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Editorial

Current Approaches and Successes toward Mycochemical in Sustainable Weed Management: An Editorial

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Weeds are undesirable vegetation directly or indirectly inferring with human welfare. Weeds are serious threat to agriculture lands, forest, environment and human health. There were several methods of weed management. Physical method has known as popular method of weed control but having several demerits. Due to sever labour shortage and increase cost of labour has affected this method. Second approach of weed control by chemical herbicide have play important role in weed control. The pesticide application having several problems viz., contamination of water, residues and resistance problem in weed, narrow spectrum of activity, effect on non-target organisms. So, we need alternative approach for weed control and discovery, develop of novel, economically and ecofriendly sustainable weed control management method. The biocontrol of weeds is based on application of insect, Biotrophic fungi (rust fungi), necrotrophic fungi and their secondary metabolites. Application of living fungal cells or the natural metabolites have ability to control weed populations without harming the environment. This approach is ecofriendly and avoid herbicide resistance. Now a day, the application and demand of organic agriculture has increased, due to that the demand for new mycoherbicide with organic nature has increase. The novel mycoherbicide developed from fungal pathogens spores or their natural products. During my PhD research work, I have isolated and recovered more than 1000 isolates of pathogenic fungi from major weeds of Central India such as *Parthenium hysterophorus, Lantana camara, Xanthium strumarium, Hyptis suaveolens*, *Sida acuta*, *Cassia tora* and *Antignon leptopus* etc. The recovered and identified fungal strains are *Alternaria alternata, Alternaria macrospora, Curvularia lunata, Colletotrichum gloeosporioides f.sp. parthenii, C. dematium, Myrothecium roridum, Sclerotium rolfsii, Fusarium solani, F. oxysporum, Fusarium moniliforme, Drechslera sp. Helminthosporium sp* and *Phoma herbarum,* etc. These strains have shown significant pathogenic potential and satisfied most of the requirements and desired for mycoherbicidal development for above mentioned weeds [1].

The idea of using fungal spores to control weeds is almost as old as the science of plant pathology itself. Host specific, virulent and genetically stable fungi are selected as mycoherbicidal candidate in weed management [2]. But they have several limitations like low inoculums production, environmental dependency and poor dissemination. To overcome these problems of mycoherbicides, application of natural herbicidal constituents from culture filtrates of fungi is one of the alternative strategies to manage the weeds. Natural herbicidal phytotoxin of fungi are natural secondary metabolites produced during host–pathogen interactions. Possibilities of exploitation of Fungal toxins as herbicides have been reviewed in many publications [3-14]. They belong to different classes of naturally occurring compounds as: aromatic, amino acids, coumarins and isocoumarins, cytochalasans, ethanones, furopyrans, nonenolides, oxazatricycloalkalenones, pyrones, spirophytotoxins, terpenes, trichothecenes, and some others with a complex and original carbon skeleton [15].

The secondary metabolites appear to be a lucrative source of novel structures having unique mode of action which could be exploited as commercial herbicides directly or as their derivatives [16]. Several fungal phytotoxin viz., Tentoxin (*Alternaria tenusis*) for *Galium aparine*, Cornexistin, AAL-toxins (*Alternaria alternata*) for *Lemna pausicostata*, Fumonisin (*Fusarium moniliforme*) for *Duckweed* (*Lemna minor*), Moniliformin (*Fusarium oxysporum*) for

Jimsonweed, 5-Methyl-Trp(*Cantharellus cibarius*) for Water hyacinth (*Eichhornia crassipes*), Cinnacidin (*Nectria* sp. DA060097) for *Amaranthus retroflexus*, Cyperin (*Arabidophsis thaliana*) for *Presussia fleischhakii* and Maculosin(*Alternaria alternata*) for Spotted Knapweed (*Centaurea maculosa*) etc. have been successfully exploited [17,18]. Out of several microbial strains and their metabolites tried, only few fungal species have been exploited commercially and sold in market with different trade names. Several non-pathogenic strains of fungi have proved to be the most accessible source of novel by-products. There are various work has done in chemically characterizing several metabolites of several fungi but very few have developed as herbicidal potential. The scientists should work in the field of discovery of more potential agents, development of rapid and easy methods of evaluation, production and formulation [19].

Several natural phytotoxins have novel mode of action. Thus, the growing need for new biochemical herbicide for organic agriculture and herbicides with new herbicides mode of action for conventional agriculture are both drivers for intensification of research into natural products as herbicides or templates for synthetic herbicides. There is great need of successful research and development to develop commercial mycoherbicide product with taking consideration for various range of criteria like biological, environmental, toxicological, regulatory, and commercial. There are various challenges to successful mycoherbicide candidate products to reach the market are the sustainable use of raw materials, standardization of chemically complex microbial extracts, and the regulatory requirements and approval of product.

In future, there are several fungal natural products will useful for weed management as new products directly having novel original modes of action. The application of fungal phytotoxic metabolite could be a replacement for synthetic herbicide which is more economical in controlling weeds than the synthetic herbicides. We are confident that the future of fungal metabolites-based herbicide will accelerate agriculture production and serve as an alternative to the chemical herbicides because of its safety in the environment. The tremendous structural diversity and the promising herbicidal potential of many of these natural products reported in this editorial will prompt a continued interest in developing fungal metabolites as natural safe herbicides. Therefore, research community should be aware of new emerging techniques which set basis for a more efficient extraction, analysis, production and formulation of fungal metabolites in weed managements.

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Bibliography

1. Singh AK. "Isolation and characterization of herbicidal compounds from some selected fungi". PhD Thesis. Bioscience. R.D. University, Jabalpur (2007).

2. Charudattan R. "The mycoherbicide approach with plant pathogens". In: Microbial Control of Weeds, ed D.O. Tebeest, Chapman and Hall, New York, USA (1991): 24-57.

3. Barbosa LCA., *et al*. "Phytotoxic natural products as models for the development of crop protection agents". In: Epifano, F. (Ed.), Current Trends in Phytochemistry. Research Signpost, Kerala (2009a): 21-59.

4. Cantrell CL., *et al*. "Natural products as sources for new pesticides". *Journal of Natural Products* 75 (2012): 1231-1242.

5. Dayan FE., *et al*. "Natural products in crop protection". *Bioorganic and Medicinal Chemistry* 17 (2009): 4022-4034.

6. Demuner AJ., *et al*. "Phytotoxic constituents from Nimbya alternantherae". *Biochemical Systematic and Ecology* 34 (2006): 790-795.

7. Duke SO., *et al*. "Chemicals from nature for weed management". *Weed Science* 50 (2002): 138-151.

8. Duke SO., *et al*. "Natural products as sources for new mechanisms of herbicidal action". *Crop Protection* 19 (2000): 583-589.

9. Passos JL., *et al*. "Effects of Corynespora cassiicola on Lantana camara". *Planta Daninha* 28 (2010): 229-237.

10. Pandey AK., *et al*. "Herbicidal activities of secondary metabolites of Strepomyces sp. against Hyptis suaveolens". *Journal of Basic and Applied Mycology* 3 (2004b): 95-97

11. Pandey AK., *et al*. "Herbicidal potential of secondary metabolites of Sclerotium rolfsii against Parthenium: A preliminary observation". *Journal of Basic and Applied Mycology* 2.1 (2003): 27-30

12. Pandey AK. "Herbicidal potential of microorganism: Present status and future prospects". In: Microbial Biotechnology for Sustainable Developments and Productivity. Rajak, R.C. (Ed.) Scientific Publications, Jodhpur, Rajasthan, India (1999): 87-105.

13. Thapar R., *et al*. "Bioactivity of CFCF of Curvularia lunata in Parthenium hysterophorus L". *Journal of Basic and Applied Mycology* 1.1 (2002): 126-129.

14. Singh AK and Pandey AK. "Fungal metabolites as a natural source of herbicide: a novel approach of weed management". *Journal of Applied and Natural Science* 11.1 (2019): 158-163.

15. Evidente A and Motta A. In Bioactive Compounds from Natural Products, ed. C. Tringali, Taylor and Francis, London (2001): 473-525.

16. Abbas HK., *et al*. "Production of fumonisins by Fusarium moniliforme culture isolated from Jimson weed in Missisipi". *Journal of Phytopathology* 136 (1992): 199-203.

17. Hoagland RE. "The genus Streptomyces. A rich source of novel phytotoxins". In: Ecology of Desert Environments (ed. Ishwar Prakash) Scientific Publishers, Jodhpur, India (2001): 139-169.

18. Barbosa A., *et al*. "Phytotoxin produced by Bipolaris euphorbiae in-vitro is effective against the weed Euphorbia heterophylla". *Brazilian Archives of Biology and Technology* 45 (2002): 233-240.

19. García-Pajón CM and Collado IG. "Secondary metabolites isolated from Colletotrichum species". *Natural Product Reports* 20 (2003): 426-431.