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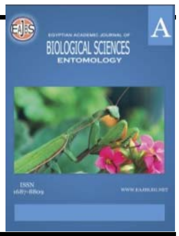


# Survey, Seasonal Abundance of Thrips Species and First Record of Two Thrips Species Associated With Soybean and Weed Plants in Egypt

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## ABSTRACT

Several thrips species are known to feed on soybean (*Glycine max* Merr.) and can cause yield reduction. Beside, the other important reason for thrips survey is to determine its role as vectors of Tospovirus in soybean. There is little information available about thrips species present on soybean crop, and their abundance in Egypt. Field survey took place at the farm of Agricultural Experiment Station, Faculty of Agriculture, Cairo University, Giza Governorate, Egypt (season 2014) to survey the different thrips species. Soybean cv. Giza 111 was sown in late May. The experimental area received all the usual agricultural practices except for any pest control measures. Thrips species associated with soybean were collected and differentiated to species. A total of 16 different thrips species was surveyed. These included 14 phytophagous and 2 predator thrips species. The most abundant species was *Thrips tabaci* with an average No. 226.2 individual/plant, it had two major peaks on soybean, the first peak was at late June (21.9 individual/ plant), while the second one was occurred on mid-August (38 individual/plant). *Frankliniella occidentalis* occupied the second rank (107.02 individual/plant, *Neohydatothrips variabilis* came third in that order (57.5 individual/plant) followed by, *Caliothrips phaseoli, F. tritici* and *F. Schultzei* (٥٦.٥ ،٤٣.٢ & ٤٢.١ individual/plant respectively). *N. variabilis*, *Caliothrips phaseoli* and *F. schultzei* were reached their highest numbers (13.2, 19.4 & 16.3 individual/plant) by the end of the season, respectively. Generally speaking, both soybean thrips, *N. variabilis* and bean thrips, *Caliothrips phaseoli*, were recorded for the first time in the present study. Characterization and identification of both two species are presented. There were 27 weed plant species collected from soybean field. Both of *T. tabaci* and *F. occidentalis* were the most common species of soybean and associated weeds.The highest average No. of thrips species was recorded on *Ammi majus* L. (70.7 individual/plant) followed by *Medicago intertexta* L., *Convolvulus arvensis* L., *Melilotus indicus* L., and *Malva parviflora* L., which harboured (52.3, 48.8, 44.3 & 44.5 individual/plant, respectively), while the lowest average no. (3.3 individual/plant) was occurred on *Urtica urens* L. Seasonal abundance of the thrips species associated with weeds, proved that both *T. tabaci* and *F. occidentalis* were the most dominant species (36.7 & 17.4 individual/ weed plant, respectively). In conclusion, weeds can serve as reservoir alternative hosts for plant viruses and thrips vectors, therefore should be considered when endeavoring to manage and control plant viruses of cultivated soybean plants.

## INTRODUCTION

The earliest known cultivation of soybean (*Glycine max* Merr.) in Africa was in Egypt in 1858. followed by Tunisia in 1873, and Algeria in 1880, (http://soybeanafrica.com/index). It's to use in Egypt was started from the year 1976, since it is a basic source of protein in the poultry and animal feed.

Soybean is an important oil seed crop following cotton in Egypt. It has high seed protein content (30-40%) and about 30% seed oil content. It is very important food and feeds crop. Several investigators reported that factors affecting soybean; fertilization, sowing date, insects and virus infestation play an important role in crop productivity (Hassan *et al.,* 2002 and Soliman *et al.* 2007). Soybean is attacked by many kinds of pests and a total of many species of insect pests *viz*. cotton leafworm *Spodoptera littoralis* (Bosid.), cotton aphid, *Aphis gossypii* (Glov) and different thrips species was recognized.

Thrips are important insect pests in many soybean production areas due to the feeding injury caused by larvae and adults, the indirect damage is caused by transmission of tospoviruses (Almeida *et al*., 2003; Gent *et al*., 2004). About 50% of thrips species are fungivorous (Mound, 2003). A few are obligate predators on other small arthropods of the other 50% species (Palmer & Mound, 1990) and most of them are phytophagous, including several opportunist species considered as crop pests (Lewis, 1997& Moritz *et al*., 2004).

Soybean thrips; *Neohydatothrips variabilis* (Beach) is one of the most abundant thrips species found in soybean fields. Other species that are present include eastern flower thrips; *Frankliniella tritici* and tobacco thrips; *Frankliniella fusca* (Hinds) (Irwin *et al*., 1979). Other reports of thrips found on soybean include *Caliothrips impurus* (Priesner), *Caliothrips phaseoli* (Hood), *Frankliniella insularis* (Franklin), *Frankliniella occidentalis* (Pergande), *Frankliniella schultzei* (Trybom), *Scirtothrips dorsalis* (Hood), *Sericothrips occipitales* (Hood), *Taeniothirps sjostedti* (Trybom), *Thrips palmi* (Karny) and *Thrips tabaci* (Lindeman) (Viteri *et al*., 2010).

Since, Tospoviruses are not seed transmissible (Zhou *et al*., 2011) also, SVNV (soybean vein necrosis virus) lacks seed transmission in soybean. Limited studies were conducted on SVNV (Khatabi *et al*., 2012, Zhou & Tzanetakis, 2013), still, the main factors of tospoviruses transmission are thrips vectors, similar to the other tospoviruses ( Zhou *et al*., 2013 and Abd El-Wahab & El-Shazly 2016). SVNV is vectored by different thrips species therefore, it is important to monitor thrips populations in relation to the incidence of the virus to predict the epidemics. Alternative hosts, such as weeds, can also contribute to the spread of Tospoviruses and thrips vectors from infected winter weed hosts (Chappell *et al*., 2013). Also, summer weeds are thought to be involved as well, spreading Tospoviruses to winter weeds after crops are harvested (Kahn *et al*., 2005).

Management of SVNV in soybean should focus on the thrips vector of the virus. Thrips, as well as the secondary plant hosts are the main local sources of inoculum for the spread of SVNV to and within soybean fields (Hajimorad *et al*., 2015). There are at least 11 species of the genera *Thrips* and *Frankliniella* reported to transmit tospoviruses in nature (Mound, 2005).

*Thrips tabaci* is the most damaging Thysanoptera species (Trdan *et al*., 2007), it is an extremely polyphagous species and a serious pest of a wide range of economically important crops including soybean in many parts of the world

(Theunissen and Schelling, 1998; Cho *et al*., 2001; Macintyre-Allen *et al*., 2005 and Duchovskiene, 2006). It infests all parts of the soybean plant at all growth stages and can lead to 20 to 50% yield losses thus leads the farmers into the use of pesticides to protect their crops (Bag *et al*., 2014, Sedaratian *et al*., 2010, Massoud *et al*., 2014 and Hala *et al*., 2015).

Soybean thrips, *N. variabilis*, is among the thrips species that are reportedly found in soybean seedlings (Mueller, 1994). Although thrips are reportedly not an economic pest in soybean (Gouge, 1999). *Caliothrips phaseoli* was reported as an economically important pest of soybean in Mexico and of dry beans in the United States and in Central and South America (Irwin *et al*., 1979; Mound & Marullo 1996). The three thrips species *Caliothrips graminicola* Bagnall & Cameron, *Caliothrips impurus* Priesner, and *Caliothrips sudanensis* Bagnall & Cameron http://anic.ento.csiro.au/thrips/Egypt, were previously recorded in Egypt (Priesner, 1949 & Priesner, 1964), but no information available about *Caliothrips phaseoli*. Also, thrips was observed and recorded on weed plant species, some weed species are known to be major sources of TSWV infection within various crops (Wilson,1998) and IYSV (Smith, 2010).

In Egypt, a little knowledge is yet, available about thrips associated with soybean, therefore, the main objectives of this study were to survey thysanopterous species which attack soybean in Egypt, and to record the new thrips species as well. This information might be important for management strategies to reduce the damage caused by Tospoviruses e.g., SVNV as a newly isolated Tospovirus in Egypt (Abd El- Wahab and El-Shazly, 2016).

## MATERIALS AND METHODS

**Thrips species associated with soybean plants in the field:**

Present field survey study was conducted at the farm of Agricultural Experimental Station, Faculty of Agriculture, Cairo University, Giza, Egypt for the purpose of recording different thrips species occurring on soybean, plants in the field and studying their seasonal abundance. The experimental area received all the recommended normal agricultural practices except for insecticides application. Thrips fauna were sampled weekly from late May until September (2014). Fifty soybean plants were randomly selected, 10 plants were selected from each of the 4 corners and the last 10 plants from the center of the field. The direct count method was used to determine the species of thrips by shaking each plant 3 times onto a white paper and then counting the adults of thrips (winged form) (Irwin and Yeargan, 1980 & Duchovskiene, 2006).

Adults (winged) thrips were collected from plant tissues and placed in glass bottles with 70% ethyl alcohol. The insects were clarified with 5% potassium hydroxide for 30 s and mounted on slides with Canada balsam. Slides were dried at 30°C for 24 h. A Taxonomic Key for Thysanoptera was used for species identification and determination of each specimen (Moritz *et al*., 2004, Mound & Marullo, 1996).

A number of each adult (winged) thrips species was counted and recorded using a 10X magnification pocket lens. Thrips species were transferred with a fine Camel's brush and inserted into vials containing AGA (60% ethyl alcohol, glycerine and acetic acid (6:1:1)) and labeled. Thrips collected from the whole plant were mounted on glass slides then identified under a stereomicroscope (ZEISS). For microscopic examination, thrips body parts such as antennae, wings, abdomen, and legs were mounted in Canada Balsam, or Hoyer`s medium in the case of temporary mounts (Mound *et al*., 1976). For quick identification, a wet mounting is easy and rapid. Specimens were prepared according to (Palmer *et al*., 1992 and Mound & Kibby 1998). Illustrations were made by using the microscope connected with a digital camera using various magnifications of 10X, 40X, 100X and 400X and identification was done following the key of Moritz *et al*.(2004), Mound & Marullo (1996), and Mound (1999), using thrips morphological identification techniques of adults (winged) thrips .

**Thrips species associated with weeds in and around soybean field:**

A parallel sample of the dominant wild plant species associated with soybean field was taken and examined, for surveying different thrips species occur. Five plants were selected randomly from each weed species. The different parts (leaves, stems, flowers) of the different weed plants were carefully inspected and the present thysanopterous insects were recorded. The abundance of each thrips species throughout the growing season was expressed as the number of individuals/ plant at weekly interval samples. Dominant wild plants in soybean field were identified according to (Zaki, 1991, Zaki, 2000 & Attalla, 2002). The actual count method was used, and only five plants from each weed species were taken to survey thrips species associated with different weed plants in soybean field (Carrizo, 1996 & 2001, Chellemi *et al*., 1994). Total adult forms were extracted and counted from each sample, using a dissecting microscope (40X). Adults thrips were separated for major morphological characteristics and three representative specimens from each suspected thrips species were mounted on glass slides in Faure media. Adults were identified using a compound microscope, descriptions, and keys from Mound and Marullo (1996).

## RESULTS AND DISCUSSIONS

The present study revealed the occurrence of 16 different thrips species; 14 out of them are phytophagous species; they were identified as *Thrips tabaci* (Lindeman), *Frankliniella occidentalis* (Pergande), *Frankliniella tritici* (Fitch), *Frankliniella schultzei* (Trybom), *Frankliniella fusca* (Hinds) *Neohydatothrips variabilis* (Beach), *Caliothrips phaseoli (*Hood*), Caliothrips graminicola* (Bagnall), *Caliothrips sudanensis* (Bagnall), *Scirtothrips dorsallis* (Hood), *Thrips palmi* (Karny), *Megalurothrips sjostedti* (Trybom), *Anaphothrips sudanensis* (Trybom), *Arorathrips* (*Chirothrips*) *mexicanus* (Crawford), *Aeolothrips fasciatus* (Linnaeus) and *Scolothrips sexmaculatus* (Pergande).

Both of *Arorathrips* (*Chirothrips*) *mexicanus* (Crawford, *Anaphothrips sudanensis* are grass thrips while, *Scolothrips sexmaculatus* and *Aeolothrips fasciatus* (Linnaeus) are predator thrips species (Fig. 1). In addition, multiple specimens were encountered and yet under identification species.

The most abundant thrips species was *T. tabaci* with an average no. 226.2 individual/plant followed by *F. occidentalis* 107.02 individual/plant). Obtained results showed that *N. variabilis* came third in that order (57.5 individual/plant). While *C. sudanensis* was the lowest thrips species (4.2 individual/plant) recorded on soybean plants (Fig. 2). *T. tabaci* was the most common species, it had two major peaks on soybean, the first peak was at late June (21.9 individual/ plant), while the second one occurred on mid-August (38 individual/plant). These results are in agreement with the previous study conducted by (Smith *et al*., 2011&Dominic *et al*., 2012). *F. occidentalis was* appeared in two peaks 11.9 & 23.4 individuals/plant in late June and mid-September, respectively (Fig. 3). All of *N. variabilis*, *C. phaseoli* and *F. schultzei* reached their highest numbers by the end of the season (13.2, 19.4 & 16.3 individual/plant), respectively.

Both of *A. mexicanus* and *A. sudanesis* were appeared from mid-July in a very low number, then reached its maximum number by mid-September and end of the season 14.61 and 12.7 individual /plant respectively Fig. (4). The two thrips species; *A. fasciatus* and *S. sexmaculatus* are predator thrips recorded in very low numbers all over the season and reacheded its maximum number (16.1 &10.8 individual/plant by mid-September. The average numbers of unidentified thrips species were 7.1 individual/plant. Fig. (5). Our finding agrees with a previous study which indicated that 65% of the thrips species collected were *N. variabilis* , 17% *Frankliniella tritici*, 17% *Echinothrips americanus*, and less than 1% *Frankliniella fusca,* (Red *et al*., 2001, Jacobson *et al*., 2016).


**Fig.(1): Showing morphological characteristics of 16 different thrips species recorded on soybean plants in the field ( Season 2014) at Giza, Egypt.**

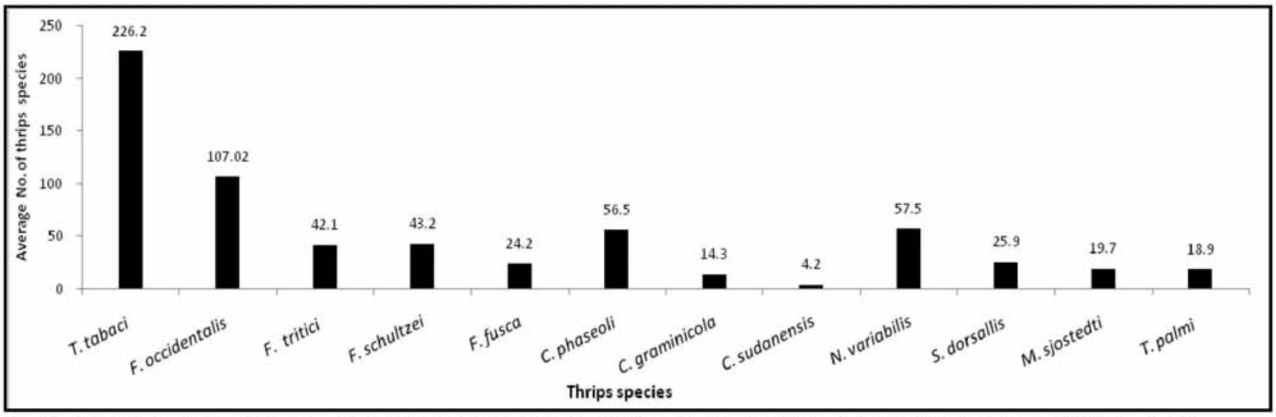


**Fig.(2): Occurrence of 12 different phytophagous thrips species associated with soybean plants cv (Giza 111) in the field (2014,Giza , Egypt).**

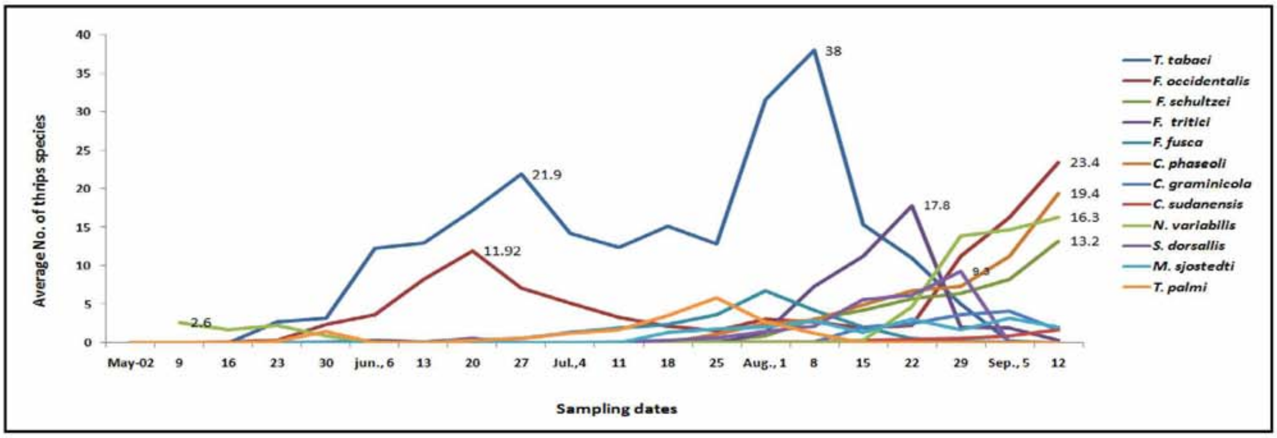


**Fig.(3): Seasonal abundance of 12 different phytophgous thrips species associated with soybean cv (Giza, 111) in the field, (season 2014, Giza ,Egypt).**

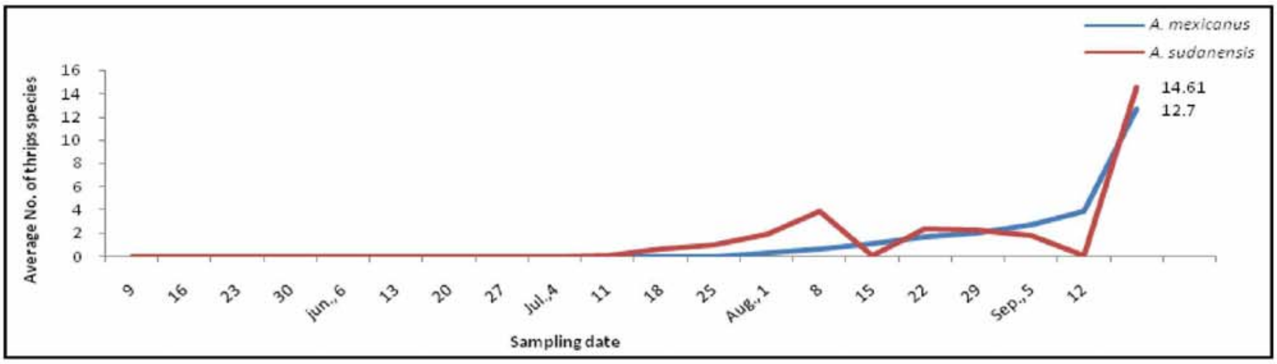


**Fig.(4): Seasonal abundance of 2 different grass thrips species associated with soybean plants (cv Giza,111 in the field, (2014, Giza, Egypt).**

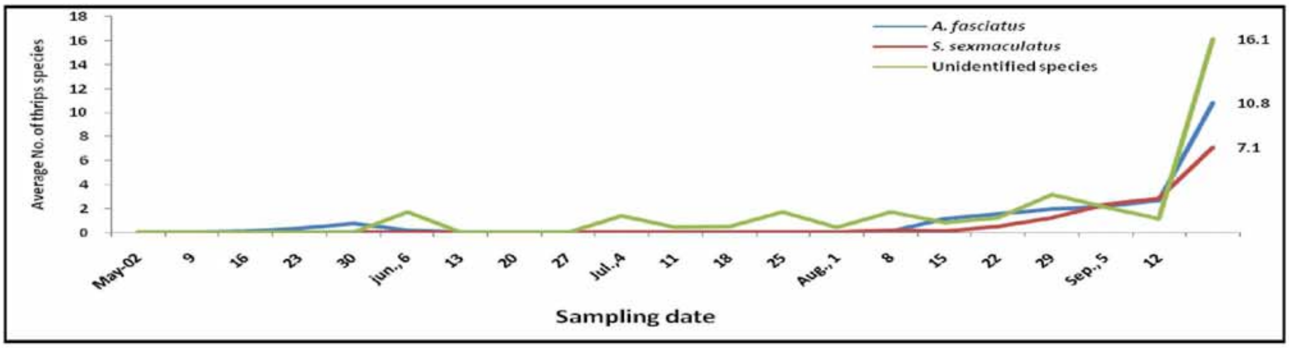


**Fig.( 5 ): Seasonal abundance of 2 different predator thrips and unidentifed thrips species associated with soybean (cv Giza, 111) in the field, (season ,2014, Giza ,Egypt).**

The topic of present study was done for the first time on soybean crop in Egypt, obtained results showed that 14 phytophagous thrips in addition to 2 predator thrips species were presented on soybean. This finding is similar to several previous studies (Irwin *et al*., 1979; Kogan and Turnipseed, 1987; Higley and Boethel, 1994; Cabrera *et al*., 2006: Sedaratian *et al*., 2010). Our results are going in line with those that obtained by (Abraham, 2008 & Gouge 1999). Also they were observed that *T. tabaci* was the dominant thrips species on soybean leaves, but *F. intonsa* was dominant in the flowers. Only a few representatives of *Anaphothrips obscurus* and *Thrips angusticeps* were found. Among the predatory thrips *Aeolothrips intermedius* and *Scolothrips longicornis* were present in greater numbers.

Generally speaking, both of soybean thrips, *N. variabilis* and bean thrips, *Caliothrips phaseoli*, are recorded for the first time in the present study. Our results are in agreement with those obtained by (Matorell 1976 & Medina 2003),who they were reported the first record of *C. phaseoli*, *F. gossypiana* and *E. americanus* attacking soybean, in Puerto Rico. Characterization and identification of both two thrips species are presented as follows:

**Soybean thrips *Neohydatothrips variabilis* (Beach):**

This species is bicolor and adults body brown with pronotum and posterior part of metathorax pale; Fig. (6: a). Head with three pairs of ocellar setae, pair 3 on anterior margins of the triangle; postocular region short Fig.(6: b). Forewings pale with two transverse dark areas, small dark area at the base, fore wing with the first vein seta row complete; second vein with two setae distally Fig. (6: c). Tibiae and tarsi yellow, also basal half of antennal segments 3-5; Antennae 8-segmented; segments 3-6 with forked sensorium. Fig.(6: d). Pro-notum anterior half with transversely elongate reticules, "blotch" slightly darker with more closely spaced stria. Metanotal striations transverse at anterior, closely longitudinal medially. Fig. (6: e): Abdominal segments 4-6 yellowish with dark ante costal ridge and brown area, abdominal tergites 2-4 median setae often with the distance between their bases scarcely twice diameter of seta pore. Abdominal tergites 2-5 median setae often with the distance between their bases scarcely twice diameter of setal pore; Fig.(6: f). Abdomen segments 7-8 with a posted marginal comb of microtrichia complete. Sternites with many microtrichia medially as well as laterally Fig. (6: g). Abdomen segments 9-10 are much paler than the eight segment, Fig.(6: h). This finding is similar to that of the thrips identification key http://keys.lucidcentral.org/keysthrips. California) and (Mound & Marullo,1996) identification keys.

**Bean thrips:*Caliothrips phaseoli* (Hood)**

Adults are bicolour dark brown Fig. (7: a). The head and pronotum have internal sculptured markings. The pronotum has no long setae, Fig. (7: b). Antenna 8 segments. Antennal segments 3-5 are yellow with brown shading apically Fig. (7: c) . Forewing brown with 3 sub-apically transverse bands and a sub basally white band. The medial band is light brown . Forewing colour at extreme apex dark. Forewing second vein with 6 setae Fig. (7: d). Legs brown, tarsi yellow, also base and apex of tibiae Fig. (7: e).

Metanotum without campaniform sensilla. Metathoracic endofurca elongate and lyre shape Fig. (7: f). Sculpture on lateral thirds of tergites 3-5 comprised mainly of transverse parallel lines Fig. (7: g). Tergite 8 with crisped medially (Fig. 7: h). Our results are in parallel line with the finding of Moritz *et al*., (2014) and the thrips identification key http://keys.lucidcentral.org/keysthrips. California).

**The occurrence of the different thrips species on weed plants associated with soybean crop in the field**.

The present study revealed the occurrence of 16 different thrips species on the dominant 27 weed plant species namely (*Ammi majus* L., *Amaranthus cruentus* L., *Amaranthus viridis* L., *Amarantus sylvestris* Desf. *Beta vuligaris* L., *Chenopodium murale* L., *Chenopodium ambrosioides* L., *Chenopodium album* L., *Convolvulus arvensis* L., *Cynanchum acutum* L., *Cynodon dactylon* L., *Gynandropsis gynandra* L., *Datura stramonium* L., *Emex spinous* L., *Lablab purpureus* L., *Malva parviflora* L., *Medicago intertexta* L., *Melilotus indicus*, *Ipomoea tricolor* L., *Portlaca oleracaea* L., *Portulacaria afra* L., *Senecio valgaris* L., *Setaria verticillata* L,. *Sorghum virgatum* L., *Sisymbrium irio* L., *Sonchus olerecous* L. and *Urtica urens* L.), associated with soybean crop in the field during 2014 season. Obtained results are in harmony with those obtained by (Verti *et al*., 2010 & Lima *et al*., 2000).

*T. tabaci* and *F. occidentalis* were recorded on all the 27 weed plant species and *F. tritici* was recorded on 26 of them. In this respect, *F. occidentalis* was the most common thrips, inhabiting 80 of the 82 weed species (Paola, 2001). In addition, 20 thrips species were collected on 28 of the 33 plant species sampled in the States of Maranhão (Élison, 2016).

All of *C. graminicola, C. sudanensis* , *A. sudanensis* , *A. mexicanus* , and *S. sexmaculatus* were recorded on a number of weeds ranged from 5-9 species only. While, *C. phaseoli*, *N. variabilis* and *M. sjostedti* were recorded on 12-14 weed plant species Fig. (8).

The highest average No. of thrips species was recorded on *A. majus* (70.7 individual/ plant). *M. intertexta, C. arvensis* L., *M. indicus* and *M. parviflora* harboured (52.3, 48.8, 44.3 & 44.5 individual / plant, respectively) , while *U. urens* harboured the lowest No. of thrips Fig. (9). In addition to the grass thrips; *A. sudanensis & A. mexicanus* (Crawford), the two predator thrips species; *Aeolothrips fasciatus* (Linnaeus) & *Scolothrips sexmaculatus* (Pergande) were recorded (Fig. 9). Similarly, only a few representatives of *Anaphothrips obscurus* and *Thrips angusticeps* were found. Among the predatory thrips *Aeolothrips intermedius* and *Scolothrips longicornis* were present in low numbers, their number was not enough to reduce the number of phytophagous thrips. Besides, there were two dominant grass thrips species found on soybean and the soybean thrips *N. variabilis* was recorded in commercial sweet potato (*Ipomoea batatas* L.) fields (Reed *et al*., 2009).

Seasonal abundance of the thrips species on weeds, proved that both *T. tabaci* and *F. occidentalis* were the most dominant thrips species recorded on the dominant 27 weed species, where they appeared in a relatively high number (36.7 & 17.4 individual/ weed plant, respectively) recorded at the beginning of the season followed by *F. tritici* Fig. (10).

Results in Fig. (11a) show the occurrence of *T. tabaci* , *F. occidentalis* , *F. tritici* , *F. schultzei* , *F. fusca* and *C. phaseoli* on the 27 weed plant species collected from a soybean field.

The highest no. of *T. tabaci* (36.7 individual/weed plant) was found on *A. majus,* followed by (21.3 individual/weed plant) recorded on *I. tricolor* ; these data go in line with the previous study recorded, 25 of the 69 weed species were identified as hosts for *T. tabaci* larvae and populations were highest on the Brassicaceous weeds, (Smith *et al*., 2011). Also, *F. occidentalis* was recorded in a relatively high no. on *A. majus* , *C. ambrosioides & S. olerecous* (17.4, 14 & 12.7 individual/weed plant), respectively. *F. tritici* was found on 26 weed species highest average no. (12.4 individual/weed plant) was recorded on *A. majus,* while *F. fusca* recorded the highest average no. (14 individual/weed plant) on *C. murale, F. schultzei* was found on 19 weed plant species and its highest average no. (7.2 individual/weed plant) was recorded on *C. arvensis.* Whereas, *C. phaseoli* were presented on 11 weed plant species only, and its highest average no. (8.5 individual/weed plant) was found on *D. stramonium* (Fig .11a).

Obtained results of our study show that, *Caliothrips graminicola* occurred on 8 weed plant species, the maximum no. (7.3 individual/plant) presented on *Lablab purpureus, Caliothrips sudanensis* recorded on 10 weed species and its maximum average no. (4.7 individual /plant) was occurred on *Melilotus indicus* while, *N. variabilis* recorded on 12 weed plant species, with a relatively high no. (17.2 & 8.4 individual/plant) on *Lablab purpureus* and *Medicago intertexta* respectively. *Scirtothrips dorsallis* was recorded on 7 weed plant species, with a relatively low average no. (7.2 & 1.2 individual/plant) was found on *Portulacaria afra* and *Melilotus indicus* respectively. While *Megalurothrips sjostedti* was recorded on 18 weed plant species with an average no. (7.2 & 0.5 individual /plant) occurred on *Lablab purpureus* and *Sonchus olerecous,* respectively Fig. (11b).

The grass thrips; *Anaphothrips sudanensis* was recorded on 5 weed plant species with an average no. (4.2 & 0.1 individual/plant) occurred on *Cynodon dactylon* and *Ipomoea tricolor* respectively. Also, *Arorathrips mexicanus* was recorded on 6 weed plant species with an average no. (5.2 & 4.7 &3.1 individual /plant) was occurred on *Cynodon dactylon*, *Setaria verticillata* and *Sorghum virgatum* respectively.

The predator thrips; *Aeolothrips fasciatus* was recorded on 16 weed plant species, its maximum no. found on *Sonchus olerecous* L with an average no. (7.6 individual /plant). while the other predator; *Scolothrips sexmaculatus* was recorded on 9 weed plant species only. Fig. (11c). It is worth to mention that a previous study recognized and identified predator in the genus *Scolothrips* (Mound, 2011).

In this respect, previous studies indicated that weed species hosts for onion thrips, *Thrips tabaci* play an important role as sources of Iris yellow spot virus (Smith, 2010) and wild plant hosts harbuared thrips vectors of TSWV (Chellemi *et al*., 1994). Also, a previous study showed that the thrips abundance on weeds is an indicator of TSWV vectors at any time (Carrizo, 1998 & Wilson, 1998).

Similar results showed that thrips species collected on weeds were *C. phaseoli Bradinothrips musae*, *Chaetanaphothrips orchidii* and *Hoodothrips lineatus.* Although these species are pests of many economic crops in Brazil, (Montero *et al*., 1999). Other three thrips species, *F. tritici* , *F. fusca* and *N. variabilis* were collected in present work and *F. tritici* was the most abundant species (Michael and Gary, 1999).

Irwin *et al*.,(1979) recorded ten species of thrips on soybean ; *Leiothrips mali, Denderothrips oratus, Thrips physapus, Anaphothrips obsecurus ,Thrips tabaci, Franklinella fusca, F.tritci, S.varibilis, Aeolothrips bicolor* and *A. fasciata* .While, Elison *et al*., (2013) collected eight thrips species which were identified as *Caliothrips phaseoli* (Pergande, 1895*), Frankliniella brevicaulis* Hood*, F. gardeniae* Moulton, *F. insularis* (Franklin), *F. schultzei* (Trybom), *F. tritici* (Fitch), *Haplothrips gowdeyi* (Franklin) and *Salpingothrips minimus* Hood. Two other unidentified thrips species were collected: *Plesiothrips* sp. and *Scolothrips* sp. The thrips species *F. schultzei* was recorded on six fabaceous crops and *F. gardeniae* was the first record in the State of Piauí. The first records of thrips on *Phaseolus lunatus* L. in Brazil were established. Some species are known as pests of Fabaceae mostly in southern and southeastern Brazil.

Fig. (6 a) : Soybean thrips is bicolor, adults body brown with pro-notum and posterior part of meta-thorax pale

Fig. (6 b): Head with three pairs of ocular setae, pair 3 on anterior margins of triangle; postocular region short.

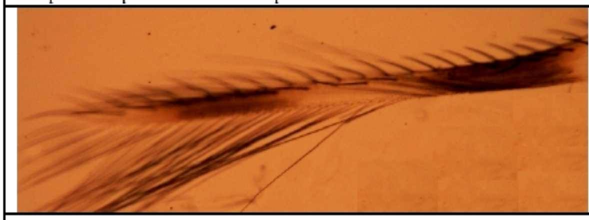

Fig. (6 c): Fore wing with first vein seta row complete

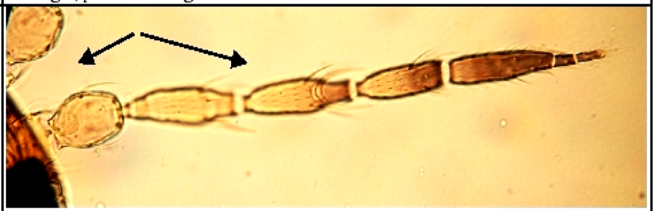

Fig. (6 d): *N. variabilis*, showing 8-segmented antenna. segments 3-5 with forked ensorium.

Fig.(6 e) :*Neohydatothrips variabilis*, showing both meso- and metasternal endofurca with spinula.

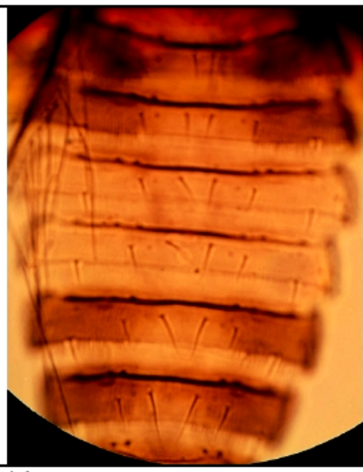

Fig.(6 f) :*N. variabilis* showing several rows of microtrichia on abdominal tergites, segments 4-6 yellowish with dark antecostal ridge.

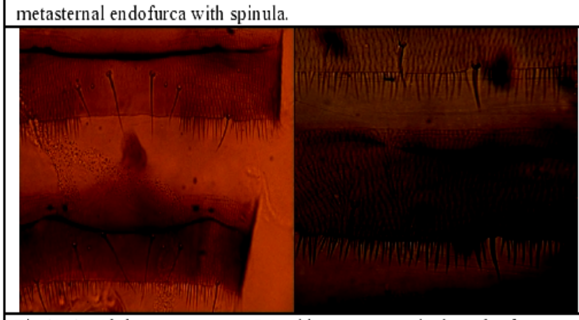

Fig.(6 g) : Abdomen segments 7-8 with posteromarginal comb of microtrichia complete.

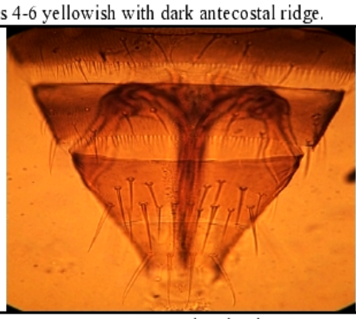

Fig.(6 h) : Abdomen segmants ,9-10 much paler than 8

**Fig.(6):Showing distinguishing features of Soybean thrips; *Neohydatothrips variabilis* (Beach).**

Fig.(7a):Bean thrips Adult are 1 mm long, dark brown.

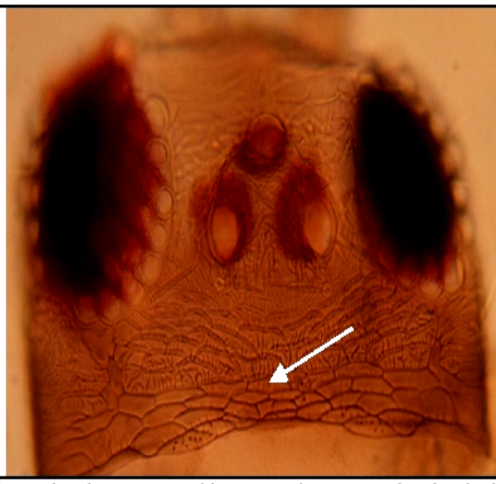

Fig.(7b):Head and pronotum without prominent setae; head reticulate with markings inside each reticle, pronotal sculpture forming lines. Pronotum sculpture markings

Fig.(7 c):Antennae 8-segmented, 3-5 were yellow with brown shading apically with sensorium forked, 7-8 elongate

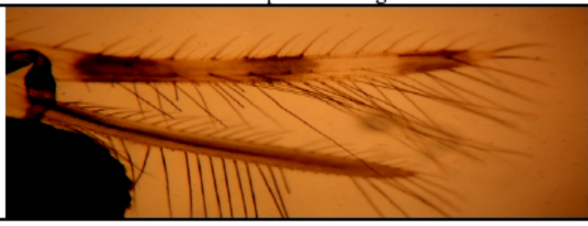

Fig.(7d):Forewing brown with 3 subapically transverse bands and a subbasally white band. The medially band was light brown

Fig.(7 e). Legs brown, tarsi yellow, also base and apex of tibiae

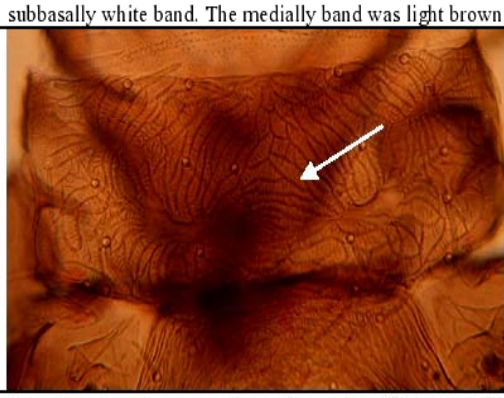

Fig.(7 f). Metanotum strongly sculptured, median setae wide apart,metathoracic endofurca lyre-shaped and extending to mesothorax

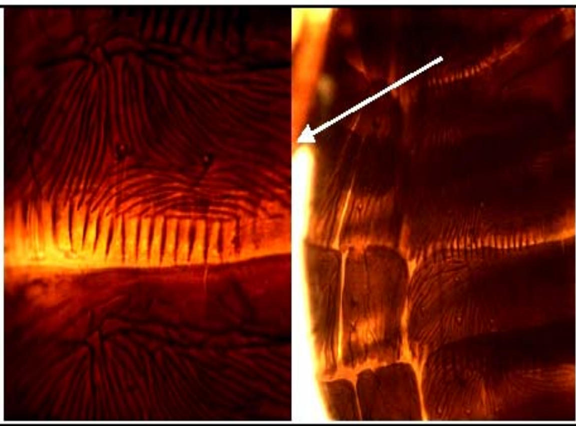

Fig.(7g): *Caliothrips phaseoli* with tergites II-III showing sculpture.

Fig.(7 h): Tergite 8 with crisped medially

**Fig: (7) Showing distinguishing features of soybean thrips *Caliothrips phaseoli (Hood).***

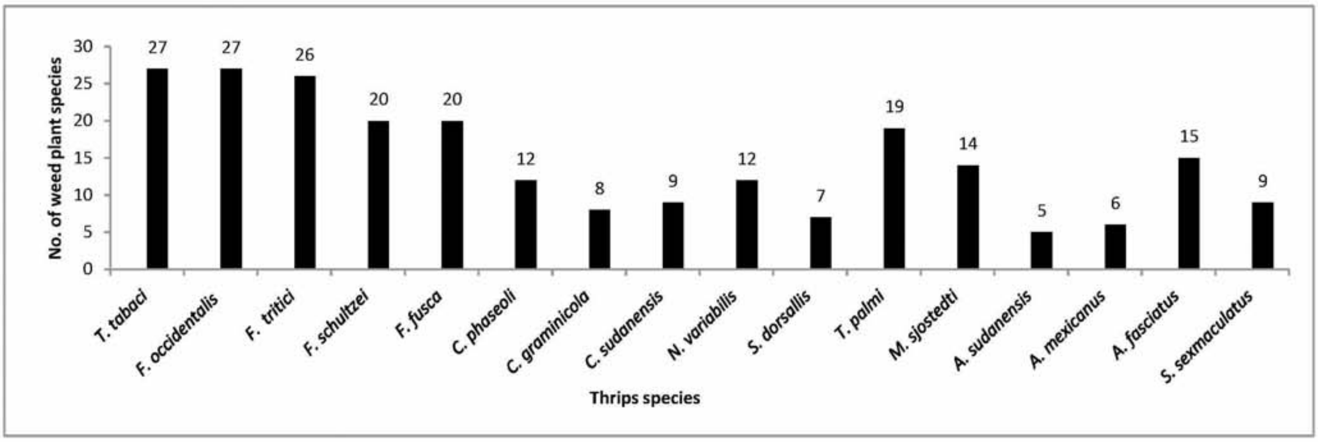


**Fig.(8):Occurrence of 16 different thrips species recorded on 27 different weed plant speciess associated with soybean crop in the field,( season 2014,Giza, Egypt).**

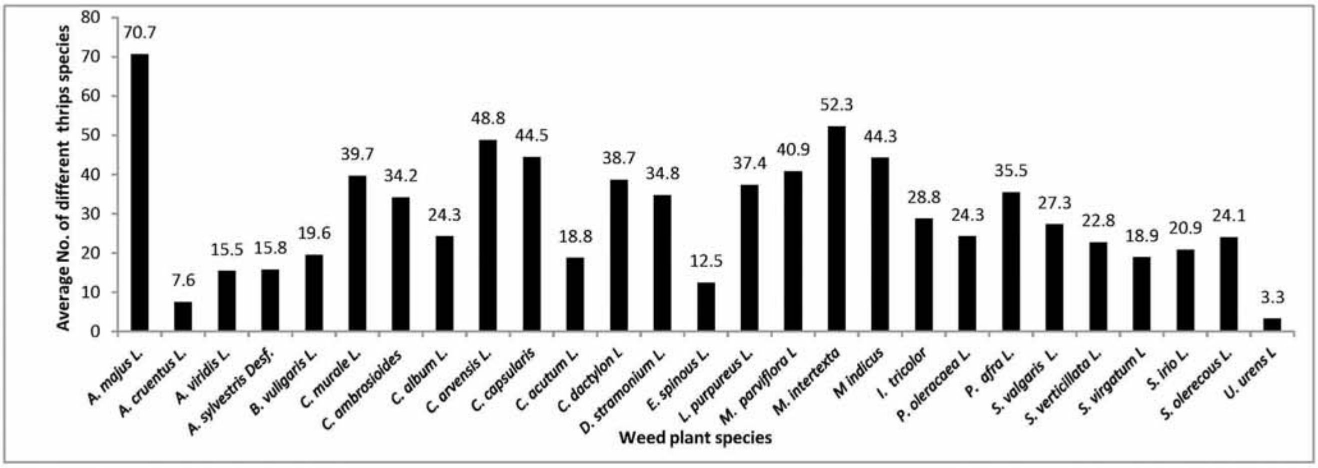


**Fig.(9):Occurrence of 16 different thrips species recorded on the dominant 27 different weed plant species associated with soybean crop in the field,(season 2014,Giza, Egypt).**

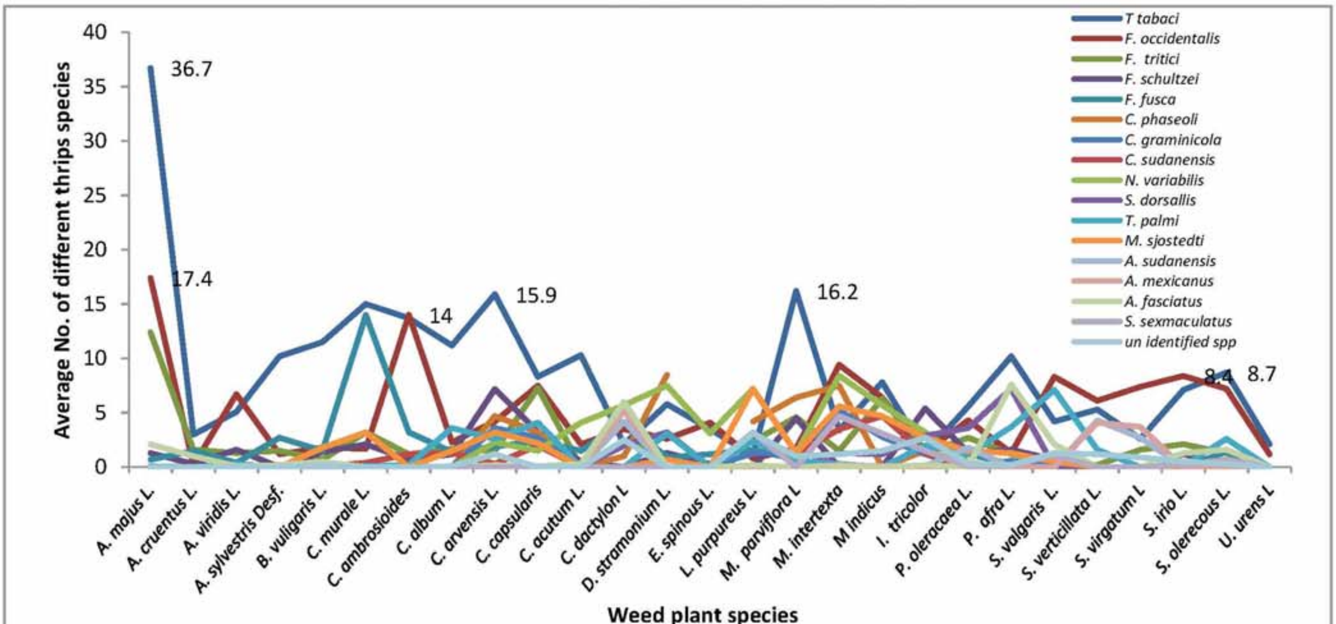


**Fig. (10) : Abundance of 16 different thrips species recorded on the dominant 27 different weed plant species associated with soybean crop in the field,(season 2014,Giza, Egypt).**

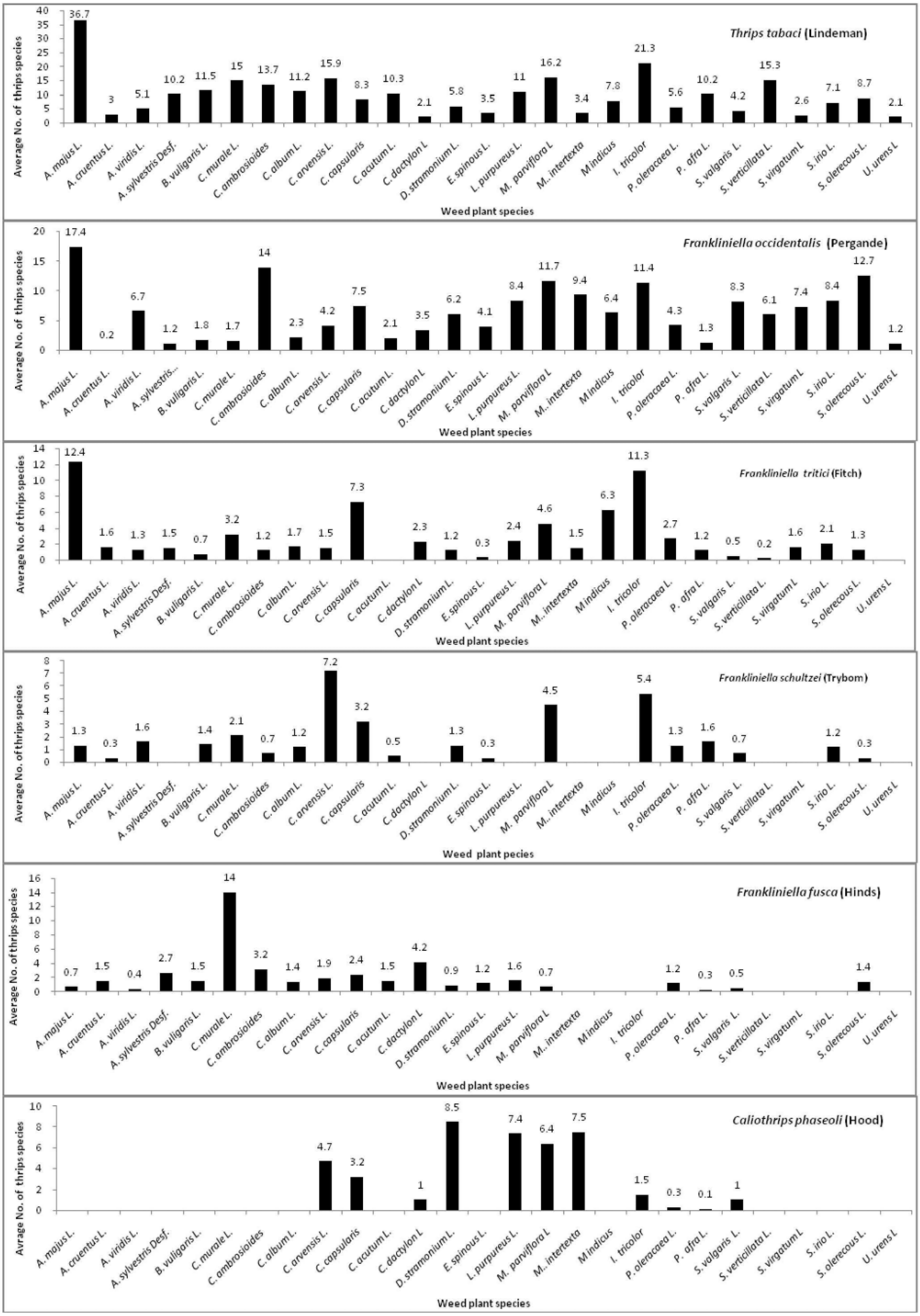


**Fig.(11a):Occurrence of 16 different thrips species recorded on the dominants 27 different weed plant species associated with soybean crop in the field, (season 2014,Giza, Egypt).**

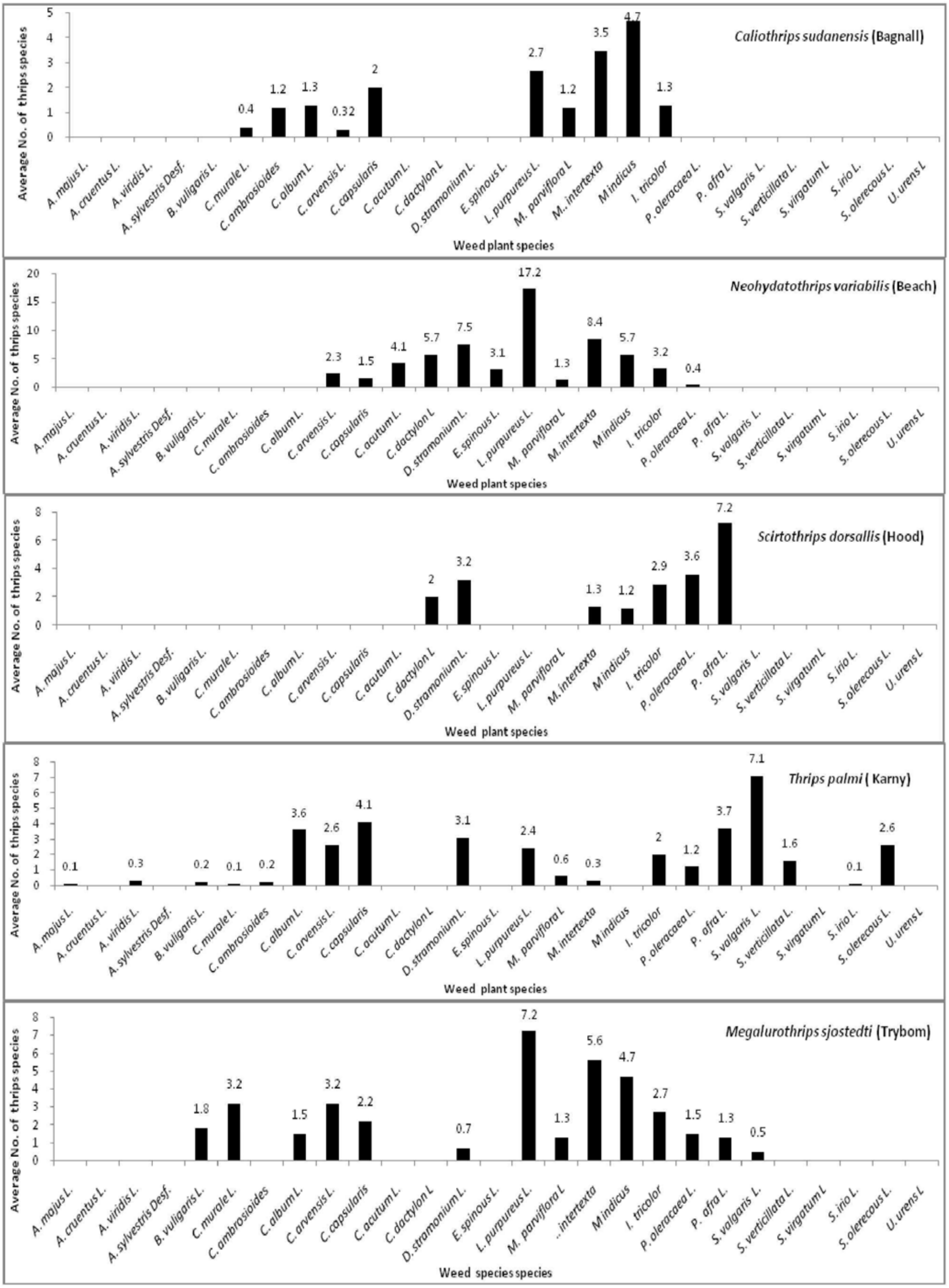


**Fig.(11b):Occurrence of 16 different thrips species recorded on the dominants 27 different weed plant species associated with soybean crop in the field, (season 2014,Giza, Egypt).**

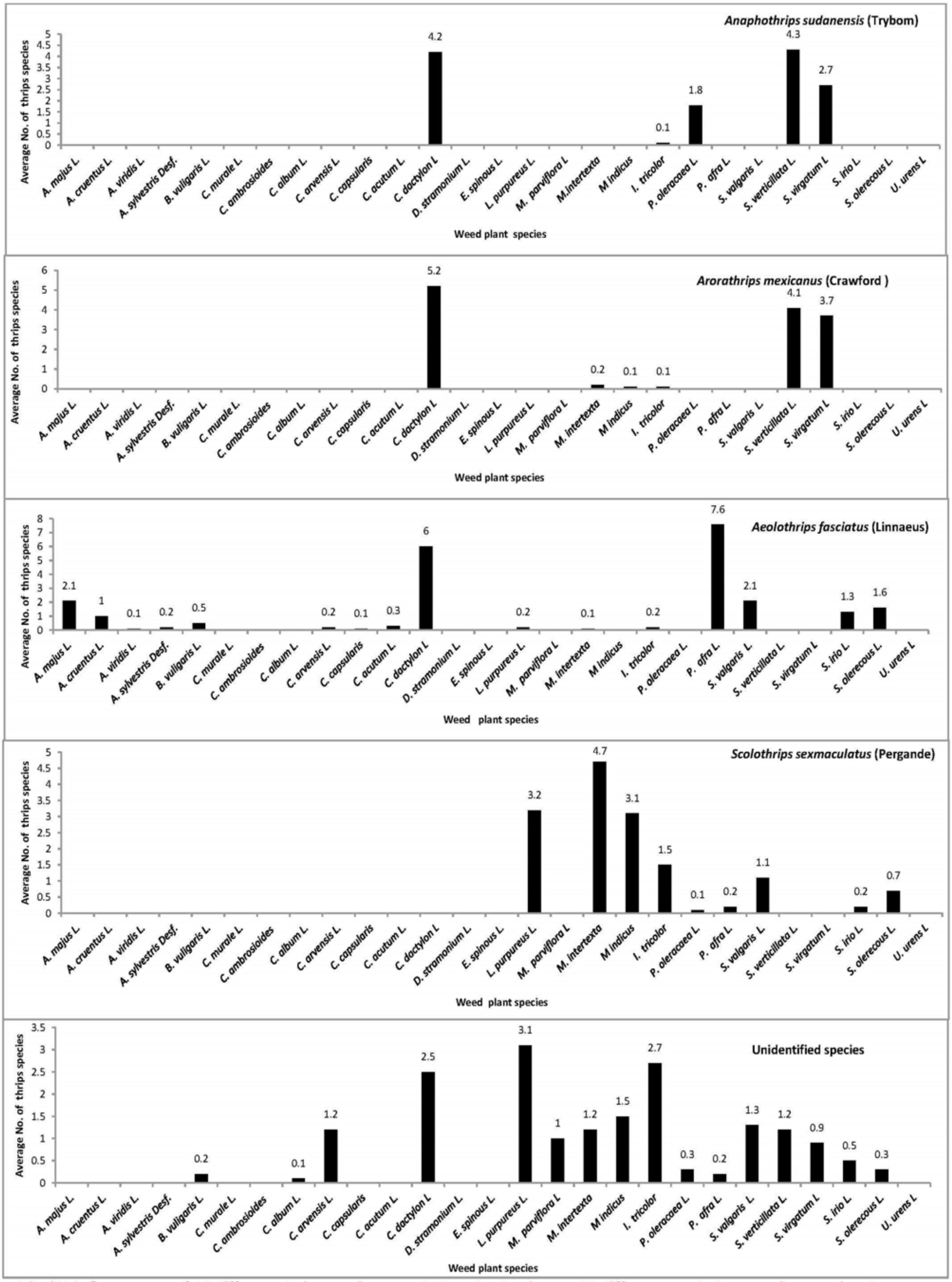


**Fig.(11c):Occurrence of 16 different thrips species recorded on the dominant 27 different weed plant species associated with soybean crop in the field, (season 2014,Giza, Egypt).**

## CONCLUSION

This is the first study of the survey and seasonal abundance of 16 thrips species attacking soybean and 27 weed species in and around soybean field. Both of *T. tabaci* and *F. occidentalis* were the most common on *Glycine max* (L.) and weeds. Different thrips species are vectors of Tospoviruses, it is important to monitor thrips vector populations in relation to the incidence of the virus to predict the epidemics. Also, a survey of thrips and associated weeds are important in order to establish cultural practices to reduce or prevent invasions of thrips populations that are harboured in these weeds into the crop.

In alternatively, weeds have shown to be important overwintering reservoirs for TSWV (Groves *et al*., 2001). Given the relative similarities between Tospovirus spp., these traits may be similar for IYSV. Previous studies have reported that the morning glory weed is a symptomless host of SVNV and can act as a source of inoculum for soybean fields (Sikora *et al*., 2016). SVNV was not only vectored by Thrips but also affect the life history of thrips (Keough *et al*., 2016). Knowledge of the weed species in which thrips develop helps in the management of a pest thrips by removing the weed or by using it as trap (Lima *et al*., 2000)

However, further studies are required in order to continue identification of collected unidentified thrips specimens, investigating the impact of (SVNV) on soybean yield and isolating & identifying new “Tospovirus” associated with soybean.

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## الملخص العربي

**الحصر والوفرة الموسمية لأنواع التربس على فول الصويا والحشائش المرتبطة به وتسجيل لنوعين جديدين في مصر:**

**عبير صلاح الدين عبد الوهاب**
وحدة فيرولوجيا الحشرات ، قسم الحشرات الاقتصادية و المبيدات - كلية الزراعة - جامعة القاهرة - الجيزة – مصر

توجد أنواع عديدة من حشرات التربس معروف عنها أنها تتغذى على فول الصويا و يمكنها أن تحدث خفضاً في المحصول. بجانب أن السبب الهام الثاني لعملية حصر حشرات التربس على فول الصويا هو أن نقوم فيما بعد بتقدير دورها كناقلات لفيروسات (Tospoviruses)، هناك معلومات قليلة متاحة عن الأنواع المختلفة لحشرات التربس المتواجدة على محصول فول الصويا ، ووفرتها الموسمية في مصر. من هنا كان الهدف من هذه الدراسة وهو عمل حصر حقلي وتسجيل الأنواع المختلفة من حشرات التربس على نباتات فول الصويا والحشائش المصاحبة له خلال موسم النمو. تم إجراء الدراسة بمزرعة محطة التجارب الزراعية – كلية الزراعة- جامعة القاهرة خلال موسم ٢٠١٤ على الصنف المنزرع جيزة (١١١) ، تمت الزراعة من أواخر مايو و استمر المحصول حتى منتصف سبتمبر. أجريت جميع المعاملات الزراعية على المحصول فيما عدا إجراء أي عمليات مكافحة للحشرات. تم إجراء المتابعة الأسبوعية وأخذت عينات بصفة دورية لحصر وتعريف أنواع حشرات التربس ، حيث تم جمع وفصل وعد أنواع حشرات التربس المختلفة بطريقة العد المباشر وتمت عملية التفريق بين الأنواع المختلفة وبعضها البعض طريق الفحص الدقيق بالميكروسكوب الضوئي والتصوير والمقارنة باستخدام المفاتيح التقسيمية لحشرات التربس و من ثم عدّ الأنواع وتسجيل أعدادها. أسفرت نتائج الدراسة عن تواجد ١٦ نوعاً من حشرات التربس المختلفة مرتبطة بمحصول فول الصويا، من هذه الأنواع ١٤ نوع متغذيات نباتية وهى كالتالي:

*Thrips tabaci* (Lindman), *Frankliniella occidentalis* (Pergande), *Frankliniella tritici* (Fitch), *Frankliniella schultzei* (Trybom), *Frankliniella fusca* (Hinds), *Neohydatothrips variabilis* (Beach), *Caliothrips phaseoli* (Hood), *Caliothrips graminicola* (Bagnall), *Caliothrips sudanensis* (Bagnall), *Scirtothrips dorsallis* (Hood), , *Megalurothrips sjostedti* (Trybom), *Thrips palmi* (Karny)

و نوعين من تربس الحشائش و هما:

*Anaphothrips sudanensis* (Trybom), *Arorathrips* (*Chirothrips*) *mexicanus* (Crawford)

بالإضافة إلى نوعين من حشرات التربس المفترس هما:

*Scolothrips sexmaculatus* (Pergande) and *Aeolothrips fasciatus* (Linnaeus)

وخلال الدراسة تم تعريف وتوصيف كل من النوعين *Neohydatothrips variabilis* (Beach) ، *Caliothrips phaseoli* Hood كنوعين جديدين يسجلا لأول مرة في مصر على محصول فول الصويا.

أظهرت النتائج أن حشرات تربس البصل *Thrips tabaci* كان أكثر الأنواع تواجداً على نباتات فول الصويا (٢٢٦.٢ فرد/النبات).وكانت ذروة التعداد الأولى في أواخر يونيو (بمتوسط ٢١.٩ فرد/نبات) أما الأخرى فكانت في منتصف أغسطس (بمتوسط ٣٨ فرد/نبات). بينما النوع تربس الأزهار *Frankliniella occidentalis* فقد جاء في المرتبة الثانية حيث سجلت بمتوسط (١٠٧.٢ فرد/نبات)، تلي ذلك تواجد أنواع حشرات تربس فول الصويا *N. variabilis*، تربس الفاصوليا *Caliothrips phaseoli*, تربس القمح *F. Tritici* ثم تربس الطماطم *F. schultzei* بمتوسطات (٥٧.٥، ٥٦.٥، ٤٣.٢ & ٤٢.١ فرد/نبات على التوالي).

ومن خلال دراسة الوفرة الموسمية فقد سجل أقصى تعداد لهذه الأنواع (١٣.٢، ١٩.٢ &١٦.٢ فرد/نبات على التوالي) خلال الموسم. كما تم حصر ٢٧ نوع من الحشائش المنتشرة في وحول حقول فول الصويا وقد وجد أن كلا من تربس البصل وتربس الأزهار هما الأكثر انتشارا على الحشائش المرتبط بنباتات فول الصويا. كما تواجد أعلى تعداد للتربس المختلفة على حشيشه الخلة *Ammi majus* ثم الحندقوق *Medicago intertexta* L., ويليها العليق *Convolvulus arvensis* ثم النفل *Melilotus indicus* L., وأخيراً الخبيزة *Malva parviflora* (٧٠.٧، ٤٨.٨ ،٤٤.٣ & ٤٠.٩ فرد/نبات على التوالي). بينما حشيشه الحريق كانت تأوي ٣.٣ فرد/للنبات) اقل تعداد من بين أنواع الحشائش المختلفة.

نستخلص من هذه الدراسة انه من الأهمية بما كان الربط بين دور الحشائش كعائل لحشرات التربس والذي هو بدوره ناقل أساسي للعديد من الفيروسات خاصة ال Tospoviruses وهذا يجب أخذه في الاعتبار عند عمل مكافحة لفيروسات النبات على محاصيل فول الصويا المنزرعة. تتضح أهمية هذه الدراسة بالربط بينها وبين الدراسة التالية لها و الخاصة بعزل وتشخيص فيروس موت العرق في فول الصويا Soybean vein necrosis virus المنقول بواسطة حشرات التربس في مصر.