CONTENTS

SUMMARY

Field and laboratory experiments were carried during three consecutive sugar beet seasons; 2002/03, 2003/04 and 2004/05. The field plots were included in 25-30 feddans assigned annually for conducting experiments of Sugar Beet Research Program (Sugar Crops Research Institute) located at Sakha Agricultural Research Station. Laboratory Studies were conducted at entomology laboratories of Faculty of Agriculture, Kafr El-Sheikh, Tanta University and Sugar Crops Research Department, Sakha Agricultural Station.

The study aimed to survey insect pests, insect predators, and spiders occurring in sugar beet fields. In addition, some factors affecting predatory populations were considered:

1. Insect pests inhabiting sugar beet fields:

Sixteen insect pest species, causing a considerable damage, were surveyed. Three species [*Gryllotalpa gryllotalpa* L.; *Agrotis* spp. and *Spodoptera littoralis* (Boisd.)] resulted in poor plant establishment. Three species were severe defoliators; *S. littoralis*, *S. exigua* (Hubn), and *Cassida vittata* Vill. Five mining insect species invaded different plant parts; *Pegomyia mixta* Vill., *Scrobipalpa ocellatella* (Boyd.), *Lixus junci* Boh, *Temnorhinus brevirostris* Gyll and *Ostrinia nubilalis* Hubn. Also, five insect species fed on plant sap., and caused leaf curling; aphids, *Bemisia tabaci* Gann., *Nezara viridula* L., *Empoasca* spp. and *Thrips tabaci* Lind.

2. Insect predators inhabiting sugar beet fields:

Survey studies were carried out using six collecting techniques: pit-fall trap, vacuum machine (D-vac), sweep net, leaf-litter, Tullgren funnel and water pan trap.

2.1. Surveyed species:

The survey revealed the occurrence of 42 insect predator species belonging to ten families and six orders; Coleoptera, Hemiptera, Dermaptera, Neuroptera, Diptera and Hymenoptera. The majority of taxa (27 species constituting 64.29% out of total species) were those of Coleoptera, followed by those of Hymenoptera (8 species, representing 19.05%). Three species (7.14%) were classified as dipterous, two (4.76%) as hemipterous and only one species for each of Dermaptera and Neuroptera (each consisting 2.38% out of total species).

The following predatory species are new records in sugar beet fields of Egypt:

Coccinellidae: *Rhizobus litura dismacula* Mulsant, *Scymnus interruptus rufescens* Was., *Scymnus pallidivestis malsantianus* Sie, *Scymnus deserticola* Sie, *Stethorus gilviforns* (Muls.) and *Rodalia cardinalis* (Mulsant).

Carabidae: *Bembidion mixtum* Schaum, *Rembus aegyptiaca* Dejean, *Bembidion* sp., *Pterostichus pharao* Lutshnik, and *Tachys* sp.

Anthicidae: *Anthicus* sp.

Staphylinidae: *Paederus memnonius* Erickson, *Oxytelus nitidulus* Gravenhorst, *Paederus* sp., *Oxytelus* sp., *Pinophilus* sp., *Philonthus* sp.

Reduviidae: *Reduvius* sp.

Syrphidae: *Paragus aegyptius* Macquart and *Scaeva albomaculata* (Macquart).

Formicidae: *Monomorium* sp., *Tetramorium depressiceps* Menozzi, *Solenopsis* sp., *Tetramorium brevicoryne* Brondroit, *Camponotus thoracius* (Fab.), *Camponotus* sp., *Cataglyphis* sp., *Tapinoma simorthi* Krausse.

2.2. Population fluctuation:

2.2.1. Using pit-fall traps:

Monitoring predators in mid-August plantation (2002/03 season), showed that insect predators were more occurring during September and October, with peaks on 6 October, 4 November and 9 December. The population fluctuation in 2003/04 took almost the same trend, with peaks on 13 October, 4 November, and 9 December. In mid-September plantation, one peak was recorded in the first season (on 27 October), and two peaks were recorded in the second one (on 9 December and 12 January). In the late plantation (mid-October), three peaks were detected in the first season, while two peaks were recorded in the second one. In general, predators of Formicidae were the most dominant, followed by those of Carabidae, while predators of Staphylinidae occupied the third rank.

2.2.2. Using D-vac machine:

In general, Coccicnllidae was the most frequent family, followed by Staphylinidae. In mid-August plantation, the highest peaks were recorded on 15 & 25 December. However, no distinct peaks of predatory insects were recorded in mid-September plantation. In mid-October plantation, three peaks were detected in 2002/03; on 5 February, 5 March and 25 April, but in 2003/04, only two peaks were found; on 15 March and 5 April.

3. Spiders inhabiting sugar beet fields:

Identifications of the collected spiders revealed the occurrence of 32 spider species belonging to 14 families (Order Araneae). Family Araneidae contained the highest number of surveyed taxa, as eight species were identified, representing 25.00% out of total surveyed species. The second rank was occupied by family Lyosidae (5 species, 15.63%), followed by Salticidae (4 species, 12.50%), Philodromidae (3 species, 9.38%). Two families; Gnaphosidae and Linyphiidae were represented by two species each (6.25%). The remaining families; Thomisidae, Theridiidae, Dysderidae, Amaurobiidae, Tetragnathidae, Dictynidae and Miturgidae were each represented by only one species (3.13%). None of the surveyed species of Liocranidae could be identified even to genus.

3.1. Surveyed species:

The following are surveyed spider speeies accompanied with their families. With the exception of *Pardosa* sp. and *Lycosa* sp., all spiders are first record in sugar beet fields of Egypt:

Lycosidae (Wolf spider): *Pardosa* sp., *Lycorma ferox* Simon, *Pirata* sp., *Lycosa* sp. and *Trochosa* sp.

Gnaphosidae (ground spider): *Gnaphosa* sp. and *Zelotes* sp.

Salticidae (jumping spider): *Bianor* sp., *Ballus* sp., *Plexippus paykulli* (Savigny & Audouin) and *Thyne* sp.

Thomisidae (crab spider): *Thomisius* sp.

Philodromidae (philodromid crab spider): *Thanatus albini* (Audouin), *Thanatus* sp. and *Philodromus* sp.

Theridiidae (comb-footed spider): *Theridion* sp.

Linyphiidae (sheet-web spider): *Erigone* sp. and *Bathyphantes* sp.

Dysderidae (dysderid six-eyed spider): *Dysdera crocata* C.L. Koch.

Amaurobiidae (hackled-mesh weavers): *Amaurobius* sp.

Tetragnathidae (long-jawed spider): *Tetragnatha* sp.

Araneidae (typical-orb weavers): *Singa* sp., *Singa albobivittata* Di Caporiacco, *Cyclosa* sp., *Larinia* sp., *Argiope* sp., *Argiope trifasciata* Forscal, *Araneus* sp. and *Cyrtophora citricola* (Forscal).

Liocranidae (running foliage spider): One unidentified species.

Dictynidae (mesh-web weaver): *Dictyna* sp.

Miturgidae (long-legged sac spider): *Chieracanthium* sp.

3.2. Population fluctuation:

3.2.1. Using pit-fall trap:

Field observations revealed that the most occurring spider species in the three sugar beet plantations, using pit-fall traps, were *Pardosa* spp., *Lycorma ferox* and *Thanatus albini.*

In mid-August plantation, *Pardosa* spp. exhibited seven peaks in 2002/2003 sugar beet season, and six peaks in the second one. *Lycorma ferox* was detected in six and seven peaks in the first and seeond seasons, respectively . *Thanatus albini* was more frequent in the first season (8 peaks), than in the second season (6 peaks).

In mid-September plantation, the peaks of the three considered spider species were more frequent. In the first season (2002/03), *Pardosa*

spp., *Lycorma ferox* and *Thanatus albini* exhibited eight, eight and six peaks, respectivcly. The corresponding number of peaks in 2003/04 season were seven, six and six.

In mid-October plantation, *Pardosa* spp. exhibited seven and eight peaks, *Lycorma ferox* exhibited eight and nine peaks, and *Thanatus albini* exhibited eight and seven peaks in 2002/03 and 2003/04 seasons, respectively.

3.2.2. Using D-vac machine:

Field colleetions ndicated hat he ost ommon pider pecies n sugar beet fields using D-vac machine, at Kafr El-Sheikh region were *Erigone* sp. and *Bathyphantes* sp. (Linyphiidae).

In mid-August plantation, *Erigone* sp. was detected in three peaks in thc first season, and five peaks in the second one. As for *Bathyphantes* sp., three spider peaks appeared in 2002/03 season, and four peaks in 2003/04 season.

In mid-October plantation, more peaks were observed for both spider species. *Erigone* sp. was detected in six peaks in the first season, and in five peaks in the second one. *Bathyphantes* sp. exhibited three and four peaks in 2002/03 and 2003/04 seasons, respectively.

In mid-October plantation, four peaks were detected for both species in both seasons, except in 2002/03 season, when *Bathyphantes* sp. appeared in one peak more.

4. Some factors affecting predatory populations:

4.1. Farmyard manure application:

Populations of spiders and insect predators occurring in two sugar beet plots (100 m^2 each) were monitored using pit-fall traps. The first plot

was treated with 1 m^3 of farmyard manure (FYM), while the second one was left untreated.

Population densities of spiders and insect predators were usually higher in FYM-treated plots than in untreated ones. The highest increase due to FYM treatment was that of Philodromidae that achieved 476.12% increase over the untreatment. By contrast, the lowest increase (7.41%) was that of Formicidae. The lycosids increased by 386.36% due to treatment, salticids by 144.44%, linyphiids by 133.33%, gnaphosids by 120.00%, earabids by 300.00% and staphylinidis by 276.92%. Thus, it was clear that the increase in all arthropods, over familics, was 223.48%.

These results reveal the possibility of enhancing populations of predator, insects and spiders, through a simple technique, i.e. application of FYM. The addition of the latter material encourages the development of some insects, not harmful to sugar beet plants, upon which the predators can feed. This enhancement of beneficial arthropods may reflect lower damage by insect pests, and consequently higher sugar beet yield.

4.2. Retaining borders of weeds:

Weeds growing on the borders of sugar beet fields act as a shelter for both insect pests and their natural enemies. Three treatments; complete weed cut, half-weed cut, and without cut, were practiced to investigate the effect of weed cutting on the populations of insect predators and spiders. The highest populations of predators were detected in the weedy borders, particularly those of Linyphiidae, Araneidae, ants, Staphylinidae and *Coccinella undecimpunctata*. In the borders of half-cut weed, all predatory populations were reduced (except Lycosidae) with values of reductions ranging between 20.00 and 87.50%. Ant population was the most reduced (91.43%), followed by Philodromidae (87.50%), *Reduvius* sp. (75.00%), and then Theridiidae and Staphylinidae (70.00% reduction each). Miturgidae, Carabidae, and Araneidae suffered moderate population

reductions. However, populations of Linyphiidae, Salticidae and *Scymnus interruptus* were thc least predators to be reduced by half cutting of weeds. In borders of complete-cut weed, the following predators were completely absent: Miturgidae, Lyeosidae, *Scymnus interruptus,* Staphylinidae, *C. undecimpunctata, Orius* spp., *Reduvius* sp., *Paederus alfierii* and Carabidae. Overall reduetion of predators when the weeds were half-eut figured as 55.45%, while that of the complete cut figured 88.72%. These results clearly demonstrate the great signifieanee of weeds surrounding the fields as a shelter for natural enemies. When these weeds still not competing the growing crops, and without harbouring serious insect pests, they act as a source of natural enemies, from which are spiders and insect predators.

4.3. Field margins:

Population densities of four spider families (occurring in considerable numbers) inhabiting sugar beet field margins were compared with those in the field interior, using D-vac machine. Over eight samples collected during 2003/04 and 2004/05 sugar beet seasons (four samples per season), population densities of spiders were always highcr in the margins than interior. The population density of Linyphiidae was less by 67.71% in interior than in margin. The same situation was found with the other families, as Araneidae, Salticidae and Philodromidae populations were reduced by 84.21, 71.73 and 73.08%, respectively. The higher population density of spiders in the sugar beet field margins compared to field interior may be attributed to the less disturbancc in field margins or field borders. Thus, the undisturbed margins, act as a shelter to beneficial arthropods, that can practice shuttle invasions inside the cultivated ficlds, and devour many of sugar beet insect pests.

4.4. Insecticides:

The current study was carried out to find out the adverse effect of curacron (Selecron 72% EC at a rate of 750 ml/fed.) on population of spiders in sugar beet fields. Curacron was applied because it is the recommended insecticide for control of sugar beet insects. Numbers of spiders per 20 sugar beet plants were recorded just before insecticide treatment. The numbers were recorded twenty-four hours, one week and two weeks after insecticide application in treated plots, and compared with the numbers in untreated plots. The plot receiving the insecticide lost 85.83% of spider population complex compared to that untreated using the formula of **Henderson and Tilton (1955)**. One week after insecticide applieation, the reduction in spider population was 66.76%, and two weeks after application was 41.36%. Thus, it appears clearly the sharp deeline in spider population 24 hr after insecticide application. Despite the reductions were not severe two weeks after insectieide application (41.36%), the population of spider complex was adversely affected, and did not recover. This clearly shows the destructive effect of insecticides on spiders dominant in sugar beet fields.

5. Predation of the philodromid, *Thanatus albini* Audouin upon some sugar beet insect pests:

5.1. A preliminary test:

The philodromid, *Thanatus albini* females, kept individually in petri dishes and starved for two days, were confined alternatively with immature stages and adults of different sugar beet insects. The latters were *Pegomyia mixta, Spodoptera littoralis, Scrobipalpa ocellatella, Cassida vittata,* leafhoppers and planthoppers. *T. albini* accepted feeding upon adults of *P. mixta, S. ocellatella*, and adults and nymphs of leafhoppers and planthoppers. In addition, larvae of *S. littoralis, S. ocellatella* and *C. vittata* and nymphs of leafhoppers and planthoppers were accepted by this philodromid spider. On the other hand, several prey species were not accepted by *T. albini:* eggs, larvae and pupae of *P. mixta,* eggs of *S.*

littoralis, and adults of *C. vittata*. However, the wide variety of prey species upon which *T. albini* fed shows the significance of this philodromid as an important predator in sugar beet fields.

5.2. Feeding preference:

Larvae of *Scrobipalpa ocellatella, Spodoptera littoralis* and *Cassida vittata* were offered to *Thanatus albini* females to find out the feeding preference of this philodromid. Five spider females consumed 17 individuals of *S. ocellatella*, out of 50 individuals, thus 34% of the prey were consumed. Values of *S. littoralis* and *C. vittata* larvae were 30 and 20% consumption, respectively. Thus, the larvae of *S. ocellatella* were more preferred by *T. albini* than the other two prey species.

CONCLUSION

The current study was carried out at Sakha Agricultural Research Station and Faculty of Agriculture, Kafr El-Sheikh, Tanta University from 2002/03 through 2004/05 sugar beet seasons. Survey and population fluctuations of insect predators and spiders were emphasized. Also, some factors enhancing or suppressing the predatory complex were investigated. The following points were concluded:

1. **It was found that pit-fall traps were the most efficient collecting technique for ground predators.** On the other hand, D-vac machine was the best in collecting predators from plant foliage.
2. **Forty-two insect predator species were detected**. However, the new records in sugar beet fields of Egypt are:
   a. **Coccinellidae**: *Rhizobus litura dismacula* Mulsant, *Scymnus interruptus rufescens* Was., *S. pallidivestis mulsantiacus* Sie, *S. deserticola* Sie, *Stethorus gilviforns* (Muls.) and *Rodalia cardinalis* (Mulsant.).
   b. **Carabidae**: *Bembidion* sp., *B. mixtum* Schaum, *Rembus aegyptiaca* Dejean, *Pterostichus pharao* Lutschnik, and *Tachys* sp.
   c. **Anthicidae:** *Anthicus* sp.
   d. **Staphylinidae:** *Paederus* sp., *P. memnonius* Erickson, *Oxytelus nitidulus* Gravenhorst, *Oxytelus* sp., *Pinophilus* sp. and *Philonthus* sp.
   e. **Reduviidae:** *Reduvius* sp.
   f. **Syrphidae:** *Paragus aegyptius* Macquart and *Scaeva albomaculata* (Macquart).
   g. **Formicidae:** *Solenopsis* sp., *Monomorium* sp., *Tetramorium depressiceps* Menozzi, *Tetramorium brevicoryne* Brondroit,

Camponotus thoracius (Fab.), *Camponotus* sp., *Cataglyphis* sp., *Tapinoma simorthi* Krausse.

3. **Thirteen spider families are recorded** herein for the first time from the Egyptian sugar beet fields. The following is a list of families accompanied with species:
   - **Gnaphosidae (ground spider):** *Gnaphosa* sp. and *Zelotes* sp.
   - **Salticidae (jumping spider):** *Bianor* sp., *Ballus* sp., *Plexippus paykulli* (Savigny & Audouin) and *Thyne* sp.
   - **Thomisidae (crab spider):** *Thomisius* sp.
   - **Philodromidae (philodromid crab spider):** *Thanatus albini* (Audouin), *Thanatus* sp. and *Philodromus* sp.
   - **Linyphiidae (sheet-web spider):** *Erigone* sp. and *Bathyphantes* sp.
   - **Dysderidae (dysderid six-eyed spider):** *Dysdera crocata* C.L. Koch.
   - **Amaurobiidae (hackled-mesh weavers):** *Amaurobius* sp.
   - **Tetragnathidae (long-jawed spider):** *Tetragnatha* sp.
   - **Araneidae (typical-orb weavers):** *Singa* sp., *Singa albobivittata* Di Caporiacco, *Cyclasa* sp., *Larinia* sp., *Argiope* sp., *Argiope trifasciata* Forscal, *Araneus* sp. and *Cyrtaphora citricola* (Forscal).
   - **Liocranidae (running foliage spider):** One unidentified species.
   - **Dictynidae (mesh-web weaver):** *Dictyna* sp.
   - **Miturgidae (long-legged sac spider):** *Chieracanthium* sp.
   - **Theridiidae (Comb-Footed spider):** *Theridion* sp.

4. **Farmyard manure application among sugar beet rows at a rate of 1 m^3/100 m^2 enhanced the populations of insect predators and spiders.** Over different families and species, the predatory complex in farmyard manure-treated plots were almost twice that in untreated plots.

5. **Weeds growing on the borders of sugar beet fields are an important source of predators.** Complete removal of weeds eliminated 88.72% of predatory eomplex. However, half-cut eliminated 55.45% of predators inhabiting these weeds.

6. **Undisturbed field margins harboured usually more insect predators and spiders compared to the field interior.** Thus, the undisturbed field margins act as a shelter to beneficial arthropods, that can practice shuttle invasions inside the cultivated fields, and devour many of sugar beet insect pests.

7. **Curacron (Selecron 75% EC at a rate of 750 ml/fed.) application seriously reduced the population of predatory complex.** Twenty-four hours after insecticide application, 85.83% of spider population were lost. The reductions in population of spiders one and two weeks after insecticide applications were 66.76 and 41.36%, respectively. This clearly shows the destructive effect of insecticides on spiders dominant in sugar beet fields.

8. **Choice feeding test of the philodromid, *Thanatus albini* showed that the spider fed upon adults of *Pegomyia mixta*, *Scrobipalpa ocellatella*, leafhoppers and planthoppers.** In addition, larvae of *Spodoptera littoralis, Scrobipalpa ocellatella* and nymphs and adults of leafhoppers and planthoppers were accepted by *T. albini*. When larvae of *S. ocellatella, S. littoralis* and *Cassida vittata* were offered to the spider at the same time, the philodromid preferred most larvae of *S. ocellatella* followed by larvae of *S. littoralis* and then larvae of *C. vittata*.