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CHAPTER 5

SUMMARY

The present study was conducted at the Agricultural Experimental Farms of El-Nubaria and El-Sabahia Research Stations, Alexandria Governorate, during the subsequent growing seasons from 2005 up to 2008. In this work the main fragile insect and animal-pests attacking cantaloupe plants were surveyed and identified before the performance of insecticides application. For that purpose, six chemical compounds belonging to different groups were evaluated to be involved in an IPM program for managing and controlling the main pests of cantaloupe plants, i.e., *Aphids* spp. [*Aphis gossypii* (Glov.) and *Aphis craccivora* (Koch.)] (Homoptera : Aphididae), whitefly [*Bemisia tabaci* (Genn.)] (Homoptera: Aleyrodidae) leaf miners [*Lyriomyza* spp.] (Diptera : Agromyzidae); and both species of the red spider mites [*Tetranychus urticae* and *T. cinabarinus*] (Acarina : Tetranychidae) that severely attack cantaloupe plants. The evaluated chemical compounds were thiamethoxam (Actara®) and pymetrozine (Chess®), while the natural products were azadirachtin (Achook®), soyabean oil (Natural oil®), abamectin (Vertemic®) and milbemectin (Milbeknock®). Moreover, five tested natural fine dusts of the leaves of Kamphor (*Eucalyptus globules*), Lemon (*Citrus aurantifolia*), Orange (*Citrus sinensis*), Barnoof grass (*Conyza discoridis*) and Lantana (*Lantana camara*) compared with talc powder were evaluated against the abovementioned pests. Also, both of the natural compounds azadirachtin and soyabean oil and the fine dusts of Kamphor and Barnoof were tested consequent treatments against these pests attacking the cantaloupe plants.

5.1. Efficiency of tested and/or phytocompounds against the occurring pests on cantaloupe plants under low tunnels in 2005 and 2006 seasons.

5.1.1. Effect on inspected aphids [*Aphis gossypii* (Glov.) and *Aphis craccivora* (Koch.)].

5.1.1.1. Season 2005

1st application

thiamethoxam (Actara®) was proved to be the highly efficient tested chemicals against aphids population and gave high an average rate of reduction comprised 78.29% after 30 days post-application of 1st spray during the summer season of 2005, followed by soyabean oil (Natural oil®) (63.74%).

2nd application

Similar trend of results was also detected after the 2nd spray of the same chemicals. The superiority of thiamethoxam (Actara®) was also proved and resembled by a general mean of reduction which comprised 81.38% followed by soyabean oil (Natural oil®) (76.00%), pymetrozine (69.37%) and the least efficient one was azadirachtin (53.45%) when they were evaluated 10 days post-treatment.

5.1.1.2. Season 2006

1st application

During the summer season of 2006, the highest toxic efficiency on aphids was detected for thiamethoxam (Actara[®]) and soyabean oil (Natural oil[®]) which gave a merely similar high average rate of reduction comprised 76.74% and 76.40%, respectively.

2nd application

After the 2nd application of same tested chemicals, pymetrozine (Chess[®]) showed comparative and significant efficiency against the retreated aphids, followed by thiamethoxam (Actara[®]), soyabean oil (Natural oil[®]) and the least efficient compound was azadirachtin (Achook[®]), where the calculated significant residual value of pymetrozine (Chess[®]) after 10 days post treatment was 74.36% in comparison to that calculated one for each of the tested compounds thiamethoxam (Actara[®]), soyabean oil (Natural oil[®]) and azadirachtin (Achook[®]) (71.99%, 62.51% and 53.94%), respectively.

5.1.2. Effect on inspected whitefly (adults and immatures) [*Bemisia tabaci* (Genn.)]

5.1.2.1. Season 2005

5.1.2.1.1. Adults

1st application

The higher reduction percentage of whitefly adults was revealed for thiamethoxam (Actara[®]) which gave a high rate of reduction that reached 66.14% after 30 days post-treatment.

2nd application

Similar trend of results was also detected after the application of 2nd spray of the same chemicals used in 1st spray. The highest rate of whitefly adults reduction was revealed for thiamethoxam (Actara[®]) and resembled by a calculated general mean of reduction calculated by 81.69%, followed by pymetrozine (Chess[®]) (74.63%); soyabean oil (Natural oil[®]) (72.47%). The least efficient tested compound was azadirachtin (Achook[®]) (49.04%).

5.1.2.1.2. Immatures

1st application

Thiamethoxam (Actara[®]) was also proved to be the highly effective compound against the immatures of whitefly population giving a high rate of reduction comprised 67.54% during the 30 days post-application; followed by pymetrozine (Chess[®]) (59.73%), soyabean oil (Natural oil[®]) (53.91%) and azadirachtin (Achook[®]) (36.49%) which was the least efficient among the tested compounds.

2nd application

A same trend of results was also revealed after the application of 2nd spray of the tested compounds. The superior effectiveness of the thiamethoxam (Actara[®]) was also ascertained and resembled by the calculated general mean of reduction which was as high as 85.19%, followed by soyabean oil (Natural oil[®]) (78.75%); Pymetrozine (Chess[®]) (70.57%) and the least efficient one was azadirachtin (Achook[®]) (52.15%).

5.1.2.2. Season 2006

5.1.2.2.1. Adults

1st application

The results of the field experiments during the summer season of 2006 confirmed the efficient role of each of the tested chemicals and plant oil, which gave more or less a reduced value of a adult whitefly number on the treated cantaloupe plants. Thiamethoxam (Actara[®]), pymetrozine (Chess[®]) and soyabean oil (Natural oil[®]) proved to be the more efficient compounds tested against the whitefly adults population and gave a merely similar rate of reduction which comprised 68.15%, 68.40% and 70.01%, respectively.

2nd application.

The toxic efficacy of some tested chemicals after the performance of 2nd application was observed. The highest rate of the whitefly adults reduction (93.00%) was achieved using thiamethoxam (Actara[®]), followed by pymetrozine (Chess[®]) (88.17%) at the 3rd day and 83.31% for soyabean oil (Natural oil[®]) at the 1st day after retreatment. The least effective compound was azadirachtin (Achook[®]) which gave a reduction of adults as equal to 73.39% 3 days post-treatment compared with the other tested compounds. There were no significant differences between the tested compounds concerning their efficiency against retreated the whitefly adults, where the calculated insignificant residual values (general means) were 75.12, 77.83, 51.15 and 64.89% for thiamethoxam (Actara[®]), pymetrozine (Chess[®]), azadirachtin (Achook[®]) and soyabean oil (Natural oil[®]), respectively.

5.1.2.2.2. Immatures

1st application

The higher reduction percentage of the immature individuals of the whitefly was revealed using thiamethoxam (Actara[®]) throughout the elapsing period from 1st day up to 17 days post-treatment. Both of pymetrozine (Chess[®]) and soyabean oil (Natural oil[®]) were the most efficient tested compounds against the immatures of whitefly population and gave merely high rates of reduction comprised 73.42 and 72.19%, respectively, followed by thiamethoxam (Actara[®]) (69.24%) and azadirachtin (Achook[®]) (53.14%).

2nd application

After the performance of 2nd application of these tested compounds, the reduction of whitefly immatures was observed along the extended period from the 2nd till the 5th day post-application. Thiamethoxam (Actara[®]) showed a comparative significantly residual efficiency of 85.63% against the sprayed immatures of whitefly, followed by azadirachtin (Achook[®]) (74.88%), soyabean oil (Natural oil[®]) (71.51%) and then pymetrozine (Chess[®]) (68.81%).

5.1.3. Effect on inspected leaf miners [*Liriomyza trifolii* (Burg.)]

5.1.3.1. Season 2005

Most of the evaluated compounds were found to have a comparative less toxic effect against the leaf miners. Azadirachtin was efficient against the treated insect-pest (73.67% at the 7th day), compared to the other three tested compounds. Nevertheless, azadirachtin (Achook[®]) was proved to be an efficient compound tested against leaf miner population with an average rate of reduction comprised 56.54%. The least efficient compounds were

thiamethoxam (Actara[®]) and soyabean oil (Natural oil[®]) which gave the same rate of reduction (38.39 and 37.88%), respectively.

5.1.3.2. Season 2006

During the summer season of 2006, the results confirmed the previously detected lower effect of the tested chemicals and plant oils gained in the season of 2005. In a comparative less extent, all tested compounds reduced the number of the inspected leaf miners on the treated cantaloupe plants. The same trend of recorded values of efficiency of each compound, the period of reduction and average rate of reduction were merely identical to those deduced values in the season of 2005, whereas, azadirachtin (Achook[®]) was relatively the efficient tested one against the leaf miners population, followed by the other tested compounds soyabean oil (Natural oil[®]), pymetrozine (Chess[®]) and least effective one thiamethoxam (Actara[®]).

5.1.4. Effect on inspected spider mite [*Tetranychus urticae* (Koch.) and *T. cinabarinus* (Boisd.)]

5.1.4.1. Season 2005

Two days post-treatment, soyabean oil (Natural oil[®]) was found to be the most effective compound among all the running treatments since it gave a reduction percentage of 40.58%, followed by azadirachtin (Achook[®]) (35.67%). Thiamethoxam (Actara[®]) and pymetrozine (Chess[®]) were less efficient and indicated detectable increase in mites infestation at the beginning of the first two days post-treatment till the end of experimental period (17th day). On the other hand, soyabean oil gave the highest reduction average percentage followed by azadirachtin (Achook[®]) (64.62 and 45.18%, respectively).

5.1.4.2. Season 2006.

The highest toxic efficiency of soyabean oil (Natural oil[®]) against the spider mite was detected along the elapsing period 2nd day up to 17 days post-treatment, followed by azadirachtin (Achook[®]). The chemical compound pymetrozine (Chess[®]) was the least efficient, but thiamethoxam (Actara[®]) was entirely un toxic and un efficient against this animal-pest.

5.2. The drastic effect of the tested new chemicals on the prevailing insects in cantaloupe field during the growing seasons of 2005 and 2006.

5.2.1. Drastic effect on the biological agent, the lacewing, *Chrysopa* sp. (Schn.)

5.2.1.1. Season 2005

According to the general mean of residual reduction percentage throughout the inspection periods (1, 3, 5, 7 and 10 days after application), the effect of the tested compounds on the larvae and adults of the aphid lion (lacewing), *Chrysopa carnae* and *Chrysopa vulgaris*) indicated that thiamethoxam (Actara[®]) was the most toxic compound showing a negative side effect and giving 60.85% reduction percentage of that biological agent, while pymetrozine (Chess[®]) was in the 2nd rank giving a reduction of 52.56%. Soyabean oil (Natural oil[®]) came in the 3rd rank giving 44.83% reduction followed by azadirachtin (Achook[®]) giving 39.28%. Azadirachtin (Achook[®]) was the most harmless

compound which gave 39.28% reduction in the population of the lacewing throughout the period of investigation when it was compared with the other tested compounds.

5.2.1.2. Season 2006

During the season of 2006, the same trend of results was observed. Herein, thiamethoxam (Actara®) has the high drastic effect against the predatory aphid lion population and gave a high average rate of reduction (54.32%) after 10 days post spraying, followed by soyabean oil (Natural oil®) (50.96%). The less drastic compound was azadirachtin indicating a merely lower average rate of reduction of 45.76% of the control.

5.2.2. Drastic effect on solidier bugs, *Orius* sp.

5.2.2.1. Season 2005

All of the evaluated compounds were found to have a toxic effect on the predaceous bugs, whereas, higher hazardous reduction was extended along the elapsing period, especially from 5th up to 10th day post spraying. Soyabean oil (Natural oil®) and thiamethoxam (Actara®) exhibited the highest drastic effect against the population of the predatory bugs of *Orius* sp. with an average rate of reduction of 51.62% and 49.91%, in respect, followed by pymetrozine (Chess®) (43.83%) and the less hazardous azadirachtin (Achook®) (36.68%).

5.2.2.2. Season 2006

The same drastic effect of the same tested compounds was observed during the growing season of 2006. Soyabean oil (Natural oil®) and thiamethoxam (Actara®) showed the highest drastic effect against the population of the bugs of *Orius* sp. The general mean of residual reduction percentage throughout the elapsing period from 1st day up to 10th day from spraying were 61.73% and 58.27% for soyabean oil (Natural oil®) and thiamethoxam (Actara®) respectively, followed by pymetrozine (Chess®) 52.15% and the most harmless compound was azadirachtin (Achook®) which gave 46.14% reduction percentage.

5.3. Efficiency of five tested fine dusts of natural plants and talc powder against the prevailing homopterous insects attacking cantaloupe plants in greenhouse in nili season of 2007.

5.3.1. Effect on inspected adults and immature individuals of the whitefly.

5.3.1.1. Adults

1st application

The first application of the tested fine dusts of certain selected plant leaves gave more or less a weak variable reduction percentages of inspected adults of whitefly on those cantaloupe plants, treated with. For all of the tested plant dusts, the relative lower efficiency of each was detected in the 1st and 3rd day post-treatment. This efficiency was somewhat increased from the beginning of the 5th day till the 7th one, in particular for Kamphor fine dust, followed by Barnoof grass, showing a general mean of reduction ranged between 22.52-32.63% and 11.73-18.14%, in respect. The other tested fine dusts showed more decreased values of calculated averages of general reduction.

2nd and 3rd application

The same trend of results was revealed after the 2nd and 3rd applications of the same tested concentrations of those prepared fine dusts, whereas, the more increased percentages

of the whitefly adults reduction were recorded for Kamphor fine dust, followed by Lemon and Barnoof. These results were also confirmed by the calculated averages of general reduction for those plant fine dusts, which comprised 43.21 and 30.43%, 42.85 and 30.97% for Kamphor fine dust/talc powder (10% w/w) and crude fine dusts; 25.63% and 23.44%, 26.17 and 24.23% for Lemon and 22.32% and 23.29%, 25.99 and 30.20% for Barnoof, in respect. For talc powder alone, that average of general reduction amounted to 24.91% and 26.67% after the 2nd and 3rd application, respectively.

5.3.1.2. Immatures

1st application

The 1st application of each of the tested diluted fine dust with talc powder compared with the treatment of talc powder alone gave more or less weak variable reduction percentages of the immature individuals of whitefly. The efficiency somewhat increased, in particular for the tested Kamphor fine dust/talc powder mixtures giving a general mean of reduction of 21.21% for the crude fine dust, 24.08% and 25.05% for both its tested concentrations of 5 and 10%, in respect. One application of 5 and 10% Kamphor fine dust/talc powder (w/w) can give a limited efficient control ranging between 32.11% (in the 5th day) and 43.50% (in the 7th one) against the treated immature individuals of the whitefly.

2nd and 3rd application

The same trend of results was also detected after the 2nd and 3rd applications of the same tested dusts concentrations. Somewhat more increased percentages of reduction at the 7th day post-application of Kamphor fine dusts (32.97% and 36.12%) were recorded and that was followed by talc powder alone (29.12%), Lantana fine dust at 5% (w/w) (22.24%) and the tested Barnoof grass fine dust at 5% and 10% (w/w) (18.67% and 16.28%). The same trend was also detected after the 3rd dusting application. The increase of the calculated moderate efficiency of Kamphor dust at the 5th and 7th days after application was recorded. Talc powder alone was less efficient (28.42%) and the other least efficient fine dusts were Barnoof 5% w/w (36.22%), Lantana 5% w/w (32.14%) and Orange 5% (24.18%).

5.3.2. Effect on inspected leaf miners (1st, 2nd and 3rd application)

The results show the rather weak or negligible effect of the tested fine dusts at all tested rates of application. This weak efficiency showed a little increase, in a case of the tested 10% dilutions of Kamphor which recorded 17.63% and 25.45% as a general mean and Orange fine dusts with a general mean of reduction amounted to 13.30% and 14.65%, respectively. In addition, Barnoof fine dust at dilution rate of 5% showed also little increase of efficiency reached 14.38% and 18.88% post the 2nd and 3rd dusting applications.

5.4. Effect of different sequences of the tested plant oils and natural plant fine dusts against certain pests infesting cantaloupe plants under low tunnels in 2008 season.

Five different sequences composed of two tested plant oils (Achook[®] and Natural oil[®] [soyabean oil]) and two plant fine dusts (Kamphor and Barnoof) beside talc powder were applied to cantaloupe plants grown under low tunnels to evaluate their efficacy against those insect-pests and mites infesting the plants. Each sequence included three

materials one of them was an oil. For each sequence, the three component were applied one followed by the other at one hour intervals. Also, each sequence was applied for three times (30, 45 and 60 days post-sowing date).

5.4.1. Effect on inspected Aphids (*Aphis gossypii* (Golv.) and *Aphis craccivora* (Koch.))

The sequence represented in Achook[®]/Natural oil[®]/talc powder achieved highest efficacy during the 1st application and gave a reduction percentage of 58.77% as a general mean, while the 3rd sequence which represented as Achook[®]/Natural oil[®]/Kamphor came in the first order after 2nd and 3rd applications which gave the reduction percentages of 75.50% and 81.69% as a general mean, respectively.

5.4.2. Effect on inspected whiteflies (adults and immatures [*Bemisia tabaci* (Genn.)].

5.4.2.1. Adults

The 2nd sequence represented by Achook[®]/Natural oil[®]/talc powder, and also the 4th sequence represented by Achook[®]/Kamphor/Barnooof exhibited high efficacy against the whitefly adults that reduce their count amounted by 43.65% and 42.73%, respectively after the 1st application. In the 2nd application, the 3rd sequence represented by Achook[®]/Natural oil[®]/Kamphor exhibited the highest efficacy to whitefly adults scoring 83.51% as a general mean of reduction.

During 3rd application, the 2nd sequence represented by Achook[®]/Natural oil[®]/talc powder exhibited high efficacy against whitefly adults and recorded a high reduction percentage estimated by 81.58%.

5.4.2.2. Immatures

The results revealed the superiority of 2nd sequence (Achook[®]/Natural oil[®]/talc powder) which has been and resembled by a general mean of reduction comprised 45.89% against the whitefly immatures after the 1st application. The 3rd sequence containing Achook[®]/Natural oil[®]/Kamphor achieved superior efficacy after 2nd application giving the highest value estimated by a general mean of reduction that comprised 75.40%. After 3rd application, the 3rd sequence containing Achook[®]/Natural oil[®]/Kamphor was the best one that gave immatures reduction of 87.14%.

5.4.3. Effect on inspected leaf miners (*Lyriomiza* sp.)

According to the results, it was found that the 3rd sequence containing Achook[®]/Natural oil[®]/Kamphor achieved superior efficacy after three applications giving general mean reductions amounted to 46.62, 74.96 and 61.39%, respectively.

5.4.4. Effect on inspected spider mites [*Tetranychus urticae* (Koch.) and *T. cinabarrinus* (Boisd.)

Data show that the 5th, 4th and 3rd sequences achieved high and equal efficiency giving approximately same general mean values of 47.78%, 45.91% and 45.83% spider mites reduction after the 1st application, respectively. After the 2nd application, the 3rd sequence comprising of Achook[®]/Natural oil[®]/Kamphor gave the highest general mean reduction (86.74%). Regarding the general mean of performance percentage after the 3rd

application, the sequence of Achook[®]/Natural oil[®]/Kamphor came in the 1st rank giving a reduction of 81.91%, while the sequence of Achook[®]/Kamphor/Barnoof came in the 2nd order giving 80.34% and there were no significant differences between both of them.

5.5. Efficiency of two new compounds compared with thiamethoxam (Actara[®]) against the occurring pests on cantaloupe plantation

5.5.1. Effect on inspected aphids (*Aphis gossypii* (Golv.) and *Aphis craccivora* (Koch.)).

1st application

Thiamethoxam (Actara[®]) proved to be the highly efficient compound against aphids compared with the other tested compounds and giving a high value of general mean of reduction that comprised 84.02%, followed by the less calculated values of 59.21% and 57.53% for abamectin (Vertemic[®]) and milbemectin (Milbeknock[®]), regardly.

2nd application

The superiority of thiamethoxam (Actara[®]) was also proved and resembled the deduced value of general mean of reduction, which comprised 72.28%; followed by milbemectin (Milbeknock[®]) (64.11%) and the less efficient one was abamectin (Vertemic[®]) after 17 days post spray

5.5.2. Effect on inspected whiteflies (adults and immatures [*Bemisia tabaci* (Genn.)].

5.5.2.1. Adults

1st application

The higher reduction percentage of whitefly adults was revealed for thiamethoxam (Actara[®]) throughout the elapsing period from 1st day up to 30 days post-treatment. Thiamethoxam (Actara[®]) gave high value of general mean of reduction comprised 69.83, followed by the less calculated values of 48.80% and 46.19% for abamectin (Vertemic[®]) and milbemectin (Milbeknock[®]).

2nd application

The superiority of thiamethoxam (Actara[®]) was proved and resembled the deduced value of general mean of reduction, which comprised 76.31%, followed by abamectin (Vertemic[®]) (55.01%) and milbemectin (Milbecknock[®]) (51.25%) after 17 days post the 2nd spray application.

5.5.2.2. Immatures

1st application

Thiamethoxam (Actara[®]) was toxic and efficient against the immatures individuals of the whitefly population giving a high rate of reduction of 71.37% during 30 days post-application, followed by milbemectin (Milbeknock[®]) (50.42%) and the least efficient compound was abamectin (Vertemic[®]) (42.59%).

2nd application

Same trend of results was also revealed after the application of 2nd spray of the tested compounds. The superior effectiveness of thiamethoxam (Actara[®]) was also ascertained and resembled by the calculated general mean of reduction which amounted to 76.51%;

followed by milbemectin (Milbeknock[®]) (59.21%) and the least efficient one was abamectin (Vertemic[®]) (55.40%).

5.5.3. Effect on inspected leaf miners (*Lyriomiza* sp.)

2nd application

The infestation by the leaf miners was not considered except during the period the second half of growing season. Abamectin (Vertemic[®]) and milbemectin (Milbeknock[®]) were found to have the highest toxic effect against the leaf miner from the 2nd day post-application till the 17th day; and they indicated efficient reduction of the existing numbers of the leaf miner individuals that inspected on those treated plants giving a range of reduction of 56.48% to 70.12% in case of abamectin (Vertemic[®]) and 52.10% to 80.16% for milbemectin (Milbeknock[®]). Comparing the all tested compounds, thiamethoxam (Actara[®]) indicated a lower efficiency at the same period (2-17 days) amounted to 22.41% to 15.33%. Abamectin (Vertemic[®]) and milbemectin (Milbeknock[®]) proved to be the efficient tested compounds against leaf miners population with an average rate of reduction that comprised 74.72% and 71.99%.

5.5.4. Effect on inspected spider mites [*Tetranychus urticae* (Koch.) and *T. cinabarinus* (Boisd.)].

1st application

According the results it was found that, abamectin (Vertemic[®]) and milbemectin (Milbeknock[®]) were efficient compounds against the spider mites population and gave an average rate of significant reduction comprised 73.02% and 79.15%, respectively.

2nd application

Similar trend of obtained results post the performance of the 1st spray was attained after the 2nd application. The higher toxic efficiency of both tested abamectin (Vertemic[®]) and milbemectin (Milbeknock[®]) against the treated mites was observed in comparison to the revealed negligible toxic effect of thiamethoxam (Actara[®]). The calculated general mean of reduction was amounted to 75.21% and 84.39% for abamectin (Vertemic[®]) and milbemectin (Milbeknock[®]), in respect.

5.6. **Pest infestation susceptibility of seven tested cultivars of cantaloupe plants in greenhouse condition during summer season of 2006 and 2007.**

In general, all the evaluated varieties showed more or less an increased susceptibility to the infestation by each of the inspected pests throughout the seasons of 2006 and 2007. The variety Fayomi was the highest susceptible one to infestation with most inspected sucking pest i.e., aphids, whitefly, spider mites, thrips. In this concern, Primal variety showed highest susceptibility to both insect-pests, aphids and whitefly. The other tested varieties showed varied categories of measured susceptibility. On the contrarily, the tested variety, Koz-assel indicated a category of less high susceptibility to infestation of the four abovementioned sucking pests. Sandafa and/or Ideal varieties were less high sensitive to aphids, whitefly and/or thrips.

The susceptibility of tested cantaloupe varieties to the leaf miner and Jassaid infestation was differed and showed that variety-Ideal was the highest susceptible one

according to the occurring infestation during the season of 2006. Most of the other evaluated cantaloupe varieties, ranked variable categories from the higher susceptibility to the less high susceptibility of Mostader Matroh and Fayomi varieties in case of jassaid infestation, and of Primal and Koz-assel ones to the leaf miner infestation.