

# MANAGEMENT OF ROOT GRUB IN ARECANUT WITH ENTOMOPATHOGENIC NEMATODES - A SUCCESS STORY

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## Introduction

The arecanut, *Areca catechu* L., is an important plantation crop largely cultivated in the plains, hilly and coastal regions of South and Eastern parts of India. Arecanut palm is attacked by an array of insect and non-insect pests. Of the major insect pests, root grub (*Leucopholis* sp.) is one of the serious insect pest affecting arecanut palms. In general this pest is observed in coastal pockets of Karnataka and Kerala. Surveys conducted in major arecanut growing areas of Karnataka confirmed that on an average this pest is responsible for causing 28 to 37 % damage with 40 to 50 % yield reduction.

## Nature of damage and symptoms of attack of root grub

Generally different larval instars of this pest are considered as damaging stage of the root grub. Second and third instars larvae feeds voraciously on arecanut roots (Fig.4.). The variety of symptoms exhibited in infested palms can be seen on the various parts of plants as follows.

**Root:** Root grubs causes damage to the palms and seedlings by directly feeding on tender roots and later the older ones. The damaged roots turned to black that affects the uptake of nutrient and water to the palms. The complete loss of

anchoring roots leads to toppling of the palms during light wind (Fig.1. & 5).

**Stem:** The stem of the affected palms exhibit prominently tapering of the stem leads to reduction in crown size (Fig.2) and number of bunch opening results low nut setting and yield of the palms.

**Crown:** Yellowing of leaves reduced internodal length, premature nut fallen and ultimately leads to reduced vigour, yield and death of plant (Fig.2 & 3).

Since the white grub larvae are subterranean in behaviour, the damage prediction is difficult and their management has always been troublesome. As the use of pesticides could be critical concerns for the environment and human safety, an integrated environment friendly management strategies are adopted for the management of root grubs by using entomopathogenic nematodes (EPNs) in four farmers garden in Karnataka.

## Entomopathogenic nematodes

Entomopathogenic nematodes (*Steinernema* and *Heterorhabditis*) have potential to manage insect pests which already proved and being used to control wide range of pests like root grubs in high value crops. The third

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Fig. 1 Damage on roots



Fig. 2 Crown symptoms - Reduction in size of crown, yellowing of leaves and tapering of stem



Fig. 3 Advanced stage of infestation (Wilting and drying)



Fig. 4 Root Grubs



Fig. 5. Toppled palms with damaged roots

stage infective juvenile (IJ) survive outside an insect host and move from one insect to another in the soil. The IJ enter a living host and release symbiotic bacteria of the genus *Xenorhabdus*. The bacteria kill the host and emerging nematodes feed on the insect cadaver and digested tissues. The nematodes go through two or more generations, producing new IJ which emerge into the soil as host resources are depleted. Safe to environment, short life cycle, high reproductive capacity easy multiplication under lab conditions and compatibility with

agricultural inputs are the potential advantages of EPNs which forms the important component of integrated management of root grubs in any agro eco system. Perennial nature of the arecanut crop, abundance of shade levels, prevalence of host insects especially root grubs and prevailing microclimatic conditions provide favorable niche for the establishment of EPN in arecanut based ecosystem. ICAR - CPCRI developed an aqua formulation of native EPN strains with a shelf life of 5-6 months at room temperature and its shelf life can be extended up to 10 - 12 months at 10 - 15°C temperature (Fig. 6).



Fig. 6. Aqua formulation of native EPN, *S. carpocapsae*

Application of aqua formulation of entomopathogenic nematodes (EPN), *Steinernema carpocapsae* (CPCRI - SC1) @ 1.5 billion infective juveniles (IJs)/ha (Fig. 7), imidacloprid 17.8 SL @ 0.0045% and neem cake @ 2 kg/palm with proper drainage system has successfully managed root grubs (*Leucopholis* sp.) in the field of four farmers in Karnataka. Continuous three year treatments provided > 90% reduction of root grub populations in the treated field during 2015 - 2017 period. The details of farmers are given below.



Fig. 7. EPN- *Steinernema carpocapsae* IJs

1. Mr. Ramesh : A farmer of Honnavalli village in Sringeri Taluk of Chikmagalur district of Karnataka with 1 acre of farm land having arecanut cultivation with intercrops such as banana, coffee and black pepper. The arecanut palms were severely infested by yellow leaf disease (YLD) and root grub pest (*Leucopholis* sp.), recorded 13 - 22 grubs per palm and arecanut yield was 120 kg per acre before imposing treatment. After three years of treatments grub populations was significantly reduced to 1 - 3 grubs/palm with 237.5 % increase in arecanut yield (Fig. 8).



Fig. 8. View of demonstration plots at Sringeri

2. Mr. K. N. Gopal Heggade: A farmer of Holvinakoppae village in Sringeri Taluk of Chikmagalur district of Karnataka with 1 acre of arecanut cultivation having intercrops banana and black pepper. The arecanut palms showed 6 - 15 grubs /palm and arecanut yield was 588 kg per acre before imposing treatment. After three years treatments the grub populations was significantly reduced to 1 - 2 grubs/palm with 39.4% increase in arecanut yield.

3. Mr. Jagajeevan Rao: A farmer of Ranjala village in Sullia Taluk of Dakshina Kannada district of Karnataka having 1 acre of farm land

with arecanut cultivation and intercrops such as banana and cocoa. The arecanut palms were severely infested by root grub pest (*Leucopholis* sp.), where we recorded 8 - 15 grubs per palm and arecanut yield 310 kg per acre before treatment. After three years treatments the grub populations was significantly reduced to 1 - 3 grubs/palm with 62.2% increase in arecanut yield (Fig. 8a).



Fig. 8a. View of demonstration plots at Sullia

4. Mr. Yogisha: A farmer of Sankesha village in Sullia Taluk of Dakshina Kannada district, Karnataka having 1 acre of arecanut cultivation with intercrops banana and pepper. The arecanut palms showed 8 - 17 grubs /palm and arecanut yield 402 kg per acre before treatment. After three year treatments the grub populations was reduced to 1 - 2 grubs/palm with 89.8% increase in arecanut yield .

Considering the overall improvement in the palm health and satisfaction of farmer, field day was organized to showcase the performance of EPN for the benefit of farmers from surrounding villages with the funding from esteemed Directorate of Arecanut and Spices Development (DASD), Kozhikode during the year 2017-18. During the field day cum training,

farmers, women and rural youth were provided technical knowledge on EPNs mass production and its application in field. Details of various field day and training programmes organized are presented here.

**1. Field day cum Training programme on 'Integrated Management of Pests and Diseases in Arecanut' organized at Bare Village, Uduma Panchayat, Kasaragod, Kerala.**

Field day cum training programme on 'Integrated Management of Pests and Diseases in Arecanut' was organized on 22<sup>nd</sup> June, 2017 at Bare village, Uduma Panchayat, Kasaragod, Kerala with special emphasis on the latest concepts, methodologies, approaches and practices in the field of eco-friendly management of pests and diseases for the benefit of stakeholders. About 150 stakeholders covering farmers, development officials, elected members, college students etc. had participated in the training.

**2. Training on 'Crop Health Management in Arecanut' organized at Enmakaje Panchayat, Kasaragod, Kerala.**

Training programme on 'Crop Health Management in Arecanut' was organized on 31<sup>st</sup> July, 2017 at Perla village, Enmakaje Panchayat, Kasaragod, Kerala. Smt. Roopavani R. Bhat, President, Enmakaje Panchayat, Kasaragod inaugurated the training programme. More than 200 farmers participated in the training programme.

**3. Training on 'Multi Species Cropping System and Management of Root**

**Grubs Using EPN in Arecanut' organized at ICAR-CPCRI, Kasaragod, Kerala.**

Training on 'Multi Species Cropping System and Management of Root Grubs Using EPN in Arecanut' was organized on 6<sup>th</sup> January, 2018 in connection with 'Kisan Conference' and 'Agri Expo 2018 at ICAR-CPCRI, Kasaragod, Kerala. Krishi Mela organized during 5<sup>th</sup> to 10<sup>th</sup> January, 2018 attracted more than 3000 stakeholders covering farmers, development officials, processors, college students etc.

Scientists from CPCRI interacted with participants on different aspects like, crop improvement, crop production, arecanut based multispecies cropping system, integrated pests & diseases management with special emphasis on root grub management using entomopathogenic nematodes. Organized exhibition to display various technologies of ICAR - CPCRI for the benefit of the farmers during krishi mela (Fig.9).



**Fig. 9. Exhibition of pest and disease management technologies**

**4. Field day cum Training on 'Management of Root Grubs in Arecanut Using Entomopathogenic Nematodes and Multi Species Cropping System in Arecanut' organized at Renjala, Sullia Tk., Karnataka.**

Training programme on 'Management of Root Grubs in Arecanut using Entomopathogenic Nematodes and Multi Species Cropping System in Arecanut' was organized at Renjala village, Sullia Tk., Dakshina Kannada Dt., Karnataka on 27<sup>th</sup> January, 2018. A total 120 stakeholders covering farmers, development officials from horticulture department and elected panchayat representatives participated in the programme. Conducted hands on training on farm mass multiplication of entomopathogenic nematodes (Fig 10).



**Fig. 10. Hands on training to participants on EPN**

**5. Field day cum Training on 'Root Grub Management Using Entomopathogenic Nematodes and Multi**

**Species Cropping System in Arecanut' organized at Sankesha Village, Sullia, Karnataka**

Training on 'Root Grub Management using Entomopathogenic Nematodes and Multi Species Cropping System in Arecanut' was organized at Sankesha village, Sullia Tk., Karnataka on 17<sup>th</sup> February, 2018. About 100 farmers participated in the programme. Shri. Monappa Poojari, Gram Panchayat President, Markanja, Sullia Tk. was the chief guest inaugurated the programme. Shri. Yogisha beneficiary farmer of the demonstration plot informed the participants about improvement in his infested garden after the imposing of EPN based integrated treatments. All the participants expressed their satisfaction about the training programme and had a very good interaction and discussions on use of EPN for root grub management.

**Acknowledgement:**

The authors acknowledge the financial support from Directorate of Arecanut and Spices Development, Calicut in the conduct of the demonstration trial in farmers field during 2015-2017. Thanks to Director ICAR - CPCRI, Kasaragod for providing facilitates for conducting demonstration on entomopathogenic nematodes.

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