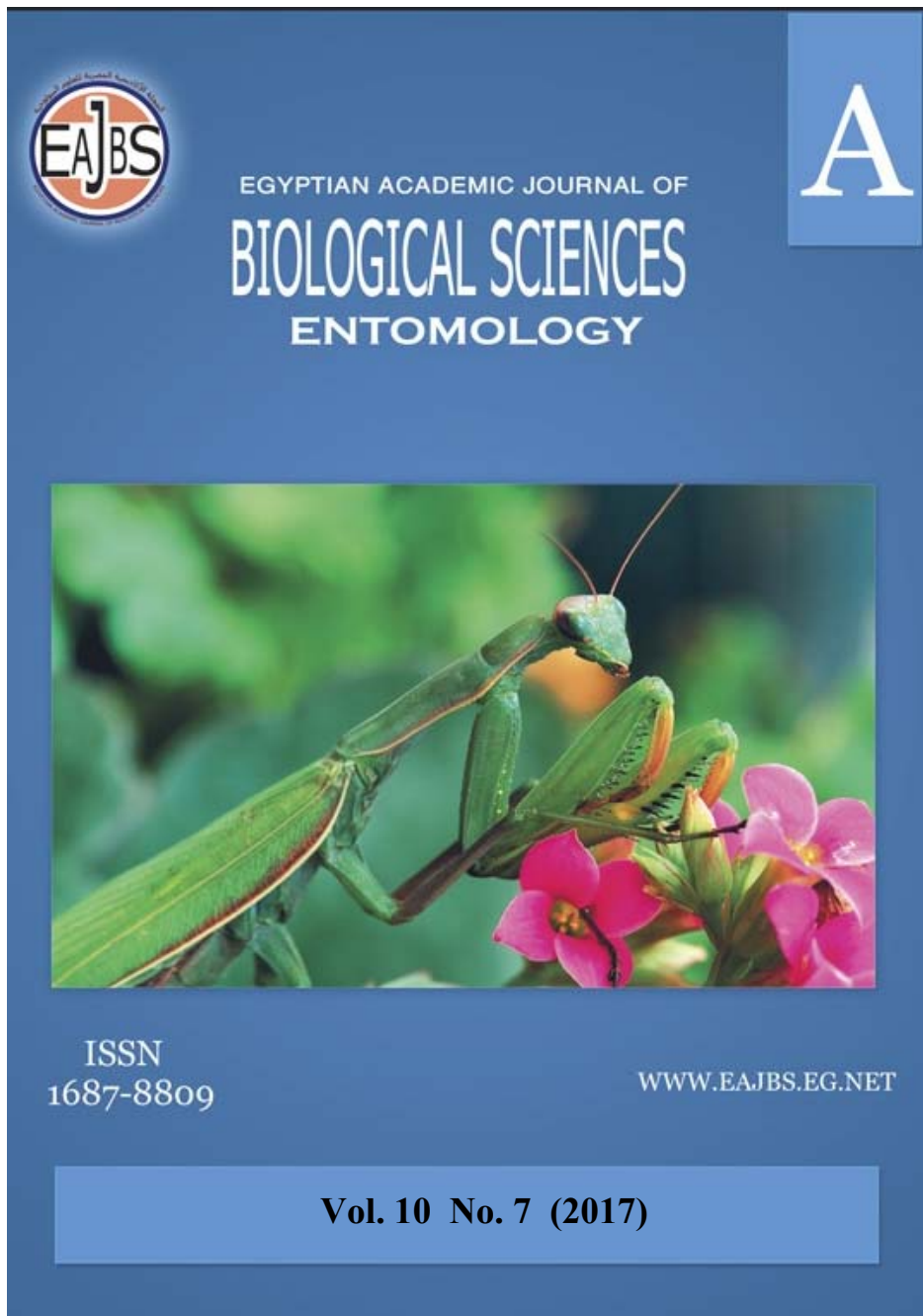


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Survey and Population Fluctuations of Arthropod Pests and Predators in Sweet Potato at Nile Delta, Egypt

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ABSTRACT

Experiments were carried out at El-Riad district, Kafr El-Sheikh Governorate during two successive growing seasons (2015 and 2016) to study the survey and population fluctuations of arthropod pests, insect predators and spiders in sweet potato, *Ipomoea batatas* (L.) (Apis Cultivar). The investigation revealed the presence of 26 Arthropods; 16 as pests and 10 as predators. *Bemisia tabaci* Genn., (Hemiptera: Aleyrodidae) was the most occurring (41.51 & 45.37%) followed by *Tetranychus* sp., (Acarina: Tetranychidae) (18.74 and 15.39%), *Empoasca* spp., (Hemiptera: Cicadellidae) (13.24 & 14.15%), *Agrius convolvuli* (L.), (Lepidoptera: Sphingidae) (7.12 & 6.18%), *Nezara viridula* (L.), (Hemiptera: Pentatomidae) (6.90 & 6.09%) and *Eysarcoris ventralis* (Westwood), (Hemiptera: Pentatomidae) (6.27 & 5.66 %), in 2015 and 2016 season, respectively. The insect pests; *Scantius aegyptius* (L.), *Gryllus domesticus* L., (Orthoptera: Gryllidae) and *Aiolopus strepens* (Latreille), (Orthoptera: Acrididae) exhibited the least population densities. Spiders were the most occurring predators (49.30 & 43.27%) followed by coccinellids (34.43 & 32.66%) and *Chrysoperla carnea* Steph., (Neuroptera: Chrysopidae) (11.36 & 11.80%), in 2015 and 2016 season, respectively), the lowest predatory densities were those of *Eupeodes corollae* (F.), (Diptera: Syrphidae) (0.95 & 0.81%) in 2015 and 2016 season, respectively. The surveyed spiders by different sampling techniques were found belonging to 13 families; Araneidae, Clubionidae, Dictynidae, Dysderidae, Eutichuridae, Gnaphosidae, Linyphiidae, Lycosidae, Philodromidae, Salticidae, Tetragnathidae, Theridiidae and Thomisidae, with araneid and lycosid being the most abundant. Pitfall traps proved to *Coccinella undecimpunctata* L. be the most efficient in collecting spiders, followed by sweep net, and hand catch. Predators were detected on sweet potato plants by mid or late June. The population density of *Stethorus gilvifrons* (Mulsant) was quite low and then increased gradually to exhibit its peak by the first week of August while, *C. carnea* adults peaked by the first week of September. The peak of *C. undecimpunctata* adult occurred on June 23 rd. Spiders recorded peaks by late June in 2015 and late July in 2016.

INTRODUCTION

Sweet potato, *Ipomoea batatas* (L.) is an important starchy food crop, especially in developing countries, where it ranks third in value of production and fifth in calorie contribution to human diets, and constitutes one of the seven most

important crops on a worldwide basis (Jones 1970, Chalfant, *et al.* 1990, Jansson and Raman 1991 and FAO 2015). In terms of production and nutrition, sweet potato is particularly important to subsistence farmers in developing tropical countries (DeVries, *et al.* 1967, Hahn, *et al.* 1984). The sweet potato are used as a raw material for the production of starch, alcohol, pectin etc. and the surplus as well as culled tubers can be used fresh or dehydrated in rations for livestock. Sweet potato green vine is an important source of green fodder.

Numerous insect species including various members of Lepidoptera, Thysanoptera, Orthoptera, and Hemiptera and spider mites have been recorded as pests of sweet potato (Wyniger 1962, Kay 1973, Chalfant, *et al.* 1990, Amies, *et al.*, 1996, Ekman and Lovatt, 2015). Some insect species of Elateridae, Scarabaeidae, Chrysomelidae, and Curculionidae (Order: Coleoptera) attack sweet potato (Wyniger 1962, Pollard 1984, Ward 1978, Korada, *et al.* 2000). Although importance of pest species varies from region to region, some weevils constitute the most important insect threat on a worldwide basis.

Spiders are among the most abundant and species-rich groups of predators in arable fields and they can play an important role in natural pest control (Hendawy and El-Fakharany, 2012 and 2015; Khan, *et al.*, 2015). Species abundance of spider communities in agricultural and horticultural ecosystems can be as high as in undisturbed natural ecosystems. About 13 spider species in vegetables were recorded (Rajeswaran *et al.*, 2005).

The objective of this study was to survey arthropods by three techniques from sweet potato plantation, and monitor the population fluctuations of the main arthropod species.

MATERIALS AND METHODS

The present study was undertaken in 2015 and 2016 seasons, at El-Riad district, Kafr El-Sheikh governorate and at Biological Control Laboratory of Rice Research and Training Center (RRTC), Sakha, Kafr El-Sheikh. On 5th of May, sweet potato cuttings (Apis Cultivar) were transplanted in both seasons. An area of one feddan was divided into four equal plots, and considered as four replicates. Inspection started 30 days after sowing or transplanting and continued weekly till the end of the crop season.

Laboratory counting of *Bemisia tabaci* and *Tetranychus* sp.

Numbers of occurring insects were recorded on 120 leaves taken from 10 plants/replicate (picked up from top, middle and base of sweet potato plants). Leaf sweet potato samples were moved to the laboratory to count the number of immature stages of whitefly, and *Tetranychus* sp. using binocular microscope.

Field survey of pests and predators:

Pests and predators collections were conducted in sweet potato plantations (about half feddan) at El-Riad district, Kafr El-Sheikh governorate.

Pitfall traps:

Wide mouthed glass jars (10 cm diameter X 15 cm deep) were used as pitfall traps having water to about 10-cm height, with 5 ml of 2% formalin solution to kill and preserve the captured arthropods, and 5 ml of Tween 80 as a detergent. Five pitfall traps were diagonally embedded in an area of about 1/2 feddan in Sweet potato plantations. Sampling was undertaken at 7- day intervals. Ground-active Arthropods were collected by these traps. The catch was collected by screening the water of the jars with its captured arthropods through a fine plastic sieve (300 pitfall traps in two seasons).

Hand-catching:

Foliage spiders occurring on plants were collected from 10 branches/ replicate by hand-catch (For collecting spiders by hand we wear soft rubber hand gloves are used) predatory insects were also counted.

Sweep net:

Samplings of insects were conducted using the conventional sweep net weekly. The samples were taken by walking diagonally through the nursery areas, and fifty double strokes were achieved each time (30 X 50 double strokes in two seasons). The obtained catch was placed into glass jars, and transferred to the laboratory for sorting, identification and counting.

RESULTS AND DISCUSSION**Survey, population density of arthropods in sweetpotato:**

lists of the arthropod pests found on sweet potato plantation during 2015 and 2016 seasons (Table 1).

Table 1: List and abundance of pests and insect visitors collected from sweet potato fields by three methods at El-Riad district, Kafr El-Sheikh Governorate in 2015 and 2016 seasons.

| Order /Family | Genus/species | Av. No./ 120 leaves | No. of individuals/ | | Occurrence % | | |
|--------------------|--|------------------------|----------------------|---------------------------------------|--------------|---------------|--------------|
| | | | 150 pitfall traps | sweep net 30 x 50 double stroke | Leaves | Pitfall traps | Sweep net |
| Hemiptera | | | | | | | |
| Cicadellidae | <i>Empoasca</i> spp. | 60.32 | 99 | 1895 | 13.37 | 7.06 | 31.93 |
| Cixiidae | <i>Oliarus</i> sp. | - | - | 9 | - | - | 0.15 |
| Aphididae | <i>Aphis gossypii</i> Glover & <i>Myzus persicae</i> (Sulzer) | 5.44 | 46 | - | 1.21 | 3.28 | - |
| Aleyrodidae | <i>Bemisia tabaci</i> Genn. | 191.96 | - | - | 42.54 | - | - |
| Delphacidae | <i>Sogatella</i> sp. | - | 46 | - | - | 3.28 | - |
| Pentatomidae | <i>Nezara viridula</i> (L.) | 28.06 | - | 1319 | 6.22 | - | 22.22 |
| | <i>Eysarcoris ventralis</i> (Westwood) | 25.8 | 16 | 518 | 5.72 | 0.14 | 8.73 |
| Rhopalidae | <i>Liorhysus hyolinus</i> (F.) | 2.78 | - | 242 | 0.62 | - | 4.08 |
| Lygaeidae | <i>Remaudiereana annulipes</i> Baerensprung | 2.32 | - | 190 | 0.51 | - | 3.20 |
| | <i>Nysius cymoides</i> (Spinola) | 2.08 | - | 175 | 0.46 | - | 2.95 |
| | <i>Spilostethus pandurus</i> (Scopoli) | - | 7 | 23 | - | 0.50 | 0.39 |
| Pyrrhocoridae | <i>Scantius aegyptius</i> (L.) | 3.14 | 12 | 40 | 0.70 | 0.86 | 0.67 |
| Coleoptera | | | | | | | |
| Anthicidae | <i>Anthicus</i> sp. * | 2.0 | 49 | 207 | 0.44 | 3.50 | 3.49 |
| Phalacridae | <i>Stilbus</i> sp. * | 3.0 | 125 | 240 | 0.66 | 8.92 | 4.04 |
| Chrysomelidae | <i>Phyllotreta cruciferae</i> Coeze | - | 161 | 265 | - | 11.48 | 4.47 |
| Curculionidae | <i>Lixus</i> sp. * | 3.0 | 8 | 38 | 0.66 | 0.57 | 0.64 |
| Scarabaeidae | <i>Pentodon bispinosus</i> Kust. | - | 10 | - | - | 0.71 | - |
| Lepidoptera | | | | | | | |
| Sphingidae | <i>Agrius convolculi</i> (L.) | 28.64 | 27 | 250 | 6.35 | 1.93 | 4.21 |
| Noctuidae | <i>Spodoptera littoralis</i> Biosd. | 6.28 | 8 | 115 | 1.39 | 0.57 | 1.94 |
| | <i>Autographa gamma</i> (L.) | 3.1 | 6 | 104 | 0.69 | 0.43 | 1.75 |
| | <i>Spodoptera exigua</i> Hb. | 6.0 | - | 25 | 1.33 | - | 0.42 |
| Nymphalidae | <i>Vanessa cardui</i> (L.) | - | 47 | - | - | 3.35 | - |
| Orthoptera | | | | | | | |
| Gryllotalpidae | <i>Gryllotalpa gryllotalpa</i> L., | - | 82 | - | - | 5.85 | - |
| Gryllidae | <i>Gryllus domesticus</i> L. | 1.54 | 205 | 95 | 0.34 | 14.62 | 1.60 |
| | <i>Liogryllus bimaculatus</i> de Geer | - | 10 | - | - | 0.71 | - |
| Acrididae | <i>Aiolopus strepens</i> Latr. | 1.38 | 12 | 78 | 0.31 | 0.86 | 1.31 |
| | <i>Euprepocnemis plorans</i> Charp. | - | 49 | 20 | - | 3.50 | 0.34 |
| | <i>Thisocetrus littoralis</i> Ramb. | - | 12 | 31 | - | 0.86 | 0.52 |
| | <i>Melanoplus</i> sp. | 1.34 | - | 56 | 0.30 | - | 0.94 |
| Collembola | | | | | | | |
| Collembola | Unidentified | - | 365 | - | - | 26.03 | - |
| Acarina | | | | | | | |
| Tetranychidae | <i>Tetranychus</i> spp. | 73.06 | - | - | 16.19 | - | - |
| | - | 451.24 | 1402 | 5935 | 100 | 100 | 100 |

* Visitor

Data revealed the presence of 32 arthropod species, 20 families and 6 orders. *B. tabaci* constituted the greatest number while *Melanoplus* sp. appeared in few numbers. Population density of whitefly per 120 leaves was 191.96 individuals

forming about 42.54 % of the total pest arthropods. *Empoasca* spp. constituted the greatest number, and population density of this pest per 30x50 double net sweeps was 1895 individuals forming about 31.93% of the total pests, but *Oliarus* sp. was recorded in few numbers. By pitfall traps collembola individuals was the most abundant 26.03%, while the least occurring insect pest individuals were those of *E. ventralis* 0.14%. (Sorensen, 2009) recorded over forty insect pest species of worldwide attacking Sweet potato.

Diagne (2004) in Louisiana found that the three Scarabaeid species belonging to *Phyllophaga* spp. most abundant species in sweet potato fields, while, the Scarabaeid, *Pentodon bispinosus* was less abundance in this study (only 10 individuals/150 pitfall traps). Nderitu, *et al.* (2009) found that more than 50 insect species belonging to several orders and at different stages of development infested the crop sweetpotato. About eight insect species caused major damage on the crop leaves, vines and tubers. Ames, *et al.* (1996) and Ekman and Lovatt (2015) found that *B. tabaci*, *Aphis gossypii*, *Myzus persicae*, *N. viridula*, *Nysius vinitor*, *S. litura*, *A. convolvuli*, *Tetranychus* spp. and gryllotalpids as the major damaging pests in sweet potato fields. Tanzubil (2015) found that *B. tabacci* and *Empoasca* spp. all attacked the crop with the first two being most important.

Table (2) lists the predatory insects and mites found in sweet potato plantation during 2015 and 2016 seasons. Data revealed the presence of 22 predator's species, 14 families and 5 orders.

Table 2: List and abundance of predatory insects and mites collected from sweet potato fields by three methods at El-Riad district, Kafr El-Sheikh Governorate in 2015 and 2016 seasons.

| Order /Family | Genus/species | Av. No./ 40 branches | No. of individuals/ | | Occurrence % | | |
|--------------------|---------------------------------------|----------------------|---------------------|-------------------------------|--------------|---------------|-----------|
| | | | 150 pitfall traps | 30x50 double stroke sweep net | Branches | Pitfall traps | Sweep net |
| Coleoptera | | | | | | | |
| Coccinellidae | <i>Coccinella undecimpunctata</i> L. | 17.56 | 143 | 281 | 17.09 | 21.90 | 13.97 |
| | <i>Scymnus interruptus</i> (Goeze) | 15.9 | 68 | 502 | 15.48 | 10.41 | 24.95 |
| | <i>Scymnus</i> sp. | 10.46 | - | 322 | 10.18 | - | 16.00 |
| | <i>Stethorus gilvifrons</i> (Mulsant) | 14.30 | - | 316 | 13.92 | - | 15.71 |
| Carabidae | <i>Calosoma chlorostictum</i> Dej. | - | 13 | - | - | 1.99 | - |
| | <i>Bembidion</i> sp. | - | 12 | - | - | 1.84 | - |
| Cicndellidae | <i>Cicndella</i> sp. | - | 9 | - | - | 1.38 | - |
| Staphylinidae | <i>Paederus affierii</i> (koch) | 6.44 | 8 | 35 | 6.27 | 1.23 | 1.74 |
| | <i>Philonthus</i> sp. | - | 24 | - | - | 3.68 | - |
| | Unidentified | - | 32 | - | - | 4.9 | - |
| Neuroptera | | | | | | | |
| Chrysopidae | <i>Chrysoperla carnea</i> Steph. | 18.56 | 8 | 385 | 18.07 | 1.23 | 19.14 |
| Diptera | | | | | | | |
| Syrphidae | <i>Eupeodes corolla</i> (F) | 1.44 | 14 | 24 | 0.97 | 2.14 | 1.19 |
| | <i>Sphaerophoria</i> sp. | 0.7 | 14 | 18 | 0.68 | 2.14 | 0.89 |
| Hemiptera | | | | | | | |
| Anthocaridae | <i>Orius albidipennis</i> (Reut) | 1.16 | 10 | - | 1.13 | 1.53 | - |
| | <i>Orius laevigatus</i> (Fieber) | 1.5 | - | 24 | 1.46 | - | 1.19 |
| Hymenoptera | | | | | | | |
| Formicidae | <i>Solenopsis</i> sp. | - | 191 | - | - | 29.25 | - |
| | Unidentified | - | 91 | - | - | 13.94 | - |
| Sphicidae | Unidentified | - | 16 | - | - | 2.45 | - |
| Vespidae | <i>Polistes gallica</i> L. | - | - | 27 | - | - | 1.34 |
| Orthoptera | | | | | | | |
| Mantidae | <i>Sphodronantis viridis</i> Forskal | 3.1 | - | 52 | 3.02 | - | 2.58 |
| Odonata | | | | | | | |
| Caenagrionidae | <i>Ischnura senegalensis</i> (Rambur) | 0.92 | - | 26 | 0.90 | - | 1.29 |
| Acarina | | | | | | | |
| Phytoseiidae | <i>Amblyseius</i> sp. | 10.7 | - | - | 10.41 | - | - |

Population density of this predator was 1211 and 2108 individuals per 150 pitfall traps and 30 x 50 double struck sweep net respectively, but *Sphaerophoria* sp. was recorded in few numbers.

Syrphids and coccinellids plays an important role in regulating aphid populations (Ames, *et al*, 1996). Brunke, *et al*. (2009) found that *Bembidion quadrimaculatum oppositum* Say was identified as common species on the basis of activity density in sweetpotato. Nderitu, *et al*. (2009) found that predators such as individuals belong to Formicidae on insect pests in sweet potato. Ekman and Lovatt (2015) found that *Coccinella transversa*, and *Labidura truncata* were predators on insect pests in sweet potato fields.

Survey of spider species in sweet potato plantations.

Spiders inhabiting sweet potato plants were surveyed at the experimental fields at El-Riad, Kafr El-Sheikh governorate for sweet potato seasons; 2015 and 2016 (Table 3).

Table 3: List and abundance of spiders collected from sweet potato fields by 200 pitfall traps, hand-catching from 200 branches and 30 x 50 double struck by sweep net at El-Riad district, Kafr El-Sheikh Governorate in 2015 and 2016 seasons.

| Family | Taxon | Period of activity | No. of individuals | Occurrence% |
|----------------|-------------------------------------|----------------------|--------------------|-------------|
| Araneidae | <i>Araneus</i> sp. | Jul. | 2 | 28.05 |
| | <i>Larinia</i> sp. | Jun. Jul. Aug. Sept. | 277 | |
| | <i>Metepeira</i> sp. | Jun. Jul. Aug. | 210 | |
| | <i>Singa</i> sp. | Jun. Jul. Aug. Sept. | 102 | |
| | Spiderlings | Aug. | 7 | |
| Clubionidae | <i>Clubiona</i> sp. | Aug. | 2 | 0.09 |
| Dictynidae | <i>Dictyna</i> sp. | Jun. Jul. Aug. Sept. | 20 | 6.38 |
| | <i>Lathys</i> sp. | Jun. Jul. Aug. Sept. | 35 | |
| | Unidentified | Jun. Jul. Aug. Sept. | 43 | |
| | Spiderlings | Jun. Jul. Aug. | 38 | |
| Dysderidae | <i>Dysdera crocata</i> C. L. Koch | Jun. Aug. Sept. | 3 | 0.14 |
| Eutichuridae | <i>Cheiracanthium</i> sp. | Sept. | 5 | 0.23 |
| Gnaphosidae | Unidentified | Jul. Aug. Sept. | 5 | 0.23 |
| Linyphiidae | <i>Drapetisca</i> sp. | Jun. Jul. | 105 | 5.07 |
| | <i>Erigone</i> sp. | Jun. | 1 | |
| | Spiderlings | Aug. | 2 | |
| Lycosidae | <i>Pardosa</i> spp. | Jun. Jul. Aug. Sept. | 45 | 26.31 |
| | Unidentified | Jun. Jul. Aug. Sept. | 491 | |
| | Spiderlings | Aug. Sept. | 25 | |
| Philodromidae | <i>Thanatus albini</i> (Audouin) | Jun. Jul. Aug. Sept. | 331 | 18.25 |
| | <i>Thanatus</i> sp. | Jun. Jul. Aug. Sept. | 34 | |
| | <i>Philodromus</i> sp. | Jul. Aug. | 5 | |
| | Spiderlings | Aug. Sept. | 19 | |
| Salticidae | <i>Ballus</i> sp. | Aug. Sept. | 5 | 0.89 |
| | Unidentified | Jul. Aug. | 7 | |
| | <i>Thyene imperialis</i> (Rossi) | Aug. | 1 | |
| | Spiderlings | Jul. Aug. | 6 | |
| Tetragnathidae | <i>Tetragnatha nitens</i> (Audouin) | Jun. Jul. Aug. Sept. | 248 | 11.91 |
| | <i>Tetragnatha javana</i> (Thorell) | Sept. | 6 | |
| Theridiidae | <i>Theridion</i> sp. | Jun. Jul. Aug. | 3 | 1.74 |
| | Spiderlings | Jul. Aug. Sept. | 34 | |
| Thomisidae | <i>Runicnia</i> sp. | Jun. | 3 | 0.70 |
| | <i>Thomisius</i> sp. | Jun. Jul. Aug. | 11 | |
| | Spiderlings | Sept. | 1 | |
| Total | - | - | 2132 | 100 |

The survey, achieved by pitfall traps, sweep net and hand catch revealed the occurrence of 13 families; Araneidae, Clubionidae, Dictynidae, Dysderidae, Eutichuridae, Gnaphosidae, Linyphiidae, Lycosidae, Philodromidae, Salticidae, Tetragnathidae, Theridiidae and Thomisidae. The most abundant families were Araneidae and Lycosidae. The following ranks were occupied by Philodromidae (18.25%), Tetragnathidae (11.91%) and Dictynidae (6.38%) and then Linyphiidae

(5.07%). The remaining families were slightly represented; Clubionidae (0.09%), Dysderidae (0.14%), Eutichuridae (0.23%), Gnaphosidae (0.23%), Thomisidae (0.70%) Salticidae (0.89%) and Theridiidae (1.74%). The most common were *Thanatus albini*, *Larinia* sp., *Tetragnatha nitens* and *Metepeira* sp. from sweet potato fields.

Results in Table (4) show that spider density was the greatest by pitfall traps, followed by net sweeps, and hand catch.

Table 4: Spiders collected three methods on sweet potato plants at El-Riad, Kafr El-Sheikh Governorate in 2015 and 2016 seasons

| Family | Taxon | No. of individuals | | |
|----------------|-------------------------------------|--------------------|-------------------------------|-----------------------------|
| | | 200 Pitfall traps | Sweep net 30x50 double struck | Hand-catching/ 300 branches |
| Araneidae | <i>Araneus</i> sp. | | - | 2 |
| | <i>Larinia</i> sp. | 7 | 92 | 186 |
| | <i>Metepeira</i> sp. | 2 | 109 | 90 |
| | <i>Singa</i> sp. | 3 | 45 | 58 |
| | Spiderlings | - | - | 7 |
| Clubionidae | <i>Clubiona</i> sp. | - | - | 2 |
| Dictynidae | <i>Dictyna</i> sp. | - | 9 | 11 |
| | <i>Lathys</i> sp. | - | 28 | 7 |
| | Unidentified | - | 12 | 23 |
| | Spiderlings | - | 19 | 19 |
| Dysderidae | <i>Dysdera crocata</i> C. L. Koch | 3 | - | - |
| Eutichuridae | <i>Cheiracanthium</i> sp. | - | 5 | - |
| Gnaphosidae | Unidentified | 4 | - | - |
| Linyphiidae | <i>Drapetisca</i> sp. | 87 | 5 | - |
| | <i>Erigone</i> sp. | 1 | - | - |
| | Spiderlings | - | - | 2 |
| Lycosidae | <i>Pardosa</i> spp. | 31 | 14 | 1 |
| | Unidentified | 487 | 5 | - |
| | Spiderlings | 21 | 2 | 2 |
| Philodromidae | <i>Thanatus albini</i> (Audouin) | 198 | 92 | 28 |
| | <i>Thanatus</i> sp. | 7 | 23 | 4 |
| | <i>Philodromus</i> sp. | - | 9 | 1 |
| | Spiderlings | - | 19 | - |
| Salticidae | <i>Ballus</i> sp. | 4 | 1 | 1 |
| | Unidentified | 6 | - | - |
| | <i>Thyene imperialis</i> (Rossi) | 1 | - | - |
| | Spiderlings | 1 | 5 | - |
| Tetragnathidae | <i>Tetragnatha nitens</i> (Audouin) | 1 | 112 | 148 |
| | <i>Tetragnatha javana</i> (Thorell) | - | 2 | 4 |
| Theridiidae | <i>Theridion</i> sp. | - | 1 | 2 |
| | Spiderlings | 6 | 11 | 17 |
| Thomisidae | <i>Runicnia</i> sp. | - | - | 3 |
| | <i>Thomisius</i> sp. | - | 8 | 2 |
| | Spiderlings | - | - | 1 |
| Total | - | 882 | 632 | 618 |
| Occurrence% | - | 41.37 | 29.64 | 28.99 |

The corresponding percentages of the spiders in the above-mentioned ways were 41.37, 29.64 and 28.99% respectively. Many authors reported spiders as common predators in different vegetable fields; Rajeswaran, *et al.* (2005) recorded about 13 spider species in vegetables. Sankari and Thiyagesan (2010) recorded eight species of spiders in eggplant fields. Hendawy and El-Fakharany (2012) recorded fourteen species belonging to eight families of spiders on eggplant and tomato fields.

Population fluctuation of pests and predators:

Results in (Table 5) showed population density of the pests progressively increased to reach peaks during August and September with leafhoppers, whitefly and *A. convolvui* while *Tetranychus* spp., *N. viridula* and *E. ventralis* were July and August in the two seasons.

Table 5: Population fluctuations of pests in sweet potato plantation at El-Riad district, Kafr El-Sheikh Governorate

| Sampling date | Average No. of pests /30 leaves | | | | | | | | | |
|---------------|---------------------------------|-----------------------|--------|--------|------------------------|--------------|-------------------------|--------|------------------------|------------------------------|
| | <i>Empoasca</i> spp. | <i>Bemisia tabaci</i> | | | <i>Tetranychus</i> sp. | | <i>Herse convolculi</i> | | <i>Nezara viridula</i> | <i>Esyricoris venteralis</i> |
| | Nymph | Egg | Nymph | Adult | Egg | mobile stage | Egg | Larvae | Nymph & adult | Nymph & adult |
| 2015 | | | | | | | | | | |
| Jun. 9 | 2.0 | 0.0 | 0.0 | 0.0 | 1.75 | 2.75 | 0.0 | 0.75 | 0.0 | 2.0 |
| 23 | 11.25 | 1.0 | 1.75 | 12.25 | 3.0 | 2.0 | 1.5 | 1.5 | 6.5 | 29.0 |
| Jul. 7 | 12.5 | 11.75 | 10.0 | 11.75 | 39.25 | 17.25 | 4.0 | 4.0 | 20.0 | 9.0 |
| 21 | 27.0 | 14.0 | 13.0 | 19.0 | 46.0 | 37.0 | 2.0 | 1.75 | 12.0 | 5.0 |
| Aug. 4 | 21.5 | 12.0 | 12.0 | 12.5 | 5.0 | 7.75 | 5.5 | 2.0 | 10.5 | 14.0 |
| 18 | 5.75 | 16.25 | 15.75 | 19.5 | 13.75 | 6.75 | 1.75 | 4.25 | 10.5 | 11.0 |
| Sept. 1 | 28.75 | 23.25 | 16.75 | 29.25 | 11.25 | 10.25 | 11.5 | 5.75 | 0.5 | 1.5 |
| 15 | 7.75 | 21.0 | 25.75 | 16.5 | 2.0 | 3.5 | 9.25 | 3.75 | 0.5 | 0.75 |
| 29 | 1.5 | 1.5 | 0.0 | 0.0 | 0.0 | 0.0 | 4.5 | 4.75 | 0.25 | 0.0 |
| Total | 118 | 100.75 | 169.25 | 120.75 | 122 | 87.25 | 40 | 28.5 | 60.75 | 72.25 |
| 2016 | | | | | | | | | | |
| Jun. 9 | 5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 2.0 | 0.5 | 3.0 |
| 23 | 22.0 | 0.0 | 0.0 | 11.5 | 1.75 | 1.75 | 2.0 | 2.25 | 7.25 | 16.5 |
| Jul. 7 | 26.5 | 0.75 | 3.25 | 20.0 | 2.5 | 5.0 | 2.75 | 5.25 | 16.25 | 16.0 |
| 21 | 30.75 | 31.75 | 38.25 | 31.0 | 29.75 | 26.75 | 2.25 | 5.75 | 24.25 | 7.5 |
| Aug. 4 | 36.5 | 46.5 | 58.0 | 49.25 | 56.5 | 87.0 | 8.0 | 10.0 | 21.5 | 18.0 |
| 18 | 19.0 | 40.0 | 59.5 | 35.0 | 11.0 | 6.5 | 13.5 | 3.0 | 9.5 | 13.75 |
| Sept. 1 | 25.25 | 71.0 | 31.0 | 41.75 | 21.0 | 17.5 | 5.0 | 9.0 | 1.5 | 4.0 |
| 15 | 22.25 | 27.0 | 21.5 | 15.75 | 5.0 | 11.0 | 6.5 | 8.0 | 0.0 | 5.0 |
| 29 | 5.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.0 | 4.25 | 0.0 | 0.0 |
| Total | 192.75 | 217 | 211.5 | 204.25 | 127.5 | 182.25 | 43.5 | 49.5 | 80.75 | 83.75 |

Predators were detected on sweet potato plants by mid or late June (Table 6). The population density of *S. gilvifrons* was quite low and then increased gradually to exhibited it peaks on August 4 with 21.0 and 16.25 while, *C. carnea* adult was peaks on September 1 with 19.25 and 17.0 individuals/10 branches in 2015 and 2016 respectively. However, those peaks were on June 23 with *C. undecimpunctata* adult. Spiders were recorded peaks on June 23 in 2015 and on July 21 in 2016 (Table 6).

Table 6: Population fluctuations of predators in sweet potato plantation at El-Riad district, Kafr El-Sheikh Governorate

| Sampling date | Average No. of predators/10 branches | | | | | | | |
|---------------|--------------------------------------|---------------------------|-------|-----------------------------------|-------|----------------------------|-------|-----------------|
| | <i>Stethorus gilvifrons</i> | <i>Chrysoperla carnea</i> | | <i>Coccinella undecimpunctata</i> | | <i>Scymnus interruptus</i> | | Spiders |
| | adult | Larvae | Adult | Larvae | Adult | Larvae | Adult | Sipping & adult |
| 2015 | | | | | | | | |
| Jun. 9 | 0.0 | 0.0 | 0.0 | 0.0 | 5.75 | 0.0 | 2.5 | 9.5 |
| 23 | 0.0 | 2.25 | 0.5 | 3.75 | 14.0 | 0.0 | 2.5 | 20.5 |
| Jul. 7 | 2.0 | 1.0 | 0.5 | 1.5 | 5.0 | 0.5 | 1.5 | 10.0 |
| 21 | 14.0 | 0.25 | 0.25 | 0.5 | 3.0 | 0.25 | 0.5 | 4.0 |
| Aug. 4 | 21.0 | 3.0 | 1.75 | 0.25 | 1.5 | 1.25 | 2.75 | 7.0 |
| 18 | 5.5 | 6.75 | 6.5 | 2.5 | 0.5 | 0.5 | 3.5 | 11.25 |
| Sept. 1 | 3.25 | 17.0 | 19.25 | 1.75 | 1.25 | 2.25 | 3.0 | 9.5 |
| 15 | 0.5 | 9.0 | 15.75 | 1.0 | 1.0 | 1.25 | 1.75 | 15.0 |
| 29 | 0.0 | 6.25 | 2.5 | 0.0 | 0.25 | 2.0 | 2.0 | 12.5 |
| Total | 46.25 | 45.5 | 47.0 | 11.25 | 32.25 | 9.0 | 120.0 | 109.25 |
| 2016 | | | | | | | | |
| Jun. 9 | 0.0 | 1.0 | 0.0 | 0.0 | 13.25 | 0.0 | 1.25 | 11.0 |
| 23 | 5.0 | 0.0 | 0.5 | 1.5 | 20.0 | 0.0 | 3.5 | 27.5 |
| Jul. 7 | 12.0 | 0.75 | 5.25 | 2.0 | 16.75 | 0.0 | 2.75 | 33.5 |
| 21 | 12.75 | 12.0 | 1.0 | 2.5 | 5.5 | 2.5 | 22.25 | 38.25 |
| Aug. 4 | 16.25 | 7.25 | 5.5 | 1.0 | 1.5 | 2.5 | 9.25 | 36.25 |
| 18 | 5.0 | 5.5 | 6.5 | 2.5 | 0.5 | 1.5 | 4.0 | 11.75 |
| Sept. 1 | 0.5 | 25.25 | 17.0 | 1.25 | 1.0 | 2.0 | 4.25 | 29.25 |
| 15 | 0.0 | 12.75 | 9.75 | 1.0 | 0.0 | 1.0 | 3.0 | 7.25 |
| 29 | 0.0 | 1.5 | 0.25 | 0.0 | 0.0 | 0.5 | 1.5 | 12.5 |
| Total | 51.5 | 66.0 | 45.75 | 11.75 | 58.5 | 10.0 | 51.75 | 207.25 |

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ARABIC SUMMARY

حصر و تقلبات تعداد الآفات مفصلية الأرجل و مفترساتها في حقول البطاطا في الدلتا - مصر

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أوضح الحصر وجود ٢٦ نوعا من مفصليات الأرجل كان منها ١٦ نوعا الآفات، و عشرة أنواع كمفترسات. كانت الأكثر شيوعا هي الذبابة البيضاء ثم العنكبوت الأحمر ثم نطاط الأوراق الأخضر ثم فراشة أوراق البطاطا ثم أخيرا نوعين من البق ذو الرائحة الكريهة (البقة الخضراء و البقة البنية الصغيرة). كانت الأنواع نطاط الأرز والبق المهرج الأحمر المصري و صرصور الغيط الأليف هي الأقل تواجدا. أوضحت الدراسة أن العناكب هي أكثر المفترسات شيوعا في حقول البطاطا تلاها أنواع أبو العيد ثم أسد المن، بينما كانت ذبابة السيرفس هي الأقل تواجدا. العناكب و التي تم حصرها في ١٣ عائلة و هي Araneidae, Clubionidae, Dictynidae, Dysderidae, Eutichuridae, Gnaphosidae, Linyphiidae, Thomisidae, Lycosidae, Philodromidae, Salticidae, Tetragnathidae, Theridiidae، وكانت عائلة Lycosidae هي الأكثر شيوعا. أوضحت الدراسة أن مصائد الحفرة كانت الأكثر كفاءة في جمع العناكب تلاها شبكة جمع الحشرات، ثم الاصطياد المباشر باليد. ظهرت العناكب بكثافة خلال منتصف و أواخر يونيو. كان تعداد مفترس *Stethorus* منخفضا معظم الوقت، و لكنه زاد تدريجيا في بداية الأسبوع الأول من أغسطس، بينما بلغت ذروة تعداد أسد المن خلال الأسبوع الأول من سبتمبر، و ذروة تعداد حشرات أبي العيد في الأسبوع الأخير من يونيو. و سجلت العناكب ذروة تعدادها في أواخر يونيو، و أواخر يوليو.