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Survey and Abundances of Common Ichneumonoid Parasitoid Species in Suez Canal Region, Egypt

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ABSTRACT

A survey of common ichneumonoid (braconid and ichneumonid) parasitoid wasp species and their relative abundances in Suez Canal Region; Ismailia and North Sinai Governorates, using Malaise trap, was carried out for two successive years 2007 and 2008. Biweekly catches were collected, classified and identified. The survey revealed the presence of a total number of 52 ichneumonoid species; 20 braconid species (of which 4 haven't been identified yet) and 32 ichneumonid species (of which 7 haven't been identified yet). The 16 identified braconid species belong to 14 genera and 7 subfamilies, while the 25 ichneumonid species belong to 19 genera and 10 subfamilies. Collected specimens were identified by the authors and were sent to the specialists abroad for confirmation. A checklist of the recorded identified species and their abundances was provided.

Key words: Survey, abundance, Ichneumonidae, Braconidae, parasitic wasps, Suez Canal region, Egypt.

INTRODUCTION

Ichneumonoidea is one of the largest groups of parasitic insects and by far the most well known hymenopteran parasitoids (over 100,000 estimated species worldwide) of primary parasitoid insects that attack other arthropods, especially the immature stages of other insects (Gauld and Bolton, 1988 and Wahl and Sharkey, 1993). They are important elements for biological control of insect pests.

Despite their importance, they remain taxonomically and biologically one of the most poorly known groups of insects (Quicke, 1997). This situation may be attributed to the following reasons: their relatively large numbers of species (about hundred thousands), many of them look very similar; many structural characters of these insects have comparatively high degrees of variations depending on the environmental conditions. This situation leads to numerous convergent similarities of parasitic wasps that involve their external/ internal morphology (Quicke and van Achterberg, 1990 and Gokhman, 1995).

Dominant families of the superfamily Ichneumonoidea are; Braconidae and Ichneumonidae (with approximately 40,000 and 60,000 species, respectively), both of which attack a wide range of host species around the world (Wahl and Sharkey, 1993).

Family Braconidae is the second largest family of the order Hymenoptera. Its members are cosmopolitan, with more than 40,000 species, occurring around the world and are diverse in all areas with no striking preference for tropical or temperate regions, for wet or dry habitats (Wahl and Sharkey, 1993 and Wharton, 1993). Braconids have been used extensively and very successfully in biological control of insect pests. It includes a large number of species that are effective enough to exert a definite regulatory impact on the increase of numerous important plant pests. They are also widely used as models for the study of host-parasitoid interactions (Wharton, 1993).

Ichneumonidae, as well, is one of the largest families of order Hymenoptera, with an estimated 60,000 extant or known species worldwide (Townes, 1969). Members of this family are cosmopolitan, occurring in most terrestrial habitats. Most of them occupy the temperate regions and the humid tropics; relatively few species occur in hot, dry areas (Gauld and Carter, 1983). Most ichneumonids are primary parasitoids, and many exert a pronounced effect on the host population. They attack the larvae or pupae of holometabolous insects, particularly those of the orders; Lepidoptera and Symphyta.

In Egypt, taxonomy of this group is still incomplete and needs more studies to be done. Morsi (1977) studied the family Braconidae comprehensively in Egypt. In his survey of this family, different regions were covered excluding Suez Canal and Sinai regions, which are the regions under the present study. He recorded 56 species belonging to 20 genera and 10 subfamilies. Sarhan and Quicke (1989a) introduced a key to the genera of subfamily Braconinae in Egypt and neighboring countries. They cited 20 braconin genera occurring in Egypt. In the same year, a new species of *Glyptomorpha* was described from Saudi Arabia, Egypt, Pakistan, and Yemen by the same authors to

be a new addition to the Egyptian fauna (Sarhan and Quicke, 1989b). El-Heneidy and Hassanein (1992) recorded two braconid parasitoid species; *Meteorus gyrator* Thurberg and *M. rubens* Nees, as a new addition to the Egyptian fauna attacking some economic lepidopterous pests.

Shaumar (1966) offered the first real and comprehensive study of family Ichneumonidae in Egypt, where 79 species belonging to 9 subfamilies collected from different regions of Egypt were listed. Out of these numbers, 7 species were considered as new records to the Egyptian fauna. Further addition to the ichneumonids of Egypt was made by Aubert and Shaumar (1978) in their supplementary list of the Ichneumonidae of Egypt, in this list, nine new species were added. This work also included a list of 59 species mentioned elsewhere from Egypt. Azab (2007) listed 146 ichneumonid species in a comprehensive study concerning this family. These species belong to 13 subfamilies; his work was provided with keys, descriptions and distribution of the different species under study.

Several works concerned with the survey of most common parasitoid species belonging to the Superfamily Ichneumonoidea in Egypt were carried out as those by El-Heneidy *et al.* (2001a, b) and Zaki et *al*. (2002).

The present study was carried out with the aim of surveying the relatively most common braconid and ichneumonid parasitic species, as well of estimating their abundances in Suez Canal region.

MATERIALS AND METHODS

Collection of relatively most common ichneumonid species was carried out at two locations in the Suez Canal region; the Experimental Farm of the Agricultural Research Station (about 2 feddans), at Ismailia district, Ismailia Governorate and the Experimental Farm of the Faculty of Environmental Agricultural Sciences (about 2.5 feddans), at El-Arish district, North Sinai Governorate.

Sampling was undertaken biweekly at each of the two locations, using Malaise traps, for two successive years; from January 2007 to December 2008. One trap was placed at the center of each of the two experimental farms, surrounded crops were mostly fruit trees; Olive, Mango and Guava in the Ismailia's farm and Guava, Citrus, Date palm, Olive and Mulberry in El-Arish's farm. The Malaise traps usually capture flying insects by interception. Those were built with black cloth bands that intercept the insects leading them through two white bands up to the upper part where two plastic flasks (20 ml) were attached and connected to each other by a screw cap (Fig. 1). The lower flask contained a fixing liquid where the insects fall and die. These flasks were deposited towards the North direction for better attraction of the parasitoid wasps. Attracted specimens were collected biweekly using a fine mesh sieve, coded and then stored in 70 % ethanol for further laboratory preliminary classification to the levels of subfamilies and/or genera.

Specimens obtained from the traps were prepared, pinned by special stainless steel pins. Then labeled, identified and kept in preservation drawers, supplied with some repellent chemicals. The specimens were arranged into more than one replicate.

Identification of the specimens was carried out by the authors and was confirmed by Dr. Gavin Broad (Natural History Museum of London, UK) and Professor Vladimir Gokhman (Moscow State University, Russia) (Ichneumonidae); and Professor Michael Sharkey (Department of Entomology, University of Kentucky, USA).

The materials examined were deposited in the collections of Biological Control Department, Agric. Res. Center, Giza; Department of Entomology, Faculty of Science, Cairo University, Giza and Department of Entomology, Faculty of Science, Suez Canal University, Ismailia, Egypt.

Numbers and seasonal abundance of each of the collected parasitic species/ location/ year were recorded.

Malaise trap used for parasitic wasps' collection

RESULTS AND DISCUSSION

1- Survey of common braconid and ichneumonid species in Suez Canal region

The survey of the ichneumonid parasitic wasps in Suez Canal region, revealed the presence of a total of 52 species; 20 bracoinds (of which 4 haven't been identified yet) and 32 Ichneumonids species (of

which7 haven't been identified yet) through 24 sample collections throughout the two successive years 2007 and 2008. The identified braconid species belong to 14 genera and 7 subfamilies; while those of ichneumonidae belong to 19 genera and 10 subfamilies. Collected specimens were identified by the authors and were sent to the specialists abroad for confirmation.

The following checklist includes only the confirmed identified species of both families.

I. Family Braconidae

Subfamily Agathidinae Haliday 1833
- Genus *Coccygidium* Saussure 1892
  - *Coccygidium sudanense* (Gahan 1915)

Subfamily Alysiinae Leach 1815
- Genus: *Chorebus* Haliday 1833
  - *Chorebus* sp.

Subfamily Aphidinae
- Genus *Aphidius* Nees 1819
  - *Aphidius matricariae* Haliday 1834
- Genus *Ephedrus* Haliday 1833
  - *Ephedrus* sp.
- Genus *Praon* Haliday 1833
  - *Praon necans* Mackauer 1959
- Genus *Trioxys* Haliday 1833
  - *Trioxys pallidus* (Haliday 1833)

Subfamily Cheloninae Forster 1862
- Genus *Chelonus* Panzer 1806
  - *Chelonus* sp.
- Genus *Phanerotoma* Wesmael 1838
  - *Phanerotoma* sp.

Subfamily Meteorinae Cresson 1887
- Genus *Meteorus* Haliday 1835
  - *Meteorus rubens* (Nee 1811)
  - *Meteorus* sp.1
  - *Meteorus* sp.2

Subfamily Microgastrinae Forster 1862
- Genus *Cotesia* Cameron 1891
  - *Cotesia* sp.
- Genus*: Dolichogenidea* Viereck 1911
  - *Dolichogenidea* sp.
- Genus *Microplitis* Förster 1862
  - *Microplitis rufiventris* Kokujev 1914

Subfamily Opiinae Blanchard 1845
- Genus *Opius* Wesmael 1835
  - *Opius* sp.
- Genus *Psyttalia* Walker 1860
  - *Psyttalia concolor* (Szepligeti 1910)

II. Family Ichneumonidae

Subfamily Anomaloninae Viereck 1918

Genus *Anomalon* Panzer 1804
- *Anomalon foliator* Fabricius 1798
- *Anomalon* sp.

Genus *Barylypa* Förster 1869
- *Barylypa amabile* (Tosquinet 1900)

Subfamily Banchinae Wesmael 1845
- Genus *Exetastes* Gravenhorst 1829
  - *Exetastes syriacus* Schmiedeknecht 1910

Subfamily Campopleginae Förster 1869
- Genus *Campoplex* Gravenhorst 1829
  - *Campoplex* sp.
- Genus *Casinaria* Holmgren 1859
  - *Casinaria trochanterator* Aubert 1960
- Genus *Diadegma* Förster 1869
  - *Diadegma aegyptiator* Shaumar 1966
  - *Diadegma armillata* (Gravenhorst 1829)
- Genus *Sinophorus* Förster 1869
  - *Sinophorus xanthostoma* (Gravenhorst 1829)
- Genus *Venturia* Schrottky 1902
  - *Venturia canescens* (Gravenhorst 1829)
  - *Venturia* sp.

Subfamily Cryptinae Kirby 1837
- Genus *Cryptus* Fabricius 1804
  - *Cryptus armator* Fabricius 1804
- Genus *Dichrogaster* Doumerc 1855
  - *Dichrogaster* sp.
- Genus *Mesostenus* Gravenhorst 1829
  - *Mesostenus transfuga* Gravenhorst 1829

Subfamily Diplazontinae Viereck 1918
- Genus *Diplazon* Nees 1819
  - *Diplazon laetatorius* (Fabricius 1781)

Subfamily Ichneumoninae Latreille 1802
- Genus *Ctenichneumon* Thomson 1894
  - *Ctenichneumon nitens* (Christ 1791)

Subfamily Metopiinae Förster 1869
- Genus *Exochus* Gravenhorst 1829
  - *Exochus* sp**.**

Subfamily Ophioninae Shuckard 1840
- Genus *Enicospilus* Stephens 1835
  - *Enicospilus merdarius* (Gravenhorst 1829)
  - *Enicospilus tournieri* (Vollenhoven 1879)
- Genus *Ophion* Fabricius 1798
  - *Ophion obscuratus* Fabricius 1798

Subfamily Pimplinae Wesmael 1845
- Genus *Exeristes* Förster 1869
  - *Exeristes roborator* (Fabricius 1793)
- Genus *Pimpla* Fabricius 1804
  - *Pimpla contemplator* (Müller 1776)
  - *Pimpla spuria* Gravenhorst 1829

Subfamily Tryphoninae Shuckard 1840
- Genus *Netelia* Gray 1860
  - *Netelia testacea* (Gravenhorst 1829)
  - *Netelia thoracica* (Woldstedt 1880)

2- Abundances of braconid and ichneumonid parasitic species in Suez Canal region

Numbers and seasonal abundances of the collected parasitic species/ location/ year during the two years of the study, 2007 and 2008 were tabulated in tables 1-4. Abundances of identified and unidentified braconid species at El-Arish, North Sinai Governorate and Ismailia Governorate were

Table (1): Abundances of braconid species collected by Maliase trap from El-Arish district, North Sinai Governorate from January 2007 to December 2008.

Subfamily	Scientific Name	Frequency 2007	Percentage 2007	Frequency 2008	Percentage 2008
Cheloninae	*Phanerotoma* sp.	0	0	1	4.3
Homolobinae	Unidentified sp. 1	1	3.7	2	8.7
	Unidentified sp. 2	6	22.2	4	17.4
Macrocentrinae	Unidentified sp. 1	5	18.5	8	34.8
Meteorinae	*Meteorus rubens*	1	3.7	0	0
	Meteorus sp. 1	1	3.7	0	0
	Meteours sp. 2	2	7.4	0	0
Microgastrinae	*Cotesia* sp.	4	14.8	3	13.1
	Dolicogenidea sp.	2	7.4	0	0
	Microplitis rufiventris	1	3.7	1	4.3
Opiinae	*Psyttalia concolor*	3	11.1	4	17.4
Rogadinae	Unidentified sp. 1	1	3.7	0	0
Total		27	100	23	100

Table (2): Abundances of braconid species collected by Malaise trap from Ismailia district (Ismalia Governorate) from January 2007 to December 2008.

Subfamily	Scientific Name	Frequency 2007	Percentage 2007	Frequency 2008	Percentage 2008
Agathidinae	*Coccygidium sudanense*	9	24.3	8	13.3
Alysiinae	*Chorebus* sp.	3	8.1	3	5.0
Aphidinae	*Aphidius matricariae*	0	0	3	5.0
	Ephedrus sp.	0	0	2	3.3
	Praon necans	0	0	3	5.0
	Trioxys pallidus	0	0	3	5.0
Cheloninae	*Chelonus* sp.	1	2.7	4	6.7
	Phanerotoma sp.	0	0	4	6.7
Homolobinae	Unidentified sp. 2	5	13.5	4	6.7
Macrocentrinae	Unidentified sp. 1	4	10.8	7	11.7
Meteorinae	*Meteorus* sp.2	3	8.1	3	5.0
Microgastrinae	*Cotesia* sp.	3	8.1	4	6.7
	Dolicogenidea sp.	3	8.1	4	6.7
	Microplitis rufiventris	3	8.1	5	8.3
Opiinae	*Opius* sp.	3	8.1	3	5.0
Total		37	100	60	100

summarized in tables (1) and (2), respectively. As shown in the tables, number of the braconid species occurred at Ismailia was relatively more than what occurred at El-Arish, as well were their abundances (almost double) at Ismailia. 5 species were recorded in both locations.

An equivalent abundance of the 8 braconid species at El-Arish, 27 and 23 individuals in years 2007 and 2008 respectively was recorded. *Cotesia* sp. and *Psyttalia concolor* were the most abundant braconid species occurred. They represented 25.9 and 30.4% of the total number of individuals collected from the location (Table 1). Abundance of the 13 braconid species at Ismailia was nearly doubled in year 2008 compared to year 2007 (37 and 60, respectively). *Coccygidium sudanense* was the relatively dominant braconid species at Ismailia in both years (represented respectively 24.3 and 13.3% of the total number of individuals collected from the location) (Table 2).

Abundances of identified and unidentified ichneumonid species at El-Arish (North Sinai Governorate) and Ismailia Governorate were summarized in tables (3) and (4), respectively. As shown in the tables, number of the ichneumonid species occurred at El-Arish was relatively more than what occurred at Ismailia, as well were their abundances. Eight species were recorded in both localities.

Abundance of the 20 ichneumonid species at El-Arish was doubled in year 2007 compared to year 2008 (64 and 32, respectively). *Anomalon foliator*, *Diadegma armillata, Diplazon laetatorious* and *Enicospilus tournieri* were the most abundant ichneumonid species occurred at El-Arish in both years. Those represented together 32.8 and 52.3% of the total number of individuals collected from the location (Table 3).

Abundance of the 20 ichneumonid species at

Table (3): Abundances of ichneumonid species collected by Malaise trap from El-Arish district (North Sinai Governorate) from January 2007 to December 2008.

Subfamily	Scientific Name	Frequency 2007	Percentage 2007	Frequency 2008	Percentage 2008
Anomaloninae	*Anomalon foliator*	8	12.5	3	9.4
	Barylypa amabile	1	1.6	0	0
Banchinae	*Exetastes syriacus*	4	6.3	0	0
Campopleginae	*Campoplex* sp.	1	1.6	0	0
	Casinaria trochanterater	1	1.6	1	3.1
	Diadegma aegyptiator	1	1.6	0	0
	Diadegma armillata	2	3.1	6	18.7
	Venturia canescens	2	3.1	0	0
	Venturia sp.	1	1.6	2	6.3
	Unidentified sp. 1	1	1.6	0	0
	Unidentified sp. 2	2	3.1	0	0
	Unidentified sp. 3	4	6.3	2	6.1
Cryptinae	*Cryptus armator*	4	6.3	2	6.3
	Dichrogaster sp.	2	3.1	0	0
	Mesostenus transfuga	1	1.6	1	3.1
	Unidentified sp. 1	4	6.3	3	9.1
Diplazontinae	*Diplazon laetatorious*	6	9.4	3	9.4
	Unidentified sp. 1	2	3.1	0	0
Ichneumoninae	*Ctenichneumon nitens*	1	1.6	1	3.1
	Unidentified sp. 1	2	3.1	0	0
Metopiinae	*Exochus* sp.	1	1.6	0	0
Ophioninae	*Enicospilus tournieri*	5	7.8	5	15.6
Pimplinae	*Pimpla contemplator*	1	1.6	0	0
	Pimpla spuria	4	6.3	3	9.4
Tryphoninae	*Netelia testacea*	1	1.6	0	0
	Netelia thoracica	2	3.1	0	0
Total		64	100	32	100

Table (4): Abundances of ichneumonid species collected by Malaise trap from Ismalia district (Ismalia Governorate) from January 2007 to December 2008.

Subfamily	Scientific Name	Frequency 2007	Percentage 2007	Frequency 2008	Percentage 2008
Anomaloninae	*Anomalon foliator*	9	33.4	7	13.7
	Anomalon sp.	2	7.4	0	0
	Unidentified sp. 1	0	0	6	11.8
Banchinae	*Exetastes syriacus*	4	14.8	6	11.8
Campopleginae	*Sinophorus xanthostomus*	0	0	2	3.9
	Venturia sp.	0	0	3	5.9
	Unidentified sp. 1	1	3.7	2	3.9
Cryptinae	*Cryptus armator*	0	0	3	5.9
	Mesostenus transfuga	0	0	2	3.9
	Unidentified sp. 1	0	0	1	2
Diplazontinae	*Diplazon laetatorious*	5	18.5	10	19.6
Ophioninae	*Enicospilus merdarius*	5	18.5	3	5.9
	Ophion obscuratus	0	0	1	2
Pimplinae	*Exeristes roborator*	1	3.7	1	2
	Pimpla contemplator	0	0	2	3.9
	Pimpla spuria	0	0	2	3.9
Total		27	100	51	100

Ismailia was doubled in year 2008 compared with year 2007 (51 and 27, respectively). *Anomalon foliator*, *Diadegma armillata, Diplazon laetatorious* and *Enicospilus tournieri* were the most abundant ichneumonid species occurred at El-Arish in both years. Those represented together 32.8 and 52.3% of the total number of individuals collected from the location (Table 3). *Anomalon foliator*, *Exetastes syriacus, Diplazon laetatorious* and *Enicospilus medarius* were the relatively highest abundant ichneumonid species occurred at Ismailia in both years. They represented together 85.2 and 51 % of the total number of individuals collected from the location (Table 4).

Obtained results agree with the braconid species early recorded by Morsi, 1977, El Heneidy and Hassanein, 1992, El-Heneidy, *et al.* 2001a and El-Heneidy, *et al.* 2001b in Egypt. As well with those of the ichneumonid species recorded by Shaumar, 1966, Aubert and Shaumar, 1978 and Azab, 2007.

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