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Population dynamics of *Vespa orientalis* wasp, including both the queen and workers, by using bait traps in Kafr El-Sheikh Governorate

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Abstract

Vespa orientalis L. (Hymenoptera: Vespidae) is a significant threat to beekeeping worldwide. This study aims to study the population dynamics that manage the oriental hornet. The baits used included a pollen substitute, fermented solution, and tuna. The research was conducted from the first week of September until the last week of November 2022 during worker wasp activity. Traps were set up and baited from the first week of March until the last week of May in 2023 during the queen wasp activity. Results indicated that the pollen substitute bait was the most successful in attracting *V. orientalis*, followed by the fermented solution, while tuna was the least effective. Based on the study, the recommendation is to use a pollen substitute bait for the most effective wasp control method.

Introduction

Hornets are widely acknowledged as significant predators of honeybees, with many species of Vespidae posing serious threats to bee populations and causing damage (Mattu and Sharma, 2017). Various methods have been proposed to safeguard honeybee colonies from hornet attacks. *Vespa orientalis* L. (Hymenoptera: Vespidae) is identified as a key factor in the expansion of apiaries in Egypt (Al-Heyari *et al*., 2016).

One such method involves dusting hornets, with insecticides and allowing them to return to their nests, thereby destroying them. The oriental wasp, *V. orientalis*, is recognized as a significant pest in the honeybee industry in Egypt. Several authors, Khalil *et al*., 2000 and Khater *et al*., 2001 have observed that the activity of oriental wasps is minimal in winter, spring, and early summer, gradually increasing in autumn. *V. orientalis* is a social insect belonging to the family Vespidae, and it constructs underground nests organized around a caste system dominated by the queen. Beehives are attractive to wasps due to the optimal combination of proteins and carbohydrates they offer (Bacandritsos *et al*., 2006).

Hornets tend to target weaker bee colonies before turning their attention to healthier ones (Ifantidis, 2003). Beekeepers often avoid establishing apiaries in areas infested by hornets and may need to relocate their apiaries when attacks intensify (Abdelaal and El-Defrawy, 2014).

The present work aims to study the population dynamics of *V. orientalis*, including both the queen and workers, to manage it by using bait traps in Kafr El-Sheikh Governorate.

Materials and methods

The current investigation was conducted in the Sidi Salem apiary over two distinct seasons: the first season spanned from September to November 2022, while the second season extended from March to May 2023.

1. Trap description:

A wooden trap consisting of wooden bars and a wire screen, measuring 45 x 45 x 85 cm, was utilized (Abdelaal and El-Defrawy, 2014). These traps were positioned atop open Langstroth boxes, with two traps employed for each bait.

2. Baits utilized:

- Pollen substitute
- Fermented sugar solution
- Tuna fish

3. Assessment of bait efficacy in attracting *Vespa orientalis*:

The study commenced during the first week of September and concluded by the last week of November 2022, coinciding with the activity of wasp workers. Subsequently, trap deployment and baiting occurred from the first week of March until the last week of May 2023, aligning with the activity of wasp queens. Bait replacement within the traps transpired every three days, with wasp attraction and counting performed weekly.

Results and discussion

Table (1) presents the weekly average number of *V. orientalis* individuals per trap during the active season of 2022. The data indicates that oriental hornet sightings commenced in September, reaching a peak in mid-October, and gradually declining until the end of November. Among the baits tested, pollen substitute demonstrated the highest effectiveness, while tuna fish exhibited the least effectiveness. For instance, on October 18th, there were 62, 55.4, and 50.4 hornets per trap per week attracted by pollen substitute, fermented solution, and tuna fish, respectively. By November 29th, these numbers decreased to 2.4, 1, and 1 hornet per trap per week for pollen substitute, fermented solution, and tuna fish, respectively. The study concludes that pollen substitute bait proved to be the most efficient and effective in attracting *V. orientalis*.

Table (1): The weekly mean count of *Vespa orientalis* per trap during the active period of 2022.

Date	Queen Average /trap		
	Pollen substitute	**Syrup**	**Tuna fish**
7-9-2022	35.7	35.4	27.4
14-9-2022	39.4	35.7	30
21-9-2022	48.4	38.7	35
28-9-2023	49.4	45.4	41.7
4-10-22	52.4	50	47.4
11-10-22	56.4	48	45.7
18-10-22	62	55.4	50.4
25-10-22	40.7	36.4	36
1-11-22	37.4	30.7	27.4
8-11-22	32.4	22	20.4
15-11-22	24.4	20	18.4
22-11-22	6.7	4.4	2.7
29-11-22	2.4	1	1
Total	488	423.1	383.5
Mean	37.6	32.6	29.5

Table (2) displays the weekly average number of *V. orientalis* queens per trap during the active season of 2023. The data reveals that pollen substitute bait attracted the highest number of wasp queens per trap, followed by fermented solution bait, with tuna fish bait attracting the least number of wasp queens.

For instance, on March 7th, there were 23.7, 21, and 18 wasp queens per trap per

week attracted by pollen substitute, fermented solution, and tuna fish, respectively. By May 23rd, these numbers decreased to 2, 1, and 1 wasp queen per trap per week for pollen substitute, fermented solution, and tuna fish, respectively.

These findings are consistent with the research conducted by Dwara and Hatom (2013), who investigated the effectiveness of three trap types in reducing damage caused by the red wasp (*V. orientalis*) on bees. Additionally, studies by Wafa *et al.* (1968) and Ibrahim and Mazeed (1967) examined the population density of the oriental hornet, noting its low presence during spring and early summer, followed by gradual increases in September and October.

Gomaa and Abd El-Wahab (2006) recorded the highest hornet population in the third week of October, while Khater *et al*. (2001) in Lower Egypt observed the highest trapped numbers of hornet workers during September. In Egypt, various authors, including Sharkawi (1964), Ibrahim and Mazeed (1967), Khalil *et al.* (2000), and Khater *et al.* (2001), have reported similar observations, noting the low activity of Oriental wasps during winter, spring, and early summer, with gradual increases leading to peak abundance in autumn, particularly during October.

The number of wasps begins to decline gradually during the second half of November, disappearing by mid-December. Various types of traps, whether baited or not, have been studied, with Sweelam *et al.* (2019) finding that pollen substitutes exhibited the highest hunting efficiency for queens, followed by tuna compared to control methods.

Table (2): The average number of oriental hornet queens (*Vespa orientalis*) per trap weekly during the active season of 2023.

Date	Queen Average /trap		
	Pollen substitute	Syrup	Tuna fish
7-3-2023	23.7	21	18
14-3-2023	21.4	20	17
21-3-2023	18.7	17.4	15.7
28-3-2023	16.7	15	14.4
4-4-2023	15	12.4	11.4
11-4-2023	12.7	9	8.7
18-4-2023	9.4	7.7	7.4
25-4-2023	6.4	5.4	4.4
2-5-2023	4.7	3	3.3
9-5-2023	4	2.7	2.4
16-5-2023	3.4	2	1.4
23-5-2023	2	1	1
30-5-2023	1	1	1
Total	139.1	135	106.1
Mean	10.7	10.4	8.2

As shown in Table (3), a two-way ANOVA was performed to analyze the effect of type of diet and date on the wasp population. A two-way ANOVA revealed that there was a statistically significant interaction between the effects of type of diet and date df=23, F-value=1.763, p=.034. Simple main effects analysis showed that diet did have a statistically significant effect on the wasp's population df=2, F-value=17.699, p=0.000. Simple main effects analysis showed that data did have a statistically significant effect on wasp's population df=12, F-value=103.566, p=0.000.

Table (3): Effect of type of diet and date on wasp's population.

Source	df	F	Sig.
Diet	2	17.699	.000
Date	12	103.566	.000
diet * Date	23	1.763	.034

As shown in Table (4), a two-way ANOVA was performed to compare diet groups in the wasp population. The differences between syrup, tuna fish, and pollen were statistically significant near syrup, and tuna fish with sig. 0.003, 0.00, and confidence interval (1.16- 6.38), (3.77 – 9.00) respectively. The differences between tuna fish and syrup were statistically significant near tuna fish with sig. 0.50 and confidence (0.00 – 5.23).

Table (4): Compared between diet groups on wasp population.

(I) diet	(J) diet	Sig.	95% Confidence Interval	
			Lower Bound	Upper Bound
Syrup	Pollen	.003	1.16	6.38
Tuna fish	Pollen	.000	3.77	9.00
	Syrup	.050	.00	5.23

***. The mean difference is significant at the .05 level.**

References

Abdelaal, A. A. A. and El-Defrawy, B. M. (2014): Efficacy of new designed traps for controlling the oriental hornet (Vespa orientalis) in Egyptian apiaries and its measurements. International Journal of Advanced Research, 2(10): 1-8.

Al-Heyari, B. N.; AL Antary, T. M. and Nazer, I. K. (2016): Effectiveness of some insecticide mixed with bait and heptyl burate on the oriental wasp, *Vespa orientalis* L. (Hymenoptera: Vespidae). Advances in Environmental Biology, 10(12): 17-25.

Bacandritsos, N.; Papanastasiou, I.; Saitanis, C. and Roinioti, E. (2006): Three non-toxic insect traps useful in trapping wasps enemies of honey bees. Bulletin of Insectology, 59(2): 135-145.

Dwara, M. H. and Hatom, A. (2013): Effectiveness of some traps and baits in reducing the red hornet harm on bees in Sweida, South of Syria. Arab Journal of Plant Protection, 31(2): 133-137.

Gomaa, A. M. and Abd El-Wahab, T. E. (2006): Seasonal abundance and the efficiency of yeast liquid culture (*Candida tropicalis*) as bait for capturing the oriental wasps (Vespa orientalis L.) under Egyptian environment. Journal of Applied Science Research, 2(11): 1042-1046.

Ibrahim, M. M. and Mazeed, M. M. (1967): Studies on the oriental hornet, *Vespa orientalis*. Agriculture Research Review, 45(2): 163-180.

Ifantidis, M. (2003): The social wasps. Apiculture Review, 2: 76-83.

Khalil, S. L.; Ebadah, I. M. A. and Khater, A. M. (2000): Preliminary investigation on the efficiency of developed sticky trap in controlling Vespa orientalis L. attacking honeybee colonies, Egypt. Journal of Applied Science, 15: 282-294.

Khater, A. M.; Ebadah, I. M. A. and Khalil, S. I. (2001): The seasonal activity of oriental wasp, *Vespa orientalis* L. populations attacking honeybee colonies. Arab University Journal of Agricultural Sciences, Ain Shams University, Cairo, 9: 447-455.

Mattu, V. K. and Sharma, I. (2017): Seasonal variation of *Vespa auraria* S. and *Vespa mandarinia* S. (Hymenoptera: Vespidae) attacking *7* L. colonies in district Kangra of western Himalayas, Himachal Pradesh (India). Journal of Entomology and Zoology Studies, 5(3):1862-1864.

Sharkawi, S. G. (1964): The morphological, biological, ecological and control studies of Vespa orientalis (Hymenoptera: Vespidae). M.Sc. Thesis, Faculty of Agriculture, Cairo University.

Sweelam, M. E.; Abdelaal, A. A.; Khattaby, A. M. and Mettwaly, Y. A. (2019): Integrated management of Vespa orientalis in honeybee colonies at Elsharkia Governorate. Menoufia Journal of Plant Protection, 4: 163-172. DOI:10.21608/mjapam.2019.122988

Wafa, A. K.; El-Borolossy, F. M. and Sharkawi, S. G. (1968): Studies on Vespa orientalis, Fab. (Hymenoptera: Vespidae). Bulletin of the Society of Entomology of Egypt, 11(9): 9-29.