

**Menoufia University  
Faculty of Agriculture  
Entomology & Zoology Dept.**



# **The Biological Control of some Piercing Sucking Vegetable Pests in Plastic Houses**

**Thesis by**

**Wedyan Fathy Moslhy El-Madboh**

**B. Sc. Agricultural Sciences (Plant protection) Menoufia University, 2003**

**M. Sc. Agricultural Sciences (Economic entomology) Menoufia University, 2009**

**Submitted in Partial Fulfillment of the Requirements**

**For the Degree of**

**Doctor of Philosophy (Ph. D.)**

**in**

**Agricultural Sciences**

**(Economic Entomology - Biological Control)**

**Supervisory Committee**

**Prof. Dr. Makram B. Attia**

**Professor of Economic Entomology, Faculty of Agriculture, Menoufia University**

**Prof. Dr. Mohamed A .O.Kolaib**

**Professor of Economic Entomology, Faculty of Agriculture, Menoufia University**

**Prof. Dr. Mohamed Elameen M. Sweelam**

**Professor of Parasitology , Faculty of Agriculture, Menoufia University**

**Prof. Dr. Violette Shoukry Gurguis**

**Head Researcher, Plant Protection Institute, Agricultural Research Center.**

**2016**

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## SUMMARY

### **The Biological Control of some Piercing Sucking Vegetable Pests in Plastic Houses**

**Ph D Thesis by  
Wedyan Fathy Moslhy El-Madboh**

**Doctor of Philosophy (Ph. D.) (Economic Entomology- Biological Control)**

This work was conducted in a private farm and greenhouse located at the province of Shebin Elkom , Elmenoufia Governorate , Egypt, during 2012 , 2013, 2014 years. Four varieties of Common bean, *Phaseolus vulgaris* L. were cultivated at two plantations one in winter and the other at spring season for two successive years.

#### **The research points:**

#### **1- Effect of different biofertilizers on three piercing sucking pests:**

The effect of different bio-fertilizers ; organic fertilizers ; compost ; NPK in comparison with check treatment on the population density of aphid , *aphid gossypii* , white fly , *Bemisia tabaci* attacking , and the two spotted spider mite , *Tetranychus urticae* was studied along ten weeks for two years.

#### **1.1. Bemisia tabaci:**

- **Nebraska variety:** Results in the first year of study reported the presence of white fly as sedentary and movable stages on the four varieties along the study period. Least numbers of population densities was recorded at Phosphoren followed by Nitrobein and compost (8.2, 9.2 stage/5 leaf) (8.3, 10.1 stage/5 leaf) (10, 10.2 stage/5 leaf) comparison with (without treatment) (20.6, 22.5 stage/5 leaf) in plantation 1, 2 respectively. On the other hand, as for field experiments least numbers of population densities was recorded at Phosphoren followed by Nitrobein and compost comparison with (without treatment) (17.1,18.8 stage/5 leaf) (20.8,22.4 stage/5 leaf) (21.6, 22.5 stage/5 leaf) (33.7,36.5 stage/5 leaf) in 1,2 plantation respectively.

- **Samantha 2010 variety:** Obtained data from the first year of study declared the presence of white fly as sedentary and movable stages on the four varieties along the study. Least numbers of population density was recorded at Phosphoren followed by Nitrobein and compost (8.5, 8.6 stage/5 leaf) (9.2, 10.3 stage/5 leaf) (9.9, 9.7 stage/5 leaf) (15, 18.4 stage/5 leaf) in plantation 1, 2 respectively. On the other hand, as for field experiments least numbers of population densities was recorded at Phosphoren followed by Nitrobein and compost comparison with (without treatment) (30.2,27.2 stage/5 leaf) (13.7,15 stage/5 leaf) (22,18.5 stage/5 leaf) (22.9,21.5 stage/5 leaf) in plantation 1, 2 respectively.

- **Giza 6 variety:** Obtained data from the first year of study showed the presence of white fly as sedentary and movable stages on the four varieties along the study. Least numbers of population density was recorded at Phosphoren followed by Nitrobein and compost (18, 16.7 stage/5 leaf) (21.4, 19.5 stage/5 leaf) (22.3, 20.3 stage/5 leaf) (31.1, 28.2 stage/5 leaf) in plantation 1, 2 respectively. On the other hand, as for field experiments the least numbers of population density was recorded at Phosphoren followed by Nitrobein and compost comparison with check (36.8,33.7 stage/5 leaf) (17,15.3 stage/5 leaf) (19.5,16.9 stage/5 leaf) (20.5,17.4 stage/5 leaf) in plantation 1, 2 respectively.

- **Bronco variety:** Obtained data from the first year of study cleared the presence of white fly as sedentary and movable stages on the four varieties along the study. Least numbers of population density was recorded at Phosphoren followed by Nitrobein and compost (34.9, 31.5 stage/5 leaf) (20.6, 17.4 stage/5 leaf) (21.9, 19.1 stage/5 leaf) (22.7, 18.9 stage/5 leaf) in plantation 1, 2 respectively. On the other hand, as for field experiments the least numbers of population density was recorded at Phosphoren followed by Nitrobein and compost comparison with check (43.4,40.4 stage/5 leaf) (23.6,22.2 stage/5 leaf) (24.9,23.4 stage/5 leaf) (26.8,24.9 stage/5 leaf) in plantation 1, 2 respectively.



### 1.2. *Aphis gossypii*:

- **Nebraska variety:** Obtained data from the first year of study proved the presence of aphid stages on the four varieties along the study. Least numbers of population density was recorded at Phosphoren followed by Nitrobein and compost (9.7, 10.7 stage/5 leaf) (10.6, 11.4 stage/5 leaf) comparison with (without treatment) (19.5, 21.4 stage/5 leaf) in plantation 1, 2 respectively. On the other hand, as for field experiments the least numbers of population density was recorded at Phosphoren followed by Nitrobein and compost comparison with (without treatment) (22,26.8 stage/5 leaf) (11,12.1 stage/5 leaf) (12.1,13.2 stage/5 leaf) (12.7,14.2 stage/5 leaf) in plantation 1, 2 respectively.

- **Samantha 2010 variety:** Obtained data from the first year of study proved the presence of aphids stages on the four varieties along the study. Least numbers of population density was recorded at Phosphoren followed by Nitrobein and compost (23.4, 26.3 stage/5 leaf) (10.5, 11.9 stage/5 leaf) (11.2, 12.7 stage/5 leaf) (12, 13.6 stage/5 leaf) in plantation 1, 2 respectively. On the other hand, as for field experiments least numbers of population densities was recorded at Phosphoren followed by Nitrobein and compost comparison with (without treatment) (27.7, 30.5 stage/5 leaf) (12.5,13.5 stage/5 leaf) (13.7,16.5 stage/5 leaf) (14.9,17 stage/5 leaf) in plantation 1, 2 respectively.

- **Giza 6 variety:** Obtained data from the first year of study cleared the presence of aphid stages on the four varieties along the study. Least numbers of population densities was recorded at Phosphoren followed by Nitrobein and compost (10.7, 11.8 stage/5 leaf) (11.7, 13.4 stage/5 leaf) (13.2, 15.1 stage/5 leaf) (22.1, 27.7 stage/5 leaf) in plantation 1, 2 respectively. On the other hand, as for field experiments least numbers of population densities was recorded at Phosphoren followed by Nitrobein and compost comparison with (without treatment) (26.8,29.8 stage/5 leaf) (12.4,13.8 stage/5 leaf) (13.8,15.7 stage/5 leaf) (15.6,17.1 stage/5 leaf) in plantation 1, 2 respectively.

- **Bronco variety:** Obtained data from the first year of study proved the presence of aphid stages on the four varieties along the study. Least numbers of population density was recorded at Phosphoren followed by Nitrobein and

compost (25.2, 28.9 stage/5 leaf) (11, 13 stage/5 leaf) (12.2, 14.4 stage/5 leaf) (14.5, 16.6 stage/5 leaf) in plantation 1, 2 respectively. On the other hand, as for field experiments least numbers of population density was recorded at Phosphoren followed by Nitrobein and compost comparison with (without treatment) (31.1,29.4 stage/5 leaf) (12.9,14.8 stage/5 leaf) (14.3,16.6 stage/5 leaf) (16.6,18.1 stage/5 leaf) in plantation 1, 2 respectively.

### **1.3. *Tetranychus urticae*:**

- **Nebraska variety:** Obtained data from the first year of study cleared the presence of mite stages on the four varieties along the study. Least numbers of population density was recorded at Phosphoren followed by Nitrobein and compost comparison with (without treatment) (131.6, 113 stage/5 leaf) (70.3, 82.5 stage/5 leaf) (74.8, 80.1 stage/5 leaf) (80, 92.5 stage/5 leaf) in plantation 1, 2 respectively. On the other hand, as for field experiments least numbers of population density was recorded at Phosphoren followed by Nitrobein and compost comparison with (without treatment) (142.9,164.8 stage/5 leaf) (81.7,95.8 stage/5 leaf) (80.2,92.5 stage/5 leaf) (88.4,100.6 stage/5 leaf) in plantation 1, 2 respectively.

- **Samantha 2010 variety:** Obtained data from the first year of study cleared the presence of mites stages on the four varieties along the study. Least numbers of population density was recorded at Phosphoren followed by Nitrobein and compost (102.2, 123.1 stage/5 leaf) (71.6, 82.1 stage/5 leaf) (67.7, 80.9 stage/5 leaf) (71.6, 87.4 stage/5 leaf) in plantation 1, 2 respectively. On the other hand, as for field experiments least numbers of population density was recorded at Phosphoren followed by Nitrobein and compost comparison with check (128.6,152.8 stage/5 leaf) (71.7,85 stage/5 leaf) (69.4,86.7 stage/5 leaf) (81.1,92.7 stage/5 leaf) in plantation 1, 2 respectively.

- **Giza 6 variety:** Obtained data from the first year of study cleared the presence of mite stages on the four varieties along the study. Least numbers of population densities was recorded at Phosphoren followed by Nitrobein and compost (113.5, 136.2 stage/5 leaf) (70, 84.9 stage/5 leaf) (70, 82.3 stage/5 leaf) (77.3, 83.2 stage/5 leaf) in plantation 1, 2 respectively. On the other hand,

as for field experiments least numbers of population densities was recorded at Phosphoren followed by Nitrobein and compost comparison with (without treatment) (124.4,158.1 stage/5 leaf) (77.9,91.2 stage/5 leaf) (70,91.6 stage/5 leaf) (84.2,99.2 stage/5 leaf) in plantation 1, 2 respectively.

- **Bronco variety:** Obtained data from the first year of study cleared the presence of mite stages on the four varieties along the study. Least numbers of population density was recorded at Phosphoren followed by Nitrobein and compost comparison with (without treatment) (119.2, 140.1 stage/5 leaf) (88.9, 94.7 stage/5 leaf) (83.5, 95.4 stage/5 leaf) (90.2, 104.2 stage/5 leaf) in plantation 1, 2 respectively. On the other hand, as for field experiments least numbers of population densities was recorded at Phosphoren followed by Nitrobein and compost comparison with check (153.6,171.6 stage/5 leaf) (78.6,91.2 stage/5 leaf) (78.9,92.4 stage/5 leaf) (89.4,103.9 stage/5 leaf) in plantation 1, 2 respectively.

## **2- The population density of the predator, *Coccinella undecimpunctata*.**

No individuals of the predator were recorded at the last week of January in the tested varieties under study. The beginning of the appearance of the predator was registered in the end of November month and increase gradually until recorded the highest population in the first week of December on (Samantha 2010, Giza 6, Bronco) (30, 31, 35), respectively under shield conditions in the plantation 1, the first year. On the other hand the highest population recorded on bronco variety in the begging of December, while the least population recorded in the last of January (6, 7, 9) on (Samantha 2010, Giza 6, Bronco) respectively.

Data in plantation 2 in the second year recorded high population in the last half of April on (Giza 6 and Bronco) (25 and 28) respectively on shield conditions while the least population was recorded in the last half of February on (Nebraska and Samantha 2010) (14 and 16) respectively. As for open field, the highest population recorded on the last half of April on (Giza 6 and Bronco)

(30 and 33) respectively. The least population recorded in the end of February on (Samantha 2010 and Nebraska) (16 and 17) respectively.

### **3- Decrease percentages of different pests as influenced by the application of treatments.**

#### **3.1. Bemisia tabaci:**

- **Nebraska variety:** the highest decrease percentages were recorded at Phosphoren and Nitrobein (51.7, 51.1%) followed by compost (41.1%), while the least decrease percentages recorded on NPK (18.2%) comparison with plants without treatments in plantation 1 under shield condition. P 2 the highest decrease percentages recorded on Phosphoren and Nitrobein (54, 59.5)%, while the least decrease recorded on NPK (28%). As for open field, the highest decrease percentages recorded on Phosphoren and Nitrobein (48.4, 38.6%) and the compost (36%) respectively. While the least decrease percentages recorded (21%) on NPK in plantation 1. P2 the highest decrease percentages recorded on Phosphoren (48.4, 38.6%) and the compost (35.3%), While the least decrease percentages recorded (19.7%) on NPK.

-**Samantha 2010 variety:** the highest decrease percentages were recorded at Phosphoren and Nitrobein (43, 38.6 %) followed by compost (35.3%), while the least decrease percentages recorded on NPK (14%) comparison with plants without treatments in plantation 1 under shield condition. P 2 the highest decrease percentages recorded on Phosphoren and Nitrobein (53.2, 44%), while the least decrease recorded on NPK (26.08%). As for open field, the highest decrease percentages recorded on Phosphoren and Nitrobein (44.1, 31.1%) and the compost (20.1%) respectively. While the least decrease percentages recorded (15%) on NPK in plantation 1. P2 the highest decrease percentages recorded on phosphoren (42.1, 27.15%) and the compost (24.17%), While the least decrease percentages recorded (12.5%) on NPK.

-**Giza 6 variety:** The highest decrease percentages were recorded at Phosphoren and Nitrobein (41, 31%) followed by compost (28%), while the least decrease percentages recorded on NPK (18%) comparison with plants without treatments in plantation 1 under shield condition. At second plantation,

the highest decrease percentages recorded on Phosphoren and Nitrobein (42.12, 41%) , while the least decrease was recorded at NPK (23.15%). As for open field, the highest decrease percentages were recorded at the treatments of Phosphoren and Nitrobein (55, 50%) and the compost (48.36%) respectively, while, the least decrease percentages were recorded at NPK treatment (25.22%) in plantation 1. The highest decrease percentages were recorded at Phosphoren (54, 47%) and the compost (44.29%), while the least decrease percentage was recorded at NPK treatment (26%).

**-Bronco variety:** The highest decrease percentages were recorded at Phosphoren and Nitrobein (45, 39.36 %) followed by compost (40%), while the least decrease percentage was recorded at NPK (15%) comparison with check in plantation 1 under shield condition. As for P 2, the highest decrease percentages recorded with Phosphoren and Nitrobein (41, 37.24%) , while the least decrease recorded at NPK (20%). As for open field, the highest decrease percentages recorded on Phosphoren and Nitrobein (45.04, 42.7%) and the compost (38.36%) respectively, while, the least decrease percentage was recorded at NPK (33%) in plantation 1. As for P2, the highest decrease percentages were recorded on Phosphoren (46, 43%) and the compost (38.24%), while the least decrease percentage was recorded at NPK (26.26%).

### **3.2. *Aphis gossypii*:**

**-Nebraska variety:** The highest decrease percentages were recorded with Phosphoren and Nitrobein (50.25, 46 %) followed by compost (43.07 %), while the least decrease percentage was recorded at NPK (27%) comparison with check in plantation 1 under shield condition. As for P 2 the highest decrease percentages were recorded with Phosphoren and Nitrobein (50, 47 % ), while the least decrease was recorded with NPK (26.16 %). As for open field, the highest decrease percentages were recorded with Phosphoren and Nitrobein (40, 47.01%) and the compost (36%) respectively. The least decrease percentage was recorded at NPK (17%) in plantation 1. As for P2, the highest decrease percentages were recorded with Phosphoren (55, 45%) and

the compost (42.27%), while the least decrease % was recorded at NPK (25%).

**-Samantha 2010 variety:** the highest decrease percentages were recorded at phosphoren and Nitrobein (55.12, 52.13 %) followed by compost (49 %), while the least decrease percentages recorded on NPK (32.47 %) comparison with plants without treatments in plantation 1 under shield condition. P 2 the highest decrease percentages recorded on Phosphoren and Nitrobein (55, 52)%, while the least decrease recorded on NPK (30.41%). As for open field, the highest decrease percentages recorded on Phosphoren and Nitrobein (55, 51%) and the compost (46.20 %) respectively. The least decrease percentages recorded (25.27%) on NPK in plantation 1. As for P2 the highest decrease percentages were recorded with Phosphoren (56, 46 %) and the compost (44.26%), while the least decrease percentage was recorded at NPK (22%).

**-Giza 6 variety:** the highest decrease percentages were recorded at Phosphoren and Nitrobein (54, 49.35%) followed by compost (43%), while the least decrease percentages recorded at NPK (26%) compared with check in plantation 1 under shield condition. As for P2, the highest decrease percentages were recorded with Phosphoren and Nitrobein (57.40, 52 %), while the least decrease recorded with NPK (29 %). As for open field, the highest decrease percentages were recorded with Phosphoren and Nitrobein (54, 48.50 %) and the compost (42 %) respectively, while the least decrease percentage was recorded at NPK (20%) in plantation 1. As for P2, the highest decrease percentages were recorded with Phosphoren (54, 47.31 %) and the compost (43 %), while the least decrease % was recorded at NPK (18.12%).

**-Bronco variety:** The highest decrease percentages were recorded at Phosphoren and Nitrobein (56.34, 52 %) followed by compost (42.46 %), while the least decrease percentage was recorded at NPK (20.23 %) compared with check treatment in plantation 1 under shield condition. As for P 2, the highest decrease percentages were recorded with Phosphoren and Nitrobein (55.01, 50.17 %), while the least decrease was recorded at NPK (21.10 %). As for open field, the highest decrease percentages were recorded with Phosphoren

and Nitrobein (56.12, 51.36 %) and the compost (44 %) respectively. While the least decrease percentages recorded (22%) on NPK in plantation 1. As for P2 the highest decrease percentages were recorded with Phosphoren (52.41, 47 %) and the compost (35.3%), while the least decrease percentage was recorded at NPK (16 %).

### 3.3. *Tetranychus urticae*:

**-Nebraska variety:** The highest decrease percentages were recorded at Phosphoren and Nitrobein (38, 3%) followed by compost (29.2 %) while the least decrease percentage was recorded at NPK (5.4 %) compared with check in plantation 1 under shield condition. As for P 2, the highest decrease percentages were recorded with Phosphoren and Nitrobein (37.3, 39.1%) , while the least decrease recorded at NPK (8 %). As for open field, the highest decrease percentages were recorded with Phosphoren and Nitrobein (43 %) and the compost (38.1%), while the least decrease percentage was recorded at NPK (11.4 %) in plantation 1. As for P2, the highest decrease percentages were recorded with Phosphoren (42, 44%) and the compost (39%), while the least decrease percentage was recorded at NPK (13.3 %).

**-Samantha 2010 variety:** The highest decrease percentages were recorded at Phosphoren and Nitrobein (30, 34%) followed by compost (30%), while the least decrease percentage was recorded at NPK (6%) compared with check treatment in plantation 1 under shield condition. As for P 2, the highest decrease percentages were recorded with Phosphoren and Nitrobein (33.3, 34.8%) , while the least decrease was recorded at NPK (8%). As for open field, the highest decrease percentages were recorded with Phosphoren and Nitrobein (44.2 , 46 %) and the compost (37 %). The least decrease percentage was recorded with NPK (9 %) compared with check in plantation 1. As for P2, the highest decrease percentages were recorded with Phosphoren (54, 43.3%) and compost (39.3 %), while the least decrease percentage was recorded with NPK (7 %).

**-Giza 6 variety:** The highest decrease percentages were recorded at Phosphoren and Nitrobein (38.3, 38.3 %) followed by compost (32%), while

the least decrease percentage was recorded at NPK (10.4%) compared with check in plantation 1 under shield condition. As for P 2, the highest decrease percentages were recorded with Phosphoren and Nitrobein (38, 40%) , while the least decrease was recorded at NPK (8.4 %). As for open field, the highest decrease percentages were recorded with Phosphoren and Nitrobein (37.4, 44%) and compost (32.3 %) respectively. The least decrease percentage was recorded with NPK (4%) in plantation 1. As for P2, the highest decrease percentages were recorded on Phosphoren (42.3, 42 %) and compost (20.25%), while the least decrease percentage was recorded with NPK (3%).

**-Bronco variety:** The highest decrease percentages were recorded at Phosphoren and Nitrobein (25.4, 30 %) followed by compost (24.3%), while the least decrease percentage was recorded with NPK (4.2%) compared with check in plantation 1 under shield condition. As for P 2, the highest decrease percentages were recorded with Phosphoren and Nitrobein (32.4, 3 %) , while the least decrease was recorded with NPK (2%). As for open field, the highest decrease percentages were recorded with Phosphoren and Nitrobein (49, 5 %) and the compost (42%) respectively. The least decrease percentage was recorded with NPK (8 %) in plantation 1. As for P2, the highest decrease percentages were recorded with Phosphoren (47, 46.2%) and compost (39.5%), while the least decrease percentage was recorded with NPK (8 %).

#### **4- Effect of bio-fertilizers on the green yield of four bean varieties under shield and field conditions.**

At shield conditions, the obtained data indicated that the highest overall increase percentages in green yield weights were recorded with the treatments of Phosphoren, Nitrobein and compost giving (81, 99.4, 91 % P1),(139.5,101,113 % P2) respectively , while the least weights of green yield recorded at NPK treatment (45.5 % P1,68 % P2). At open field conditions, the obtained data indicated that the highest overall increase percentages in green yield weights were recorded with the treatments of Phosphoren, Nitrobein and compost giving (74, 83.3, 85.6 % P1),(136.5,119,131 % P2) respectively ,



while the least weights of green yield recorded at NPK treatment (30 % P1,49.3 % P2)

**5- The effect of leaf phenol contents on the degree of infestation by sucking piercing insects.**

The obtained results indicated that biofertilizers activate and increase the ability of plants to produce more of the total phenol, moreover there were negative correlation between the phenol compounds and the infestation with harmful insects especially sucking piercing ones.

The obtained results recommend that bio fertilizer applications to vegetable plants especially leguminous plants, successively decrease insect populations and eliminate the need to chemical pesticides, leading to clean agriculture and safe vegetable crops.

**6- The effect of different release levels of the predatory, *Coccinella undecimpunctata* on the target insects.**

The highest reduction percentages of preys were recorded four weeks after releasing. The grand mean reduction percentages, of aphid and whitefly stages, along ten weeks of releasing, were 38.24, 45.86, and 49.68 % for the treatments of 5, 10, and 15 newly hatched larva/plant, respectively under shield conditions. As for open field, the grand mean reduction percentages of aphid and whitefly stages along ten weeks of releasing were 38.0, 39.9, and 40.9 % for the treatments of 5, 10, and 15 newly hatched larva/plant, respectively.