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Survey of Aphid Species and their Associated Parasitoids and Predators on Wild Plants in North Sinai Governorate, Egypt

Aziza, M. EL-Gantiry*; S. A. Ahmed; M. N. El-Bassioni**; H. M. Mahfouz** and M. G. A. El-Deeb****

*Plant Protection Research Institute, Agricultural Research Centre, Giza, Egypt.

**Plant Production Dept., Fac. of Environmental Agric. Sciences, Suez Canal Univ., El-Arish, Egypt.

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ABSTRACT

A survey of the most abundant aphid species (Homoptera: Aphididae) and their associated parasitoids and predators found on 16 wild plants was conducted in the region of El-Arish, El-Sheikh Zewaid and Rafah in North Sinai, Egypt in two successive years 2011 and 2012. Fourteen aphid species were identified, 7 were recorded for the first time, *Dysaphis foeniculus* (Theobald), *Aphis compositae* Theoblad, *Brachycaudus helichrysi* (Kaltenbach), *A. spiraecola* Patch, *Macrosiphum rosae* (L.), *Toxoptera odinae* (Van der Goot) and *Maculolachnus submacula* (Walker). Also, *Myzus persicae* (Sulzer), *A. fabae* Scop., *B. amygdalinus* (Schouteden), *A. gossypii* Glover., *Brevicoryne brassicae* (L.), *A. craccivora* Koch and *A. nerii* Boyer. Associated parasitoid and predatory species were; 5 primary hymenopterous parasitoid species: *Aphidius matricariae* Haliday, *Binodoxys anagelicae* (Haliday), *Ephedrus persicae* Froggatt, *Lysiphlebus confuses* Tremblay et Eady, *L. fabarum* (Marshall), 2 hyperparasitoid species: *Syrphophagus* sp. and *Alloxysta* sp. and 6 predatory species: *Coccinella undecimpunctata* L., *C. septempunctata* L., *Hippodama convergens* Guérin-Méneville, *Scymnus interruptus* (Goeze), *Chrysoperla carnea* (Steph.) and *Syrphus corollae* Fabricius. Occurrence periods, locations, infested plant parts and abundance rates of the surveyed species were recorded.

Key words: Survey, Wild plants, Aphid species, Parasitoids, Predators, North Sinai, Egypt.

INTRODUCTION

In the last few years, the agricultural policy of Egypt gives a great attention to increase the horizontal cultivated area by adding new lands, particularly in North Sinai Governorate. With respect of insect fauna, aphids are considered one of the most important insect pests. Aphids are one of the insect groups of which economic importance increases with the development of agriculture and they have a wide range of hosts in agro-ecosystems (Stary, 1976). Wild plants play an important role in supporting aphids. Therefore, aphids tend to be disregarded for the rest of the year, in addition to the numerous types of losses caused by wild plant, *e.g.* the competitions which lead to loss in yield and quality of the economic plants. Wild plants are referred to be a reservoir for aphid populations from which winged forms migrate to infest economic crops, thus, wild plants appear to have an important role in the survival of aphids. Few studies have been carried out on the aphids' fauna on several economic crops and wild plants in North Sinai, Egypt (Attia and El-Hamaky, 1992; Abdel-Salam, 1999; Semeada *et al.*, 2004; Ahmed *et al.*, 2007 and El-Deeb, 2008).

The present study aimed to survey the most abundant aphid species and their associated parasitoid and predatory species found on wild plants in the region of El-Arish, El-Sheikh Zewaid and Rafah in North Sinai, Egypt.

MATERIALS AND METHODS

A field survey for the aphid species and their associated parasitoids and predators on the wild plants was carried out at three localities in North Sinai Governorate; El-Arish, El-Sheikh Zewaid and Rafah for two successive years, 2011 and 2012. The wild plants infested with aphids were sampled biweekly and identified by the specialists of the Plant Production Dept., Faculty of Environmental Agricultural Sciences, Suez Canal University, El-Arish, Egypt.

Samples were collected as follows, five infested plants were randomly chosen and three infested leaves (or stems for Sow- thistle, El- Aadar, Shook El-Gamal and El-Shanan) from each plant were collected. Collected data included host plant(s) species, date of occurrence, location, infested plant part(s) and abundance rate. Samples were kept in paper bags and carefully transferred to the laboratory for examination.

Specimens were first classified by their morphological characteristics to different groups according to Habib and El-Kady (1961) keys, and then mounted in swan's medium on glass slides for identification (Van Emden, 1972). Identification was made by Prof. Dr. Aziza M. EL-Gantiry, Piercing & Sucking Insects Department, Plant Protection Research Institute (PPRI), Agricultural Research Centre (ARC) Giza, Egypt. Predaceous insect species associated with aphids were directly counted biweekly on the inspected wild plants in the field according to El- Heneidy, (1991) and El-Serafi *et al.*, (2004).

Emerged parasitoid adults were cleared in hot KOH 5% and chloral phenol and mounted on slides in Hoyer's medium according to the method described

by Lambers (1950). The specimens of parasitoids were identified by Prof. Dr. Aziza M. EL-Gantiry and confirmed by Dr. P. Stary, Laboratory of Aphidology, Institute of Entomology, Biology Center, Academy of Sciences of the Czech Republic.

RESULTS AND DISCUSSION

Survey of aphid species on the wild plants in North Sinai

The survey included 16 wild plants: Dirs El-Agooz, (*Emex spinosa* (L.) Campd.), Small Nettle, (*Urtica urens* L.), Cheesweed, (*Malva parviflora* L.), Lampsquarter, (*Chenopodium murale* L.), Shoak El-Gamal, (*Echinops spinosissimus* Turra), Golden Crown Beard, (*Verbesina encelioides* (Cav.), Common Reed, (*Phragmitis communis* Trin., Fund. Agrost), Pursalne, (*Portulaca oleracea* L.), Black-Night-Shade, (*Solanum nigrum* L.), Sow- Thistle, (*Sonchus oleraceus* (L.)), Silver-Leaved Nightshade, (*Solanum elaeagnifolium* Cav.), Aader, (*Artemisia monosperma* Delile), El –Shanan, (*Salsola regida* Pall.), Bur Clover, (*Melilotus indica* (L.)), Bind weed, (*Convolvus* sp.) and Oshaar, (*Calotropis procera* (Aiton) Dryand).

Survey of the most abundant aphid species found on the above mentioned host plants in North Sinai Governorate revealed the presence of 14 aphid species. Obtained data included, occurrence periods, locations, most infested plant parts and abundance rates of each of the surveyed aphid species are summarized in Table (1).

1- Dirs El-Agooz, (*E. spinosa*):
6 aphid species were observed attacking leaves and stems of Dirs El-Agooz, *i.e., Dysaphis foeniculus* (Theobald), *Aphis compositae* Theoblad, the green peach aphid, *Myzus persicae* (Sulzer), the black bean aphid, *A. fabae* Scop., the almond leaf curl aphid, *Brachycaudus amygdalinus* (Schouteden) and the leaf-curling plum aphid, *B. helichrysi* (Kaltenbach).

2- Small Nettle, (*U. urens*):
The cotton aphid, *A. gossypii* Glover, *M. persicae* and the green citrus aphid, *A. spiraecola* Patch were recorded attacking the leaves.

3- Cheesweed, (*M. parviflora*):
A. gossypii, *M. persicae*, *A. spiraecola* and *B. helichrysi* were found attacking the leaves.

4- Lampsquarter, (*Ch. murale*):
M. persicae, *A. gossypii*, *A. fabae*. and *A. compositae* were observed attacking the leaves.

5- Shoak El-Gamal, (*Echinops spinosissimus*):
B. helichrysi, the rose aphid, *Macrosiphum rosae* (L.) and *A. fabae* were recorded attacking the leaves and the stalks.

6- Golden Crown Beard, (*V. encelioides*):
A. gossypii and *A. fabae* were found attacking the leaves.

7- Common Reed, (*Ph. communis*):
The mango aphid, *Toxoptera odinae* (van der Goot) was observed attacking the leaves.

8- Pursalne, (*P. oleracea*):
A. gossypii was observed attacking the leaves.

9- Black-Night-Shade, (*Solanum nigrum*):
A. fabae was recorded attacking the leaves.

10- Sow- Thistle, (*Sonchus oleraceus*):
The cabbage aphid, *Brevicoryne brassicae* (L.) was found attacking the stems.

11- Silver-leaved Nightshade, (*Solanum elaeagnifolium*):
A. gossypii was observed attacking the leaves.

12- Aader, (*Artemisia monosperma*):
Maculolachnus submacula (Walker), was recorded attacking the stems.

13- El –Shanan, (*Salsola regida*):
The cowpea aphid, *A. craccivora* Koch. was found attacking the stalks.

14- Bur Clover, (*Melilotus indica*):
A. craccivora was recorded attacking the leaves.

15- Bind Weed, (*Convolvus* sp.):
The oleander aphid, *A. nerii* Boyer was found attacking the leaves.

16- Oshaar, (*Calotropis procera*):
A. nerii was observed attacking the leaves.

Data presented in Table (1) showed 7 aphid species; *D. foeniculus*, *A. compositae*, *B. helichrysi*, *A. spiraecola*, *Macrosiphum rosae*, *T. odinae* and *M. submacula* recorded for the first time on the wild plants in North Sinai, Egypt.

Also, 6 aphid species; *D. foeniculus*, *B. amygdalinus*, *M. rosae*, *T. odinae*, *B. brassicae* and *M. submacula* were observed infesting 5 wild plants; Dirs El-Agooz, Shoak El-Gamal, Common Reed, Sow-Thistle and Aader during April-May, April-May, April-June, March-April, February-May and April - May, respectively, in the two study seasons.

From the foregoing results, it could be concluded that the aphid, *A. gossypii* occupied the first category for its wide host range among the surveyed aphid species on the wild plants, followed by *A. fabae*, *M. persicae* and *B. helichrysi*, then *A. spiraecola*, *A. compositae*, *A. craccivora* and *A. nerii*, and then *D. foeniculus*, *B. amygdalinus*, *M. rosae*., *T. odinae*, *B. brassicae* and *M. submacula*.

In previous studies, surveying aphid species on economic crops in North Sinai, *B. amygdalinus* was found infesting peach trees from March to September and almond from March to June (Abd El-Salam, 1999 and Ahmed *et al.*, 2007). Also, *B. brassicae* was found attacking cabbage and cauliflower from

Table (1): Survey of abundant aphid species infesting wild plants in North Sinai Governorate, Egypt in 2011 and 2012 years

No	Common name	English Name	Scientific Name	Aphid Species	Occurrence Period	Localities	Infested Plant part	infestation Rate
1	Dirs El-Agooz	-	*Emex spinosa* (L.) Campd.	*Dysaphis foeniculus* (Theobald)	April-May	El-Arish –El-Sheikh Zewaid & Rafah	Leaves& Stems	+
				Myzus persicae (Sulzer)	March-May			+++
				Aphis compositae Theobald	March-April	El-Arish & Rafah		+
				Aphis fabae Scop.	February-May	El-Arish		+++
				Brachycaudus amygdalinus (Schouteden)	April-May	El-Sheikh Zewaid & Rafah		++
				Brachycaudus helichrysi (Kaltenbach)	April-May			+
2	Horreiq	Small Nettle	*Urtica urens* L.	*Aphis gossypii* Glover.	February-April	El-Arish - El-Sheikh Zewaid & Rafah	Leaves	+++
				Myzus persicae (Sulzer)	March-May	El-Sheikh Zewaid & Rafah		+
				Aphis spiraecola Patch.	March-May			+++
3	Khobbeiza	Cheesweed	*Malva parviflora* L.	*Aphis gossypii* Glover.	March-May	El-Arish - El-Sheikh Zewaid& Rafah	Leaves	+++
				Myzus persicae (Sulzer)	May-June	El-Sheikh Zewaid & Rafah		++
				Aphis spiraecola Patch.	April-May			+
				Brachycaudus helichrysi (Kaltenbach)	May-June			+
4	Zorbeih	Lampsquarter	*Chenopodium murale* L.	*Myzus persicae* (Sulzer)	May-June	El-Sheikh Zewaid & Rafah	Leaves	++
				Aphis gossypii Glover.	April-May	Rafah		+
				Aphis fabae Scop.	May- July	El-Arish& Rafah		+
				Aphis compositae Theobald	May-June	Rafah		+
5	Shoak El-Gamal	-	*Echinops spinosissimus* Turra	*Brachycaudus helichrysi (Kaltenbach)*	April-May	Rafah	Leaves& Stalks	++
				Macrosiphum rosae (L.)	April-June			+++
				Aphis fabae Scop.	May-June			+
6	-	Golden crown beard	*Verbesina encelioides* (Cav.)	*Aphis gossypii* Glover.	mid/March-mid/May	Rafah	Leaves	+++
				Aphis fabae Scop.	May			+
7	Hagna-Booss	Common reed	*Phragmitis communis* Trin., Fund. Agrost.	*Toxoptera odinae* (van der Goot)	March-April	El-Arish	Leaves	++
8	Rigla	Pursalne	*Portulaca oleracea* L.	*Aphis gossypii* Glov.	mid/April-mid/July& October-mid/November	Rafah	Leaves	+++
9	Enab-El-Deib	Black-night-shade	*Solanum nigrum* L.	*Aphis fabae* Scop.	Allover the year	El-Arish - El-Sheikh Zewaid & Rafah	Leaves	++
10	Godeid	Sow- thistle	*Sonchus oleraceus* (L.)	*Brevicoryne brassicae* (L.)	February-May	El-Arish& Rafah	Stems	+++
11	-	Silver-leaved Nightshade	*Solanum elaeagnifolium* Cav.	*Aphis gossypii* Glover.	March-May	El-Arish& Rafah	Leaves	+++
12	Aader	-	*Artemisia monosperma* Delile	*Maculolachnus submacula* (Walker)	April-May	Rafah	Stems	+++
13	El -shanan	-	*Salsola regida* Pall.	*Aphis craccivora* Koch.	March- June & September-October	El-Arish	Stalks	+++
14	Nafal	Bur clover	*Melilotus indica* (L.)	*Aphis craccivora* Koch.	February-April	El-Arish	Leaves	++
15	Ollaiq	Bind weed	*Convolvus* sp. L.	*Aphis nerii* Boyer	March-May & August-November	El-Sheikh Zewaid & Rafah	Leaves	+
16	Oshaar	*Calotropis procera* (Aiton) Dryand		*Aphis nerii* Boyer	April-June	El-Arish	Leaves	+++

+ Scarce (1-20) ++ Occasional (20-40) +++ Abundant (40-60).

Table (2): Survey of the parasitoid and predatory species associated aphids' species on the wild plants at North Sinai, Egypt in 2011-2012 years

Parasitoid species	Aphid species	Host plant	Predator Species	Rate	Order	Family
	Primary parasitoids					
***Aphidius matricariae* Haliday**	*Aphis fabae* Scop.	Black-Night Shade	***Coccinella undecimpunctata* L.**	+++	Coleoptera	Coccinellidae
	Aphis caraccivora Koch	Bur Clover				
	Aphis gossypii Glov.	Cheesweed				
	Myzus persicae (Sulzer)					
	Aphis gossypii Glov.	Small Nettle	***Coccinella septempuncatata* L.**	+		
	Aphis gossypii Glov. *Aphis spiraecola* Patch. *Myzus persicae* (Sulzer)					
***Binodoxys anagelicae* (Haliday)**	*Aphis fabae* Scop.	Black-Night-Shade	***Hippodima convergens***	+		
	Aphis gossypii Glov.	Golden Crown Beard				
	Aphis gossypii Glov. *Aphis spiraecola* Patch. *Myzus persicae* (Sulzer)	Small Nettle				
***Ephedrus persicae* Froggatt**	*Maculolachnus submacula* (Walker)	Aader	***Scymnus interruptus***	++		
***Lysiphlebus confuses* Tremblay et Eady**	*Aphis fabae* Scop.	Black-Night-Shade				
	Aphis gossypii Glov.	Small Nettle				
	Aphis gossypii Glov. *Aphis spiraecola* Patch.					
***Lysiphlebus fabarum* (Marshall)**	*Aphis fabae* Scop.	Black-Night-Shade	***Chrysoperla carnea* (Steph.)**	+++	Neuroptera	Chrysopidae
	Aphis caraccivora Koch	Bur Clover				
	Hyperparasitoids					
***Syrphophagus* sp.**	*Aphis gossypii* Glov.	Silver-Leaved Nightshade	*Syrphus corolla* Fabricius	+	Diptera	Syrphidae
		Small Nettle				
	Aphis gossypii Glov. *Aphis spiraecola* Patch. *Myzus persicae* (Sulzer)	Small Nettle				
***Alloxysta* sp.**	*Aphis gossypii* Glov. *Aphis spiraecola* Patch.	Small Nettle				

\+ Scarce (1-5) ++ Occasional (5-10) +++ Abundant (10-15)

November to April (Attia and El-Hamaky, 1992; Abd El-Salam, 1999 and Ahmed *et al.*, 2007).

Finally, 8 aphid species were recorded migrating from one host to another among wild plants and economic crops as:

1. *A. gossypii* was recorded attacking leaves of Small Nettle from February-April, then migrated to infest Lampsquarter plants from April to May and it was found attacking Cheesweed, Silver-Leaved Nightshade and Golden Crown Beard plants from March to May and migrated to infest Pursalne from April to July and from October to November. On economic crops, *A. gossypii* was recorded attacking cantaloupe from June to August, eggplant from July-August, guava from March to November, orange and mandarin from February to June (Attia and El-Hamaky, 1992; Abd El-Salam, 1999 and Ahmed *et al.*, 2007).
2. *M. persicae* was observed attacking leaves of Dirs El-Agooz and Small Nettle plants from March to May, then migrated to infest Cheesweed and Lampsquarter from May to June. On economic crops, *M. persicae* was found infesting eggplant from July to August, potato plants from September to November, cabbage, pepper and cauliflower from January to March (Abd El-Salam, 1999 and Ahmed *et al.*, 2007).
3. *A. fabae* infested Black-Night-Shade all over the year. It migrated to attack leaves of Dirs El-Agooz, Golden Crown Beard, Shoak El-Gamal and Lampsquarter during February –May, May, May- June and May- July, respectively. On economic crops, it was observed attacking Hibiscus plants from October to February and Fennel from February to June (Attia and El-Hamaky, 1992; Abd El-Salam, 1999 and Ahmed *et al.*, 2007).
4. *B. helichrysi* was recorded attacking leaves of Dirs El-Agooz and Shoak El-Gamal from April to May and then it migrated to infest Cheesweed from May to June.
5. *A. compositae* was found on leaves of Dirs El-Agooz, from March to April and then it migrated to attack Lampsquarter from May to June.
6. *A. spiraecola* was observed infesting leaves of Small Nettle from March to May and migrated to attack Cheesweed from April to May.

7. *A. nerii* was recorded attacking Bind Weed plants from March to May and from August to November during the period from April to June and then it migrated to infest Oshaar plants.
   A. craccivora was found attacking leaves of Bur Clover plants from February to April also, infesting stalks of El –Shanan from March to June and September to October. On economic crops, *A. craccivora* was recorded on broad bean and lentil from November to May, cowpea plants from May to August (Attia and El-Hamaky, 1992; Abd El-Salam, 1999 and Ahmed *et al.*, 2007).

It could be concluded that wild plants are alternative hosts for aphids as they are reservoirs for aphids' populations from which winged forms migrate to infest economic crops (Loxdale and Brookes, 1990). Thus, wild plants appear to have an important role in survival of aphids (Van den Boch and Telford, 1964).

Parasitoids and predators associated with aphids on wild plants

A) Parasitoids

As shown in Table (2), the survey revealed the presence of 5 primary hymenopterous aphidiid parasitoid species and 2 hyperparasitoid species associated with the different aphid species on the wild plants in North Sinai, Egypt in the two years of the study.

1- Primary parasitoid species

- *Aphidius matricariae* Haliday was found associated with *A. fabae* on Black-Night Shade, *A. caraccivora* on Bur Clover, *A. gossypii* and *M. persicae* on Cheesweed, *A. gossypii* on Small Nettle and *A. gossypii*, *A. spiraecola* and *M. persicae* on Small Nettle.
- *Binodoxys anagelicae* (Haliday) was recorded associated with *A. fabae* on Black-Night-Shade, *A. gossypii* on Golden Crown Beard, *A. gossypii*, *A. spiraecola*. and *M. persicae* on Small Nettle .
- *Ephedrus persicae* Froggatt was observed associated with *M. submacula* on Aader.
- *Lysiphlebus confuses* Tremblay et Eady was found associated with *A. fabae* on Black-Night-Shade, *A. gossypii* on Small Nettle and *A. gossypii* and *A. spiraecola* on Small Nettle .
- *L. fabarum* (Marshall) was observed associated with *A. fabae* on Black-Night-Shade and with *A. craccivora* on Bur Clover.

2- Hyperparasitoid species

- *Syrphophagus* sp. (Family: Encyrtidae) was recorded associated with *A. gossypii* on each of Silver-leaved Nightshade and Small Nettle and with *A. gossypii*, *A. spiraecola* and *M. persicae* on Small Nettle
  Alloxysta sp. (Family: Figitidae) was found associated with *A. gossypii* and *A. spiraecola* on Small Nettle.

These results agree with those of Morales *et al.* (1992) who mentioned that wild plants support aphid populations and act as reservoirs for parasitoids.

B) Predatory species

Six predatory species belong to 3 orders and 3 families were surveyed. Order Coleoptera was represented by four species, *i.e., Coccinella undecimpunctata* L., *C. septempunctata* L., *Hippodamia convergens* Guérin-Méneville and *Scymnus interruptus* (Goeze). It was the most dominant in the two years of study. As well, Order Neuroptera and Diptera were represented only each by one species *Chrysoperla carnea* (Steph.) and *Syrphus corollae* Fabricius, respectively (Table 2).

Further studies on the parasitoid and predatory species associated with pests on the wild plants are still needed in North Sinai.

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