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Studies on Seasonal Variation of Pollen Collected by Honeybee in North Sinai Governorate

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ABSTRACT

The present work was carried out at El-Arish, North Sinai Governorate, Egypt during two successive years (2014 and 2015) to study these points; Record the different plant species and their flowering periods as pollen sources of honeybees, evaluate pollen-collecting activity of the honeybee colonies, determine the chemical composition of collected pollen grains and identify the trapped pollen grains microscopically. The obtained results showed that, the plant species number recorded at El-Arish region as pollen sources of honeybees was 123 plants of 49 botanical families includes 4 groups, fruit and vegetables, ormental, wild weeds and medicinal plants. The most of the affiliated plants for 4 groups were flowering in the spring season. The results of pollen collection revealed that, Trapped pollens total weight in 1^{st} year of Italian race (1447 g/colony/year) was greater than those of Carniolan race (1415 g/colony/year). But, the total weight of trapped pollens in 2^{nd} year of Italian race (1350 g/colony/year) was lower than those of Carniolan race (1385 g/colony/year). The largest amounts were collected in April month. Chemical analysis of the major trapped pollen groups showed that pollen of palm recorded the highest level of moisture and crude lipids, while olive pollen recorded the highest amount of crude protein and ash. The highest crude fiber and educing sugar were recorded with orange pollen. The major trapped pollen groups were identified microscopically.

Keywords:honeybee, plant species, El-Arish, pollen-collecting activity, chemical composition, identify, microscopically.

INTRODUCTION

Pollen is one of the vital important components to honeybee and so to beekeeper. It is the only source of nitrogenous food for bee larva, brood rearing, and adult growth (Loidl and Crailsheim, 2001). Pollen grains are microscopic structures found in the anthers of stamens in angiosperms (Arruda *et al*., 2013), they constitute the male reproductive cells in plants (Basim *et al*., 2006), and their aim is to transmit their gametes to the female sex organ of the flower (Arruda *et al*., 2013). Bees, other insects, wind and water pollinate plants by carrying pollen from the stamen to the stigma of another plant (LeBlanc *et al*., 2009). The quantity and quality of pollen collected by honeybees affects reproduction, brood rearing and longevity, and productivity of the colony (Human and Nicolson, 2006). By increasing beekeeping activity, it is important to detect the major pollen sources of a region and their values to bee colonies and to pollen production. Many studies were carried out on bee plants to define their flowering periods, pollen and/or nectar gathering by honeybee colonies and how these activities are affected by prevailing weather factors, e.g., Faye *et al.* (2002); Zaitoun and Vorwohl (2003); Bastos *et al*. (2004); Addi *et al*. (2006); Abdrakhmanova *et al.* (2007); Blsk *et al.* (2008); Elfeel (2008); Hassan(2009) and Noor *et al.* (2009).Except the study of El-Basiony (2002), no data about the recent status of bee pollen sources in Al-Arish, North Sinai are available.

The present work aims to record the different plant species and their flowering periods in the region of El-Arish, North Sinai as pollen sources of honeybees, to study pollen-collecting activity of the honeybee colonies, to determine the chemical composition of collected pollen grains and to identify the trapped pollen grains microscopically.

MATERIALS AND METHODS

Location:

The present study was carried out in apiary of Honey Bee Research Center, Environmental Agricultural Sciences Faculty, Arish University, Egypt from 2014 to 2015.

Honeybee colonies:

Sex colonies {3 of each first hybrid Carniolan (*Apis mellifera* L.) and Italian (*Apis. mellifera ligustica*)} honey bees were used .The experimental colonies were in an equal strength (bees covered 8 wax combs) and headed with sister recently mated queens.

Pollen trap and its efficiency:

The pollen trap is a wooden box, it has a slope roof and two vertical metal strips each 32 cm. in width and 17 cm. in length. Each strip has holes of about 0.3 cm. in diameter. A slide wooden box (collecting tray) 34 cm. in width, 27 cm. in length fixed under the fine wire screen to collect pellets which fall from the worker legs when try to pass from the trap to the hive.

Collecting efficiency was determined by recording 100 worker bees in each hive entering with pollen loads through an empty trap. Number of pellets fallen in the tray was counted and the efficiency was calculated according to the equation reported by Ewies *et al*., 1980, as the following:

Trap efficiency = (Number of pollen pellets in the box /200) x 100

Efficiency was found to be 28%

Pollen collecting activity:

A pollen trap was fixed on the hive entrance of each colony in the experiment. The pollen traps that fixed at the entrances of the experimental colonies during two successive years (2014 and 2015) were daily inspected to get out their pollen content. The monthly rates of pollen collection were estimated over the two seasons. The collected pollen grains were stored according to the color in groups until chemical analysis and microscopically examination.

Determination of the different flowering plants and their flowering periods:

The different species of flowering plants and their flowering periods in different localities in the region of El-Arish, North Sinai were determined. Regular visits were made to these localities all over two successive years (2014 and 2015).Different species of weeds were identified and classified at Faculty of Science, Arish University.

Chemical composition of the trapped pollen:

A representative sample of each major trapped pollen group (Palm, olive and orange pollen grains) was subjected to chemical following analysis: Chemical analysis of the trapped stored pollen was carried out in laboratory of National Research Center, Cairo, Egypt

A- Moisture: It was determined according to (Bell *et al*., 1983) by drying pollen samples to constant weight in an air oven at 60°C, then percentage of moisture content was estimated.

B- Crude protein: Crude protein content was determined according to A.O.A.C. (2012). Total nitrogen content was determined using an elemental analysis (National Research Center), Calibrated against standards. Pollen sample (0.2 g) was weighted into a combustion boat, and combusted at 950°C. to determine total crude protein, nitrogen values were multiplied by a conversion factor of 6.25 (Roulston *et al*., 2000**)**

C- Crude Lipids: Lipids content of the pollen samples were measured gravimetrically after extraction with petroleum ether through using a Soxhilts lipids extraction apparatus. (Bell *et al*.,1983)

D- Ash content: It was measured through heating pollen samples in a muffle furnace at 450 °C until a uniform gray-white ash remained. The samples were then weighted for estimation the average percentage of the ash content (Bell *et al.*, 1983).

E- Reducing sugar: The content of the reducing sugars was determined according to the method reported by Gordon and Diane, (2002).

F- Crude fiber: It was determined by following the standard procedure of A.O.A.C. (2012) and then representative percentage of fiber was estimated.

Identification of the trapped pollen grains:

A representative sample of each major trapped pollen group was mounted and spread on a slide microscope , a small drop of Glycerin Jelly is added, then covered by a cover slide and examined microscopically for identification. These pollen pellets were compared with standard slides mounted -as mentioned by Ibrahim and Salim (1965).

RESULTS AND DISCUSSION

Pollen plant sources:

Data presented in Tables (1-4) indicated the different plant species and their flowering periods in the region of El-Arish, North Sinai Governorate throughout tested two years. It could be observed from the data that, there were 123 plants species of 49 botanical families which were recorded as sources of pollen. These species were classed into 4 main groups: the 1st group , the fruit and vegetable plants (Table, 1) ,contains 12 species of 21 families. The ^{2}nd group, ornamental plants (Table, 2), includes 37 species of 16 families. The ^{3}rd group, Wild weeds (Table, 3), includes 39 species of 23 families. Finally, the 4th group, medicinal plants (Table, 4), contains 26 species of 14 families. The plant species belong to Oleaceae, Rutaceae , Palmaceae, Crucefera , Solanaceae, Cucurbitaceae, Luguminoseae and Myrtaceae , were recorded as the most predominant flower visitor by honey bee workers.

Table 1. Fruit and vegetable plants as pollen sources and their flowering periods at El-Arish, in North Sinai Governorate

Family	Scientific name	English name	Flowering periods
Anacardiaceae	*Mangifera indica*	Mangoes	Sp
Cactaceae	*Opuntia ficus indica*	Prickly pear	Sp+Su
Moraceae	*Ficus carica*	Figs	Sp+w
	Morus sp	Mulberry	Sp+Su
Myrtaceae	*Psidium guajava*	Guava	Sp
Oleaceae	*Olea europaea*	Olive	Sp
Palmaceae	*Phoenix dactylifera*	Date palm	Sp+w
Punicaceae	*Punica granatum*	Pomeranates	Su
Rosaceae	*Malus domestica*	Apple	Sp+w
	Prunns persica	Peach	Sp+w
	Prunus anygdalus batsch	Almond	Sp+w
	Prunns armeniaca	Apricot	Sp+w
Rutaceae	*Citrus sinenesis*	orange	Sp
Brassicaceae	*Brassica oleracea var. capitata*	Cabbage	Su
Cucurbitaceae	*Cucumis melo*	Melon	Sp
	Cucumis sativus	Cucumber	Sp+Su
	SP Cucurbita	Courgettes	Sp+Su+A
	Citrullus lanatus	watermelon	Sp+Su
Solanaceae	*Solanum lycopersicum*	tomato	Four season
	Solanum melongena	Eggplant	Sp+Su
	Capsicum annuum	capsicum	Sp+Su

Su: Summer Sp: Spring A: Autumn W: Winter

Also, it could be seen that the most of the affiliated plants for 4 groups were flowering in the spring season. The results showed that 78, 48, 45, and 25 % of the total plants belonging to 4 groups bloomed in the spring, summer, winter and autumn, respectively. These results are in agreement with those obtained by El-Bassiony (2002), but this study added the vegetables and fruit plants.

Different bee-pollen sources in Egypt were recorded in many studies, e.g. El-Dakhakhni (1980), at Kafer El-Sheikh, observed honeybees collecting pollens from citrus, clove, rose, eucalyptus, sunflower, maize and wild mustard, through spring, but through summer pollen sources were: clover, eucalyptus, rose, maize, sunflower and wild mustard. In autumn, sources were: eucalyptus, rose, sunflower, maize, casuarinas and lambsqurater. In winter they were: broad bean, eucalyptus, casuarinas and lambsqurater. In Assiut, 23 plants were recorded as pollen sources, mainly broad bean, clover, wild mustard, maize, sunflower, date palm, citrus, coriander, and casuarina. Most of pollens (65%) were gathered from Fabaceae then Cruciferae (Hussein, 1982).

Table 2. Ornamental plants as pollen sources and their flowering periods at El-Arish, in North Sinai Governorate

Family	Scientific name	Flowering periods
Acanthaceae	*Adhatoda vasica*	Four season
Apocyanaceae	*Thevetia peruviana*	SP+A+W
	Nerium olaender	Four season
	Vinca rosea	SP
Boraginaceae	*Myoporum pictum*	SP
Convolvulaceae	*Impomoea palamata*	Four season
Compositae	*Gazania splendens*	SP+ W
	Gazania zignes	SP+ W
	Gervera jamesanii	SP+ W
	Gaillarida pulehlla	SP+Su+W
	Dimorphotaca echionis	SP+ W
	Chrysanthmum coronarium	W
	Calendula officinalis	W
	Tagetes erecta	Sp
	Aractotis aurantiaca	W
	Venidum calandulaceum	SP+ W
	Iberis amara	W
Crucifera	*Matthiola pumila*	SP+ W
	Matthiola incana	SP+ W
	Alyssum martimum	SP+ W
Geraminaceae	*Pelargonium zonale*	SP+ W
	Pelargonium odoratismium	SP+ W
Leguminosae	*Caesalpinia gilldesil*	Sp+Su
	Cassia occidentaeis	Sp
Liliaceae	*Asparagus sp.*	Sp
Malvaceae	*Hibiscus sinensis*	Four season
	Hibiscus rosa sinensis	Four season
	Althaea rosea	Sp+W
Myrtaceae	*Eucaluptus globosus*	Sp
	Callistemon ericifolia	Sp+W
Nyctaginaceae	*Bougainvillea glabra*	Four season
Oleaceae	*Jasminum grandiflorum*	Four season
	Jasminum sambac	Four season
Scrophulariaceae	*Liharia tnuis*	Sp
	Antirrhimum majus	Sp
Tropaelaceae	*Tropaeolum majus*	Sp+W
Verbenaceae	*Lantana comara*	Four season

Su: Summer Sp: Spring A: Autumn W: Winter

In Fayoum, pollen sources were classed into four groups: the 1st one contained four main sources: *Z. mays*, *V. faba*, *T. alexandrinum*, and *Citrus* spp.; the 2nd one had *P. dactylifera*, *Eucalyputus* spp., *Salix aegyptica* and *B. kaber*; the 3rd had *X. spinosum*, *Cichorium pumilum*, *H. annuus*, and *Chysenthemum carinatum,* but the 4th, the least predominant group, included wild weeds, medicinal and aromatic plants Ghoniemy (1984). Also, Fathy (2008), in Dakahlia, recorded 26 pollen species in 15 families mainly *Z. mays*, *T. alexandrinum*, *V. faba*, *Eucalyptus rostrata*, *C. sinensis* and *P. dactylifera*. In Siwa oasis, different pollen sources were found Elfeel, 2008). He classified pollen sources according to their representative amounts as the following: *H. annus*, *P. dactylifera*, *Eucalyptus* sp., *Acacia* sp., *M. sativa*, *C. pepo*, *Casuarina* sp., *Portulaca oleraceae*, *T. articulate*, *Citrus* spp., stone fruits, *S. indicum*, *dandelion, O. europea*, *Hibiscus* sp., *Prunus domesticus*, and *Datura* sp.

Table 3. Wild weeds as pollen sources and their flowering periods at El-Arish, in North Sinai Governorate

Family	Scientific name	Flowering periods
Aizoaceae	*Fors skali*	Su
Amaryllidaceae	*Polygonum equisetiform*	Su+ A
Asclepiadaceae	*Gomphocarpus sinaicus*	Four season
	Solenostemma arghel	Sp+Su
Compositae	*Artemisia monosperma*	A+W
	Senecio desfontainei	Sp+A
	Nicotiana glauca	W
	Somchus oleraeeus	Sp+Su
	Ceniaurea glomerata	Sp
	Centaurea dimorpha	Sp
	Calendula aegyptiaca	Sp
	Launaea capitata	Sp+w
	Sisymbrium irio	Sp+w
Crucefera	*Labularia arabica*	Sp+w
	Ekucaria pinnata	Sp+w
	Brassica tournefortii	Sp+w
	Chenopodium murale	Sp+w
Chenopodiaceae	*Cornulaca monacantha*	Sp+w
	Colchicum vitchii	A
Convolvulaceae	*Convolvulus arvensis*	Four season
Cleomaceae	*Cleome africana*	Four season
Cucurbitaceae	*Citrullus colocynthis*	Su+A
Euphoibiaceae	*Euphorbia retusa*	Sp+Su
Gramineae	*Panicum turqidum*	Su
Leguminoseae	*Sesbania sesban*	Su+A
Liliaceae	*Urginea maritima*	Sp+W
	Linaria thuis	Sp
Malvaceae	*Malva parviflora*	Su+A
Ongraceae	*Epilobium hirsutum*	Su
Plantaginaceae	*Plantago albicans*	Sp+W
	Plantago afra	Su
Polygonaceae	*Centaurea calctirapa*	Su+A
Scrophulariaceae	*Mesembryanthemum*	W
Solanaceae	*Pancratium martimum*	Su+A
	Hyoscyamus muticus	Four season
Thymelaceae	*Thymelaea hirsuta*	Su
Unbellifera	*Ammi majus*	Su
Urtiaceae	*Urtica wrens*	Sp+W
Zygophllaceae	*Tribulus terrestris*	Sp+Su

Su: Summer Sp: Spring A: Autumn W: Winter

Activity of pollen collection:

The obtained results in Tables (5 and 6) showed that the average amounts of bee-collected pollen in El-Arish region during the two studied years. In the 1st year (Table 5), the highest amount of average amounts of pollen was gathered in April by Italian followed by Carniolan race in the same month, with an average 165 and 155 gm./colony, respectively , where temperature was 26.1°C and relative humidity was 73.5% . While, the lowest activity of pollen collection was recorded in November month for Italian and Carniolan races with average amount 91 gm./colony, where temperature was 23.9 °C and relative humidity was 75.9% . Total weight of trapped pollens in 1st year by Italian race (1447 g/colony/year) was greater than Carniolan race (1415 g/colony/year).

Concerning the 2nd year, results in (Table 6) revealed that the highest average amount of trapped pollen was recorded in April month for Carniolan (172 g./colony), where temperature was 38.6 °C and relative humidity was 62.3% . However, the lowest amount of the trapped pollen was recorded in December month for Italian race (83 g./colony), where temperature was 28.3 °C and relative humidity was 76.2% . Total weight of trapped pollens in 2nd year of Italian race (1350 g/colony/year) was lower than Carniolan race (1385 g/colony/year).

Table (4): Medicinal plants as pollen sources and their flowering periods at El-Arish, in North Sinai Governorate

Family	Scientific name	Flowering periods
Amarnthaceae	*Amaranthus graacizans*	Su
Asclepidaceae	*Calotropis procera*	Four season
	Leptadenia pyrotechnica	Sp+Su
Boraginaceae	*Heliotropium luteu.*	Sp
Compositae	*Artimisia incuita*	Sp+Su
	Cichorium pumilum	Sp+Su
	Echinops spinosissmus	Sp
Coryophllaceae	*Polycarpeae repens*	Sp
Crucefera	*Anestatica hierochantica*	Sp
	Diplotaxis harra	Sp+Su
	Sinapis arvensis	Sp+Su
	Eruca sativa	Sp
	Zilla spinosa	Sp+Su
Larniaceae	*Marruhium vulgar*	Sp+Su
	Salvia aeryptiace	Su
Leguminoseae	*Alhagi maurorum*	Su+A
	Acacia eherenbergiana	Four season
	Melilotus induica	Sp
Liliaceae	*Asfhodelus fistulosus*	Sp+Su+A
Papaveraceae	*Papaver rhoeas*	Sp+Su
Resedaceae	*Ochradenus baccatus*	Sp+Su
Solanaceae	*Solanium nigrum*	Four season
	Lycium shawii	A
	Withna sownifera	Four season
Verbenaceae	*Lippa nodiflora*	Sp+Su
Zygophllaceae	*Fagonia bruguieri*	Sp+Su

Su: Summer Sp: Spring A: Autumn W: Winter

The present pollen quantities are lower than those reported by Shaheen (2012), in El-Arish,North Sinai, who averaged 1731.0 g/colony/year and 2415.8. g/ colony/year. He recorded the highest amounts in spring season (204.2 g/colony and 265.0 g/colony for two studied years, respectively. Several studies in this field were performed, for example, Taha (2006), in Mansoura, found 1697.0 g/colony/year. Fathy (2008), in Dakahlia, found spring as the best season for collecting pollen with an average of 316.68 g/colony (38.18%). Contrarily, he added that winter was inferior season with 88.97 g/colony (10.73%). Elfeel (2008), in Siwa oasis, observed the highest pollen collection in summer (31.26%) followed by spring (29.0%) and autumn (21.89%) then winter (17.85%) of the total. Elsayh (2012), In Fayoum Governorate, she found that, the total pollen yields were 1061.77 g/colony and 826.36 g/colony in 2009 and 2010 years, respectively.

The variations in amounts of trapped pollens recorded by those authors, compared to the present ones, are due to many factors, e.g. locations, available flowering areas, trap efficiency, colony strength, as well as local environmental conditions of the tested areas.

Table 5. Pollen grains collecting (g/colony) during 2014 at El -Arish, in North Sinai Governorate

Month	Races		Temperature (°C)	Humidity (%)
	Crainolan	Italian		
1/1/2014	138	127	19.1	84
1/2/2014	125	132	20.6	78.3
1/3/2014	137	148	22.9	73.6
1/4/2014	155	165	26.1	73.5
1/5/2014	120	128	28.8	67.4
1/6/2014	106	110	31.1	67.9
1/7/2014	122	120	31.6	74.9
1/8/2014	107	116	32.8	73.3
1/9/2014	101	100	31.6	66.9
1/10/2014	114	110	28.2	67.4
1/11/2014	91	91	23.9	75.9
1/12/2014	99	100	22.5	76.8
Total (g/colony/year)	1415	1447		

Table 6. Pollen grains collecting (gm/colony) during 2015 at El-Arish, in North Sinai Governorate

Month	Races		Temperature (°C)	Humidity (%)
	Crainolan	Italian		
1/1/2015	116	109	26.8	64.1
1/2/1015	124	124	30.1	64
1/3/2015	146	133	37.8	67.4
1/4/2015	172	161	38.6	62.3
1/5/2015	128	127	45.2	61.8
1/6/2015	106	108	39.6	63.3
1/7/2015	109	110	40.9	66
1/8/2015	97	105	44.3	64.9
1/9/2015	89	94	38.9	65.7
1/10/2015	112	106	36.4	70
1/11/2015	91	90	30.5	75
1/12/2015	95	83	28.3	76.2
Total (g/colony/year)	1385	1350		

Chemical composition of the trapped pollen:

The chemical composition of the samples{the major pollen plant sources (palm ,olive and orange) illustrated in Table (7).The obtained data indicated variation in moisture content of the trapped pollen, where highest level of moisture (30.11%) was found with Palm pollen grains, while the lowest one (20.73%) was recorded for orange pollen grains. The moisture value of palm pollen in this study was higher than those of obtained by Hassan (2011) who reported that the moisture of palm pollen was 28.80%. Also, the moisture value of orange pollen was higher than those of recorded by Hassan *et al*. (2015) who showed that it was 18.98%. The water content plays an important role in the organoleptic characteristics and “shelf lifetime” of bee pollen (Nogueira *et al*., 2012). The highest values of ash and crude fiber were noticed with olive and orange pollen grains, respectively. The ash content is influenced by soil type, flora species and capacity of the plant to accumulate minerals (Bonvehi and Jorda, 1997). These results are in an agreement with Funari *et al*. (2003) who found that the ash content of pollen ranged between 2% and 6%. The crude lipid content varied from 5.93 to 31.45%. The value of crude fat content was within the values (0.8-31.7%) obtained by Roulston and Cane (2000). The crude protein content of palm and olive pollen grains was almost similar. The crude protein content of orange was 20.26% .The value of crude protein content was within the values (12-61%) obtained by Human and Nicolson (2006). Also, Campos *et al*. (2008) reported that protein content of pollen ranges between 10-40 g/100 g dry weight. The highest reducing sugar content was observed in orange pollen grain .The high reducing sugar content of bee pollen has been correlated with the presence of nectar/honey, commonly used by bees as glue for the pollen of plants (Nogueira *et al*., 2012).Variations in the chemical composition of pollen grains reflect differences in species, environmental conditions through maturation and age and vigor of the plants (Solberg and Remedios, 1980).

Table 7. Chemical composition of the major trapped pollen% at El-Arish, in North Sinai Governorate

Component (%)	Olive pollen grains	Palm pollen grains	Orange pollen grains
Moisture	29.46	30.11	20.73
Ash	6.57	6.20	3.57
Crude fiber	2.50	2.27	7.93
Crude lipids	30.60	31.45	5.93
Crude protein	41.05	40.94	20.26
Reducing sugar	20.51	20.40	25.97

Identification of the trapped pollen grains:

Mert (2010), reported that the pollen grains have a specific shape, size, color, and structure for each species, genus, and family, and these characters are useful for systematic botany. The major trapped pollen groups at El-Arish-North Sinai during the tested seasons were photographed, identified and presented in Fig(1).

Citrus sinensis, also known as the *Citrus aurantium* sweet orange group, includes the cultivated sweet orange, blood oranges, and navel oranges. Pollen grain of *Citrus sinensis* (orange) is circular to elliptic.

The date palm (*Phoenix dactylifera* L.) is perennial and diploid and classified under the genus Phoenix, which is the only member of tribe Phoeniceae, monocotyledonous family Palmae. “Phoenix,” meaning purple or red in the Greek language, indicating the colour of the fruit and “dactylifera” means finger, referring to the fruit shape (Chao and Krueger(2007). The pollen grains of date palm were appeared with elliptical shape.

The olive (*Olea europaea L.)* tree was one of the earliest fruit crops to be domesticated. It spreads at El-Arish. The pollen grain of olive is circular to elliptic (equatorial view).

Eruca sativa is an edible annual plant, commonly known as salad rocket, rucola, rugula, colewort, roquette, and arugula. The pollen grain shape of *Eruca sativa* is suboblate.

Matthiola incana known as hoary stock, is a species of flowering plant under the genus *Matthiola*. The common name stock usually refers to this species, though it may also be applied to the whole genus. The pollen grain shape of *Matthiola incana* is oblate spheriodal to spheriodal.

Cucurbita pepo appears to be one of the first domesticated species. The pollen grain shape of *Cucurbita pepo* is spherical.

The *Solanum melongena* L. (eggplant) is a vegetable crop species belonging to the Solanaceae family. The pollen grain shape of *Solanum melongena* L. is prolate spheroidal

Eucalyptus is a diverse genus of f lowering trees and shrubs in the myrtle family, Myrtaceae. The pollen grain shape of *Eucaluptus ssp.* is prolate.

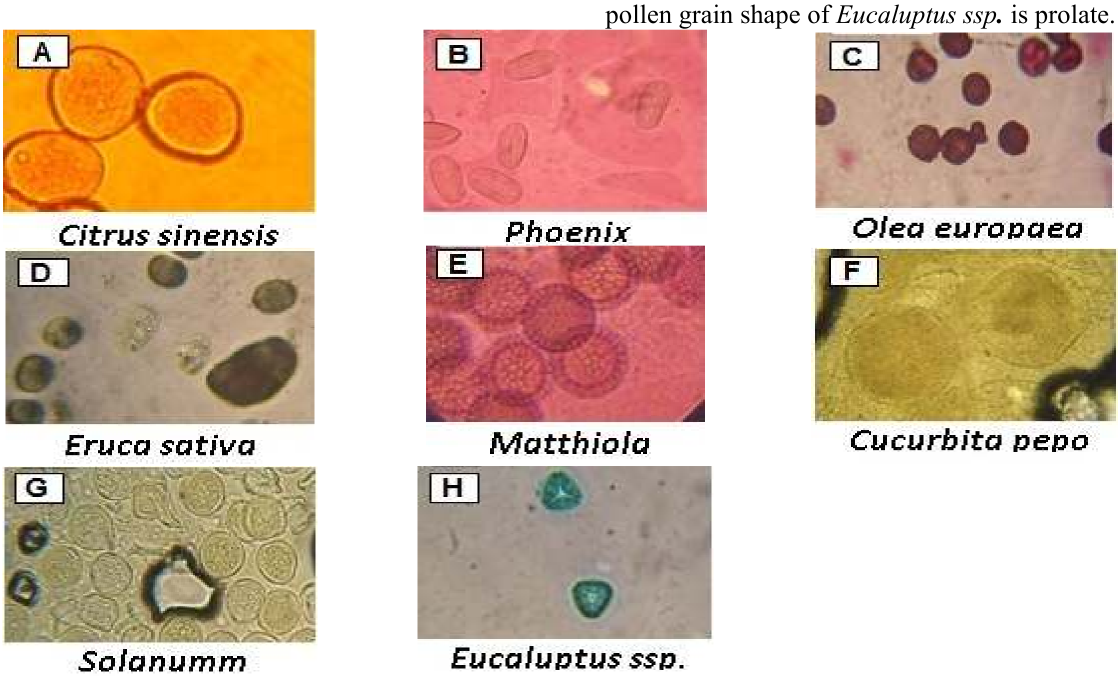

Fig. 1. Morphology of major trapped pollen grains

CONCLUSION

123 plants of 49 botanical families includes 4 groups, fruit and vegetables, ormental, wild weeds and medicinal plants were recorded as pollen sources for honey bee at El-Arish, North Sinai Governorate, Egypt during successive years (2014 and 2015). The best month for pollen collection was April. The olive, palm and orange plants were the main pollen sources for honey bee. Chemical analysis of the trapped pollen showed that pollen of palm pollen recorded the highest level of moisture and crude lipids, while olive pollen recorded the highest amount of crude protein and ash. The shape of trapped pollens was circular to elliptic to suboblate.

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دراسات على التغيرات الموسمية لحبوب اللقاح المجمعة بواسطة نحل العسل فى محافظة شمال سيناء

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اجريت هذه الدراسة فى مدينة العريش – محافظة شمال سيناء- مصر خلال سنتين متتاليتن (٢٠١٤و٢٠١٥) لمعرفة الانواع النباتية المختلفة وفترات تزهيرها كمصادر حبوب لقاح لنحل العسل ،لدراسة نشاط نحل العسل فى تجميع حبوب اللقاح ، لتقدير التركيب الكيماوى لحبوب اللقاح التى تم تجميعها وللتعرف ميكروسكوبيا على حبوب اللقاح التى تم تجميعها. اوضحت النتائج ان هناك ١٢٣ نبات فى مدينة العريش كمصادر لحبوب اللقاح تتبع ٤٩ عائلة وهى تندرج تحت ٤ مجموعات هى الفواكه والخضر،نباتات الزينة ، النباتات البرية والنباتات الطبية .ومعظم هذه النباتات ازهرت فى الربيع. وقد اوضحت نتائج تجميع حبوب اللقاح ان الوزن الكلى للحبوب اللقاح التى تم تجميعها بالمصيدة فى السنة الاولى (٢٠١٤) لنحل العسل الايطالى(١٤٤٧ جم/طائفة/سنة) كان اكبر مما فى نحل العسل الكرنيولى (١٤١٥ جم/طائفة/سنة) ولكن الوزن اللكلى لحبوب اللقاح التى تم تجميعها بالمصيدة فى السنة الثانية(٢٠١٥)لنحل العسل الايطالى (١٣٥٠ جم/طائفة/سنة) كان اقل مما فى نحل العسل الكرنيولى (١٣٨٥ جم/طائفة/سنة) .شهر ابريل كان هو الشهر الذى تم فيه تجميع كميات كبيرة من حبوب اللقاح. اوضحت نتائج التحليل الكيماوى للمجموعات الرئيسية لحبوب اللقاح التى تم تجميعها بالمصيدة ان اعلى نسبة للرطوبة والليبيدات كانت لحبوب لقاح نخيل البلح فى حين ان اعلى للبروتين والرماد كانت لحبوب لقاح الزيتون.اعلى نسبة الياف وسكريات مختزلة سجلت لحبوب لقاح البرتقال. وقد تم التعرف ميكروسكوبيا على المجموعات الرئيسية لحبوب اللقاح التى تم تجميعها بالمصيدة .