BEE FAUNA (APOIDEA: HYMENOPTERA) OF THE SUEZ CANAL REGION, EGYPT

Mohamed Shebl[1]*, Soliman Kamel[1], Hatem Mahfouz[2]

[1]Department of Plant Protection, Facaulty of Agriculture, Suez Canal University, Ismailia, Egypt
[2]Department of Plant Protection, Faculty of Agriculture and Environmental Science, Suez Canal University, Ismailia, Egypt
*corresponding author: mohamedshebl2002@hotmail.com

Received 05 September 2012; accepted 14 January 2013

S u m m a r y

The diversity of solitary bees varies depending on the vegetation, nesting habitats, and nesting fragmentation. The agriculture development in the Suez Canal region is receiving a great deal of attention in Egypt, thus, the diversity of solitary bees are essential for high quality production of seeds, vegetables, and fruit. The objective of this study was to evaluate the biodiversity of solitary bee populations around the Canal region. About 900 - 1000 specimens of bees were collected from different locations of the Ismailia, Suez, and Sinai Governorates. Fifty-five species of bees were identified. With the exception of Melittidae family, all the bee families were present in the Canal region. The total number of species for each family were 7, 9, 11, 13, and 15 species for Andrenidae, Colletidae, Apidae, Halictidae, and Megachilidae, respectively. *Lasioglossum mandibularie* (Morawitz, 1866) is a newly recorded species collected from Egypt. In the Suez Canal region, the most abundant species found with large populations were *Andrena ovatula* ssp. *ovatula* (Kirby, 1802), *Ceratina tarsata* Morawitz, 1872, and *Colletes lacunatus* Dours, 1872.

Keywords: solitary bees, nesting habitats, biodiversity, pollination, Suez Canal region, Egypt.

INTRODUCTION

Pollinators provide essential ecosystem services that contribute to the maintenance of biodiversity and the survival of plant species, including crops that offer food security to numerous households (Morse and Calderone, 2000). Over 80% of flowering plants and over three quarters of the major crops rely on animal pollinators. The principle pollinators of the most important crops are bees. Twenty-thousand bee species are known worldwide, and this number is continuously increasing (Michener, 2007). Honeybees and bumble bees are very important from an economical point of view but wild bees are also necessary for plant pollination. Many studies revealed that some plants need certain species of pollinators or bees other than honeybees. Alfalfa is one example; *Medicago sativa* is pollinated by leafcutting bees and commonly used as animal fodder in the USA, Canada, and other parts of the world (Richards, 1995). Certain wild bees are more superior to honeybees for pollination (Kamel et al., 2007; Shebl et al., 2008a; b). Throughout the world, agriculture production and biodiversity are threatened by decreasing populations of bees and other pollinators. The decline is due to habitat loss resulting in fragmentation, agriculture industrial chemicals, parasites and diseases, and/or the introduction of alien species. Deserts and xeric areas are extremely rich in bee-pollinated plants. The preservation and reproduction of these plants may be essential in preventing erosion and other problems. The bee fauna in the Mediterranean region is varied, which could be due to variations in: size, local vegetation, temperature, rainfall, edaphic, and topographic conditions (Al Ghzawi et al., 2006). Many cultivated plants are bee pollinated, so maintenance of the wild bee populations is important for genetic diversity.

The exact number of bee species in Egypt is unknown due to lack of studies. There are a few studies about various bee genera, for example, *Anthophora* (Priesner, 1957), *Halictus* (Blüthgen, 1933; 1934), *Andrena* (Moustafa et al., 1979), *Osmia* (Moustafa and El Berry, 1976), *Spechodes* (El Akkad and Kamel, 2002), and *Nomia* (Shoukry et al., 2004). It is expected, that bee diversity throughout Egypt is very high due to the high flora diversity. In the last century, the Suez Canal region, especially the cultivated area, was restricted to the areas surrounding the three main cities: Ismailia, Suez, and Port Said. Nowadays, this region is expanding due to new rapidly growing projects. However, this area now takes in some areas on the east bank of the Suez Canal including the city of Ras Sudr, and the villages of El Abtal and El Takdom, and on the west bank; El Salhia, 6th October, Sarapiuom, and El Nafak. Research of wild bee populations, their diversity, and their importance as crop pollinators will be undertaken in different parts of Egypt. Because many wild bees undergo stress due to climate change, nesting habitat fragmentation, and pathogens, it is critical to assess the current situation of bees in the Canal Zone. The aim of the current study is to address the biodiversity of native bee populations, their floral resources, and nesting habitats, around the Canal region of Egypt.

MATERIAL AND METHODS

Collection of bees

Using a sweep net, several bee species were collected from different locations of the Canal areas (Fig. 1) during the 2011 and 2012 time period. About 900 - 1000 specimens of bees were collected. Bees were killed in normal cyanide jars, pinned, and stored in wooden boxes at the Department of Plant Protection, Faculty of Agriculture, the Suez Canal University. Labels containing the collecting time and date, area of collection, and scientific name of the host plant were attached to the specimens. The major cities and localities (Fig. 1) with their GPS co-ordinates were as follows:

Ismailia

Ismailia and the collecting localities associated with it, are in northeast Egypt at the north and mid terminal of the Canal, and have a dry climate. There are a diverse crops and fruits cultivated in Ismailia but the major fruit grown is mango. Bees were collected from alfalfa, *Medicago sativa* L., clover, *Trifolium alexandrinum* L., *Brassica* L., and broad beans, *Vicia faba* L. The localities were the Suez Canal University's new campus 30.26N 32.16E, the village of El Saba Abar 30. 32N 32.09E, the villages of El Masaid and El Quantra Gharb 30.49N 32.18E, and El Qassasin and El Tal El Kebir 30.31N 31.48E.

Suez

Suez is a city located on the north cost of the Suez gulf at the south terminal of the Canal. A diversity of wild plants and cultivated crops, especially: alfalfa, *Medicago sativa* L, and clover, *Trifolium alexandrinum* L. are in this area. Bees were collected from previous crops and the main wild flowers of *Zygophyllum* L. The localities were the Ahmed Hamdy Tunnel 30.02N 32.34E, El Ganian 30.01N 32.33E and El Shaluofa 30.06N 32.31E.

South Sinai

Ras Sudr (29.36N 32.47E) is a city on the Gulf of Suez, at South Sinai. The area is mostly covered by wild plants, palm, and olive trees.

Species identification

Most bee species have been identified based on reference collections from the following Institutes:

- British Museum of Natural History, UK
- Laboratory of Zoology, Faculty of Science, University of Mons, Belgium
- Royal Belgian Institute of Science, Belgium
- Entomological Institute, Munich, Germany
- Osmiine bees web site, ETH Zürich - Eidgenössische Technische Hochschule Zürich, Switzerland
- Linz biologiezentrum, Austria.

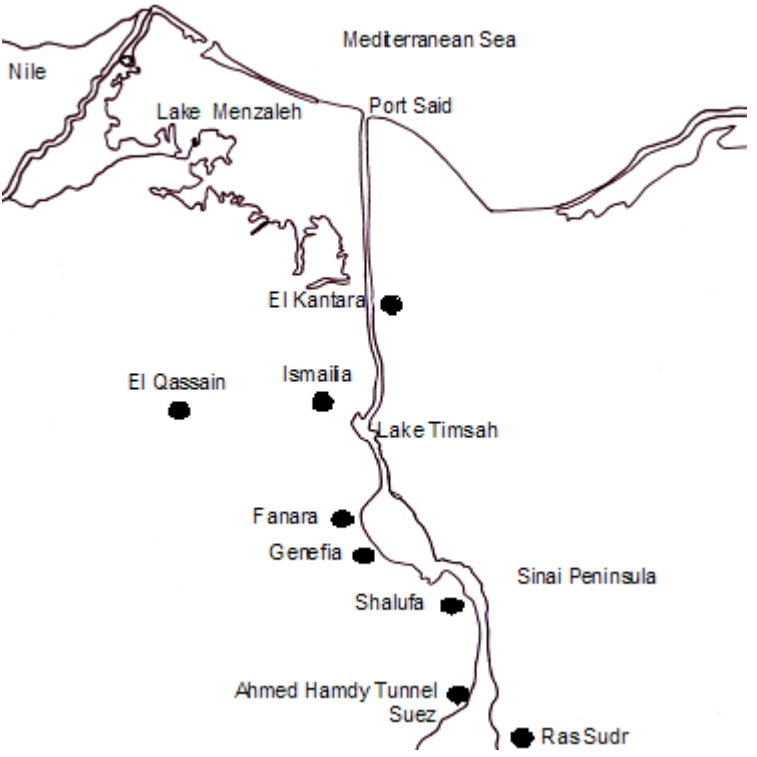

Fig. 1. This is a filed collection map of around the Suez Canal Region.

RESULTS AND DISCUSSION

Species checklist

About 55 species have been collected and identified around the Suez Canal Region. These species are each summarized according to family, locality, flight range, and floral resources. All species are listed in Tables 1-6.

Family: Andrenidae

Another two unknown species of *Andrena* were collected from the Canal region. Gusenleitner and Schwarz (2002) listed a number of *Andrena* species for or near the region and these species were *A. aegyptiaca* Friese, 1899, *A. aegypticola* Friese, 1922, *A. aerinifrons* Dours, 1873, *A. amicula* Warncke, 1967, *A. argyreofasciata* Schmiedeknecht, 1900, *A. arisinoe* Schmiedeknecht, 1900, *A. bengasinensis* Schulthess, 1924, *A. biskrensis* Pérez, 1895, *A. caroli* Pérez, 1895, *A. curtivalvis* Morice, 1899, *A. erberi* Morawitz, 1871, *A. eremobia* Guiglia, 1933, *A. euzona* Pérez, 1895, *A. flavipes* Panzer, 1799, *A. fuscosa* Erichson, 1835, *A. f.* ssp. *rutila* Spinola, 1838, *A. gazella* Friese, 1922, *A. govinda* Warncke, 1974, *A. helouanensis* Friese, 1899, *A. hesperia* Smith, 1853, *A. impunctata* Pérez, 1895, *A. innesi* Gribodo, 1894, *A. isis* Schmiedeknecht, 1900, *A. langadensis* Warncke, 1965, *A. longibarbis* Pérez, 1895, *A. mariana* Warncke, 1968, *A. medeninensis* Pérez, 1895, *A. melaleuca* Pérez, 1895, *A. miegiella* Dours, 1873, *A. minapalumboi* Gribodo, 1894, *A. minima* Warncke, 1974, *A. nitidiuscula* Schenck, 1853, *A. ovatula* (Kirby, 1802), *A. ovatula* spp. *heliopolis* Friese, 1914, *A. planiventris* Dours, 1872, *A. pratincola* Warncke, 1974, *A. pyrrhula* Pérez, 1895, *A. rubecula* Warncke, 1974, *A. savignyi* Spinola, 1838, *A. speciosa* Friese, 1899, *A. spinaria* Warncke, 1974, *A. spreta* Pérez, 1895, *A. spolata* Warncke, 1968, *A. tiaretta* Warncke, 1974, *A. vachali* Pérez, 1895, *A. varicornis* Pérez, 1895, and *A. vetula* Lepeletier, 1841.

Table 1.

List of location, flight range, and floral resources of the collected species of the family: Andrenidae

Species	Location	Flight range	Floral resources
Andrena arsione Schmiedeknecht, 1900	Ismailia	February	*Brassica* sp.
Andrena fuscosa Erichson, 1835	Suez	May	*Zygophyllum* sp.
Andrena mariana Warncke, 1968	Ismailia	March - April	*Brassica* sp.
Andrena ovatula (Kirby, 1802)	Ismailia	March - April	*Brassica oleracea*, *Brassica* sp.
Andrena ovatula ssp. *heliopolis* Friese, 1914	Ismailia	March - April	*Medicago sativa*, *Trifolium alexandrinum*.
Andrena fuscosa ssp. *rutila* Spinola, 1838	Suez	March	*Zygophyllum* sp.
Andrena savignyi Spinola, 1838	Ismailia	January - March	*Brassica* sp.

Family: Colletidae

Table 2.

List of location, flight range, and floral resources of the collected species of the family: Colletidae

Species	Location	Flight range	Floral resources
Hylaeus albonotatus (Walker, 1871)	Suez	May	*Zygophyllum* sp.
Hylaeus dinkleri (Friese, 1898)	Suez and Ismailia	February - May	*Zygophyllum* sp., *Brassica* sp.
Hylaeus moricei (Friese, 1898)	Ismailia	March	*Brassica* sp.
Colletes intricans Spinola, 1838	Ismailia	January - March	*Brassica* sp., *Trifolium alexandrinum*
Colletes lacunatus Dours, 1872	Suez and Ismailia	January - March	*Brassica* sp., *Zygophyllum* sp.
Colletes maidli Noskiewicz, 1936	Ismailia, Suez	May	*Trifolium alexandrinum*, *Zygophyllum* sp.
Colletes nanus Friese, 1898	South Sinai, Ismailia, Suez	March - May	*Trifolium alexandrinum*, *Zygophyllum* sp.
Colletes perezi Morice, 1904	Ismailia, South Sinai and Suez	February - June	*Brassica* sp., *Medicago sativa*, *Zygophyllum* sp.
Colletes pumilus Morice, 1904	Ismailia, Suez	January -March	*Brassica* sp., *Zygophyllum* sp.

Family: Halictidae

Lasioglossum mandibulare (Morawitz, 1866) is a newly recorded species collected from Egypt. This species is widely distributed in Europe and Israel. Three species were recognized as the genus Nomioides, but there was no information about their locality, flight range, and floral resources. Specifically, these species were *Nomioides deceptor* Saunders, 1908, *N. squamigera* Saunders and *N. turanicus* Morawitz, 1876.

Family: Megachilidae

An additional two species of the genus *Megachile* (*M. concinna* Smith, 1879 and *M. leachella* Curtis, 1828) were recorded without information about their locality, flight range, and floral resources.

Table 3.

List of location, flight range, and floral resources of the collected species of the family: Halictidae

Species	Location	Flight range	Floral resources
Halictus lucidipennis Smith, 1853	Ismailia	March - May	*Trifolium alexandrinum*, *Zygophyllum* sp.
Halictus senilis (Eversmann, 1852)	Ismailia	March - May	*Brassica* sp., *Trifolium alexandrinum*
Halictus pici ssp. *falx* Ebmer, 2008	South Sinai,	May	*Zygophyllum* sp.
Halictus pici Pérez, 1895	South Sinai, Ismailia	May	*Zygophyllum* sp., *Brassica* sp.
Lasioglossum callizonium (Pérez, 1896)	Ismailia	May	Trifolium alexandrinum
Lasioglossum mandibulare (Morawitz, 1866)	Suez, South Sinai	March - May	*Medicago sativa*, *Zygophyllum* sp.
Lasioglossum vagans (Smith, 1857)	Ismailia	March - May	Trifolium alexandrinum
Pseudapis nilotica (Smith, 1875)	Ismailia, Suez, South Sinai	May - June	*Medicago sativa*, *Trifolium alexandrinum*

Table 4.

List of location, flight range, and floral resources of the collected species of the family: Megachilidae

Species	Location	Flight range	Floral resources
Megachile coelioxoides Cresson, 1878	Suez	March - May	Medicago sativa
Megachile dorsalis Pérez, 1879	Suez	April - May	*Zygophyllum* sp.
Chalicodoma flavipes (Spinola, 1838)	Ismailia	May - June	*Medicago sativa*, *Trifolium alexandrinum*
Megachile minutissima Radoszkowski, 1876	Ismailia	March - May	*Medicago sativa*
Megachile patellimana Spinola, 1838	Ismailia	May - June	*Medicago sativa*, *Trifolium alexandrinum*
Megachile submucida Alfken, 1926	Ismailia	March - May June - July	*Trifolium alexandrinum*, *Sesamum indicum*, *Alhagi graecorum*
Chalicodoma nigripes (Spinola, 1838)	Ismailia	May - June	*Trifolium alexandrinum*
Chalicodoma siculum (Rossi, 1792)	Ismailia	February - March	*Vicia faba*
Osmia latreillei (Spinola, 1806)	Ismailia, Suez	March	*Zygophyllum* sp.
Osmia submicans Morawitz, 1870	Ismailia	January - May	*Brassica* sp., *Trifolium alexandrinum*

Family: Apidae

During summer, an unknown species of *Amegilla* was collected from Ismailia foraging on *Lantana camara,* and from Sinai foraging on *Medicago sativa*. *Eucera* and *Tetralonia* were collected from Ismailia foraging on *Brassica* spp. *Anthophora pauperata* Walker, 1871 is the only known endemic species of St. Katherine, South Sinai foraging on *Alkana* flowers (Semida, 2000).

Parasitic (Cuckoo) Bees

Two species (*Nomada cleopatra* Schwarz, 1989 and *N. glaucopis* Pérez, 1890) were recognized of the genus *Nomada* (Apidae) without information about their locality and flight range. Additionally, *Sphecodes albilabris* (Fabricius, 1793) ssp. *rubripes* Spinola, 1838 and *Sphecodes olivieri* Lepeletier, 1825 as two species of the genus *Sphecodes* (Halictidae), were recorded.

Journal of Apicultural Science

Table 5.

List of location, flight range, and floral resources of the collected species of the family: Apidae

Species	Location	Flight range	Floral resources
Xylocopa aestuans (Linnaeus, 1758)	Suez	May	*Medicago sativa*
Xylocopa pubescens Spinola, 1838	Ismailia Suez	March - May	*Trifolium alexandrinum*, *Sesamum indicum*, *Zygophyllum* sp.
Ceratina citriphila Cockerell, 1935	Ismailia	March	*Brassica* sp.
Ceratina tarsata Morawitz, 1872	Suez, South Sinai	March - June	*Trifolium alexandrinum*, *Sesamum indicum*, *Zygophyllum* sp., *Medicago sativa*
Amegilla quadrifasciata (de Villers, 1789)	Ismailia	May	*Brassica* sp.
Anthophora senescens Lepeletier, 1841	Suez, Ismailia	March	*Zygophyllum* sp., *Brassica* sp.

Table 6.

List of location, flight range, and floral resources of the collected cleptoparasitic bees

Species	Family	Location	Flight range
Ammobates arsinoe Engel, 2009	Apidae	Ismailia	May
Coelioxys coturnix Pérez, 1884	Megachilidae	Ismailia	May - June
Coelioxys decipiens Spinola, 1838	Megachilidae	Ismailia	May - June
Epeolus flevociliatus Friese, 1899	Apidae	Suez	May
Radoszkowskiana rufiventris (Spinola, 1838)	Megachilidae	Ismailia	May - June
Thyreus hyalinatus(Vachal, 1903)	Apidae	Ismailia Suez	September

The biology of some cleptoparasitic bees and their immature stages are well investigated in the Canal region (Rozen and Kamel, 2006; 2007; 2008; 2009).

Wasps

Very few specimens of wasps had been found in the Canal region. The following species have been collected: *Tachysphex* spp., *Oxybelus* spp., *Palarus* spp., *Bembix* spp., *Philanthus* spp., and *Gastrosericus Liris* (Family: Crabronidae), *Micromeriella* spp., *Campsomeriella* spp., *Scolia* spp., (Family: Scoliidae) and *Cyphononyx* spp. (Family: Pomplidae).

Species diversity

Different field surveys had been conducted in Egypt during the 1970s for collecting non-*Apis* bees. The previous studies did not fully cover this important region. Most attempts in the previous studies, covered part of Northern and Upper Egypt around the Nile Valley. They surveyed about 44 species of bees and 16 species of other Hymenopteran wasps (Ibrahim, 1973; 1979; Rashad, 1979; 1980).

The total species number collected only from the Canal Zone is 45. There were 10 species of cleptoparasitic bees and 17 species of Hymenopteran wasps. This number is equal to the species number collected from all over Egypt by the previous projects during the 1970s (Fig. 2). Although there was a long duration between the surveys, the species number seems very tricky to figure, but the expected total species number in Egypt should be over 400 species. The Canal Zone during the 1970s, was a neglected and destroyed area but today this is completely changed. The agriculture areas and vegetation cover has increased. The place has become an economical area for agriculture production in Egypt.

Most bee genera are present in the Canal region, except for the family Melittidae, which are oligolectic bees on Asteracea

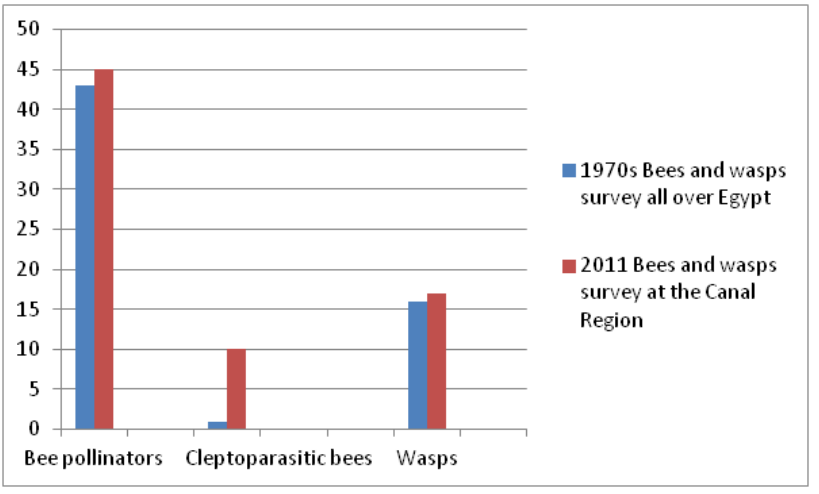

Fig. 2. '1970 survey of bees and wasps taken from all of Egypt' and: '2011 survey of bees and wasps in the Canal region'.

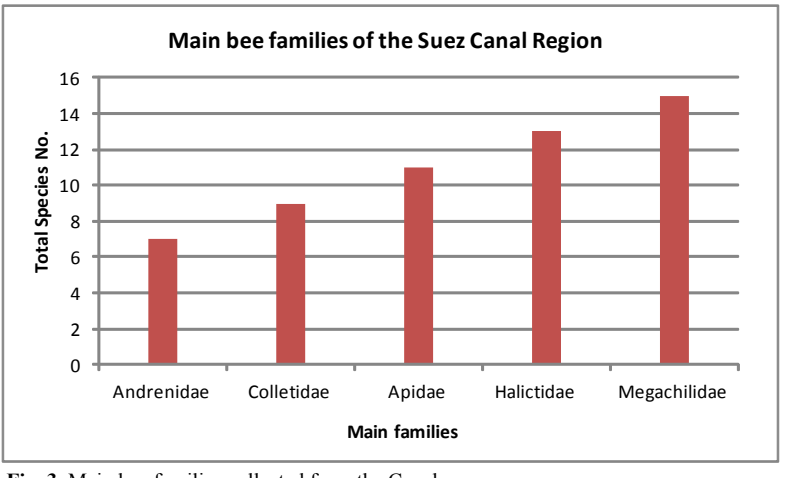

Fig. 3. Main bee families collected from the Canal zone.

and Fabaceae (Michez and Eardley, 2007). The Australian Stenotritidae is not present in high numbers, but, other bee families are present with a high species number including 7, 9, 13, 11, and 15 species for Andrenidae, Colletidae, Halictidae (bees with a short tongue), Apidae and Megachilidae (bees with a long tongue), respectively (Fig. 3). The Canal borders close to Jordan, Palestine, and Israel, and all of these areas have the same Mediterranean ecosystem. Thus, bee diversity is the same or very close, in these areas. Five families were collected from extensive orchards in Jordan: Apidae, Megachilidae, Halictidae, Andrenidae, and Colletidae. Apidae and Megachilidae had the highest diversity but Halictidae was the highest in abundance. The total species number collected from Jordan orchards was 53 species (Al Ghzawi et al., 2006).

Bee nesting habitats

Many attempts have been carried out to encourage solitary bee nest sites because of the loss of many natural nesting habitats (Kamel et al., 2007). The leafcutting bees are under great risk because nesting fragmentation takes place due to the use of concrete houses. During the survey, we found an extraordinary nesting habitat of

Fig. 4. This is a picture of the extraordinary nesting habitats of *Osmia* sp. inside a car trunk.

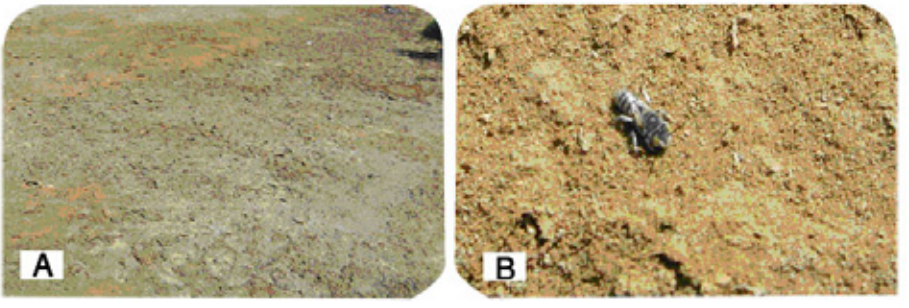

Fig. 5. A. Nesting habitats of various species of *Megachile, Andrena, Pseudoapis* and *Halictus*, B. *Megachile* sp. at Suez (Ahmed Hamdy Tunnel) hovering around the nest.

one species of *Osmia* inside a car trunk on the Suez Canal University campus (Fig. 4). The conservation of native bees could easily and successfully be managed in the Canal Zone, and other parts of Egypt, by protecting the bees' natural habitats.

Some species were collected around their natural habitats, like *Andrena, Anthophora,* and *Lasioglossum*. Others, like *Colletes,* were collected around their floral resources but never collected around their natural nests. *Andrena*, *Eucera*, *Nomada*, and *Anthophora* were closely associated with their natural habitats whereas *Colletes* was associated with almond orchards in Israel (Mandelik and Roll, 2009).

We found different species of ground nesting bees from the Family: Andrenidae, Megachilidae, and Halictidae at the Suez (Ahmed Hamdey Tunnel). This area may be a natural reservoir of many species of native bees for it is far from any human interference. Human activity has a negative impact on wild bee diversity (Osborne et al., 1991), and causes nest site elimination (Opdam et al., 1993). Native bees are the main pollinators of wild and medicinal plants at this area such as *Zygophyllum* sp. (Fig. 5).

Common and abundant species

Most species collected and identified during the survey were commonly found in other parts of Egypt. The most abundant species found, with great numbers in the Suez Canal region, are *Andrena ovatula* ssp. *ovatula* (Kirby, 1802) (total collected specimens over 100), *Ceratina tarsata* Morawitz, 1872 (collected from Ismailia,

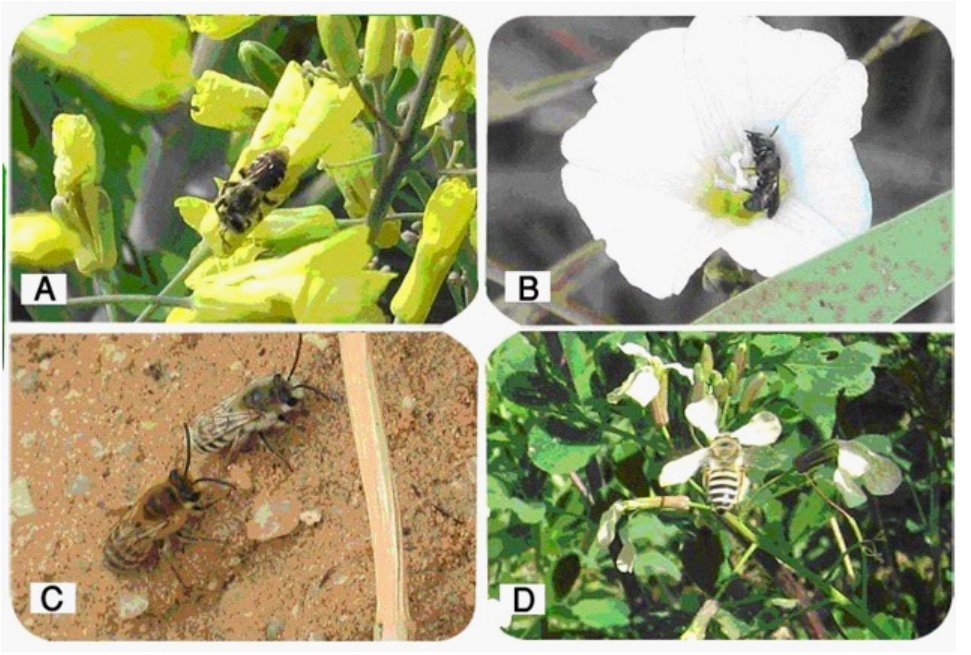

Fig. 6. The most common species of bees were: A. *Andrena ovatula* ssp. *ovatula* (Kirby, 1802), B. *Ceratina tarsata* Morawitz, 1872, C. Male and female courtship of *Colletes lacunatus* Dours, 1872, D. *Colletes lacunatus* foraging on Brassicaceae.

Fig. 7. Sand wasp *Bembix oculata* Panzer, 1801.

Suez, and Sinai) and *Colletes lacunatus* Dours, 1872 (total collected specimens over 250) (Fig. 6). In addition to bees, some wasps were collected from the region. The most common species of wasp was the sand wasp *Bembix oculata* Panzer, 1801 (Fig. 7). *Lasioglossum* and *Andrena* species were the most dominant genera collected from almond orchards in Israel (Mandelik and Roll, 2009).

CONCLUSION

This paper presents valuable information about the faunal composition of bees in the Canal region. There is a particular lack of information about solitary bees and their pollination services in Egypt. To date, no real data about populations of bee species are available in Egypt. This is the first study investigating bee faunstics in the Canal region. These bees are very important pollinators for high quality production of crops, and survival of vegetation in Egypt. It is obvious from the current study, that protection of solitary bee pollinators and their nesting habitats will contribute to the development of agriculture. This is especially true about important crops such as alfalfa and clover as well as fruits like citrus. More studies should be performed as they would explore necessary information about bee diversity in Egypt and pollination services bees provide.

ACKNOWLEDGEMENT

We are very grateful to the following researchers: Andreas Ebmer, Andreas Muller, Alain Pauly, Erwin Scheuchl, Christophe Praz, Christian Schmid-Egger, Holger Dathe, Maximilian Schwarz, Micheal Terzo, and Michael Kuhlmann. This study was supported by the ownership and partnership fellowship program, Egyptian Ministry of Higher Education. We appreciate the research facilities made available by all the members of the Zoology Lab., Fac. of Science, Mons University, Belgium. We would like to express our deep thanks to Prof. Jerome Rozen, American Museum of Natural History for the first proofreading of the manuscript. Our deep thanks for the chief editor and the two anonymous referees of the journal for their comments.

REFERENCES

Al Ghzawi, A., Zaitoun, S., Mazary, S., Schindler, M., Wittmann, D. (2006) - Diversity of bees (Hymenoptera, Apiformes) in extensive orchards in the highlands of Jordan. *Arxius de Miscel·lània Zoològica*, 4: 42-48.

Blüthgen, P. (1933) - Ein beitrag zur kenntnis der bienenfauna Aegyptens (Hymenoptera: Apidea-Halictidae-Halictinae). *Bull. Soc. Entom. Egypte*, 17: 1-27.

Blüthgen P. (1934) - Zweiter beitrag zur kenntnis der Halictinenfauna Aegyptens (Hymenoptera: Apidea-Halictidae-Halictinae). *Bull. Soc. Entom. Egypte*, 18: 188-200.

El Akkad M. K., Kamel S. M. (2002) - Revision of the genus Sphecodes Latreille of Egypt (Hymenoptera: Halictidae) *Egypt. Agric. Res. J.*, 80(4): 1579-1595.

Gusenleitner F., M. Schwarz. (2002) - Weltweite checkliste der Bienengattung *Andrena* mit Bemerkungen und Ergänzungen zu paläarktischen Arten (Hymenoptera, Apidae, Andrenidae, *Andrena*). *Entomofauna* Suppl., 12: 1-1280.

Ibrahim M. M. (1973) - Breeding and propagation of some efficient insect pollinators in newly reclaimed land in Egypt. Final Technical Report, Ministry of Agriculture, Egypt, pp. 1-75.

Ibrahim M. M. (1979) - Breeding and propagation of some efficient insect pollinators in newly reclaimed land in Egypt. Project Report No. 4, Ministry of Agriculture, Egypt, pp. 1-67.

Kamel S. M., Abu Hashesh T. A., Osman M. A., Shebl M. A. (2007) - A new model of polystyrene foam for renesting leafcutting bees (*Megachile* spp., Megachilidae, Hymenoptera). *Agric. Res. J.*, 7(2): 97-101.

Mandelik Y., Roll U. (2009) - Diversity patterns of wild bees in almond orchards and their surrounding landscapes. *Isr. J. Plant Sci.*, 57: 185-191.

Michener C. D. (2007) - Bees of the world. The John Hopkins Uni. Press, Baltimore & London, pp. 1-992.

Michez D., Eardley C. D. (2007) - Monographic revision of the bee genera Melitta Kirby 1802 (Hymenoptera: Apoidea: Melitidae). *Ann. Soc. Entomol. Fr*., 43(4): 379-440.

Morse R. A., Calderone N. W. (2000) - The value of honeybees as pollinators of U.S. Crops in 2000, *Bee Culture*, 128: 1-15.

Moustafa M. A., El Berry A. A. (1976) - Morphological studies on *Osmia submicans*. *Mitt. Zool. Mus. Berlin*, 52: 209-225.

Moustafa M. A., El-Hefny A. M., Abd El-Salam A. L., Salem M. M. (1979) - Taxonomical studies on some common *Andrena* spp. In Egypt. 185-Bee Symposium. (Affiliated to 3rd Arab Pesticide Conf.), Tanta Univ., pp.185-238.

Opdam P., Van Apeldoorn R., Schotman A., Kalkhoven J. (1993) - Population responses to landscape fragmentation, in: Vos C. C. and Opdam P. (Eds.) Landscape ecology of a stressed environment, Chapman and Hall, London, pp. 148-171.

Osborne J. L., Williams I. H., Corbet S. A. (1991) - Bee pollination and habitat change in the European Community. *Bee World*, 72: 99-116.

Priesner, H. (1957) - A review of the *Anthophora* species of Egypt. *Bull. Soc. Entomol. Egypte*, XLI: 1-115.

Rashad S. E. (1979) - Utilization of Non-*Apis* bees as a crop pollinators. Annual Report No. II, Ministry of Agriculture, Egypt, pp. 1-40.

Rashad S. E. (1980) - Utilization of Non-*Apis* bees as a crop pollinators. Annual Report No. III, Ministry of Agriculture, Egypt, pp. 1-34.

Richards K. W. (1995) - The alfalfa leafcutter bee, *Megachile rotundata*: a potential pollinator for some annual forage clovers. *J. Apic. Res*., 34(3): 115-121.

Rozen J. G. Jr., Kamel S. M. (2006) - Interspecific Variation in immature larvae of the cleptoparasitic bee genus *Coelioxys* (Hymenoptera: Megachilidae). *J. Kans. Entomol. Soc*., 79(4): 348-358.

Rozen J. G. Jr., Kamel S. M. (2007) - Investigations on the biologies and immature stages of the cleptoparasitic bee genera *Radoszkowskiana* and *Coelioxys* and their *Megachile* hosts (Hymenoptera: Apoidea: Megachilidae: Megachilini). *Am. Mus. Novit*., 3573: 1-43.

Rozen J. G. Jr., Kamel S. M. (2008) - Hospicidal behavior of the cleptoparasitic bee *Coelioxys* (*Allocoelioxys*) *coturnix*, including descriptions of its early larval instars (Hymenoptera: Megachilidae). *Am. Mus. Novit*., 3636: 1-15.

Rozen J. G. Jr., Kamel S. M. (2009) - Last larval instar and mature oocyte of the old world cleptoparasitic bee *Stelis murina*, including a review of *Stelis* biology. (Apoidea: Megachilidae: Megachilinae: Anthidiini). *Am. Mus. Novit.*, 3666: 1-24.

Semida F. M. (2000) - Nesting behavior of *Anthophora pauperata* (Hymenoptera, Anthophoridae) in the St. Katherine ecosystem, *Sinai. Egyptian. J. Biol.*, 2: 118-124.

Shoukry A., El Akkad M. K., Kamel S. M., El Akkad S. (2004) - Revision of the subfamily Nomiinae of Egypt (Hymenoptera: Halictidae). *Agric. Res. J., Suez Canal Uni.*, 3(2): 145-158.

Shebl M. A., Kamel S. M., Abu Hashesh T. A., Osman M. A. (2008a) - The impact of leafcutting bees (*Megachile minutissima*, Megachilidae, Hymenoptera) (Radoszkowski, 1876) artificial nest sites on seed production of alfalfa, Ismailia, Egypt. *Agricultura*, 5: 33-35.

Shebl M. A., Kamel S. M., Abu Hashesh T. A. Osman M. A. (2008b) - Seasonal abundance of leafcutting bees (*Megachile minutissima*, Megachilidae, Hymenoptera). *Phegea*, 36(4): 135-147.

Journal of Apicultural Science

PSZCZOŁOWATE (APOIDEA: HYMENOPTERA) REGIONU KANAŁU SUESKIEGO, EGIPT

Shebl M., Kamel S., Mahfouz H.

S t r e s z c z e n i e

Skład gatunkowy zgrupowań pszczół samotnic zmienia się w zależności od roślinności, obecności dogodnych siedlisk gniazdowania oraz stopnia fragmentacji tych siedlisk. W Egipcie rozwój rolnictwa w regionie Kanału Sueskiego stanowi duże wyzwanie z uwagi na fakt, że różnorodność pszczół samotnic jest kluczowa dla produkcji wysokiej jakości nasion, warzyw i owoców. Większość nielicznych badań fauny pszczół Egiptu przeprowadzono w latach siedemdziesiątych XX w. Badania te dotyczyły terenu całego Egiptu, ale region Kanału Sueskiego pozostał pod tym względem mało zbadany. Celem niniejszych badań była ewaluacja zróżnicowania gatunkowego populacji pszczół samotnic w regionie Kanału Sueskiego. Badania prowadzono w różnych częściach tego regionu w latach 2011 i 2012. Ogółem, za pomocą siatki entomologicznej, odłowiono około 900 - 1000 osobników z prowincji gubernatorskich Ismailia, Suez i Synaj. Osobniki zebrane zostały z różnych gatunków roślin uprawnych i dzikich. Oznaczono 55 gatunków owadów pszczołowatych. Stwierdzono obecność przedstawicieli wszystkich rodzin pszczołowatych z wyjątkiem rodziny Melittidae. W obrębie rodzin odnotowano następujące ilości gatunków: 7 (Andrenidae), 9 (Colletidae), 11 (Apidae), 13 (Halictidae) i 15 (Megachilidae). *Lasioglossum mandibulare* (Morawitz, 1866) został odnotowany w Egipcie po raz pierwszy. Następujące gatunki występowały w regionie Kanału Sueskiego najczęściej i najliczniej: *Andrena ovatula* ssp. *ovatula* (Kirby, 1802), *Ceratina tarsata* Morawitz, 1872 i *Colletes lacunatus* Dours, 1872. Niektóre gatunki, np. *Andrena, Anthophora i Lasioglossum*, rejestrowane były w ich naturalnych siedliskach. Inne, jak *Colletes*, zebrano z okolicy roślin, którymi się żywią. Nie były jednak notowane w okolicy swoich gniazd. Skład gatunkowy pszczół z regionu Kanału Sueskiego zbliżony jest do składu gatunkowego pszczół w Jordanie, Palestynie i Izraelu. Ekosystemy wszystkich tych państw leżą w strefie klimatu śródziemnomorskiego. Niniejsze badania oceniające skład apifauny zapylającej są pierwszymi realizowanymi w regionie Kanału Sueskiego i mogą być kontynuowane w innych regionach Egiptu. Badania terenowe tego typu mogą zainicjować powstawanie większej liczby projektów badawczych dotyczących zapylania i interakcji między pszczołami a roślinami.

Słowa kluczowe: pszczoły samotnice, siedliska gniazdowania, bioróżnorodność, zapylanie, region Kanału Sueskiego, Egipt.