Influence of pH, Temperature, and Nutrient Media on the Growth of *Curvularia lunata* (FCXS#07) for *Xanthium strumarium* Management"

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Abstract

Common cocklebur (*Xanthium strumarium*), a member of the Asteraceae family, is an annual weed prevalent in the warmer regions of the world. This weed is notorious for being a significant agricultural pest, especially in cotton and soybean crops. Additionally, it negatively impacts the germination and growth of various other crops, including maize, oats, peanuts, and pearl millet. The plant contains harmful alkaloids, including sesquiterpene lactones such as xanthatin, xanthumin, and xanthumal, which are toxic to both plants and animals. Furthermore, these compounds pose a danger to human health, as they are known to cause severe contact dermatitis in both humans and animals. Biological control with mycoherbicides has gained significant attention as an eco-friendly alternative to chemical herbicides. In the case of *Xanthium strumarium*, a microbial control program was initiated, focusing on identifying effective fungal pathogens that could act as mycoherbicides. Further investigation into the fungal growth conditions revealed that *C. lunata* showed optimal sporulation when cultured on Potato Dextrose Agar (PDA) and Asthana & Hawker's media, at a temperature of 30°C and a pH of 6.0. In terms of nutrient sources, the potential of *C. lunata* as a mycoherbicide presents a sustainable and environmentally friendly solution to managing *Xanthium strumarium* infestations in agricultural settings.

Key words. *Xanthiurn strumariurn, Curvularia lunata, Management,* pH, temperature and nutrient medium.

Introduction:

Weeds are unwanted and undesirable plants, which interfere with the utilization of land and water resources and thus adversely affect human welfare. In croplands and forests weeds compete with the beneficial and desired vegetation reducing the yield and quality of produce. Undesirable vegetation also flourishes in aquatic system forestry and non-cropped areas such as industrial sites, roadsides,

railway-lines, airfields land scape plantings water tanks, waters ways etc. Thus, all plants may become weeds in particular situation. Weeds are an important factor in the management of all land and water resource, but their effective impact is greatest on agriculture. *Xanthiurn strumariurn* is a coarse annual herb belongs to family Asteraceae popularly known as Common Cocklebur, Banokra, Gokhru & Chhota Dhatura. The weed is considered one of the world's worst weed as listed by Holm *et al.,* 1977). It causes several severe problems in agriculture, forestry and environment as a hole. All the parts of the weed are highly toxic and allergenic to humans and animals. The potential value of bio-products as a source of compounds for development is widely, underappreciated. Types of species of *Curvularia lunata* (FCXS#07).are known to produce many phytotoxins, but only some have been proven to play roles in pathogenesis Mass production of secondary metabolites are known to be influenced by physicochemical factors viz., nutrients, temperature, pH, static or rotary conditions (Saxena et al., 2001; Singh and Pandey, 2010). To improve the efficacy or modify virulence, viability, host specificity or environmental requirement, formulations are required. Then, host-specific from *Curvularia lunata* (FCXS#07).fungi will be discussed with a review of the available literature as well as recent findings from our laboratory. Finally, the development of Bioherbicides from phytotoxins of *Curvularia lunata* (FCXS#07). In the present study to investigate the effect of various environmental condition like nutritional media's temperature, pH and photo period for growth and large scale toxic production of *Curvularia lunata* (FCXS#07).

Material & Methods:

Fungal culture: - *Curvularia lunata* (FCXS#07) were isolated from different diseases samples collected from *Xanthiurn strumariurn* Raipur. *C. lunata* (FCXS#07) were isolated on PDA media by serial dilution and pour plate, technique the *C. lunata* (FCXS#07) were identified using Research literature the culture was stored at 4°C for further study.

Fugal Culture growth at different temperature: - To study the effect of different temperature mycelial growth and their phytotoxin production of *C. lunata*

(FCXS#07) was observed on eight different levels of temparuture ranging from low mesophilic to therophilic (viz. 5, 10, 15, 20, 28, 30, 40 and 50°C) these temperatures were maintained on solid and liquid media. Mycelia biomass was recorded after 14 days incubation (Sohni et al., 2018 and Roli et al., 2017).

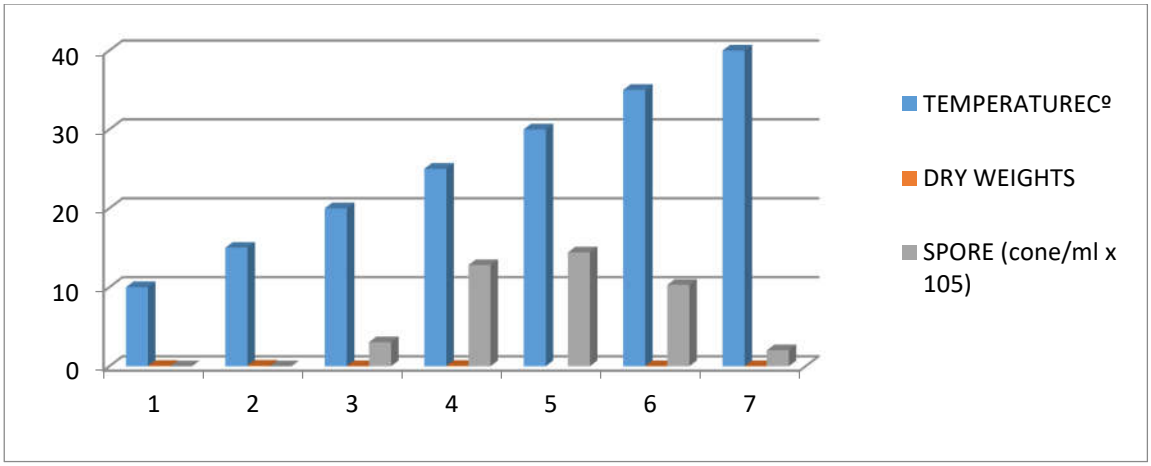
Fungal Culture growth at different pH: - Hydrogen ion concentration of the growth medium is a significant factor that affected the rate of growth and sporulation of fungi establishing the optimum pH for phytotoxin production by the *C. lunata* (FCXS#07) it was grown at various pH level. The pH required for optimum growth was taken as standard for subsequent experiment.

Fungal Culture growth at different Nutrient media:- To determine optimum conditions for maximum growth, sporulation and efficacy of selected pathogen C. *luanta* (FCXS#07) against *X strumarium L.* the pathogen was subjected to different nutrient conditions. The media producing higher spores and less dry weight was selected as the basal medium for further studies. To determine the maximum growth and of *C. lunata* (FCXS#07) various natural - synthetic and semi synthetic media were used for observation.

Results

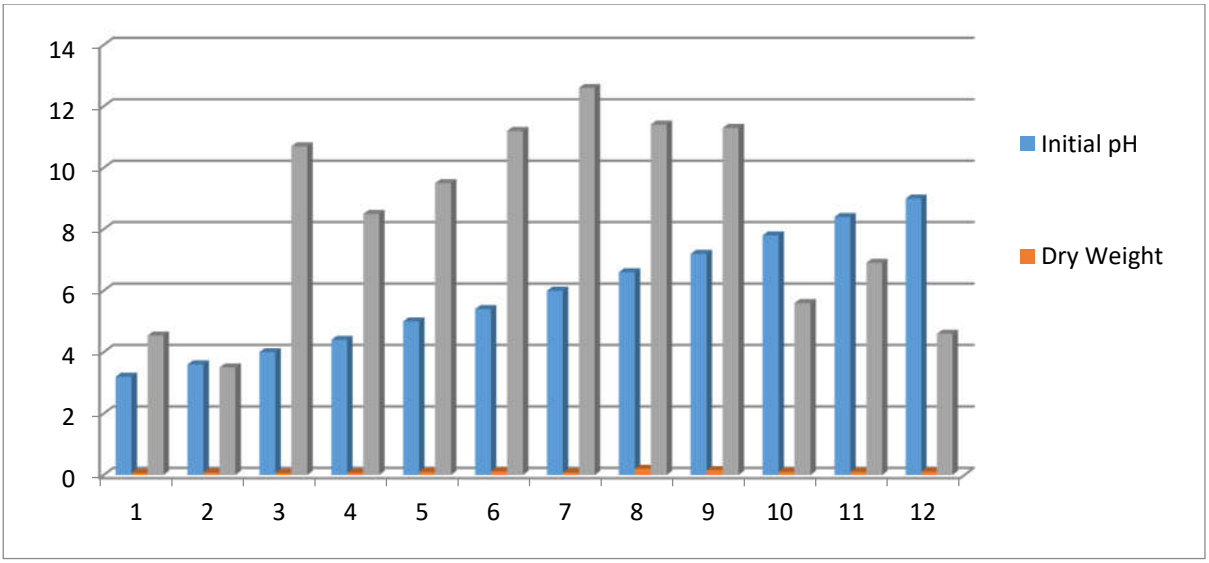
The *Curvularia lunata* (FCXS#07) isolated from *Xanthiurn strumariurn* fungus were identified and used for further optimization investigation. Effect of Temperature The test fungi *C. lunata* (FCXS#07) could grow within a wide range of temperature i.e., 15°C to 40°C. Maximum growth and sporulation were recorded at 30 °C. It was followed by 27 °C. Beyond these, growth and sporulation both reduced significantly.

Graph. 01 Effect of Different Termperatures On Growth And Sporulation of *C.lunata (FCXS#07)*



Effect of pH (Hydrogen ion concentration) Hydrogen ion concentration exerts indirect effects upon cellular metabolism through changes in chemical environment. Hydrogen ion concentration has important effect in the enzymatic control system of fungi. There is a great ambiguity still prevailing in relation to the mechanism of action of pH on growth, and toxin production. *C. lunata* (FCXS#07) could grow well within a pH range of 3.5 - 6.0. Maximum growth was recorded at 7.2 pH, however sporulation was comparatively better at pH 6.00. In general, slight shift in pH was towards alkalinity, but there is no correlation between growth and sporulation with alkalinity of media. Therefore, it can be concluded that pH 6.00 is the better pH for growth and sporulation of the pathogen *Curvularia lunata.*Similar results were recorded by Ramakrishnan (1941) with *C. fallatum*. Drastic changes in final pH were also recorded by number of other workers (Tandonand Verma, 1962; Armstrong, 1921 and Agarwal and Shikhende, 1959).

Graph no. 02 Effect of pH on Growth And Sporulation of *C.lunata (FCXS#07)*



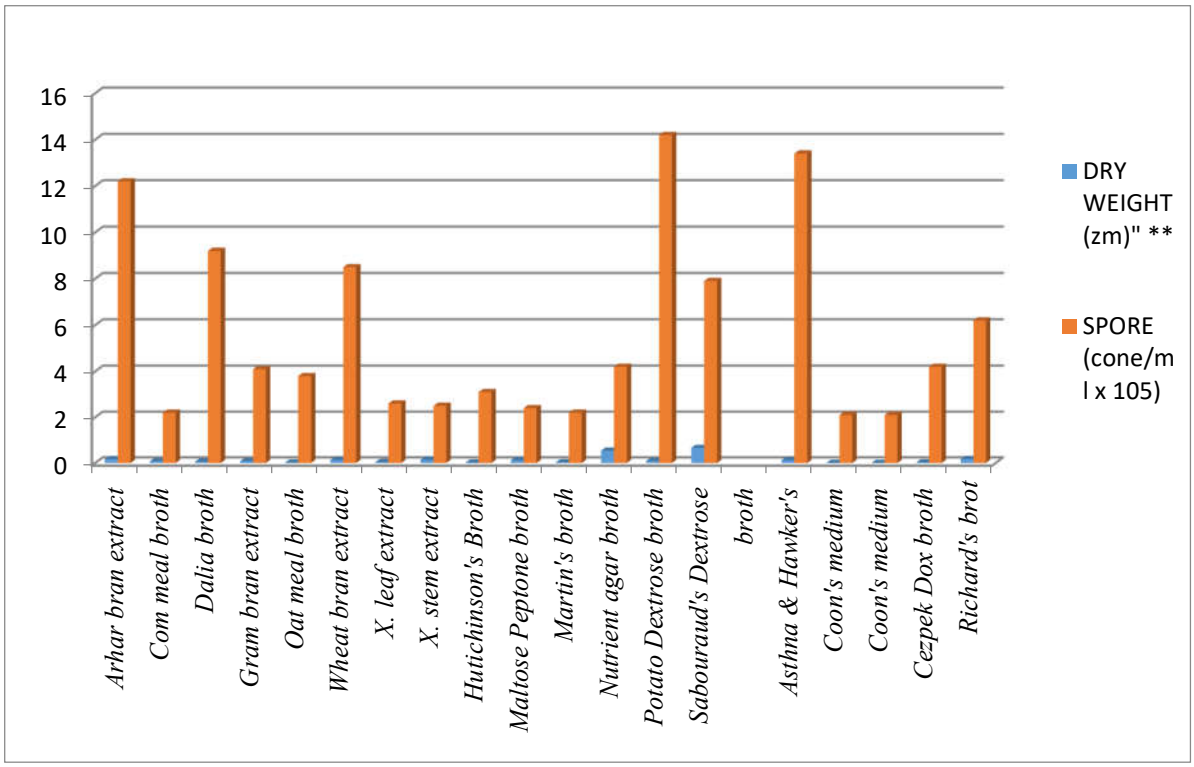
Fungi are extremely versatile in their nutrition. Except certain fluorine - containing plastics and a few detergents, there is nothing which fungi cannot degrade to derive nutrition. But knowledge of nutrition of fungi is necessary, in order to cultivate them in laboratory for various purposes.

Natural media Wheat bran extract, Dalia broth, and Arhar bran extract favoured excellent growth and sporulation, whereas Oat meal broth and gram bran broth did not supported growth and sporulation. Host leaf and stem extracts (decoction media) supported very poor growth and sporulation. Similarly semi-synthetic media also showed significant variations as for growth and sporulation is concerned. Potato-dextrose broth supported excellent sporulation but failed to support growth. In Sauboard's – dextrose broth and nutrient agar broth supported good growth but failed to induce significant sporulation.

Amongst synthetic media, Asthana & Hawker's medium was found to be excellent for sporulation and moderately effective for growth of test pathogen. Richards's medium produced better growth but sporulation was very poor in the medium. Significant variations in growth and sporulation of various other strains and species of the genus *Curvularia* have also been obtained by many earlier investigators (Agarwal, 1958; Tandon & Chandra, 1962; Singh & Tandon 1969; Panwar, 1972; Singh J.1976; Bhale and Khare, 1984).Though, the natural media are of low cost and easy to prepare, however their complex nature, unknown chemical composition limits their use as a basal medium in physiological studies.

On the basis of above investigations, Potato Dextrose Agar medium was selected for general-purpose studies while Asthana & Hawker's medium was used for subsequent physiological studies.

Graph. No. 03 Effect of Nutrient Media on Growth and Sporulation of C. *Lunata (FCXS#07).*



Conclusion

On the basis of all observation, it is concluded that the effect of different factors like pH, temperature and nutrient medium was played a important role for the growth of *Curvularia lunata* (FCXS#07) and the physiological factors are essential for large scale production of biomass of the *Curvularia lunata* (FCXS#07) for the management of *Xanthiurn strumariurn* weeds.

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