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"Studies on the important insect pests and natural enemies on the sugar beet plants"

By

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Thesis
Submitted in Partial fulfillment of the requirements
For the PhD. degree of Agriculture Sciences
In
(Economic Entomology)

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(2021)

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SUMMARY

This work was carried out at Sakha Agricultural Experimental Station Farm in Kafr El-Sheikh Governorate during four sugar beet growing seasons, 2013/2014, 2014/2015, 2015/2016 and 2016/2017 respectively.

The current study was aimed to:

1. Susceptibility of some sugar beet varieties to the main insect pests infestation and using molecular and biochemical markers to identify resistance varieties to insect infestation.
2. Investigate the effect of host plant preference for sugar beet insects and feeding using Sugar beet, Fodder beet, Table beet and Chard on insect populations infesting leaves of sugar beet plants, and their predators under field conditions.
3. Study the effect of addition of silica (sodium silicate and magnesium silicate), as sources of silica, against sugar beet insects as sprayed on sugar beet plants.
4. Using anhydrous ammonia to control sugar beet insects and to determine the optimum rate of application for increasing the number of natural enemies.

1. Susceptibility of the eight sugar beet cultivars to insect pest infestations:

The susceptibility of eight sugar beet cultivar; Tarbelli, Pepite, Amina, Sarah, Asketa, Karima, Dina and Paeikles to the main insect pests *Pegomia mixta*, *Cassida vittata* and *Spodoptera littoralis* and the values of estimated plant characters of the tested cultivars were studied during two successive seasons; 2014/2015 and 2015/2016. The obtained results were as follow: -

1.1. *P. mixta*:

The sugar beet cultivar Sarah attracted the highest mean number of *P. mixta* larvae blotches during the two seasons 2014-15 and 2015-16 (208.3 Larvae blotches and 183.7 Larvae / 10 plants. Followed by Paeikles, Amina, Asketa,

Pepite, Dina, Tarbelli and Karima cultivars (187, 178.7, 170.3, 169.7, 142, 135.7 and 109.3 larval blotches / 10 plants), respectively, for the season 2014-15.

On the other hand, Karima cultivar was the relatively resistant, and then the other seven tested cultivars to the fly infestation as it received the least number 107.3 larval blotches / 10 plants.

1.2. *C. vittata:*

Data revealed that the Paeikles cultivar was moderate resistant for *C. vittata* and highly resistant than the Tarbelli cultivar. The Paeikles cultivar recorded (110.7 and 116 (A&L) of *C. vittata* /10 plants for the season 2014-15 and 2015-16 respectively. On other hand the Tarbelli cultivar recorded (300 and 298.3 (A&L) *C. vittata* /10 plants for the season 2014-15 and 2015-16 respectively. Also the data showed that the beetle infestations were higher in the 1st season than in the 2nd one.

1.3. *S. Littoralis*:

Females of the cotton leaf-worm were attracted to Asketa cultivar plants more than the other cultivars. The recorded larvae on the considered cultivar plants were (266.7 L and 232.7 L / 10 plants) for the season 2014 -15 and 2015 – 16, respectively. The Pepite cultivar was less susceptible for *S. Littoralis* recorded (41.7 L and 21.3 L/10 plants) for the season 2014 -2015 and 2015 – 2016 respectively. The *S. Littoralis* infestations were higher in the 1st season than in the 2nd one.

1.4. Biochemical and Molecular analysis

Regarding *Cassida vittata,* the band with Mw 115 KDa and 85 KDa were present in Paeikles variety the high resistant varieties and was absent in Tarbelli the high susceptible genotype, these bands can be considered as positive markers for resistance to *Cassida vittata.*

Concerning *Pegomyia mixta,* the band with Mw 37 KDa was found in Karima variety the high resistant genotype and was absent in Sarah the high susceptible genotype, the band can be considered as positive marker for resistance

to *Pegomyia mixta,* on other hand the band with Mw 23 KDa was present in Sarah and was absent in Karima, this band can be considered as a negative marker for *Pegomyia mixta.*

For the *Spodoptera littoralis* the band with Mw 160 KDa was not found in Pepite variety the high resistant genotype and was present in Asketa the high susceptible genotype, the band can be considered as negative marker for resistance to *Spodoptera littoralis.*

A high level of DNA polymorphism was detected by RAPD technique. For the eight genotypes, RAPD markers amplified using RAPD primer.

With regard primer NO.1 (AGG GGT CTT G). The bands has Mw 755 bp and 675 bp can be considered as positive markers for *Cassida vittata* infestation.

Regarding the *Spodoptera littoralis* the band with Mw 170 bp and 155 bp the bands can be considered as positive markers for resistance to *Spodoptera littoralis.*

For the eight genotypes with RAPD markers amplified using primer NO.2 (CAG GCC CTT C) the bend has Mw 110 bp can be considered as positive markers for *Cassida vittata* infestation. On other hand the band with Mw 85 bp can be considered as potential negative marker for *Cassida vittata* infestation.

Concerning the *Spodoptera littoralis* with primer NO.2 (CAG GCC CTT C) the bands with Mw 495 bp and 360 bp can be considered as positive markers for resistance to *Spodoptera littoralis.*

For *Pegomyia mixta* with primer NO.3, the bands with Mw 935 bp and 815 bp can be considered as potential negative markers for *Pegomyia mixta* infestation.

For *Pegomyia mixta* with primer NO.5, the band with Mw 605 bp can be considered as a positive marker for *Pegomyia mixta* infestation.

Concerning the eight genotypes with RAPD markers amplified using primer NO.6 (CTG CTG GGA C) the bend has Mw 353 bp can be considered as positive marker for *Cassida vittata* infestation.

Clustering of RAPD variations:

The genetic distance matrix was utilized for cluster analysis based on UPGMA. The dendrogram showed two major clusters. Cluster 1 and Cluster 2 were separated from a cluster1 of susceptible for insect infestation to Cluster 2 resistance for insect infestation.

2. Effect of different host plants on population density and monthly average number of the main insect pests:

The effect of the four host plants; Sugar beet, Fodder beet, Table beet and Chard on the infestation rate with the most serious insect pests; *Pegomia mixta*, *Cassida vittata* and *Scrobipalpa ocellatella* was studied in two sugar beet growing seasons; 2013/14 and 2014/15.

For the total monthly average number of *Pegomia mixta*, Fodder beet showed the highest average followed by Sugar beet; Table beet and Chard indicate the lowest average number for the seasons 2013-14 and 2014-15. Also the maximum population density of *P. mixta* reached its peak in Feb., and the lowest population density was recorded in April.

Concerning *Cassida vittata*, the Fodder beet harbored the is highest average number (2.78) followed by Sugar beet, Chard and Table beet which recorded 2.72, 0.92 and 0.45 average number for *Cassida vittata* respectively during season 2013-14. The same result found in the season 2014-15 with the no significant with fodder beet and sugar beet average number for *Cassida vittata* during season 2014-15. Also, data appeared that the highest population density was recorded in April, while the lowest population density was recorded in Feb.

Regarding *Scrobipalpa ocellatella* also, the Fodder beet is highest average number (1.78) followed by Sugar beet, Table beet and Chard which recorded 1.69, 1.22 and 0.09 insect of *Scrobipalpa ocellatella*, respectively during season 2013-14. The same result found in the season 2014-15. (1.88, 1.7, 1.36 and 0.12) for Fodder beet, Sugar beet, Table beet and Chard respectively. Also, data showed the highest population density was apper in March, while the lowest population density was found in April.

3. Role of added silica for Sugar beet plants in reducing some insect pest's infestation:

Sugar beet plants are severely attacked by *Cassida vittata* and *Scrobipalpa ocellatella*, the current investigation was conducted to test the role of silica in reducing infestation by *Cassida vittata* and *Scrobipalpa ocellatella* in sugar beet during 2013/2014 and 2014/2015 seasons.

Data indicated that the sugar beet plants treated with Magnesium silicate 3 g / L followed by Magnesium silicate 6 g / L showed the highest reduction percent of insect infestation during 2014 and 2015 seasons, whereas the all average of reduction for *Cassida vittata* 42.08 and 38.6% respectively. On the other hand, the all average of reduction for *Scrobipalpa ocellatella* was 69.05 and 50.79% for Sodium silicate 6 g / L followed by Sodium silicate 3 g / L respectively.

Concerning Si element for sugar beet leaves treated with Silica foliar spray showed the highest concentration for magnesium silicate treatment (0.83 and 0.63) for 6 g / L and 3 g / L respectively, and 0.43 for sodium silicate 3 g / L and 6 g / L.

Results revealed that Silica seems to enhance sugar beet plants in controlling the *Cassida vittata* and *Scrobipalpa ocellatell*a in sugar beet plants.

4. Effect of anhydrous ammonia on Sugar beet insects and their associated predators:

Effect of anhydrous ammonia on populations of seedling sugar beet insects and associated natural enemies was studied at Kafr El Sheikh region, El Ryaid district.

1- Colembolla:

Anhydrous ammonia levels were more effective in reducing the insect population after 10 and 20 days from treatment followed by 30, 40 and 50 days respectively.

Also, from the same data it can observed that the 90 unit/feddan of anhydrous ammonia level was more effective in reducing the insect populations (followed by 80 unit/ feddan and 70 unit/ feddan).

2- Crickets:

Results revealed that the total reduction of insects population was observed with all levels of ammonia after 10 and 20 days of application (0.00) insect / traps.

The percent of reductions were reached the highest, when ammonia applied by level of 90 unit/feddan (79.31%) and the lowest was recorded at 70 unit/ feddan (62.07%).

3- Cut worms:

Reductions values in insect population recorded, 80.65, 93.55 and 83.87 insect/trap when the soil treated by ammonia at 70, 80 and 90 unit/feddan, respectively.

The statically analysis revealed that there were significant differences between three levels of ammonia treatment. In the second season 2016/2017 the same similar results were found.

4- Predators population:

The average number of predators increased after 40 and 50 days from injection. On the other hand, reduction percent reached the highest value when the soil injected by 90 unit/fed. followed by 80 and 70 unit/fed. of ammonia, respectively.