

QUANTITY OF COLLECTING POLLEN BY HONEY BEE (*Apis mellifera* L.) AND ITS RELATION WITH CLIMATIC CONDITIONS IN GHARBIA GOVERNORATE, EGYPT

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ABSTRACT

The present study was carried out at a private apiary in Ayash village, Mehalla El-Kobra, Gharbia governorate in 2011- 2012 seasons. The aim of this study to detect the quantity income pollen collected from clover and maize crops. Survey of the area vegetation showed that clover was the dominated crop in winter and some *viacia faba* been fields, while rice, maize and may be some cotton fields in summer . Nine colonies with 10 combs were used in this study. In general, the mean of collected pollen was higher in clover season than those in maize (103.924 and 77.981g in 2011, however, in 2012 it was 47.232 and 45.425 g\ 9 colony\3 days), respectively. Air temperature and relative humidity were also registered. The highest collected quantity of pollen reached its maximum values between 70% and 78% of relative humidity and 23 °C and 25 °C. The number of pollen loads increased as relative humidity ($r = 0.109; 0.151$) and temperatures had a strong negative influence on the collected pollen ($r = -0.193; -0.375$) in clover season. The pollen loads decreased positively with temperature ($r_s = -0.375, 0.463$ and 0.127), negatively correlated with relative humidity ($r_s = 0.151, -0.391$ and 0.248) in maize season. The high values of loading pollen were in clover than those in maize, it may be related with the long flowering of clover as well as the effect of climatic influences .

INTRODUCTION

Pollen is a nutrient- rich food that like honey ,can be stored in the hive indefinitely to serve as a reserve during times or seasons of shortages (Somerville, 2001). Honeybees are one of the most important pollinators of angiosperms because of their vegetarian diet, flower visiting habits and hairy bodies that readily pick up pollen grains, and the fact that they exclusively visit many flowers of the same species during a single trip (Delaplane and Daniel 2000). As honey bees visit a succession of flowers, in search of food, their bodies become dusted with pollen grains and in the process the pollen grains make contact with receptive stigmas and effect pollination.

Pollen is widely used as a source of food by various insects and by honeybees for brood rearing. Numerous studies have been undertaken on the chemical composition and nutritive value of pollen and its effect on brood rearing growth and the longevity of honeybee colonies. Pollen provides bees with their only natural source of protein, which is needed for larval development and also fulfils other dietary requirements for lipids, sterols, vitamins and minerals (Herbert 1992). The protein content of the pollen is a direct measure of pollen quality in the diet of the honeybee (Pernal and Currie 2001). Moreover, it was found that fresh pollen contains high protein content

and is 100% effective in the development of the hypopharyngeal glands of worker honeybees (Haydak, 1970) that secrete the royal jelly for the feeding of young larvae of honeybees.

Pollen-gathering activities of honeybees from different plant species have been widely studied for example by Percival (1965) and Free (1970) who found that the availability, quantity and nutritive value of pollen varies among the plant species.

Pollen load is a good indicator of the surrounding flowering plant species that are providing pollen for the honeybees. The pollen loads also reflect the availability of the dominant pollen food resource for the different pollinators in the ecosystem. Honeybee collected pollen loads have become economically important due to their high content of protein and amino acids. It has different applications including a nutritional complement for humans and of medicinal value for the preparation of antibiotics and feed for animals (Diaz-Losada *et al.* 1998).

In this investigation, comparison studies were conducted between quantities of pollen collected from winter crops especially clover and dominated summer crops i.e. maize plants. Also, the effect of climatic conditions on pollen collection.

MATERIALS AND METHODS

The experiments in this study were carried out in a private apiary at El-Mehalla El-Kobra, Gharbia governorate during the period from 2011 – 2012 .

Nine colonies included the same strength of *Apis mellifera*, 10 combs for each, standard langstroth bee hive and having mated queens at the same age were used in this study.

1- Area of study.

The study was carried out in apiary at Ayash village, EL-Mehalla ElKobra district, Gharbia governorate during the period 2011-2012 . The area is dominated by a variety of plant crops ,which are important for bee forage. The available water resource near the site makes the area suitable for bee research and practical beekeeping.

2- Survey of area vegetation.

The vegetation of the area consists mainly of clover, and some faba bean fields in winter and maize, rice, may be cotton in summer . Number previous vegetation survey had been detected in this area .

3 - Determination of collected pollen.

The clover trapped pollen pellets were collected from the hives every three days , while , those trapped from maize were collected every seven days, allowed to dry overnight at room temperature then weighed.

4 - meteorological factors.

Metrological data were taken from the weather station at Gemmeiza Research Station during the months from the first of May up to July for the two years of study. Temperature, and relative humidity were pooled to obtain the mean value for each month and year, 2011 and 2012 seasons.

5 - Statistical analysis.

Correlation coefficient between the weather factors i.e. temperature , relative humidity and the collected pollen was performed.

RESULTS AND DISCUSSION

Quantities of collecting pollen:

In clover seasons, data in Table (1) and (Fig. 1- 2)show the mean of incoming pollen weight per nine colonies during 33 days throughout 2 years. It ranged from 55.66 in the first three days to 178.50 g in the 6th period in 2011 with mean pollen income 2.06 – 6.61 g / colony /day. However, in 2012, The mean incoming pollen ranged between 49.00 to 84.00 g/ 9 colonies /3 days with an average 1.81 – 3.11g \ colony a day. The mean income of pollen increased greatly during the second half of May, it could be attributed to the increment of clover flowers during this period which provide the bee with abundant pollen. Similar result was found by (Free, 1970) who stated that Honeybees communicate the source of good forage to other honeybee workers from the hive and entire colony tends to collect nectar and pollen from only a few plant species at any one time . Also, Merti (2003) found that the field observation of pollen source plant species reveal that most of the income pollen was from clover (*Trifolium alexandrinum* Leguminosae) in winter season in spite of the existence of some other crops i. e. *Vicia Faba* been as well as from maize plants in summer. Also, Merti (2003)found that Fabaceae are represented by 9% at the study site.

Effect of climatic conditions on pollen collection activity.

In general, data in Table (1) and (Figs.1&2) clear that, the mean of temperature degrees (24.4 °C) during 2011 were less than those in 2012 season (28.00 °C). On contrast, the mean relative humidity % were higher in 2011(63.00%) than those in 2012 season(58.40%). The highest values of collected pollen(178,08 g) was recorded with Temperature 25 °C and 61% relative humidity in 2011 season, however, the lowest value (49.00 g)was recorded with temperature 26 °C and 51% relative humidity in 2012 season. The highest collected quantity of pollen reached its maximum values between 70% and 78% of relative humidity and 23 °C and 25 °C. The number of pollen loads increased as relative humidity ($r = 0.109$) and temperatures had a strong negative influence on the pollen loads collected ($r = -0.193$). Fidalgo and Klenert (2010) stated that the collected quantity of pollen reached its maximum value between 70% and 90% of relative humidity and 18 °C and 23 °C. The number of pollen loads increased as relative humidity ($r_s = 0.401$) and high temperatures had a strong negative influence on the number of pollen loads collected ($r_s = -0.228$; $P < 0.01$).

Table(1). Quantities of collecting pollen (g) collected from clover plants and their correlation with temperature and relative humidity during 2011 – 2012 seasons.

Date of collection	Season 2011			Season 2012		
	Temp °C	R. H.%	Pollen (g)	Temp °C	R.H.%	Pollen (g)
9/ 5	25	58	55.66	26	51	49.00
12/ 5	25	57	58.00	28	57	64.66
15/ 5	27	61	50.00	28	58	84.00
18/ 5	23	63	51.00	28	60	81.00
21/ 5	25	59	102.00	27	61	63.00
24/ 5	25	78	178.50	29	58	31.66
27/ 5	23	76	172.08	29	59	36.00
30/ 5	23	70	169.00	28	59	29.00
2/ 6	23	61	123.00	28	60	20.00
5/ 6	22	60	125.00	29	61	14.00
Mean	24.40	63.00	103.924	28.00	58.4	47.232
R	-0.193	0.109		-0.375	0.151	

R= correlation coefficient.

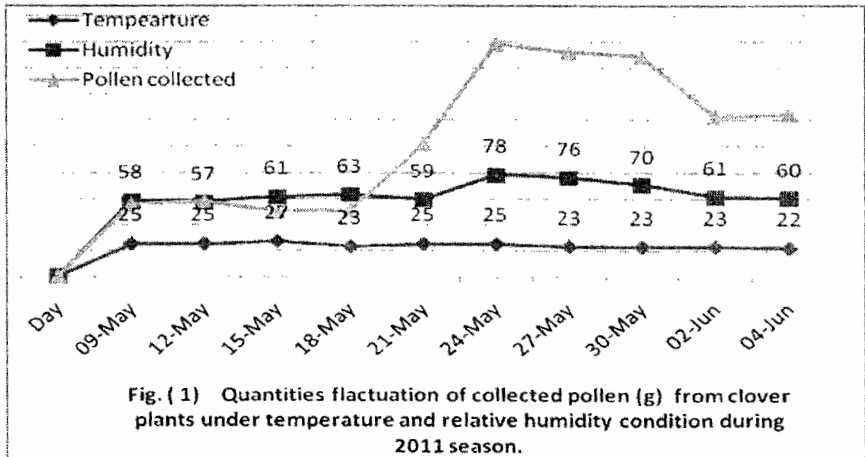


Fig. (1) Quantities fluctuation of collected pollen (g) from clover plants under temperature and relative humidity condition during 2011 season.

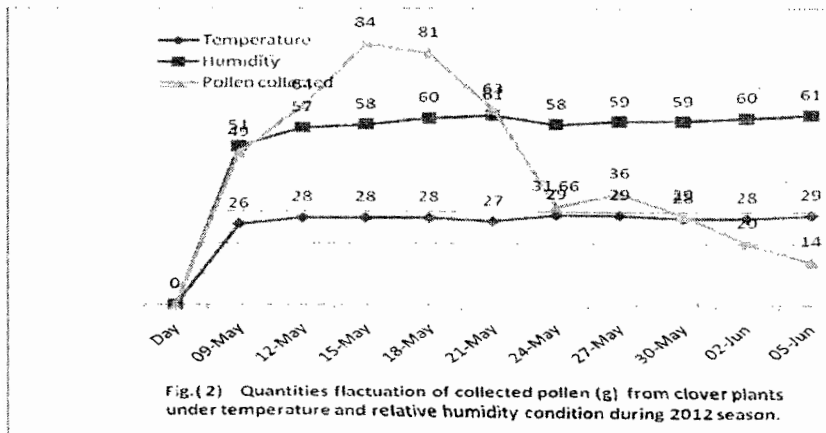


Fig.(2) Quantities fluctuation of collected pollen (g) from clover plants under temperature and relative humidity condition during 2012 season.

Data in Table (2) and (Fig.3&4) show the average of incoming pollen weight per nine hives from maize plants during 56 days in 2011 – 2012 seasons.. The mean income pollen weight ranged from 33.71 in the first 7 days to 115.85 g in fifth period / 9 colonies with an average 0.535 to 1.838 g / colony a day. However, in 2012, The mean incoming pollen ranged between 28.00 to 84.57 g / 9 colonies /7 days with an average 3.11 – 9.39 g \ colony a day. In similar study Merti (2003) found that of the 37 plant species identified, the bulk of pollen came from only a few plant species, that are abundant and provided greater quantities of pollen for foraging *Apis mellifera capensis*. These plant species are from different vegetation origins such as Fynbos, Shrubland Forest exotic and grassland. Fynbos, Shrubland are the most abundant pollen source plants in the area. The highest pollen yield came from a few species of plants such as *metalsiamuricata*, *Erica chamissonis*, *Helichrysumodoratissimum*, and *Helichrysumanomalum*. This shows that the pollen yielding potential of the plants not only depend on number of plant species but also abundance of the plants in the area.

Effect of climatic conditions on pollen collection activity.

The highest pollen value (105.00 ; 115.85g) was collected between 68 to 71% relative humidity. While, the lowest one (22.85g) was collected at 30 °C and 57% relative humidity. The analysis of correlation revealed that the decrease in collected pollen positively($r = 0.496 ; 0.391$)and relative humidity($r = 0.391 ; 0.248$) . Merti (2003) found that There was no significant correlation found between daily or monthly relative humidity and collected pollen. However, the influence of relative humidity became more pronounced on rainy days and when there was heavy cloud cover. However, Fidalgo and Kleinert (2010) Stated that bees collected more pollen loads between 18°C and 23 °C and between 70% and 90% of relative humidity.

Table (2): Quantities of collecting pollen (g) collected from maize plants and their correlation with temperature and relative humidity during 2011 – 2012 seasons.

Date of collection	Season 2011			Season 2012		
	Temp. °C	R.H.%	Pollen (g)	Temp. °C	R.H.%	Pollen(g)
25/ 6	25	64	33.71	31	63	28.00
2/ 7	28	66	68.28	30	57	22.85
9/ 7	30	67	90.00	31	61	35.57
16/7	28	68	105.00	32	53	55.71
23/ 7	28	71	115.85	29	69	57.00
30/ 7	31	67	57.00	31	69	84.57
6/ 8	28	72	82.28	30	68	40.85
13/ 8	32	70	90.00	28	59	44.57
20/ 8	32	68	89.71	30	61	39.71
Mean	29.11	68.11	77.981	30.22	62.22	45.425
R	0.463	-0.391		0.127	0.248	

R= correlation coefficient.

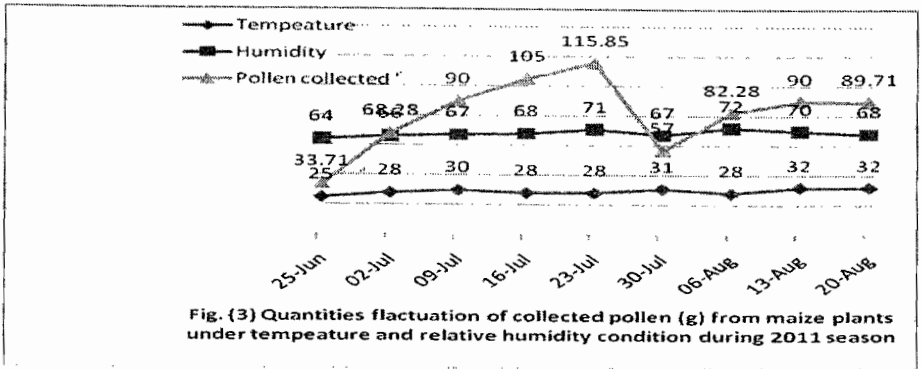


Fig. (3) Quantities fluctuation of collected pollen (g) from maize plants under temperature and relative humidity condition during 2011 season

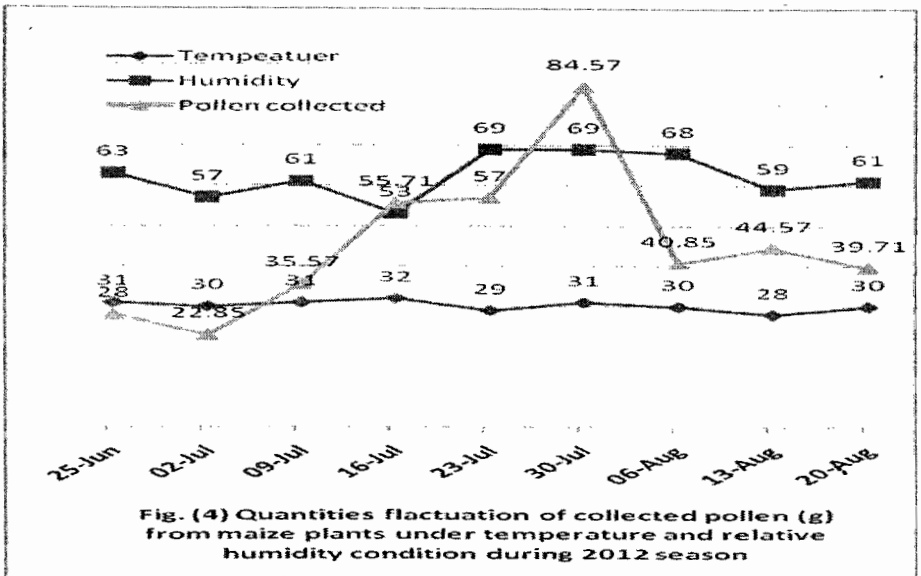


Fig. (4) Quantities fluctuation of collected pollen (g) from maize plants under temperature and relative humidity condition during 2012 season

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كمية حبوب اللقاح المجموعة بواسطة نحل العسل وعلاقتها بالظروف الجوية في محافظة الغربية - مصر

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أجريت هذه الدراسة بأحد المناحل الخاصة بناحية عياش مركز المحلة الكبرى - محافظة الغربية. تهدف الدراسة إلى تقدير كمية حبوب اللقاح المجموعة بواسطة نحل العسل خلال موسمي التزهير لمحصولي البرسيم والذرة الشامية. كان عدد الخلايا التي تم التقدير من خلالها 9 خلايا كل منها يتكون من عشرة براوييز . تم عمل حصر للمحاصيل المنزرعة بمنطقة الدراسة خلال موسمي الشتاء والصيف ٢٠١١ - ٢٠١٢ وكانت زراعات البرسيم هي السائدة خلال موسم الشتاء مع مساحات ضئيلة من الفول البلدي بينما كانت زراعات الأرز والذرة الشامية هي السائدة في الموسم الصيفي. تم تسجيل درجات الحرارة والرطوبة النسبية خلال فترة الدراسة. وقد أظهرت النتائج أن كمية حبوب اللقاح المجموعة خلال موسم تزهير البرسيم أعلى منها خلال موسم تزهير الذرة الشامية وقد يرجع ذلك إلى انخفاض درجات الحرارة وارتفاع الرطوبة النسبية وخاصة في عام ٢٠١١ عنها في موسم ٢٠١٢ بالإضافة إلى طول فترة تزهير البرسيم عن الذرة الشامية. وقد سجلت أعلى قيم لحبوب اللقاح المجموعة ما بين ٢٣ - ٢٥ درجة مئوية و ٧٠ - ٧٨ % نسبة رطوبة. وكانت الزيادة في كمية حبوب اللقاح مرتبطة إلى حد ما إيجابيا بزيادة الرطوبة النسبية ($r = 0.109$, $r = 0.151$) وسلبيا بارتفاع درجات الحرارة ($r = 0.193$, $r = -0.375$) خلال موسم البرسيم. بينما كان النقص في كمية حبوب اللقاح مرتبطا إيجابيا بكل من درجات الحرارة ($r = 0.127$, $r = 0.463$) وكذلك الرطوبة النسبية ($r = 0.248$, $r = -0.391$).

قام بتحكيم البحث

كلية الزراعة - جامعة المنصورة
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