

Floral phenology and quantity of pollen collected from different sources by honeybees under Nasr City conditions

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Abstract

This study carried out at apiary of plant protection Department, Faculty of Agriculture, Al-Azhar University, Cairo, Egypt, to survey and determine pollen types and their quantities and blooming periods under Nasr City conditions during Sept. 2013 to Sept. 2014 by F₁ hybrid carniolan honeybee. The different pollen sources collected by honeybees were identified and classified into major and minor pollen sources of 35 plant species, included the Eucalyptus trees, ornamental and agriculture crops and weeds.

Major pollen yielding plants were *Eucalyptus spp*, *Tanaris articulata*, *Acacia spp*, *Pinus sp*, *Calendula officinalis*, *Phoenix dactylifera*, *Morus alba* and *Citrus spp*, (3647.51 - 2138.75 - 803.37 - 777.25 - 562.45 - 443.45 - 225.75 - 110.74g.) respectively per four colonies during year. While the minor were *Calendula arvensis*, *Trifolium alexandrenum*, *Aloe vera*, *Pelargonium spp*, *Medicago sativa* and *Salvia officinalis* (91.35 - 75.25 - 40.08 - 38.25 - 37.65 - 25.85g.) respectively, for the rest plant sources which yielded small amounts of pollen.

The highest mean weights of pollen were collected during and winter (1453.6gm./col. and 475.8gm./col.) respectively, while the lowest ones was during autumn and summer, seasons (211.1 and 171.3 gm.) /colony, respectively.

Introduction

Pollen is the only natural protein source in the honeybee colonies, it is very important and necessary for the development, strength, and healthy of the

honeybee colony, many researchers studied the importance and identification of collected pollen by honeybees,

Hussein et al. (1982) studied species composition of pollen and prepared floral calendar for Assuit region. Pollen grains from 63 genera identified during this work. Correlation coefficients calculated between pollen density and other parameters.

Shawer et al. (1986) in Kafr EL-Sheikh region surveyed major pollen sources and they found that beebread areas were differed significantly and their more in spring summer and autumn depending on size and strength of honeybee colony. **Shawer et. al. (2003)** surveyed 31 of bee forage plant belonging to 28 plant species and 16 plant families in Rashid and Deseok regions. In Metobus region, **Taha et. al. (2009)** found that blooming period of loofah, *Loff aegyptiaca*, during Jun-November months, which considered being a good source of pollen and nectar in this region. **Shaheen, (2012)** studied the pollen gathering including periodical activity at North Sinai. He found that the highest amount recorded during spring season.

At Fayoum Governorate **Salem, R.A.(2011)**evaluated the pollen species collected by honeybee, *Apis mellifera* L., colonies during 2009 and 2010 years. They showed that, there were 24 plant species of 16 botanical families from which bees collected pollen, The largest amounts were collected in summer followed by winter then spring, while least ones were in autumn. Our work aim to study identification, quantities and flowering periods of collected pollen for plant flora, under Nasr city conditions.

Materials and methods

Four honeybee colonies (carniolan F1 hybrid) of the same strength, each colony consisted of (four brood combs, two honey and pollen combs and headed by new mated queen sister were prepared, this experiment which carried out at Nasr city region from Sep.2013 to Sep. 2014.

Determination of the efficiency of pollen trap.

The efficiency of the pollen trap in collecting pollen loads was determined by counting 100 worker bees from each hive entering with pollen loads on their hind legs through the empty trap. The number of pellets that fall in the tray was counted and the efficiency of the trap was calculated according to the equation reported by **Khattab (1976)**, **El-Shakaa (1977)** and **Ewies *et al.* (1980)** as the following:

Pollen trap efficiency = (number of pollen pellets in the box /200) x 100.

Examination of pollen loads

Pollen pellets were collected for three days every morning in paper bags of 10-20 cm. and send to the lab., where they were cleaned, weighed, and classified by their colors, size, shape and texture using a small drawing brush, and the total weight of the pellets of each type was recorded. Similar samples were placed in a packet. Each packet was labeled with date, colony number, color of the load and time of collection. Pollen pellets were stored in freezers and were analyzed after words. **Mehwish *et. al* (2009)**

Identification of pollens

For identification of pollens, a representative sample of each pollen type was taken on a light microscope slide where it mounted in glycerin jelly and compared with already prepared slides of pollen made from nearly opened anthers of flowering plants growing at the research region. **Ibrahim and Salim,(1965)**.

Statistical analysis

Data were subjected to analysis of variance (ANOVA) using SPSS" computer statistical program. Mean values were compared using Duncan's multiple range test **Duncan, (1955)**.

Results and Discussion

Data presented in Table (1) and Fig. (1,2) show that the collected pollen quantities by honey bee colonies from major and minor sources under Nasr city conditions during 2013/ 2014

The recorded major sources:

1 - *Eucalyptus spp*, the collected pollen quantities were (50.34, 270.23, 393.72, 245.61, 297.34, 393.25, 549.85, 341.71, 1080.9 and 24.56 g.) during (Sept., Oct., Nov., Dec., Jan., Feb., Mar., Apr., May and Jun.) respectively, there was no collected pollen during (Jul. and Aug.) it was very clear that the largest quantity (1080.9 g.) was collected during May and the smallest one (24.56 g.) was collected during June.

2 - *Tanaris articulata*, the collected pollen quantities were (28.6, 5.11, 6.22, 8.14, 18.15, 1206.02, 845.56 and 20.95 g.) during (Nov., Dec., Jan., Feb., Mar., Apr., May and Jun.) respectively, there was no collected pollen during (Sept., Oct., Jul. and Aug.)

it was clear that the largest quantity recorded (1206.02 g.) was collected during Apr. and the smallest one (5.11 g.) was collected during Dec.

3 - *Acacia spp*, the collected pollen quantities were (10.25, 55.35, 80.95, 174.25, 366.45, 112.47 and 3.65 g.) during (Nov., Dec., Jan., Feb., Mar., Apr. and May) respectively, there was no pollen collected during (Sept., Oct., Jun., Jul. and Aug.) it was clear that the largest quantity recorded (366.45 g.) collected during Mar. and the smallest one (3.66 g.) collected during May.

4 - *Pinus halepensis*, The collected pollen quantities were (20.95, 59.55, 65.25, 76.35, 340.65 and 214.5 g.) during (Feb., Mar., Apr., May, Jun. and Jul.) respectively, there was no pollen collected during (Sep., Oct., Nov., Dec., Jan., and Aug.) it was clear that the largest quantity recorded (340.65

g.) was collected during Jun. and the smallest one (20.95 g.) was collected during Feb.

5 – *Calendula officinalis*, The collected pollen quantities were (8.2, 70.65, 100.25, 119.35, 185.75, and 78.25 g.) during (Nov., Dec., Jan., Feb., Mar., and Apr.) respectively, there was no pollen collected during (Sept., Oct., May, Jun., Jul., and Aug.) it was clear that the largest quantity recorded (185.75 g.) collected during Mar. and the smallest one (8.2 g.) was collected during Nov.

6 – *Phoenix dactylifera*, The collected pollen quantities were (40.55, 301.15 and 101.75 g.) during (Feb., Mar., and April) respectively, there was no pollen collected during the rest months.

7 – *Morus alba*, The collected pollen quantities were (141.55 and 184.2 g.) during (Feb. and Mar.) respectively there was no pollen collected during the rest months.

8 – *Citrus spp*, The collected pollen quantities were (4.65, 4.59, 7.77 and 93.37 g.) occurred during (Oct., Nov., Mar. and April) respectively, there was no pollen collected during the rest months.

The recorded minor sources include:

The remain plant species were the minor sources for pollen collected by honeybee where the ratios ranged between 0.99% - 0.001% from the pollen collected Table (1) and Fig (1&2). From the previous data in Table (1) it's clear that there are 33 identified various major and minor sources of pollen in Nasr city and all over the year months (except Aug.). There are two unknown minor sources. The total quantities of collected pollen per four honey bee colonies from different sources was (9246.96 g.), all over the year and the largest quantity collected per four colonies (2031.15 g.) occurred during April followed by collected quantity (2015.22 g.) during

May while the collected quantity (1767.94 g.) during Mar. ranked the third order and the collected quantity (989.39 g.) during Feb. ranked the fourth order and the collected quantities during the rest months arranged as the following Jan. (534.36 g.),Nov.(466.26 g.)Jun.(409.9 g.),Dec.(379.62 g.), Oct. (315.98 g.), Jul. (275.1 g.) and finally during Sep. (62.04 g.).

On the other hand these sources can be arranged according to their total quantities collected per four colonies during year to the following orders:-

Eucalyptus spp (3647.51 g.), ranked the first order followed by *T.articulate* (2138.75 g.) , *Acacia spp* (803.37g.), *Pinus sp* (777.25 g.), *Calendula officinalis* (562.45 g.), *Phoenix dactylifera* (443.45 g.) , *Bombax cieba* (325.75 g.) ,*Citrus spp* (110.74 g.), *Calendula arvensis* (91.35 g.), *Trifolium alexandrenum* (75.25g.) , *Medicago sativa* (37.65 g.) , *Aloe vera* (20.08g.) , *Salvia officinalis* (25.85g.), *Dodonea viscos* (16.15g.), *Zizyphus spina Christi* (14.7g.), *Convolvulus arvensis* (15.65g.) , *Zea mays* (12.7g.) , *Olea europaeas* (11.45g.), *Callistemon citrinus* (11.25g.) , *Casuarina glauca* (10.15g.) , *T. efficinale* (9.33g.), *H. annus* (8.25g.) , *Malus sylvestris* (6.85g.) and *Agave sisalana* (3.45g.), Table (1).Our data were indisagreement with **Mehwish, et. al.(2009)**, in Pakistan they found that the foraged plants are available throughout the year and from January to April and July to August are major, whereas April and May are minor flow period of pollen while June is the dearth period. This study gives the general idea of range of plant species that occur in the area of Nasr City and their utility to the honeybees, which is important for them so that they can make efficient use

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Table (1): Phylogeny and monthly quantities (in g.) of the major and minor pollen sources per four colonies during different seasons at Nasr City throughout the period from 13/9/2013 – 12/9/2014.

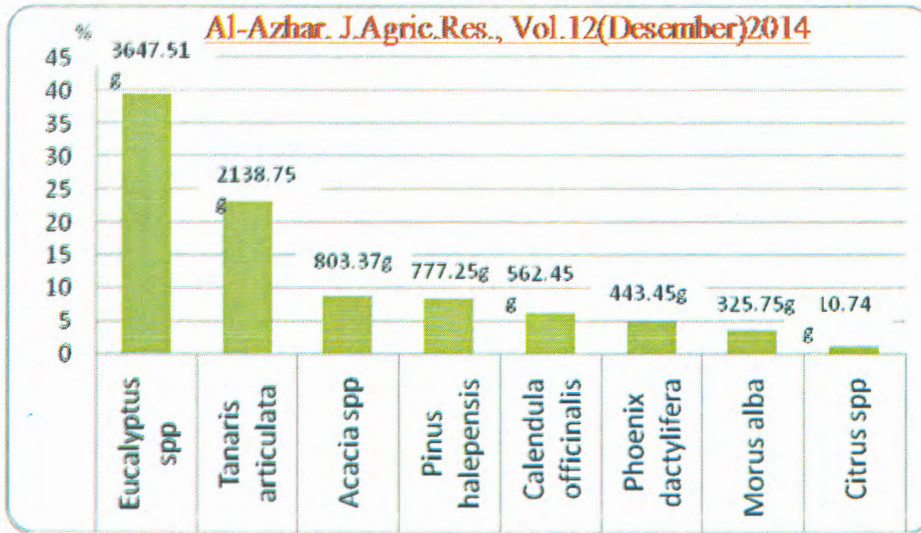
Plant	Common name	Scientific name	Arabic name	Flowering	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Total	%
					9	10	11	12	1	2	3	4	5	6	7	8		
Eucalyptus		<i>Eucalyptus spp</i>	كافور	From 13/9 to 16/6	50.34	270.23	393.72	245.61	297.34	393.25	549.85	341.71	1080.9	24.66	-	-	3847.51	39.46
Tamarisk		<i>Tanaris articulata</i>	الحلج	From 12/11 to 10/6	-	-	28.6	5.11	6.22	8.14	18.15	1206.02	845.58	20.95	-	-	2138.75	23.14
Acacia		<i>Acacia spp</i>	اكاسيا	From 15/11 to 2/5	-	-	10.25	55.35	80.95	174.25	366.45	112.47	3.65	-	-	-	803.37	8.69
Pines		<i>Pinus halepensis</i>	الصنوبر	From 19/2 to 27/7	-	-	-	-	-	20.95	59.55	65.25	78.35	340.85	214.5	-	777.25	8.41
Marigold		<i>Calendula officinalis</i>	القحوان	From 3/11 to 16/4	-	-	8.2	70.65	100.25	119.35	165.75	78.25	-	-	-	-	562.45	6.08
Date-palm		<i>Phoenix dactylifera</i>	طلع النخل	From 13/2 to 23/4	-	-	-	-	-	40.55	301.15	101.75	-	-	-	-	443.45	4.8
Mulberry tree		<i>Morus alba</i>	توت	From 13/2 to 30/3	-	-	-	-	-	141.55	184.2	-	-	-	-	-	325.75	3.52
Citrus		<i>Citrus spp</i>	موالح	From 9/3 to 5/5	-	4.65	4.59	-	-	-	7.77	93.73	-	-	-	-	110.74	1.2
Daisy		<i>Calendula arvensis</i>	زهرة الربيع	From 20/1 to 3/3	-	-	-	-	40.95	47.7	2.7	-	-	-	-	-	91.35	0.99
Egyptian clover		<i>Medicago sativa</i>	برسيم مصري	From 25/6 to 20/7	-	-	-	-	-	-	-	-	-	20.65	54.4	-	75.25	0.81
Aloe		<i>Aloe vera</i>	صبار	From 25/2 to 2/5	-	-	-	-	-	4.55	22.25	9.63	3.65	-	-	-	40.08	0.43
Geraniums		<i>Pelargonium spp</i>	الجارونيا	From 20/1 to 3/4	-	-	-	-	3.55	12.35	16.55	5.8	-	-	-	-	38.25	0.41
Alfa alfa		<i>Medicago sativa</i>	برسيم حجازي	From 13/9 to 7/11	7.25	28.15	4.25	-	-	-	-	-	-	-	-	-	37.65	0.41
Sage		<i>Salvia</i>	مرمرية	From 7/2	-	-	-	-	-	10.55	12.77	2.59	-	-	-	-	25.85	0.25

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	<i>officinalis</i>		to2/4														
Dodonea	<i>Dodonea viscosa</i>	دادنيا	From 7/2 to2/4	-	-	-	-	-	2.75	10.85	2.55	-	-	-	-	16.15	0.17
Field weed	<i>Dolichos lablab</i>	لهلاب الحقول	From11/1 to17/4	-	-	-	-	2.65	4.5	5.85	2.65	-	-	-	-	15.65	0.17
Nabk	<i>Zizyphus spina Christi</i>	السدر	From 25/6 to20/11	1.55	4.25	2.45	-	-	-	-	-	-	1.75	4.15	-	14.15	0.15
Bottle brush	<i>Callistemon viminalis</i>	فرشاة الزجاج	From2/1 to13/4	-	-	-	-	1.25	2.85	4.95	2.5	-	-	-	-	11.55	0.12
Olive	<i>Olea europaea</i>	الزيتون	From 26/2 to 8/3	-	-	-	-	-	3.2	8.25	-	-	-	-	-	11.45	0.12
Casuarina	<i>Castorina glauca</i>	كازورينا	From 25/10 to9/12	-	1.65	6.85	1.65	-	-	-	-	-	-	-	-	10.15	0.11
Blow bells	<i>Taraxasum officinale</i>	الداندليون	From 26/2 to 8/4	-	-	-	-	-	0.85	6.25	2.25	-	-	-	-	9.35	0.1
Sunflower	<i>Helianthus amuus L.</i>	زهرة الشمس	From 3/10 to 15/11	-	3.55	4.7	-	-	-	-	-	-	-	-	-	8.25	0.09
Apples	<i>Malus sylvestris</i>	تفاح	From 13/9 to19/10	2.45	2.75	-	-	-	-	-	1.65	-	-	-	-	6.85	0.07
Guava	<i>Psidium guajava</i>	الجوافة	From22/9 to 16/5	0.25	1.15	0.75	-	-	-	1.35	1.05	1.11	-	-	-	5.66	0.06
Maize	<i>Zea mays</i>	ذرة	From 25/6 to20/7	0.2	1.05	-	-	-	-	-	-	-	1.05	2.05	-	4.35	0.05
Sisal	<i>Agave sisalana</i>	السيمال	From 5/5 to 23/5	-	-	-	-	-	-	-	-	3.45	-	-	-	3.45	0.04
Zygophyllum	<i>Zygophyllum spp</i>	البسيط	From 15/11 to 13/12	-	-	1.3	1.25	-	-	-	-	-	-	-	-	2.55	0.03
Poinciana	<i>Delonix regia</i>	البونسيانا	From9/3 to15/5	-	-	-	-	-	-	0.65	1.25	0.55	-	-	-	2.45	0.005
Cabbage	<i>Brusica oleracea</i>	الكرنب	From 11/1 to28/2	-	-	-	-	0.85	1.4	-	-	-	-	-	-	2.25	0.02
Passion	<i>Passiflora</i>	زهرة العاطفة	From 3/3	-	-	-	-	-	-	1.85	-	-	-	-	-	1.85	0.02

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	<i>cearulea</i>		to27/3														
Mango	<i>Mangifera indica L.</i>	المانجو	From 11/1 to 28/4	-	-	-	-	0.35	0.65	0.55	-	-	-	-	-	1.55	0.01
Prickly pear	<i>Opuntia ficus-indica</i>	التين الشوكي	From 4/10 to 29/11	-	0.55	0.6	-	-	-	-	-	-	-	-	-	1.15	0.01
	<i>Plantago coronopus</i>	رجل الغراب	From 12/3 to 27/3	-	-	-	-	-	-	0.25	-	-	-	-	-	0.25	0.003
Un known source				-	-	-	-	-	-	-	0.11	-	-	-	-	0.11	0.001
Un known source				-	-	-	-	-	-	-	-	0.09	-	-	-	0.09	0.001
Total				62.04	315.98	466.26	379.62	534.36	989.39	1767.94	2031.15	2015.22	409.9	275.1	0	9246.96	100



(Plant species and their blooming)

Fig. (1):Phylogeny (percentage and quantities in g.) of the major pollen sources per four colonies during different seasons at Nasr City throughout the period from 13/9/2013 – 12/9/2014.

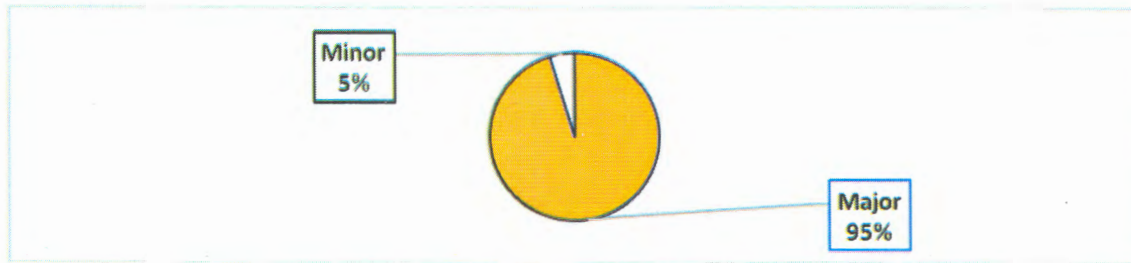


Fig. (2):Percentage of the major pollen sources per four colonies during different seasons at Nasr City throughout the period from 13/9/2013 – 12/9/2014.

Data presented in Table (1) also show the sources of pollen which collected by honeybee and their blooming periods during 2013/2014 under Nasr City conditions.

Its clearly show the sequences of flowering periods of the major sources start from Sep. 2013 to Jul. 2014, and the sequences of flowering periods starts from Jan to Jul. 2014 and the limited blooming periods for each of major and minor source recorded in the same Table. There are two unknown

minor sources. Phenology is the scientific study of periodic biological phenomena, such as the flowering of plants, in relation to climatic conditions, such as the number of days in flowering (length of flowering) (Amssalu, 2014). Add to that, beekeepers must have a working knowledge of flowering periods of both major and minor nectar and pollen producing plants in the vicinity of their apiaries for successful honey production to enable them determining when to carry out various management practices with their colonies (Francis, 1990).

Data presented in Table (2) and Fig.(3) show that collected pollen occurred all over the year except Aug. The largest collected amount per honey bee colony recorded (507.8

g.) during April , the lowest one (15.5 g.) occurred during Sept. and the rest quantities ranged from 79.0 to 442.0 g. during the rest months.

As respect to the quantities during the different seasons, the largest amount (1453.6 g.) per colony occurred during spring and the lowest one (171.3 g.) recorded during summer while the quantity recorded during winter (475.8 g.) larger than that in autumn (211.1 g.).These results were in disagreement with (Mehwish *et al.*,2009) they found that the foraged plants are available throughout the year in the locality but January to April and July to August are major, whereas April and May are minor flow period of pollen while June is the dearth period . and in agreement with **Shawer *et al.* (1986)** in Kafr EL-Sheikh region surveyed major pollen sources and they found that beebread areas were differed significantly and their more in spring and autumn depending on size and strength of honeybee colony.

It's clear that Nasr city has different sources of pollen all over the year and the largest amounts occurred during spring and winter, its encourage the early activity of honey bee queens and promote high population of honey

bee workers which give high yield of pollen and honey, for producing different products of honey bee. and very important region for honeybee wintering under the Egyptian conditions

Table (2): Quantity of collected pollen by honey bee in gm./four colonies during different seasons of 2013/2014 under Nasr City conditions.

Season	Month	Rep.				Total	Mean
		R1	R2	R3	R4		
Autumn	Sep.	11.19	19.45	14.15	17.25	62.04	15.5
	Oct.	49.59	93.55	84.88	87.96	315.98	79.0
	Nov.	93.66	131.82	133.93	106.85	466.26	116.6
Total		154.4	244.8	233.0	212.1	844.28	211.1 c
Winter	Dec.	71.75	104.65	110.15	93.07	379.62	94.9
	Jan.	95.45	152.35	161.41	125.15	534.36	133.6
	Feb.	176.25	285.45	294.74	232.95	989.39	247.3
Total		343.5	542.5	566.3	451.2	1903.37	475.8 b
Spring	Mar.	327.66	480.65	529.71	429.92	1767.94	442.0
	Apr.	393.15	573.25	589.5	475.25	2031.15	507.8
	May	380.45	569.41	587.21	478.15	2015.22	503.8
Total		1101.3	1623.3	1706.4	1383.3	5814.31	1453.6 a
Summer	Jun.	89.95	104.88	113.52	101.55	409.9	102.5
	Jul.	51.25	74.45	85.05	64.35	275.1	68.8
	Aug.	0	0	0	0	0	0.0
Total		141.2	179.3	198.6	165.9	685	171.3 c
L.S.D at 5%		226.37					
F value		66.51					

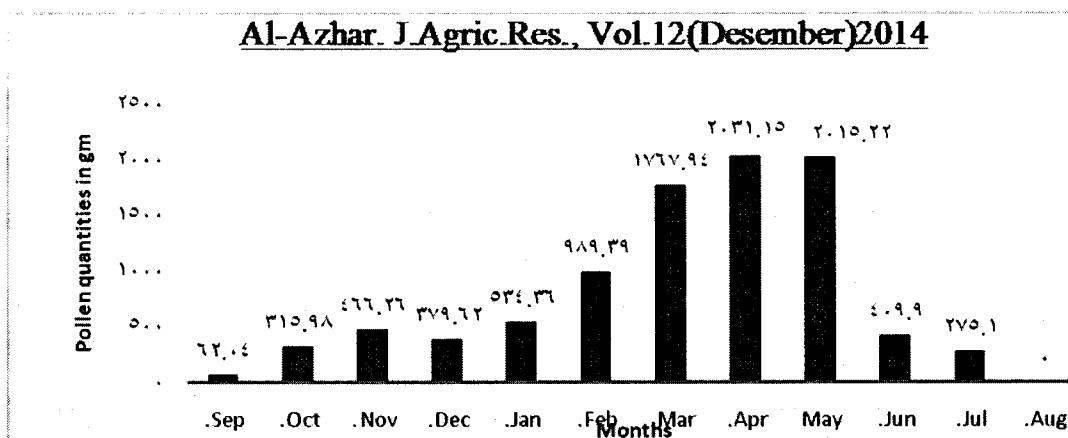


Fig. (3): Quantity of collected pollen by honeybee in gm./four colonies during different seasons of 2013/2014 under Nasr City conditions.

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التصنيف النباتي وكمية حبوب اللقاح التي جمعت من مصادر مختلفة بواسطة نحل العسل تحت ظروف مدينة نصر (القاهرة)

إ.د / عبدربه عيد حسين د / ابراهيم عبد الرازق عبدالله د / جمعه فتح الله ابو لبن

/ عادل احمد العياط

اجريت هذه الدراسة في المنحل التابع لقسم وقاية النبات - كلية الزراعة - جامعة الأزهر القاهرة (مدينة نصر) في الفترة من ١٣ / ٩ / ٢٠١٣ حتى ١٢ / ٩ / ٢٠١٤ م

وكان الهدف من الدراسة هو التعرف على المصادر النباتية التي يزورها النحل على مدار السنة وعلى كميات حبوب اللقاح التي يقوم النحل بجمعها من تلك النباتات وموعد ظهورها وانتهائها ومن ثم تصنيفها الى مصادر رئيسية وثانوية.

المصادر الرئيسية لحبوب اللقاح في مدينة نصر (القاهرة)

تنوعت مصادر حبوب اللقاح المجموعة بواسطة نحل العسل. حيث بلغ عدد المصادر النباتية التي زارها النحل (٣٥) مصدرأ نباتياًتم التعرف على (٣٣) منها بينما لم يتم التعرف على مصدرين. واطهرت النتائج ان:

اهم المصادر النباتية التي زارها النحل على مدار السنة واكبر كميات حبوب اللقاح التي جمعها النحل من الكافور - العبل - الأكاسيا - الصنوبر - الاقحوان - طلع النخيل حيث كانت (٣٦٤٧,٥١- ٢١٣٨,٧٥ - ٨٠٣,٣٧ - ٧٧٧,٢٥ - ٥٦٢,٤٥- ٣٢٥,٧٥) جم / ٤طوائف من نحل العسل على الترتيب.

كما اظهرت النتائج ان:

اكبر كمية من حبوب اللقاح جمعت كانت في فصل الربيع (٥٨١٤,٣١) بمتوسط (١٤٥٣,٦) يليه فصل الشتاء (١٩٠٣,٣٧) بمتوسط (٤٧٥,٨) يليه فصل الخريف (٨٤٤,٢٨) بمتوسط (٢١١,١) وكانت اصغر كمية جمعت في فصل الصيف (٦٨٥) بمتوسط (١٧١,٠٣) جم / ٤طوائف من نحل العسل.