بينما كانت أقلهم كفاءة المصيدة المعلقة والتى بلغت أعدادها بالمقارنة ٥٨,٦ فرد/المصيدة.

٣- تقييم جاذبية بعض الطعوم لأفراد الدبور.

تم مقارنة ستة من الطعوم من حيث جاذبيتها للدبور وهى سكر متخمر، عسل طازج، عسل متخمر، نحل ميت، سمك طازج، ورئة الحيوان وذلك باستخدام ثلاثة من مصائد وزارة الزراعة لكل نوع من الطعوم وزودت كل منها بوزن ١٠٠ جم من الطعم. سجلت الأعداد التى انجذبت للطعوم والتى تم صيدها من الساعة ١٠ ص- ٤م مرة أسبوعيا خلال شهر أكتوبر فى كل عام من عامى الدراسة.

أظهرت النتائج تفوق كل من طعم السمك الطازج ورئة الحيوان على باقى الطعوم المختبرة. بينما كان أقلها جاذبية هو النحل الميت.

٤-المكافحة الكيماوية.

أ - اختبار سمية بعض المبيدات معمليا.

أختبر التأثير السام لثلاثة من المبيدات هى اللانت ٩٠%، اللانت السائل ٢٠%، الملاثيون ٥٧% على الدبور وذلك رشا من خلال أقفاص سلكية أبعادها ٢٠×٢٠×٢٠ سم يحوى كل منها ٢٠ دبور وخصصت ٤ أقفاص لكل مبيد رش كل منها ب ٢٠سم^3 من الجرعة الموصى بها للمبيد المختبر. تم حساب نسبة الموت بعد ٥ دقائق من الرش ثم كل ١٥دقيقة وعلى مدى ساعتين.

ب- تسميم العشوش.

استخدمت المبيدات الثلاثة السابقة أيضا فى إعداد طعوم سامة ذات تركيزات مختلفة وذلك بخلط ٥، ١٠ أو ٥ جم أو سم من كل مبيد مع ١ كجم من العسل وتم معاملة عشوش الملاحظة ب ١٠٠ جم من الطعم واستخدمت ثلاثة مكررات لكل تركيز. تم حساب نسب موت الدبور كل ١٥ دقيقة بعد المعاملة وعلى مدى ساعتين.

ويمكن ترتيب المبيدات المختبرة حسب فعاليتها كما يلى: لانت ٩٠% >لانت ٢٠% > ملاثيون٥٧% بالإضافة الى أن زيادة تركيز المبيد فى الطعم السام يزيد من نسب موت الدبور.