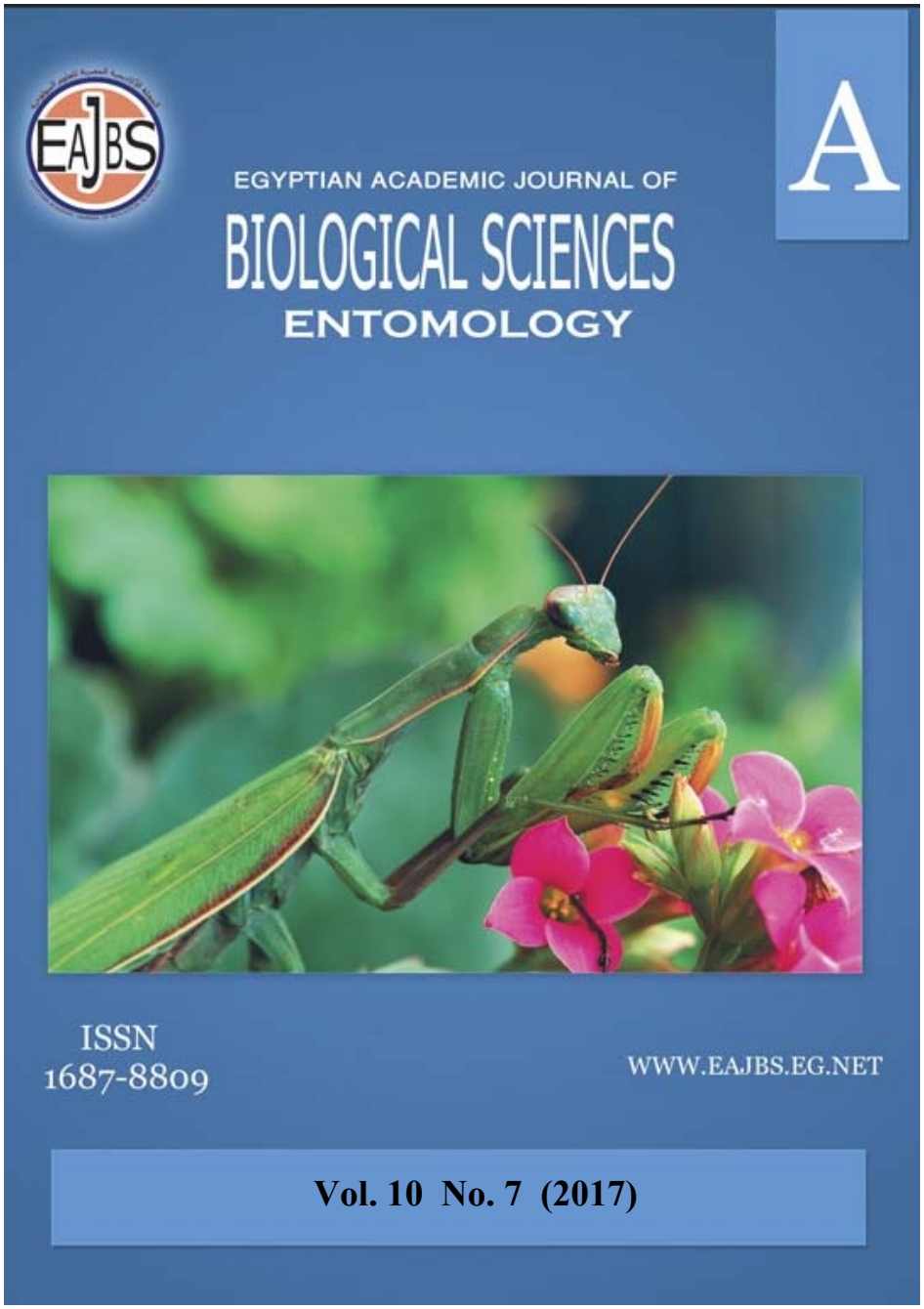

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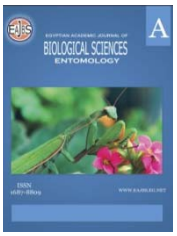

Studies on the Activities of Honey Bee Colonies under Environmental Circumstances in BeniSweif Governorate-Egypt.

E.W. Zidan and A. M. M.Ghania

Dept. of Apiculture, Plant Protection Research Institute, Agricultural Research Center, Dokki, Giza, Egypt.

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ABSTRACT

Environmental Circumstances is playing an important role in honey bee activities. This study at apiary of the Agriculture Research Sids Station, BeniSweif Governorate middle Egypt, during the 2016seasons. Which that the from broad bean(*Vicia faba*), citrus (*Citrus* spp.), clover (*Trifolium alexandrinum*)and maize (*Zea mays*) pollen trapped grain were collected from the hives by using traps put on the entrance of honeybee colonies. The average values of the recorded temperatures ranged from 8.9 to 28.1°C and the averages of the recorded relative humidity values ranged from 48.9 to 79.70 % all over the years of study. There was a significant correlation between temperature or relative humidity and collecting pollen amount. Correlation coefficients were - 0.16 & -0.18 in broad bean pollen, -0.07 & 0.07 in citrus pollen, 0.36 & -0.25 in clover pollen and -0.76 & -0.07 in maize pollen. On other hand the amount of pollen gathering fluctuating from plant source and date of collecting, and it's obvious that study conditions. On the other hand obvious that there is a significant effect of pollen trapping on the brood rearing activity which recorded 67.08 % reduction of brood activity in colony in Broad bean pollen season , 45.03 % in citrus pollen season, 43.30 % in clover pollen season and 17.68 % in maize pollen season. In the end we can conclusion the environmental ecology is important playing in different activity of honeybee colonies.

INTRODUCTION

Honey bee colonies gather pollen grains and nectar from different floral sources and process them to provide food to support the current population and rearing of the next cycles of brood. Previously, a simple mathematical model of honey bee population dynamics was proposed to explore the impact of varying forager death rate on colony growth and development (Khouryet al., 2011). so the bees could use them as mentions to discriminate different types of pollen. Pollen provides bees with lipids, protein, and vitamin and mineral nutrients. Honey, nectar and pollen are consumed and used to produce a protein rich brood food, which is fed to the queen and developing larvae (Brodschneider&Crailsheim2010). Bee behaviour is very sensitive to changes in levels of stored food or food influx. Pollen is the only protein food of a honeybee colony gathered by bee foragers in their natural

environment. In order to satisfy its needs,an honeybee colony uses from ca. a dozen to more than 35 kg of pollen (Hodowla pszczó1983). The presence of pollen in the nest is a precondition for normal colony development and, first of all, for regular growth and development of the brood. The rich amino acid composition of the pollen protein and other valuable pollen infrastructure (fats, enzymes, vitamins, phytohormones, mineral compounds) made pollen one of products recovered from the bees gathering by man so it is often referred to as bee pollen (Wilde and Wilde 2002). It is important to get knowledge of all factors affecting the pollen efficiency of bee colonies and of how the factors correlate to one another. Many authors worldwide studied the effect of weather factors on pollen and nectar gathering e.g. Faye *et al*., 2002 in Spain; Addi *et al.,* 2006 in South Africa and Blsk *et al.,* 2008 in Turkey;. Also, in Egypt, e.g. Wafa, 1956; El-Shakaa, 1977and Hassan, 2009. Studied the pollen and nectar status at several regions, asaffected by prevailing environmental condition.

This work was aimed to study the relationship between honeybee activities and the environmental circumstance in BeniSweifEgypt, during the year 2016 seasons.

MATERIALS AND METHODS

This experiment was carried out at the apiary of the Sids, Agricultural Research Station, Beni-Sweif Egypt throughout year2016 seasons. The area has variable plant crops that are important for bee foragers, and water source is available. The experimental colonies were in an equal strength (bees covered 7 wax combs) and headed with sister recently mated queens. Three pollen traps were used to collect the coming pollen by the forager workers of the experimental colonies. Each trap was fixed at the hive entrance. The experimental colonies and the collected pollen were subjected to different mensuration as follows:

Dominant plantcrops:

The plant crops of the area consists mainly of the broad bean(*Vicia faba*), citrus (*Citrus* spp.), clover (*Trifolium alexandrinum*)and maize (*Zea mays*)

Measuring of collected pollen and sealed worker brood:

The trapped pollen grains collected from different sources were excluded dried and weight. The area of sealed worker brood was measured in square inches at 12 days intervals according to the technique of Fresnay (1962).

Meteorological factors:

Metrological data were taken from The Central Laboratory for Agriculture Climate, Agricultural Research Center, Dokki, Giza, Egypt, from the first of Jan up to Aug, 2016. Temperature and relative humidity were aggregated to obtain the mean value for each month.

Statistical analysis:

Correlation coefficients using SPSS between collected pollen grains and each of temperature and relative humidity were calculated. Analysis of variance (ANOVA) was carried out by using F-test and least significant difference ($LSD_{0.05}$) was used to compare between the differences.

RESULTS AND DISCUSSION

Correlation between Pollen collecting activity and environmental conditions.

The pollen amounts collected by the pollen trap for four plant source recorded

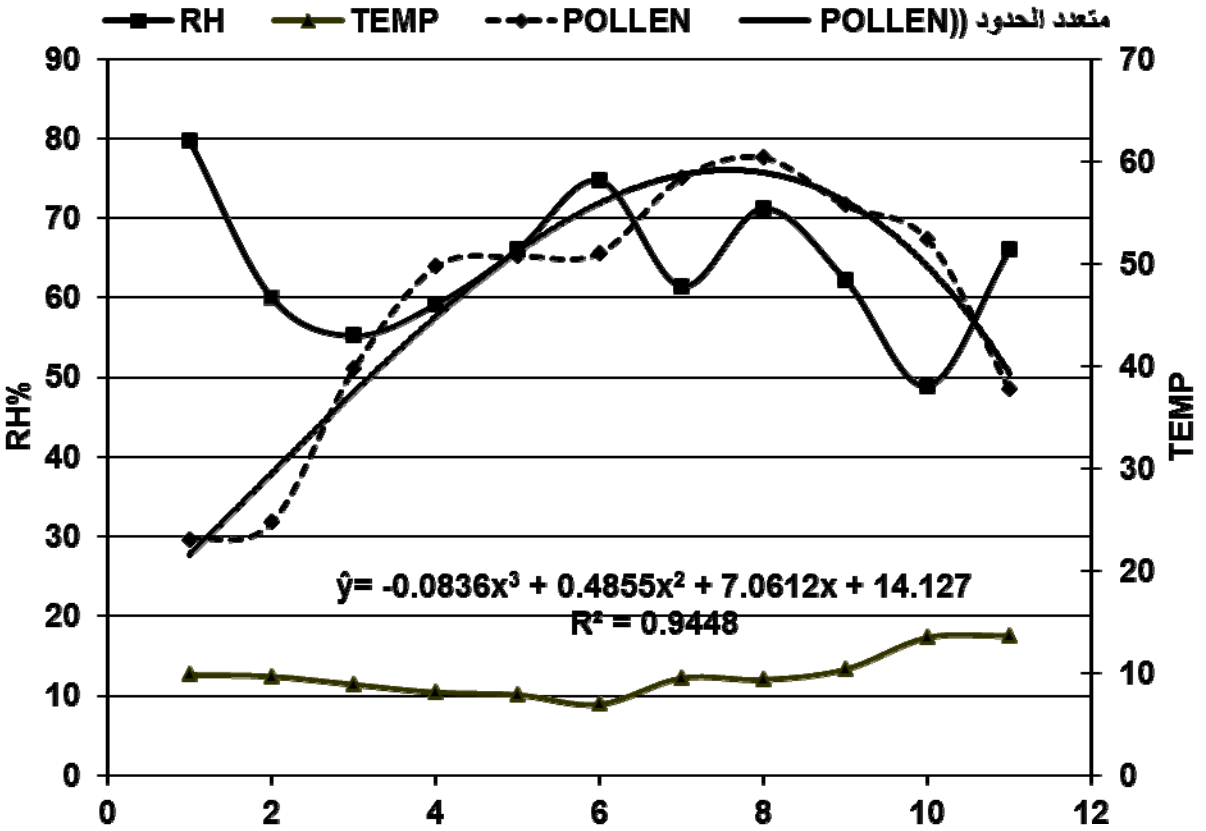
gradually during the nectar flow seasons for the Broad bean, Citrus , Clover and Maize plant ,in addition temperatures and relative humidity were recorded in Table 1 and fig 1 which indicate that ,There was a significant correlation between the temperature and pollen gathering activity. The average values of the recorded temperatures ranged from 8.9 to 28.1°C and the averages of the recorded relative humidity values ranged from 48.9 to 79.70 % all over the year of study. There was a significant correlation between temperature or relative humidity and collecting pollen amount. Correlation coefficients were (-0.16 & -0.18) in broad bean pollen, (- 0.07 & 0.07) in citrus pollen, (0.36 & -0.25) in clover pollen and (-0.76 &-0.07) in maize pollen, respectively. On other hand the amount of pollen gathering fluctuating by plant source and date of collecting, and it's obvious that environmental conditions is effecting in the forager behavior and pollen gathering.

(Heinrich, 1996)observed that honey bees can forage over a 30°C range of air temperature largely because they have behavioral and physiological mechanisms for regulating the temperature of their flight muscles. Meanwhile, the minimum temperature needed for active foraging for European honeybees was approximately 13°C.(Gary 1999) He also concluded that above 43°C nectar and pollen foraging were ceased but water foraging was continued. The number of pollen foragers, amount of pollen stored as beebread and brood in the colony differed significantly during different seasons.

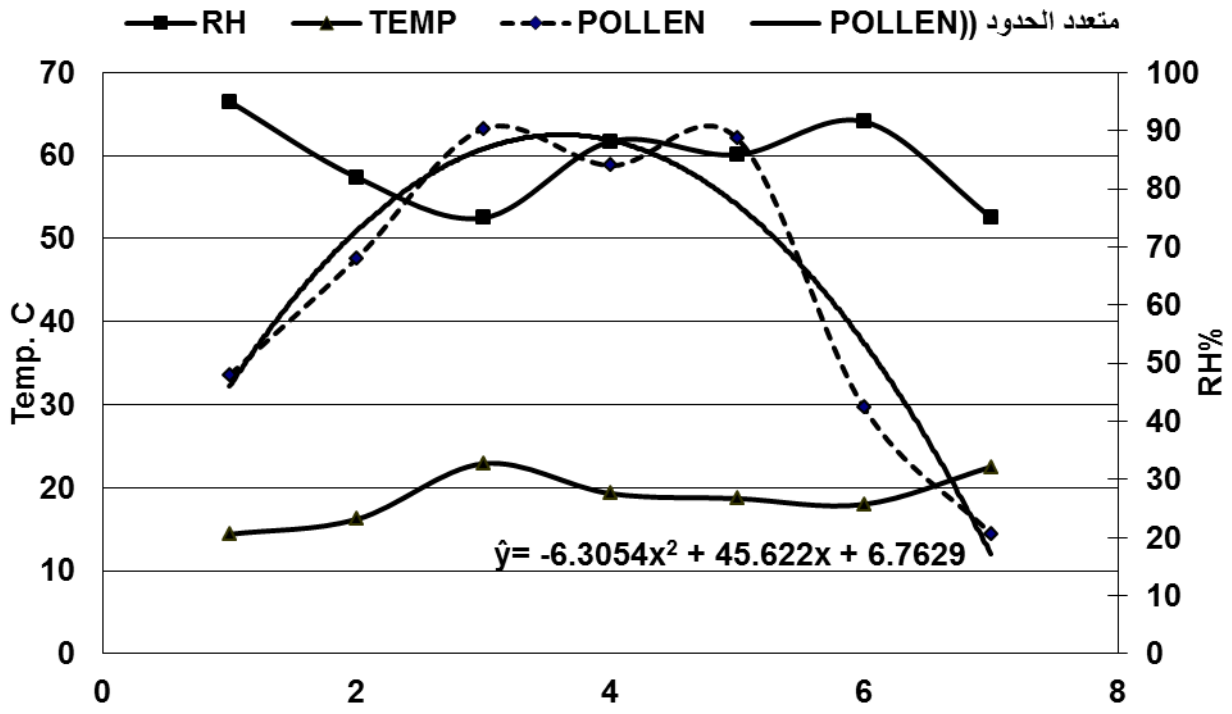
Table 1.The correlation between the mean quantities of pollen (g)/colony collected from broadbean,citrus,clover andmaizeplants with temperature and relative humidity during 2016 seasons

Date of collection /colony	Broad bean			Date of collection /colony	Citrus			Date of collection /colony	Clover			Date of collection /colony	Maize		
	Pollen amount (g)	Avg Temp. (°C)	Avg RH (%)		Pollen amount (g)	Avg Temp. (°C)	Avg RH (%)		Pollen amount (g)	Avg Temp. (°C)	Avg RH (%)		Pollen amount (g)	Avg Temp. (°C)	Avg RH (%)
28-12	23.00	12.60	79.70	21-3	48.00	14.40	66.50	9-5	36.67	21.90	62.00	19-6	42.67	27.00	61.30
31-12	24.67	12.40	60.00	24-3	68.00	16.20	57.40	12-5	46.33	23.80	59.20	22-6	51.67	25.90	63.00
3-1	39.67	11.40	55.20	27-3	90.33	22.90	52.50/	15-5	70.67	21.80	59.80	25- 6	165.00	25.00	62.50
6-1	49.67	10.40	59.10	30-3	84.00	19.30	61.70	18-5	92.33	21.60	61.30	28-6	161.67	25.50	62.70
9-1	50.67	10.10	66.00	2-4	88.67	18.70	60.10	21-5	104.33	25.10	58.30	1-7	141.33	25.40	60.70
12-1	51.00	8.90	74.70	5- 4	42.33	18.00	64.10	24-5	79.33	23.50	63.00	4-7	108.33	24.50	67.50
15-1	58.33	12.20	61.40	8-4	20.67	22.50	52.60	27-5	36.00	28.10	51.30	7-7	106.67	26.10	65.60
18 -1	60.33	12.00	71.20	9-4	-	-	-	30-5	-	-	-	10-7	61.67	26.00	64.10
21 -1	55.67	13.30	62.20	10-4	-	-	-	2-6	-	-	-	13-7	-	-	-
24 -1	52.33	17.30	48.90	11-4	-	-	-	5-6	-	-	-	16-7	-	-	-
27 -1	37.67	17.50	66.00	12-4	-	-	-	8-6	-	-	-	19-7	-	-	-
mean	45.73	12.55	64.04	Mean	63.14	18.90	59.30	Mean	66.52	23.70	59.30	Mean	104.88	25.7	63.4
$r_=$	1.00	-0.18	-0.16	$r_=$	1.00	0.07	-0.07	$r_=$	1.00	-0.25	0.36	$r_=$	1.00	-0.76	-0.07

Abrol2010, who recorded that the foraging behavior in relation to five environmental parameters. It was concluded that the foraging population correlated significantly and positively with air temperature, light intensity, solar radiation and nectar-sugar concentration and negatively with relative humidity. Statistical analysis showed that correlation between mean max. or min. temperatures and weekly mean of pollen weights was positively high significant ($r_=$ 0.644 and 0.653,respectively), while it was negatively insignificant for relative humidity ($r_=$−0.158). In the 2nd year, correlation between weekly pollen weight and max.temperature was positively high significant ($r_=$0.543), while it was insignificant for min. temp. ($r_=$0.164) or negatively insignificant for relative humidity ($r_=$−0.180) (Ismail et al., 2013).



Broad bean



Citrus

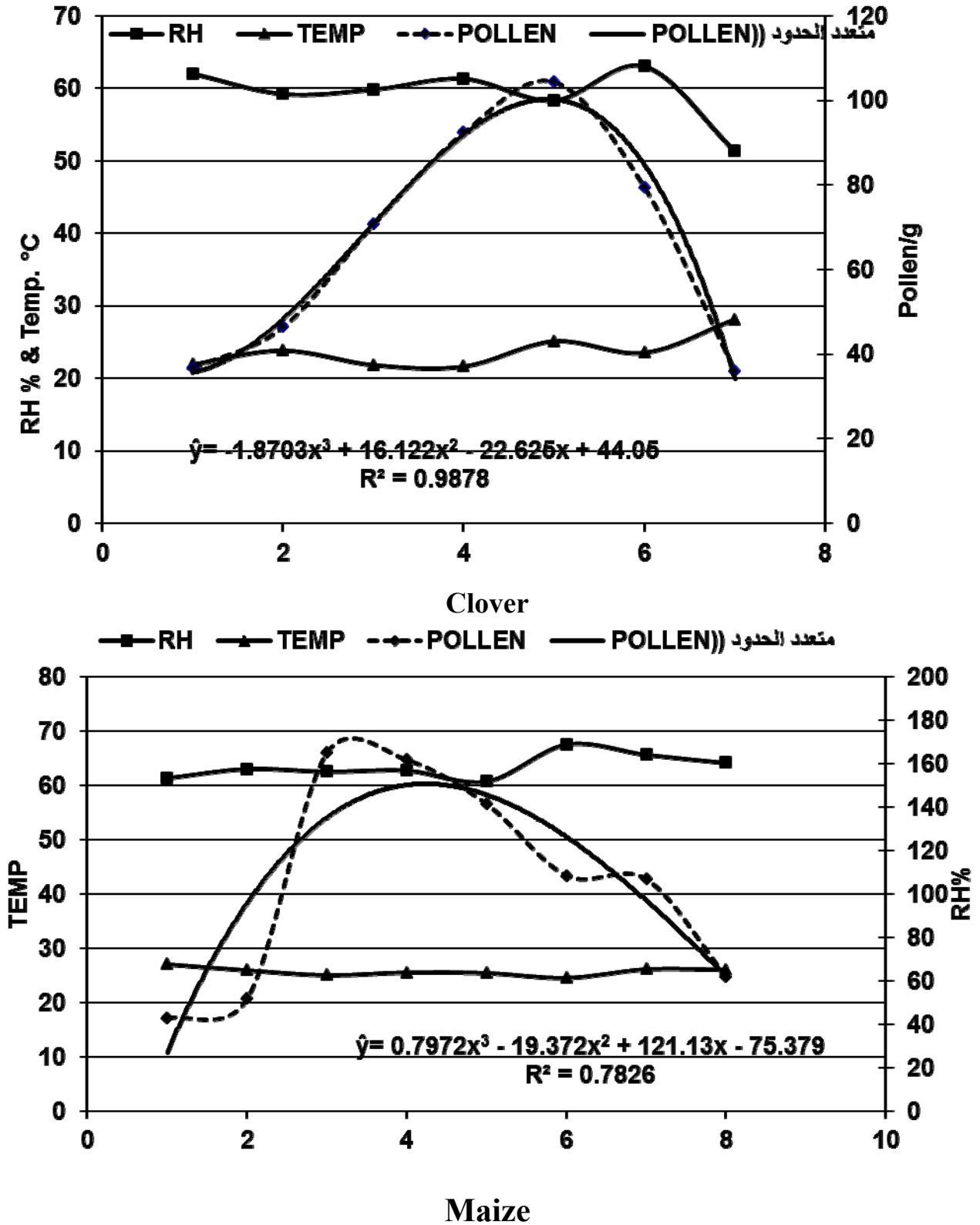


Fig 1. Correlation between the mean quantities of pollen (g)/colony collected from broad bean , citrus , clover and maize plants with temperature and relative humidity during 2016 seasons.

It was studied the activities of honeybee colonies of indigenous *Apismelliferajemenitica* (AMJ) and imported *Apismelliferacarnica* (AMC) during the

late summer and autumn in KSA (Alqarni et al., 2014). In Assir, the mean maximum temperature was less than 32°C and the minimum was below 2°C. Workers of the two races exhibited relatively similar forage timings throughout the period of study (August–November). Although foraging activity was negatively affected by decreased temperature, AMJ was more resistant to cold than AMC.

The Italian hybrid and Carniolan colonies were more sensitive to temperature and the Italian and Italian hybrid colonies were more sensitive to relative humidity. There was a significant positive correlation between temperature and stored pollen amount in Italian hybrid and Carniolan colonies. Correlation coefficients were 0.377 and 0.583 and determination coefficients were 14.20 and 34.02%, respectively. Meanwhile, there was a significant negative correlation between relative humidity and stored pollen amount in Italian and Italian hybrid colonies. Correlation coefficients were -0.385 and -0.343 and determination coefficients were 14.81 and 11.77%, respectively (Elaidy and Tolba, 2017).

Effect of pollen trapping on worker brood rearing:

According to obtained data in table2and fig. 2clearly showed the effect of pollen trapping on the brood rearing activity in the colony and it's obvious that there is a significant effect of pollen trapping on the brood rearing activity which recorded 67.08 % reduction of brood activity in colony in faba bean pollen season, while it was 45.03 % in citrus pollen season, 43.30 % in clover pollen season and 17.68 % in maize pollen season , in addition there was a highly significant difference between the normal colony and pollen trapping colony in brood rearing activity, it may be due to the reduction of pollen introduce to the colony. Trapping reduce the amount of protein in come to the colony (pollen) which needed for brood rearing , so, the continuously pollen trapping had negative effect to the colony strength and production. Analysis of variance showed significant differences in workers brood amount between the normal colony and trapped colony. For these deficiency effects on brood as a result of pollen trapping, production of pollen should be independent.

This research shows that the quality of spring-reared workers is strongly influenced by the availability of pollen in colonies during larval development; in addition the amount of pollen stored in the colonies depends on the amount of collected pollen as well as the rate of pollen consumption by brood and bees.

Rashad and Parker (1958) reported that each larva needs more than 100 mg of pollen for its complete development. According to them, one cell of pollen contains 183 mg of beebread, which is sufficient to rear about one bee. Based on the findings of the study the number of cell with beebread in a colony during rainy season can rear properly about 53 bees at a time. Under such situation, if large numbers of larvae are developing in a colony, they are deprived of required amount of pollen. Then the bees become physically and physiologically weak. Such bees cannot produce enough royal jelly as their hypopharyangeal glands are not properly developed. Pollen is the only protein food of full nutritional value available for the honeybee (*Apis mellifera* L.) that is brought to the nest from the outer environment. The demand of a bee colony for pollen is dependent on colony strength, number of reared brood, and the availability of pollen in the environment. Given that 89 mg of pollen is required to feed a single bee larva and assuming the egg-laying ability of a queen in the second half of the season (second half of July and August) (Bornus, 1989) collective work.

(De Grandi-Hoffman et al., 1989) reported that worker longevity, nursing activity and foraging patterns were used as important measures of worker quality because they are so intimately tied to the pollen status of colonies. In addition to the population size of colony, brood rearing and population growth in the colonies are affected by the quality of the queen and the nutritional factors.

Table 2. Average areas of worker sealed brood/colony at 12day interval and pollen trapping factors during 2016 seasons.

Date (inch^2/colony)	worker sealed brood areas (inch^2 /colony)		% Reduction	F	P
	Trapped colonies	Normal colonies			
Broad bean					
16-12	123.33	359.00	65.65		
29-12	115.00	375.67	69.39		
11-1	96.67	423.33	77.16		
24-1	193.33	560.00	65.48	92.48	<.0001
6-2	250.00	646.67	61.34		
Average	155.67^b	472.93^a	67.08		
LSD $_{0.05}$	34.417				
Citrus					
8-3	565.66	795.00	28.85		
21-3	506.33	868.33	41.69		
3-4	484.66	930.00	47.89		
16-4	476.33	973.33	51.06	43.54	<.0001
1-5	517.66	1073.33	51.77		
Average	510.13 ^{b}	927.99^a	45.03		
LSD $_{0.05}$	94.20				
Clover					
24-4	517.66	888.33	41.73		
7-5	667.66	1016.67	34.33		
20-5	713.33	1140.00	37.43		
2-6	580.33	1228.33	52.75	33,06	<.0001
15-6	692.66	1320.00	47.53		
Average	634.33 ^{b}	1118.67 ^{a}	43.30		
LSD $_{0.05}$	133.28				
Maize					
7-6	980.00	966.67	1.36		
20-6	1020.00	1046.67	2.55		
3-7	1026.67	1110.00	7.51		
16-7	976.67	1223.33	20.16		
29-7	896.67	1283.33	30.13	8.35	<.0001
11-8	856.67	1363.33	37.16		
Average	959.45 ^{b}	1165.56 ^{a}	17.68		
LSD $_{0.05}$	91.338				

In this respect Ewies et al., (1980) found that pollen trapping caused a decrease in amount of brood reared ranged between 19.9% and 42.3%. Ghoniemy and Abo-Lila (1998) recorded significant difference in areas of sealed worker brood in colonies with and without traps.

EL-Kazafy and Saad(2013) reported that there was a Significant positive correlations were found between worker sealed brood area and each of stored pollen area, colony population and the honey yield (r = 0.95, 0.63 and 0.73, respectively). In addition, Mladenovic et al., (1999) reported that there is a positive correlation between the increases of collected pollen activity and increase of brood rearing.

Abou El-Naga et al., (2008) showed that the highest brood areas, in trapped and non-trapped colonies, were recorded in summer and spring, while the lowest areas were in autumn. They added that brood area in non-trapped 12 colonies was much greater (457 sq. in.) than that (188 sq. in.) of trapped colonies.

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ARABIC SUMMARY

دراسة نشاط طوائف نحل العسل تحت الظروف البيئية فى منطقة سدس محافظة بنى سويف- مصر

ايهاب وفيق محمود زيدان و أيمن محمد محمد غنية
قسم بحوث النحل – معهد بحوث وقاية النباتات – مركز البحوث الزراعية- مصر

تلعب الظروف البيئية دورا مهما فى نشاط طوائف نحل العسل 0أجريت هذه الدراسة فى محطة البحوث الزراعية بسدس محافظة بنى سويف مصرالوسطى أثناء مواسم سنة 2016 م0جمع حبوب اللقاح من الفول البلدى *Viciafaba*والموالح.*Citrus* spp والبرسيم*Trifoliumalexandrinum* والذرة*Zea mays* وجمع حبوب اللقاح 0 تتراوح متوسط قيم درجات الحرارة من8,9 -28,1 م^{5}و متوسط درجة الرطوبة النسبية من 48,9-79,70 % خلال مواسم الدراسة0وجد ارتباط معنوي بين درجة الحرارة والنسبة المئوية للرطوبة النسبية وجمع النحل لحبوب اللقاح،حيث بلغت قيمتهمع حبوب لقاح الفول البلدى -0,16و- 0,18 ومع حبوب لقاح الموالح-0,07 و 0,07 ومع حبوب لقاح البرسيم0,36و -0,25 ومع حبوب لقاح الذرة -0,76و -0,07 ومن ناحية أخرى كان هناك تذبذب واضح في كمية اللقاح المجموعة حسب المصدر النباتى والظروف الجوية ،ومن ناحية أخرى كان هناك تأثير معنوي واضح على تربية الحضنة بين الطوائف التى بها مصائد حبوب اللقاح والمقارنة(بدون مصائد حبوب اللقاح) حيث بلغت نسبة الخفض 67,08% في موسم حبوب لقاح الفول البلدى45,03 % في موسم الموالح و43,30 % فى موسم البرسيم وفى موسم الذرة كانت 17,68 % وفى النهاية نستنتج أن الظروف البيئية المختلفة تلعب دورا هاما فى نشاط طوائف نحل العسل،واستخدام مصائد حبوب اللقاح ذو تأثير سليم على نشاط طوائف نحل العسل وكذا الظروف البيئية المختلفة على مدار العام0