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SEASONAL FLACTUATION OF ORIENTAL HORNET, *VESPA ORIENTALIS* FAB., ITS TRAPPING EFFICIENCY AND HONEY BEE ACTIVITIES

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ABSTRACT

The seasonal flactuation and non-chemical control of the oriental hornet, *Vespa orientalis* Fab.; which caused heavy losses in Apiculture development, were carried out during two successive years (2001 and 2002) in the Apiary of Faculty of Agriculture, Ain Shams Univ. The hornet individuals were caught by using two types of traps and counted. The obtained data revealed that the over-wintered hornet queens appeared and reached the maximum in April of both years and continued in May. Hornet workers appeared in May-December and reached their maximum counts in September of both years. Males appeared in September-December with maximum counts in September of both years. A new generation of hornet queens appeared one month later to males (October-December) and reached the maximum count in October of both years. Mated queens were hibernated in sheltered habitats while workers and males were died with the onset of cold weather in late autumn and during winter.

Sugar syrup fortified by either 25% grape or date fruits in the outdoor feeder traps significantly attracted the highest number of hornets. Meanwhile, 25% ripe honey, grape or apple fruits in sugar syrup significantly caused more honey bee brood counts, as compared with the other feeds. 25% grape fruits in sugar syrup was the best diet for attracting the hornets and build-up of the bee colonies. The daily brood rates in bee colonies were positively correlated with dead hornets and negatively correlated with the alive hornets or both types of caught in out-door feeder traps.

Keywords: Seasonal and annual fluctuations, hornet, *Vespa orientalis*, Double box traps, baits, Food attractants, Outdoor feeder traps, Bee activities, Brood rearing, Honey bee activities.

INTRODUCTION

The giant oriental hornet, *Vespa orientalis* Fab. is one of the most important hymenopterous predator for honey bees. It causes heavy losses in Apiculture development; invads weak bee colonies and destroys them by either feeding on adult bees and their broods or robbing honey reserves in late Summer and Autumn (Muzaffar & Ahmad, 1986 and Sihag, 1992). It indirectly, disrupts pollination of fruit and vegetable crops, damaging of ripened grapes, apples, pears, peaches and apricots and often aggressive towards human (Manio & Patetta, 1987 and Yildirim & Ozbek, 1992). Therefore, the hornet control is necessary immediate vicinity of bee-hives or ripening fruits in the field (Manio and Patetta, 1987).

Control measures included, killing hornet queens in early spring (Ahmed, 1999), destroying hornet nests by poisonous dusts on the hornets and release them to poison their nests (Wang *et al.* 1985) or by honey baits

mixed with different insecticides (Wafa *et al.* 1969; Aihara, 1980 and Ahmed, 1999) and usage of different types of traps: coloured plastic traps baited with pale ale (Delmotte and Mathot, 1983), wire screen traps baited with fermented sugar or honey (Ibrahim & Mazeed, 1967; Hussein, 1989; Shoreit, 1998; Ahmed, 1999 and Abou El-Enain, 1999), and sticky traps (Yousifkhalil *et al.* 2000 and Khater *et al.* 2001). None of these traps are highly effective, but their caught hornets throughout the year indicated their seasonal abundance (Kadymov, 1981; Brar *et al.* 1985; Abrol, 1995; Shoreit, 1998; Ahmed, 1999; Abouel-Enan, 1999 and Khater *et al.* 2001). The hornets hovered near hive entrances and caught returning bee foragers (Abrol, 1995), therefore, the bee colonies should not be kept in the habitat of the hornets without artificial protection (Matsuura, 1988). This may be occurred by usage of a box with 1cm diameter entrance hole to fit over the hive entrance to protect bees from hornet attack (Sharma *et al.* 1985 and Srivastava *et al.* 1995). Usage of traps baited with fruit apples (Bunn, 1988), fruit pears (Mishra *et al.* 1989), grape juice (Lim *et al.* 1989) and pineapple (Rahman and Rahman, 1995) gave good results.

Feeding bee colonies with sugar syrup fortified by medicinal fruit extracts increased their brood rearing rates and longevity of produced workers (Watanable, 1993 and El-Sherif, 2002) and sugar cane juice increased the number of bee foragers returning with pollen loads (Raj *et al.* 1993).

Therefore, the present work aimed at studying the seasonal fluctuations of different individuals of the oriental hornet through 2001 and 2002 years by two developed double-box traps with different sizes, and to find out a simple device at the hive entrance for feeding the bees and protecting their colonies from this hornet, during late Summer and Autumn.

MATERIAL AND METHODS

Two sets of experiments were conduced in the apiary of Faculty of Agriculture, Ain Shams University during the years 2001/2001 and 2002/2002. The first set of experiments aimed to study the seasonal and annual fluctuations of the oriental hornet, *Vespa orientalis* Fab. attacking honey bee colonies. These fluctuations were measured by counting the caught hornet individuals weekly from November, 2000 till October, 2002. Eight double-box traps (4 small and 4 large) were used and distributed randomly in the apiary.

The small trap was a hang trap, made of two wooden boxes; the lower (30 x 10 x 10 cm) had 4 narrow holes (3 cm) provided with metal cones (3 x 3 x 1 cm each) to allow the attraction of hornets to food bait inside the box (pieces of old comb filled with sugar syrup in a small metallic jar measured 25 x 3 x 3 cm. The upper box (30 x 10 x 20 cm) was provided with wire screen on its sides and a piece of queen excluder on its upper surface. Three wire gauze cones (3 x 3 x 1 cm) were fitted on narrow holes (3 cm) in the median plate between the two boxes.

The larger double-box trape was a stand trap; made of two wooden boxes (52 x 42 x 24 cm). The lower box with 4 narrow holes (3 cm), provided with metal cones (3 x 3 x 1 cm) and fixed over a plastic paten (38 x 30 x 18

cm) provided with pieces of old comb filled with sugar syrup (1:1) as food bait. The upper box had three wide holes (5 cm) provided with wire guaze cones (5 x 5 x 1 cm) in the median plate between the two boxes and covered with a queen excluder to permit bee escaping from the trap. The caught hornets were killed in the traps by drowing them in water and counted weekly.

The second set of experiments aimed to evaluate a simple device (an outdoor feeder trap) developed and fixed on the hive entrance for feeding the bees and protecting their colonies from the hornets predection in late Summer and Autumn. It consisted of a small wooden box (18 x 11 x 10 cm) having two narrow holes (3 cm) and provided with metal cones (3 x 3 x 1cm) to prevent the attracted hornet from escaping. It's upper surface had two wide holes; the first (4 cm) for the upset feeder and the other hole (6.5 cm) for the hornets trapping in an upset) plastic bribe (16 x 8 x 6 cm) provided with everted metal (5 x 5 x 1 cm) to prevent the hornet from escaping. The upper surface had 10 narrow holes (5 mm diameter) in its top to allow the captured bees to escape outwards. In one side of the box, there were three small holes (5 mm diameter), near the entrance of the colony, to allow the bee entery inside the box for feeding on the syrup and returning back to its colony.

The feeders were filled with sugar syrup (1:1) fortified by either 25% of blended apple, grape, date fruits, or ripe honey. Plain sugar syrup was used as a control. The effect of feeding the colonies on these different types of syrups was evaluated for building of colonies by counting this sealed worker broods at 13 day intervals and calculating the daily brood rearing rates before and after feeding.

Attraction of hornets to these syrups and captivation them inside the trapes was measured by counting the captivated hornets either alived in plastic bribes or dead in wooden boxes, at 7 day-intervals.

Twenty Carniolan hybrid honey bee-colonies of relatively similar strengths headed with open-mated Carniolan queens, each provided with outdoor feeder trap, were divided into five groups of colonies, each composed of four colonies (replicates). Each group of colonies were received one of the following feeding treatments twice every week from October 30, 2002 till December 31, 2002. 200 g. sugar syrups (1:1) fortified with 25% of apple fruit extracts (group A), grape fruit extract (group B), ripe honey (group C) and date fruit extract (group D), in addition to plain sugar syrup only as control (group E). The fruits of Apple, grape or date were blended in the sugar syrup. The sealed worker broods of colonies and the captivated hornets were counted from November, 2002 to January, 2003 with 13 day intervals for sealed worker brood and 7 days-intervals for captivated hornets.

RESULTS AND DISCUSSION

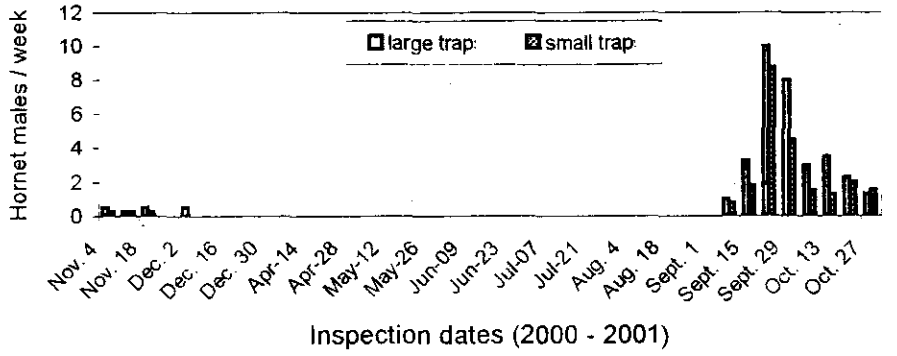
1. Population fluctuations of *V. orientalis:*

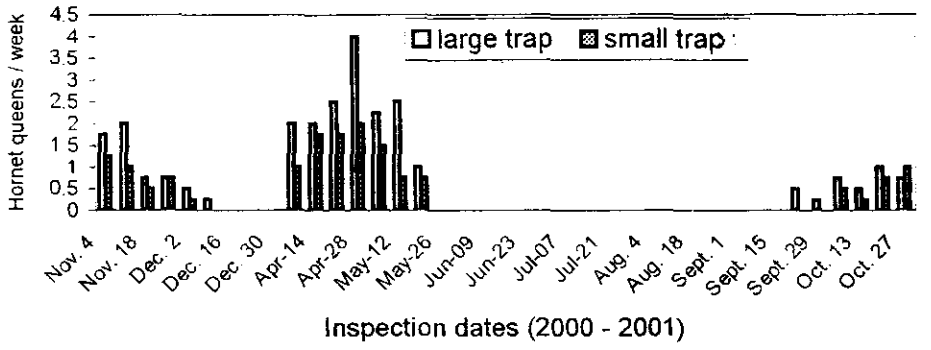
The weekly and monthly counts of males, queens and workers of *V. orientalis* caught by small and large double box traps in 2001 and 2002 are given in Tables (1 and 2) and graphically illustrated in Figs. 1 and 2.

Table (1): Weekly and monthly averages of hornet individuals, *V. orientalis* caught from November 2000 to October 2001 by different sizes of traps (n=4 for each trap size).

Inspection dates	Weekly counts / trap in 2000-2001							
	Large traps				Small traps			
	Male	Queen	Worker	All individuals	Male	Queen	Worker	All individuals
Nov. 4, 2000	0.5	1.75	61.75	64.0	0.25	1.25	38.0	39.5
Nov. 11, 2000	0.25	2.0	32.75	35.0	0.25	1.0	23.75	25.0
Nov. 18, 2000	0.5	0.75	29.75	31.0	0.25	0.5	20.75	21.5
Nov. 25, 2000	0.0	0.75	17.5	18.25	0.0	0.75	12.5	13.25
Nov. counts	1.25	5.25	141.75	148.25	0.75	3.5	95.0	99.25
Dec. 2, 2000	0.5	0.5	11.75	12.75	0.0	0.25	7.0	7.25
Dec. 9, 2000	0.0	0.25	8.25	8.5	0.0	0.0	6.5	6.5
Dec. 16, 2000	0.0	0.0	1.0	1.0	0.0	0.0	0.5	0.5
Dec. 23, 2000	0.0	0.0	0.75	0.75	0.0	0.0	0.25	0.25
Dec. 30, 2000	0.0	0.0	0.75	0.75	0.0	0.0	0.75	0.75
Dec. counts	0.5	0.75	22.5	23.75	0.0	0.25	15.0	15.25
April 7, 2001	0.0	2.0	0.0	2.0	0.0	1.0	0.0	1.0
April 14, 2001	0.0	2.0	0.0	2.0	0.0	1.75	0.0	1.75
April 21, 2001	0.0	2.5	0.0	2.5	0.0	1.75	0.0	1.75
April 28, 2001	0.0	4.0	0.0	4.0	0.0	2.0	0.0	2.0
April counts	0.0	10.5	0.0	10.5	0.0	6.5	0.0	6.5
May 5, 2001	0.0	2.25	1.75	4.0	0.0	1.5	0.75	2.25
May 12, 2001	0.0	2.5	2.75	5.25	0.0	0.75	1.5	2.5
May 19, 2001	0.0	1.0	3.5	4.5	0.0	0.75	2.0	2.75
May 26, 2001	0.0	0.0	5.75	5.75	0.0	0.0	5.25	5.25
May counts	0.0	5.75	13.75	19.5 0	0.0	3.0	9.5	12.5
June 2, 2001	0.0	0.0	3.5	3.5	0.0	0.0	2.25	2.25
June 9, 2001	0.0	0.0	4.25	4.25	0.0	0.0	2.5	2.5
June 16, 2001	0.0	0.0	7.5	7.5	0.0	0.0	6.25	6.25
June 23, 2001	0.0	0.0	10.0	10.0	0.0	0.0	6.0	6.0
June 30, 2001	0.0	0.0	10.0	10.0	0.0	0.0	8.0	8.0
June counts	0.0	0.0	35.25	35.25	0.0	0.0	25.0	25.0
July 7, 2001	0.0	0.0	12.5	12.5	0.0	0.0	9.25	0
July 14, 2001	0.0	0.0	20.5	20.5	0.0	0.0	11.0	11.0
July 21, 2001	0.0	0.0	27.0	27.0	0.0	0.0	17.75	17.75
July 28, 2001	0.0	0.0	28.0	28.0	0.0	0.0	23.0	23.0
July counts	0.0	0.0	88.0	88.0	0.0	0.0	61.0	61.0
Aug. 4, 2001	0.0	0.0	37.5	37.5	0.0	0.0	19.0	19.0
Aug. 11, 2001	0.0	0.0	36.25	36.25	0.0	0.0	23.75	23.75
Aug. 18, 2001	0.0	0.0	58.75	58.75	0.0	0.0	35.0	35.0
Aug. 25, 2001	0.0	0.0	75.75	75.75	0.0	0.0	41.75	41.75
Aug. counts	0.0	0.0	220.75	220.75	0.0	0.0	119.5	119.5
Sept. 1, 2001	0.0	0.0	102.75	102.75	0.0	0.0	43.75	43.75
Sept. 8, 2001	1.0	0.0	119.5	120.5	0.75	0.0	55.00	55.75
Sept. 15, 2001	3.25	0.0	169.5	172.75	1.75	0.0	82.5	84.25
Sept. 22, 2001	10.0	0.5	123.25	133.75	8.75	0.0	68.75	77.50
Sept. 29, 2001	8.0	0.25	53.0	61.25	4.5	0.0	37.5	42.0
Sep. counts	22.25	0.75	568.0	591.0	15.75	0.0	287.5	303.25
Oct. 6, 2001	3.0	0.75	30.5	34.25	1.50	0.5	25.75	27.75
Oct. 13, 2001	3.5	0.5	35.5	39.5	1.25	0.25	19.25	20.75
Oct. 20, 2001	2.25	1.0	78.5	81.75	2.0	0.75	71.25	74.00
Oct. 27, 2001	1.25	0.75	77.25	79.25	1.5	1.0	47.5	50.0
Oct. counts	10.0	3.0	221.75	234.75	6.25	2.5	163.75	172.5

N.B. No hornets were recorded during of January, February and March, months.





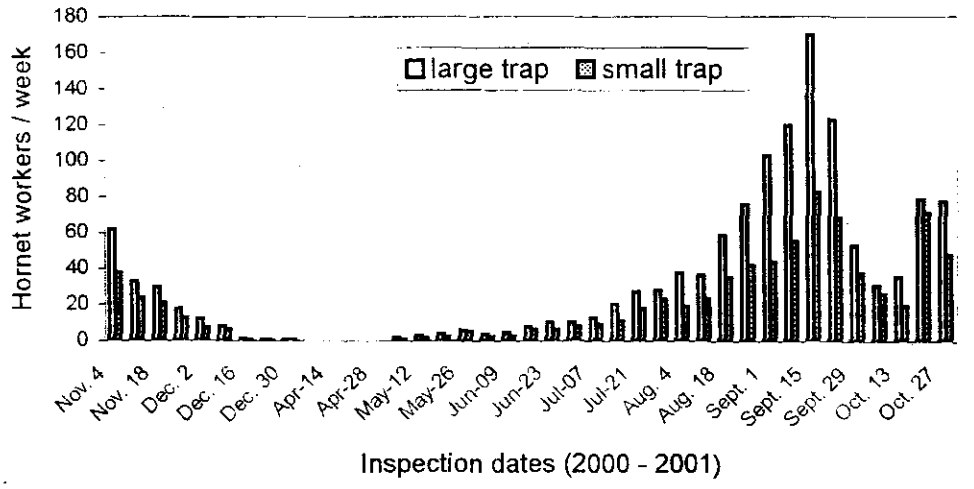


Fig. (1): Weekly averages of hornet individuals, *Vespa orientalis* caught by different sizes of traps during November 2000 to October 2001

Table (2): Weekly and monthly averages of hornet individuals, *V. orientalis* caught from November 2001 to October 2002 by different sizes of traps (n=4 for each trap size).

Inspection dates	Weekly counts / trap in 2001-2002							
	Large traps				Small traps			
	Male	Queen	Worker	All individuals	Male	Queen	Worker	All individuals
Nov. 4, 2001	0.75	0.5	19.5	20.75	0.25	0.25	14.25	14.75
Nov. 11, 2001	0.75	0.75	21.0	22.5	0.5	0.25	10.75	11.5
Nov. 18, 2001	0.5	0.25	17.75	18.5	0.25	0.25	10.25	10.75
Nov. 25, 2001	0.25	0.25	10.5	11.0	0.0	0.0	8.0	8.0
Nov. counts	2.25	1.75	68.75	72.75	1.0	0.75	43.25	45.0
Dec. 2, 2001	0.0	0.25	2.0	2.25	0.0	0.0	1.5	1.5
Dec. 9, 2001	0.0	0.25	0.75	1.0	0.0	0.25	0.5	0.75
Dec. 16, 2001	0.0	0.0	0.25	0.25	0.0	0.0	0.25	0.25
Dec. 23, 2001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dec. 30, 2001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dec. counts	0.0	0.5	3.0	3.5	0.0	0.25	2.25	2.5
April 7, 2002	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0
April 14, 2002	0.0	0.75	0.0	0.75	0.0	0.25	0.0	0.25
April 21, 2002	0.0	0.25	0.0	0.25	0.0	0.5	0.0	0.5
April 28, 2002	0.0	0.75	0.0	0.75	0.0	0.75	0.0	0.75
April counts	0.0	2.25	0.0	0.75	0.0	1.5	0.0	1.5
May 5, 2002	0.0	0.75	1.0	1.75	0.0	0.5	0.75	1.25
May 12, 2002	0.0	0.5	2.25	2.75	0.0	0.25	1.5	1.75
May 19, 2002	0.0	0.5	2.5	3.0	0.0	0.0	0.5	0.5
May 26, 2002	0.0	0.0	2.25	2.25	0.0	0.0	1.75	1.75
May counts	0.0	1.75	8.0	9.75	0.0	0.75	4.5	5.25
June 2, 2002	0.0	0.0	2.5	2.5	0.0	0.0	1.75	1.75
June 9, 2002	0.0	0.0	3.0	3.0	0.0	0.0	2.0	2.0
June 16, 2002	0.0	0.0	3.75	3.75	0.0	0.0	2.25	2.25
June 23, 2002	0.0	0.0	4.5	4.5	0.0	0.0	0.25	0.25
June 30, 2002	0.0	0.0	5.0	5.0	0.0	0.0	0.5	0.5
June counts	0.0	0.0	18.75	18.75	0.0	0.0	6.75	6.75
July 7, 2002	0.0	0.0	10.25	10.25	0.0	0.0	3.5	3.5
July 14, 2002	0.0	0.0	11.0	11.0	0.0	0.0	4.25	4.25
July 21, 2002	0.0	0.0	10.0	10.0	0.0	0.0	9.5	9.5
July 28, 2002	0.0	0.0	13.5	13.5	0.0	0.0	8.0	8.0
July counts	0.0	0.0	44.75	44.75	0.0	0.0	25.25	25.25
Aug. 4, 2002	0.0	0.0	26.25	26.25	0.0	0.0	12.5	12.5
Aug. 11, 2002	0.0	0.0	27.5	27.5	0.0	0.0	19.75	19.75
Aug. 18, 2002	0.0	0.0	35.0	35.0	0.0	0.0	20.0	20.0
Aug. 25, 2002	0.0	0.0	13.75	13.75	0.0	0.0	10.0	10.0
Aug. counts	0.0	0.0	102.5	102.5	0.0	0.0	62.25	62.25
Sept. 1, 2002	0.0	0.0	22.5	22.5	0.0	0.0	13.25	13.25
Sept. 8, 2002	2.0	0.0	44.5	46.5	1.25	0.0	35.25	36.5
Sept. 15, 2002	2.25	0.0	54.25	56.50	1.0	0	40.75	41.75
Sept. 22, 2002	2.0	0.0	56.75	58.75	1.5	0.0	42.75	44.25
Sept. 29, 2002	3.25	0.0	67.0	70.25	2.25	0.0	48.5	50.75
Sep. counts	9.50	0.0	245.0	254.5	6.0	0.0	180.5	186.5
Oct. 6, 2002	2.75	1.0	27.0	30.75	1.5	0.75	16.5	18.75
Oct. 13, 2002	1.0	1.25	19.75	22.0	0.75	0.75	18.0	19.5
Oct. 20, 2002	0.75	1.0	20.75	22.5	0.5	0.25	13.75	14.5
Oct. 27, 2002	0.75	0.5	20.75	22.0	0.25	0.25	12.0	12.5
Oct. counts	5.25	3.75	88.25	97.25	3.0	2.0	60.25	65.25

N.B. No hornet of any individual was recorded in months of January, February and March.

a) Hornet queens:

The data clearly show that the over-wintered mated queens started to appear in the first week of April of both years under study.

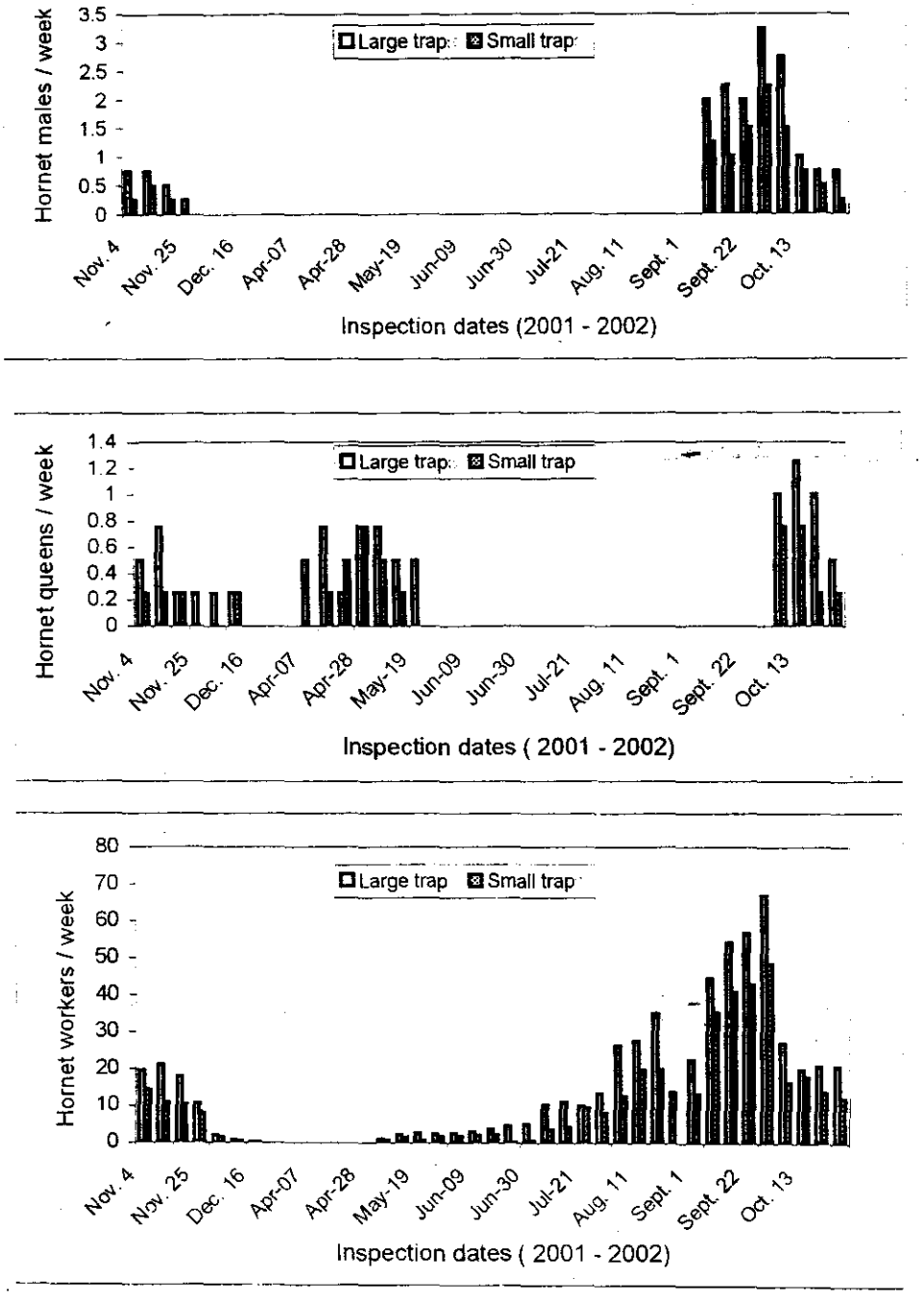


Fig.(2): Weekly averages of hornet individuals, *Vespa orientalis* caught by different sizes of traps during November 2001 to October 2002.

A gradual increase in queen population occurred in the successive weeks to reach their maximum counts/trap (4.0 and 2.0 queens in large and small traps, respectively) in the last week of the same month. Then, the population gradually decreased during May. The queens completely disappeared and hidden in their nests till the end of September and at the beginning of October. A new generation of queens started to appear in late September and continued to exist till December. The maximum counts/trap were recorded in second week of November as 2.0 and 1.0 queens/trap in large and small traps, respectively were obtained. The queens began to decrease and completely disappeared in the last week of December as they were hibernated in sheltered habitats till the next spring.

b) Hornet workers:

The first generation of hornet workers began to appear in the first week of May 2001 and 2002. A gradual increase in worker population occurred in the following weeks to reach the maximum (169.5 and 82.5 workers/trap in large and small traps, respectively) in the third week of September, 2001. The corresponding values in the last week of September, 2002 were 67.0 and 48.5 workers/trap in large and small traps.

A gradual decrease in worker population occurred during October, November and December of both years as they were died with the onset of cold weather in late Autumn and during the whole winter season.

c) Hornet males:

The males of hornet started to appear at the beginning of September 2001 and 2002. A gradual increase in male counts occurred in the following days to reach the maximum (10.0 and 8.75 males / trap in large and small traps, respectively) in the third week of September 2001. The corresponding values of male population in the last week of September, 2002 were 3.25 and 2.25 males/traps., Then, the male counts decreased gradually in the successive weeks of October and November and completely disappeared in late of December, as they were died with the onset of cold weather in late Autumn and in Winter.

The annual averages of the males, queens, workers of hornet caught by large and small double-box traps in 2001 and 2002, and their inter-relation percentages are recorded in Table (3). Their analysis of variance shows significant difference between sizes of traps and the year of catching.

F values were highly significantly for males between traps and between years. Therefore, the large traps in 2001 significantly caught the highly number of males, followed by the small trap in 2001, and large and small traps in 2002 without any significant difference between them.

Also, F values were highly significant for caught queens between the sizes of traps and between the years of catching. By applying L.S.D value, the large traps in 2001, significantly caught the highest number of queens, followed in descending order by the small traps in 2001, and the large and small traps in 2002 with significant differences between them.

F values for caught workers were highly significant between sizes of traps and between the years of catching. According to the LSD value, the large traps in 2001 significantly caught the highest number of workers,

Table 3. Annual averages of hornet individuals, *V. orientalis* caught by different sizes of traps during two successive years and their inter-relations.

Year	Annual counts / trap								Rate of increase in large to small traps (%)
	Large double box trap				Small double box trap				
	Males	Queens	Workers	All individuals	Males	Queens	Workers	All individuals	
2000-2001 (A)	34.0	26.0	1311.75	1371.75	22.75	15.75	776.25	814.75	68.36
Mean ± s.e	±3.34	±3.87	±28.16	±32.46	±3.07	±1.65	±7.76	±6.97	
%	2.48	1.89	95.63	100	2.79	1.93	95.28	100	
2001-2002 (B)	17.0	10.0	579.0	606.0	10.0	5.25	385.0	400.25	51.41
Mean ± s.e	±0.71	±2.58	±9.26	±10.35	±1.68	±0.85	±4.53	±6.97	
%	2.81	1.65	95.54	100	2.50	1.31	96.19	100	
% increase or decrease : $\frac{B-A}{A} \times 100$	-50.0	-61.54	-55.86	-55.82	-56.04	-66.67	-50.40	-50.87	

- **F value between traps for males = 12.698**, LSD = 5.79 hornet males/trap.**
- **F value between traps for queens = 15.23**, LSD = 4.35 hornet queens/trap.**
- **F value between traps for workers = 982.87**, LSD = 26.32 hornet workers/trap.**
- **F value between traps for all individuals = 805.67**, LSD = 30.39 hornet individuals/trap.**
- F value between years for males = 33.74**
- F value between years for queens = 47.52**
- F value between years for workers = 2333.35**
- F value between years for all individuals = 1929.03**

followed in descending order by the small traps in 2001 and the large and small traps in 2002. The same trend could be applied for the total number of caught hornets irrespective of sex.

The interrelation percentages between the different individuals (males, queens and workers) in the annual population of hornet were 2.48, 1.89 and 95.63%, respectively, in large traps of 2001. The corresponding figures in small traps were 2.79, 1.93 and 95.28% of the same year. In 2002, the males, queens and workers of hornet caught decreased by 50, 61.54 and 55.86% in large traps and by 56.04, 66.67 and 50.40% in small traps, respectively.

The present results agree with the findings of Kadymov (1981); Brar *et al.* (1985); Abrol (1995); Ahmed (1999) and Khater *et al.* (2001) and disagree with those of Sihag (1992) who stated that hornet workers in Korea were observed from June to November; Shoreit (1998) who stated that *V. orientalis* queens in Egypt were observed from January to May and workers were observed from June to December and Abouel-Enain (1999) who stated that the queens of the same insect species were observed in Egypt from February to May and from October to December and workers were found from June to December while males were found from October to December.

2) Effect of different carbohydrate diets on attracting of hornets and brood rearing of the bee colonies:

A) Attracting and captivating of hornets:

Table (4) shows the average numbers of caught hornet in outdoor feeder traps provided with different diets of carbohydrate source for hybrid-Carniolan colonies during November and December, 2002. Highly significant difference, in caught alive and dead hornets was noticed between types of diets. According to the LSD value, the feeder-traps provided with sugar syrup (1:1) fortified by either 25% grape or date fruits significantly attracted the highest number of hornets (28.25 and 27.5 caught hornets / feeder-trap / colony, respectively). Traps provided with sugar syrup fortified by either 25% apple fruits, plain sugar syrup or 25% ripe honey came next in descending order with no significant difference between them. Their averages were 17.5, 15.25 and 13.25 caught hornets/feeder trap/colony; respectively.

Statistically, there were high significant differences, between either alive or dead hornets, between types of diets, between hornet survivars in the traps and between their interaction. According to the LSD for hornet survivars in the traps, the number of dead hornets in feeder-traps provided with syrups fortified by 25% grape or date fruits significantly came first in order with significant differences between them, followed by those provided with syrups fortified by 25% apple fruits, plain sugar syrup or 25% ripe honey as second statistical group. On the other hand, the number of alive hornets in the feeder-traps supplied with syrups fortified by 25% date or grape fruits came the next in order without any significant difference between them, followed in descending order by those provided with syrups of 25% apple fruits. The number of alive hornets in those provided with plain sugar syrup or fortified with 25% ripe honey significantly came the last in order. These findings agree with those of Bunn (1988); Lim *et al.* (1989); Mishra *et al.* (1989) and Rahman & Rahman (1995).

Table(4): Averages of caught hornet counts in outdoor feeder traps provided with different diets for hybrids Carniolan colonies during November-December 2002.

Replicates	Diets in outdoor feeder-traps														
	(A) Sugar syrup + 25% Apples			(B) Sugar syrup + 25% Grapes			(C) Sugar syrup + 25% honey			(D) Sugar syrup + 25% dates			(E) Plain Sugar syrup		
	Alive	Dead	Total	Alive	Dead	Total	Alive	Dead	Total	Alive	Dead	Total	Alive	Dead	Total
1	6	11	17	9	21	30	4	12	16	11	21	32	4	18	22
2	8	14	22	6	16	22	4	10	14	8	17	25	4	5	9
3	7	10	17	8	18	26	3	8	11	10	19	29	5	11	16
4	6	8	14	9	26	35	3	9	12	9	15	24	6	8	14
Total	27	43	70	32	81	113	14	39	53	38	72	110	19	42	61
Mean ±	6.75 ±	10.75 ±	17.5 ±	8.0 ±	20.25 ±	28.25 ±	3.5 ±	9.25 ±	13.25 ±	9.5 ±	18.0 ±	27.5 ±	4.75 ±	10.5 ±	15.25 ±
S.E	0.48	1.25	1.66	0.71	2.17	2.78	0.29	0.85	1.11	0.65	1.29	1.85	0.48	2.78	2.69

- F value between types of diets = 14.83** and LSD = 2.65 hornets.
- F value between alive and dead hornets = 80.87** and LSD = 1.68 hornets.
- F value between interaction of diets and case of hornets = 3.02*.

B) Brood rearing counts of honey workers:

Table (5) shows that daily brood rearing rates of workers brood counts at 13 day intervals in the different groups of colonies offered different types of diets of carbohydrates sources, in outdoor feeder traps during dearth of nectar (in November and December, 2002).

Highly significant difference in the daily brood rearing rates was noticed between the types of the diets.

Table(5): Averages of daily worker brood rearing rates at 7 day intervals before and after feeding hybrid Carniolan colonies with different diets in outdoor feeder traps.

Periods	Diets in out-door feeder-traps					
	A Sugar syrup + 25% Apple	B Sugar syrup + 25% grape	C Sugar syrup+25% honey	D Sugar syrup + 25% dates	E Plain sugar syrup	Mean ± s.e
Before feeding: Oct. 30, 2002	209.5	198.25	211.75	203.25	202.5	205.05 ± 2.46
After feeding :						
Nov. 11, 2002	270.0	281.0	261.0	268.0	220.0	260.0 ± 10.50
Nov. 24, 2002	276.0	323.75	291.25	246.0	239.5	275.3 ± 15.40
Dec. 7, 2002	332.25	336.25	348.25	297.25	307.25	324.25 ± 9.49
Dec. 20, 2002	338.75	342.25	388.25	291.75	289.0	330.0 ± 18.39
Jan. 2, 2003	340.75	373.75	404.25	294.25	298.5	342.30 ± 21.28
Mean ± s.e	311.55 ±15.83	331.4 ±15.06	338.60 ±27.51	279.45 ±9.84	270.85 ±17.30	306.37 ± 16.26

F value between types of diets = 5.61 and LSD = 42.71 worker brood cells/day.**
F value between successive periods = 8.05 and LSD = 42.71 worker brood cells/day.**

This proved that the addition of ripe honey as well as blended grape or apple fruits in sugar syrup significant caused more brood counts than plain sugar syrup or fortified by blended date fruits during fall till January 2003. The obtained data also indicated that the sugar syrup fortified by 25% ripe honey, grape or apple fruits encouraged the bees to give more brood rearing rates but without significant difference between them. Meanwhile, plain sugar syrup or fortified by 25% date fruits, significantly gave the least brood rearing rates, without significant difference between both and that fortified by 25% apple fruits.

On the other hand, the data clearly showed highly significant difference in the daily brood rearing rates between the successive periods of feeding. Feeding colonies till January 2, 2003 and December 20 and 7, 2002 significantly gives the highly brood rearing rates without significant difference between them. Meanwhile, feeding colonies till November 24 and 11, 2002, significantly came the last in order without significant difference between them. The L.S.D. value emphasizes the obtained results. These findings coincide with those of Raj *et al.* (1993); Watanable (1993) and El-Sherif (2002).

C) Correlation between the daily rates and numbers of caught hornets:

As shown in Tables (4 and 5), providing sugar syrup (1:1) fortified by 25% grape fruits in outdoor feeder-traps for the colonies during late Autumn (November and December) helped the colonies to strongly build-up referred in reducing the damage caused by the hornets. It gave the best brood rearing rates (331.4 broods/day) beside it attracted and caught the highest number of hornets (28.25 hornets) as compared to the other feeding treatments offered in the outdoor feeder traps in the present study.

Statistical analysis of the data in Tables (4 and 5) revealed an insignificant positive correlation between the daily worker brood rates in the honey bee colonies and the dead individuals of caught hornets in outdoor feeder-traps of the same colonies (b = +0.00856 and r = +0.00519). On the other hand, insignificant negative correlations were observed between the daily brood rates and the alive individuals of caught hornets (b = -0.0208 and r = - 0.2607), and between the daily brood rates and all individuals of caught hornets (b = - 0.06699 and r = - 0.0155). These findings coincide with those of Sharma *et al.* (1985); Matsuura (1988); Abrol (1995) and Srivastava *et al.* (1995).

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التغيرات الموسمية للدبور الشرقى ***Vespa orientalis*** **Fab. ، كفاءة صيده وأنشطة نحل العسل.**

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تم دراسة التغيرات الموسمية والمكافحة غير الكيميائية للدبور الشرقى الذى يسبب خسائر باهظة في تنمية النحالة ، خلال عامى ٢٠٠١ ، ٢٠٠٢ حيث استخدمت نوعين من المصائد لتقدير كفائتها في صيد الأفراد الثلاثة من هذا المفترس الحشرى وحصره.

وقد أوضحت النتائج المتحصل عليها أن ملكات الدبور التى أنهت فترة التشتيه ظهرت بأعلى معدل في إبريل في كلا عامى الدراسة واستمرت حتى مايو. أما شغالات الدبور فقد ظهرت في الفترة من مايو إلي ديسمبر ووصلت إلي أقصى معدل في سبتمبر لكلا العامين. أما ذكور الدبور فقد ظهرت في الفترة من سبتمبر حتى ديسمبر ووصلت إلي أقصى معدلاتها في سبتمبر. وقد وجد أن الجيل الجديد من الملكات العذارى يظهر متأخرا عن موعد ظهور الذكور خلال الفترة من أكتوبر حتى ديسمبر ووصل تعداد هذه الملكات أقصى معدلاتها في أكتوبر. كما وجد أن الملكات الملقحة تدخل بياتها الشتوى مختبئة بينما تموت الشغالات والذكور مع بداية الطقس البارد في أواخر الخريف ويستمر ذلك في الشتاء.

أما التجربة الثانية ، التى تشمل مصائد الغذاية الخارجية للخلايا ، فقد أوضحت النتائج أن المحلول السكرى المقوى بـ ٢٥% ثمار عنب أو بلح بالمصائد ، قد جذب أعلى تعداد للدبابير بمعنوية واضحة، بينما المحلول السكرى المقوى بـ ٢٥% عسل ناضح أو ثمار عنب أو تفاح فقد تسبب في انتاج أعداد كبيرة من حضنه نحل العسل بالمقارنة مع أنواع التغذية الأخرى. ويتضح أيضاً أن ٢٥% من ثمار عنب في المحلول السكرى المقدم بالمصائد كان أفضل الأغذية في جذب الدبابير وبناء طوائف النحل. واتضح أيضاً من معدلات الحضنه اليومية في طوائف النحل كانت مرتبطة ارتباطا موجباً مع أعداد الدبابير الميته وارتباطاً سالباً مع أعداد الدبابير الحية أو الاثنين معا (الميتة والحية) في مصائد التغذية الخارجية للخلايا.