ULTRA VIOLET LIGHT STIMULATION OF ORGANIC FERTILIZERS ANTIFUNGAL ACTION

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Abstract: Although organic fertilizers as a whole do not express any pesticide action in some cases, some of them can prove a completely satisfactory level of pest protection, acting as fungicides or zoocides. Some of them even can express induced system resistance effectiveness. In the present study, the effectiveness of four novels, organic fertilizers created by Bulgarian company Agriflor on the base of fulvic acid and algal extracts was established in the *in vitro* conditions towards conidiospores of *Monilia fructigena* and *Monilia laxa* – major plant pathogens on orchard plants causing a lot of damages every year. The conducted trials reveal from the one side that all of tested products can express a strong antifungal action towards the germination of the conidiospores and ultra violet light can have a strong stimulation effect on the antifungal action of tested fertilizers from the other side.
Keywords: organic fertilisers, fulvic acid, *Monilia fructigena*, *Monilia laxa*, ultra violet light

1. INTRODUCTION

Although organic fertilizers as a whole do not express any pesticide action in some cases, some of them can prove a completely satisfactory level of pest protection, acting as fungicides or zoocides. Some of them even can express induced system resistance effectiveness. The classical example in such a case is the Neem tree (*Azadirachta indica*) which contains several active compounds, the most important of which is azadirachtin which has diverse pesticide activities, such as insect repellent, antifeedant, oviposition deterrent, reduced hatchability of eggs and increased emergence of malformed adults (Thoh et al, 2011). Neem oilcake, however after extracting oil from the seeds can be used as excellent organic fertilizer (Singh & Chaturvedi, 2013). The same can be observed according to oilcakes of oil – yielding rose, lavender, rosemary and other essential oil cultures. After extracting the oil, the oilcake can be used both as a natural pesticide (with fungicidal, insecticidal , mitecidal and nematocidal properties), both as a natural fertilizer. In the same case – even as feed for animals (Lis-Balchin , 2004; Chemat et al, 2012; Sumbul et al, 2015;). Phosphite (phosphorous acid) is another example of a compound which can act both as fertilizer and fungicide (Reuveni et al, 1998; Thao& Yamakawa, 2009). A field study reveal the effectiveness the effect of soil incorporation of calcium silicate, a source of silicon (Si) towards Tan spot, caused by *Pyrenophora tritici-repentis*, and fusarium head blight caused by the *Fusarium graminearum* (Pazdiora et al, 2021). Natural foliar fertilizers for horse radish (*Armoracia rusticana Gaertn*) was established to provide excellent pest management towards many fungal diseases(Gleń, 2008). The inorganic potassium chloride also can act as fungicide according to the septoria leaf blotch of winter wheat (Mann et al, 2004). Pigeon droppings, poul, try droppings and cotton-seed cake were highly toxic to the *Rotylenchulus reniformis* and *Tylenchulus semipenetrans* nematodes was established in 1979 (Badra et al, 1979). The secondary metabolite harzianolide isolated from *Trichoderma harzianum* strain SQR-T037 is described to manifest both plant growth stimulation and ISR activity (Cai et al, 2013). The same can be valid for dl-β-aminobutyric acid (BABA) and an aqueous extract of *Penicillium chrysogenum* (Tamm et al, 2011). Seaweeds or brown algae re mainly composed of polysaccharides such as laminarin, fucoidan, and alginates. Extracts obtained from seaweeds contain several bioactive compounds. Such bioactive compounds induce resistance in plants against different biotic and abiotic stresses. Seaweed extracts can also contain countless plant-bioactive inorganic and organic compounds such as mannitol, polysaccharides, oligosaccharides, phytohormones (auxins, cytokinins, gibberellins, betaine), antioxidants, and vitamins. It also contains a low concentration of minerals (calcium, boron, zinc, potassium, phosphorus, magnesium, and several other trace elements). Seaweed extract can stimulate plant growth and enhance the rate of photosynthesis (Mukherjee & Patel , 2020; Patel & Mukherjee, 2021).

The ultraviolet light can strongly decrease the effectiveness of the pesticides or so called photodecomposition (Crosby, 1969; Peterson et al, 1990; Kiss & Virág, 2009). This is a serious problem in the pest management due to the fact that in the most cases, application of the pesticides is performed during summer months when extensive sunshine and respectively UV lightt radiation exit.

In the present study, the effectiveness of four novels, organic fertilizers created by Bulgarian company Agriflor on the base of fulvic acid and algal extracts was established in the *in vitro* conditions towards conidiospores of *Monilia fructigena and Monilia laxa* – major plant pathogens on orchard plants causing a lot of damages every year.

The content of the tested fertilizers was:

- Panatop Fulvic Max 1: 20 % fulvic acid, 5 % alga extracts, 1 % amino acids and 20 % microelements
- Panatop Fulvic Max 2: 20 % fulvic acid, 10 % alga extracts, 1 % amino acids and 20 % microelements

- Panatop Fulvic Max 3: 25 % fulvic acid
- Panatop Fulvic Max 4: 25 % fulvic acid, 10 % amino acids and 20 % microelements

From the information above is obvious that there is actually one fertilizer but in four different modifications. Additional tests for examination of the UV stability and photodecomposition of the tested compounds according the antifungal effectiveness were performed.

2. MATERIALS AND METHODS

A microscopic slides pattern “hanging drop” was used (four slides formed one variant). The slides were preliminarily treated by spraying with a respective products in tested concentrations. After drying the solution, a conidial suspension made from relevant phytophathogen (3*104 spores / ml – 20 µl) was added. The microscopic slides was incubated in thermostat (humid chamber) under 22 – 24°C. After 48 h four observation in four different directions of the slides was made with light microscope to determination the germination of conidia. On every observation field, the number of germinated and non-germinated conidia was counted. The percent of germination in each observation field was calculated with the formula:

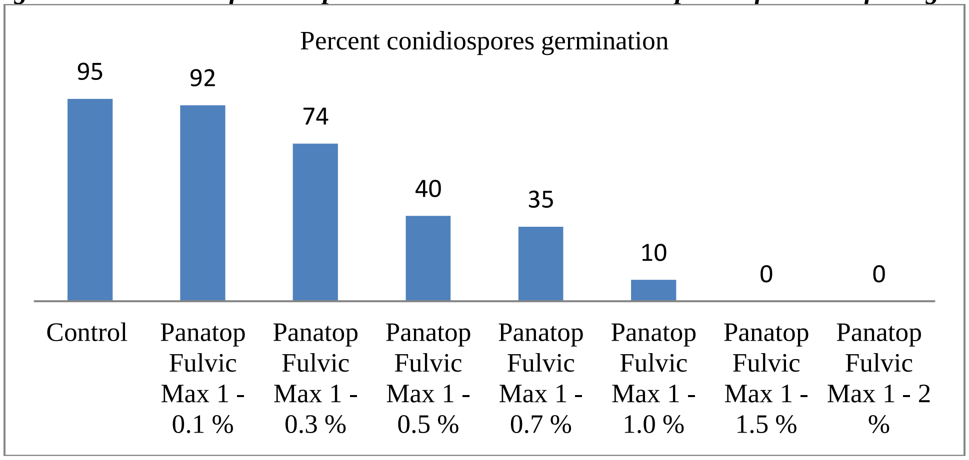
Percent germinated conidia=Number of germinated *100 / (Number of germinated + Number of non – germinated)

For the evaluation of the ultra violet light on the effectiveness of the products, water solutions of them were put under UV light (UV - UV-30A lamp) for 0.5 -1 hour and after drying a conidial suspension was added.

3. RESULTS

In the figures below is presented the antifungal effectiveness of the tested organic ferilizers towards conidiospores of *Monilia fructigena* and *M.laxa*.

Figure.1 The action of Panatop Fulvic Max1 towards conidiospores of Monilia fructigena



From Figure. 1 is obvious that Panatop Fulvic Max1 at 1.0- 1.5 % can block the germination of spores. At 0.5 - 1.0 % there was 40 - 10 % germination, however the germs of the spores were significantly shorter than in the Control variant. There were no statistically significant differences between Panatop Fulvic Max1 at 0.1 % concentration and the Control variant as and between effectiveness of the Panatop Fulvic Max1 towards M. frucigena and M.laxa ($p>0.05$).

Figure.2 The action of Panatop Fulvic Max2 towards conidiospores of Monilia fructigena

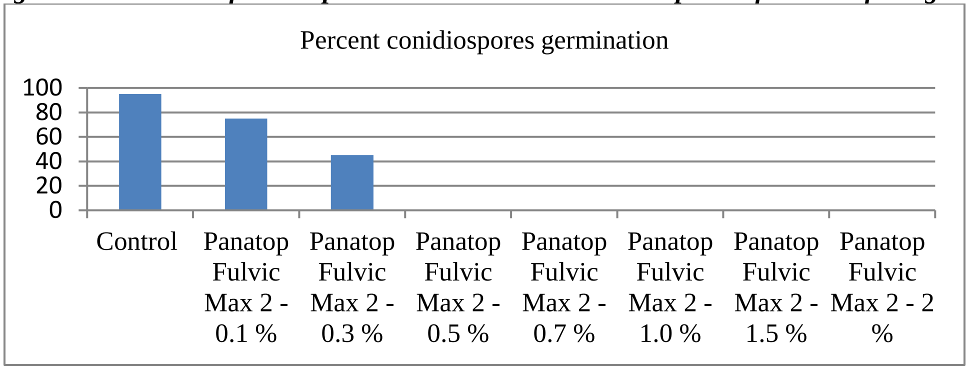


Figure.2 shows the antifungal action Panatop Fulvic Max2. Unlike Panatop Fulvic Max1, this product can completely inhibit the germination of conidiospores in 0.5 %. In 0.3 % concentration, the percent of germination was 45 % but just like in the Panatop Fulvic Max1 tests, the germs of spores were significantly shorter than in the Control variant. There were no statistically significant differences in the effectiveness between M. frucigena and M.laxa ($p>0.05$).

Figure.3 The action of Panatop Fulvic Max3 towards conidiospores of Monilia fructigena

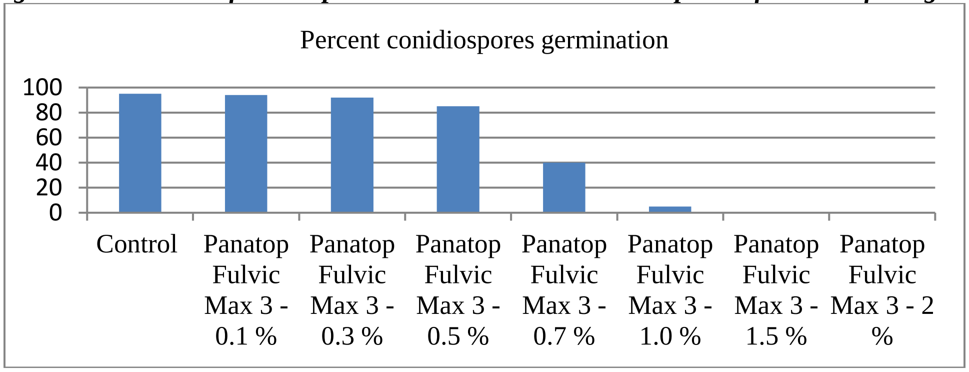


Figure.3 shows the antifungal action Panatop Fulvic Max3. In 1.0 % concentration it was identical with Panatop Fulvic Max1 ($p>0.05$). In 0.7 % concentration the percent germinating was 40 %. In this both concentrations the germs of the spores were also significantly shorter than in the Control variant. There were no statistically significant differences between Panatop Fulvic Max3 in 0.5 % 0.3%, 0.1 % and the Control variant ($P>0.05$). No statistically significant differences between the action of Panatop Fulvic Max3 between M. frucigena and M.laxa.

Figure.4 The action of Panatop Fulvic Max4 towards conidiospores of Monilia fructigena

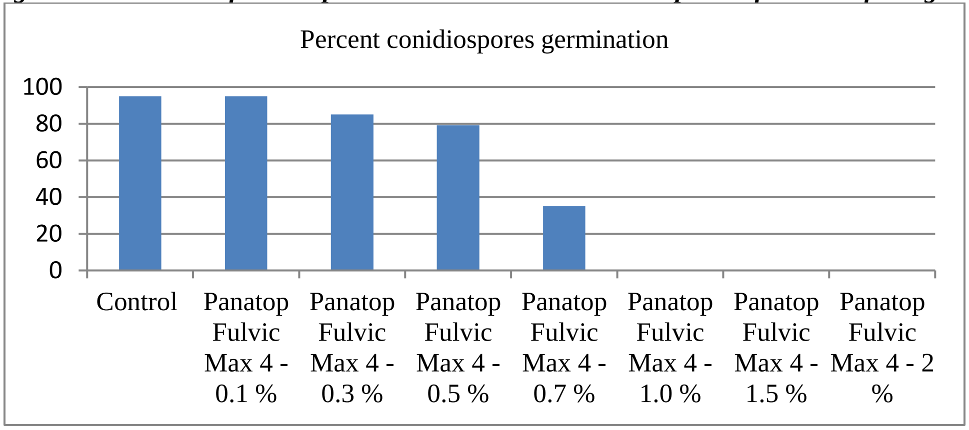
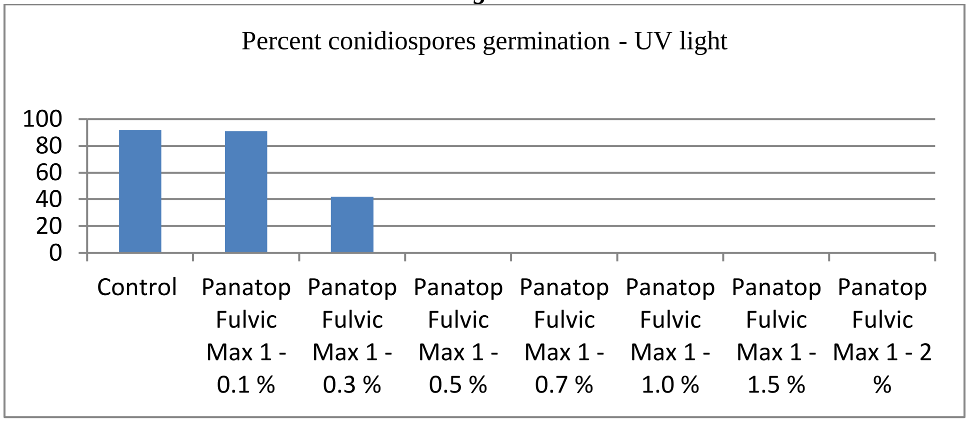


Figure4 shows the antifungal action Panatop Fulvic Max4. The 1.0 % concentration completely block the germination of spores. In 0.7 % concentration, there was 35 % germination again with significantly shorter germs than Control. No statistically significant differences between Panatop Fulvic Max4 in 0.3%, 0.1 % and the Control variant ($P>0.05$) and between M.fructigena and M. laxa.

The next set of figures presented the effect of tested organic fertilizers on M. frictigena and M.laxa when working solutions were placed under UV lamp for 0.5-1 hour.

Figure.5 The action of Panatop Fulvic Max1 towards conidiospores of Monilia fructigena radiated with UV light



The results presented in the Figure 5, shows that UV light not only does not cause photodecomposition – it strongly increase the antifungal effectiveness of tested fertilizer.

Figure.6 The action of Panatop Fulvic Max2 towards conidiospores of Monilia fructigena radiated with UV light

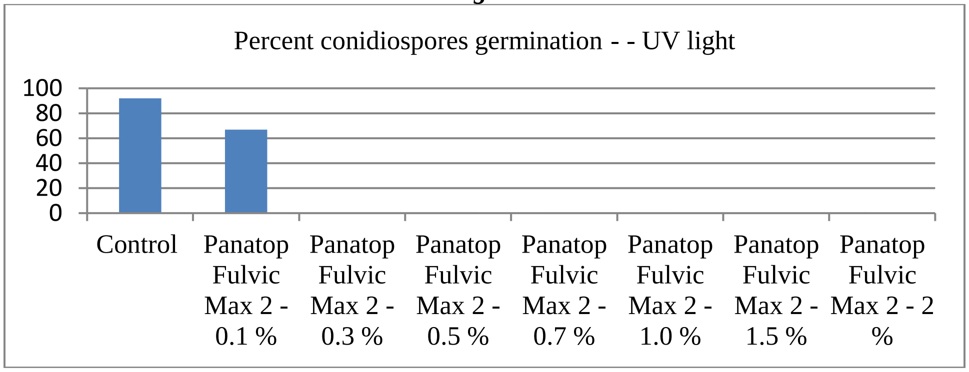


Figure 6, presented the action of Panatop Fulvic Max2 after radiation with UV light. The effectiveness was even stronger than of Panatop Fulvic Max1. The 0.3 % concentration completely block the germination of spores. In 0.1 % concentration, there was 67 % germination and just like the rest of the results, germs were significantly shorter than Control variant.

Figure.7 The action of Panatop Fulvic Max3 towards conidiospores of Monilia fructigena radiated with UV light

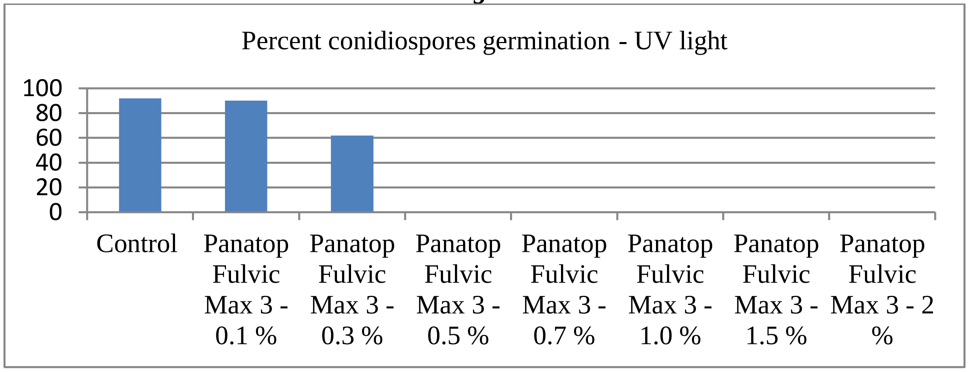


Figure.8 The action of Panatop Fulvic Max3 towards conidiospores of Monilia fructigena radiated with UV light

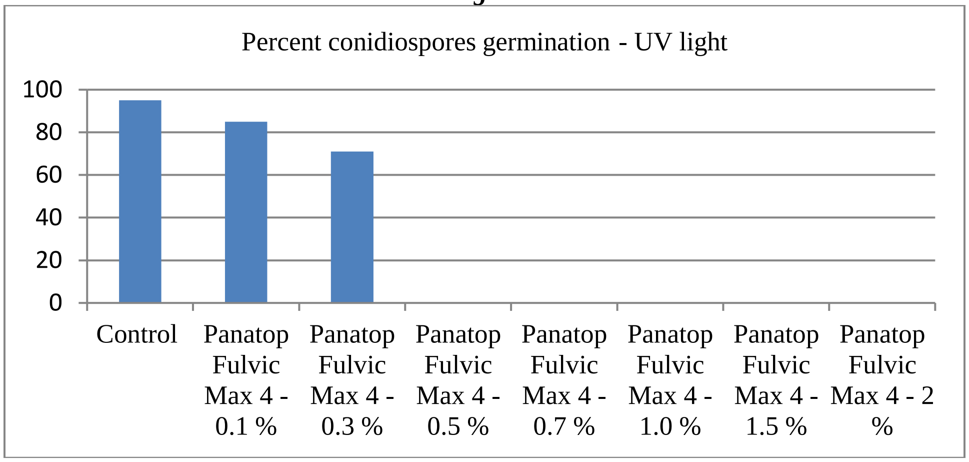


Figure 7 and Figure 8 presented the action of Panatop Fulvic Max3 and Panatop Fulvic Max4 after radiation with UV light which was very similar to the Panatop Fulvic Max1.

4. DISCUSSIONS

The received results show that even tested products to be organic fertilizers can express very strong antifungal effectiveness allow by this way simultaneously stimulation and protection of the treated plants. Even more, UV light not only does not cause decreasing in the effectiveness of the products, it strongly increases their antifungal action.

5. CONCLUSIONS

The present research proves that some organic compounds although acting as fertilizers can have a very strong pesticide (in this case fungicide) activity, which will mean that treatment of the plants with them can provide simultaneously growth stimulation and protection from the pests. Unlike the common perception, ultra violet light does not cause photodecomposition of the compounds and respectively – decreasing their antifungal effectiveness. Actually, tests prove the opposite – UV light strongly increases the effectiveness. This means that treatments of the plants with these products during clear and sunshine weather will provide better pest protection.

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