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SELECTION AND APPLICATION OF A VAM-FUNGUS FOR PROMOTING GROWTH AND RESISTANCE TO CHARCOAL ROT DISEASE OF SUNFLOWER VAR. HELICO-250

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Abstract

Of the 7 VAM-fungi, *Scutellispora auriglobosa* was found consistently associated with sunflower var. Helico-250. Sunflower plants suffer from charcoal rot disease caused by *Macrophomina phaseolina.* Ten days old sunflower seedlings when inoculated with *M. phaseolina* either before or after 7 days of inoculation with the VAM-fungus were found to increase the growth of sunflower with reduction in the incidence of charcoal disease.

Introduction

Pakistan is an agricultural country but is perennially deficient in edible oil production. The traditional oilseed plants viz., mustard, raya, rapeseed, corn oil, cottonseed oil and canola meet up about 35% of the demand. The rest of the demand (65%) is met by importing palm oil and soybean oil at the cost of 1 billion dollar every year. Vesicular-arbuscular mycorrhizal (VAM) fungi, almost a universal plant symbiont (Nicolson, 1967) are well recorded for increasing the uptake of one of the major nutrient elements i.e. Phosphorus (P) by the host plants (Gerdemann & Nicolson, 1963; Bagyaraj, 1968; Mosse, 1973; Sieverding, 1991). Beneficial soil-borne VAM-fungi in addition to increasing the 'P' uptake are reported to reduce the incidence of root-rot diseases of host plants (Dehne, 1982; Baker & Cook, 1974; Campbell, 1989). Since the soil in farm fields are generally reported to be deficient in 'P', it was thought worthwhile to study the effect of inoculation of VAM-fungi in sunflower pots and experimental plots to find out its effect on the growth and in resisting charcoal root-rot disease of sunflower.

Materials and Methods

Earthen pot of 50 cm diam., containing 5 kg of steam sterilized sandy-clay-loam soil was sown with seeds of sunflower and kept in greenhouse under prevailing day and night temperature (20-30°C) and R.H. of 40-50%. Thirty pots, divided in 6 replicate series for 5 different mode of treatments were watered regularly to maintain the water regime of soil at 10% up to 5 cm depth by the method of Keen & Raczowski (1921). *Macrophomina phaseolina*, the charcoal root-rot fungus isolated from the foot of sunflower roots was multiplied in corn-meal sand medium for 4 weeks at 25°C. The propagated mass was passed through 150 µm mesh sieve. The sclerotia passing through the sieve was collected and stored in glass vials at 20°C as stock culture. VAM-fungi from the rhizospheric regions of sunflower growing under farm field condition were extracted by the method of Gerdemann & Nicolson (1963). The extracted spores were put in sterilized soil and stored at 10°C as soil-base culture. A series of 6 pot culture with 10-days old sunflower seedlings inoculated with 500 VAM-fungal spores from soil-base stock culture (maintained @ of 50 spores per g of the soil) or 500 g charcoal rot *pycnidia* from corn meal medium either before or after each other. In all 30 pot cultures with a series of 6 pots each containing 5 kg of sandy-clay loam soil were subjected to 5 different treatments. The pot cultures either

inoculated or uninoculated were uprooted on maturity of sunflower plants and roots were observed for charcoal rot lesions and stained for assessing parasitic and mycorrhizal infection by the method of Phillips & Hayman (1970).

Results and Discussion

The seedlings either inoculated or uninoculated were uprooted at maturity. The uprooted roots were seen to produce black sclerotia of *Rhizoctonia bataticola* (Taub) Butler with globose ostiolate pycnidia which has been named as *Macrophomina phaseolina* (Maubl) Ashby (Fig. 1). The VAM-spores extracted from the rhizospheric regions of sunflower were pale-yellow, globose-210 x 120 µm in diam., spore wall 2 layered, spores formed on suspensors measuring 50 µm in diam., subtending hyphae with lateral projections, septa formed in subtending hyphae (Fig. 2). The outline of the vesicle (Fig. 3) produced in-between and arbuscule (Figs. 4 & 5) produced inside the cortical cells of the sunflower roots are similar with the description given by Schenck & Perez (1990) which was identified as *Scutellispora auriglobose* (Hall) Walker & Sander. The inoculation of the axenic culture of the VAM-fungus 7 days prior to the inoculation of the charcoal root rot fungus produced on an average 398 seeds per head and an average 10-seed weight was 0.65g whereas when the charcoal root rot fungus was inoculated 7 days before the VAM-fungus, an average of 390 seeds per head and an average 10-seed weight of 0.60g was obtained (Table 1). The beneficial effects of VAM-fungi on inoculation under farm field condition has been reported to increase the uptake of Phosphorus and bioprotection of plants from root parasites in general including sunflower (Harrier & Watson, 2003; Aggarwal *et al*., 1999; Kumar *et al*., 2004) which is in conformity with our results. It was concluded that the VAM-fungus *Scutellispora auriglobosa* can increase the uptake of Phosphorus as was evident from the number of seeds per head and weight of the seeds and can also reduce the incidence of *Macrophomina phaseolina* causing charcoal root rot in sunflower var.Helico-250 cultivated in Sindh (Table 1).

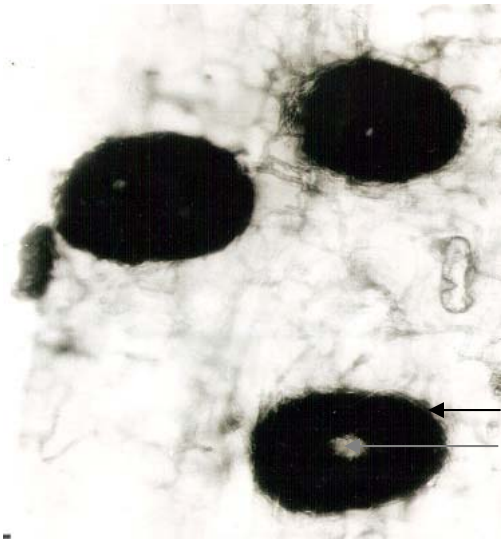

Fig. 1. Globose, black and ostiolate pycnidia of *Macrophomina phaseolina* (Maubl) Ashby. × 100.

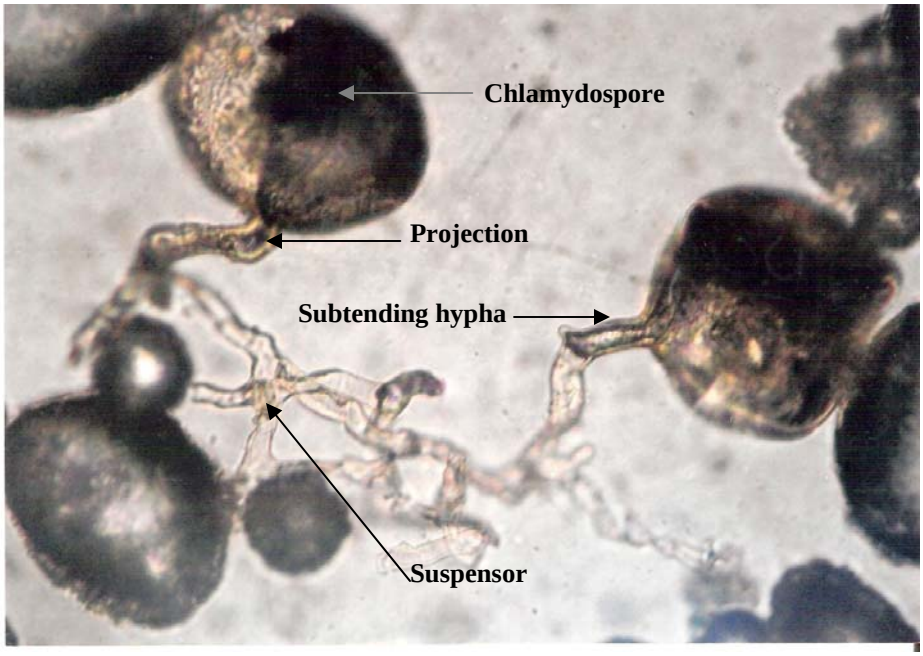

Fig. 2. *Scutellispora auriglobosa* with spores, suspensor and subtending hyphae with lateral projections. × 400.

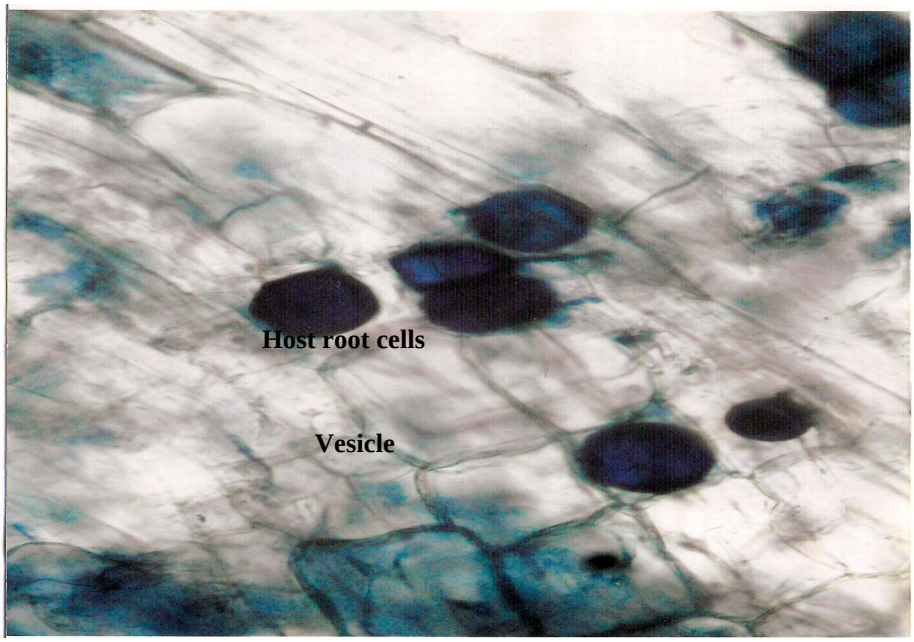

Fig. 3. Vesicles produced in the infected cortical tissues of the sunflower root. × 100.

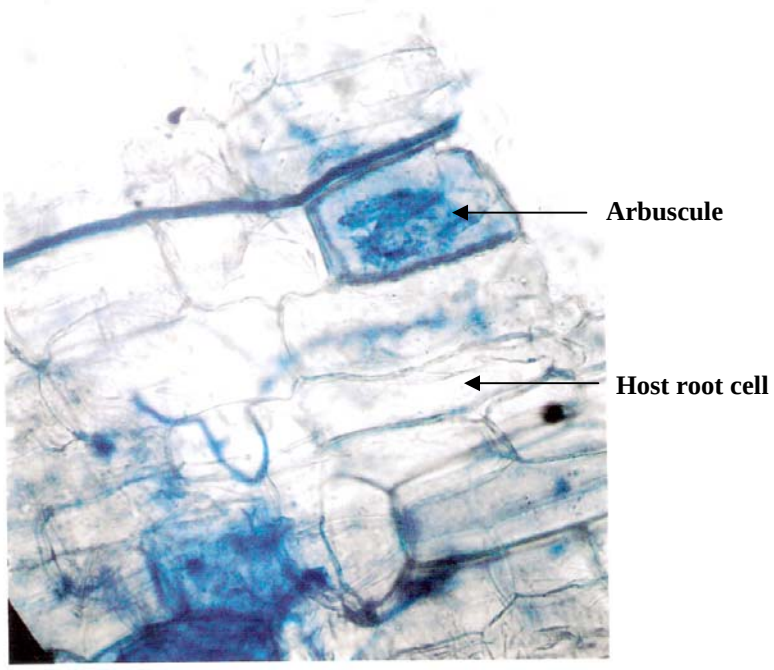

Fig. 4. Arbuscule formed inside infected cortical cells of the sunflower root. × 400.

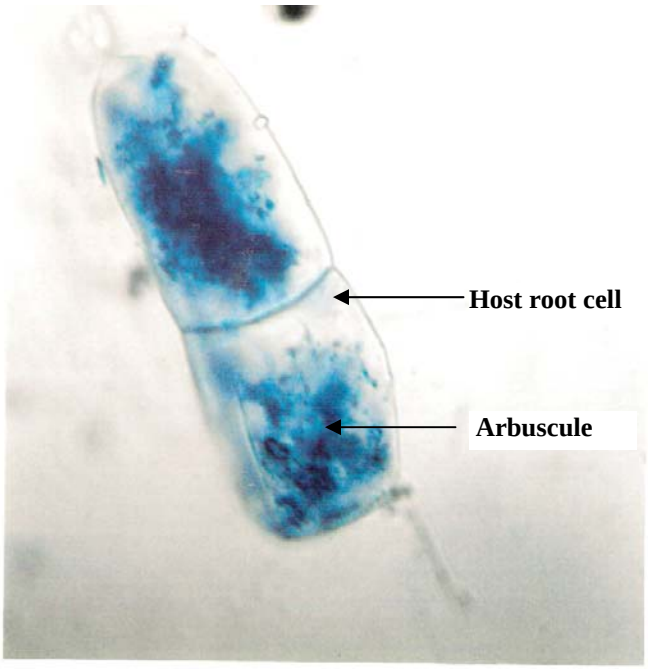

Fig. 5. Arbuscules formed inside the infected two cortical cells of the sunflower root. × 400

Table 1. Effect of interaction between *Scutellispora auriglobosa* and *Macrophomina phaseolina* in varying treatments on the growth and yield of sunflower variety Helico-250 in pot culture.

S. #	Treatments	No. of AM spore / g of soil	No. of *M.phaseolina* pycnidia / g of soil	Charcoal root rot formation in host roots (%)	VAM-infection in host roots (%)	Average No. of seeds per head	Average seed weight (g) per 10 seeds
1.	Control	-	-	-	-	392	0.62
2.	*S. auriglobosa* (VAM-fungus) – symbiont	18	-	-	70	428	0.72
3.	*M. phaseolina* (Charcoal root rot fungus)	-	9	12	-	375	0.54
4.	VAM-fungus + *M. phaseolina* after 7 days	13	5	3	62	398	0.65
5.	*M. phaseolina* + VAM fungus after 7 days	8	7	5	55	390	0.60
	LSD	7.66	9.33	6.66	70.00	53.00	0.60

The probability level at $p < 0.05$ is significant.

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