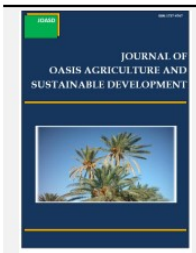

JOURNAL OF OASIS AGRICULTURE AND SUSTAINABLE DEVELOPMENT

www.joasdjournal.org

JOASD

p-ISSN: 2724 – 699X
e-ISSN: 2724-7007

Effectiveness of Flonicamid 50 wg against *Bemisia tabaci* (Genn.) under greenhouse conditions in Tunisia.

Besma Hamrouni Assadi*[1,2], Sabrine Chouikhi[1] & Mohamed Sadok Belkadhi[1,2]

[1] *Dryland and Oases Cropping Laboratory, Arid Regions Institute, Street El Jorf, 4119 Medenine, Tunisia*[2]
[2] *Technical Center for Protected and Geothermal Crops (CTCPG Gabes Tunisia)*

Article info

Article history:
Received 08/03/2022
Accepted 16/06/2022

Keywords: *Bemisia tabaci*, IPM, geothermal greenhouses, southern Tunisia

*** Corresponding author**
bessadi_27@yahoo.fr

Conflict of Interest : The authors declare no conflict of interest.

Abstract

Flonicamid is a systemic insecticide that acts as a feed blocker with potential use against whiteflies in an IPM program. The efficacy of flonicamid against populations of *Bemisia tabaci* in geothermal greenhouses in southern Tunisia. Flonicamid was tested in irrigation and foliar spraying on a greenhouse tomato crop. The use of the insecticide in irrigation or foliar spraying showed significant insecticidal activity on eggs, larvae and adults of *B. tabaci*. They are comparable to those caused by the reference insecticide confidor and different from those of the control on the different stages of development of *B. tabaci*. It is advisable to use flonicamid in an integrated pest management program in a heated greenhouse.

1. INTRODUCTION

The sweetpotato whitefly, *Bemisia tabaci*, Gennadius (Hemiptera: Aleyrodidae) is among one of most economically important insect pests of various vegetable crops under greenhouse in the southern Tunisia. It damages plants directly by feeding and indirectly by vectoring plant viruses (Sparks et al. 2013). *B. tabaci* is recognized as a species complex which includes at least 31 cryptic species (Qin *et al*., 2013). The chemical control has been the most effective tool to control these insect-pests (Jech and Husman, 1998). While different approaches have been developed to control *B. tabaci*, such as biological control (Liu et al. 2015), physical control (Nyoike and Liburd 2010), and genetic methods (Mishra et al. 2016), chemical control through insecticides remains the primary method for suppressing *B. tabaci* (Caballero et al. 2015). Though, chemical control is effective but frequent and injudicious use of insecticides has led the development of resistance in insect-pests. Among chemicals, now-a-days, the neonicotinoids are the most widely used insecticides against sucking insect-pests. They are systemic in action, passing through plant tissues and protecting all parts of the crop, and are widely applied as seed dressings. Neonicotinoids are relatively safe for use around people, animals and the environment (Wakita et al., 2003).

2. MATERIAL AND METHODS

2.1. Experimental method

A tomato crop (solanum lycopersicum) under greenhouse of 9 × 30 m located in Ben ghilouf Tunisia-Gabès, naturally infested by *B. tabaci*: was chosen to test the effect of 2 insecticides compared to confidor and an untreated control. It is an early crop in a monotunnel greenhouse with an area of 500 m2, conducted in conventional mode. During the trial, the farmer agreed to stop the treatments against the whitefly.

The tests were conducted according to the device in completely random blocks represented by a crop line, each block was divided into four elementary plots of 15 meters in length. The

lines chosen avoiding the border lines. During the treatments, the plots were isolated from each other by a 2m / 2m plexiglass plate. Within the blocks, the elementary plots are each treated with a product according to the pre-established system.
The dose applied is 160 g/ha according to the indications required, representing a pre-harvest duration (DAR) of 3 days.

2.2. Treatments

The treatments took place during the period from April 2 to May 15, 2019. The treatments applied in the tomato greenhouse are:
T1: Control (without treatment).
T2: Flonicamid 500 g/kg by foliar spray
T3: Flonicamid 500 g/kg by drip irrigation
T4: Foliar treatment of plants with "Confidor" at a dose of 50 ml/hl.
The irrigation treatment required the installation of a specific network that was installed during the treatment. This network has been designed in such a way that the treatment product only touches the plots indicated for the product in question.
Sampling was carried out each week as follows: for each elementary plot four plants were chosen at random and for each plant three leaves were taken, one from the lower part, one from the middle part and the other from the upper part. top of the plant. Each sample was put in a plastic bag, accompanied by a label which indicates its arrangement in relation to the plant, the row number and the block number. Subsequently, these samples are kept at 4°C until observation under a binocular magnifying glass.
The first sampling was carried out before the treatments to assess the level of infestation at the start of the trial and to compare the effect of the products tested by referring to the level of the population before treatment. Four sampling spaced 7 days intervals were conducted. Immediately after collection, the leaves were examined in the laboratory under binocular loupe to count the number of individuals of egg, larvae and adult stages by identifying the dead individual.
The evaluation of the efficacy of the products was based on the calculation of the percentage of mortality at the level of the different stages of development of *B. tabaci.*

Mortality percentage = (Number of dead individuals / Total number of individuals)*100

2.3. Statistical analyses

For variance analysis (ANOVA), egg, larval populations of the whitefly, against *B. tabaci*, were subjected to unidirectional analysis associated with a Tukey HSD test ($p < 0.05$) using the XLSTAT 2019 software, Microsoft Excel.

3. RESULTS AND DISCUSSION

3.1. Evaluation of the effect of insecticides on *B. tabaci* eggs

The evaluation of the effect of treatments on eggs, larvae and adults of *B. tabaci* is based on the calculation of mortality rates caused by insecticides for six weeks. Table 1 shows the effect of the two treatments to be tested, Flonicamid used in irrigation (T3) and Flonicamid in foliar spraying (T2) compared to the reference insecticide Confidor (T4) and the control (T1) on the eggs. of the whitefly *B. tabaci* along tracking. The comparison of the average mortality of the treatments shows that the three pesticides tested are effective on the eggs of *B. tabaci* compared to the untreated control which causes mortality rates not exceeding 2.292% along the test. Statistical analysis shows that the three insecticides have a comparable effect from the first week of treatment. The egg mortality rates caused by Flonicamid in foliar spraying and

Table 1. Mortality caused insecticides on *B. tabaci* eggs

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Flonicamid by drip irrigation	67.582a	60.472a	60.790a	63.325a	66.720a	68.207a
Flonicamid by foliar spray	65.617a	62.169a	63.860a	50.304a	70.914a	73.589a
Confidor	62.952a	68.000a	59.633a	61.034a	71.412a	67.245a
Control	1.974b	2.292b	1.245b	1.566b	1.870b	1.601b
Pr> F (Model)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Significant	Oui	Oui	Oui	Oui	Oui	Oui
Pr> F (Treatment name)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Significant	Oui	Oui	Oui	Oui	Oui	Oui

Flonicamid in irrigation are significant, reaching respectively 73.589% and 68.207% at the sixth week of treatment. There is no significant difference between the mortality rates of *B. tabaci* eggs caused by Flonicamid by changing the mode of application.

3.2. Evaluation of the effect of insecticides tested on *B. tabaci* larvae

The effect of pesticides on *B. tabaci* larvae is assessed by calculating mortality rates caused by insecticides for six weeks. Table 2 shows the effect of the two treatments to be tested, Flonicamid used in irrigation (T3) and Flonicamid in foliar spraying (T2) compared to the reference insecticide Confidor (T4) and the control (T1) on the larvae. of the whitefly B. tabaci along tracking. The analysis of variance shows that the three insecticides are effective against B. tabaci larvae causing mortality rates exceeding 49.479% when compared to those caused by the untreated control which remain below 7.292% along the test. The three insecticides have a strong and comparable effect on the larvae during the first five weeks. At the sixth week, Flonicamid in irrigation has the highest insecticidal effect on the larvae with a mortality rate of 70.662% followed by Flonicamid in foliar spraying (68.408%) then by confidor (53.058%).

3.3. Evaluation of the effect of the insecticides tested on adults of *B. tabaci*

The evaluation of the effect of insecticides on *B. tabaci* adults is based on the calculation of mortality rates caused by insecticides for six weeks. Table 3 shows the effect of the two treatments to be tested, Flonicamid used in irrigation (T3) and Flonicamid in foliar spraying (T2) compared to the reference insecticide Confidor (T4) and the control (T1) on adults. of the whitefly *B. tabaci* along tracking. The comparison of the average mortality of the treatments shows that the three pesticides tested are effective compared to the untreated control which causes adult mortality rates that do not exceed 11.458% along the test. Statistical analysis shows that the three insecticides have a comparable effect on adults throughout the trial

Table 2: Mortality caused insecticides on *B. tabaci* larvae

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Flonicamid by drip irrigation	60.472a	49.479a	51.563a	52.083a	62.321a	70.662a
Flonicamid by foliar spray	62.169a	59.167a	66.979a	58.787a	60.104a	68.408a
Confidor	68.000a	37.604a	69.896a	43.229a	59.707a	53.058a
Control	2..292b	3.125b	1.563b	7.292b	5.417b	4.390b
Pr> F (Model)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Significant	Oui	Oui	Oui	Oui	Oui	Oui
Pr> F (Treatment name)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Significant	Oui	Oui	Oui	Oui	Oui	Oui

Table 3: Mortality caused insecticides on *B. tabaci* adults

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Flonicamid by drip irrigation	67.582a	61.458a	78.229a	74.375a	58.973a	71.354a
Flonicamid by foliar spray	65.617a	59.464a	57.500a	64.479a	64.955a	47.396a
Confidor	62.952a	71.250a	76.667a	58.646a	55.816a	71.324a
Control	1.974b	6.771b	6.250b	9.375b	11.458b	3.125b
Pr> F (Model)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Significant	Oui	Oui	Oui	Oui	Oui	Oui
Pr> F (Treatment name)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Significant	Oui	Oui	Oui	Oui	Oui	Oui

except for the third and sixth weeks when flonicamid irrigation is the most effective.

4. CONCLUSION

It emerges from these trials that the insecticides tested, Flonicamid used in irrigation and Flonicamid in foliar spraying, lead to high mortality rates of eggs, larvae and adults throughout the trial. They are comparable to those caused by the reference insecticide confidor (T4) and different from those of the control (T1) on the different stages of development of *B. tabaci.* It is advisable to use flonicamid in an integrated pest management program in a heated greenhouse. When the population of *B. tabaci* consists mainly of adults, it is recommended to use Flonicamid in irrigation.

REFERENCES

Caballero, R. J., Farhi, E., & Gourinchas, P. O. (2015). Global imbalances and currency wars at the zlb.

Jech, L. E., & Husman, S. H. (1998). Voluntary area-wide whitefly monitoring project implementation 1195-1997 Gila Bend, Arizona. *Journal of Environmental Sciences (China) English Ed*, 1084-1087.

Mishra, P., & Chan, D. C. (2016). Metabolic regulation of mitochondrial dynamics. *Journal of Cell Biology*, *212*(4), 379-387.

Nyoike, T. W., & Liburd, O. E. (2010). Effect of living (buckwheat) and UV reflective mulches with and without imidacloprid on whiteflies, aphids and marketable yields of zucchini squash. *International Journal of Pest Management*, *56*(1), 31-39.

Qin, L., Pan, L. L., & Liu, S. S. (2016). Further insight into reproductive incompatibility between putative cryptic species of the Bemisia tabaci whitefly complex. *Insect science*, *23*(2), 215-224.

Sparks, T. C., Watson, G. B., Loso, M. R., Geng, C., Babcock, J. M., & Thomas, J. D. (2013). Sulfoxaflor and the sulfoximine insecticides: chemistry, mode of action and basis for efficacy on resistant insects. *Pesticide Biochemistry and Physiology*, *107*(1), 1-7.

Wakita, T., Kinoshita, K., Yamada, E., Yasui, N., Kawahara, N., Naoi, A., ... & Kodaka, K. (2003). The discovery of dinotefuran: a novel neonicotinoid. *Pest Management Science: formerly Pesticide Science*, *59*(9), 1016-1022.