



"Impact Of Ph, Temperature, And Nutrient Media On The Development Of *Curvularia Lunata* (FCXS#07) Aimed At Managing *Xanthium Strumarium* Biologically."

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Abstract

Common cocklebur (*Xanthium strumarium*), a member of the Asteraceae family, is an annual weed widely distributed in warmer regions across the globe. This weed is notorious as a major agricultural pest, particularly affecting cotton and soybean crops. Moreover, it adversely influences the germination and growth of various other crops such as maize, oats, peanuts, and pearl millet. The plant produces toxic alkaloids, including sesquiterpene lactones like xanthatin, xanthumin, and xanthumal, which are harmful to both plants and animals. These compounds also pose health risks to humans, causing severe contact dermatitis in both people and livestock.

Biological control using mycoherbicides has gained considerable interest as an environmentally friendly alternative to chemical herbicides. For *Xanthium strumarium*, a microbial control program was launched to identify fungal pathogens capable of serving as effective mycoherbicides. Studies on fungal growth conditions demonstrated that *Curvularia lunata* exhibited optimal sporulation when grown on Potato Dextrose Agar (PDA) and Asthana & Hawker's media, at 30°C and pH 6.0. Regarding nutrient sources, *C. lunata* shows great promise as a sustainable and eco-friendly mycoherbicide for managing *Xanthium strumarium* infestations in agricultural fields.

Keywords: *Xanthium strumarium*, *Curvularia lunata*, management, pH, temperature, nutrient medium.

Introduction:

Weeds are unwanted plants that interfere with the optimal use of land and water resources, thereby negatively impacting human welfare. In agricultural fields and forests, weeds compete with desirable vegetation, leading to reduced crop yield and quality. Undesirable vegetation also thrives in aquatic systems, forestry, and non-cultivated areas such as industrial sites, roadsides, railway lines, airfields, landscaping, water tanks, and waterways. Essentially, any plant can become a weed under certain conditions. Weeds play a significant role in the management of all land and water resources, with the greatest impact felt in agriculture.

Xanthium strumarium, commonly known as common cocklebur (also called Banokra, Gokhru, and Chhota Dhatura), is a coarse annual herb belonging to the Asteraceae family. It is listed among the world's worst weeds (Holm et al., 1977) due to its severe negative effects on agriculture, forestry, and

the environment. All parts of the plant are highly toxic and allergenic to humans and animals. Despite this, the potential of bioproducts derived from such plants as sources of useful compounds remains largely underexplored.

Species of *Curvularia lunata* (FCXS#07) are known to produce a variety of phytotoxins, though only some have been confirmed to contribute to disease development. The production of these secondary metabolites is influenced by physicochemical factors such as nutrient availability, temperature, pH, and culture conditions (static vs. rotary) (Saxena et al., 2001; Singh and Pandey, 2010). To enhance efficacy or modify virulence, viability, host specificity, or environmental requirements, suitable formulations of these fungi are necessary.

This study focuses on host-specific strains of *Curvularia lunata* (FCXS#07), reviewing both existing literature and recent laboratory findings. It aims to develop bioherbicides based on phytotoxins produced by *C. lunata* (FCXS#07). Specifically, this research investigates the effects of various environmental conditions—including nutrient media, temperature, pH, and photoperiod—on the growth and large-scale toxin production of *Curvularia lunata* (FCXS#07).

Materials & Methods:

Fungal Culture:

Curvularia lunata (FCXS#07) was isolated from diseased samples of *Xanthium strumarium* collected in Raipur. Isolation was performed on Potato Dextrose Agar (PDA) media using serial dilution and pour plate techniques. Identification was confirmed through research literature. Cultures were stored at 4°C for subsequent experiments.

Fungal Growth at Different Temperatures:

To evaluate the effect of temperature on mycelial growth and phytotoxin production, *C. lunata* (FCXS#07) was cultured at eight different temperatures ranging from 5°C to 50°C (5, 10, 15, 20, 28, 30, 40, and 50°C) on both solid and liquid media. Mycelial biomass was recorded after 14 days of incubation (Sohni et al., 2018; Roli et al., 2017).

Fungal Growth at Different pH Levels:

The hydrogen ion concentration (pH) of the growth medium significantly influences fungal growth and sporulation. *C. lunata* (FCXS#07) was grown at various pH levels to determine the optimum pH for phytotoxin production. The pH that supported optimal growth was used as the standard in subsequent experiments.

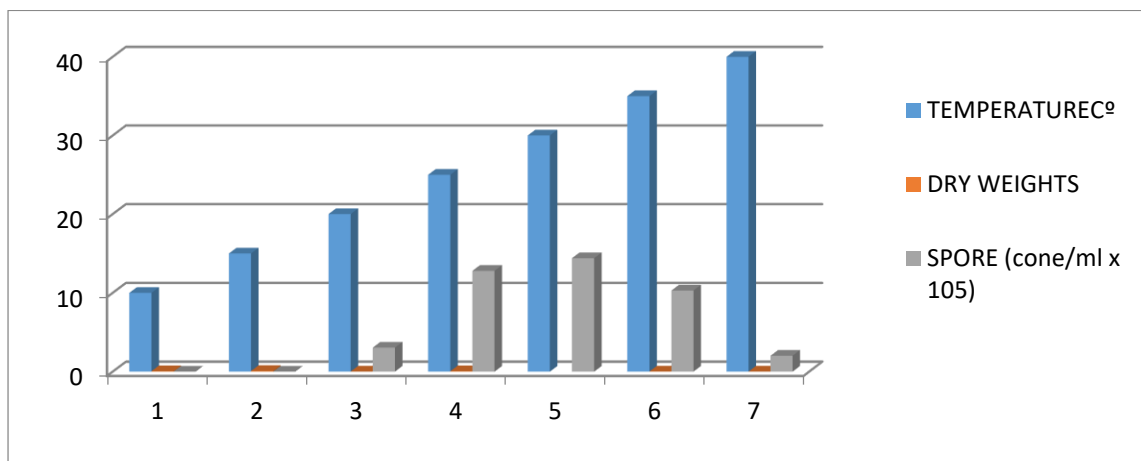
Fungal Growth on Different Nutrient Media:

To identify the best conditions for maximum growth, sporulation, and efficacy against *Xanthium strumarium*, *C. lunata* (FCXS#07) was cultured on various natural, synthetic, and semi-synthetic media. The medium that yielded the highest spore count with minimal dry weight was selected as the basal medium for further study.

Results:

The *Curvularia lunata* (FCXS#07) isolate from *Xanthium strumarium* was successfully identified and used for optimization studies. The fungus grew across a wide temperature range, from 15°C to 40°C. Maximum growth and sporulation were observed at 30°C, followed by 27°C. Temperatures outside this range resulted in significantly reduced growth and sporulation.

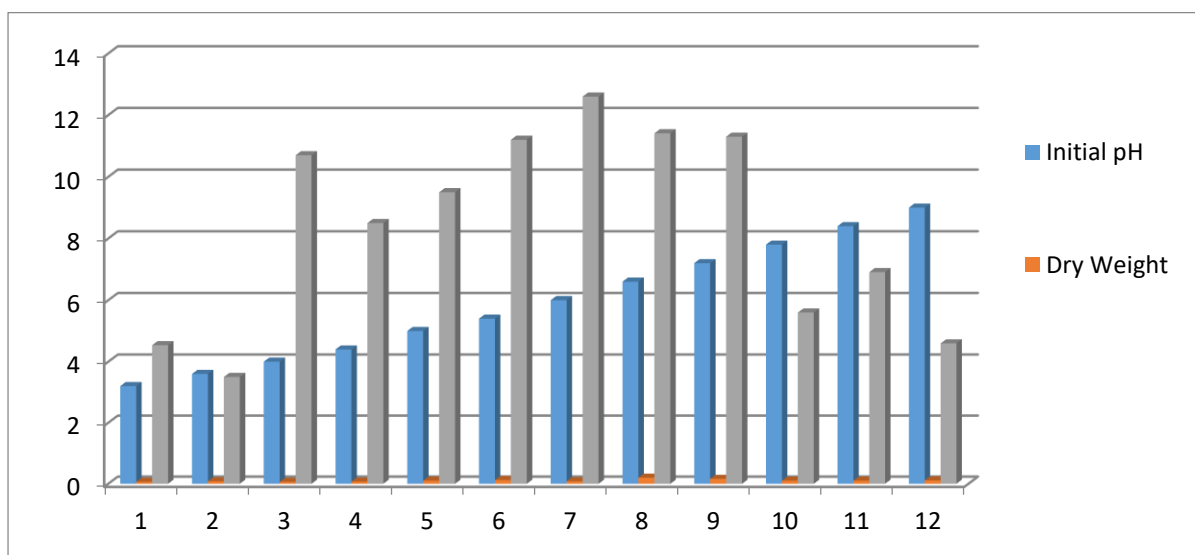
Graph. 01 Effect of Different Temperatures On Growth And Sporulation of *C.lunata* (FCXS#07)



Effect of pH (Hydrogen Ion Concentration):

Hydrogen ion concentration indirectly influences cellular metabolism by altering the chemical environment. It plays a crucial role in the enzymatic regulatory systems of fungi. However, the exact mechanism by which pH affects fungal growth and toxin production remains unclear. *Curvularia lunata* (FCXS#07) was able to grow well within a pH range of 3.5 to 6.0. Although maximum mycelial growth was observed at pH 7.2, sporulation was notably higher at pH 6.0. Generally, a slight shift toward alkalinity was noted, but no clear correlation was found between increased alkalinity and fungal growth or sporulation. Therefore, pH 6.0 can be considered optimal for both growth and sporulation of *Curvularia lunata*. Similar findings were reported by Ramakrishnan (1941) for *C. fallatum*. Significant changes in final pH during fungal growth were also documented by other researchers (Tandon and Verma, 1962; Armstrong, 1921; Agarwal and Shikhende, 1959).

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



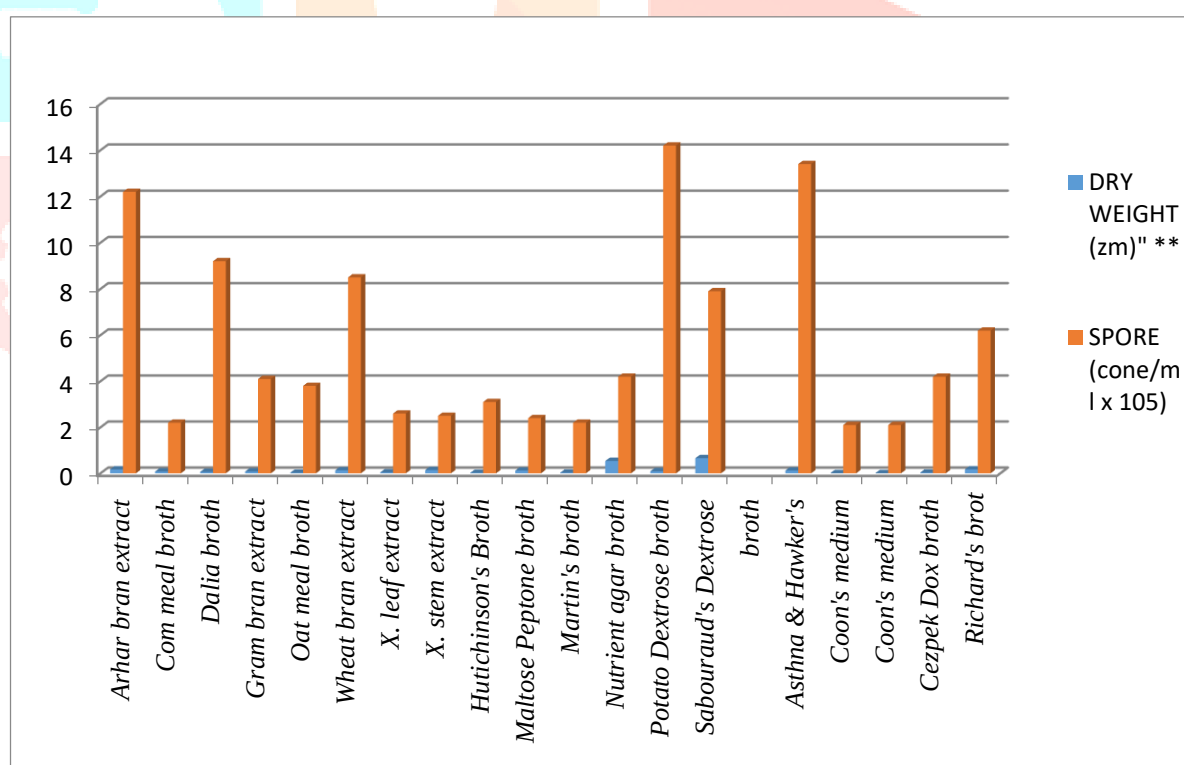
Fungi exhibit remarkable nutritional versatility, capable of degrading nearly all substances except certain fluorine-containing plastics and a few detergents to obtain nutrients. However, understanding fungal nutrition is essential for their successful cultivation in the laboratory for various applications.

Among natural media tested, wheat bran extract, dalia broth, and arhar bran extract supported excellent fungal growth and sporulation. In contrast, oat meal broth and gram bran broth did not support growth or sporulation effectively. Host leaf and stem extracts (decoction media) resulted in very poor growth and sporulation. Similarly, semi-synthetic media showed notable differences in their ability to promote growth and sporulation. Potato dextrose broth induced excellent sporulation but did not support significant mycelial growth. On the other hand, Sabouraud's dextrose broth and nutrient agar broth facilitated good growth but failed to stimulate substantial sporulation.

Among synthetic media, Asthana & Hawker's medium was found to be excellent for sporulation and moderately supportive of pathogen growth. Richards's medium favored better growth but resulted in poor sporulation. Similar variations in growth and sporulation among different strains and species of *Curvularia* have been documented by earlier researchers (Agarwal, 1958; Tandon & Chandra, 1962; Singh & Tandon, 1969; Panwar, 1972; Singh, 1976; Bhale and Khare, 1984).

Although natural media are cost-effective and easy to prepare, their complex and variable chemical composition limits their suitability as basal media in physiological studies. Based on these findings, Potato Dextrose Agar (PDA) was selected for general cultivation purposes, while Asthana & Hawker's medium was used for detailed physiological experiments.

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



Conclusion

Based on all observations, it is concluded that factors such as pH, temperature, and nutrient medium play a crucial role in the growth of *Curvularia lunata* (FCXS#07). These physiological parameters are essential for the large-scale production of *C. lunata* biomass, which is vital for the effective management of *Xanthium strumarium* weeds.

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