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Short communication

Effect of herbicides on *Fusarium pallidoroseum* – a potential biocontrol agent of water hyacinth [*Eichhornia crassipes* (Mart.) Solms]

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Abstract

The effect of four herbicides (paraquat, pretilachlor, glyphosate, and 2,4-D Na salt), and a herbicidal mixture (anilofos + 2,4-D EC) on growth and sporulation of *Fusarium pallidoroseum* was evaluated under *in vitro* conditions. Pretilachlor (1.0, 0.25, 0.06, and 0.02 kg ai ha^{-1}), 2,4-D (1.0 and 0.25 kg ai ha^{-1}), and 2,4-D + anilofos (0.4 and 0.1 kg ai ha^{-1}) completely inhibited fungal growth and sporulation, while paraquat and glyphosate (0.01 kg ai ha^{-1}) showed a lesser extent of growth inhibition (68 and 62 % of control respectively). Lower concentrations of paraquat (0.05 and 0.01 kg ai ha^{-1}), glyphosate (0.8, 0.2, 0.06, and 0.02 kg ai ha^{-1}), 2,4-D (0.06 and 0.02 kg ai ha^{-1}), and anilofos + 2,4-D (06 and 0.02 kg ai ha^{-1}), however, supported *F. pallidoroseum* growth.

Keywords: Compatibility, Mycoherbicides, Paraquat, Glyphosate, 2,4-D.

The utility of *Fusarium pallidoroseum* (Cooke) Sacc. as a bicontrol agent in the management of water hyacinth [*Eichhornia crassipes* (Mart.) Solms], a problematic aquatic weed in Kerala, has been documented (Naseema and Balakrishnan, 1999). Integrating mycoherbicides (plant pathogens) with chemical herbicides at moderate doses, however, may enhance the efficiency of weed management treatments (Rayachhetry and Elliott, 1997). For example, *Cercospora rodmanii*, a mycoherbicide of water hyacinth gave better performance, when applied in conjunction with 2,4-D at 5 and 154 ppm (Charudattan, 1986). Reports on *F. pallidoroseum* application in combination with chemical herbicides are, nonetheless, lacking. Hence, a study to determine the compatibility of *F. pallidoroseum* with common herbicides under *in vitro* conditions was undertaken.

The biocontrol agent *F. pallidoroseum* was treated with four herbicides *viz*., paraquat, pretilachlor, glyphosate, and 2,4-D EE Na salt, besides the combination of anilofos (24 %)+ 2,4-D (32 %) EC. The herbicides were tried at field doses and three lower concentrations (Table 1), each replicated thrice. The herbicidal effect on fungal growth was studied by poisoned food technique (Zentmeyer, 1955). For this, 100 ml of Czapek's (Dox) broth was dispensed into 250 ml conical flasks and was sterilized. Requisite quantities of herbicides as per the treatment protocol were also added to the broth, followed by thorough mixing. Five mm discs from 7-day old cultures of *F. pallidoroseum* were inoculated and incubated at room temperature. Czapek's broth without herbicide served as control. Observations on fungus growth and spore count were recorded 10 days after inoculation. For this, the mycelial mat was filtered through a previously weighed Whatman No. 1 filter paper and oven-dried at 60°C until constant weights. Spore count in the liquid medium was recorded using a haemocytometer.

Herbicidal treatments differed significantly (p=0.05) in their ability to inhibit mycelial growth (Table 1). Among

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Table 1. Effect of chemical herbicides on the growth and sporulation of *F. pallidoroseum under in vitro* conditions.

Herbicides (kg ai ha^{-1})	Mean mycelial dry weight (g)	Inhibition over control (%)	Mean spore count	Inhibition over control (%)
Pretilachlor				
1.00	0	100 (90)	0	100 (90)
0.25	0	100 (90)	0	100 (90)
0.06	0	100 (90)	0	100 (90)
0.02	0	100 (90)	0	100 (90)
2,4-D Na salt				
1.00	0	100 (90)	0	100 (90)
0.25	0	100 (90)	0	100 (90)
0.06	0.17	81 (64)	256	60 (51)
0.02	0.37	70 (57)	223	53 (47)
Paraquat				
0.75	0.18	81 (64)	0	100 (90)
0.19	0.19	79 (63)	0	100 (90)
0.05	0.25	73 (59)	2.56	99 (86)
0.01	0.30	68 (55)	2.93	99 (85)
Glyphosate				
0.80	0.15	84(67)	242	57 (49)
0.20	0.40	62 (52)	228	54 (47)
0.05	0.39	62 (52)	210	49 (45)
0.01	0.33	62 (52)	132	31 (34)
Anilofos (24 %) + 2,4-D (32 %) EC				
0.40	0	100 (90)	0	100 (90)
0.10	0	100 (90)	0	100 (90)
0.03	0.07	92 (74)	295	70 (57)
0.01	0.37	61 (51)	273	64 (53)
Control	0.93	–	425	–
CD (0.05)	–	2.3	–	1.4

Figures in parentheses indicate arc sine transformed values.

the five herbicides tested, pretilachlor completely inhibited the fungal growth at all concentrations (1.0, 0.25, 0.06, and 0.02 kg ai ha^{-1}), besides 2,4-D (1.0 and 0.25 kg ai ha^{-1}) and anilofos (0.4 and 0.1 kg ai ha^{-1}). These treatments and paraquat (0.75 and 0.19 kg ai ha^{-1}) also inhibited sporulation of the fungus in liquid media. Lower concentrations of paraquat and glyphosate, however, showed moderate mycelial growth (68 and 62% of the control at 0.01 kg ai ha^{-1}). Likewise, 2,4-D and its combination product at the lowest concentration showed 53 and 64 % sporulation respectively. Susha and Naseema (1998) also observed that 2,4-D at 0.1 % inhibited the growth of *F. pallidoroseum* mildly. Among the five herbicides tested, glyphosate recorded the least inhibition in growth and spore count of *F. pallidoroseum*, implying the feasibility of using these herbicides in conjunction with *F. pallidoroseum.* However, further studies may be necessary to optimize the concentration of chemical herbicides to be applied under such situations.

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