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The Maturity and Semen Quantity Inside Endophallus of Collected Drones *Apis mellifera* l. in Different Conditions Under the Egyptian Environment

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ABSTRACT

The bee drones have an important role for bees such as mating with the queen in the mating season. Here is, the drones reared in March and April then they start to go out of colonies in May and collected them through (May –June –July and August) in two difference periods of time (13.30 h -14.30 h and 15.30 h -16.30 h) under different weather condition. Then measure these entire factors and their effects on maturity of drones and amount of produced semen. Highest total average number of mature drones was 24.00±13.36 drone with the biggest amount of semen 14.50±11.02 µl and for one mature drone was 0.552±0.142 µl / mature drone in July. In addition, the highest average number of mature drones was 23.00±5.75 drones through the period of time 15.30 h – 16.30 h with the biggest amount of semen 13.00±4.68 µl and 0.540±0.090 µl / one mature drone. The correlation between temperature and mature drones indicated that the significant effect was R^2 = 0.157 and P = 0.045, and between temperature and semen quantity was R^2 = 0.153 and P = 0.048. The correlation between humidity and mature drones was R^2 = 0.249 and P = 0.009 also between humidity and semen quantity was R^2 = 0.237 and P = 0.012. In addition for the wind speed was found that the significant effect on mature drones was R^2 = 0.226, and P = 0.014) and for quantity of semen was R^2= 0.215 and P = 0.017.

Keywords: *Apis mellifera*; honey bee drones; drones flying time; drones rearing; collected semen; endophallus; drones collected time; weather condition.

INTRODUCTION

The drones are not involved in the process of collecting or storing food reserves for the colony. Their only task is to produce sperm and to mate with a queen. In order to meet this challenge they are strong and forceful flyers (Gmeinbauer and Crailsheim, 1993). They derive the energy for these flights from honey, which they ingest from the stores in the colony. Young queens reared in emergency queen cells at the end of the season may mate with these small drones. Large and small drones were compared previously with respect to mating success (Berg *et* al., 1997) and also compared with their sperm numbers (Schlüns *et* al., 2003)

The quantity and quality of semen parameters such as sperm number, ejaculate volume, sperm concentration, sperm length and sperm viability are biological data to evaluate drone fitness and spermatozoal competitiveness. Sperm storage success is a function of semen quality of a drone, whilst fertilization success is a function of individual sperm quality (Baer, 2005). The mating ability for natural mated queens is affected by the weather especially at the end of the season; also the ability to store the spermatozoa inside the spermatheca is dependent upon the physiological characteristics of the queen in the end of the season for both naturally mated queens and artificially mated queens. Hassona *et al* (2012)

The previous comparative study conducted between the number of spermatozoa found inside spermatheca for Italian queen F_1 and F_2 in 2004 and 2005 in Egypt, proved that the mean number of spermatozoa was 2.613 million sperm/ spermatheca for F_1 and 2.131 million sperm/ spermatheca for F_2. It is considered very little than the normal average of 5.00 ±1.5 million sperms Hassona (2006).

Schlüns et al. (2004) demonstrated in instrumentally inseminated queens that ejaculate volume of a drone had a significant effect on the patriline frequency; drones with larger ejaculates were consistently over-represented in offspring. Kraus *et. al*. (2005), reported that the number of colonies rather than the actual number of individuals in the population, primarily determined the effective population size. They presented a method where microsatellite data of haploid males could be used to estimate the number of male producing queens in honeybee populations. Hassona *et al* (2013) proved that, microsatellite loci indicated the genetic diversity within and between colonies offspring and these diversity related to the number of drones mated with the queen.

Drones breeding is one of the most difficult and important operations in bee breeding. The timing for drone production is most important. Drones do not become properly sexually mature until they are at least 14 days old and have had five good flying days as orientation flying.

Drone comb is often removed by beekeepers as a mistaken belief that they will get more honey as a result. To obtain early drones we must ensure that there are patches of drone sized cells available to the bees as the colony expands in spring. In this experiment, drones reared in special colonies and feed well by workers, in pollen and honey syrup, to be highly quantity and quality in semen to inseminate queens in the apiary. On the other hand, drones collected in front of the colonies in different periods / days through 4 months. Then, in the laboratory semen collected from drones collected before to measure the quantity of semen obtained from mature drones and to calculate the percentage of maturity for drones collected. In addition, to see the effect of different periods of collected time and may be return to change weather through 4 months.

MATERIALS AND METHODS

The experiments were carried out ‹from March 2015 to August 2015 ‹in the apiary in Edco region, EL-

Behira government and in laboratory of Agriculture Faculty) Saba Basha ‹(Alexandria University.

Drones rearing:

In the end of March and beginning of April, two of colonies used for rearing drones with strong headed queens, used as units for rearing and saving drones in the apiary. Previous colonies were composed of two chambers for each colony. the first chamber (bottom chamber), contained a queen with four closed brood combs, two pollen combs, two honey combs and two empty wide cells combs for egg drones laying. There was a queen excluder between the two chambers. The second chamber contained two combs of open brood workers, two combs of closed brood workers. Two open drones brood combs were transferred in the middle and four combs each of them contained honey and pollen. Previous colonies were checked every week to assure about the available of food and status until the drones emergence.

Supply Feeding:

To produce good drones quality, must have adequate provisions for doing so, and these provisions also need to be in the right place within a hive and be replaced on an exact time. Liquid supply feed for drones was (1 kg sugar + 1 liter water + Thymol), added Thymol was important to avoid Varroa mite diseases that effects drone survival and viability.

Drones collection:

Drones were collected from the colony's entrance by hand in different two times per day at 13.30 h - 14.30 h and 15.30 h - 16.30 h. It was found that the best time for collecting drones was after 1:00 pm that's because at this time drones were more active and flying for orientation or mating with queens, through 4 months from May to August under different weather like temperature, humidity and wind speed (Table. 2). Then putted in small wooden box and transferred them to the lab, for collecting semen. But before collected semen opened small wooden box inside the mish wire box (Fig. 1), then it was left 15 mints until drones flying inside the mish wire box (30×30×50) to increase the volume inside the abdomen by forcing air into the air sacs through lighting the box internally then drones collected by hand according to (Hassona, 2006 and Hassona *et al*. 2012).

Fig (1) Small wooden material used in collecting drones in front of colony's entrance inside mish wire box (30×30×50)

Semen collection:

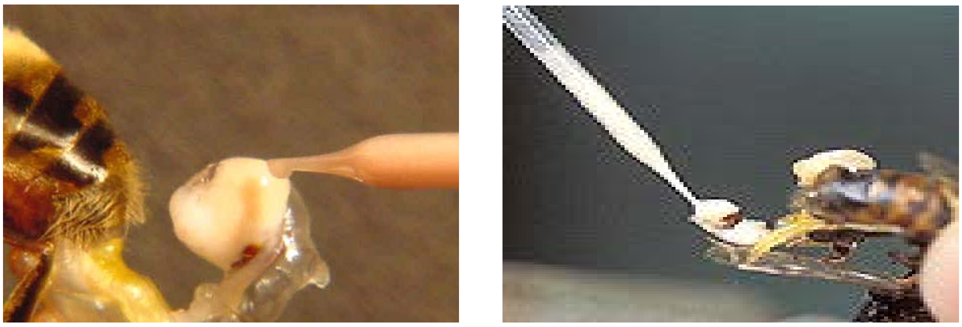
Before collecting semen, drones must be examines for maturity to know if they mature (Fig. 2) or immature (Fig. 3) and that's happened by pressing on their thorax by two fingers in order to see their endophallus. Orange membranes of the cornua play an important role in the mechanism of the movements (woyke, 1955). After partial eversion of the endophallus, the pressure inside it increases as a result of this, the outside thin compact epicuticle with the orange layer bursts at the dorsal wall of the cornua (Woyke, 2011). Then, the number of mature and immature drones is counted to calculate the ratio between them. After that, semen is collected from mature drones (Fig. 2 and 4) under stereomicroscope by microsyringe, used for collecting semen and injects it inside queen's genitalia in the artificial insemination operation (Schley, 1988). Semen quantity measured by microliter (µl). Syringe tip swing a few inches towards the operator and the microscope was moved correspondingly. Ejaculated drone was brought near the syringe tip with the left hand (Fig. 5A). Plunger of the syringe was withdrawn slightly to provide air space between the used saline solution and semen, also to facilitate measuring the amount of collected semen.

Surface of semen was brought to touch the point of the syringe tip at about 45° angle. Ejaculated drone was slightly pulled away from the syringe tip without breaking contact, the semen continued to adhere to the syringe and flowed towards it as the plunger was withdrawn (Fig. 5B). This procedure helped to avoid taking up the mucus, which was too thick to pass into the syringe tip that stop the passage of semen. If mucus clogs the tip; the plunger was pushed out until the passage was cleared; then taking semen was resumed according to (Hassona, 2006).

Fig. (3) Immature drone

Fig. (2) Mature drone

Fig. (4) Mature drone with semen in its endophallus



(A) The semen covering the mucus. **(B) The semen connected with a glass tip.**

Fig. (5): Semen collection

Statistical analysis:

Statistical analysis was used in calculated the mean for all result. T test was used to compare between the two periods of collecting time. ANOVA was used to compare between experimental months and calculated the mean with the standard division. Statistical analysis was indicated the effectiveness of temperature, humidity and wind speed on mature drones and the collection of semen. The statistical analysis program was SPSS, V 20.

RESULTS

1. The mature, immature drones and the semen quantity collected:

Table (1) indicated that, in May drones collected four times through 13.30 h – 14.30 h per day and another four times through 15.30 h – 16.30 h per day with mean of temperature 21.5˚C, mean of humidity 64.5% and mean of wind speed 3.5 meters/ second (table, 2). Through previous conditions in the first time 13.30 h – 14.30 h, statistical analysis indicated the mean number of collected drones was 17.25 drones, mean number of mature drones was 5.25 drones, mean number of immature drones was 12 drones and the mean of semen quantity collected from mature drones was 1.50 µl. In the second time 15.30 h – 16.30 h the mean number of drones was 29.25 drones, the mean number of mature drones was 14.25 drones and the mean number of immature drones was 15 drones and the mean of semen quantity collected from mature drones was 6.25 µl. Total mean of both times for drones was 23.25 drones with std. 7.890, for mature drones was 9.75 drone with std. 1.500, for immature drone was 13.50 drones with std. 7.071 and semen quantity was 3.88 µl with std. 2.850 from mature drones (Table,1 and Fig.6)

In June, drones collected three times through the previous two times per day with mean of temperature 24.3˚C, mean of humidity 69% and mean of wind speed 3.6 meters/second (table, 2). Result of mean number of drones in 13.30 h - 14.30 h was 23 drones, for mature drones was 6.33 drones, for immature was 16.67 drones and mean of semen quantity was 1.67 µl. In another time 3:30 – 4:30 pm the mean number of collected drones was 52.33 drones, 26.33 mature drones, 26.00

immature drones and 16.00 µl for semen quantity from mature drones. Total mean in two periods of time for drone's number was 37.67 drones with std. 16.207, 16.33 mature drones with std. 11.99, 21.33 immature drones with std. 7.394 and 8.83 µl for semen quantity with std. 8.060 (Table, 1 and Fig.6).

In July, the weather was 26.5 ˚C of temperature, 73% of humidity and 4 meter /second of wind speed (Table, 2). Under this weather, at the first time 13.30 h - 14.30 h the mean number of drones collected was 24.67 drones, 9.00 mature drones, 15.67 immature drones and the mean quantity of semen collected from mature drones was 8.00 µl in the second time 15.30 h - 16.30 h the mean number of all drones collected was 49 drones, 32.33 mature drones, 16.67 immature drones and 21.00 µl. of semen quantity from mature drones. Total mean for the two times through July was 36.83 drones with std. 16.36, 24.00 mature drones with std. 12.73, 12.83 immature drones with std.5.115 and 14.50 µl semen quantity with std.10.502 (Table, 1 and Fig. 6).

In the fourth month, August the temperature mean was 28.7˚C, humidity mean was 72% and the wind speed mean was 4.00 meter / second (table, 2). Under the weather condition of August in the first time of the day 13.30 h – 14.30 h the mean number of drones was 19.00 drones, 9.67 mature drones, 9.33 immature drones and 4.67 µl semen quantities from mature drones. In the second time 15.30 h – 16.30 h pm, the mean numbers of drones was 28.67 drones, 22.00 mature drones, 6.67 immature drones and the semen quantity mean from mature collected drones was 11.00 µl. the total mean for two collected times was 23.83 drones with std.5.707, 15.83 mature drones with std. 7.333, 8.00 immature drones with std. 1.673 and 7.83 µl semen quantity with std. 4.167 (Table, 1 and Fig. 6).

General total mean through the four collected months was 29.85 drones with std.13.58, 15.96 mature drones with std. 10.36, 13.88 immature drones with 6.849 and 8.38 µl semen quantities with std.7.510 (Table, 1).

Table (1) Mean of collected mature and immature drones' number, semen quantity by µl through four months with different times collected

Months Mean	No. of col. Per.	Collecting times/day	Drones collected	Mature drones	Immature drones.	semen quantity(µl)
May	4	13.30 h - 14.30 h	17.25	5.25	12.00	1.50
	4	15.30 h – 16.30 h	29.25	14.25	15.00	6.25
Total	8		23.25	9.75	13.50	3.88
Std.			7.890	1.500	7.071	2.850
June	3	13.30 h - 14.30 h	23.00	6.33	16.67	1.67
	3	15.30 h – 16.30 h	52.33	26.33	26.00	16.00
Total	6		37.67	16.33	21.33	8.83
Std.			16.21	11.99	7.394	8.060
July	3	13.30 h - 14.30 h	24.67	9.00	15.67	8.00
	3	15.30 h – 16.30 h	49.00	32.33	16.67	21.00
Total	6		36.83	24.00	12.83	14.50
Std.			16.36	12.73	5.115	10.502
August	3	13.30 h - 14.30 h	19.00	9.67	9.33	4.67
	3	15.30 h – 16.30 h	28.67	22.00	6.67	11.00
Total	6		23.83	15.83	8.00	7.83
Std.			5.707	7.333	1.673	4.167
G. total	26		29.85	15.96	13.88	8.38
G. std.			13.58	10.36	6.849	7.510

Col. = collecting per. = periods no. = number std. = standard division

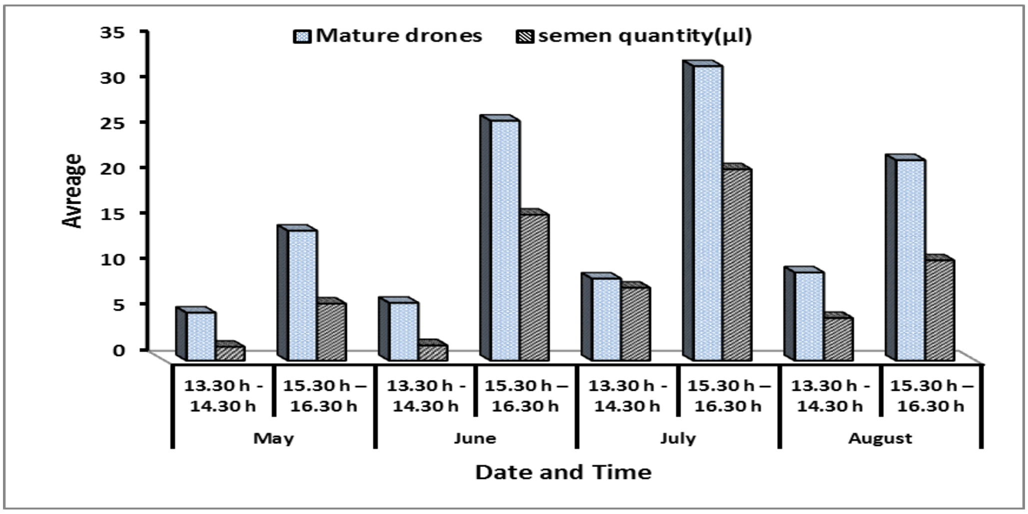


Fig. (6) Average of mature drones numbers and semen quantity through the four months and two collected times.

Table (2): Average of the temperature ˚C, humidity and wind speed/second through four collected drones' months.

Wind speed/second	Humidity %	Temperature ˚C	Months average
3.5	64.5	21.5	May
3.6	69.0	24.3	June
4.0	73.0	26.5	July
4.0	72.0	28.7	August

2. The effective of two periods of time on mature, immature drones and semen quantity (µl) collected.

Data in Table (3) illustrated that, Mature and immature drones collected 13 times in the first period (13.30 h - 14.30 h), and another 13 times in the second period (15.30 h – 16.30 h) through the four months. *T test* indicated the average number of the mature drones in the first period (13.30 h - 14.30 h) was 8.92±3.06 (n=13) drones and in the second period (15.30 h – 16.30 h) was 23.00±5.75 (n=13) drones. The immature drones' average was 11.77±2.44 (n=13) drones in the first period and 16.00±5.12 (n=13) immature drones in the second period. Result of semen quantity was collected from mature drones was 3.77±2.04 (n=13) µl in the first period and 13.00±4.68 (n=13) µl in the second period. Also, the amount of semen per one mature drone in the first period was 0.3730.087 (n=13) µl/drone and in the second period of time semen amount were 0.540±0.090 (n=13) µl/ mature drone.

Table (3): Effect of collecting time on the average number of mature and immature drones are collected and quantity of semen by µl through four months.

Time/ day Average	No. of collecting times	Mature drones	Immature drones	Semen amount	Semen (µl)/ m-drone
13.30 h - 14.30 h	13	8.92±3.06	11.77±2.44	3.77±2.04	0.3730.087
15.30 h – 16.30 h	13	23.00±5.75	16.00±5.12	13.00±4.68	0.540±0.090

3. The average number of mature, immature drones and semen quantity (µl) through the four collected months.

The result in table (4) indicated that, the average number of mature drones was 9.75±4.33 (n=8) drone, 13.50±4.54 (n=8) immature drone, semen quantity from mature drones was 3.88±2.39 (n=8) µl and 0.371±0.083 (n=8) µl semen/ mature drone through 8 collected times in May. In the second collected month June through 6 collected times the average number of drones was 16.33±12.58 (n=6) mature drone, 21.33±7.76 (n=6) immature drone. Also, the average amount of semen from mature drones was 8.83±8.46 (n=6) µl and for each mature drone was 0.441±0.302 (n=6) µl/ mature drone. In July the result was 24.00±13.36 (n=6) of mature drone, 12.83±5.36 (n=6) of immature drone, semen quantity was 14.50±11.02 (n=6) µl from mature drones and 0.552±0.142 (n=6) µl/ mature drone through 6 collected times. In August through another 6 collected times the average number was 15.83±7.69 (n=6) mature drone, 8.00±1.76 (n=6) immature drone, semen quantity was 7.83±4.37 (n=6) µl from mature drones and for each mature drone was 0.490±0.051 (n=6) µl/ mature drone. In Table (3) the total average through the four collected months and through 26 collected times was15.96±4.18 (n=26) mature drone, 13.88±2.76 (n=26) immature drones. In addition the average of semen quantity was 8.38±3.03 (n=26) µl from all mature drones and 0.456±0.068 (n=26) µl/ mature drone.

Table (4): Average number of mature, immature drones were collected and semen quantity by µl through 4 months

Months Average	No. of collecting times	Mature drones	Immature drones	Semen quantity	Semen by µl/ mature drone
May	8	9.75±4.33	13.50±4.54	3.88±2.39	0.371±0.083
June	6	16.33±12.58	21.33±7.76	8.83±8.46	0.441±0.302
July	6	24.00±13.36	12.83±5.36	14.50±11.02	0.552±0.142
August	6	15.83±7.69	8.00±1.76	7.83±4.37	0.490±0.051
Total average	26	15.96±4.18	13.88±2.76	8.38±3.03	0.456±0.068

4. The effective of temperature (t), humidity (h) and wind speed (wsp) through the four months on mature drones (DM) and semen quantity (QS) by µl collected.

Through four months the higher average of mature drones was 24.00±13.36 (n=6) mature drones in July and lowest average was 9.75±4.33 (n=8) mature drones in May, and the highest average of semen amount was 14.50±11.02 (n=6) µl with 0.552±0.142 (n=6) µl/mature drone also in July but the lowest average of semen quantity was 3.88±2.39 (n=8) µl with0.371±0.083 (n=8) µl/ mature drone in May (Table, 4). According to table (2) average of temperature in May was 21.5˚C and in July was 26.5˚C. It was found significant correlation between temperature and mature [DM = -18.468+ 1.379t (R^2 = 0.157, F = 4.47, P = 0.045)] also, between temperature and semen quantity [QS= -16.186+0.986t (R^2 = 0.153, F = 4.38, P = 0.048)].

The significant correlation was found between humidity and average number of mature drones [DM = -82.121+ 1.417 h (R^2 = 0.249, F = 7.950, P = 0.009)]. The highest average of mature drones was in July when the humidity was 73% in the same month and the lowest average of mature drones was in May when the humidity was 64.5% in the same month (Tables 2, 4). There was significant correlation between humidity and average of semen amount [QS = -60.812+1.000h (R^2 = 0.237, F = 7.451, P = 0.012)]. Under the average of humidity 73% collected highest average number of mature drones and had biggest amount of semen and with the average of humidity 64.5% collected lowest average number of mature drones and had lowest amount of semen.

The same result indicated in the wind speed for mature drones and semen amount. Wind speed in July was 4 meter/second and in May was 3.5 meter/second. It was found significant correlation between wind speed and average number of mature drones [DM = -37.764+14.551wsp (R^2 = 0.226, F = 6.990, P = 0.014)]. Also, between wind speed and semen quantity [QS= -29.551+14.859 wsp (R^2 = 0.215, F= 6.588, P = 0.017)].

DISCUSSION

In relation to mature, immature drones and semen quantity through months, honey bee drones flying between 13:00 h – 17:00 h through the four months in the experiment. Through this period of time collected drones two times (one hour between 13.30 h - 14.30 h and 15.30 h – 16.30 h) every 10 days with different weather of temperature, humidity and wind speed. Boucher and Schneider (2009) cleared that most activity for flying drones happened between 14:00 h – 16:30 h. Statistical analysis found that in first month total average of all drones collected was 23.25 drones between them 9.75 (41%) mature drones and 13.50 (58%) immature drones. The total average amount of semen was 3.88 µl through May (table, 1). May, the first month for flying drones after drones collection from the entrance was in this month that may agree with Rueppell *et al* (2006) who illustrated that drones start flying in age 8.82±1.74 days as orientation flying. Because that, the percentage of mature drones was lower than immature followed by the lowest of total semen quantity (3.88 µl) with 0.371±0.083 µl/one mature drone (Table. 4)

On the other hand, in the last month August the total average of all drones collected was 23.83 drones divided in two groups and found the average for the mature drones was 15.38 (64.54%) and for immature drones was 8.00 (33.57%) also the total average of semen quantity was 7.83 µl from mature drones (Table. 1) and semen quantity was 0.490±0.051 µl/ one mature drone (Table. 4). Average numbers of mature drones, quantity of semen and semen quantity for one mature drone in August were higher than in May. The weather in August was much better than in May the temperature was 28.7˚C, humidity was 72% and wind speed was 4meter/second, may be the weather in August suitable for flying than may and also in this month the drones more mature than the first flying month (May) according to Ruttner (1966) higher temperature start later and longer flying.

In other two months June and July the total average numbers of all drones, mature drones, immature drones and semen quantity from mature drones were sequentially 37.67, 16.33(43.35%), 21.33 (56.62%) and 8.83 µl in June (Table, 1) with the average of semen quantity 0.441±0.302µl per one mature drone. Otherwise in July the total average number of all drones, mature, immature drones and semen quantity from mature drones were frequently 36.83, 24.00 (65.16%), 12.83 (34.83%) and 14.50 µl (Table. 1) with the average of semen quantity 0.552±0.142 µl per one mature drone (Table. 4). Statistical analysis indicated that the highest total average number of mature drones was collected in July 24.00 mature drones (65.16%) followed by the average amount of semen from the same mature drones 14.50 µl (Fig.6), and in the same month the mature drone was full with semen than any month else 0.552±0.142 µl/ mature drones. Even if it's not much amount of semen as Cobey (2013) cleared in the beginning that the amount of semen was varies, but in general each drone probably yield 1 µl. previously the amount of semen much in July that means produced mature drones with more semen in summer season was better than in spring season and may be back to the weather action. John *et al* (2010) agreed with the drones have more semen in summer and autumn than spring season.

In relation to maturity of drones and amount of semen through times, Through *T test* in statistical analysis found that was significantly different between the two collected times. The highest average number of mature drones happened in the second collected time between 15.30 h – 16.30 h and it was 23.00±5.75 mature drone through 13 time collected with biggest amount of semen was13.00±4.68µl. On the other hand, the lowest average number of mature drones was 8.92±3.06 mature drone in the first collected time 13.30 h - 14.30 h with lowest amount of semen was 8.92±3.06 µl (Table. 3). In addition the average of semen quantity found in endophallus form one mature drone was 0.540±0.090 µl/ mature drone in the second time 15.30 h – 16.30 h and that was more than another collected time (first time) that was 0.3730.087 µl/ mature drone in 13.30 h - 14.30 h (Table. 3).

As a discussion, the highest average numbers of all drones collected, mature drones and immature drones with the biggest amount of semen quantity from mature drones were found in July and especially in the second collected time 15.30 h – 16.30 h (Fig. 1). That means, the good period of time per day to collect drones in front of the colonies is between 15.30 h – 16.30 h and that was a good flying time for drones especially mature drones have good quantity and quality of semen in their seminal vesicles. These results agreed with Benstead (2009) in the peak of drones' flight activity occur between 14:30 h - 16:30 h.

Effectiveness of temperature, humidity and wind speed through the drones collection, previous result and discussion indicated that the most important month in collected drones was July and in this month got a highest average number of mature drones with the biggest amount of semen quantity (Table. 1 & 4 and Fig. 6). Pervious discussion illustrated also that the best period of time for collected drones was 15.30 h – 16.30 h. With focus on the drones, they feeding well through breeding and they ready to copulation with the queens around their congregations' areas but what about their need for flying? Before anything they need good weather from temperature, humidity and wind speed. In July noticed that the average of temperature was 26.5C°, the average of humidity was 72% and average of wind speed was 4 meter / second (Table, 2). In addition statistical analysis indicated that the weather has important effect on the mature drones and quantity of semen and that was happened during July. The result in this research work was agreed with (Ruttner, 1956 &1976, Drescher, 1969 and Bol'shakova, 1978) they illustrated that drones fly only during suitable weather as the air temperature higher than 19˚C. Otherwise, the research result agreed with Rowell *et al* (1986) they cleared that drones cannot fly when temperature exceeds 38˚C. In addition Ruttner (1956) supposed that the activity of drone is reduced when wind speed exceeds 4-6 meter / second. And agreed with that, drones fly 10-40 meter above ground and that was dependent on the windy weather according to Ruttner (1966), Koeniger *et al* (1989)

CONCLUSION

The drones have a very important role in all their life this role is to mate with a queen in the congregation area. So beekeepers must be take care of drones, especially in mating season, they must feeding them good with pollen and nectar and they must not kill them during the season and live them for nature, as known that after season ended the workers already get them out of the colonies. Otherwise some beekeepers think that drones not important in the colony they only feed in the nectar collected by workers. Through this experiment I noticed that all queens I reared them in the region were successfully mated and quickly start laying eggs.

As a conclusion the best season for breeding drones was the end of spring to get drones in the first summer and in the good weather (temperature, humidity and wind speed). Through good weather condition we have good mature drones with good quantity and quality of semen to mate with a queen naturally through flying or artificially by artificial insemination. The perfect time for flying mature drones was in the afternoon between 15.30 h–16.30 h per day and the perfect month for collecting drones was July.

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النضج الجنسى وكمية السائل المنوى المخزن بالعضو الذكرى لذكور نحل العسل المجمعة فى ظروف مختلفة تحت تأثير البيئة المصرية

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تقوم ذكور نحل العسل بدور هام فى تلقيح ملكات نحل العسل خلال موسم التلقيح. لذا تهدف هذة الدراسة إلى تربية الذكور فى شهري مارس وأبريل وبعد ذلك تم جمعها خلال الشهور مايو ويونيو ويوليو وأغسطس في الوقت من الساعة ١٣.٣٠ الى ١٤.٣٠ وأيضا من١٥.٣٠ الى ١٦.٣٠ تحت ظروف مناخية مختلفة. ومن ثم قياس هذه العوامل وآثارها على نضج ذكور نحل العسل وكمية السائل المنوي المنتجه بداخلها. وكان أعلى متوسط لعدد ذكور النحل الناضجة ٢٤.٠٠±١٣.٣٦) ذكر) مع أكبر كمية من السائل المنوي ١٤.٥٠±١١.٠٢ µl)) وكانت كمية السائل المنوى فى الذكر الواحد منها (٠.٥٥٢±٠.١٤٢ µl) في شهر يوليو. وبالإضافة إلى ذلك كان أعلى متوسط لعدد الذكور الناضجة٢٣.٠٠±٥.٧٥) ذكر) خلال الفترة الزمنية من الساعة ١٥.٣٠ الى الساعة ١٦.٣٠ وذلك مع أكبر كمية من السائل المنوي (١٣.٠٠±٤.٦٨ µl) و(٠.٥٤٠±٠.٠٩٠ µl) لكل ذكر ناضج. بالأضافة لما سبق عند دراسة درجة أرتباط العوامل الجوية مثل درجات الحرارة والرطوبة والرياح بذكور النحل كانت النتيجة وجود أرتباط معنوى لدرجات الحرارة على أعداد ذكور النحل الناضجة R^2 = ٠.١٥٧ & P = ٠.٠٤٥))، وأيضا على كمية السائل المنوي (R^2 = ٠.١٥٣ & P = ٠.٠٤٨) وكان الارتباط بين الرطوبة وعدد ذكور النحل الناضجة(R^2 = ٠.٢٤٩ & P = ٠.٠٠٩) وأيضا بين الرطوبة وكمية السائل المنوي (R^2 = ٠.٢٣٧ & P = ٠.٠١٢). بالإضافة لسرعة الرياح حيث وجد أن لها تأثير كبير على أعداد الذكور الناضجة (R^2 = ٠.٢٢٦ & P = ٠.٠١٤). وكمية السائل المنوي (R^2 = ٠.٢١٥ & P = ٠.٠١٧).