



**EFFECT OF THE PHYSIOLOGICAL PARAMETERS ON THE SPORE
PRODUCTION ON SOLID MEDIA OF *BEAUVERIA BASSIANA*: A
REVIEW**

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ABSTRACT

The entomopathogenic fungus *Beauveria bassiana* is used to protect crops from pests. *Beauveria bassiana* is a globally distributed hyphomycete strain that causes white muscadine disease in a variety of insects. Pests damage the crops and decrease the yield of agriculture product. *Beauveria bassiana* is used as a biocontrol agent and infect the insects and control the damage of crops and decrease the effect of pests and increase the agrological product yield. In this review, the effect of various parameters such as pH, temperature, C/N sources on the growth of the *Beauveria bassiana* is revealed. The C/N sources are used as a nutrient source and play important role in increasing the spore production of *Beauveria bassiana* so the C/N sources are also helpful to increase the yield during solid-state fermentation. In solid state fermentation, microorganisms are grown in a solid substrate with moist in the absence of free water. Solid state fermentation (SSF) has emerged as the ideal technology for controlling the remnants of agricultural industries and their extensions, Agricultural by-products has a potentiality for mass production of *Beauveria bassiana*, agricultural byproducts are rise husk, wheat bran, bagasse, tea leaf waste, coffee waste etc. are used as a

substrate. Carbon and nitrogen sources are added in substrate as an additional nutrient source and they help to increase the spore production.

Keywords: *Beauveria bassiana*, pH, temperature, carbon nitrogen source, solid state fermentation

INTRODUCTION

Insecticides is the best option for the control on the pest and this is the reliable strategy for emergency action when insects at the time blooming. Pest control led in several problems in pest management such as the emergence of pesticides, reviving insects with unpleasant toxic effects on the natural enemies of target insects, disruption of ecosystem, toxic residues in plants and environmental problems. As a result, the research into a new environmentally friendly method strengthening [1].

Biopesticides is consider as the best replacement of chemical pesticides in the pest control programed. Current ratings indicate that year-round potential pesticide market other biological methods. entomopathogenic fungus (EPF) can be used as Comprehensive Pest Management many insects. Under natural conditions, these germs are the cause and are always caused natural mortality of insects. The major drivers behind the Push of mycoinsecticides need more specificity agents as part of the IPM programs to be implemented concern about chemical residues in human's health and nature. Many types of Hypocreales (Ascomycota) live in the soil an integral

part of their northern life cycle latitudes. For these, the *Beauveria bassiana* are these especially common [2].

Entomopathogenic fungi have played an important role in the microbial control of pest. Entomopathogenic fungi are first recognize as a disease-causing pathogen in insects. *Beauveria bassiana* is a fungus that attacks a variety of insects, including whiteflies, aphids, grasshoppers, and some types of beetles, causing white muscadine disease [3]. *Beauveria bassiana* is a potential alternative of chemical pesticides and for the control of pest and it is commercially available in nearly worldwide for such a purpose. *Beauveria bassiana* achieve from the different methodologies such as solid-state fermentation and liquid state fermentation use for the mass production. Environmental conditions, generally temperature and humidity, play a meaningful role on the growth of epizootic pathogens, its impact on survival and germination rate of *Beauveria bassiana* [4].

pH of medium is also playing a significant role in growth, metabolism and development of fungus, it affect conidia formation, germination, growth rate,

pigment production, inhibition by antimycotics [5] and toxin formation [6]. For the germination and growth of the *Beauveria bassiana* fungi nutrition are required and Various C/N sources can affect the growth rate of *Beauveria bassiana* and as well as on the development, for the germination occur carbon must be present in media, carbon utilize as an energy source for germination. Nitrogen sources is needed for continued hyphal growth, organic and inorganic both source of nitrogen are readily utilized for growth [7].

The biocontrol program necessitated the cultivation of a large number of entomopathogenic fungi, which necessitated the use of high-quality inoculum capable of providing optimal growth and condition. This suggests that Agra-industrial wastes with high levels of nutrients and solid growth support to promote filamentous fungi growth are a good option for mass fungi production. In the agriculture west, the abundance of carbon and other nutrients such as sucrose and moisture provide ideal conditions for the mass production of entomopathogenic fungi.

EFFECT OF DIFFERENT PARAMETERS (pH OF MEDIUM, AND TEMPERATURE, CARBON NITROGEN SOURCES) ON GROWTH AND CONIDIATION OF *BEAUVERIA BASSIANA* EPF

These physical parameters are studied by testing the ability of the strain of *Beauveria bassiana* to grow in different media with different initial pH, incubation period with temperature and measuring by various technique like radial growth of colony and production of conidiospore on different composition of media.

Effect of pH

The effect of pH on the survival, ecological distribution, and virulence of entomopathogenic fungi is essential for fungal growth and development. Galani (1988) analyzed that the pH of the medium had the greatest effect on biomass production in *Beauveria bassiana*, with the highest biomass generated between pH 6 and 8.5 [8]. Information on the pH tolerance spectrum of entomopathogenic fungal isolates would be beneficial for inundative applications; fungal isolates that can tolerate alkaline pH are useful for the formulation of mucopeptides [9]. And the radial growth of the colony of individual strains were measured it would be help to record the impact of pH on the strain.

Effect of temperature

St. leger and screen recommended genetically depended resistance to desiccation and temperature extremes would be distinct advantages during infection and during mucopeptide formulation and storage [10]. Studies have been referring the response of *Beauveria*

bassiana to a wide range of temperatures [11]. In vitro assays to fungal response to temperature needed constant temperature, few entomopathogenic fungi are active above 32° C. this temperature exceeded tropical habitats, fortunately temperatures often only retard fungi, but do not harm them, In topical conditions, night temperature is normally around 20° to 25°C, and that providing a favorable condition suitable for fungal growth and germination occur [12]. *Beauveria bassiana* tested at various temperature to experienced agricultural crops. *Beauveria bassiana* was found to be highly sensitive to fluctuate temperatures, but the infectivity decreases as the temperature variation increased [13]. *Beauveria bassiana* have ability to grow at a wider range temperature from 20-30°C, most entomopathogenic fungi require temperature between 25-30°C and relative humidity above 97 per cent for germination.

Effect of carbon nitrogen source on the growth of *Beauveria bassiana*

Many entomopathogenic fungi's condos can live in the atmosphere until they are exposed to a food source that allows them to germinate. Carbon sources such as glucose, Glucosamine, chitin, and starch are required for *Beauveria bassiana* to develop. Nitrogen is also needed for hyphal growth. For past decades most of the work has been done on the enzyme secreted by

growing mycelia of entomopathogenic fungi. In this area, organic and inorganic nutrients containing carbon and nitrogen are needed for macromolecule biosynthesis and growth metabolic regulation. It is well known that fungi prefer glucose, aldehyde, acetamide, and other carbon sources [14]. Several studies are mentioned that the connection of catabolic respiration during the fungal pathogenesis, catabolic respiration is more relevant if mycelia are to be in particular conditions. Amino acids, carbohydrate, purines, ammonia, and other basic or complex macromolecules are examples of primary carbon and nitrogenous nutrients.

Selective nutrient sources are categorized according to their natural environment and lifestyle, and fungus is best known for its ability to metabolize various nitrogen compounds by expressing catabolic enzymes and saturating it [15]. Nitrogen is the second most abundant factor in fungal cells in terms of quantity and is important for growth and metabolism. Nitrogen source become mandatory to the economic feasibility of industrial fermentation processes of spore production; nitrogen sources are economically expensive component in for large scale production of hypocrealean entomopathogenic fungi. A wide range of complex nitrogen sources, especially low-cost agricultural products containing protein and oligopeptides, may

be suitable for the production of fungal biocontrol agents and reduce media costs [16].

MASS PRODUCTION OF *BEAUVERIA BASSIANA* BY SOLID STATE FERMENTATION

Improved potential control agents often revolve around a suitable mass-production process for large-scale production of infective propagules. Entomopathogenic fungi must be a mass generated in large quantities before they can be used on a large scale in the field. A surface culture with a solid substrate, such as moistened wheat bran, millet, or rice, or a submerged culture with a liquid medium are also common methods for cultivating fungal spores [17]. *Beauveria bassiana* is an arthropod parasite that affects over 200 species of insects and acaridae. These entomopathogens are produce in vitro through fermentative processes are solid state fermentation and diphasic technique, here we study about solid-state fermentation technique by using agro-industrial waste and effect of the carbon nitrogen sources on it.

Solid state fermentation by using of agro-industrial waste

Solid state fermentation can be defined as the grow the microorganisms on the moist solid substrate in the absence of free water, The SSF differs from submerged fermentation because of its low moisture

content. There is no systematic research that guides the creation and activity of a broad SSF with adequate controls, unlike the state of submerged fermentation. Solid state fermentation is divided into solid phase work; can serve as a basis for the growth of germs also become inert for healthy food purpose and in such a case the healthy nutrient source needed for the growth of microorganisms are shown to be supported [18]. Solid state fermentation have some advantages like it is provide spore production In a short period of time [19], in the industrial process this method is very useful for the production of the fungal spore, but this process required idol, cheap, and heavy productive culture media, for the raw material have been tested for the production of entomopathogenic fungi such as grains like wheat, rice, sorghum [20], and agricultural wastes like bagasse, tea and coffee husk, rise husk, wheat bran, jetropha seed cake, refused potato [21] etc. The development of large quantities of high-quality inoculum capable of optimum growth and development is required for the biocontrol agent using entomopathogens to be successful. In this regard, agro-industrial waste may be a good way to replicate ENPF on a large scale, as it contains a lot of nutrients and provides a lot of support for filamentous fungal growth [22]. The presence of carbon, other nutrients, and moisture in agricultural waste creates ideal

conditions for microorganism growth, allowing for more opportunities for their reuse in the SSF process. [23]. Cellulose, hemicelluloses, and lignin, which are also categories as lignocellulosic compounds, make up a large portion of agricultural and industrial waste. Agro-industrial waste contains sugars, proteins, minerals, and water, which give a perfect setting for the expansion of microorganisms, primarily flora strains, thanks to their ability to grow on complicated solid substrates and secrete a large variety of enzymes [24]. Some studies mention that the entomopathogenic fungus *Beauveria bassiana* spore production is good on a rice husk, wheat bran, molasses etc. [25].

Growth and sporulation in entomopathogenic fungus are analyzed demands of appropriate nutritional and the pH conditions. Carbon and nitrogen sources are also affecting the solid-state fermentation for spore production because growth of conidia depends on the carbon sources and the nitrogen source provide hyphal growth [26].

Studies mention that the spore production of industrial waste are inoculated with several essential nutrient sources like dextrose 1.5%, NaNO_3 0.25%, KH_2PO_4 0.1%, MgSO_4 0.05% which provide comparatively more spore production than without nutrient supplements, in their study rice husk (without nutrient supplement)

gain higher (4.3×10^8) spore production than other substrates but with nutrient supplement added substrate's yield is higher (1.8×10^9) than without nutrient supplement media. And with nutrient sources growth incrementation of spore production was also noticed in other substrates wheat bran, pigeon pea husk, urad husk, tea leaf waste etc. [27].

CONCLUSION

The strain of *Beauveria bassiana* is affected with different parameters are pH, temperature, carbon nitrogen sources are affecting the growth of spore production also it is increase it. The solid-state fermentation of agro-industrial residues are producing a high spore production but the nutrients sources are mix with that agro-industrial substrate and inoculate with spore suspension and it increase the spore production than without nutrient added substrates, the variability of carbon, nitrogen, and energy sources which satisfy the germination and growth requirement of *Beauveria bassiana*. Agricultural cheap byproducts are used for the mass production of the *Beauveria bassiana* but nutrient sources are increasing the production than nutrient without substrate.

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