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Study of the influence of biological inputs of plant origin on the entomofauna of tomatoes

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***Abstract*—** This study focused on the evaluation of two bio fertilisers, compost, seaweed extract compared to a mineral fertilization based on fertilizer type 15-15-15, urea and potassium sulphate on the availability and abundance of pests and auxiliaries on the tomato variety Alexandra F1 grown under greenhouse. The objective is to identify the most effective biofertilizer on the reduction of the main bioaggressors and the promotion of their auxiliaries. Our study, which lasted 2 months, allowed us to make seven observations of the entomaufaune captured with yellow traps at the greenhouse tomato culture of the faculty of natural sciences in Blida . The results of the biofertilizers show that the chemical fertilizer shows an important activity towards compost and algasmar in relation to the relative abundance of species. All relative abundances of the taxa of pests encountered exceed those of the control. The highest relative abundance is found in the Aleyrodidae, Aphididae, Cicadellidae and Thripidae regardless of the fertilisation treatment carried out.A low proportion of parasitoids including Ichneumonidae, Braconidae, Ceraphronidae, Platygastridae, Mymaridae and Scelionidae were observed in a greenhouse without any phytosanitary treatment. The polyphagous predatory Coccinellidae were captured with a very small number also. Keywords: Organic fertilizers, compost , tomato , pests , parasitoids .

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I. Introduction

The tomato (Solanum lycopersicum L.) belongs to the Solanaceae family. This plant is grown all over the world, in very different altitudes and latitudes. It is the third most produced vegetable in the world after potatoes and sweet potatoes, and the second most consumed (De Broglie and Guéroult, 2005). Biological protection and integrated crop protection are based on the use of different types of preventive and curative methods (Tabone et al., 2012) and have been used on tomatoes since the 1980s (Trottin et al., 2012). Adequate fertilisation is a prerequisite for modern agriculture, in order to be able to satisfy high yields with optimal crop quality. The industrial revolution in fertilization has produced exceptional results through the use of synthetic products, commonly known as chemical inputs. The massive use of fertilizers and pesticides is recognized as having adverse effects on ecosystems, and on the sustainable management of bio-aggressors through the emergence of resistance (Aubertot et al., 2005), and human health (Horrigan et al., 2002). To this end, many farmers have become increasingly aware of and interested in their health and the environment, applying an agriculture that collaborates with nature and tries as much as possible to save their resources (Hull et al.,

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1975). Organic fertilizers provide minerals, soil structuring compounds, and improve water retention as well as some stimulating properties of the natural defenses of plants as they promote resistance against biotic and abiotic stress.As part of the management of bio-aggressors, the objective is to optimize the system by maximizing the capacities of natural regulation and resilience of the agro-ecosystem to sustainably manage pest populations .Through the action of the farmer, we try to anticipate changes in the flow of harmful or useful living organisms and control these flows (Valantin-Morison, 2012). At the international level, various literature studies highlight the effect of cultural practices in general and of rational fertilization in particular on protecting crops against major bioaggressors, including invasive species. In this context, our work consists of studying the availability of the interaction of the main bioaggressors of tomato, a crop of agronomic interest in Algeria, and the auxiliary entomofauna associated with them under the effect of inputs of biological fertilizers, under cover tight. The idea is to experiment with biofertilizers of two different origins based on seaweed, vegetable compost and compare them with a conventional chemical fertilizer. The aim is to see what fertiliser could have an impact on reducing tomato pest populations (or their stability) while maintaining their antagonistic populations.

II. MATERIALS AND METHODS

Presentation of the study environment

The trials of this study were carried out in a greenhouse tunnel at the experimental station level of the Faculty of Natural and Life Sciences of Blida University, during the period from 29/03/2019 to 30/06/2019 in three phases. A sowing phase Le Semis was carried out on 16/01/2019 and germination ,a transplanting phase of the plants to four-six leaves and a phase of capture and monitoring of the tomato entomofauna in a shelter in tunnel greenhouse . The catches were made in a shelter greenhouse, where a hybrid variety is grown, ALEXANDRA F1 tomato. Insect trapping was carried out from 29/03/2019 to 30/06/2019. The greenhouse shelter in which were laid the traps had an area of at least 200m2 (25 m x 8 m).This greenhouse tomato culture did not undergo any phytosanitary treatment during the entire test period and whose temperature varied between 16°C and 38°C, and the relative humidity of the area between 45 and 80%.

Material

The plant material used in our experiment is the tomato family solanaceae (Solanum lycopersicumL.), variety Alexandre F1. This variety has the following characteristics:-dark green foliage and high yield. -round fruit of red color. -the average weight 230-280 Grs.-for crops in outdoor and greenhouse. -resistant to TMV virus, Verticilium and Nematodes .Sticky traps are commonly used for pest sampling on all crops (Heinz et al. 1992). These sticky traps are used to detect them and track their populations over a long period of time. This non-selective screening method captures all flying insects attracted by the yellow color. The adhesive wafers used are made of a thin rectangular double-sided plastic, bright yellow and coated with glue, an adhesive substance that is water resistant and remains sticky for long periods

Method

Crop preparation and maintenance

We carried out a sowing on 3 plates of 345 alveoli in ortibox on 16/01/2019, at the rate of 2grains per alveole, in black peat. A superficial plough with a disc plough and the tracing of the furrows in the width direction of the tunnel arbi before transplanting seedlings at stage 4 to 6 leaves.It was carried out on 27/03/2019 at a rate of 12 plants per treatment line. The planting distance is 40 cm between plants, and 1 metre between lines, and

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2 metres between blocks.We carried out a manual weeding during the whole test.A binning was carried out ten days after the transplanting of the plants, to aerate the soil and promote new root emission. The operation is repeated whenever necessary.Water channel irrigation once a week.

Experimental device

The experimental set-up consists of 4 blocks, each block being divided into 4 rows of 12 plants.Each block consists of four (04) treatments.Number of blocks: 04 (ABCD).Number of treatments: 04 (T1, T2, T3, T4).Number of varieties: 01.Number of lines: 04.Number of plants (observations) : 07.

Treatment tested

In the experiment, we tested four (04) treatments which are as follows:T1: Control treatment.T2: Compost treatment.T3: Treatment of chemical fat NPK and urea.T4: Blue Algae Extract Treatment .It should be noted that the destructive measurement method has been adopted, that is to say, a series of measurements is carried out each week on the four (04) treatments.The test thus shows a total of 192 plants, or 48 plants per block.

Table : Application of different field

treatments	dose	period	number of application
T1: control treatment (without fertilization)	/	/	/
T2: compost treatment	1kg / plant	At the time of transplanting	single dose
T3:chemical fertilizer treatment			
NPK(15.15.15)	10gr /plant	Before transplanting	Single dose:(soil fertilizer)
Urea 46%	5.2 gr /plant	20 days after transplanting and every fortnight thereafter	Applied 5 times
potassium sulphate	4gr/ plant	20 days after transplanting And then every fortnight	Applied 5 times
T4: blue algae extract treatment	3ml/1000ml	3 days after transplanting and then every fortnight	Applied 6 times

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Capture of tomato insects

For the collection of tomato-infested insects, only one method was used. The yellow traps were placed under cover in a greenhouse with one trap per fertiliser treatment block, a total of four traps were installed at the height of the tomato plant. The periodicity of surveys and renewal of traps is 7 days.

Identification of insects

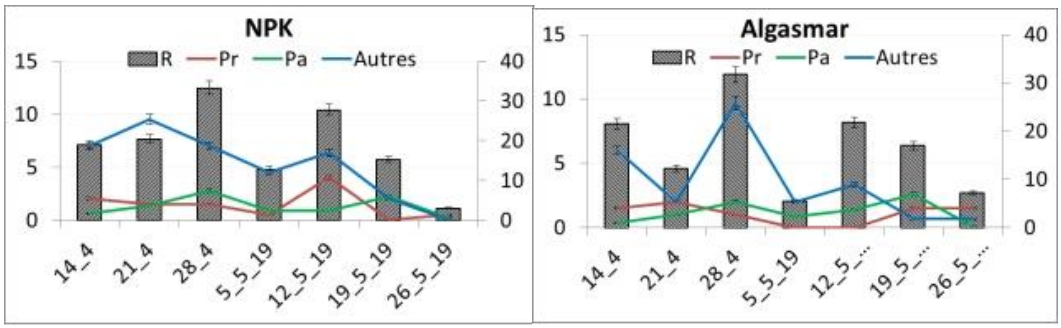
The yellow traps were read at the laboratory level with a binocular magnifying glass. We used magnifications (x20, x40, x80) as needed for better identification.

dentification was based on morphological traits . It was made following: the key of recognition of the families of Delvare and Aberleng (1989).And the methods described by Roth M.(1980) and Gauld ID and Bolton (1988). Samples were then sent to specialists for confirmation

Exploitation of results by statistical methods

Data analysis was done using the Past software version 7.1. The variables studied were first submitted to an analysis of variance with a classification criterion (ANOVA). The objective of ANOVA is to know whether the applied treatments produce significant effects or not on the measured numerical variables. The analysis of variance was completed by comparison of averages if ANOVA test is significant, the study is completed by the test of the smallest significant difference (LSD) of Student.Average abundance of taxa found on foliage or yellow plates were evaluated. A number of 7 leaves were taken from each block (control, compost block, Algasmar block and chemical fertilizer block). The average number of taxa observed per leaf as well as the average foliar areas were calculated on excel. When the averages are not significantly different at the 5% threshold, they are followed by the same alphabetical letter on the graphs.

Variation in the abundance of entomofauna captured in the incorporation blocks of different inputs and control during the monitoring period



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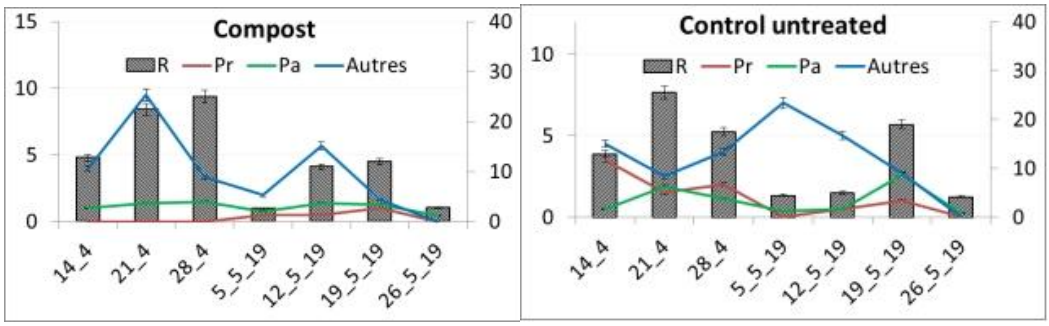
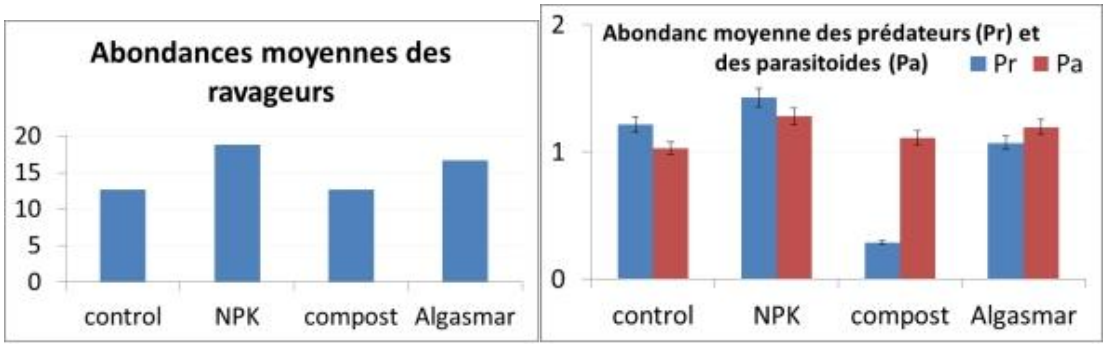


After two months of observation of the entomofauna infested to greenhouse tomato culture:3 trophic groups were recorded: pests , predators , parasitoids .It should be noted that there is a difference in the abundance of tomato pests between treatments;noting higher abundance on tomato plants that received NPK intakes and lower abundance on unfertilized tomato culture and under compost intake Regarding the parasitoids and predators they are present under the tomato plants of the different treatments however with low abundance

In vitro and in vivo studies were conducted to determine the suppressive effect of five compost extracts, formed from various combinations of composted animal manure (poultry manure (FV), sheep manure (FO), bovine manure (FB) and equine manure (FE)], on the Welsh nematode, Meloidogyne incognita, and the effect on tomato growth (Kerkeni et al. 2007). In vitro, incubatio of egg masses in 10% diluted compost extracts showed nematicidal activity towards M. incognita eggs.



Mean abundance of predators and parasitoids results showed the suppressive effect of compost on parasites by comparison with NPK has a favourable effect on mean abundance of predators and parasitoids.In the work of Mohamadi et al., (2016), the effects of vermicompost (20, 40 and 60%) and humic fertilizer (2, 4 and 6 g/kg soil) were studied on T. absoluta life traits on tomato plants in a growth chamber. Reproduction rates were lower than those of the control. The lowest values of this parameter were obtained with 2 g/kg humic fertilizer and 40% earthworm compost, which reduced T. absoluta populations in tomato crops. The application of 60% solid worm compost in tomato culture medium resulted in a lower number of eggs per leaf and increased mortality at the larval stages of the tomato miner (Peimani Foroushani et al. 2017

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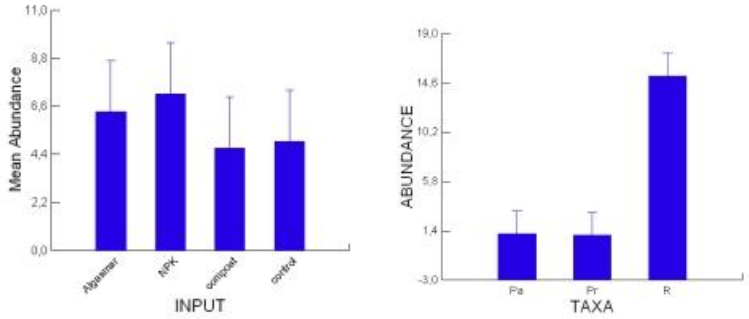
Analysis of tomato entomofauna abundances according to the input tested

(ANOVA, Systat vers. 12)



During our experiment we recorded the highest average abundance at the level of plants treated with NPK coventional followed no treatment Algasmear what is most remarkable is the effect of compost on the entomofauna of tomato crops of which we recorded the lowest abundance .The analysis of abundance in focus of trophic groups has revealed a greater abundance of pests while parasitoids and predators have shown values of abundance faile in the whole .The thesis work of Royer (2013) focused on the study of relationships between growth, concentrations in primary and secondary metabolites and availability of nitrogen resources in tomatoes with or without bioaggressors .

I. Conclusion

Regarding the availability of pests depending on the type of fertilizer used, we observed major species belonging to Thysanoptera, Aleyrodidae, Aphididae with a low presence of Cicadellidae . Thysanoptera are most abundant compared to other pests encountered, there is a lower relative abundance at the level of the block of plants fertilized with Algasmar compared to control. While the incorporation of compost generated a density of these phytophages similar to that recorded with the chemical fertilizer and that observed on the unfetified control Whiteflies , aphides and cicadoidea are significantly less represented than Thysanoptera in all treatment blocks. The intake of seaweed extract appears to have an effect on the increase in aphid abundance, which is much greater compared with that of conventional fertilizer, according to our observations. We recorded the presence of predators such as Coccinellidae and Araneidae. Among the parasitoid hymenoptera encountered and most represented are Encarsia sp, Aphelinus sp , Lysiphlebus sp, Aphidius sp, as well as taxa belonging to the family Mymaridae, Eulophidae and Trichogrammatidae . In the predatory taxa, very few Coccinellidae were captured during the follow-up period, unlike Araneidae

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