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New technique for protecting honey bee colonies from oriental wasp (*Vespa orientalis* L.) attacks at Dokki region, Giza, Egypt.

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Abstract

Field experiment was carried out to reduce the risk of oriental wasp (*Vespa orientalis* L.) attacks by placed honeybee colonies under wire cages with holes in different diameters (7, 5.3, 4.2 and 2 mm) in comparing with queen excluder placed at the entrance of honey bee hives during September to December 2015 at the Beekeeping Research Department. Honeybee colony strength were measured (brood area, number of combs covered with bees and stored pollen area) in relation with captured oriental wasps number. Wire screen traps were used for catching wasps in the apiary, using fermented sugar syrup solution and honey as bait. Results showed that cage with holes 4.2 mm gave the highest brood area (68.30cm^2 /colony), number of combs covered with adult bees (4.63 comb/colony) and stored pollen area (22.01cm^2/colony). The maximum weekly number of captured wasps during the experimental period was 5761.33wasp in first November. Also, results revealed that the highest monthly number of captured wasps were 2514.92 and 2459.42 wasp in October and November, respectively.

Key words: Honeybees, *Vespa orientalis*, cages, traps, population, brood, pollen.

Introduction

Hornet *Vespa orientalis* L. (Hymenoptera, Vespidae) is particularly known to induce serious damage to apiaries by killing many individual honeybees or even by destroying entire colonies and occupying the beehive using its resources (honey, pollen, brood and adult honeybees) to feed their brood (**Ken *et al*., 2005**). Hornet activities outside the nest are coordinated with the metrological conditions **(Chhuneja *et al*., 2008** and **Volynchik *et al*., 2008).** The number of *V. orientalis* wasps was positively correlated with air temperature and negatively correlated with relative humidity (**Abou El-Enain, 1999**).The activity of wasp *V. orientalis* increases to reach maximum population in the autumn, particularly during October, and starts to fall down during November, and disappears in December (**Khalil *et al*., 2000**; **Gomaa& Abdel-Wahab, 2006; El-Bassioni *et al*., 2010** and **El-Hady & Sanad, 2014**). Several methods have been reported to protect honeybee colonies from wasps, such as destruction of wasp nests (**Bhutani, 1950** and **Singh, 1962**), by honey baits mixed with different insecticides (**Wafa *et al*., 1969** and **Aihara, 1980**), and usage of different types of traps (**Hussein, 1989; Shoreit, 1998** and **Abou El-Enain, 1999**), Also invent a new barrier device named (Bee-Wasp protector) effectively protect bees from wasp attack at the hive entrance (**Srivastava *et al*., 1995**), and using fermented sugar syrup or honey as bait for captured the oriental hornet queens and workers (**Taha, 2014**) and dusting the trapped wasps with Linnet insecticide 90% and return release them every week to reduce their population (**Ghania and Abd El-Aziem, 2015**).

The present work aimed to find out a simple and more effective method for protecting honeybee colonies from oriental wasp severe attacks.

Material and Methods

The present experiment was carried out on honeybee colonies *Apis mellifera* L. (Carniolan hybrid) during the activity of oriental wasp (*Vespa orientalis* L.) extended from September until December 2015 at Beekeeping Research Department, Dokki region, Giza Governorate, Egypt to reduce the risk of wasp attacks by placed honeybee colonies under wire cages with holes in different diameters in comparing with queen excluders placed at the entrances of honey bee hives.

Experimental cages:

Four cages were prepared for this study, every one measure 150×100×100cm (Fig. 1), the cages were covered by wires with holes in deferent diameters, 7, 5.3, 4.2 and 2mm holes, respectively.

Fig (1): Experimental cage.

Honeybee colonies:

Fifteen honeybee colonies in langstroth hives headed by newly-mated queens were prepared for this study. All the honeybee colonies were equal in strength; i.e. each colony contained four frames of brood and three of honey and pollen combs, all the combs were covered with adult bees. Three honeybee colonies were used for each treatment by putting them under the cage in comparing with queen excluders placed at the entrances of three hives.

Honeybee colony strength:

The following parameters were measured in this study for colony strength:

1- **Brood area in cm^2:** Square centimeters of sealed worker brood were measured at 13 days intervals for experimental colonies by using a measuring sheet (modified from **Jeffree, 1958).**
2- **Frames of bees:** Number of frames covered with adult bees in experimental colonies were counted and recorded at 13 days intervals.
3- **Stored pollen area in cm^2**: The same method of measuring the brood area was used for measuring stored pollen area at 13 days intervals.

Wasp traps:

Three wire screen traps were used for trapping *V. orientalis* in the apiary (Fig. 2), using fermented sugar syrup solution and honey as bait. The captured wasps were collected and counted weekly after spraying the trap with malathion 0.5% (**Abou El-Enain, 1999).**

Fig. (2): Wasp trap.

Meteorological Data:

Meteorological data was obtained from the Central Laboratory for Climate, Dokki, Giza, Egypt.

Experimental design and analyses:

Data were statistically analyzed by using (SAS computer program). By ANOVA and least significant differences (L.S.D) were calculated at 0.05 according to **Little and Hills (1978)**.

Results and discussion

In this study we covered the honeybee hives by wired cages with different holes diameters (7, 5.3, 4.2 and 2 mm) in comparing with queen excluder placed at the entrance of the hives, in addition the captured wasps were collected and counted weekly during experimental study extended from September until December 2015, and honeybee colony strength were measured.

1- Brood area (cm^2):

Data presented in table (1) showed that, the mean areas of sealed worker brood for tested honeybee colonies at end of experiment were 42.62, 49.20, 68.30, 39.13 and 47.69cm^2/colony for wire cages with holes/mm 7, 5.3, 4.2, 2 and queen excluder respectively. Statistical analysis indicated that there were no significant differences were found among all experimental colonies.

Table 1. Mean areas (cm^2) of sealed worker brood for experimental honeybee colonies during study period.

Treat. / Date	Wire cages holes / mm				Queen excluder
	7	5.3	4.2	2	
10-Sep	270.08	250.62	240.46	254.84	254.84
23-Sep	110.92	82.12	198.12	97.36	93.98
06-Oct	0	7.62	16.94	0	10.16
19-Oct	0	0	0	0	0
01-Nov	0	0	0	0	0
14-Nov	2.54	3.38	5.92	0	0
27-Nov	0	5.08	15.24	0	12.70
10-Dec	0	32.18	40.64	0	18.62
23-Dec	0	61.80	97.36	0	38.94
Mean	**42.62**	**49.20**	**68.30**	**39.13**	**47.69**

L.S.D. at 0.05= 45.753

2- Frames of bees:

Data in table (2) showed that, the mean number of combs covered with bees for tested colonies were 2.85, 4.33, 4.63, 2.81 and 2.96 comb/ colony for wire cages with holes/mm 7, 5.3, 4.2, 2 and queen excluder respectively. Statistical analysis indicated that there were no significant differences between the cages with holes 4.2 and 5.3mm. Also there were no significant differences among cages with holes 7, 2mm and queen excluder. While, there were clearly significant differences between cages with holes 4.2&5.3mm and other treatments.

Table 2. Mean numbers of combs covered with adult bees for experimental honeybee colonies during study period.

Treat. / Date	Wire cages holes / mm				Queen excluder
	7	5.3	4.2	2	
10-Sep	7.00	7.00	7.00	7.00	7.00
23-Sep	6.33	6.67	6.67	5.33	6.33
06-Oct	4.33	5.67	6.00	3.67	4.67
19-Oct	3.33	4.00	4.33	2.67	2.67
01-Nov	2.67	3.33	3.67	2.33	2.00
14-Nov	1.67	3.33	3.67	2.33	1.33
27-Nov	0.33	3.00	3.33	1.00	0.67
10-Dec	0.00	2.67	3.33	0.67	1.00
23-Dec	0.00	3.33	3.67	0.33	1.00
Mean	**2.85 b**	**4.33 a**	**4.63 a**	**2.81 b**	**2.96 b**

L.S.D. at 0.05= 1.14

3- Pollen area (cm^2):

Data presented in table (3) showed that, the mean areas of stored pollen grains for tested colonies were 21.4, 21.99, 22.01, 21.26 and 21.45cm^2/colony for wire cages with holes/mm 7, 5.3, 4.2, 2 and queen excluder respectively. Statistical analysis indicated that there were no significant differences were found among all experimental colonies.

Table 3. Mean areas (cm^2) of stored pollen grains for experimental honeybee colonies during study period.

Treat. / Date	Wire cages holes / mm				Queen excluder
	7	5.3	4.2	2	
10-Sep	88.90	93.98	99.06	104.14	91.44
23-Sep	69.42	61.80	48.26	41.48	51.64
06-Oct	25.40	24.56	24.56	36.40	21.16
19-Oct	5.51	2.97	5.92	6.78	9.32
01-Nov	3.38	0.20	0.84	2.54	5.08
14-Nov	0	0	0	0	0
27-Nov	0	0.43	1.70	0	2.54
10-Dec	0	4.65	4.24	0	5.08
23-Dec	0	9.32	13.54	0	6.78
Mean	**21.40**	**21.99**	**22.01**	**21.26**	**21.45**

L.S.D.at 0.05 = 17.399

Data recorded in tables 1, 2 and 3 observed that, cage with holes 4.2mm had the highest average of sealed worker brood areas, number of combs covered with adult bees, and the average of stored pollen areas, followed by cage with holes 5.3mm which allowed foraging bees at the same time an acceptable degree of protection of the wasps, after that the queen excluder which observed very weak in the strength of colonies with increased attacks by wasps, followed by cage with holes 7mm which gave the best holes for bee foraging but the bees were exposed to severe attacks from wasps when return from foraging ,while the cage with holes 2mm give the lowest numbers because high rates of death in foraging bees who can't pass from the cage.

4- Number of trapped wasps and its relationship to some climatic factors:

Data presented in table (4) showed that, the mean numbers of trapped wasps from three traps were 843.25, 2514.92, 2459.42 and 5.42wasps for months September, October, November and December respectively. Also the maximum average of captured wasps during the experimental period was 5761.33wasp/week which recorded in the beginning of November.

Table 4. Mean numbers of trapped wasps (*V. orientalis*) in relation with temperature and relative humidity.

Treat. / Date	Mean Wasps No.	Mean Temp. (C^o)	Mean R.H. (%)
08-Sep	597.67	29.74	54.50
15- Sep	844.33	30.11	59.71
22- Sep	917.33	30.26	42.86
29- Sep	1013.67	30.20	47.29
Mean	**843.25**	**30.08**	**51.09**
06-Oct	1442.33	27.13	57.43
13- Oct	2129.00	26.70	58.43
20- Oct	2993.00	26.26	62.43
27- Oct	3495.33	25.86	57.00
Mean	**2514.92**	**26.49**	**58.82**
03-Nov	5761.33	22.17	60.43
10-Nov	3163.00	20.76	70.43
17-Nov	823.33	20.89	67.14
24-Nov	90.00	20.23	67.14
Mean	**2459.42**	**21.01**	**66.29**
01-Dec	18.33	19.69	57.43
08- Dec	2.67	16.34	59.00
15- Dec	0.67	15.43	74.00
22- Dec	0.00	15.23	68.33
Mean	**5.42**	**16.67**	**64.69**

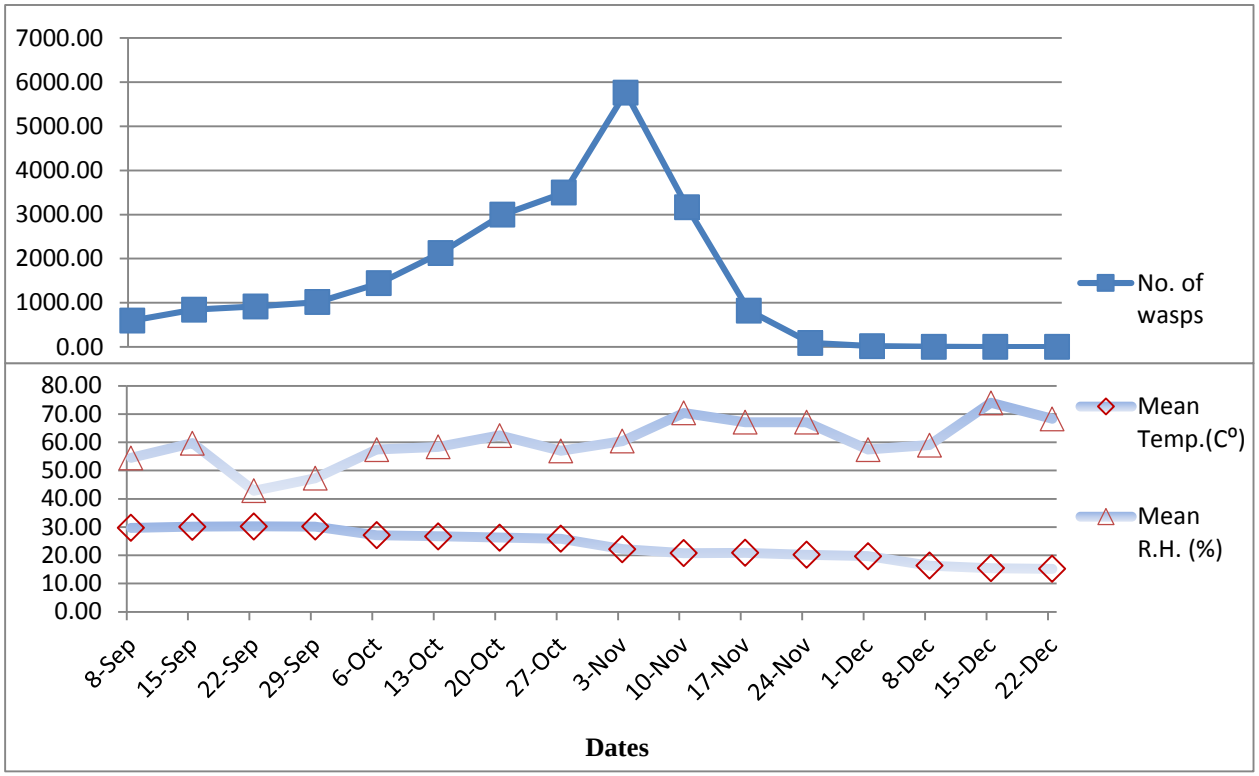

Fig.(3): Mean numbers of trapped wasps (*V. orientalis*) in relation with temperature and relative humidity (R.H.).

These results are agreement with **Khalil *et al.*, 2000**; **Gomaa&Abdel-Wahab, 2006; El-Bassioni *et al.*,2010 and El-Hady&Sanad,2014** whose stated that the population density of the oriental wasp *V. orientalis* was gradually increased to reach its peak of abundance in September, October and starts to fall down during November, and disappears in December.

The means of temperature were 30.08, 26.49, 21.01 and 16.67 C°, also means of relative humidity (R.H.) were 51.09, 58.82, 66.29 and 64.69 % for months September, October, November and December respectively.

From data recorded in table (4) and showed in fig (3) there is no relationship between number of wasps and some climatic factors like temperature and relative humidity in the autumn season.

Conclusion

The previous results showed a new technique to protect honeybee colonies from oriental wasp (*V. orientalis* L.) severe attacks through the autumn season of each year by covering the apiary by wired barrier with holes 4.2 which allows foraging bees and not allows to enter the wasps. While, wasp traps are placed outside the apiary to reduce the wasps number in the following year.

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تقنية جديدة لحماية طوائف نحل العسل من هجمات الدبور الشرقى بمنطقة الدقى- جيزة- مصر.

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قسم بحوث النحل- معهد بحوث وقاية النباتات- مركز البحوث الزراعية- جيزة- مصر

أجريت هذه الدراسة بهدف تقليل الخطر الناتج من هجمات الدبور الشرقي وذلك بوضع طوائف نحل العسل أسفل أقفاص سلكية ذات فتحات مختلفة الأقطار (7، 5,3، 4,2، 2 مم) ومقارنتها بإستخدام حاجز الملكات علي مداخل الخلايا خلال الفترة من شهر سبتمبر وحتي شهر ديسمبر 2015 وذلك بمنحل قسم بحوث النحل بالدقي.

تم قياس بعض أنشطة طوائف النحل (مساحات حضنة الشغالات المقفلة وعدد الأقراص المغطاة بالنحل و مساحات حبوب اللقاح المخزنة) وعلاقتها بعدد الدبابير التي تم إصطيادها بواسطة مصايد الدبور السلكية بإستعمال المحلول السكري المتخمر والعسل كمواد جاذبة للدبور.

وأوضحت النتائج ما يلي:

1- تفوق القفص السلكي ذو فتحات بقطر 4,2 مم حيث أعطي أكبر مساحة لحضنة الشغالات المقفلة بمتوسط (68,3 سنتيمتر مربعة/طائفة) وأعلي عدد من البراويز المغطاة بالنحل بمتوسط (4,63 برواز/طائفة) كما أعطي أفضل مساحة لحبوب اللقاح المخزنة حيث بلغ المتوسط (22,01 سنتيمتر مربعة/طائفة) مقارنة بالأقفاص السلكية الأخري وحاجز الملكات علي ابواب الخلايا.

2- كان أعلي متوسط اسبوعي للدبابير المصادة خلال فترة التجربة 5761,33 دبور في بداية نوفمبر.

3- كان أعلي متوسط شهري للدبابير المصادة خلال شهري أكتوبر ونوفمبر حيث بلغ 2514,92 ، 2459,42 دبور علي التوالي.

التوصية:-

ومن النتائج السابقة قد أمكن التوصل إلي تقنية جديدة لحماية المناحل الموجودة في المناطق الموبؤة بدبور البلح (الدبور الشرقي) والذي يهاجم طوائف النحل بشراسة خلال فصلي الصيف والخريف من كل عام عن طريق تغطية المنحل بحاجز سلكي ذو فتحات 4,2 والذي يسمح بسروح النحل ولا يسمح بدخول الدبور مع وضع مصائد للدبابير خارج المنحل للحد من اعداد الدبابير في العام التالي.