



Dipteran and coleopteran natural enemies associated with cantaloupe crop in Qalyubiya Governorate, Egypt

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Abstract:

Studying diversity of natural enemies associated with their pests in agro ecosystems is urgent for the integrated pest management. Two sampling techniques (i.e. water traps (pit-fall traps) and direct count of insects in the field) were used to survey pests, natural enemies and pollinators on six cantaloupe cultivars in Qaha region of Qalyubiya Governorate, Egypt over 2006 and 2007 summer plantation seasons. Thirty-two species belonging to two insects in Diptera and Coleoptera orders presented by 18 superfamilies and 23 families and 22 genera. They were recorded on Ideal, E81-065, Mirella, Vicar, E81-013 and Magenta cantaloupe cultivars. Diptera was represented by eighteen species belonging to 13 families (Sepsidae, Phoridae, Scenophilidae, Dolichopodidae, Otitidae, Agromyzidae, Ephydriidae, Drosophilidae, Tachinidae, Anthomyiidae, Muscidae, Syrphidae and Cecidomyiidae). Field observations indicated that *Liriomyza trifolii* (Burg), Agromyzidae infested cantaloupe leaves in moderate populations, while *Melanogromyza cuntans* (Meign) infested leaves in low populations. The present study revealed that the parasite *Tachina larvarum* L. (Tachinidae) and the predator *Syrphus corolla* F. (Syrphidae) were found in low levels. *Pheanobremia aphidivora* (Rubsamen) (Cecidomyiidae) was observed in moderate populations on leaves. However, other dipteran species were recorded in cantaloupe leaves at low levels. Most coleopteran insects in the present survey were pests, however, others were predators such as *Coccinella undecimpunctata*, *Coccinella septempunctata* and *Cydonia vicina* (Coccinellidae), *Paederus aliferii* Koch. (Staphylinidae) and *Clasoma chlorostictum* Deg. (Carabidae).

Introduction

Successful Integrated Pest Management requires a thorough knowledge of the pest insect's biology, their natural enemies and the crop to allow rational use of a cultivar of

cultivation and control techniques under differing circumstances (Gullan and Cranston, 2017). So, it is necessary to know and conserve the diversity of agents of

biological control (predators and parasitoids) present in the agro ecosystems (Crowder and Jabbour, 2014).

Vinutha *et al.* (2017) indicated the presence of several predators from the orders Coleoptera, Mantodea, Hemiptera, and Odonata. This information can be used to improve the integrated pest management in the crops. The survey of insect pests and their associated natural enemies of cantaloupe in Qaha of Qalyubiya Governorate over 2006 and 2007 summer plantation was studied. The results included survey of pests from two classes (Insecta and Arachnida). Six insect orders were recorded; Hemiptera, Lepidoptera, Orthoptera, Thysanoptera, Neuroptera and Dermaptera. Arachnida was represented by two orders (Acarina and Araneida) (Younes *et al.*, 2010).

The aim of this study was to survey dipteran and coleopteran natural enemies associated with cantaloupe crop pests.

Materials and methods

The study was carried out in the Experimental Farm of Plant Protection Research Institute at Qaha region, southwest of Qalyubiya Governorate (30°17'00 "N, 31° 12'00 "E of 133 meters (436 ft) below sea level) in Egypt. An area of about 2100 m² was cultivated with six cantaloupe cultivars (i.e. Ideal, E81-065, Mirella, Vicar, E81-013 and Magenta) over 2006 and 2007 summer plantation during the period of vegetative growth until the harvest of cantaloupe. Each cultivar was cultivated in 350 m² with three replicates (of about 116.67 m²). Seeds were sown on April 13th and 16th over 2006 and 2007, respectively at 30 cm apart between hills in CRBD. The recommended agricultural practices for cantaloupe cultivation was completely adopted without any chemical control measures through the period of study. The survey was carried out by two sampling techniques

a. Water traps filled with water and detergent (pit-fall traps) and distributed between plants

in considerable distance during only 2006 season.

b. Direct field observation followed by laboratory examination which were carried out during two investigated seasons.

Pit-fall traps, 10 cm diameter and 14 cm depth (filled with water and detergent) were installed at 14 cm below soil surface after 32 days of sowing date (they were located one trap per each replicate of the tested cantaloupe varieties). Traps were replaced every 5 days during the first season of study. The trap catches were transferred to the laboratory, where pests and natural enemies were obtained by using a sieve plate to isolate the different species in the same day.

The second sampling technique was carried out for two consecutive seasons, sampling started after about two weeks from cultivation date and on 7-day intervals (continued for 15 weeks). Samples of 180 leaves (10 leaves x 3 replicates) for each cultivar were randomly picked out from different levels "upper, middle and lower" of the plant in the morning. A primary examination was made by naked eyes, in the field then randomized leaf samples were kept separately in polyethylene bags and transferred to the laboratory. All the collected species from both sampling techniques were isolated and counted either by naked eyes (in case of large insect species) or by aid of a stereomicroscope (in case of small insects). Some of these species can be identified immediately, but others were difficult to be known, so they were assorted into orders then into species and preserved in vials containing 70% ethanol alcohol to be identified.

The different pests, predators and parasitoids recorded on leaves of cantaloupe cultivars were estimated by counting the total number on both leaf sides.

A label including all necessary information concerning locality, date of collection and name of the host plant (cantaloupe) was stuck on a vial of each

unknown specimen, also the abundance and developmental stage of species were considered. Also, there was a complete systematic arrangement of classes, orders, suborders, super families, families and sub-families of all arthropod species as possible. Identification of most insect species belong to orders Diptera and Coleoptera was carried out in Survey and Taxonomy Research Department, Plant Protection Research Institute, Agricultural Research Center, Giza.

Results and discussion

A taxonomic list of each species together with their economic importance, frequency, site occurrence, insect stage, time of occurrence were found in detail as follow:

1. Order: Diptera:

Adults are among man's greatest tormentors ever-persistent nuisances and his most effective enemies as carriers of innumerable agencies of disease and death. Although no other order of insects affects humans so adversely, many large families do much good in the reduction of carrion and in the destruction of phytophagous insects that destroy agricultural crops. Flies are among swiftest and most agile fliers and can outmaneuver any other insect on the wing. Regardless of exaggerated claims, certain species can probably travel 50 miles an hour which is a real accomplishment for such small, light and fragile bodies. While, many species are more or less noiseless in the air, most members of the group are decidedly noisy and hum with a soft or loud, low or high-pitched tune which is somewhat characteristic of the families, and may serve in locating the opposite sex in mating. This order comprises three suborders (Brachycera, Cyclorrhapha and Nematocera).

1.1. Suborder: Brachycera:

Suborder Brachycera is divided in the present survey into five superfamilies (Sciomyzoidea, Platypezoidea, Asiloidea, Empidoidea and Tephritoidea) (Table, 1). Sciomyzoidea was represented by one family (Sepsidae) and one species *Sepsis fissa*

Becker was recorded as adults in soil during August, however, this species considered as pest on cantaloupe cultivars. Superfamily Platypezoidea was represented by one species belonging to family Phoridae; *Megaselia scalaris* Loew and this species occurred as adults infested cantaloupe leaves during July-August. Superfamily Asiloidea was found to be represented by one species *Scenopinus glabrifrons* (Meign) belongs to the family Scenopinidae observed as predator adults on cantaloupe leaves and flowers during May. Superfamily Empidoidea was represented by one family (Dolichopodidae) and two predator species observed as adults; (*Hydrophorus praecox* Lehmann during July-August and *Tachytrechus planitarsis* (Becker) during August on cantaloupe leaves. Superfamily Tephritoidea was represented by one family (Otitidae) and one species (*Physiphora demandata*) observed as adult on plant flowers and this species considered as pollinator and/or visitor (Table 1).

1.2. Suborder Cyclorrhapha:

Suborder Cyclorrhapha was represented in the present study by four superfamilies (Opomyzoidea, Ephydroidea, Muscoidea and Syrphoidea). Opomyzoidea was represented by one family (Agromyzidae), comprises two species considered as pests on cantaloupe. Moderate population of *L. trifolii* at different developmental stages was observed on plant leaves during May-August and the second species was *Melanagromza cunctans* Meign which was observed as few adults individuals on leaves and stems of cantaloupe during July-August. Superfamily Ephydroidea in the present study was represented by three families. The first one (Ephydridae) was represented by two species of insect pests as few adults on cantaloupe leaves. First of them was *Allotrichoma aegyptium* (Cresson) and the second was *Elphatinosoma chnumi* (Becker) and all these species were observed during August. The second family (Drosophilidae) was represented by only one

species *Drosophila melanogaster* Mg. observed during June on plant leaves. The third family (Tachinidae) was represented during August as parasite adults on cantaloupe leaves (Table, 2). Superfamily Muscoidea contains two families (Anthomyiidae and Muscidae). The first one was presented during July by *Pegomyia hyoscyami* Panzer). The second one was represented by *Antherigona varia* (Meign) during August (Table,1). The fourth superfamily Syrphoidea was represented by one family Syrphidae. The present survey revealed that there were two insect species considered as predators on the pest infesting cantaloupe plants, the first one was *Sphaerophoria flavicauda* (Zetterstedt) observed as adults on the plant flowers during May, and the second ones was *Syrphus corollae* F. observed as larvae and adults on both leaves and flowers of cantaloupe during May- July.

1.3. Suborder Nematocera:

Only one superfamily (Bibionomorpha) was recorded. Family Cecidomyiidae belong to this superfamily. The recorded species of this family were *Contarinia forskalii* (Debski) which was observed as adult pest in few individuals on plant leaves during August, and *Pheanobremia aphidivora* (Rubsaaamen) as predator observed as eggs deposited on the cantaloupe leaves during June- July (Table, 1).

2. Order: Coleoptera:

There were two suborders belonging to this order (Polyphaga and Adephaga). Suborder Polyphaga was represented by seven superfamilies (Elateroidea, Tenebrionoidea, Curculionidea, Cucujoidea, Buprestoidea, Scarabaeoidea and Staphylinoidea) (Table, 2). The superfamily Elateroidea was represented by Elateridae. This family contained *Drasterius bimaculatus* Rossi which considered as pest affected growth of cantaloupe cultivars, and the site of occurrence of this species recorded in soil during August.

Beetles of superfamily Tenebrionoidea comprised in the present survey two families (Anthicidae and Mycetophagidae). The most abundant species belonging to family Anthicidae were *Anthicus crinitus* La Ferte which was considered as pests observed on flowers of cantaloupe cultivars during July-August. Family Mycetophagidae was represented by one species *Typhaea stercorea* L. which was considered as pest observed on plant leaves of cantaloupe cultivars during August. Superfamily Curculionoidea in the present survey was represented by one family Curculionidae which was *Ceuthorrhynchus viator* Faust and considered as a pest. It was recorded on cantaloupe during May -August. There were two families belonging to superfamilies Cucujoidea (Nitidulidae and Coccinellidae) (Table, 2). Nitidulidae was represented by two insect pests *Carpophilus hemipterus* L. and *C. humeralis* F. collected from flowers of cantaloupe cultivars during August. Family Coccinellidae (Ladybirds) was represented in the present survey on the cantaloupe cultivars by different predator species (*Coccinella undecimpunctata* L., *Coccinella septempunctata* L. and *Cydonia vicina* var *isis* cr.) which was observed on plant leaves during May-August. The present observations clearly indicated that these species observed as eggs and adults on plant leaves of cantaloupe. Superfamily Buprestoidea was represented in the present survey by one species, *Anthaxia angustipennis* Klug. belonging to family Buprstidae. It was observed as adult pest collected from the stems of cantaloupe cultivars during May. *Tropinota squalida* Scop. was considered as pest collected from cantaloupe flowers as adults during June and this species belonging to superfamily Scaraboidea and family Scarabidae. Superfamily Staphylinoidea comprised one family Staphylinidae including a familiar predator *P. aliferii* which was observed as adults collected from the plant leaves during

June-July (Table, 2). Suborder Adephaga, was represented by one superfamily Caraboidea (Table, 2).

The present study indicated there was only one species *Calosoma chlorostictum chlorostictum* Deg. belonging to family Carabidae and it was recorded as predacious insects collected as adults from plant leaves of cantaloupe cultivars during July.

Surveyed insect pests and associated natural enemies inhabiting cantaloupe plants using direct count and pit-fall traps in Qaha, Qalyubiya Governorate. The current investigation results in 33 insect species comprised 19 pests, 1 parasitoid, 12 predators and 1 pollinator on the Ideal, E81- 065, Mirella, Vicar, E81-013 and Magenta cantaloupe cultivars. *L. trifolii* was the most important pest in the current investigation attacked cantaloupe plants and recorded in moderate population. Eggs of the predator; *P. aphidivora* were also recorded in moderate population. The predator, *S. corollae* was also recorded in the current investigation in few numbers. Order Coleoptera in the current investigation was represented by different pests don't have economic high importance. In other sense, it was represented by different familiar predator species such as *C. undecimpunctata*, *C. semptempunctata* and *C. vicina* var isis cr. in family Coccinellidae and *P. aliferii* in family Staphylinidae. These results are in harmony with El-Maghraby *et al.* (1994), Bachatly and Sedrak (1997) and Gameel (2013) who found that, *C. undecimpunctata* were the most common predator species associated with the cucurbit pests. Atakan and Canhilal (2004) in Turkey assessed yellow sticky traps in a field study on cotton. They recorded leafhoppers, *Asymetresca decedens* Paoli and *Empoasca decipens* Paoli, cotton whitefly, *B. tabaci* Genn., and western flower thrips *Frankliniella occidentalis* (Pergande). Presence and abundance of different insect predators against sucking insect pest of cotton were studied by Solangi *et al.* (2008).

Younes *et al.* (2010) surveyed pests and their associated natural enemies occurring on six cantaloupe cultivars at Qaha region, Qalyubiya Governorate over summer plantation of 2006 and 2007 seasons. Authors used two sampling techniques; water traps filled with water and detergent (pit-fall traps) and direct field observations followed by laboratory examination. Two arthropod classes were recorded; Insecta and Arachnida. Insecta was represented by six insect orders (Hemiptera, Lepidoptera, Orthoptera, Thysanoptera, Neuroptera and Dermaptera). However, Arachnida was represented by two orders Acarina and Araneida. Authors also made complete systematic arrangement of species into orders, suborders, superfamilies and families. Abdel-Rahman *et al.* (2016) recorded in a field study on cantaloupe in Assiut, Egypt 22 insect species derived from 17 families and 10 orders. The most important pests were *B. tabaci*, *T. urticae*, *A. gossypii*, *T. tabaci* and *Empoasca spp.* On the other hand, *Orius sp.*, *Ch. carnea* and *C. undecimpunctata* L. were the most abundant predators. Vinutha *et al.* (2017) recorded in a survey study pest and their associated natural enemies with *C. melo* var. conomon at different stages of crop growth. They documented 24 insect pests and nine natural enemies belonging to 9 orders. The most important pest on vegetative part was *L. trifolii*. The most important natural enemies recorded belonged family to Coccinellidae. Carvalho *et al.* (2018) surveyed different pests and their associated with pests on melon. The samples were collected weekly during the cycle of melon, using passive (Pitfall and Moericke traps) and active (sweep net) collection methods. The recorded families with the highest relative abundances in the passive collection method were Labiduridae, Formicidae, Chrysopidae, Coccinellidae and Staphylinidae. These families contain important species of predator which can promote crop pest suppression in melon agricultural systems.

The obtained information showed the presence of families Cecidomyiidae and Syrphidae (Diptera) and Coccinellidae (Coleoptera). The predators of these families may play an important role in regulating

cantaloupe pests. Therefore, more detailed studies should be carried out on these families to know the potential of these predators for integrated pest management in the cantaloupe crop.

Table (1): Partial taxonomic list of dipteran pests, associated with cantaloupe cultivars in Qaha region, Qalyubiya Governorate over two successive growing seasons (2006 and 2007).

| Taxonomic category | Scientific name | Insect stage | Site of occurrence | Frequency | Relationship | Period of occurrence |
|------------------------|---|-------------------------------|--------------------|-----------|--------------|----------------------|
| Order: Diptera | | | | | | |
| A- Suborder | | | | | | |
| Brachycera | | | | | | |
| 1- Superfamily: | | | | | | |
| Sciomyzoidea | | | | | | |
| Family: Sepsidae | <i>Sepsis fissa</i> (Becker) | Adults | Soil | + | Pest | August |
| 2- Superfamily: | | | | | | |
| Platypezoidea | | | | | | |
| Family: Phoridae | <i>Megaselia scalaris</i> (Loew) | Adults | Leaves | + | Pest | July- August |
| 3- Superfamily: | | | | | | |
| Asiloidea | | | | | | |
| Family: Scenopinidae | <i>Scenopinus glabrifrons</i> (Meign) | Adults | Flowers and leaves | + | Predator | May |
| 4- Superfamily: | | | | | | |
| Empidoidea | | | | | | |
| Family: Dolichopodidae | <i>Hydrophorus praecox</i> (Lehmann) | Adults | Leaves | + | Predator | July – August |
| | <i>Syn: Hydrophorus inaequalipes</i> (Macqmart) | | | | | |
| | <i>Tachytrechus planitarsis</i> (Becker) | Adults | Leaves | + | Predator | August |
| 5- Superfamily: | | | | | | |
| Tephritoidea | | | | | | |
| Family: Otitidae | <i>Physiphora demandata</i> (Fabricius) | Adults | Flowers | + | Pollinator | August |
| B- Suborder | | | | | | |
| Cyclorrhapha | | | | | | |
| 1- Superfamily: | | | | | | |
| Agromyzidae | | | | | | |
| | <i>Liriomyza trifolii</i> (Burg) | Eggs, larve, pupae and adults | Leaves | ++ | Pest | May- August |
| | <i>Melanagromza cunctans</i> (Meign) | Adults | Leaves and stems | + | Pest | July- August |

+ Few individuals were recorded in the present survey.

Table (1): continued.

| Taxonomic category | Scientific name | Insect stage | Site occurrence | of | Frequency | Relationship | Period of occurrence |
|--------------------------|--|-------------------|-----------------|-----|-----------|--------------|----------------------|
| 2- Superfamily: | | | | | | | |
| Ephydroidea | | | | | | | |
| Family: Ephydriidae | <i>Allotrichoma aegyptium</i> (Cresson) | Adults | Leaves | | + | Pest | August |
| | <i>Elphantinosoma chnumi</i> (Becker) | Adults | Leaves | | + | Pest | August |
| Family: Drosophilidae | <i>Drosophila melanogaster</i> Mg. | Adults | Leaves | | + | Pest | June |
| Family: Tachinidae | <i>Tachina larvarum</i> L. | Adults | Leaves | | + | Parasitoid | August |
| 3- Superfamily: | | | | | | | |
| Muscoidea | | | | | | | |
| Family: Anthomyiidae | <i>Pegomyia hyoscyami</i> (Panzer) | Adults | Leaves | | + | Pest | July |
| Family: Muscidae | <i>Antherigona varia</i> (Meigen) | Adults | Leaves | | + | Pest | August |
| 4- Superfamily: | | | | | | | |
| Syrphoidea | | | | | | | |
| Family: Syrphidae | <i>Sphaerphoria flavicauda</i> (Zetterstedt) | Adults | Flowers | | + | Predator | May |
| | <i>Syrphus corollae</i> F. | Larvae and adults | Flowers leaves | and | + | Predator | May- July |
| C- Suborder: | | | | | | | |
| Nematocera | | | | | | | |
| Superfamily: | | | | | | | |
| Bibionomorpha | | | | | | | |
| Family: Cecidomyiidae | <i>Contarinia forskalii</i> (Debski) | Adults | Leaves | | + | Pest | August |
| | <i>Pheanobremia aphidivora</i> (Rubsamen) | Eggs | Leaves | | ++ | Predator | June- August |

+Few individuals were recorded in the present survey.

++Moderate population.

Table (2): Partial taxonomic list of Coleopteran pests and the associated predators on six cantaloupe cultivars at Qaha region, Qalyubiya Governorate over two successive growing seasons (2006 and 2007).

| Taxonomic category | Scientific name | Insect stage | Site of occurrence | Frequency | Relationship | Period of occurrence |
|------------------------|---|--------------|--------------------|-----------|--------------|----------------------|
| A Suborder: | | | | | | |
| Polyphaga | | | | | | |
| 1- Superfamily: | | | | | | |
| Elateroidea | | | | | | |
| Family: Elateridae | | | | | | |
| | <i>Drasterius bimaculatus</i> Rossi | Adults | Soil | + | Pest | August |
| 2- Superfamily: | | | | | | |
| Tenebrionoidea | | | | | | |
| Family: Anthicidae | | | | | | |
| | <i>Anthicus crinitus</i> La Ferte. | Adults | Flowers | + | Pest | July- August |
| Family: | | | | | | |
| Mycetophagidae | | | | | | |
| | <i>Typhaea stercorea</i> L. | Adults | Leaves | + | Pest | August |
| 3- Superfamily: | | | | | | |
| Curculionoidae | | | | | | |
| Family: | | | | | | |
| Curculionidae | | | | | | |
| | <i>Ceuthorrhynchus viator</i> Faust | Adults | Leaves | + | Pest | August |
| 4- Superfamily: | | | | | | |
| Cucujoidea | | | | | | |
| Family: | | | | | | |
| Nitidulidae | | | | | | |
| | <i>Carpophilus hemipterus</i> L. | Adults | Fruits | + | Pest | August |
| | <i>Carpophilus humeralis</i> F. | Adults | Fruits | + | Pest | August |
| Family: | | | | | | |
| Coccinellidae | | | | | | |
| | <i>Coccinella</i> spp. | Eggs | Leaves | +++ | Predator | May and July |
| | <i>Coccinella undecimpunctata</i> L. | Adults | Leaves | + | Predator | May- August |
| | <i>Coccinella septempunctata</i> L. | Adults | Leaves | + | Predator | August |
| | <i>Cydonia vicina</i> var <i>isis</i> cr. | Adults | Leaves | + | Predator | June |
| 5- Superfamily: | | | | | | |
| Buprestoidea | | | | | | |
| Family: Buprestidae | | | | | | |
| | <i>Anthaxia angustipennis</i> Klug. | Adults | Stems | + | Pest | May |
| 6- Superfamily: | | | | | | |
| Scarabaeoidea | | | | | | |
| Family: | | | | | | |
| Scarabaeidae | | | | | | |
| | <i>Tropinota squalida</i> Scop. | Adults | Flowers | + | Pest | June |
| 7- Superfamily: | | | | | | |
| Staphylinoidea | | | | | | |
| Family: | | | | | | |
| Staphylinidae | | | | | | |
| | <i>Paederus aliferii</i> Koch. | Adults | Leaves | + | Predator | June – July |
| B- Suborder: | | | | | | |
| Adephaga | | | | | | |
| Superfamily: | | | | | | |
| Caraboidea | | | | | | |
| Family: Carabidae | | | | | | |
| | <i>Calosoma chlorostictum</i> Deg. | Adults | Leaves | + | Predator | July |

+ Few individuals were recorded in the present survey.

+++ High population.

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