
Rearing honeybee queens in, *Apis mellifera* L. colonies during the activity season of oriental wasps *Vespa orientalis* L.

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The following parameters were measured for the virgin queens during their rearing and production process in the Vespa wasps season; August, September and October months; mean queen weight and mean no. of queen ovarioles. The following races and hybrids were conducted for this study; Egyptian race, Carniolian race, Carniolian hybrid and Italian hybrid. The results indicated that, in august with low activity of Vespa wasps Carniolian hybrid was recorded the highest values of all parameters and followed by Italian hybrid, Carniolian race and Egyptian race, respectively. Whereas in September month with gradually increased the activity of wasps all parameters were decreased in all races and hybrid. On the other hand with high activity of wasps in October month, the parameters were sharply decreased in Carniolian hybrid and Italian hybrid followed by Carniolian and Egyptian races, respectively.

Introduction

Honeybee queens are play an important role in controlling for the population of colonies, and it's influence on workers activity through the queen pheromones (Al-Ghzawi and Zaitoun, 2008). Queen rearing is consider an essential step in the improvement of beekeeping and bee stocks (El-Enany, 2010). The economic characteristics of honeybee colonies are stand on queen quality which depend on environmental conditions and heredity differences (Taha, 2005). Whereas the fertility of queens can be associated with the physiological activities which reflect on queens productivity (Abdel- Fattah *et al.*, 2007). The quality of produced queens are depends on heredity differences and environmental condition seasons and natural enemies. One of the most important of bee colonies enemy is oriental wasps *Vespa orientalis* which reflected on the honeybee colony characteristics and activities that serious enemies of honeybees and causes considerable damages (Ahmed, 2014). The population dynamics of hornets are seasonally fluctuated according to several environmental factors (Ibrahim, 2009). The Vespa wasps activity are effect on all honeybees activity specially queen rearing which get negative influenced on honeybee colonies activity (Marzouk, 2013). The present study aimed to study the

influence of oriental wasp's activity on the rearing and production of honeybee queens during the autumn season in August, September and October months.

Materials and Methods

The present study was conducted during the active months of oriental wasps (*Vespa orientalis*); August, September and October months in 2015 at the apiary of the Agricultural Experiment Station, Faculty of Agriculture, Cairo University.

Twelve honeybee colonies were used for this study. The colonies were represented the following races and hybrids of bees (three colonies each); Carniolian race from Manzala region, Dakahlia governorate, Egyptian race from Manfalout region, Assiut governorate and Carniolian and Italian hybrids. The queens of the tested colonies were newly open mated and the colonies were equal in strength and exposed to the routine work during the experimental period.

The technique used for rearing newly emerged virgin queens during the experimental period (August, September and October months based on the grafted method of (Laidlaw, 1975). Before grafting the larvae of about 24hrs. the mated queens were removed from the rearing colonies, then there were queenless builder colonies. The introduced larval queen cells to the queenless builder colonies were grafted from the same genetic origin of rearing colonies in bee wax cups fixed on wooden bars hanging in the rearing frame. Each frame contained 45 grafted queen cells (Moretto *et al.*, 2004).

The following parameters were recorded for each reared frame for each race and hybrid under the activity of *Vespa orientalis* in August where the wasps begin at low activity and in September and October during the high activity of wasps to detect the effect of the presence *Vespa* wasps on the quality of queen production reared by tested colonies:

1. Mean acceptance % of larvae/month/race and hybrid.
2. Mean % of newly emerged queen cells/month/race and hybrid.
3. Mean size (cm./queen) of the sealed queen cells/month/race and hybrid.
4. Mean weight of newly emerged virgin queens (less than 24 hrs.) /month/race and hybrid.
5. Mean number of ovarioles/queen/month/race and hybrid.

Data obtained were subjected to the appropriate statistical analysis according to Snedecor and Cochran (1980). Treatment means were compared using the Least Significant Difference (LSD) at 5% level of probability. The statistical analysis system (SAS) computer program version 6.12 was used to perform the statistical analysis.

Results and Discussion

As shown in Fig. (1) there were clear differences in the larval acceptance percentage between different races and hybrids during the season of *Vespa* wasps activity during the experimental period. The Carniolian and Italian hybrids recorded the highest value of acceptance percentage during low wasps activity in August. Whereas Carniolian and Egyptian races showed the lowest mean acceptance percentage. During September month while the activity of wasps increased gradually, the mean of acceptance percentage clearly decreased in all experimental races and hybrids of bees. Sharply decreased in the acceptance percentage were detected in all races and hybrids under experimentation in October month where the highest activity of *Vespa* wasps were observed.

Data presented in table (1) showed clearly significant differences between different races and hybrids, in August during the beginning of low wasps activity. The highest mean of cell queen size was found in Carniolian and Italian hybrids. The values were; 2.04cm/ queen cell and ranged between (1.96 to 3.85cm/ queen cell) and 2.01cm/ queen cell and ranged from (1.92 to 2.71cm/ queen cell), respectively. While the lowest mean value of cell queen size was recorded in Carniolian and Egyptian races. The values were 1.96cm/ queen cell and ranged between (1.88 to 2.46cm/ queen cell) and 1.51 cm/ queen cell and ranged between (1.15 to 1.71cm/ queen cell), respectively.

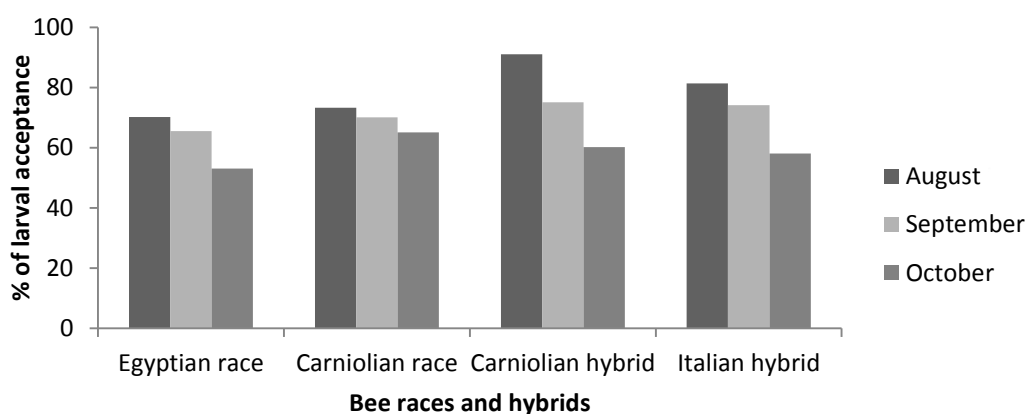


Fig 1. Mean of larval acceptance percentage of different races and hybrids during the active season of *Vespa* wasps in August, September and October months.

As shown in table (1) the values of cell queen size were clearly decreased in all races and hybrids of bees, when the high activity of wasps was observed during September month. The mean value of all size in Italian hybrid was 1.44 cm/ queen cell and ranged from (1.22 to 1.65cm/ queen cell) and for Carniolian hybrid was 1.52 cm/ queen cell and ranged

between (1.45 to 1.85cm/ queen cell). On the other hand, the lowest mean value was detected in Carniolian and Egyptian races where the values were 1.21cm/ queen cell and ranged between (1.18 to 1.90cm/ queen cell) and 1.10 cm/ queen cell and ranged between (0.92 to 1.32cm/ queen cell), respectively.

Sharply decreased in the mean value of cell queen size was found in all races and hybrids of bees under experimentation during high activity of wasps in October month. The mean value in Italian and Carniolian hybrids were 1.04 cm/ queen cell and ranged from (0.96 to 1.15cm/ queen cell) and 1.32 cm/ queen cell and ranged from (1.11 to 1.37cm/ queen cell), respectively. Whilst, in Carniolian and Egyptian races the values were 1.01 cm/ queen cell and ranged between (0.91 to 1.15cm/ queen cell) and 0.90cm/ queen cell and ranged between (0.71 to 1.01cm/ queen cell), respectively at data presented in table (1).

The Data in Table (1) also indicated that, the highest mean percentage of newly emerged virgin queens in August month during low wasps activity was found in Carniolian hybrid and followed by Carniolian race which recorded 94.37% and ranged between (89.15 to 97.05%) and 82.50% which ranged between (79.04 to 85.15%), respectively. While the lowest mean value was recorded in Italian hybrid and Egyptian race, the values were 77.37% and ranged between (69.22 to 78.17%) and 63.10% which ranged between (59.41 to 66.20%), respectively.

With increasing the activity of *Vespa* wasps, the values of newly emerged virgin queen percentage were clearly decreased in all races and hybrids of bees. The highest mean values of percentage of newly emerged virgin queens was found in Carniolian hybrid and followed by Carniolian race which recorded 83.72% and ranged between (79.65 to 86.37%) and 77.31% which ranged between (74.22 to 78.52%), respectively. While the lowest mean value was recorded in Italian hybrid and Egyptian race, the values were 63.72% and ranged between (58.23 to 66.31%) and 59.04% which ranged from (49.32 to 62.31%), respectively as presented data in table (1).

The lowest mean value of newly emerged virgin queen percentage was found in all races and hybrids of bees under experimentation during higher activity of wasps in October month. The mean value of all mean percentage of newly emerged virgin queens in Carniolian and Italian hybrids was recorded as 70.19% and ranged between (68.32 to 72.46%) and 55.19% which ranged between (48.31 to 57.20%), respectively. While the lowest mean value was recorded in Carniolian and Egyptian races, the values were 54.70% and ranged between (51.18 to 56.46%) and 40.10% which ranged between (37.65 to 41.37%), respectively as shown in table (1).

Table 1. Mean queen cell size and percentage of newly emerged virgin queens (less than 24 hrs.) of different races and hybrids during the active season of *Vespa* wasps in August, September and October months.

Months	Bee races and hybrids							
	Egyptian race		Carniolian race		Carniolian hybrid		Italian hybrid	
	Cell size (cm/ queen cell)	Newly emerged queens %	Cell size (cm/ queen cell)	Newly emerged queens %	Cell size (cm/ queen cell)	Newly emerged queens %	Cell size (cm/ queen cell)	Newly emerged queens %
August	1.51a	63.10 a	1.96 a	82.50 a	2.04 a	94.37 a	2.01 a	77.37 a
September	1.10 b	59.04 b	1.21 b	77.31 b	1.52 b	83.72 b	1.44 b	63.72 b
October	0.90 b	40.10 c	1.01 c	54.70 c	1.32 c	70.19 c	1.04 c	55.19 c

Measurements that followed by the same letter in the same column were not significant according to Duncan's multiple range test at 0.05

Data in table (2 and 3) showed that, the mean queen weight and the mean no. of ovarioles/ queen during the active season of *Vespa* wasps of August, September and October months for all races and hybrids. High mean values were recorded in all races and hybrids during August where low activity of wasps was found. Carniolian and Egyptian races indicated the lowest mean weight/ queen as 153.33mg/ queen and ranged between (148.32 to 155.40mg/ queen) with highest mean of ovarioles as 211.83/ queen and ranged between (204.50 to 214.75/ queen) in Carniolian race. While the Egyptian race showed mean weight as 140.83mg/ queen and ranged from (137.01 to 142.51mg/ queen) with mean no. of ovarioles as 205/ queen and ranged between (198.42 to 207.01/ queen). On the other hand, Carniolian and Italian hybrids recorded the highest mean weight of queen and mean no. of ovarioles/ queen. The values were 161.67mg/ queen and ranged between (159.63 to 164.40mg/ queen), 250.25/ queen and ranged between (248.37 to 258.41/ queen) and 157.50mg/ queen and ranged between (148.32 to 159.51mg/ queen), 243.75/ queen and ranged between (237.63 to 248.32/ queen), respectively.

Data presented in table (2 and 3) showed that, the mean weight/ queen and the mean no. of ovarioles were decreased gradually in all races and hybrids in September month under high activity of wasps. In Carniolian race the values were 121.22mg/ queen and ranged between (117.40 to 124.47mg/ queen) and 198.47/ queen which ranged between (191.49 to 201.47/ queen), while in Egyptian race 100.50mg/ queen and ranged between (96.32 to 102.40mg/ queen) and 189.32 which ranged between (182.52 to 194.40/ queen). Whereas in Carniolian hybrid the values were 146mg and ranged between (141.40 to 150.00mg/ queen) and 221.40/ queen which ranged between (218.52 to 230.40/ queen), while in Italian hybrid 132.56mg and ranged between (127.40 to 136.32mg/ queen)

and 215.63/ queen which ranged between (207.38 to 220.51/ queen). The lowest values for mean queen weight and mean no. of ovarioles were detected during high activity of wasps in October month in all bee races and hybrids. In Carniolian race the values were 111.40mg/ queen and ranged between (99.32 to 114.50/ queen) and 188.50/ queen which ranged between (178.56 to 190.32/ queen), while in Egyptian race 98.01mg and ranged between (89.01 to 100.47mg/ queen) and 190.56/ queen which ranged between (187.83 to 197.51/ queen). Whereas in Carniolian hybrid the values were 125.63mg/ queen and ranged between (120.25 to 127.53mg/ queen) and 201.83/ queen which ranged between (197.56 to 204.32/ queen), while in Italian hybrid 119.56mg/ queen and ranged between (109.63 to 121.56mg/ queen) and 200.32/ queen which ranged between (191.75 to 204.50/ queen).

Table 2. Mean weight (mg/ queen) of virgin queens (less than 24 hrs.) and mean no. of ovarioles of Egyptian and Carniolian races during the active season of Vespa wasps in August, September and October months.

Months	Bee races			
	Egyptian race		Carniolian race	
	Mean queen weight/ queen	No. of ovarioles/ queen	Mean queen weight/ queen	No. of ovarioles/ queen
August	140.83 a	205.00 a	153.33 a	211.83 a
September	100.50 b	189.32 b	121.22 b	198.47 b
October	98.01 b	190.56 b	111.40 c	188.50 c

Measurements that followed by the same letter in the same column were not significant according to Duncan's multiple range test at 0.05

Table 3. Mean weight (mg/ queen) of virgin queens (less than 24 hrs.) and no. of ovarioles of Carniolian and Italian hybrids during the active season of Vespa wasps in August, September and October months.

Months	Bee hybrids			
	Carniolian hybrid		Italian hybrid	
	Mean queen weight/ queen	No. of ovarioles/ queen	Mean queen weight/ queen	No. of ovarioles/ queen
August	161.67 a	250.25 a	157.50 a	243.75 a
September	146.00 b	221.40 b	132.56 b	215.63 b
October	125.63 c	201.83 c	119.56 c	200.32 c

Measurements that followed by the same letter in the same column were not significant according to Duncan's multiple range test at 0.05

From the results it could be suggested that, the presence of Vespa wasps during the production of honeybee queens in bee colonies may be considered one of the most factors affecting the quality of the queens in all tested races and hybrids. At the beginning of the wasps activity low effects were recorded in the quality of the produced queens. With increasing the activity of the wasps during September and October months, the effects were clearly detected in all parameters of the produced queens. It could be

also concluded that, decreased the quality of produced queens under wasps conditions may be due to the most of the workerbees were under stress for defence their nest against the attacking wasps. So the workers gave low attentions to the queens during their rearing and production. *Vespa* wasps during Autumn season (August, September and October months) is considered one of the most problems against queen rearing and production during this time in Egypt. The present results were confirmed with Brar *et al.*, (1985) reported that, the *Vespa* wasps attacked honeybee colonies from July to December, with peak population in August to October. Li (2000) who said that, in autumn maybe under fertilized due to low temperatures and thus don't performed well at egg laying. Zohairy (2001) stated that the mean weight of produced queens were decreased at August and September. Mustafa *et al.*, (2002) found that under Giza governorate the mean weight of virgin queens 150.93mg in Carniolian hybrid in autumn season. Taha (2005) showed that the mean percentage of accepted queen cells was affected by nectar and pollen source and showed high significant positive correlation between mean weight of newly emerged queens with different races and hybrids. Abdel- Fattah *et al.*, (2007) cleared that better numerous virgin queens and percentage of emerged queens could be successfully reared during summer and spring seasons than those reared during autumn season. Ibrahim (2009) found that during the activity of *Vespa* wasps the honeybee colonies were affected in all its activity specially during autumn season. Abd Al-Fattah and Ibrahim, (2009) found that, by the beginning on November, hornet numbers decline and disappear by the second week of December. Costa *et al.*, (2012) found that, the activity of *Vespa* wasps effect on the amount of reared brood in honeybee races and hybrids, so the bee population of the colony. Marzouk (2013) stated that the activity of wasps are low in spring and early summer and then increased gradually during late summer and reach the maximum peak of abundance during autumn season. During the period from August to November the demand of hornet for food is greatest and bee colonies are greater risk.

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