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TESTING THE EFFICACY OF SOME METHODS RECOMMENDED ABROAD FOR CONTROLLING THE ORIENTAL HORNET, *VESPA ORIENTALIS* L., ATTACKING HONEY BEE, *APIS MELLIFERA* L., COLONIES IN IRAQ

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ABSTRACT

Some methods recommended abroad to control the oriental hornet, *Vespa orientalis* L., attacking the honey bee, *Apis mellifera* L., colonies were tested, with some modifications, for the first time under the Iraqi conditions. One of these methods was carried out by covering the hive entrance with a piece of queen excluder to prevent the hornet from entering the hive. Also, the position of hive stand was reversed to deprive the hornet from using the flight board as a stage for waiting and creeping toward the defending bees. The second method was carried out by fixing a cardboard cone as a bee passage at the hive entrance to hinder the entry of the hornet into the hive. Both of these methods were found to be unsuccessful to control the hornet. Also, the use of vinegar traps had an adverse effect, for only worker honey bees and dipterous insects, rather than the hornets, were trapped in large numbers.

INTRODUCTION

The oriental hornet, *Vespa orientalis* L., is a key pest attacking honey bee colonies in many countries (Ishay *et al.* 1967; Klein and Adler, 1996; Gomaa and Abd El-Wahab, 2006; Haddad *et al.*, 2006).

Beekeepers in different countries including Iraq have practiced many measures invented by the beekeepers themselves to control all the species of the genus, *Vespa*. These measures include the extermination of queen hornets in early spring to get rid of thousands of would-be enemies in summer and fall, the crush of worker hornets flying at the apiaries after these workers are caught by hand nets or beaten by wooden sticks with flat heads, etc., and the destruction of hornet nests by applying insecticides or fire after dusk. Although these measures are effective, they are tedious and costly.

Scientific studies on hornets including their control are rare when compared with those on other pests and diseases attacking honey bees. However, workers in different countries have tested and / or suggested some methods and ideas to control this hornet as well as other species of the genus, *Vespa*. The use of baited and not baited traps placed at the apiaries and traps attached to the front of the hives represent well-known kinds of these methods. However, the efficacy of these traps is controversial. While Ibrahim and Mezid (1967) had highly recommended the use of this method in Egypt, Matsuura and Sakagami (1973) stated that the

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traps in Japan did not always function efficiently.

During the last decade many workers abroad have highly recommended the use of baited traps for controlling *Vespa orientalis* and *Vespa germanica*. In Palestine Klein and Adler (1996) stated that using poisoned meat baits was very effective method. They used the organic phosphate, acephate. Bacandritsos *et al.* (2006) cited that the use of wood-glue trap in combination with the fish as a non-toxic bait in Greece was a reliable solution for controlling these wasps in apiaries. In Egypt, Gomaa and Abd El-Wahab (2006) said, "Application of liquid yeast culture (*Candida tropicalis*) as bait is efficient procedure to capture the oriental wasps by the recommended traps".

In India, Subbiah and Mahadevan (1958) suggested the idea of pushing the hive bodies to the very front of the bottom board, thereby not providing any spaces in front for the bees and the hornets to alight. The application of this idea was mentioned to hinder the hornets from snatching off the bees. The results of our another study have also encouraged us to include this idea in our present study (Glaiim, unpublished date). In Japan, Mastuura and Sakagami (1973) reported the practice of using protective screens such as wire fishing nets to cover hive entrances. Muzzaffar and Ahmed (1986) mentioned that a wire-gauze tube fixed as a bee passage at hive entrance reduced the frequent entry of *Vespa* spp. in Pakistan. Beljavsky (1937) mentioned that vinegar traps were very effective for hornet and wasp control in Italy.

The present study was based on our another study on the hornet attack behavior (Glaiim, unpublished data), as well as on some ideas suggested by foreign investigators.

MATERIALS AND METHODS

The study was carried out at an apiary located ca.30 km north of Baghdad. It was initiated in early August and terminated in late November, 1989, for most of the damage caused by the hornet to honey bee colonies occurs in this period. All honey bee colonies involved were housed in wooden Langtroth hives. The honey bee colonies are of a random cross between the native race and introduced races, especially *Apis mellifera carnica*. Brother Adam (as cited by Abdellatif *et al.* 1977) believes that the local race in Iraq is a sub-division of *A. m. syriaca*. The nests of the hornet in the vicinity of the apiary were not subjected to any kind of control during the period of study.

Methods No.1 and No.2 were applied in 15 bee-occupied hives each. Untreated (regular) bee-occupied hives of the same number were used as a test control.

Method No.1 was applied as follows: the hive entrance was covered with a piece of metal queen excluder to prevent hornet entry. The next step was made to prevent both the hornets and bees from alighting in front of the hive. For this reason, the position of the hive stand was reversed, hence the flight board became in the rear of the hive rather than in front of the hive entrance. Also, the narrow strip of the bottom board extending in front of the hive entrance was cut, hence the hive body was moved to the very front of the bottom board.

Method No.2 was implemented by fixing cardboard cone as a bee passage at the hive entrance to lessen frequent entry of the hornet into the hive. The length of the cone was 20cm and the diameter of its distal round opening was 2cm. The cone broad base was flattened in order to be inserted into the 0.95 x 8.0cm hive entrance.

Also, five 250cm^3-glass flasks filled with vinegar up to one fourth of their height were hung at different sites at the apiary to examine their efficacy as hornet traps. The vinegar used was made of dates.

RESULTS AND DISCUSSION

Method No.1

The start of the present study was by applying this method only. But after about one month of daily basis observations, we reached a conclusion that the results were discouraging and the method would not be promising for hornet control.

However, the application of this method was not totally devoid of some positive sides. First, the hornets were not able to enter the hive through the openings of the queen excluder, hence they could not attack bees inside the hive. It is well known that when the hornets find no enough number of bees guarding the colony at the hive entrance, especially in weak colonies, they enter the hive easily, hunt adult bees, and take the colony-reserve of honey. Under such a condition, the colony either perishs or deserts. Second, the reversion of the hive stand position and the elimination of the bottom board narrow strip deprived the hornets from using the flight board and the strip as a stage for waiting and creeping toward the bees gathering at the hive entrance and on the flight board. It has been found that such a tactic is sufficiently used by *Vespa orientalis* (Ishay *et al*., 1967; Glaiim, unpublished data).

Despite these positive sides, the application of this method showed some drawbacks that highly affected its efficacy for hornet control. Because the flight board and the narrow strip of the bottom board were absent, the hornets were alighting and waiting on the queen excluder itself to hunt incoming and outgoing bees. At such a situation and when a bee was trying to leave the hive through an opening of the queen excluder, she would be easily grabbed by a waiting hornet. The latter usually catches the bee head and pulls her out. Also, since the openings of the queen excluder are relatively narrow, the bees find no opportunity for maneuvering to retreat or escape the hornets. Incoming bees were also grabbed easily by waiting hornets since these bees usually alight on the queen excluder before entering the hive.

It is well known that the bees in hot climates, especially at afternoon, evening, and early hours of night, partially evacuate the hive to alleviate heat stress in the colony. In regular hives the evacuating bees gather on the flight board and the front strip of the bottom board, and such a gathering makes the bees more vulnerable to hornet attack (Glaiim, unpublished data). But, the problem of this vulnerability still existed despite the elimination of the narrow strip and flight board, for the bees were gathering on the queen excluder and the outer surface of the front wall of the hive body. In addition to this vulnerability, we believe that the queen excluder and the vertical hive body wall are not as convenient as the sloping flight board and horizontal narrow strip as supports for both bee evacultion and bee counterattack (Glaiim, unpublished data).

In India, Subbiah and Mahadevan (1958) stated in a very brief article, “it was observed that the wasps did not enter the hives when the hive bodies were pushed to the very front, while they continued to snatch off the bees from the hives having the usually space in front to serve as alighting board for the bees”. However, the wasps involved were *Vespa cincta* and *V. tropica* attacking the Indian honey bee, *Apis cerana*. Also, these authors did not mention any further information on how that practice prevented the hornets from entering the hive and / or snatching the bees. In Japan, Matsuura and Sakagami (1973) reviewed many practices for controlling the giant hornet, *Vespa mandarinia*, attacking the Japanese honey bee, *Apis cerana cerana*. One of these practices was the use of protective screens such as wire or fishing nets covering hive entrances. The outcome of this practice seems simillar to what we found, for these authors stated, “All these screens gradually become less effective to experienced hornets, which stay on these obstacles and catch bees, either those making counterattacks or those leaving from or returning to hives with decreased flight velocity ”.

Method No.2

The application of this method was initiated after we had terminated our observations on the previous method. The initiation was at the beginning of September while the termination was at the end of November when no more worker hornets were found at the apiary. In Iraq, all hornet colony individuals, but the queens, perish by the beginning of winter.

At the beginning we tried to test the idea mentioned by Muzzaffar and Ahmed (1986) who fixed a 2 x 17cm-wire gauze tube as a bee passage at the hive entrance. But, instead of using such a tube we used a wire-gauze cone as it was described above. We believe it is unappropriate to reduce the diameter of hive entrance to 2cm, especially in hot climate such as that of Iraq where maximum ambient temperatures exceed 45 °C. After fixing the cones we found that the flight activity of the bees reached a very low level compared with that of control colonies. Instead of moving forward toward the cone distal opening, the bees were gathering at the bases of the inner surfaces of the cones as if they were trying to find an access through the tiny openings of the cone surfaces. We believe the bees were attracted to the nearest site where the sun was shining, i.e. to the cone base. It was assumed; however, that the bees would gradually learn how to use this new passage appropriately, but we faced another problem. Worker hornets were alighting on the cone outer surface and trying to pull out the bees gathering and / or walking on the inner surface. Of course, worker hornets could not do so, but they did hurt the bees by cutting their forelegs, antennae, and even their heads. For this reason, we replaced these cones with cones made of cardboard. The outcome of using this method was as follows:

1. Although the presence of the cones minimized the rate of hornet entry into the hives to a very low level, it did not prevent the hornets from finding other accesses to reach their victims. The hornets were waiting at the cone entrances to pounce upon unaware outgoing or incoming bees. We noticed that the foraging bees were sometimes reluctant to enter the cone when they find a hornet waiting at the cone entrance. These bees were hovering around the hive for a while before trying the entry again.

From time to time, the bees were seen gathering as a clump at the cone entrance either to partially evacuate the hive or to defend the colony. The hornets were either creeping on the cone itself toward the clump or hovering over it.

Although the entry of hornets in the cones was rare, we did notice some of them entering these cones, especially when there were no bees at the cone distal opening and during the times when the bees lessen their flying activity. The fate of these hornets as well as their hunting success varied according to the condition in the hive involved. In most cases the hornets were returning without hunting success. We believe that the presence of the cone impaired the hornet ability for maneuvering compared with those attacking the bees in control hives. Sometimes, however, we noticed some of the returning hornets that were able to bring bees with them. On the other hand, some of the hornets entering the cones could not return; they must have been caught and killed by the bees in the hives.

2. In addition to its failure in minimizing hornet impact, the use of cones had also an adverse effect on the activity of bee colony itself. To evaluate this effect, we measured adult bee populations and sealed worker brood areas in both kinds of hives. After one month of fixing the cones, there were 63.4 and 41.3 percent average reductions in adult bee population per colony in cone-supplied hives and control hives, respectively. Average areas of workers sealed brood per colony were 96.0 and 567.1 cm^2 in the two kinds of hives, respectively. By the end of November, there was a loss of one-third of bee colonies in the cone-supplied hives, i.e. 5 out of 15 colonies. Three of them deserted their hives while the other two colonies perished. In control hives there was a loss of two colonies, one deserted its hive while the second perished.

We believe that this adverse effect resulted from the effect of cone presence on two components of thermoregulation process, the partial evacuation of bees and ventilation. It was

found that the size of bees evacuating the hive was remarkably smaller than that in control hives. Furthermore, it is well known that in nature, bees stand at the hive entrance and on the bottom board, and by fanning their wings vigorously they set up outgoing air current through the hive entrance; hence they cool the hive. The cone presence may have affected this exchange of air currents, for cone entrances were narrow and relatively far from the sites where fanning bees were found. On the contrary, the bees in control hives were performing the process of thermoregulation without such obstacles.

It should be kept in mind, however, that the reduction in honey bee activity during this period in Iraq is not reffered only to the attack of the oriental hornet and heat stress, but also to other important factors including the attack of the bee eater, *Merops superciliosus persicus* Pallas and the infection of the introduced parasitic mite, *Varroa jacobsoni* Oud.

In Pakistan, Muzzaffar and Ahmed (1986) stated, "The use of bee guards or fixing of a wire-gauze tube, 1.5cm x 17cm, as a bee passage at entrance of the hive reduced the frequent entry of *V. basalis, Vespa orientalis,* and *V. veluting*, but did not lessen losses because bees were caught and killed by them during their flights. This result agrees with what we found, but these authors did not mention any further information concerning hunting behavior at the tube and the effect of such a practice on the activity of the bee colony itself.

THE USE OF VINEGAR TRAP

The results of present study concerning the use of vinegar trap totally disagree with what Belkavsky (1937) mentioned. In the five vinegar traps hung at the apiary for 24 hours we found no single hornet or wasp in any of these traps despite the remarkable presence of the hornet at the apiary. Ironically, it was the honey bees rather than the hornets that were trapped in large numbers. Beside the bees, dipterous insects of different species were trapped in large number as well. After 24 hours of hanging these traps we found 80, 54, 45, 42, and 30 worker honey bees in the five traps, respectively. In Italy, Belkavsky (1937) stated, "The scent of vinegar attracts wasps and hornets and they perish in large quantities . . . . . The writer noticed that vinegar does not attract bees at all". It is worth mentioning that we have not found any mention for this method of hornet control in all other bee literature.

There were three reasons behind testing these three methods in Iraq. First, they seem reasonable and very easy to be applied. Second, they were mentioned without clear judgment showing their useful and / or adverse effects of their application. Third, some of these ideas were suggested in countries where different species of hornets and different species or races of honey bees are found. Of course, different species of hornets exhibit different strategies of hunting behavior while different species and / or races of honey bees exhibit different strategies of counterattack behavior.

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ي برولأ المسعلالحا فئ اوطةيامحا لجرا ل ليف اهيصومال قطرال طع ع بقةا فكر ا بتخا
Apis mellifera L. رمحلأ ا ربنزلا مجه نم يقرشلا) *Vespa orientalis* L.
قاعلاي ف

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الخلاصة

اختبرت ، ولأول مرة في الظروف البيئية والحياتية السائدة في العراق ، كفاءة بعض الطرق التي اقترحها مختصون في الخارج (مع بعض التعديلات والتحويرات التي أجريت على قسم منها) من أجل حماية طوائف نحل العسل الأوربي *Apis mellifera* L. من هجوم الزنبور الأحمر *Vespa orientalis* L. . تمثلت إحدى هذه الطرق بتغطية مدخل الخلية بقطعة من حاجز الملكات لضمان عدم دخول أفراد الزنبور في الخلية . وبالإضافة إلى ذلك فإن حامل الخلية (الكرسي) المثبتة عليه لوحة الطيران قد وضع تحت الخلية باتجاه معكوس وذلك من أجل حرمان الزنبور من استخدام تلك اللوحة كمنصة يستخدمها للانتظار والزحف باتجاه مدخل الخلية . أما الطريقة الثانية فإنا تمثلت بتثبيت مخروط من السلك المشبك أو الورق الثخين المقوى (كارتون) عند باب الخلية لكي يستخدم كممر لخروج ودخول النحل السارح . كان الهدف من تثبيت ذلك المخروط ، الذي ثبتت ايته العريضة عند مدخل الخلية ، هو إعاقة دخول الزنبور في الخلية على أمل أن الأمر سيكون سهلاً على النحل الحارس من مراقبة دخول الغرباء ، ومن بينها الزنبور الأحمر ، خلال الفتحة الدائرية الطرفية الصغيرة للمخروط ذات السنتمترين قطراً . أثبتت نتائج الدراسة فشل كل من الطريقتين المذكورتين في صد هجوم الآفة المذكورة من جهة كما والتأثير السلبي لكل منهما على نشاط طوائف النحل نفسها من جهة أخرى . تمثلت الطريقة الثالثة بتعليق مصائد خل في أرجاء المنحل لاصطياد أفراد الزنبور . كانت نتائج هذه الطريقة سلبية تماماً ؛ لأن ما تم اصطياده هي شغالات النحل وأنواع من لذباب بدلاً من الزنبور الأحمر!.