Formulation of Bioherbicide for Weeds Control in Wheat

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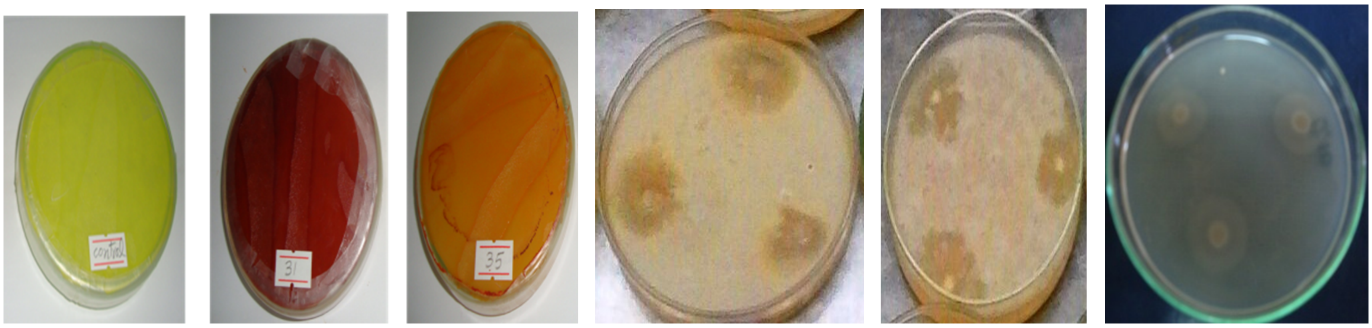
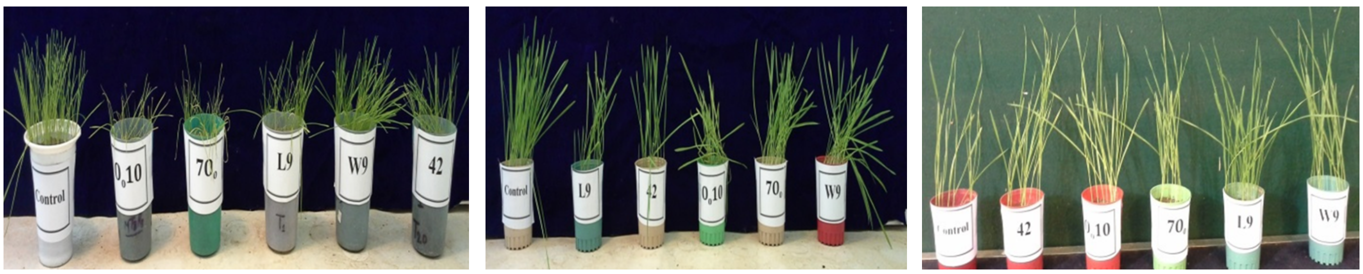
Weeds pose threats to crop production more than other pests and the conventional control practices are not much sustainable. This is due to growing cost and shortage of labor, land degradation and cost of tillage, herbicide resistance, pollution of soil, air and water-bodies by herbicides, residues in food items and deadly diseases and deaths faced by all life forms. If the costs incurred on the environmental challenges posed by conventional control are counted it is no more feasible and sustainable. The search for new and safer techniques based on biological approaches is being encouraged worldwide. In past, research on biocontrol of weeds was focused on phytophagous insects and pathogens of weeds. Excessive reliance on suitable environmental conditions by these control agents lead to inconsistent responses and discouraged such efforts. However, rhizobacteria inhibitory to weeds due to production of their phytotoxic metabolites remained ignored in the past. The production of phytotoxins in the rhizosphere avoids the exposure of these substances to other life forms and environment. The presence of selectivity in these rhizobacteria further increases the opportunities for formulation of a bioherbicide using them. Therefore, allelopathic bacteria were isolated from the rhizosphere of weeds and characterized for suppression of major weeds (wild oat, little seed canary grass, broad leaved dock, common lambs' quarter and field bindweed) associated with wheat under controlled and natural conditions.

These rhizobacteria were characterized for production of phytotoxic substances through HCN production, *E. coli* antimetabolite and agar bioassay on sensitive seedlings. The phytotoxins producing strains were then applied to target weeds and wheat in agar bioassays. The potential candidates for biocontrol agents were further tested on weeds and wheat under axenic conditions in growth room trials. Five strains of allelopathic bacteria were evaluated under natural conditions in pot and field trials.

This research work yielded nineteen strains of allelopathic bacteria which produced sufficient phytotoxic metabolites to be inhibitory to certain plants. Five of the strains were found to be suppressive to plants being non-host specific. Selective suppression of weeds but not wheat was observed with 3 strains and nine strains inhibited the germination and/or growth of one or more weeds and promoted that of wheat. Five strains showing maximum suppression of one or more weeds and non-inhibitory to wheat were tested in pot and field trials. The results of these experiments endorsed the potential of these rhizobacteria for suppression of major weeds of wheat and resultant improvement in production of infested wheat as shown in Table and Figures.



Production of phytotoxic metabolites by rhizobacteria



Effect of AB on little seed canary grass wild oat and wheat

Table. Percentage reduction in biomass of weeds and resultant improvement in grain yield of infested wheat in pot trials

Weed species	% reduction in biomass	% improvement in grain yield of infested wheat
Wild oat	53.5	114.2
Little seed canary grass	54.4	100.1
Broad leaved dock	44.8	86

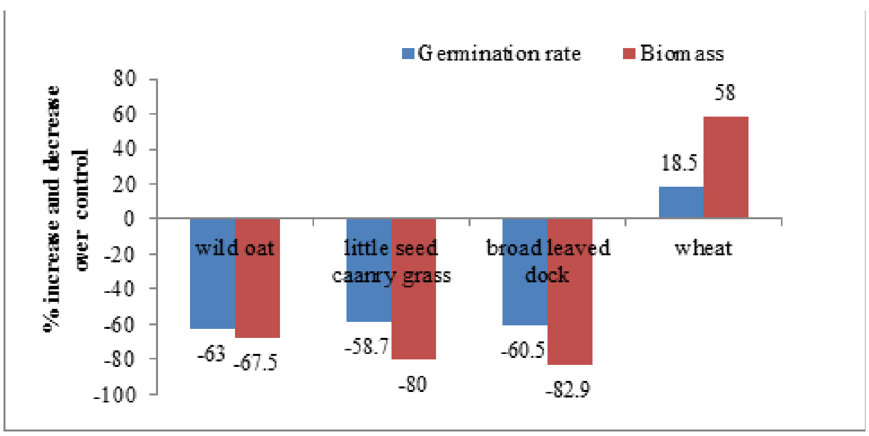


Figure. Effect of 10 strains of allelopathic bacteria on wheat and its associated weeds under axenic conditions