

Minor Research Project submitted to UGC

Title of the Project: Allelopathic effect of some weeds on growth and physiology of some common vegetable crops.

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Summary of the project

The need for research and development in allelopathy for the improvement of agriculture, forestry and ecology is of extreme urgency, because the understanding of allelopathy has major role(s) in the interactions between invasive/ exotic and native weeds, weeds-crops, crops-crops etc. These studies are of utmost importance in agriculture, forestry, ecology and environmental degradation. Many of these weeds cause damages to agro-ecosystems and disturb natural phytodiversity. Their dominance, luxuriant growth, persistence throughout the year, tolerance to biotic and abiotic stress conditions and allelopathic potential might be the probable factors of successful invasion in new habitats.

To explicate the phenomenon of very high dominance of weeds like *Cassia*, *Dalbergia*, *Synedrella*, *Alternanthera*, *Acalypha* *Euphorbia* and *Eupatorium* which are forming monothickets/ pure stands in the campus of Pune University as well as outside, were investigated with different approaches like ecophysiological, biochemical and enzymological aspects. At the same time, the allelochemicals existing in these plants were isolated, characterized and identified. It was hypothesized that these selected invasive weeds mostly have negative or sometimes positive allelopathic influence on the other native or even exotic weeds and crops, when they naturally exude or leach out the allelochemicals from intact parts or from the residues.

For understanding the basic reasons of invasion and dominance as well as luxuriant growth of these weeds phytosociological, allelopathic potential, morphophysiological, biochemical, enzymological parameters, characterization of allelochemicals were attempted. The studies on phyto-toxicity of leachates and

extracts were undertaken with the purpose to understand the mode and mechanism of action of allelochemicals. The attempts to investigate the fate of weed seeds in the soil had contributed to explore and use such untapped weed biomass in sustainable agriculture as the agents of biological control.

The significant findings of the present study and broad conclusions emerged through it are given in nutshell:

Significant findings

1. The phytosociological studies on invasive and native weeds of Pune University campus and outside area revealed that the invasive weed species like *Cassia uniflora* and *Synedrella nodiflora* were having highest frequency, density and abundance at all the four study sites indicating their exclusive dominance and widespread distribution and successful invasion in the campus. To accomplish this, these weeds have inculted special morphophysiological, biochemical, enzymological and allelopathic superiority.
2. The selected invasive weeds and co-occurring weed species showed higher photosynthetic pigments and rate, rich organic and inorganic constituents, accumulation of osmoprotectants and stimulation of antioxidant enzymes to scavenge ROS.
3. The leaves, stems and roots of the selected invasive weeds have novel bioactive allelochemicals such as terpenoids, flavonoids, glycosides and bitter essential oils. They also showed the presence of tannins, steroids like secondary metabolites.
4. The seed germination bioassay studies in test crops like mustard revealed that lower concentrations of leachates of both the invasive weeds had less positive and more negative influence at different concentrations. These findings showed very high correlation with the physiological, biochemical and enzymological results of seedling analysis.
5. The foliar applications of aqueous leachates and extracts as well as soil applications of residues of both the selected invasive weeds in field trials clearly indicated that the range of lower concentrations had favoured the growth and yield attributes of both the test crops. However, the higher concentrations exhibited negative influence. These findings very well

correlated with physiological, biochemical and enzymological analyses of test crops.

6. The allelopathic influence on nutrient quality of test crops like mustard as well as on rhizosphere soil was of nonsignificant nature.
7. The leachates of the weeds were having different biological activities. The allelopathic influence of the invasive weeds on growth, yield as well as seed germination must be due to the synergistic action of allelochemicals existing in the plant parts and their leachates, extracts and residues.

All these aspects in combination and synergy proved their superiority in the invaded habitat, where they get established by substituting or replacing the natives and became dominant over them in the diverse ecosystem of the outside area of Pune city and the campus of Pune University.