

FRUIT TREES AND VEGETABLE PLANTS AS SOURCES OF NECTAR FOR HONEYBEE IN NORTH SINAI

1. ALMOND AND PEACHES

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ABSTRACT

Almond and peach flowers in North Sinai orchards were evaluated as source of nectar for honeybee colonies in order to draw honeybee map in this virgin Governorate. The areas cultivated with both fruit crops, the mean number of flowers per tree and per feddan were calculated. The obtained results revealed that the flowering period for almond trees started on January 25 and finished on February 25, the flowering peak was found during February 7-9, 2001. The maximum volume of nectar and its amount of solid compounds were recorded from 12 at noon till 4 p.m. The flowering period for peach trees started on February 5 and ended on February 28, the flowering peak was found during February 17-19 highest volume of nectar was obtained at 4 p.m., while the maximum amount of solid compounds was given in flower picked up during the period from 12 at noon till 4 p.m.

INTRODUCTION

Different fruit orchards and vegetable crops are cultivated in different localities of North Sinai Governorate. The main fruit crops in this Governorate are almond, peach, citrus, apple and olive, while the main vegetable crop is the cantaloupe. This may be due to the suitability of environmental conditions water resources to the productivity of the fore-mentioned crops. The nectar in the flowers during the blooming period of each crop are considered as the limiting factors for honey production and honeybee activity in this Governorate.

The fore-mentioned crops are the plant species most frequently visited by honey bees. According to Masierowska *et al.* (1993), the flowers of these plants species were protogynous, with astuctural nectaries covering the receptacle. Nectar secretion started at the bud stage and another dehiscence took place during or just after petal opening.

In 1988, Kato stated that bee workers frequently visit flowers throughout the day. The workers showed characteristic patterns of behaviour in flower used, flower choice and patch departure. The same author summarized his observations as follows: (1) Bees stayed longer on flowers which had been un-visited for a while than on a flower which had been visited recently. (2) Bees preferred visiting flowers which had been un-visited for a while to visiting those which had been visited recently, and to visiting those which had been un-visited for a long period. (3) Bees had a higher probability of leaving a patch after they had stayed on a flower for a short, period then after they had stayed for a longer period.

The aim of the present work is to evaluate the different fruit and vegetable crops as sources of nectar for honeybee colonies in Sinai Governorate in order to draw honeybee map in this location.

In this piece of research, the quantity and concentration of nectar produced by the flowers of almond and peach crops were determined. Such results may deviate light to the future of honeybee and its products in this virgin Governorate.

MATERIALS AND METHODS

Experiments were conducted during the blooming periods of almond and peach orchards. Three orchards for each kind of fruit trees were selected in Al-Arish locality. From each orchard 20 trees of the relatively similar age (10 years) were chosen to find out the volume of nectar, quantity of solid compounds in the nectar and its concentration during the day time. All experimental trees received similar agricultural practices, without using any pesticidal chemicals.

For obtaining the nectar secretion, 10 flowers from each experimental tree were marked and bagged the day before opening by using muslin cloth to prevent honeybees from sucking their nectar. After opening, the bagged flowers were cut, kept in paper bags and transferred to the laboratory for nectar collection and analyses.

Almond and peach flowers from each orchard were gathered simultaneously at seven times daily: 10 and 11 a.m., 12 noon, 1,2,3 and 4 p.m. during seven days (the day of flowering peak. As well as 3 days before and after this day). In the laboratory, the nectar of each flower was sucked by glass micropipette from the gathered flowers, and estimated the volume by a microsyringe and determined the concentration of T.S.S. by refractometer. The quantity of solid compounds in nectar of the flower was calculated according to the volume of nectar and its concentration.

The data recorded for the areas cultivated with almond and peach in different localities of North Sinai Governorate were obtained from Ministry of Agriculture, Al-Arish (2001).

The obtained data in the present work were statistically analyzed.

RESULTS AND DISCUSSION

1. Cultivated area with almond and peaches :

Four experimental localities; Bear El-Abd, Al-Arish, El-Sheikh Zowayed and Rafah were surveyed to account the areas cultivated with almond and peaches in order to calculate the mean number of flowers during the blooming period for each crop. The obtained data summarized in Table (1). The data clearly show that 14265 feddans were cultivated with almond trees in all tested localities. The largest area (7194 fedd.) was found in El-Sheikh Zowayed representing 50.43% of the total area followed by Rafah (3803 fedd.) representing 26.66% of the total area. However in Bear El-Abd

and Al-Arish localities, total areas of 1652 and 1616 feddans were cultivated with this fruit crop respectively, representing 11.58 and 11.33% of the total areas cultivated with almond in North Sinai (Table 1).

Table 1. Cultivated area with almond and peaches in different localities of North Sinai.

Localities	Experimental crops	
	Almond	Peaches
	Cultivated area (fedd.)*	Cultivated area (fedd.)*
Bear El-Abd	1652 (11.58)	3005 (4.25)
Al-Arish	1616 (11.33)	1244 (1.76)
El-Sheikh Zowayed	7194 (50.43)	27038 (38.24)
Rafah	3803 (26.66)	39414 (55.75)
Total	14265	70701

* According to the data recorded by Ministry of Agriculture, Al-Arish (2001).

- Data betweenbrackets represent the percentages.

In case of peaches, a total of 70701 feddans were cultivated with this crop. The widest area (39414 fedd.) were found in Rafah representing 55.75% of the total areas, followed by El-Sheikh Zowayed, where 27038 feddans of peaches were found, representing 38.24% of the total areas. The small areas were found in both Al-Arish (1244 feddans and 1.76%) and Bear El-Abd (3005 feddans and 4.25%). This means that Rafah and Sheikh Zowayed have the largest area cultivated with both almond and peach trees.

The mean number of flowers per tree as well as the mean number of tree per feddan of either almond or peach were counted and the mean number of flowers per feddan was also calculated.

2- Numbers of almond and peach flowers :

For almond, each tree contains two main branches, each contains the average number of 926 flowers, with the mean total number of 1852 flowers/tree. Taking into consideration the mean number of 100 trees/feddan, the total number of flowers per feddan is about 185200. In case of peach, each tree contains three main branches, having an average number of 462 flowers on each branch, with the mean total number of 1386 flowers/tree. Taking into consideration the mean number of 100 peach trees/feddan, the total number of flowers per feddan is about 138600. These counts for both fruit crops were carried out during the main flowering period. Therefore, it is easy to calculate the mean number of flowers in each tested area cultivated with either crop. And the expected amounts of nectar in each location.

Such calculation may be considered as a good indicator for the amount of nectar, which may gather from these trees by honeybees during the blooming period.

3. Volumes and properties of nectar picked up from almond and peaches flowers :

a. Almond flowers :

The volumes and properties of nectar taken from the flowers of almond in experimental areas of North Sinai was determined during the day times of the flowering period. The flowering period for this fruit crop started on January 25 and ended on February 25. The flowering peak was found during the period from February 7-9, 2001. During this period seven inspection periods during the day, i.e., 10, 11 and 12 noon, 1,2,3 and 4 p.m. were made to obtain the amount of nectar in gathered flowers and the quantity of solid compounds in the nectar and its concentration were determined. Moreover, the daily mean temperature and the relative humidity were registered. The obtained data are tabulated in Table (2).

From this table, it is obvious that the mean volume of almond nectar varied during the day times. The maximum volume was recorded from 12 atnoon till 4 p.m., except at 2 p.m., and the minimum was, however, obtained in the morning; at 10 and 11 a.m. The L.S.D. value emphasizes the obtained results Table (2).

The same trend could be applied for the amounts of solid compounds in the almond nectar, being high atnoon and after noon and low in the morning. However, the concentration of the almond nectar did not affect during the tested day times, ranging between 20.66 at 3 p.m. and 22.66% at 11 a.m., with no significant difference between both means. The obtained data clearly show that there was negative correlation between the relative humidity and the volume of almond nectar or its concentration, being insignificant (-0.3027) between humidity during the day and the concentration nectar, and highly significant between the humidity and volume of nectar (-0.9947). The opposite was, however, true for the correlation between the temperature degrees from one hand and the volume of almond nectar and its concentration during the day from the other hand. In both cases positive but insignificant correlation was recorded between temperature and almond nectar concentration (0.2528) and between temperature and almond nectar volume (0.2888).

Table 2. Volume and properties of nectar picked up from flowers of Almond in Northern Sinai during the day periods (flowering peaks during February 7-9).

Time of inspection during the day	Volume of nectar in 100 flowers (mm ³)	Quantity of solid compounds in nectar of 100 flowers (mg)	Concentration of nectar (%)	Mean Temperature (°C)	Relative humidity (%)
10 a.m.	83.33	17.66±2.05	21.33	15.6	58.3
11	83.33	18.75±1.84	22.66	16.7	55.6
12	141.66	30.25±7.42	21.66	17.0	57.0
1 p.m.	141.66	30.50±0.71	21.66	16.4	52.6
2	116.66	25.16±4.55	21.66	15.9	59.6
3	150	31.08±11.55	20.66	16.5	57.6
4	158.33	34.25±4.83	21.66	16.06	58.0
Mean ±SE	125.00	26.81	21.619		
F-value	2.64*	4.52*	1.2642		
LSD at 0.05	19.15	4.11	-		

b. Peach flowers :

The flowering period for the peach trees in the experimental areas started on February 5 and ended on February 28. The flowering peak was found during February 17-19. The flowering peak was found during the period from February 17-19. The volume of nectar in peach flowers during the day times varied from that in almond flowers. The highest volume was obtained after noon, especially at 4 p.m. (93.33 mm³/100 flowers), followed by nectar picked up at 2 and 3 p.m. (83.33 mm³/100 flowers). The third category was found at 12 noon and 1 p.m. (76.67 mm³/100 flowers). However the least volume of peach nectar was recorded in the morning (at 10 and 11 a.m. where 66.67 and 70.00 mm³/100 flowers were recorded, respectively). On the other hand, the solid materials in the peach nectar was significantly affected during the day times and could be arranged into the following statistically descending groups. The first group contained nectars taken during the period from 12 noon till 4 p.m. (12.96-15.90 mg/100 flowers) and the second group contained nectars picked up from flowers during the period from 10-11 a.m. (10.93-12.13 mg/100 flowers). Table (3) clearly show that the highest concentration of peach nectar was recorded at mid-day (12 noon and 1 p.m., being 19% in both times). This may be due to the high daily mean temperature during this period which causes high rate of water evaporation from the nectar and in turn, increase the nectar concentration.

Statistically, there was positive and insignificant correlation between the relative humidity and the volume of peach nectar being 0.2344. However, negative and significant correlation (-0.5753) was obtained between the relative humidity and the concentration of nectar during the day time.

The opposite findings were given for the correlation between mean daily temperature and the volume on concentration of peach nectar. Insignificant negative correlation (-0.1987) was recorded between the temperature degrees and volume of nectar, while significant and positive correlation (0.8321) was obtained between the temperature degrees and the concentration of nectar.

Table 3. Volume and properties of nectar picked up from flowers of peaches in Northern Sinai during the day periods (flowering peaks during February 17-19).

Time of inspection during the day	Volume of nectar in 100 flowers (mm ³)	Quantity of solid compounds in nectar of 100 flowers (mg)	Concentration of nectar (%)	Mean Temperature (°C)	Relative humidity (%)
10 a.m.	66.67	10.93±1.88	16.33	17	57.6
11	70.00	12.13±1.19	17.33	17.3	50
12	76.67	14.46±1.96	19.00	17.8	52
1 p.m.	76.67	14.63±1.93	19.00	17.8	56
2	83.33	14.36±1.74	17.33	17.4	60.6
3	83.33	12.96±0.75	15.67	17.3	66.3
4	93.33	15.40±0.43	16.67	16.9	65
Mean ±SE	78.57	13.55	17.33		
F-value	3.64*	3.18*	6.98*		
L.SD at 0.05	4.71	2.46	0.96		

In the available literature, the total amount of resources allocated to flowers affected the spread of nectarless plants was studied by **Sakai (1993)** in Japan. It was assumed that pollinators concentrate on patches whose nectar rewards were relatively large compared to other patches and if pollinators visited a patch, they concentrated on the plants whose nectar rewards were relatively large compared to other plants in the patch.

According to Kakutani *et al.* (1993), the average nectar volume per strawberry flower was 0.02 µl in the area containing the stingless bee, *Trigona minangkabau* and the honeybee, *Apis mellifera*, and 0.01 µl in other areas free from honeybee colonies. Nectar production in *Saponaria officinalis* and several species of genus *Selline* was examined by Witt *et al.* (1999). Nectar volume and sugar concentration were determined in relation to time of day. They found that nectar quantity in the flowers of most tested plant species increased in the afternoon. They added that in some cases, nectar volumes and nectar concentration differed significantly between hermaphroditic, male and female flowers. Female flowers contained significantly less concentrated nectar than male or hermaphroditic ones. Michaud (1990) found that mean sugar yields collected from individual flowers of fireweed ranged from 0.66 mg/flower/day to 4.11 mg/flower/day. He added that weather factors were of primary importance to nectar secretion patterns. Sun shine and mean temperature demonstrated the best correlations with nectar yield. In white clover flowers, for instant, the variation in absolute level of nectar secretion was great at high temperature (Norris, 1985). Contradicting results were given by Yasue and Yamada (1990), who stated that the amount and rate of nectar secreted in the flowers of chinese milk vetch were higher at low than high temperature. The same authors added that concentrations of glucose, sucrose and total sugars in nectars increased at temperature decreased. Generally, the period of greatest nectar production in plant flowers depended on plant species and weather conditions (Vachev *et al.*, 1983).

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أشجار الفاكهة ونباتات الخضر كمصادر للرحيق لنحل العسل في شمال سيناء

١ - اللوز والخوخ

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تم تقييم أزهار كل من اللوز والخوخ كمصادر للرحيق لنحل العسل في حدائق شمال سيناء . هذا وقد تم حساب المساحات المزروعة من كل محصول بالفدان على مستوى المحافظة ، كما حسب متوسط عدد الأزهار على الشجرة الواحدة ، ومن ثم على أشجار الفدان . ويمكن تلخيص أهم النتائج فيما يأتي :

١ - بالنسبة للوز تبدأ فترة التزهير من ٢٥ يناير وتنتهي في ٢٥ فبراير من نفس العام ، وقد وجد أن أقصى معدل تزهير قد سجل خلال الفترة من ٧-٩ فبراير . وخلال اليوم كان أقصى حجم للرحيق في الأزهار خلال الفترة من الساعة الثانية عشر ظهراً حتى الرابعة مساءً .

٢ - بالنسبة للخوخ تبدأ فترة التزهير من الخامس من فبراير وتنتهي في ٢٨ من نفس الشهر ، كما وجد أن أقصى معدل تزهير قد تم تسجيله خلال الفترة من ١٧-١٩ فبراير . وخلال اليوم كان أكبر حجم للرحيق في الأزهار التي جمعت الساعة الرابعة مساءً ، بينما كان أعلى كمية للمواد الصلبة بهذا الرحيق خلال الفترة من الساعة الثانية عشر ظهراً حتى الرابعة من مساء نفس اليوم .

هذا وقد تم حساب تركيز الرحيق خلال اليوم لأزهار كلا المحصولين وذلك بهدف رسم خريطة محلية على مستوى المحافظة مبينة على مواعيد تزهير المحاصيل المختلفة الرئيسية المنزرعة .