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Thesis Summary

Biochemical Base of Resistance Against Fusarium Wilt of Chillies and its Management Through Plant Activators

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Chilli, Fusarium wilt,
Fusarium oxysporum f. sp. *capsici*,
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Plant activators

Chilli (*Capsicum annuum* L.) is a self pollinating crop belongs to the family Solanaceae, which also includes potato, tomato and eggplant[1]. It is the third important vegetable crop of family Solanaceae after tomato and potato[2]. In Pakistan, chilli crop has an important economic value because it is used as a vegetable and spice crop. Chillies contain capsaicinoids which are alkaloids that play a significant role in the pharmaceutical industry. Fresh chillies are a rich source of carotenoids, provitamin A, vitamin B and vitamin C, which contains ascorbic acid[3,4].

More than 83 different diseases attack a chilli crop among them 40 diseases are caused due to the fungal pathogens. Fusarium wilt disease is a potential threat to chilli production, which is caused by *Fusarium oxysporum* f. sp. *capsici*[5,6]. *Fusarium oxysporum* is a soil-borne fungus. It survives for several years in soil[7]. Symptoms of Fusarium wilt is characterized by wilting of the plant. High temperature and high moisture play a significant role in the symptom development of wilt[8]. There are 80 strains of *F. oxysporum* which causes wilt diseases. It causes upward and inward rolling of the leaves. Then leaves turn yellow and die. The Fungus enters in the vascular systems through the root tissues and subsequently uses the xylem vessels as a venue to rapidly colonize the plant[9]. The temperature favourable for *F. oxysposrum* f. sp. *capsici* is 12-32ºC. Maximum growth observed at 28°C[10].

The present research was conducted under randomized complete block design (RCBD) in the research area of the Department of Plant Pathology, the University of Agriculture, Faisalabad for the screening of chilli germplasm against Fusarium wilt disease under field conditions. Twelve chilli varieties/lines Green Pridf, CBS-1292, Skyline, Capino, 1310, 49, 52-2012, 60, Fenjiao, P6, Highline and ADV-513 were collected from Ayub Agricultural Research Institute (AARI) which were used as research

material to screen resistant germplasm against Fusarium wilt disease. Out of twelve varieties five varieties 52-2012, ADV 513, Green pridf, P6 and 1310 showed moderately resistant response with 27.83, 33.06, 36.10, 36.90 and 37.73% disease incidence, respectively.

For biochemical base of resistance against fusarium wilt disease Catalase (CAT), Peroxidase (POD), Superoxidase dismutase (SOD), Hydrogen peroxide (H_2O_2) and protein activity were analyzed in the Biochemistry laboratory of University of Agriculture Faisalabad. Level of POD in moderately resistant cultivars (52-2012, ADV 513, Green Pridf, P6 and 1310) increases from (0.030, 0.151, 0.053, 0.059 and 0.147) to (1.058, 0.272, 0.297, 0.243 and 0.232) respectively. Amount of SOD in moderately resistant cultivars (52-2012, ADV 513, Green Pridf, P6 and 1310) enhanced from (0.971, 0.809, 0.627, 1.158 and 1.831) to (3.073, 2.790, 2.142, 0.639 and 2.531) respectively. Amount of H_2O_2 in moderately resistant cultivars (52-2012, ADV 513, Green Pridf, P6 and 1310) increased from (0.464, 0.765, 0.216, 6.418 and 0.094) to (2.198, 7.243, 2.662, 11.595 and 5.473) respectively. Reduction in catalase enzyme was observed in inoculated leaves of moderately resistant varieties 52-2012 (0.670), ADV 513 (2.552), Green Pridf (0.993), P6 (1.616) and 1310 (2.465) as compared to the uninoculated leaves of moderately resistant varieties which contain (5.561, 3.101, 1.661, 2.668 and 3.900) amount of catalase enzyme respectively. Protein activity in moderately resistant cultivars (52-2012, ADV 513, Green Pridf, P6 and 1310) reduced from (4.190, 4.190, 3.563, 4.063 and 4.413) to (2.196, 3.913, 3.193, 3.573 and 3.916) respectively. These antioxidant enzymes play an important role in the defence mechanism of host plants and hence these biochemical alterations can become an effective tool for the selection of resistant varieties.

P6 was a moderately resistant response with good growth parameters. It gave maximum fresh and dry weight of shoots (85.90 and 84.04 g), shoot length (84.13 cm), plant height (99.03 cm) and highest number of fruits (518.03g). ADV 513 expressed a maximum number of leaves (101.80). While moderately susceptible variety 49 showed maximum root length, which was (17.93 cm). Capino which showed moderately susceptible response gave a maximum fresh weight of roots (12.83g) and dry weight of roots (10.96 g).

Four plant activators (Salicylic acid, KH_2PO_4, Benzoic acid and Ascorbic acid) were evaluated against Fusarium wilt disease under field conditions with three different concentrations 0.5, 0.75 and 1%. Activators were applied through soil drenching method under Randomized complete block design (RCBD). Out of four plant activators, minimum disease incidence was expressed by Salicylic acid (26.681%) followed by KH_2PO_4 (30.719%), Ascorbic acid (33.381%) and Benzoic acid (38.737%) while control had showed the maximum disease incidence (63.444%). Salicylic acid at 1% concentration was found most effective against Fusarium wilt disease. At 1% concentration of 3rd application of soil drenching salicylic acid exhibited the best result 13.76 % followed by KH_2PO_4 (18.26%), ascorbic acid (20.40%), benzoic acid (28.70%) and control expressed the minimum disease incidence which is 80.43%.

Crux of the matter is out of twelve varieties, five varieties 52-2012, ADV 513, Green Pridf, P6 and 1310 were moderately resistant varieties against Fusarium wilt. P6 which was a moderately resistant variety showed maximum fresh and dry weight of shoots, shoot length, plant height and yield while ADV 513 showed maximum NOL. Reduction in CAT and protein was observed in inoculated leaves of moderately resistant varieties as compared to the uninoculated leaves of chilli varieties/lines while SOD, POD and H_2O_2 was found higher in inoculated leaves of moderately resistant varieties as compared to the uninoculated leaves of chilli varieties/lines. Salicylic Acid was found most effective among all plant activators against Fusarium wilt disease.

Conclusively, biochemical markers can become an effective tool for the selection of resistant varieties. P6 is a moderately resistant variety with good horticultural attributes it should be incorporated into the breeding programme. Salicylic acid is statistically significant plant activator to minimize the losses and disease incidence caused by *Fusarium* wilt of chilli.

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