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# STUDIES ON SOME BEHAVIOUR CHARACTERS OF HONEY BEE RACES

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## ABSTRACT

The present work aimed to study: 1- Effect of colors on aggressiveness of honeybee races. 2- Hygienic behaviour in the laboratory tests and the colony as indication of controlling of brood disease and varroa mite. 3- Relationship between aggressiveness and hygienic behaviour. 4-Ggrooming behaviour, and experience of the bees for removed disease brood as quickly by mixed some races to another colony races which the bees didn't learn the behaviour.

The results obtained showed that, the Egyptian honeybee colonies showed the severest aggressiveness and the Carniolan hybrid and Italian colonies show more aggressiveness than the other colonies of pure races. The races of honeybee colonies showed that, the severest aggressiveness to red and purple colors but the inferior aggressiveness to white and yellow colors. Highest value of hygienic bahaviour was in Egyptian colonies followed by F1 Italian and F1 Carniolan colonies but the lowest value was in Carniolan colonies.

The relationship between aggressive behaviour and hygienic behaviour in the honeybee colonies, showed that Egyptian honeybee colonies caused high aggressive behaviour (93.61%) and hygienic behaviour (94.79%), on the contrary the Italian honeybee colonies caused aggressive behaviour (17.23%) and hygienic behaviour (47.52%).

There was a positive correlation between aggressive behaviour and hygienic behaviour for the honeybee races in the experiments.

Highest grooming behaviour was found in Egyptian race, followed by Italian hybrid, Carniolan hybrid. On the contrary, the lowest grooming behaviour was found in Carniolan and Italian race. While addition Egyptian sealed worker brood in the other colony races, the debris mites maybe occurred as a result of attacking this mite by mandibles of workers bees and this behaviour (grooming behaviour) is more of F1 Italian and F1 Carniolan.

On the other hand addition Egyptian sealed worker brood in Carniolan, Italian, F1 Carniolan and F1 Italian colonies caused increase of resistance mechanism to Varroasis reached 14.21, 27.3, 28.57 and 26.32%, respectively.

## INTRODUCTION

Behaviour characters of worker bees varied according to the honeybee races and the colony states. The behaviour characters on worker honeybee colonies were studies, hygienic, grooming and aggressive behaviour.

Aggressive behaviour in honeybee workers as regulated by alarm pheromone components, which released by adults, dispense within the hive to let the bees less inclined to sting. Worker honeybee sting is an important aspect of honeybee behaviour aggressiveness. Peoch 1981, investigated effect Nassanov gland secretion reduced aggressiveness. Drum and Rothenbuhler 1984, studies effect of temperature in stinging behaviour.

Chahal *et al.* 1986, studies of aggressive behaviour at a feeding dish. Hamed 1998, studies effect of feeding, smoking and queenless on aggressive behaviour.

Hygienic behaviour is a measure of how fast a colony of bees cleans out of dead brood. Bees have many different mechanisms for resistance to mite and disease. They believed that the hygienic behaviour is controlled by 20-30 genes (Kefuss *et al.* 1996).

Tests of honeybee hygienic behaviour measured by four methods, the freeze killed brood comb by a comb section of sealed brood containing 100 cells is cut from a frame and frozen for 24 hours, then the frozen comb sections inserted in the tested colonies, killing the brood by liquid nitrogen to freeze a section of sealed brood within the frame, the pierced brood by inserting a thin pin through brood covered by wax capping and recorded the time requested for colonies to remove the pierced brood. Dry ice, freezing sealed brood by placed chunks of dry ice directly on the brood (Spivak and Reuter 1998).

Honeybees hygienic behaviour is considered as mechanism of tolerance for many disease. It includes the uncapping of the cells and the removal of dead or damaged brood from the colonies (Palacio *et al.* 2001).

Grooming behaviour is ability of honeybees to eliminate mites that parasitize adult bees (Boecking and Spivak 1999). Also the greater tolerance of Africanized bees for *Varroa jacobsoni* (Moretto and Mello, 2000).

Grooming behaviour of *Apis mellifera Syriaca* provides evidence of active mechanisms of resistance towards the parasitic Varroa mites (Zaitoun et al 2001). Bee experience determined whether hygienic behaviour could be modified by learning (Trump *et al.* 1967).

## MATERIALS AND METHODS

The experiments was carried out throughout activity season 2004 to 2005 in Beekeeping Research Department, Plant Protection Research Institute, Dokki, Giza.

Fifteen honeybee colonies were divided as follows: Egyptian pure race, Italian pure race, Carniolan pure race and the crosses of the two latters open mating with drones, to processed F1 Italian Hybrid and F1 Carniolan Hybrid. Each group of the race contained of three replicates.

**1- studies of aggressive behaviour:**

Seven balloons of different colors were filled with pressed cotton. The balloons colors were red, green, orange, yellow, white, blue and purple. The seven balloons were fastened together through separate cotton threads to along metal rod. These collections of balloons were used to excite the bees in the replicate colonies of the different races and hybrids according to the following steps.

The outer cover of the hive was removed and left for two minute to alert the bees. Balloons were moved pendolically four times over the colony to

excite it. After the balloons were attacked, the stings were counted on each balloon color. The process was repeated on all the experiments.

**2- Test of hygienic behaviour in cages**:

The worker sealed brood combs from each experimental colonies (Camiolan, Italian, Egyptian and their hybrid). The brood combs on each group were kept separately in an incubator at 33°c and 70% R.H, until worker emergency. 300 newly emerged worker from each treatment were collected and kept in three wooden cages (21×10×13cm), provided with sugar syrup 66%Conc. (Abou El-Enain 2005).

Cages in each test contained a piece of comb with about 50 sealed worker brood cells were punctured with pin to kill the pupa inside cells and a fixed to the back cage (Milne, 1982). After 72 hours the cleaned cells with bees (uncapping and/or removing pupa) were counted and recorded in all cages experimental. The rate of cleaning was calculated according to Khatter (1998) as the following formula:

$$\% \text{ Cleaned cells} = \frac{C1 - C2}{C1} \times 100$$

C1 = Number of total capped brood cells.

C2 = Number of total uncapped brood cells after cleaning with bees and/or removing pupa after 72 hours from cleaning with bees.

**3- Test of hygienic behaviour in bee colonies:**

A sealed brood comb was taken out from each experimental colonies after shaken off within each hive, 150 sealed brood cells were punctured with pin to kill the brood inside cells and the comb was return to its colony again. The rate of cleaning was calculated after 24 hours according to Milne (1982).

**4- Grooming behaviour by using mechanism of resistance to Varroasis:**

The experimental colonies were divided as follows: Carniolan, Italian, Egyption and their hybrid colonies. The honey bee colonies were infested by Varroa mite with relatively similar strength (7combs covered from both sides with adult workers each) was selected. Each colony headed by a prolific queen of nearly the came age as those of the other colonies. Each colony from experimental race was provided with one sealed brood comb from Egyptian colony, the experimental colonies on each group were covered the hive floor with plastic sheet coated with thin layer of Vaseline to capture the fallen Varroa mite individuals. Before and after 14 day from provided one worker sealed brood comb to the experimental colonies, the naturally fallen mites live and dead on the bottom board, which covered with a sheet of plastic were collected after 24 hours. The fallen dead mites were carefully examined for detecting the injured legs or bodies of mites so called debris Varroa, which caused by grooming behaviour of bees under dissecting microscope (Abdel-Rahman, 2004). The colonies that clearly showed high percentages of damaged mites were considered as tolerant colonies with high degree of grooming behaviour (Flottum, 1997).

## RESULTS AND DISCUSSION

**1- Effect of honey bee workers races on defensive behaviour:**

Table (1) show that, the mean number of stings was 5.12, 3.62 and 19.66 for the Carniolan and Italian honeybee workers, respectively. The Egyptian honeybee workers significantly surpassed of defensive behaviour of Carniolan and Italian workers but there was insignificant between Carniolan and Italian workers.

The mean number of sting from the hybrid workers were 10.86 and 11.29 in F1 Carniolan, F1 Italian and there was insignificant between both the hybrids.

It could be concluded that, the Egyptian honeybee colonies significantly showed the severest aggressiveness and the hybrid colonies Carniolan and Italian show more aggressiveness than the colonies of their pure races.

**2- Effect of colors on defensive behaviour of workers:**

Table (1) show that, the mean number of stings from the worker honeybee maybe arranged descandingly as follows: 15.41, 14.49, 10.96, 8.44, 7.35 and 5.78 in the purple color, red color, blue color, green color, white color and yellow color, respectively.

It could be concluded that, all races of colonies showed that, the severest aggressiveness to red and purple colors, but the inferior aggressiveness to blue, green, orange, white and yellow color, respectively.

**3- The hygienic behaviour of workers after killed the brood in sealed cells inserted in the colony:**

Table (2) show that, uncapping or uncapping and removing killed pupa (hygienic behaviour) between the tested colonies after 24 hours.

The present value of hygienic behaviour maybe arranged descendingly as follows: 94.79, 86.83, 77, 74.52 and 70.67 in Egyptian, F1 Italian, F1 Carniolan, Italian and Carniolan, respectively.

On the other hand, the highest value of hygienic behaviour was in Egyptian colonies followed by F1 Italian and F1 Carniolan but the lowest was in Carniolan colonies. This results similar with **Cosenza and Silva (1972)**, who found that the African bees had removed 100% of sealed dead broad inserted in the hive after 86 hours (hybrids 99.21% and Caucasian 85.9%) and coincide with **Abdel-Rahman (2004)**.

**4- The relationship between aggressive and hygienic behaviour in the colony:**

Table (3) and Fig (1) show that, the Carniolan honeybee colonies caused aggressive behaviour was 24.38% and hygienic behaviour was 70.67% with an increase of 65.5% for hygienic behaviour. Italian honeybee colonies caused aggressive behaviour was 17.23% and hygienic behaviour was 47.52% with an increase of 63.47% for hygienic behaviour. Egyptian honeybee colonies caused aggressive behaviour was 93.61% and hygienic behaviour was 94.79% with an increase 1.24%. F1 Carniolan caused

aggressive behaviour was 51.41% and hygienic behaviour was 77% with an increase of 33.23%. F1 Italian caused aggressive behaviour was 53.76% and hygienic behaviour was 86.23% with an increase of 37.66%.

It could be concluded that, there was appositive correlation between aggressive behaviour and hygienic behaviour for honeybee races in the experiments.

**5- The hygienic behaviour of worker honeybees after killed the brood in sealed cells inserted in the cages:**

Table (4) show that, the highest percent of hygienic behaviour maybe arranged descendingly as follows: 78.05, 66.74, 62.75, 61.57 and 58.49, for Egyptian, F1 Italian, F1 Carniolan, Italian and Carniolan, respectively. This result similar with Milne (1982), when investigated the relationship between uncapping and removing behaviour in test cages.

**6- Grooming behaviour by mechanism of resistance to Varroasis:**

Table (5) show that, average number of fallen dead Varroa mites before addition one Egyptian sealed worker brood comb were 3.33, 4.67, 5.33 and 5.67 in Carniolan, Italian, F1 Carniolan and F1 Italian colonies, respectively. While the average number of fallen dead Varroa mites after addition Egyptian sealed worker brood comb were 4.33, 5.67, 6.67 and 8.33 in Carniolan, Italian, F1 Carniolan and F1 Italian colonies, respectively.

On the other hand, the average number of debrised Varroa mites before addition one Egyptian sealed worker brood comb were 0.67±0.33, 1±0.58, 1.33±0.67 and 1.67±1.2 in Carniolan, Italian, F1 Carniolan and F1 Italian colonies, respectively. While the average number of debrised Varroa mites after addition Egyptian sealed worker brood comb were 1±0.58, 1.67±0.33, 2.33±1.45 and 3.33±1.86 in Carniolan, Italian, F1 Carniolan and F1 Italian colonies, respectively.

Table (6) and fig (2) show that, addition one sealed brood comb from Egyptian bee colonies in Carniolan, Italian, F1 Carniolan and F1 Italian colonies lead to increase number of fallen and debris of Varroa mite on the bees (mechanism of resistance to Varroasis).

Meanwhile, addition sealed brood comb from Egyptian bee colonies in each Carniolan colonies caused increase with 23.09 and 59.88% for both fallen Varroa and debris Varroa, while it reached mechanism of resistance to Varroasis with 14.21% increase. On the other hand, provided the Italian colonies with one Egyptian sealed worker brood comb caused increase with 17.63 and 67% for both fallen Varroa and debris Varroa, while it reached mechanism of resistance to Varroasis with 27.3% increase.

Also, addition one Egyptian sealed worker brood comb in F1 Carniolan colonies caused increase with 20.09 and 42.91% for both fallen Varroa and debris Varroa, while it reached 28.57% increase of resistance mechanism to Varroasis. The corresponding, addition one Egyptian sealed worker brood comb in F1 Italian colonies caused increase with 31.93 and 49.84% for both fallen Varroa and debris Varroa, while it reached 26.32% increase of resistance mechanism to Varroasis. The results coincide with Thakur *et al.* (1996).

It could be concluded that, the addition one Egyptian sealed worker brood comb in Carniolan, Italian, F1 Carniolan and F1 Italian colonies caused increase of resistance mechanism to Varroasis reached 14.21, 27.3, 28.57 and 26.32%, respectively.

**Table (1): Average number of stings of honeybee races and their hybrids according to noticed colors.**

| colors | Carniolan | Italian | Egyptian | F1 Carniolan | F1 Italian | Mean |
|---|---|---|---|---|---|---|
| Red | 7.5 ±0.56 | 7.34±0.96 | 28.6±1.85 | 13.42±2.53 | 15.61±2.15 | 14.49±3.88 |
| White | 4.16±0.92 | 1.1±0.62 | 16.13±2.14 | 6.25±1.67 | 9.12±1.41 | 7.35±2.56 |
| Yellow | 0.45±0.37 | 1.84±0.39 | 11.19±2.05 | 9.22±3.46 | 6.21±1.12 | 5.78±2.06 |
| Green | 5.41±0.71 | 3.3±0.76 | 13.9±2.65 | 10.44±2.72 | 9.16±3.15 | 8.44±1.86 |
| Blue | 5 ±0.22 | 2.93±0.87 | 19.21±2.17 | 15.36±3.81 | 12.31±1.61 | 10.96±3.08 |
| Purple | 8.3 ±0.39 | 6.6±0.55 | 31.51±2.63 | 13.12±1.67 | 17.51±4.12 | 15.41±4.45 |
| Orange | 4.59 ±0.81 | 2.2±0.58 | 17.06±1.21 | 8.26±1.45 | 9.16±1.28 | 8.25±2.53 |
| Mean | 5.06±0.95 | 3.62±0.91 | 19.66±2.86 | 10.86±2.38 | 11.29±0.423 | |

L.S.D. for races at 0.05 = 4.17 L.S.D. for colors at 0.05 = 3.95

**Table (2): Hygienic behaviour on sealed brood cells after killed brood in the colony.**

| Hygienic behaviour after 24 hours | | | |
|---|---|---|---|
| Treatments | Uncapping behaviour | Uncapping and removing brood | Hygienic behaviour(%) |
| Carniolan | 78.67±5.77 | 62.67±9.59 | 70.67 |
| Italian | 81.63±7.96 | 67.42±8.21 | 74.52 |
| F1 Carniolan | 86.33±6.12 | 67.67±13.59 | 77 |
| F1 Italian | 89.33±2.91 | 84.33±4.63 | 86.83 |
| Egyptian | 97.82±4.61 | 91.76±5.18 | 94.79 |

L.S.D. for Hygienic behaviour at 0.05 = 6.18

**Table (3): The relationship between aggressive behaviour and hygienic behaviour.**

| Treatments | Aggressive behaviour(%) | hygienic behaviour(%) | Increase of hygienic behaviour(%) |
|---|---|---|---|
| Carniolan | 24.38 | 70.67 | 65.5 |
| Italian | 17.23 | 47.52 | 63.74 |
| Egyptian | 93.61 | 94.79 | 1.24 |
| F1 Carniolan | 51.41 | 77.00 | 33.23 |
| F1 Italian | 53.76 | 86.23 | 37.66 |

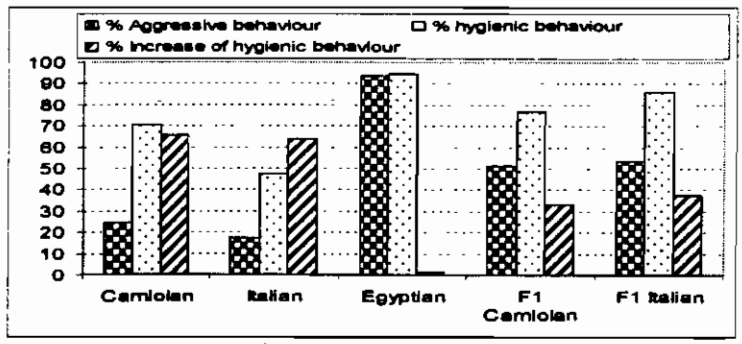


**Fig (1): The relationship between aggressive behaviour and hygienic behaviour in different races and their hybrid.**

**Table (4): Hygienic behaviour on sealed brood cells after killed brood in cages.**

| Treatments | Hygienic behaviour after 72 hours | | |
|---|---|---|---|
| | Uncapping behaviour | Uncapping and removing brood | Hygienic behaviour |
| Carniolan | 65.54±9.66 | 51.44±6.88 | 58.49 |
| Italian | 66.71±7.13 | 56.42±9.18 | 61.57 |
| F1 Carniolan | 69.63±4.15 | 55.88±4.17 | 62.75 |
| F1 Italian | 72.35±8.14 | 61.12±9.55 | 66.74 |
| Egyptian | 83.46±6.23 | 72.63±5.41 | 78.05 |

L.S.D. for Hygienic behaviour at 0.05 = 4.59

**Table (5): Grooming behaviour before and after addition Egyptian sealed worker brood in colonies Carniolan, Italian and their hybrids.**

| Treatments | No. of fallen Varroa before added Egyptian bees | | | No. of fallen Varroa after added Egyptian bees | | |
|---|---|---|---|---|---|---|
| | Fallen Varroa | Debris Varroa | %of Debris Varroa | Fallen Varroa | Debris Varroa | %of Debris Varroa |
| Egyptian | 6.33±2.19 | 2.33±.088 | 36.81 | -- | -- | -- |
| Carniolan | 3.33±0.81 | 0.67±0.33 | 19.81 | 4.33±1.33 | 1±0.58 | 23.09 |
| Italian | 4.67±2.18 | 1±0.58 | 21.41 | 5.67±1.76 | 1.67±0.33 | 29.45 |
| F1 Carniolan | 5.33±1.45 | 1.33±0.67 | 24.95 | 6.67±1.2 | 2.33±1.45 | 34.93 |
| F1 Italian | 5.67±1.67 | 1.67±1.2 | 29.45 | 8.33±0.33 | 3.33±1.86 | 39.97 |

**Table (6): Mechanism of resistance to Varroasis as resultant before and after addition Egyptian bee in Carniolan, Italian and their hybrids.**

| Treatments | % Increase of fallen Varroa | % Increase of debris Varroa | % Mechanism o esistance to Varroasis |
|---|---|---|---|
| Carniolan | 23.09 | 59.88 | 14.21 |
| Italian | 17.63 | 67.00 | 27.30 |
| F1 Carniolan | 20.09 | 42.91 | 28.57 |
| F1 Italian | 31.93 | 49.84 | 26.32 |

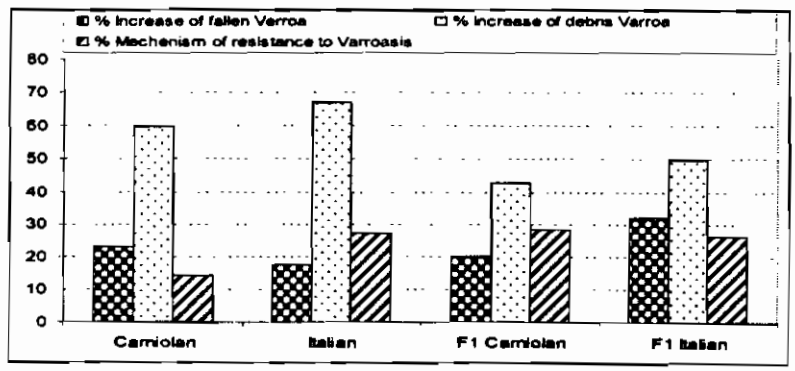


**Fig (2): Mechanism of resistance to Varroasis as resultant before and after addition Egyptian bee in Carniolan, Italian and their hybrids.**

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## دراسات علي بعض الصفات السلوكية في سلالات نحل العسل

**حمدي طاهر أبو الغنين**

**قسم بحوث النحل - معهد بحوث وقاية النباتات - مركز البحوث الزراعية – دقي – جيـزة – القاهرة.**

اجري هذا البحث في منحل قسم بحوث النحل بالدقي عـامي ٢٠٠٤-٢٠٠٥ بهـدف دراسـة بعـض الصفات السلوكية في بعض سلالات نحل العسل (المصري والكرنيولي والايطالي النقية) كذلك الهجين الاول الكرنيولي والهجين الاول الايطالي، ومن هذة الصفات تأثير بعض الالوان علي صفات الـشراسة، ودراسـة السلوك الصحي في المعمل وفي طوائف نحل العسل كمؤشر لمكافحة بعـض الامـراض و خاصـة طفيـل الفاروا، ودراسة العلاقة بين صفة الشراسة وتأثيرها علي السلوك الصحي في طوائف نحل العسل ومن ناحية اخري اهتمت الدراسة بسلوك التنظيف ومقدرة شغالات نحل العسل علي التخلص من الفاروا بإسقاطها علـي الارض وإحداث تشوهات في مناطق مختلفة بجسم الطفيل.

**وتتلخص نتائج الدراسات في الاتي:-**

اظهرت الدراسة ان سلالة النحل المصري كانت اكثر شراسة من سلالة النحل الكرنيـولي اوالايطـالي النقية بينما كانت السلالة الايطالي النقية اقل شراسة بينما كانت طوائف النحل الهجين الاول الايطـالي اكثـر شراسة من طوائف النحل الهجين الاول الكرنيولي.

وعند دراسة تأثير بعض الالوان علي صفة الشراسة في طوائف نحل العسل اظهرت جميـع الـسلالات صفة الشراسة ضد اللون الاحمر واللون الارجواني وكان اقل الالوان تأثر لصفة الشراسة هو اللون الابـيض والاصفر.

وعند اجراء اختبار صفة السلوك الصحي في سلالات نحل العسل محل الدراسة سجلت سـلالة النحـل المصري اعلي قيمة تبعها مباشرة في الترتيب طوائف النحل الهجين الاول الايطالي ثم طوائف النحل الهجين الاول الكرنيولي بينما حظيت طوائف النحل النقية الايطالي والكرنيولي المرتبة الاخيرة في الترتيب.

وعند دراسة العلاقة بين صفة الشراسة وتأثيرها علي صفة السلوك الصحي فـي طوائـف نحـل العـسل، اوضحت الدراسة ان هناك ارتباط موجب بين صفة الشراسة وصفة السلوك الصحي فـي جميـع الـسلالات محل الدراسة، بمعني ان النحل الذي يتميز بصفة الشراسة تزداد له القدرة في صفة السلوك الصحي.

وعند دراسة صفة سلوك التنظيف في السلالات محل الدراسة اوضحت نتائج الدراسة ان سلالة النحـل المصري تميزت عن باقي السلالات في هذة الصفة ولذلك امكن الاستفادة من هذة الصفة في رفع كفائة هـذة الصفة في طوائف باقي السلالات الاخري، فعند اضافة قرص حضنة مقفولة من سـلالة النحـل المـصري حديث الفقس الي طوائف سلالات النحل الاخري ادي لزيادة كفائة صفة التنظيف بمقدار ١٤,٢١% في سلالة النحل الكرنيولي، ٢٧,٣% في سلالة النحل الايطالي، ٢٨,٥٧% في طوائف النحـل الهجـين الكرنيـولي، ٢٦,٣٢% في طوائف النحل الهجين الايطالي. وبذلك يمكن الاستفادة من زيادة صفة المقاومـة الميكانيكيـة لطوائف نحل العسل في مكافحة طفيل الفاروا كطريقة طبيعية للمكافحة دون استخدام الكيماويات حيـث انهـا ليست لها تاثيرات ضارة علي النحل ومنتجاتة.