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LEAD PAPER 2

SCOPE OF ENTOMOPATHOGENS FOR PEST MANAGEMENT IN COCONUT

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Coconut palm (Cocos nucifera Linn.) known as Kalpavriksha occupies foremost role among the cultivated palm species in India as it provides livelihood securities to more than 10 million people in 18 States and 3 Union Territories of the country. In managing coconut pests, the key role of Integrated Pest Management (IPM) is well documented through systematic research programmes. Among the various components of IPM, the most effective tool for ecological sustainability is the biological pest suppression. Palm health management need to be bio-intensive simply for environmental and health reasons as coconut is mostly consumed raw or in the state of limited processing. In addition, coconut is mainly raised as a homestead crop in Kerala occupying every residential backyard.The microbial agents, which play a vital role in the bio suppression of various agricultural pests, have been investigated and thoroughly utilized in the case of coconut pests also.

The two microbial agents viz., green muscardine fungus Metarhizium anisopliae (Metchinkoff) Sorokin and the Oryctes rhinoceros nudi virus (OrNV) were proved to be very effective in the management of black beetle (Oryctes rhinoceros Linn.). M. anisopliae var. major (spore size 10-14 µm) is highly infective when incorporated in the breeding sites of the pest viz., manure pits, compost, crownless /dead trunks of palm etc @ $5x10^{11}$ spores/m^3.The pathogen is highly virulent and produces epizootics in the grub, pupae and adult particularly during humid monsoon period. The fungus gains entry into the body of the host through the cuticle. All stages of the host except the eggs are mycosed. Death and mummification occurs within 15-20 days after infection. Mass production technology using liquid and solid media were developed (Danger et al., 1991; Mohan et al., 2010). Low-cost, women friendly, farm level mass production and community based adoption of the technology were standardized and validated.

Oryctes rhinoceros nudivirus (OrNV) infects both adults and grubs. The virus of O. rhinoceros is a successful microbial control agent, which occurs naturally in the country (Mohan and Pillai, 1993). The virus gains entry in to the host through contaminated food and it multiplies in the mid gut epithelial cells and fat bodies. The pathogen kills the grubs in 15-20 days of infection and reduces the longevity and fecundity of beetles by 45% and 95%, respectively. The infected cadavers in situ could be stored at -40°C for more than six months. Immuno osmophorosis and ELISA techniques have been developed to confirm the presence of the pathogen in the midget epithelial cells. The simplest and best practical method of dissemination

of OrNV is by releasing the infected adult beetles in the field through oral feeding or wading technique. Virus inoculated beetles @ 10-12/ha is released for pest management. Studies on the utility of OrNV by introduction of the pathogen in the main land as well as in Lakshadweep and Andaman Islands carried out by ICAR-CPCRI, ICAR-CIARI and AICRP on Palm centres in several places have clearly indicated the potential nature of the pathogen in reducing the beetle damage on palms.

Coconut mite Aceria guerreronis Keifer was affected in nature by the acaropathogenic fungus, Hirsutella thompsonii Fisher (Kumar, 2002). In India, the incidence of this pathogen has been reported from different states. Various isolates of the fungus were evaluated against coconut mite with promising results. Talc-based preparation of H. thompsonii @ 20 g / litre/ palm containing 1.6 x 10^8 cfu with a frequency of three sprayings per year resulted in 63-81% reduction in mite population. Other fungal species associated with eriophyid mite include species of Paecilomyces sp., Beauveria sp., Metarhizium sp., Sporothrix sp., Verticillium sp., Acremonium sp., Aspergillus sp., Penicillium sp., Fusarium sp. and Scopulariopsis brevicaulis.

So far no effective microbial agent was identified against red palm weevil which is a fatal enemy of coconut palm. Pseudomonas aeruginosa was identified as a facultative pathogen of the pest. Higher virulence of local entomopathogenic nematode (EPN) [LC_{50} 355.5 IJ] Heterorhabditis indica in the suppression of Rhynchophorus ferrugineus grubs as well as greater susceptibility of pre-pupal stage (85%) than that of grubs was indicated. Synergistic interaction of H. indica (1500 IJ) with imidacloprid (0.002%) against red palm weevil grubs was also reported. On coconut black headed caterpillar, Opisina arenosella Walker, microbial agents like Bacillus thuringiensis, Serratia marcescens and Aspergillus flavus have been observed to be pathogenic to the pest, but not investigated in detail due to the rich parasitoid association of the pest. Steinernema carpocapsae was found promising against white grub Leucopholis coneophora Burm infesting coconut. A protozoan pathogen, Pseudomonosystis sp. was reported to infect the third instar grubs in the field.

The success of entomopathogens as effective tools in coconut IPM depends on isolation and identification of competent strains, their mass production procedures and effective delivery system. Molecular systematic has to be strengthened as effective tool for identifying virulent strains of entomopathogens. Heat tolerant strains of these entomopathogens have to be identified, mass produced and field evaluated in hot and dry zones of the country. Development of M. anisopliae and H. thompsonii based myco-pesticides fulfilling bio safety is to be promoted for virulent strains. As red palm weevil and white grubs pose serious threat to coconut palms, effective entomopathogens including field delivery of EPN have to be validated. Farmer participatory community based area wide management approach has to be popularized for successful spread of the technology.

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EPP 1

ACUTE TOXICITY OF ENTOMOPATHOGENIC FUNGI AGAINST TWO SPOTTED SPIDER MITES, *Tetranychus urticae* INFESTING GRAPEVINE

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Introduction

The entomopathogenic fungi *viz., Beuveria bassiana*, *Metarhizium anisopliae*, *Paecilomyces fumosoroseus* were known to cause significant reduction in the native population of phytophagous mites (Chandler *et al.,*2000).Exploitation of bio-control agents for the management of mites proves very effective besides overcoming the problems *viz.*,resistance, residue and secondary outbreak. .The present study was undertaken to investigate the acute toxicity of entomopathogenic fungi against mites pest of grapevine.

Materials and Methods

The slant cultures of the three entomopathogenic fungi *viz., Beauveria bassiana, Hirsutella thompsonii and Metarhizium anisopliae* were obtained from the National Bureau of Agriculturally Important Insects (NBAII), Bangalore. The fungi were sub-cultured on potato dextrose broth (PDB) in 250 ml glass conical flasks maintained at ambient temperature (28±1°C). The spore count of the fungi was taken from 14-21 days old broth culture. The fungal biomass in the liquid media was gently vortexed in a mixer for 2-3 minutes, filtered through muslin cloth, and final spore count was recorded using haemocytometer. Four different spore concentrations *viz.,* 10^2, 10^4, 10^6 and 10^8 spores/ml of each entomopathogen was prepared. Leaf discs (8 cm diameter) were prepared. Twenty five adult mites were collected from the base culture maintained in okra plants using fine camel hair brush, transferred to the surface of the prepared leaf discs and sprayed with the prepared spore suspensions using a hand atomizer. Five replicates were maintained for each treatment. Leaf discs with the mites were sprayed directly with distilled water was maintained as untreated control for comparison. The recorded means of mortality were corrected using Abbott formula (Abbott, 1925) using the statistical program SAS. Lethal concentration (LC_{50}) and lethal time (LT_{50}) were estimated using Probit analysis (Finney, 1971). Fit of the regression lines were verified using X_2 test.