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Effect of Phosphate Solubilizing Bacteria on Constitutive and Induced Responses of Tomato (*Lycopersicum esculentum*) Against Tobacco Cut Worm (*Spodoptera litura* Fabricus) (Lepidoptera: Noctuidae)

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Introduction

Plants respond to insect attack through various constitutive and induced mechanisms resulting in morphological and chemical changes. Phosphate solubilizing bacteria (PSB) are known to improve plant growth and yield by enhancing the availability of phosphorus in soil (Malik *et al.*, 2012). However, it is still unknown whether such a growth compromises resistance mechanisms in plants. In present study, we evaluated the effect of PSB on morphological and chemical changes in tomato (*Lycopersicum esculentum*) due to damage by the generalist herbivore *Spodoptera litura* Fabricus. We also studied whether these responses translate to resistance mechanisms by analyzing response of insect larvae on damaged plant

Materials and Methods

Tomato seeds (*L. esculentum*) were germinated on glass beads and later transferred individually in pots in the insect free enclosure. A commercial phosphate PSB formulation Phosphofix® was mixed during soil preparation. Third instar *S. litura* larva was placed on 3rd leaf and changes in trichomes, chlorophyll a & b and dry weight of the plants were analyzed after 7 days, while antioxidants such as peroxidase, superoxide dismutase (SOD) were determined after 9 hours of damage. Insect orientation, feeding behaviour and performance was examined on plants after 7 days of damage

Results and Discussion

Trichome density was found to be affected by both insect damage and PSB (Fig. 1). Although no significant difference in shoot dry weight between PSB inoculated and untreated plants was seen, root dry weight was decreased significantly. Insect damage reduces plant shoot as well as root biomass. Consequently, PSB inoculated damaged plants have similar biomass as both the untreated damaged and undamaged plants but lesser dry weight than PSB inoculated undamaged plants. Chlorophyll a was decreased by PSB inoculation as well as damage. However, chlorophyll b concentration was not affected. Larval leaf consumption was highest on untreated damaged followed by PSB damaged, untreated undamaged and PSB treated undamaged plants. Larval weight gain was highest on PSB inoculated undamaged plants and lowest in PSB inoculated damaged plants. The larval efficiency for conversion of digested food was highest in PSB inoculated damaged, followed by its undamaged counterpart. On the other hand, highest efficiency to convert ingested food was found on plants with no PSB treatment and were undamaged, whereas lowest was found in their damaged counterpart. The approximate digestibility was highest in untreated damaged plants and least in PSB treated damaged plants. Among antioxidants, except PPO, all antioxidants had increased specific activity in the untreated damaged plants as well as PSB inoculated undamaged plants. But in their PSB damaged counterparts, markedly decreased specific activity. Therefore, our study suggests that although the quick responses such as antioxidants were not significantly affected by PSB inoculation, but marked increase in trichome density showed that PSB inoculation has enhanced the morphological responses. Consequently, *S. litura* larvae performance was significantly decreased on PSB treated damaged plants. Therefore, PSB not only enhances the plant growth and phosphorus availability to plants, but also boosts plant immunity in *L. esculentum*.

Reference

Malik, M. A., Marschner, P. and Khan, K. S. (2012). Addition of organic and inorganic P sources to soil - Effects on P pools and microorganisms. *Soil Biology & Biochemistry*, 49: 106-113.

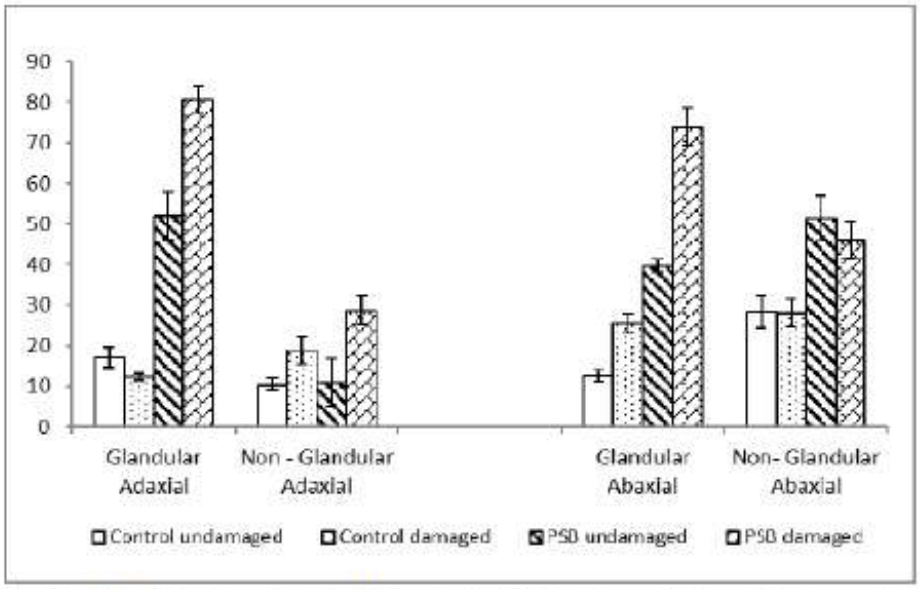

Fig. 1: Adaxial and abaxial trichome density (±SE) on day 7 of S.litura damage in L. esculentum supplemented with Phosphate Solubilizing Bacteria