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**Research Note**

# Impact of spirotetramat on the growth of beneficial microorganisms

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**ABSTRACT**: Studies were conducted to evaluate the compatibility of spirotetramat 150 OD with beneficial microorganisms, *viz., Trichoderma viride*, *Beauveria bassiana*, *Metarhizium anisopliae* and *Pseudomonas fluorescens* under laboratory conditions in Coimbatore, Tamil Nadu, during 2007-2008. Radial growth of *T. viride* and *M. anisopliae* in spirotetramat at 75 g a.i. $ha^{-1}$ was 18.33 and 20.00 mm, respectively, at 72 h of inoculation with the untreated check recording 46.00-48.00 mm. Growth of *B. bassiana* in spirotetramat at 45, 60 and 75 g a.i. $ha^{-1}$ was 18.33, 14.00 and 8.67 mm, significantly lower than that in untreated check (28.00 mm) at 10 DAI. Spirotetramat was incompatible with *T. viride*, *B. bassiana* and *M. anisopliae*, but relative compatibility was significantly better than other insecticides at 45 g a.i. $ha^{-1}$. Spirotetramat at all the doses did not inhibit *P. fluorescens* and was highly compatible.

**KEY WORDS**: Spirotetramat, *Trichoderma viride, Metarhizium anisopliae, Beauveria bassiana, Pseudomonas fluorescens*

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Chemical insecticides are used as the frontline defense against insect pests and farmers in India depend heavily on synthetic pesticides to combat pests. Most of the insecticides used on agricultural crops belong to a limited number of chemically different classes. Of them, the most important nsecticides belong to organophosphates, carbamates and synthetic pyrethroids. In the recent past, synthetic pyrethroids have been extensively used for the control of insect pests. However, their indiscriminate use has created a number of problems such as pests developing resistance to insecticides, pest resurgence, and pesticide residues in consumable produce at harvest. The use of synthetic pesticides in Indian agriculture cannot be dispensed with in view of the targets of food requirements projected for 2020 AD. However, newer molecules have a high stability and superiority over the conventional pesticides to control the pest population density at field level. In this array, spirotetramat is one of the novel and superior chemicals to replace the highly effective broad spectrum compounds. Spirotetramat 150 OD belongs to the ketoenol family, is a tetramic acid derivative and is a lipid biosynthesis inhibitor in insects. Spirotetramat 150 OD has been found to be effective against a wide spectrum of sucking insects including aphids (Combs and Reissig, 2008; Vinothkumar *et al.,* 2008), thrips (Alston *et al.,* 2008), mealybugs (Varela *et al.,* 2008), etc. Hence, the present study was carried out to know the impact of spirotetramat on the growth of beneficial microorganisms.

Cultures of *Trichoderma viride, Beauveria bassiana*, *Metarhizium anisopliae* and *Pseudomonas fluorescens* obtained from biocontrol unit of TNAU, Coimbatore, were used in the study. The experiment was conducted with nine treatments, *viz*., spirotetramat 150 OD @ 90, 120 and 150 ppm, monocrotophos 36 SL (900 ppm), imidacloprid 200 SL (50 ppm), acetamiprid 20 SP (40 ppm), methyl demeton 25 EC (250 ppm), and dimethoate 30 EC (300 ppm) which are equivalent to field doses along with an untreated check under aseptic laboratory conditions. Each treatment was replicated thrice to study the effect of spirotetramat on the growth of microorganisms.

*Trichoderma viride* was inoculated under *in vivo* conditions by following poisoned food technique. Different concen-trations of treatment insecticides were prepared in 50 ml of sterilized potato dextrose agar (PDA) medium and mixed thoroughly. Unamended PDA medium served as control. The amended and unamended media were poured to sterilized Petri dishes and allowed to solidify. After solidification, 8 mm circular discs of five days old *T. viride* culture and seven days old *B. bassiana* and *M. anisopliae* culture were transferred to the centre of the plate separately using an inoculation needle and the plates were incubated at 32 ± 2°C in an incubator. The radial growth of *T. viride* and *M. anisopliae* was observed at 24, 48 and 72 hours of inoculation and for *B. bassiana,* colony diameter was measured at five and ten days after

inoculation. King's B agar medium was used for studying the compatibility of insecticides with *P. fluorescens* (50 ml) was amended with insecticides to obtain final concentrations of treatments as mentioned above. To the amended broth *P. fluorescens* broth culture was streaked under aseptic condition and incubated at 32 ± 2°C and unamended medium served as control. The plates were observed for the presence or absence of growth at 12, 24 and 48 hours of inoculation. The radial growth of *T. viride* at various doses of spirotetramat was studied along with standard checks and the results are presented in Table 1. Spirotetramat (45 g a.i. ha$^{-1}$) recorded 34.00 mm growth at 72 hrs after treatment (HAT) and was on par with spirotetramat at 60 g a.i. ha$^{-1}$ and dimethoate at 150 g a.i. ha$^{-1}$. Higher dose of spirotetramat (75 g a.i. ha$^{-1}$) inhibited the radial growth (18.33 mm). Inhibition by spirotetramat (75 g a.i. ha$^{-1}$) was on par with imidacloprid (18.67 mm), acetamiprid (26.67 mm), dimethoate (27.67 mm) and methyl demeton (12.67 mm) and all the treatments were found to have greater impact on the growth of *T. viride* when compared with the untreated check. The results indicated that there was significant inhibition on the growth of *B. bassiana* (18.33, 14.00 and 8.67 mm at 10 DAI) in spirotetramat at 45, 60 and 75 g a.i. ha$^{-1}$, respectively, as against untreated check (28.00 mm) but in acetamiprid at 20 g a.i. ha$^{-1}$ and imidacloprid at 25 g a.i. ha$^{-1}$ treatments, the growth of *B. bassiana* was 11.67 and 9.67 mm, respectively at 10 DAI.

The radial growth of *M. anisopliae* in spirotetramat at 45 g a.i. ha$^{-1}$ was 14.00, 21.00 and 33.33 mm after 24, 48 and 72 hours of inoculation, respectively. The radial growth at 60 and 75 g a.i. ha$^{-1}$ recorded 24.67 and 20.00 mm, respectively, after 72 h of inoculation. The untreated check recorded 20.00, 32.00 and 46.00 mm at 24, 48 and 72 hours, respectively. The growth of *M. anisopliae* in imidacloprid at 25 g a.i. ha$^{-1}$, acetamiprid at 20 g a.i. ha$^{-1}$, monocrotophos at 450 g a.i. ha$^{-1}$ and methyl demeton at 125 g a.i. ha$^{-1}$ was 18.00, 22.33, 15.33 and 13.33 mm at 72 h after incubation, respectively. Spirotetramat at all the doses did not inhibit the growth of *P. fluorescens* (Table 1). The bacterial growth was uniform in all the doses of spirotetramat tested.

The present study revealed that spirotetramat was incompatible to a certain extent, but relatively better compatible than the other tested insecticides. The present results are in consonance with the findings of Purwar and Sachan (2005) who reported the fungitoxic effect of endosulfan, imidacloprid, lufenuron, diflubenzuron, dimethoate and oxydemeton methyl on *B. bassiana* (MTCC

**Table 1. Effect of spirotetramat 150 OD and other insecticides on the growth of entomopathogenic microorganisms**

| Treatments | *T. viride* (mm) | | | *B. bassiana* (mm) | | *M. anisopliae* (mm) | | | *P. fluorescens* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 24 HAI | 48 HAI | 72 HAI | 5 DAI | 10 DAI | 24 HAI | 48 HAI | 72 HAI | 12 HAI | 24 HAI | 48 HAI |
| Spirotetramat 150 OD @45 g a.i.ha$^{-1}$ | 16.67 (4.13)$^{b}$ | 22.33 (4.76)$^{b}$ | 34.00 (5.85)$^{b}$ | 12.67 (3.62)$^{b}$ | 18.33 (4.33)$^{b}$ | 14.00 (3.79)$^{b}$ | 21.00 (4.62)$^{b}$ | 33.33 (5.80)$^{b}$ | ++ | ++ | ++ |
| Spirotetramat 150 OD @60 g a.i.ha$^{-1}$ | 12.67 (3.62)$^{bc}$ | 19.00 (4.41)$^{bc}$ | 27.33 (5.27)$^{b}$ | 8.33 (2.96)$^{c}$ | 14.00 (3.81)$^{c}$ | 11.00 (3.39)$^{bc}$ | 18.00 (4.30)$^{bc}$ | 24.67 (5.01)$^{c}$ | + | ++ | ++ |
| Spirotetramat 150 OD @75 g a.i.ha$^{-1}$ | 10.00 (3.22)$^{cd}$ | 14.33 (3.83)$^{cd}$ | 18.33 (4.32)$^{c}$ | 5.67 (2.47)$^{de}$ | 8.67 (3.02)$^{de}$ | 8.67 (3.01)$^{cd}$ | 14.33 (3.83)$^{c}$ | 20.00 (4.50)$^{cd}$ | + | + | ++ |
| Monocrotophos 36 SL @450 g a.i.ha$^{-1}$ | 6.67 (2.67)$^{ef}$ | 8.67 (3.02)$^{e}$ | 15.67 (4.01)$^{c}$ | 3.33 (1.95)$^{f}$ | 6.00 (2.54)$^{e}$ | 6.67 (2.67)$^{de}$ | 9.00 (3.07)$^{d}$ | 15.33 (3.97)$^{d}$ | + | + | + |
| Imidacloprid 200 SL @25 g a.i.ha$^{-1}$ | 8.33 (2.96)$^{de}$ | 13.33 (3.71)$^{d}$ | 18.67 (4.37)$^{c}$ | 7.33 (2.79)$^{cd}$ | 9.67 (3.17)$^{d}$ | 8.00 (2.90)$^{cde}$ | 13.67 (3.75)$^{c}$ | 18.00 (4.28)$^{cd}$ | + | ++ | ++ |
| Acetamiprid 20 SP @20 g a.i.ha$^{-1}$ | 12.67 (3.62)$^{bc}$ | 17.33 (4.22)$^{bcd}$ | 26.67 (5.21)$^{b}$ | 8.33 (2.96)$^{c}$ | 11.67 (3.48)$^{cd}$ | 11.00 (3.39)$^{bc}$ | 16.33 (4.10)$^{bc}$ | 22.33 (4.77)$^{c}$ | + | ++ | ++ |
| Methyl demeton 25 EC @125 g a.i.ha$^{-1}$ | 5.33 (2.41)$^{f}$ | 7.00 (2.73)$^{e}$ | 12.67 (3.62)$^{c}$ | 4.67 (2.27)$^{ef}$ | 6.33 (2.61)$^{e}$ | 5.67 (2.48)$^{e}$ | 9.00 (3.08)$^{d}$ | 13.33 (3.72)$^{d}$ | + | + | ++ |
| Dimethoate30 EC @150 g a.i.ha$^{-1}$ | 11.67 (3.47)$^{cd}$ | 16.67 (4.12)$^{bcd}$ | 27.67 (5.28)$^{b}$ | 9.67 (3.18)$^{c}$ | 13.67 (3.75)$^{c}$ | 11.00 (3.38)$^{bc}$ | 18.67 (4.36)$^{bc}$ | 24.00 (4.92)$^{c}$ | + | ++ | ++ |
| Untreated check | 24.33 (4.98)$^{a}$ | 40.00 (6.36)$^{a}$ | 48.00 (6.96)$^{a}$ | 48.00 (4.52)$^{a}$ | 48.00 (5.33)$^{a}$ | 20.00 (4.52)$^{a}$ | 32.00 (5.70)$^{a}$ | 46.00 (6.81)$^{a}$ | ++ | ++ | ++ |

HAI – hours after inoculation, DAI – days after inoculation

984 strain) and all the insecticides except oxydemeton methyl and imidacloprid showed significant deleterious effect on fungal growth. Ansari and Sharma (2005) reported that *Bacillus thuringiensis* and *B. bassiana* were compatible with lufenuron, thiamethoxam and methomyl. Thilagam (2006) reported incompatibility of flubendiamide with *T. viride*, *P. fluorescens* and *B. bassiana*. Compatibility studies of imidacloprid with biocontrol agents like *T. viride* and *P. fluorescens* indicated all the doses of imidacloprid except the lower dose (15 g a.i. $ha^{-1}$) inhibited the radial growth of *T. viride* (Preetha, 2007). Although spirotetramat caused significant reduction in growth of *T. viride*, *B. bassiana* and *M. anisopliae,* the effect was significantly lesser at lower dose of 45 g a.i. $ha^{-1}$ than its higher doses and other insecticides. Spirotetramat 45 g a.i. $ha^{-1}$ was highly compatible with *P. fluorescens* and could be a potential insecticidal candidate to be used with *P. fluorescens* under field conditions.

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