Allelopathic *Pseudomonas* Consortium: A Sustainable Weed Control Approach in Wheat (*Triticum aestivum* L.)

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Introduction

Weeds are notorious biological pests reducing crop production by sharing soil nutrient pools, water and space, and through allelopathy. Global annual crop yield losses by weed infestation range from 20–30% while in Pakistan *Triticum aestivum* L. production loss due to weeds was estimated up to 24% annually. The environmental pollution, residual effect, weed resistance, health issues in humans and animals are some limitations of using chemicals. Thus, the situation impels to move our intentions to adopt sustainable and ecofriendly approaches (biological weed control). Pseudomonas bacteria have the potential for minimizing yield losses in wheat due to the production of phytotoxic metabolites/allelochemicals (cyanide, phenolics, antibiotics and overproduction of Indole-3-acitic acid) environment friendliness, no residual effects and no chances of weed resistance which makes them a suitable candidate for weed control.

Objective

The objective of present study was to use the potential of pre-isolated and characterized Allelopathic *Pseudomonas* strains (B11, T19, T24, T75) in consortium C9= B11xT24xT75 and C11= B11xT19xT24xT75 for suppression of *Avena fatua* L., *Phalaris minor* Retz., and *Rumex dentatus* L. in wheat.

Materials & Methods

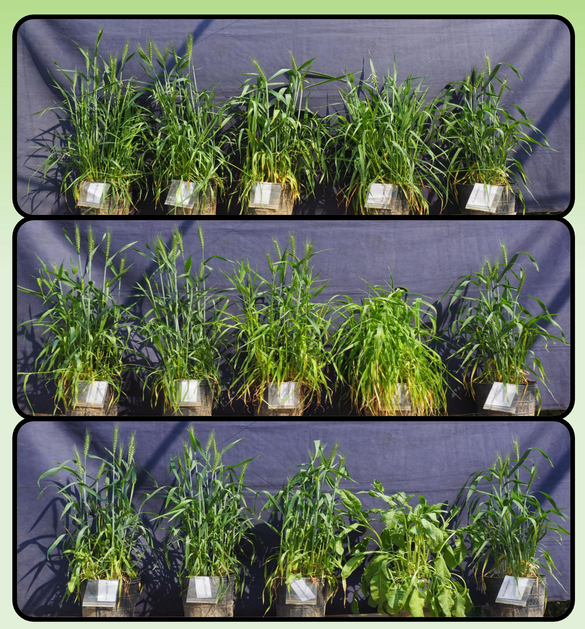
Consortium Preparation:
The fresh cultures of population density 10^8 cells mL^{-1} (OD_{600}= 0.55) were mixed and vortexed in equal volumes to make homogeneous *Pseudomonas* consortium.

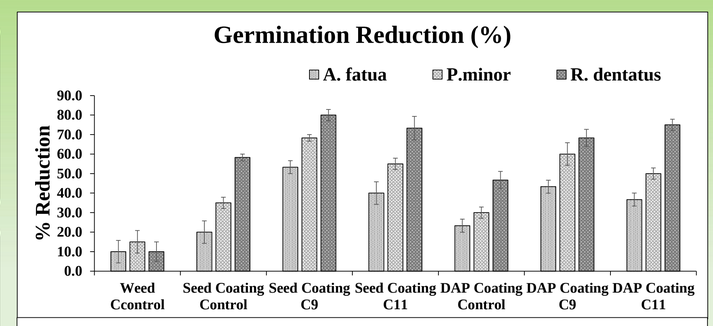
Inoculation Methods: I- Wheat Seed Coating, II- Fertilizer Coating

Carrier: pressmud

Experimental Design: Completely randomized design (CRD)

Results





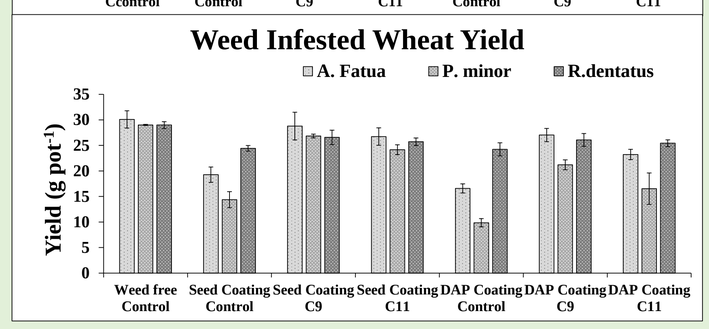


Figure-I: Germination reduction of weeds & wheat grain yield improvement by C9 and C11 combinations in pot trial

Weeds germination was significantly reduced by the Allelopathic *Pseudomonas* (AP) consortium up to 53, 68 and 80% in *A. fatua*, *P. minor* and *R. dentatus*, respectively. Whereas weeds infested wheat yield was also enhanced by AP consortium up to 63, 115.7 and 8.8% in *A. fatua*, *P. minor* and *R. dentatus*, respectively compared with non-inoculated treatment.

The physiological attributes of weeds and wheat have also showed significant results as 20, 28.5, 12.4and 20.2% reduction in *A. fatua* with 25.6, 49.1, 28.8 and 20.7% improvement of infested wheat in SPAD, A, E and gs, respectively. In case of *P. minor* AP consortium showed 24.6, 34.8, 19.2 and 23.1% reduction with 24.9, 49.7, 37.6 and 39.9% improvement of infested wheat in SPAD, A, E and gs, respectively. Similar results were found in *R. dentatus* where 25.1, 27.6, 23.7 and 22.4% reduction with 27.9, 54.3, 43.17 and 47.7% improvement of infested wheat in SPAD, A, E and gs, respectively.

Both AP consortium C9 (B11xT24xT75) and C11 (B11xT19xT24xT75) were effective in reducing weeds population density and physiological attributes while showed improvement in infested wheat yield and physiological attributes but C9 showed higher weeds reduction and wheat growth and yield enhancement as compared with C11 combinations. However inoculation methods (wheat seed coating and DAP coating) were at par in weeds reduction and wheat growth improvement in most of the cases.

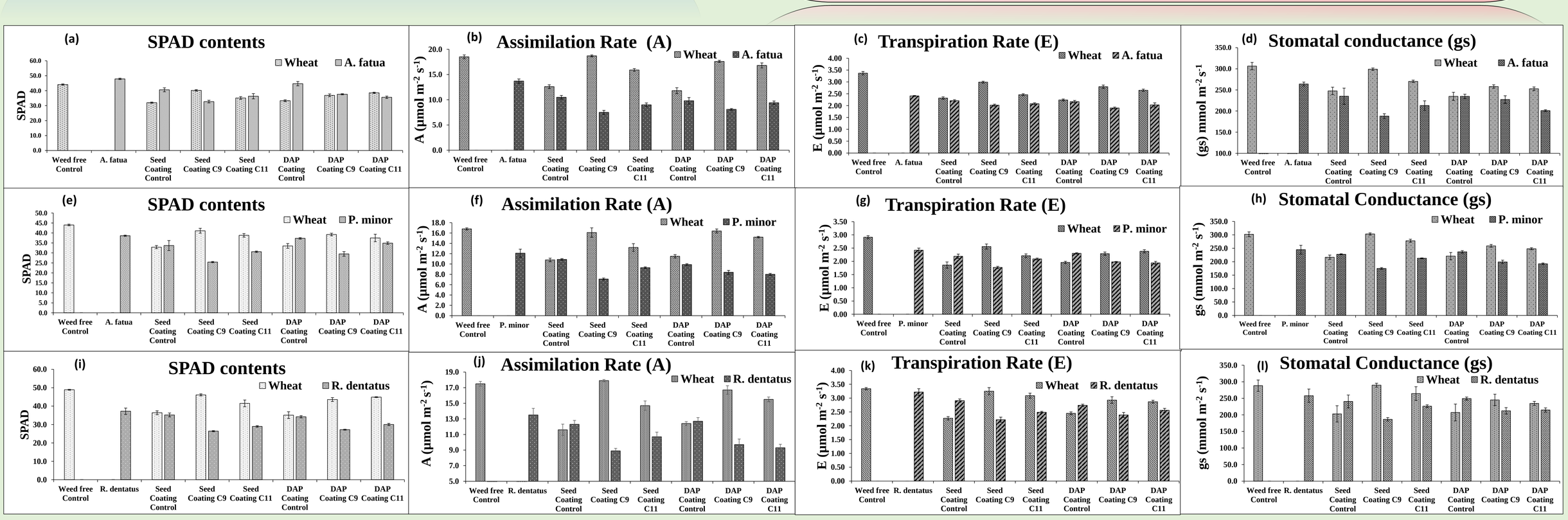


Figure-II: Effect of C9 and C11 allelopathic bacterial consortium on physiology of wheat and its associated weeds

Conclusion

It is concluded from the study that AP have potential to suppress the germination and growth of the economically important weeds (*A. fatua*, *P. minor* and *R. dentatus*) with improving growth and yield attributes of infested wheat. This dual character of these strains could be used for development of ecofriendly bioherbicides in order to reduce herbicides consumption, herbicides import, impact on environment and human health.

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