

ORIENTAL HORNET, *VESPA ORIENTALIS* ATTACKS THE ITALIAN AND CARNIOLAN VIRGIN QUEENS DURING MATING FLIGHTS

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(Received: Jun., 15, 2014)

ABSTRACT: This study was carried out at a private apiary in Meat-Fares Village, Bani Ebaied Region, El-Dakhlia Governorate, Egypt, 25 km. from Mansoura. in the period from first of February, 2011 to the end of September, 2013 to investigate the influence of Oriental hornet (*Vespa orientalis*) attacks on mating of virgin queens. Results could be summarized as follows: Average of *Vespa orientalis* wasps was (0, 15 and 64 wasp/trap/day) in March, May and September respectively. Average of Carnica queens (*Apis mellifera carnica*) lost during mating was (4.17±5.89) in March, (6.00±2.83) in May and (34.00±2.83) in September. There was a high significant difference between the average of lost queens in September and the other two months ($P<0.05$). Average of Italian queens (*Apis mellifera ligustica*) lost during mating was (2.18±3.08) in March, (20.00±5.66) in May and (90.00±2.83) in September. There was a high significant difference between the averages of lost queens in the three months ($P<0.05$). The highest average of wasps was recorded in September (64) followed by May (15) while there was no wasps trapped in March. The highest loss of virgin queens during mating in the two races was in September followed by May while the lowest loss was in March. The (T-Test) value for the difference between the two races was ($t=1.252$) while there was a significant difference on the average of lost queens between the two groups. Also there was a high positive relation between the average of queen loss and the average of wasps in the apiary and the relation was highest in Italian queens than in Carnica queens.

Key words: Honey bee, hornet, wasp, *Vespa*, mating.

INTRODUCTION

The oriental wasp, *Vespa orientalis* is one of the most important insect pests affecting honey bee industry in Egypt. It causes intense damages in apiaries, places where they can find the best combination of proteins from animal origin (bees and larvae) and carbohydrates (nectar and honey). There were a few experiments on the effect of oriental wasps on the copulation process of virgin honeybee queens all over of the world. In Egypt, Sharkawi (1964) reported that the normal distribution and the population density of oriental hornet begin with a slight increase in number during August. In September, a big jump in their number occurs, and then the insect activity reaches its peak in October. The number of hornets starts to fall off gradually during the second half of November and disappeared in the middle of December. Ahmed (1999) evaluated the seasonal abundance of *V.*

orientalis in the apiaries, in Abu-Tisht, Quena and Isna sites during 1995 and 1996 seasons. In the first season (1995), *V. orientalis* population increased from March reaching its peak in October. Hornets visiting apiaries and collected from Abu-Tisht, Quena and Isna sites reached the maximum activity in October, recording 8920, 6165 and 4758 individuals, respectively. Total number of hornets in the three sites were 24415, 15069 and 13894 individuals, in Abu-Tisht, Quena and Isna, respectively. The total number of hornets captured all over the year 1995 from the three sites were 53378 individuals. The number of hornets collected in the experimental apiaries, in Abu-Tisht, Quena and Isna during 1996 season. It is clear from the result that the hornet population were higher in September and October, while they were lower in March, April and December. Yousif -Khalil *et al.* (2000) tested yellow, white, blue and green

sticky traps. Results indicated that the tested colors could be divided into two groups according to their attraction to the oriental wasps; the first contains the higher attractant colors that included white, black and red colors, and the second less attractant group which included yellow, blue and green colors. Khater *et al.* (2001) investigated the changes in the seasonal activity of the oriental wasp, *V. orientalis*, populations attacking honeybee apiaries in Situated at Zagazig and El-Mullack districts, Sharkia Governorate based on the number of trapped adults in a developed sticky trap. Results showed that *V. orientalis* adults started to appear in the apiaries as early as the beginning of March, but in few numbers. Thereafter, a gradual increase took place up to mid-June at the two districts. A distinct increase in the number of captured wasps was noticed until the maximum of occurrence recorded during the first week of September at El-Mullack followed by gradual decrease and disappearing at the end of December. El-Sherif (2003) reported that hornet individuals were caught by using two types of traps and counted. The obtained data revealed that the over-wintered hornet queens appeared in April and reached the maximum in May of both years and, hornet workers appeared in May-December and reached their maximum counts in September of both years. Gomaa and Abd Elwahab (2006) declared that seasonal abundance of the oriental wasps (*V. orientalis*) was estimated at Dirut location, Assuit governorate during 2003 seasons and that the oriental wasps started to appear in the first week of April and gradually decreased to the minimum levels during June (late spring) and July (earlier summer). Then, the activity of wasps increased gradually from the second week of August to the fourth week of September. Total numbers of wasps reached the highest values in October, followed by September and November and then the number of oriental wasps decreased until disappeared at the fourth week of December. Elbassiouny (2007) stated that, the individuals of hornet were, first detected in early spring during the first week of February were mated queens and later, during the last week of April, workers appeared. In the first

week of September large individuals appeared workers with a developed ovary and not new queens as believed previously. New queens started to appear in the second week of November about 3 weeks after the appearance of drones in the last week of October. El-Hady (2008) explained that the appearance of red wasps, *V. orientalis* started from April month and increasing gradually up to October month at Moshtohor and Elmahala Elkobra locations of Egypt. Abd Al-Fattah and Ibrahim (2009) found that the highest mean numbers of individuals / trap was record during October, for the two studied seasons represented by, 41.9% and 65.7% of the total trapped hornets. Hussain *et al.* (2009) pointed out that oriental wasps appeared in the first week of April and decreased gradually to the minimum levels during June and July, then the activity of wasps increased gradually from the second week of August to the fourth week of September. The maximum total numbers of wasps recorded in October, September and November, after that these numbers decreased gradually at the first week of December. El-Refaay (2010) noted that the seasonal abundance of *V. orientalis* population the obtained results clearly indicated that *V. orientalis* started to appear at the beginning of April, 2002 and increased gradually to give the first peak at the end of April, then decreased gradually to record the minimum levels during June and July. In early summer the wasps increased gradually to record the highest numbers in the late summer (the second peak recorded at the end of September), the numbers fluctuated during October and early autumn. As respect to the total numbers during the months, highest total numbers were recorded in October, September and November respectively, In November the wasp numbers declined gradually till the end of December in season. Omran *et al.* (2011) revealed that the maximum monthly mean number of the oriental hornet was during November was (35.63 hornets/trap), represented by 50.89% of annual abundance The oriental hornet record a peak starting on August until December, while 84.4% of total activity was observed during October and November. Sanad *et al.* (2012) declared that the highest numbers of

Oriental hornet, *vespa orientalis* attacks the italian and carniolan virgin.....

the oriental wasp were recorded at Autumn season (September and October months), while the least numbers were registered at Spring and Summer months (April, May, June and July), there were no individuals at winter months (January, February, March). Khodairy and Awad (2013) found that hornet population began with a slight increase number during September which comprised about (12.3%). In October, a big jump occurred (52.5%) in their number. By the first week of November, the number started to decrease (26.7%) and then disappeared at the second fortnight of November. Antenna plays an important and vital role during host finding and acceptance behavior in insect life. Like many insects, oriental hornet *V. orientalis* use antennal chemoreceptors to detect the hosts during its active seasons.

Aboard Egypt, Brar *et al.* (1985) stated that *Vespa orientalis* visited colonies of *Apis mellifera* from July to December, with peak population in August- October. The number of hornets caught in apiaries varied from 18 to 74 and few hornets visited apiaries during mornings and evenings, whereas in the middle of the day 30-51 hornets observed during the peak population period. In addition, Ishay and Lior (1990) studied the activities of workers of *V. orientalis*, during flight to and from the nest, on fully active days in months of maximal colony activities. They recorded two types of flight out of the nest; flight for removal of dug-up soil and flight for foraging of building materials and food from the field. Sihag (1992) verified that *V. orientalis* started to attack an *A. mellifera* apiary in June and continued until October-November. The wasps preyed guard bees at hive entrances, and after mid-July they also captured bees from flowers in December-May. The average population density of the wasps in an apiary was 7.5 in June-mid-July and 13.5 from mid-July to Sept-Oct, and twelve queens were lost due to the effect of the hornet. Abrol (2006) examined the defensive behavior of *A. cerana* and *A. mellifera* against predator wasps. Also found that the number of bees

captured by wasps (*Vespa* sp.) ranged from 3 to 5 with an average of 4.27 ± 0.70 bees /2hr. from a minimum of 11 to 35 wasps per 2 hours with an average of 27.18 ± 6.32 wasps/2h from August to October. In India Bacandritsos *et al.* (2006) reported that the wasps attack foraging workers and guard bees at hive entrances and resulted in weakening strong colonies and minimizing their Productivity.

From the previous researches, it was clearly that the oriental wasp is a serious pest attacking honeybee industry in Egypt and allover the world , specially during the copulation process of virgin queens, therefore the main goal of this study was to discover the behavioral method of wasps during attacking virgin queens to measure the economic effect of wasps against queen rearing process.

MATERIALS AND METHODS

This study was carried out at a private apiary in Meat-Fares Village, Bani Ebaied Region, El-Dakhlia Governorate, Egypt, 25 km from Mansoura city in the period from the first of February, 2011 to the end of September, 2013.

The aim of the study was to throw a light on the dangerous effects caused by the Oriental hornet (*Vespa orientalis*) which attack the mating process of virgin Italian and Carniolan bee queens.

In this study fifty Lengstroth hive were prepared as mating nucleus, equaled size each of them contains four combs (two brood combs, two honey and pollen combs) and a side feeder.

Twenty five of colonies were headed by Carniolan (*Apis mellifera carnica*) virgin queens (group A) and the other 25 were headed by Italian (*A. m. ligustica*) virgin queens (group B) Fig. (1).

All the mating nucleus were randomized set in the same apiary yard, allowed to open mating.

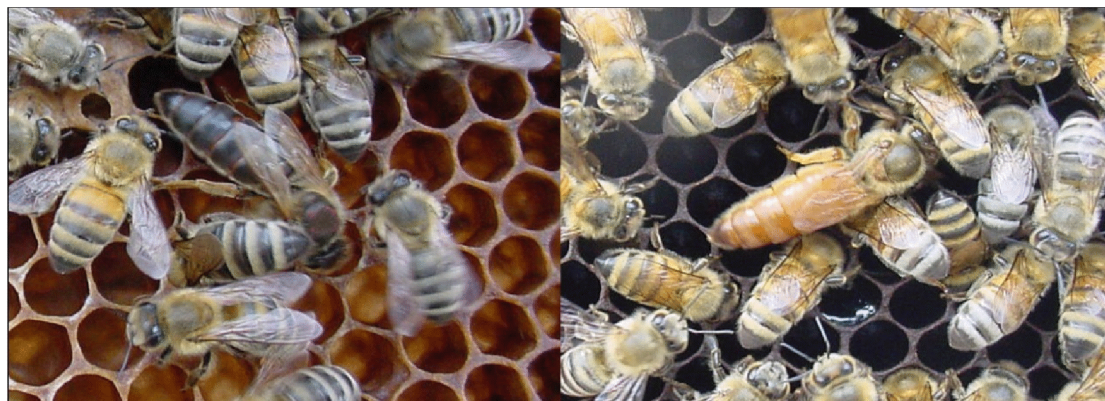


Fig.1: Virgin queens used in the study.
left *Apis mellifera carnica* right *Apis mellifera ligustica*.

Queens returned from the mating flight and begin to lay eggs were counted for each race (group) and numbers were recorded.

The experiment was replicated six times during two years in three mating seasons (March, May and September) with the same procedure.

That apiary was attacked across the year by oriental hornet, *Vespa orientalis* queens and workers Fig. (2).

Four wasp traps were placed in the four corner of the apiary Fig. (3) across the three months of the experiment, numbers of trapped wasps were counted and recorded every week in mating season for the four traps. Queens that didn't lay eggs or lay only drone eggs were excluded from the study.

RESULTS AND DISCUSSION

Data in Table (1) show that through two years there were no wasps caught in the traps during March, while there were average of $(15.00 \pm 2.83 \text{ wasp})/\text{trap}/\text{day}$ during May. The average increased significantly during September to $(64.00 \pm 4.24 \text{ wasp})/\text{trap}/\text{day}$. In addition the number of wasps was significantly different between the three months. Data also show that the percentage of lost queens were different from month to month in the Italian virgin queens. Although the average of queen lost record its lowest percentage $(2.18 \pm 3.08\%)$ during March, the

percentage increased significantly during May $(20.00 \pm 5.66\%)$ while $(90.00 \pm 2.83\%)$ of the Italian virgin queens were lost during mating flights in September record the highest percentage. Percentage of lost queens didn't differ significantly between March and May $(4.17 \pm 5.89\%)$, $(6.00 \pm 2.83\%)$ respectively in the Carniolan queens, while the percentage increased significantly during September $(34.00 \pm 2.83\%)$.

Data in Table (2) indicate that there are a clear significant positive relation between the wasp numbers and the loss of virgin queens during mating flights. Also the relation are highly significant and more positive in the Italian queens than in Carniolan queens ($r=0.998$ & $p=0.000$) and ($r=0.959$ & $p=0.002$) respectively but the difference are not significant ($t=1.252$ & $p=0.239$). The data illustrated in Fig. (4) showed that the lower point of the wasp numbers and loss of virgin queens curves are during March while the peak points were in September in the three curves and that the increase of the wasp numbers was followed by increase in the losses percentage of the virgin queens during mating flights.

Special observation: In the morning the wasps were stand in flaying board in the front of the hive waiting and catch the virgin queens before it can fly.

Oriental hornet, vespa orientalis attacks the italian and carniolan virgin.....

The obtained results coincides with Sharkawi (1964), Brar *et al.* (1985), Ahmed (1999), Khater *et al.* (2001), El-Sherif (2003), Bacandritsos *et al.* (2006), Elbassiouny (2007), El-Hady (2008), Abd Al-Fattah and Ibrahim (2009), Hussain *et al.* (2009), Omran *et al.* (2013), Sanad *et al.* (2012) also Khodairy and Awad (2013) who declared that the least numbers of oriental wasps were recorded in the spring (March and April) while the highest numbers were recorded at the autumn (September and October). On the other hand the obtained results disagreed with Sihag (1992) who verified that *V. orientalis* started to attack an *A. mellifera* apiary in June.

The obtained results also indicate that the oriental wasps prefer the Italian queens than the Carniolan queens and that results goes on the line with Yousif –Khalil *et al.* (2000) and El-Refaay (2010) who indicated that some colors had more attraction to the oriental wasps than others. Khodairy and Awad (2013) add to that oriental wasps *V. orientalis* use antennal chemo-receptors to detect the hosts during its active seasons. Bacandritsos *et al.* (2006) also demonstrated that *V. orientalis* is one of the most important insect pests affecting honey bee industry in Egypt.



Fig.2: The oriental hornet attacks the mating nucleus



Fig. 3: Wasp trap used in the study.

Table (1). Effect of wasp numbers on the loss of virgin queens during mating flights

Month	Average of wasps	Average of Italian queens lost	Average of Carniolan queens lost
March	0.00±0.00 c	2.18 ±3.08 c	4.17 ±5.89 b
May	15.00± 2.83 b	20.00 ±5.66 b	6.00 ±2.83 b
September	64.00±4.24 a	90.00 ±2.83 a	34.00 ±2.83 a
Total	26.33±30.02	37.39 ±41.64	14.72 ±15.29
Sig.	0.000	0.000	0.009

Means with the same letter in the same column are not significantly different at 0.05 level

Table (2). Relation between wasp numbers and the loss of virgin queens during mating flights.

Queen race	Correlations	Sig.	T.Test	Sig.	df
Carniolan queens	0.959**	0.002	1.252	0.239	10
Italian queens	0.998**	0.000			

** Correlations is significant at the 0.01 level.

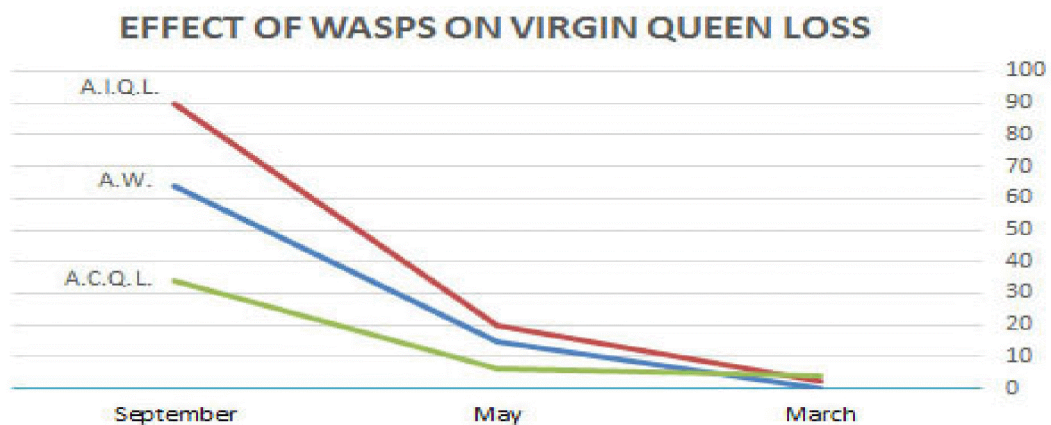


Fig. (4). Relation between wasp numbers and the loss of virgin queens during mating flights

A.W. = Average of wasps.

A.I.Q.L. = Average of Italian queens lost.

A.C.Q.L. = Average of Carniolan queens lost.

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دبور البلح الاحمر يهاجم الملكات العذارى الايطالية والكرنيولية أثناء طيران التزاوج

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الملخص العربى

أجرى هذا البحث بمنحل خاص بقرية ميت فارس مركز بنى عبيد محافظة الدقهلية خلال الفترة من فبراير 2011 و حتى نهاية سبتمبر 2013 و ذلك بغرض دراسة تأثير دبور البلح الأحمر على تلقيح و فقد عذارى ملكات النحل من السلالتين الأيطالية و الكرنبيولية.

تم فى هذه البحث دراسة تأثير تواجد ملكات و شغالات دبور البلح الأحمر على نجاح تلقيح و عودة الملكات الملقحة الى خلاياها من طيران التلقيح لسلالتين من الملكات العذارى (عذارى كرنبيولى محلية و عذارى أيطالية محلية) وذلك لمدة عامين أثناء شهور مارس و مايو و سبتمبر و تم تقدير متوسط عدد الدبابير الموجودة بالمصائد يوميا خلال تلك الفترات و كانت النتائج كما يلي :كان متوسط عدد بالمصائد كما يلي 15 و 64 و ذلك لشهور مارس و مايو و سبتمبر على الترتيب.

كان متوسط نسبة الفقد فى الملكات الكرنبيولى هو مارس (5.89±4.17) و مايو (2.83±6.00) و سبتمبر (2.83±34.00) على الترتيب مع وجود فارق معنوى واضح ($P < 0.05$) بين متوسط نسبة الفقد فى شهر سبتمبر و باقى الشهور بينما لم يوجد فارق معنوى ($P > 0.05$) فى متوسط نسبة الفقد بين شهرى مارس و مايو .

كان متوسط نسبة الفقد فى الملكات الأيطالية هو مارس (3.08±2.18) و مايو (5.66±20.00) و سبتمبر (2.83±90.00) على الترتيب مع وجود فارق معنوى مرتفع ($P < 0.05$) بين متوسط نسبة الفقد فى الشهور الثلاثة.

و يتضح من النتائج السابقة أن أعلى فقد فى الملكات لكلا السلالتين كان فى شهر سبتمبر خلال تواجد الدبور بأعلى عدد بالمنحل كما أن أقل فقد فى الملكات كان فى شهر مارس لكلا السلالتين و ذلك عند أنعدام تواجد الدبور بالمنحل.

بتحليل نسبة الفقد من السلالتين و إرتباطها بتواجد الدبور كان الأرتباط موجب على المعنوية ($P < 0.05$) وبنسبة أعلى فى السلالة الأيطالية المحلية عنه فى الكرنبيولى المحلى أى أنه عند تزايد أعداد الدبور بالمنحل يتزايد الفقد فى العذارى أثناء التلقيح و يكون الفقد فى العذارى الأيطالية أكثر منه فى العذارى الكرنبيولية.