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STUDIES ON THE MAIN INSECT PESTES INFESTING CERTAIN SOLANACEOUS VEGETABLE CROPS

BY

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6- SUMMARY

The present studies were carried out during the two successive years, 2015/16 and 2016/17 at Experimental farm belong to Agricultural Research center in Kaf El Sheikh on Three different solanaceous host plant tomato, eggplant and pepper during two plantations dates.

The obtained results could be summarized as following:

6.1. Effect of Solanaceous vegetable crops as host plants on the main insect pests and their predatory insects.

6.1.1. On the main insect pests:

6.1.1.1. On tomato:-

The cotton whitefly *B.tabaci* Came in the first category in February plantation during the first year 2015 followed by the green bug *N.viridula* and represented by 677 and 645individual, respectively. Meanwhile during the year 2016 the green bug *N.viridula* came in the first category followed by the cotton whitefly and represented by 665and 554 individual, respectively. On May plantation during the two year the cotton whitefly *B.tabaci*, ranked the first category and represented by 2129 and 2035 individuals, respectively. On the other hand the tomato leafminer *T.absoluta* came in the second ranking and recorded 1765 and 1797 individuals, respectively. Moreover, the total numbers of the main insect pests, on tomato plants was the highest in May plantation during the two years and represented by 5259 and 5249 individuals, respectively. While in February plantation was the lowest and represented by 2919 and 2880 individuals, respectively.

6.1.1. 2. On eggplant:-

The cotton aphid *A. gossypii* Came in the first category, in February plantation during the two years, and represented by 910 and 921individual, respectively. The cotton whitefly ranked the second category during the two years and represented by 605 and 479 individual, respectively. On May plantation during the two year the cotton whitefly *B.tabaci*, ranked the first category and represented by 597 and 522 individuals, respectively. On the other hand the plant hopper *E.decipiens* came in the second ranking and recorded 413 and 436 individuals, respectively. Moreover, the total numbers of the main insect pests, on eggplant plants was the highest in February plantation during the two years and represented by 2367 and 2224individuals, respectively. While in May plantation was the lowest and represented by 1858and 1820 individuals, respectively.

6.1.1.3. On pepper:-

The cotton aphid *A. gossypii* Came in the first category in February plantation during the two years, and represented by 620and 506individual, respectively. The cotton whitefly ranked the second category during the two years and represented by 469 and 453 individual, respectively. On May plantation during the two year the cotton whitefly *B.tabaci*, ranked the first category and represented by 752 and 442individuals, respectively. On the other hand the plant hopper *E.decipiens* came in the second ranking and recorded 299 and 360 individuals, respectively. Moreover, the total numbers of the main insect pests, on pepper plants was the highest in February plantation during the two years and represented by 1810and 1602 individuals, respectively. While in May plantation was the lowest and represented by 1652and 1498 individuals, respectively.

6.1.2. The population abundance of the main insect pest of different solanaceous crops.

6.1.2.1. The cotton aphid, *Aphis gossypii*

The highest peak of cotton aphid *A.*gossypii in the two plantations during the two years recorded in February plantation which occurred on eggplant represented by (116 and 122 individuals) followed by pepper and tomato and represented by (75and 52) and (40and 42 individuals), respectively .The highest average number of *A.gossypii* during two plantation in two years recoded in eggplant during the February plantation represented by (56.8 ± 9.9 in first year and 57.5 ± 9.6 in the second year) followed by pepper represented by(38.7±5.2in first year and 31.6 ± 6.0 in the second year) .Meanwhile the highest average number in May plantation recorded in Pepper represented by (13.7± 2.4 in first year and 16.0 ±1.7in the second year), respectively. Statistical analysis represented a significant difference in the number of the cotton aphid *A.gossypii* in the same type of solanaceous crop with different plantation date (February and may).Also there is a significant difference between solanaceous crops during February plantation and May plantation.

6.1.2.2: The cotton whitefly, *Bemisia tabaci*

The highest peak of cotton whitefly *B.*tabaci in the two plantations during the two years recorded in May plantation which occurred on tomato represented by (253 and 247 individuals) followed by eggplant and pepper and represented by (60and 48) and (48and 46 individuals), respectively .The highest average number of *B.tabaci* during two plantation in two years recoded in tomato during the May plantation represented by (133.0 ± 19.2 in first year and 127.1 ± 17.0 in the second year) followed by eggplant represented by(37.3±4.7in first year and 32.6 ± 3.19 in the second year) .Meanwhile the highest average number in February plantation recorded in tomato represented by (42.3± 3.8 in first year and 34.6 ±2.6in the second

year)followed by eggplant and pepper represented by(37.8± 3.8and 29.9±2.9) and (29.3±3.11and 28.3±2.5), respectively. Statistical analysis represented a significant difference in the number of the cotton whitefly *B.tabaci* in only tomato crops and no differences in eggplant and pepper plantation in the same type of solanaceous crop with different plantation date (February and may).Also there is a significant difference in number of *B.tabaci* between tomato and pepper solanaceous crops during February plantation and May plantation.

6.1.2.3 The cotton thrips, *Thrips tabaci*

The highest peak of cotton thrips *T.tabaci* in the two plantations were during the February plantation and record the highest peak which occurred on tomato represented by46and 50individuals followed by eggplant and pepper and represented by 41, 39 and 43, 36individuals, respectively .The highest average number of *T.tabaci* during two plantation in two years recoded in tomato during the February plantation represented by (21.8±3.8 in first year and 25.6±3.8 in the second year) followed by eggplant represented by(21.5±3.1in first year and 20.6±3.1 in the second year) .Meanwhile the highest average number in May plantation recorded in eggplant represented by (9.0±2.2in first year and 7.25±1.7in the second year)followed by tomato and pepper represented by(7.8±1.1and 4.43±1.4) and (5.8±0.9 and 4.8±0.9), respectively. Statistical analysis represented a significant difference in the number of the cotton thrips *T.tabaci* to each solanaceous crops in the same type of solanaceous crop with different plantation date (February and may).Also there is no significant difference in number of *T.tabaci* between tomato , pepper and eggplant in February or May plantation period .

6.1.2.4. The leafmainer, *Liriomyza trifolii*

The highest peak of leafmainer *L.trifolii* in the two plantations during the two years2015 and 2016 recorded in February plantations ,which occurred on tomato represented by 55, 48individuals, followed by eggplant and pepper and represented by 53, 48 and 41, 45individuals, respectively .The highest average number of *L.trifolii* during two plantation in two years recoded in tomato during the February plantation represented by (3.4±0.5in first year and 3.0±0.4 in the second year) followed by eggplant and pepper and represented by (3.3±0.4 in first year , 3.0±0.3in the second year) and(2.5±0.5in the first year and 2.8±0.4 in the second year),respectively . Meanwhile the highest average number in May plantation recorded in pepper represented by (2.8±1.0in first year, 2.8±0.8in the second year) followed by tomato and eggplant represented by (2.0±0.6in first year, 2.6±0.8in second year) and (2.0±0.5in first year and 2.1±0.4in second year), respectively. Statistical analysis represented no significant difference in the number of the leafmainer *L.trifolii* to each solanaceous crops in the same type of solanaceous crop with different plantation date (February and may).Also there is no significant difference in number of *L.trifolii* between tomato ,pepper and eggplant in February or May plantation period .

6.1.2.5. The green bug *Nezara viridula*

The highest peak of green bug *N.viridula* in the two plantations during the two years2015 and 2016 recorded in February plantations , which occurred on tomato and represented by 146and 159individuals,followed by pepper and eggplant and represented by 22, 18 and 17,13individuals, respectively .The highest average number of *N.viridula* during two plantation in two years recoded in tomato during the February plantation represented by (40.3±11.0in first year and 41.5±11.4 in the second year) followed by pepper represented by(7.0±1.5 in first year , 6.0±0.0in the second year) and eggplant represented by(4.7±1.2in first year and 4.0±1.0 in second

year),respectively. Meanwhile the highest average number in May plantation recorded in tomato represented by (11.6±1.8in first year and 12.2±0.6in the second year) followed by pepper and eggplant represented by (6.6±0.0in first year, 9.9±0.55in second year) and (7.1±1.1in first year and 9.9±0.55in second year), respectively. Statistical analysis represented a significant difference in the number of the green bug *N.viridula* to each solanaceous crops in the same type of solanaceous crop with different plantation date (February and may).Also there is a significant difference in number of *N.viridula* between tomato and pepper and eggplant in February or May plantation period .

6.1.2.6. The leafhoppers *Empoasca decipiens*

The highest peak of the leafhoppers *E.decipiens* in the two plantations during the two years2015 and 2016 recorded in May plantation , which occurred on tomato and represented by 81, 75individuals, followed by eggplant and pepper and represented by 37, 49 and33and 39individuals, respectively .The highest average number of *E.decipiens* during two plantation in two years recoded in tomato during the May plantation represented by (30.6±4.8in first year , 35.0±4.2in the second year) followed by eggplant represented by (25.8±2.8in first year , 27.2±2.3in the second year) and pepper represented by (18.6±1.4in first year and 22.5±1.9 in second year),respectively . Meanwhile the highest average number in February plantation recorded in tomato represented by (18.2±1.9in first year, 16.5±1.7in the second year) followed by eggplant and represented by (14.3±1.9in first year, 14.75±1.9in second year) and pepper represented by(13.1±1.8in first year and11.5±1.9in second year) , respectively. Statistical analysis represented a significant difference in the number of the leafhoppers *E.decipiens* between February and May plantation in the same type of solanaceous crop with different plantation date (February and may).Also there is no significant difference in number of *E.decipiens* between

tomato and pepper and eggplant in February, while found in May plantation period .

4.1.2.7. The cotton worm *Spodoptera littoralis*

The highest peak of the cotton worm *S.littoralis* in the two plantations during the two years2015 and 2016 recorded in May plantation recorded , which occurred on tomato represented by 19, 22individuals, followed by eggplant and pepper and represented by 16, 20, and 0, 18individuals), respectively .The highest average number of *S.littoralis during* two plantation in two years recoded in tomato during the May plantation represented by (10.4±1.4in first year and 11.5±1.9in the second year) followed by eggplant represented by (7.8±1.3in first year and 8.2±1.7in the second year), respectively. Meanwhile the highest average number in February plantation recorded in tomato represented by (1.9±0.7in first year and 2.8±3.8in the second year) followed by eggplant and represented by (5.9±1.2and 6.87±1.5), respectively. Statistical analysis represented a significant difference in the number of the cotton worm *S.littoralis* between February and May plantation in the same type of solanaceous crop with different plantation date (February and may).Also there is a significant difference in number of *S.littoralis* between tomato and pepper and eggplant in February and May plantation period .

6.1.2.8. The tomato leafminer *Tuta absoluta*

The highest peak of the tomato leafminer *T.absoluta* in the two plantations during the two years2015 and 2016 recorded in May plantations ,which occurred on tomato represented by 219and 240individuals, followed by eggplant and represented by 13and 16 individuals, respectively .The highest average number of *T.absoluta* during two plantation in two years recoded in tomato during the May plantation represented by (110.3±17.7in first year and 112.3±18.1in the second year) followed by eggplant represented by (10.5±0.5in first year and 11.3±0.5in the second year).

Meanwhile the highest average number in February plantation recorded in tomato represented by (31.0±4.8in first year and 31.5±5.0 in the second year) followed by eggplant and represented by (3.3±1.0and 2.1±0.7), respectively. Statistical analysis represented a significant difference in the number of the tomato leafminer *T.absoluta* between February and May plantation in the same type of solanaceous crop with different plantation date (February and may).Also there is a significant difference in number of *T.absoluta* between tomato and eggplant in February and May plantation period .whoever no appearance of *T.absoluta* in pepper plants during the two plantation time.

6.1.2.9. The cotton bollworm Heliothis *armigera*

The highest peak of the tomato fruit worm *H.armigera in* the two plantations during the two years2015 and 2016 recorded in May plantation ,which occurred on tomato represented by 31, 26individuals followed by eggplant and represented by 13, 14individuals and pepper represented by 11 and 10 individuals , respectively .The highest average number of *H.armigera* during two plantation in two years recoded in tomato during the May plantation represented by (10.3±2.8in first year and 11.1±2.1in the second year) followed by eggplant represented by (4.5±1.0in first year and 5.0±1.2in the second year). Statistical analysis represented a significant difference in the number of the tomato fruit worm *H.armigera* between February and May plantation in the same type of solanaceous crop with different plantation date (February and may).Also there is a significant difference in number of *H.armigera between* tomato and eggplant in May plantation period .whoever no appearance in February appearance of *H.armigera in* all plants during February plantation period.

6.1.3. The main associated predators on different solanaceous host plants

6.1.3 on Tomato

In February plantation during the two years, *C.undecimpunctata* Came in the first category and represented by 105 and 160individual, respectively. The predator *M.pygmaeus* ranked the second category during the two years and represented by 70and64individuals, respectively. On May plantation during the two *C. undecimpunctata*, ranked the first category and represented by 109 and 96 individuals, respectively. On the other hand the predator *M.corllea* came in the second ranking during the first year 2015 and recorded 96 individuals, respectively. While in the second year 2016 the predator *M.pygmaeus* ranked the second category and presented by 76 individuals, respectively .Moreover, the total numbers of the predators associated on tomato plants was the highest in May plantation during the two years and represented by 416 and 337 individuals, respectively. While in February plantation was the lowest and represented by 272and 320 individuals, respectively.

6.3.2. on eggplant

In February plantation during the two years, *C.undecimpunctata* Came in the first category and represented by 94 and 101individual, respectively. The predator *M.pygmaeus* ranked the second category in the two years and represented by 79 and77 individuals, respectively. On May plantation during the two *C.undecimpunctata*, ranked the first category and represented by 116 and 102individuals, respectively. On the other hand the predator *M.corllea* came in the second ranking during the two years and recorded 74and 60 individuals, respectively. Moreover, the total numbers of the predators associated on eggplant plants was the highest in May plantation during the two years and represented by 325 and 272

individuals, respectively. While in February plantation was the lowest and represented by 234and 245 individuals, respectively.

6.3.3. on pepper

In February plantation during the two years, *C.undecimpunctata* Came in the first category and represented by 58and 59 individual, respectively. The predator *C.carnea* ranked the second category in the two years and represented by 46and48individuals, respectively. On May plantation during the two *C.undecimpunctata*, ranked the first category and represented by 71and 102individuals, respectively. On the other hand in the first year the predator *C.carnea* ranked the second category and recorded 52, while the predator *M.corllea* came in the second ranking during the second year and recorded 60, individuals, respectively. Moreover, the total numbers of the predators associated on pepper plants was the highest in May plantation during the two years and represented by 203and 271 individuals, respectively. While in February plantation was the lowest and represented by 147and 143 individuals, respectively.

6.1.4. The seasonal activity of the main predators on different solanaceous host plants.

6.1.4.1. The eleven-spotted lady bird *Coccinella undecimpunctata*

The highest peak of *C. undecimpunctata* was on tomato crops in February plantation and represented by 15 and 18 in first year and second year, following by eggplant and represented by 13 and 17individuals, respectively. Meanwhile in May plantation the highest peak recorded on eggplant and represented by 13 and 11individuals, respectively. However, the highest average numbers of *C.undecimpunctata* during February plantation recorded on tomato plants during the two years (6.5±1.6 in the first year and 10.0±2.2 in the second year). Meanwhile in May plantation the highest average recorded on eggplant (7.2±0.9 in the first year and

6.3±2.6 in the second year). Data indicated that no significant differences in numbers of the predator between the solanecous crops in February plantation, while in May plantation there was a significant differences between tomato and eggplant.

6.1.4.2. The green lacewing, *Chrysoperla carnea*

The highest peak of *C. carnea* was on tomato crops in February plantation and represented by 11 and 11 in first year and second year. Meanwhile in May plantation the highest peak recorded on eggplant and represented by 11 and 11individuals, respectively. However, the highest average numbers of *C.carnea* during February plantation recorded on tomato plants during the two years (4.0±0.8 in the first year and 3.25±0.85 in the second year). Meanwhile in May plantation the highest average recorded on eggplant (3.75±0.7 in the first year and 3.25±0.7 in the second year). Data indicated that no significant differences in numbers of the predator between the solanecous crops in February plantation, while in May plantation there was a significant differences between tomato and eggplant.

6.1.4.3. The Syrphus flies, *Metasyrphus corrella*

The highest peak of *M. corollae* was on tomato crops in February plantation and represented by 5 and 11 in first year and second year, following by eggplant and represented by 13 and 17individuals, respectively. Meanwhile in May plantation the highest peak recorded on tomato and represented by 18 and 18individuals, respectively. However, the highest average numbers of *M.corllea* during May plantation recorded on tomato plants during the two years (6.0±1.5in the first year and 6.06±1.1 in the second year). Meanwhile in February plantation the highest average recorded on tomato (1.68±0.47in the first year and 2.62±0.86in the second year). Data indicated that no significant differences in numbers of the predator between the

solanecous crops in February plantation or May plantation, but found between the two plantations on different solanaceous crops

6.1.4.4. The predatory bug, *Macrolophus pygmaeus*

The highest peak of *M. pygmaeus* was on tomato crops in February plantation and represented by 18 and 16 individuals, respectively. Meanwhile in May plantation the highest peak recorded on tomato and represented by 9and 11individuals, respectively. However, the highest average numbers of *M. pygmaeus* during May plantation recorded on tomato plants during the two years (5.06±0.6in the first year and 4.75±0.53 in the second year). Meanwhile in February plantation the highest average recorded on eggplant (4.93±1.28in the first year and 4.81±1.1in the second year). Data indicated that no significant differences in numbers of the predator between the solanecous crops in February plantation or May plantation but found between different solanaceous crops in May plantation.

6.1.4.5. The predatory, *Peaderus alfierii*

The highest peak of *P.alfierii* was on tomato crops in May plantation and represented by 7 and 6individuals, respectively. Meanwhile in February plantation the appearance of the predator was with low numbers less than 5 in tomato without appearance on eggplant or pepper. However, the highest average numbers of *P.alfierii* during May plantation recorded on tomato plants during the two years (2.25±0.63in the first year and 1.62±0.52in the second year). Data indicated that no significant differences in numbers of the predator between the solanecous crops in February plantation or May plantation but found between plantations in tomato with a significant difference.

6.1.4.6. The common earwing, *Labidura riparia*

The common earwing, *Labidura riparia* showed no appear in February plantation in the first year 2015 and the second year 2016. In May plantation as in Figure (27) the highest peak of abundance recorded in tomato plants followed by eggplant and pepper and presented by 6 ,5and 1 individuals ,respectively in the first year 2015. Meanwhile in the second year 2016 the highest peak of abundance recorded in tomato followed by eggplant and pepper and represented by 4, 4 and 3 individuals, respectively.

6.1.5. The relationship between the insect pests and predators associated in solanaceous crops in February and May plantations.

6.1.5.1. The total Predator: prey Ratio (P: P Ratio) on different solanaceous crops

The narrowed P: P ratio was recorded on February plantation on tomato plants and represented by 1:11 in the first year and 1: 9 in the second year, respectively. However, on eggplant and pepper the narrowed rate recorded on eggplant and pepper were recorded during May plantation on eggplant with (1: 6 in the first year and 1: 7in the second year), and pepper with (1: 8 in the first year and 1: 6 in the second year).

6.1.5.1.2. The predator - prey ratio (P: P ratio) of each predator on different solanaceous crops during February and May plantation.

the narrowed P: P ratio between the insect pest and the associated predators on different solanaceous crops were recorded in February plantation on the three crops tomato, eggplant and pepper. The predators' *C. undecimpunctata* and *C. carnea* recorded the narrowed ratio on February and May plantation. Meanwhile the predator *M. correlae* showed a narrowed ratio in May plantation during the two

seasons. The predator *M. pygmaeus* recorded similar ratio in May plantation on all crops.

6.1.5.2. Simple correlation coefficients

The simple- correlations coefficient between the main solanaceous insect pests and associated predators during May plantation in two years 2015 and 2016, indicated that there was a highly positive significant effect among predators with *E. decipiens T. absoluta* and *H. armigera*. Highly correlations found between the predator *M. pygmaeus* with *T. absoluta*, *S. littoralis* and *H. armigera*, on tomato. While, in eggplant a high positive significant effect was recorded among predators, C. *undecimpunctata* and *C. carnea* and *B. tabaci, T. absoluta* and *H. armigera.* High correlations found between the predator *M. pygmaeus*, *P. alfierii* and *L. riparia* with *A. gossypii, B. tabaci, T. absoluta*, *E. decipiens* and *H. armigera.* On pepper, a high positive significant effect among predators *C. undecimpunctata* and *C. carnea* with *B. tabaci* and *H. armigera.*

6.2.: Studies on the tomato bug *Nesidiocoris tenius* (Reuter)

6.2.1: Filed studies:

6.2.1.1: The population abundance of tomato bug on different solanaceous crops.

The highest peak of abundance of the tomato bug *N.tenuis* recorded in May plantation in tomato plant in the first year 2015 and the second year 2016 and represented by 198 and 177 individuals respectively. In the other hand there was a significant difference between February plantation and May plantation on the population densities of tomato bug. Eggplant and pepper showed no significant differences.

6.2.1.2: The relationship between the main insect pests and *N.tenuis* as a Prey-Predator Ratio and simple correlations on different solanaceous crops in February and May plantation.

The highest populations of total insect pests and *N.tenius* recorded in May plantation in tomato plant and represented by 5259 and 1151 in the first year2015 and 5249 and 1050 in the second year 2016. Meanwhile in February plantation the highest population abundance of total insect pests and *N.tenius* recorded also on tomato plants and recorded 2919 and 274 for the first year 2015 and 2880 and 286 individuals in the second year 2016, respectively.

The population abundance of *N.tenuis* increased with the weekly increasing of insect pest's populations which gives a strong typical predator response to prey availability. On other hand P: P ratio showed a very narrowed range for the tomato bug and main insect pests in tomato plants during February and May plantation and ranged about 1:11 and 1:10 in February plantation and 1:5 in May plantation during the two years .

6.2.1.3: simple correlation coefficients between the main solanaceous crops and the tomato bug *N.tenuis.*

Results indicated that a strong positive correlation found between the tomato bug and *A. gossypii*, *Bemisia tabaci*, *Thrips tabaci*, *Empoasca decipiens*, *Tuta absoluta* and *Heliothis armigera.*

6.2.2: Laboratory studies on the tomato bug *Nesidiocoris tenius* (Reuter)

64.2.2.1. Effect of different host plants on the duration and survival rate of the nymphal instar of N. *tenuis* as phytophagy insect.

The total immature stage was the shortest when the insect *N. tenuis* reared on pepper (7.3±0.33days) followed by eggplant (8.3±0.33days) and tomato came in the

third category and represented by 8.8 ±0.33 days with significantly differences. On the other hand, the survival rates were the highest when the insect reared on tomato plants followed by eggplant and pepper plants and represented by 42.5, 21.7 and 10.0% respectively.

4.2.2.2: Effect of different prey on the duration and survival rate of the nymphal instar of N. *tenuis* as zoophagy insect.

The total immature stage was the shortest when the insect *N. tenuis* reared on cotton gassed and tomato borer (6.0±0.00days) followed by cotton worm and whitefly (7.0±0.58days) with significantly differences. On the other hand, the survival rates were the highest when the insect reared on tomato borer 80.8% followed by whitefly ,cotton gassed and cotton worms and represented by 72.5 ,71.5 and 63.3% respectively.

4.3.2.3: Effect of different host plant and prey on the duration and survival rate of the nymphal instar of *N. tenuis* as zoophytophagy insect.

The total immature stage was the shortest when the insect *N. tenuis* reared on whitefly and tomato borer with tomato plants (6.0±0.00days) followed by cotton worm and whitefly (6.33±0.33days) with significantly differences. On the other hand, the survival rates were the highest when the insect reared on tomato borer whitefly with tomato plants 95.8% followed by tomato borer, cotton worms and cotton gassed and represented by 92.9, 90.8 and 89.2% respectively.