

# Integrated Disease and Pest Management in Coconut by the Application of Biocides from Medicinal Herbs

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## Abstract

Coconut (*Cocos nucifera* L.) is the chief source of healthy natural drink rich in multiuse nutritional food and oil producing tree of Nature found in Asia & Pacific Regions including 93 coconut growing countries. India has 1.0 million hectares cultivable plantation area with 12.8 billion annual nuts production. Though optimized agro technology boosts its productivity, infestation by pests & diseases drastically reduce the crop product. Among the diseases grey leaf spot is a wide spread disease in tropics in young & aged plants. It is caused by *Pestalotiopsis palmarum*. The Eriophyid mite (*Aceria guerreroensis* Keife) restricts nut formation to nut production & overall nut quality in coconut. In the present study at RRL, Bhubaneswar, a holistic approach has been done to eradicate the pest & disease in coconut by biocides formulated from herbal sources like *Hyptis*, *Ocimum*, *Andrographis*, *Patchouli* & *Citronella*. For mite the application is through spray fumigation & soil incorporation. For the fungal infection crude plant extract (1%) was found effective in inhibiting the fungal growth.

**Keywords:** (botanical pesticides, essential oils, herbal plants, eco-friendly)

## Introduction

Coconut (*Cocos nucifera* L.) is a versatile plantation crop involving more than 93 coconut-growing countries with an area of 12.8 million ha. It yields more product of use to mankind than any other tree. Despite the impressive extent of coconut cultivation, the production / productivity of coconut is affected by various pests & diseases. Among the diseases, grey leaf spot (GLS) is a wide spread disease in tropics in young and aged plants. It is caused by *Pestalotiopsis palmarum* (Cooke) Stey (Das & Mahanta, 1985, Kudalkar et al. 1991, Surianchandra et al. 1991, Karthikeyan & Bhaskaran, 1998, Srinivasan, 2002). The conventional fungicides have raised many social & economical problems due to their non-specificity, high persistency & resistance etc. so the alternative to chemicals, as plant products or biocides are the first choice. Essential oils, herbal plants & their constituents have been reported to be a potent source of environmentally safe biocides, botanical pesticides that could be explored for commercial application (Singh, 1999, Bhone & Sharma, 2002, Sanapassino & Muretti, 2002).

The air blown eriophyid mite (*Aceria* or *Bryophytes gurrensis* Keifer) is one of the dreaded pest of coconut first seen in the Guerrero state of Mexico during 1965, later in Sri Lanka in 1997 & in India in 1998. In recent years it has caused extensive damage to the plants from nut formation to nut production. Ramarethinam (2000) reported that the colonies of the coconut mites live inside the white tender portion covered by inner lobes of the perianth suck sap from the tender coconut tissues. Rethinam et al. (2003) reported that the mites such the sap with their needle like mouthparts from the tender regions covered

by perianth. The chemicals that found favour with the farmers during the initial years were monocrotophos (root feeding or stem injection), dicofol, endosulfan and ethion. The shortcoming of residue, development of insect resistance & mammalian toxicity of these insecticides culminates in worldwide efforts at finding alternative insecticides from friendly pesticides from plants or plant constituents. Biocides are eco-friendly pesticides, which are stored in plants as secondary metabolites such as alkaloids, terpenoids, polyacetylenes, unsaturated isobutyl amines & rotenoids (Bhone & Sharma, 2002). Essential oils & their constituents have been & reported to be a potent source of environmentally safe biocides that could be explored for commercial application (Amevan et al. 1998)

## Materials & Methods

### For Grey Leaf Spot

### Collection of Sample

Diseased leaves of coconut showing typical grey leaf spot symptoms were collected & carefully preserved

### Isolation & Identification of the test fungus

Microscopic examination of the diseased sample was made by preparing slides, which were kept for comparison with the isolate from diseased tissues. Effort was made to isolate the organism from diseased tissue following standard methods.

The diseased tissues were cut into small pieces and surface disinfected with 0.5% sodium hypochloride followed by three to four times washing in sterile distilled water. These

cut pieces were aseptically transferred to potato dextrose agar (PDA) plates & incubated at temperature 28±1°C. The growth of the fungus was periodically observed and subsequently transferred to PDA plates to get the pure culture of the fungus.

Microscopic examination of the pure culture fungus was examined and was checked with the slides prepared from the diseased plant tissue. The test fungus was identified basing on their morphological characteristics suggested by different research workers (Gubap,1961,Sutton,1980,Singh,1987). Following Koch's postulates successfully proved the pathogenicity of the fungus.

#### **. Response of *Pestalotia palmarum* to biocides**

Biocides in two different forms i.e. crude plant extracts (Biocide – A) and their oil extracts (Biocide – B) were used against the test fungus in three different concentration.

#### **For Eriophyid mite**

Field trials were conducted at the Ishaneswar Hybrid Coconut Research Station, Konark and Regional Coconut Research Station, Sakhigopal for management/control of eriophyid mite infestation in coconut. For this purpose, various kinds of treatments like bioorganic formulation were prepared in the laboratory and applied to the coconut plants. For spraying purpose Hyptis suaveolens and Ocimum sanctum based formulations (concentration ranging from 0.3 to 2 %) were prepared & sprayed to young coconut branches. For fumigation purpose 2 to 6% Citronella oil with cow dung, coir pith & saw dust mixture in the ratio of 20:10:05 was used. Two types of manure i.e. bhui neem and sanctum based soil formulation were prepared in the laboratory & applied.

#### **Result & Discussion**

##### **For Grey Leaf Spot**

Characteristic symptoms of Grey Leaf Spot of coconut were recorded from the infected leaf samples as small, yellow spots surrounded by a grey margin, developing on older leaves. The centre of these spots later became grayish & spots coalesced, giving the leaves a blighted appearance. In case of heavy infection due to blighting, leaves withered (Fig-1). All the samples upon incubation on PDA plates produced dense white mycelial growth along with shining black beads of acervuli structure. Microscopic examination of the culture revealed the presence of mycelium & conidia of the fungus were pointed with proxy the apical cells of the conidia were pointed with the two upper cells thicker than the lower medium cells (Fig.-2). Effect of biocides against *Pestalotiopsis palmurum* was significantly different from the control in response of radial growth irrespective of concentrations at 5% level of significance (Table – 1). Biocide A at 1% concentration was found to be the best.

The biocide properties of all above plant extracts have been successful in controlling the pathogen causing diseases

in plants (Grover & Rao,1976,Chaurasia & Vyas,1977,Patnaik et al.,1999,Nivas & Usbillaga,20006,Ghosh et al. 2004). Holy basil as a part of these biocides, the extract inhibited germination of *Pestalotiopsis* spp. in vitro (Pandey et al. ,1983).

Hyptis plant parts are reported to be useful in local traditional medicine for curing a number of diseases in Nigeria (Olayinke & Olusegun,2000) and the stem is regarded as an anticancer agent (Mabberley,1990).

*Andrographis paniculata* known as 'King of Bitter' (Ghosh et al. a ,2004,Ghosh et al. b,2004), different species of patchouli (Kaul & Nigam,1977) & *Cymbopogon* grass (Patnaik et al.,1999, Virginia et al.,2001,Casella et al., 2002) are reported having antimicrobial properties to control different plant diseases & insect pests.

The result in present investigation suggest the efficiency of all the above plants in form of crude extract found highly effective in inhibiting the growth of the test fungus.

#### **Conclusion**

Biocide Hyptis as spraying technique gave maximum recovery of nuts i.e. 62.34%. Biocide Sanctum could give 25.65% recovery of nuts. Biocide applied as fumigation showed recovery of nuts ranging from 34.65% to 39.95% at Konark & 36.9 to 40.64% at Sakhigopal. In case of soil application the (Graph-1) recovery increased from 13.25% to 25.13% at Konark & from 12.42% to 26.40% at Sakhigopal with Sanctum biocide. But bhui neem as soil application was found to be superior to Sanctum biocide in recovering of nuts showing 33.86% recovery from 15.42% at Konark site.

Among different treatment applied at both the experimental sites, Hyptis based sprayable formulation could reduce the mite infestation to a remarkable extent in future. It can be concluded that essential oils & their constituents have varying degrees of pest controlling activities, further it can also be said with certainty that essential oils are a potent source of environmentally & ecologically safe biocides & could be exploited for commercialization.

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