Metarhizium based mycoinsecticide (PESTSTAT) for management of forest pests

Developed by

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Information pertaining to Forestry in Service to Nation: ICFRE Technologies

WBD Technology 1

1. Development of a *Metarhizium* based mycoinsecticide (PESTSTAT) for management of forest pests

A. Nature of technology

Introduction:

Pest management in forestry has always been a challenge before the forest development agencies and planters. It is particularly relevant in the area of plantation forestry where productivity which is the main thrust, is often affected by out break of pest and diseases. This is clearly demonstrated in one of the examples of a long term study conducted on teak in India where an estimated loss of about 44% of the potential volume increment in 4 – 9 year old trees due to frequent attack by a serious defoliator pest, *Hyblaea puera* Cramer is reported. This loss is substantial and the defoliator attack clearly affects the quality and quantity of timber yield from one of the most valued timber species in our country. Such insect infestations frequently affect many other species of timber yielding trees also, jeopardizing the economic viability of commercial forestry. Notwithstanding these reports, no appreciable effort is made yet to tackle the pest problems in any forestry species, let alone in teak. Entomopathogens, viz., bacteria, fungi, viruses, protozoa and even nematodes are increasingly tested as BCAs especially in the agricultural sector. Since they are naturally occurring and environmentally safe, there is growing interest in their use for biological control. Many of them are remarkably virulent, replicate inside the insect body and perpetuate through the population quite effectively by horizontal transmission. This self replicating ability and the capacity to cause high levels of mortality in reasonably good time are considered as strong positive aspects for their use in developing bio-pesticides. The special adaptive features of some entomopathogenic fungi to remain viable in the environment, especially in soil make them good candidates for biological control.

Bio-pesticides:

In agriculture, in recent times, bio-pesticides have strongly emerged as feasible alternatives to chemical insecticides. They are increasingly being recommended as an integral component of IPM. Therefore, they deserve merit for a serious trial in forestry too, initially at least in nurseries and young plantations, obviously with carefully designed application methods. Fungi are perhaps the maximum explored organisms among entomo-pathogens and the entomopathogenic fungus, *Metarhizium anisopliae* is one among the most exploited hyphomycetes fungi for insect pest management. While the products of this fungus have found major use in agricultural sector, they have not been either identified or become very popular in the forestry sector. Also, isolates specific to pests of forest plant species have been much less exploited for development of mycoinsecicides.

Studies on entomopathogenic fungal formulations as bio-pesticides in India have been largely confined to a few selected forest pests. The efficacy of *Beauveria bassiana* on the defoliators of teak, viz., *Hyblaea puera* and *Eutechtona machoeralis* has been reported. Efficacy of entomopathogenic fungi such as *Beauveria* and *Metarhizium* sp was studied in some detail against *Holotrichia* sp. *Nomuraea* is another potential candidate fungus reported for control of several pest species in agriculture and forestry. Certain species of *Paecilomyces* have also been reported to be pathogenic to a few forest insect pests. Mass production technologies have also been developed and standardized for fungal species like *Beauveria bassiana*, *Verticillium lecanii*, *Nomuraea releyi* and *Debaromyces hensenii* . However, there is still ample scope for exploiting several unknown native strains of these fungi which are better adapted to local conditions and therefore may be more effective in terms of virulence to regional pests and survival under local conditions.

Nature of problem in existing technologies:

Chemical methods are often unsuitable for vast areas of plantations due to the potential damage they inflict on the environment and biodiversity. Pest resistance and resurgence are also frequently encountered with insecticidal chemicals. Therefore, more safe and less problematic agents with appropriate application methods need to be identified to meet the current challenges in this area. Eco-friendly approaches such as biological control are considered the best alternatives to chemical pesticides today. Entomopathogenic fungi from different groups, viz., *Beauveria*, *Metarhizium*, *Aspergillus*, *Paecilomyces* and *Nomuraea* are reported to be impressively effective in controlling lepidopteran and coleopteran defoliators and borers of commercially important forest trees and timber. Hence there is the need for sustained research towards formulation of more effective and commercially viable fungal bio-pesticides using locally adapted fungal strains.

B. Process in brief

In a DBT sponsored project, undertaken jointly by IWST and ATREE, we isolated several native strains of the entomopathogenic fungus, *Metarhizium anisopliae* and studied their efficacy against selected pests of certain important tree species with the objective of developing a biopesticide formulation for application in forestry under IPM. 25 isolates of this fungus collected from various sources were screened for their efficacy against certain selected forest defoliator pests and termites. Three most virulent isolates, viz., MA2, MA7 and MA13 were identified for development of a mycoinsecticide with appropriate application methods. A detailed protocol for multiplication, mass production and formulation of the bio-pesticide is developed incorporating certain specific procedural modifications and improvements to achieve better efficacy for the formulation. Different isolates are incorporated in the product in order to produce a more pronounced and synergistic effect on the target pests and also to tackle multiple pest species with the same product. Certain specific low cost proteinaceous substances are also incorporated into the media to augment virulence during mass multiplication and scaling up production. For spraying and tree bark applications, oil based formulations are suggested and for soil application, a powder

formulation is recommended which can be applied by mixing with FYM, saw dust, coco-peat or press mud as per the situation and the kind of target pest. Different application methods are also recommended as per the nature and severity of attack. A mycoinsecticide product named as **PESTSTAT** in two forms, as powder and liquid formulation is ready for release and application in the field. The raw materials used are cheap and production techniques are not involving much of instrumentation, the production can be carried out with ease and without environmental contamination. Field trials were conducted in farmer's fields and forest plantations and the efficacy has been proved.

C. Beneficiaries of the Technology

1. Prominent beneficiaries/ user groups

Forest officials, NGOs, farmers and any other agency who are involved in raising forest nurseries and commercial plantations.

2. No. of clients to whom technology has been transferred/ sold – nil

3. Potential for further dissemination: Yet to be disseminated

D Economic significance:

Impact of the technology

Eco-friendly approaches such as biological control are considered the best alternatives to chemical pesticides today. This technology will form a component of organic farming for forestry crops. Since the raw materials used are cheap and production techniques are not involving much of instrumentation, the production cost will be very low and comparable to any other insecticide in the market or even lower.. With basic facilities and trained manpower the product can be made easily. As the product is from fungi, it is eco-friendly and safe for environment and human beings. The replacement of chemical pesticides will have immense non tangible benefits also.

Transfer of Technology

The metarhizium isolates are maintained in the laboratory. The protocol for the mass production of PESTSTAT and its storage has been standardized by us. The technology for formulating the product both as dust and spray formulation is available. The technology of its production can be transferred to interested parties for mass production of the product.

For detailed terms and conditions and negotiation of cost of technology, the interested parties may contact Marketing Cell of IWST. Email Id: groupco_iwst@icfre.org phone No. 080-23340115. Office Hours: 9.00 AM -5.30 P.M.

***Metarhizium* based myco-insecticide developed for the management of Defoliators of Teak, Pongamia,Ailanthus, shoot borer of mahagony, arboreal termites**

Metarhizium isolates

Peststat formulation

Metarhizium infected *Hyblaea puera* larvae

Defoliation in *Ailanthus excelsa*

Spraying the formulation in pest affected Ailanthus plantation