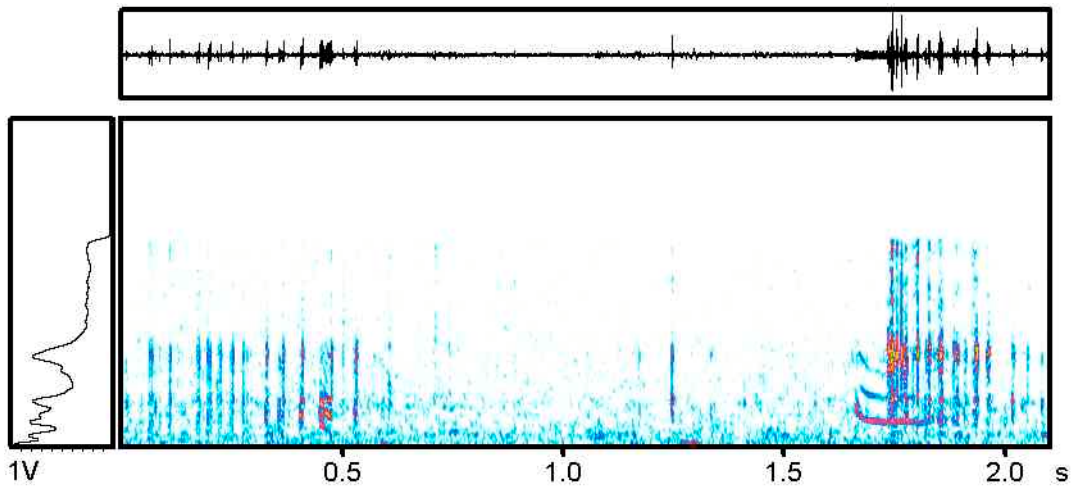


Control and Pest management of Red Palm Weevil (*Rhynchophorus ferrugineus*) with bioacoustic methods



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Introduction

One of highest destructive pests in palm plantation is the Red Palm Weevil (*Rhynchophorus ferrugineus*). Further pests are Fruit Stalk Borer (*Oryctes elegans*) and Stem Borer (*Jebuses hammerschidti*). The both last named pests are lower destructive, but especially the *Oryctes spec.* shouldn't be underestimated, because in the younger past were effects of supporting feedbacks of *Rhynchophorus spec.* and *Oryctes spec.* indicated.



Red Palm Weevil (Rhynchophorus ferrugineus)

The spread of Red Palm Weevil is from Spain over north Africa, Arabian peninsula, Iraq, Iran, Pakistan up to Malaysia/Indonesia. It can be fixed that all over the palm vegetation belt around the earth relations of *Rhynchophorus ferrugineus* are present. Whether this insects become a problem depend on the kind of cultivation of palms and the level of damages of the special ecosystem. The controlling possibilities are very limited in due to the hidden lifecycle of the weevil.

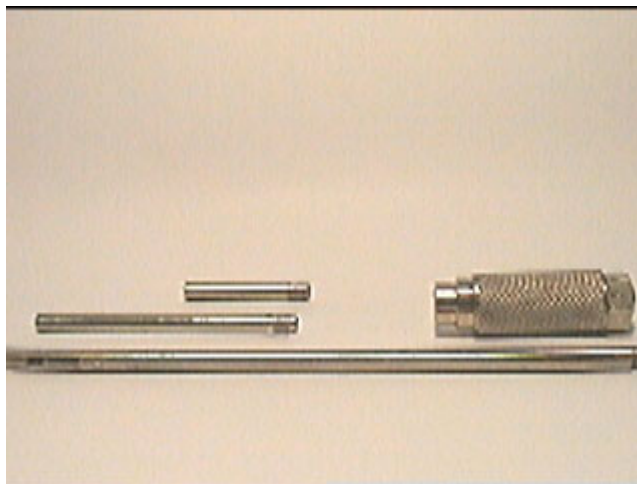
Traditional methods of monitoring like trapping carrying the risk of supporting the uncontrolled not wanted spread of the weevil, if they are used in a not well balanced strategy.

The actual newest access for monitoring and controlling of Red Palm Weevil are bioacoustic methods for measurement of sound emissions of Red Palm Weevil at early stage of infestation. This methods are also useful for *Oryctes elegans* and *Oryctes rhinoceros*.

Biocoustic

The bioacoustic is a young discipline of biology. The most wellknown applications are found by birds, bats, whales, dolphins, frogs and grasshoppers. In the last years the research for base data was concentrated also to other insects. Especially beetles and weevils came into the closer focus. Of interest were stock pests and xylobiontic weevils and beetles. The bioacoustic show good results by Grain weevils (*Calandra granaria*), Rice weevils, Red Palm weevil (*Rhynchophorus ferrugineus*), Fruit stalk borer (*Oryctes elegans*), *Oryctes rhinoceros*, Stem borer (*Jebuses hammerschmidt*), *Hylotrupes bajulus*, Asian longhorn beetle (*Anoplophora glabripennis*), but also moths/butterflies came into the focus like the Palm Moth (*Paysandisia archon*).

A very good information base is given in case of Red Palm Weevil, Grain Weevil and Fruit Stalk Borer.



CSC sensor system with different insertion probes

In nature sounds and vibrations which can be measured have a very different origin and also different functions. By mammals, birds, amphibians and grasshoppers sounds are carrying informations. In case of beetles and weevils sound emissions don't carry informations. This influence strong the kind of quality of measureble vibrations. Also define it the possibilities and limitations of the new method.

For the clear classifications of vibrations produced by weevils and beetles strong researches are necessary about the different stages of the life cycles. In case of the Red Palm Weevil it could be realized during a research period of 4 years.

The sound emissions of Red Palm Weevil could be separated into 5 sound classes of the different life cycle stages. These sounds are absolutely significant for the presence of Red Palm Weevil.

The bioacoustic measurement makes the detection possible of Red Palm Weevil at an early stage.

Based on our research results, the infestation by Red Palm Weevil can be detected 1 ½ weeks after infestation. With the highest accuracy, the determination is 3-4 weeks after infestation possible.

The bioacoustic measurement makes a hit number in the field possible about more than 90 %, by following the defined procedure with high accuracy.

Control of Red Palm Weevil

The efficiency of the use of bioacoustic methods is demonstrated by the research itself. Part of the research was also the transfer of a piece of a date palm trunk, fresh cut and naturally infested by Red Palm Weevil. The observation period started on 15th of June 2003 and was finished on 28th of July in 2004.

The dimensions of the trunk piece were, length: 70 cm and a diameter of : 38 / 43 cm.

During the named observation period over 300 adult weevils left the trunk.

This result demonstrates in a very kind way the efficiency of the bioacoustic for controlling the Red Palm Weevil. After the positive determination of the presence of Red Palm Weevil in a palm, it is necessary to remove the palm tree, because up to today no real efficient treatment method exists.

But with the removing of an infested palm a strong blow against the Red Palm weevil population will be done. If the number of weevils which left the trunk is taken as average or typical, then by removing an infested palm produce a cut of **300** individuals in the population is done. If in a plantation only 10 infested are detected then the cut is by **3000** individuals and more. So the clearing of farms from infested palms is the most effective answer against the Red Palm Weevil.

This calculation could be also done with greater numbers of infested palms. This is very interesting for regions with high infestation rates. Especially oases and island structures with more than 1000 possible infested palms show the efficiency in a very kind way. If 1000 infested palms are removed a population cut of around **300 000** weevils and more is done.

The removing of the palms needs to be done under special conditions to prevent from a further infestation caused by the removing of the infested material. Also the disinfection of the soil needs to be taken under consideration.

The cleaning of soil with insecticides isn't enough, because eggs could survive and the remaining root rests are most enough food for some larvae. An exchange of the soil and thermo mechanical cleaning is advisable.



Burned palm trunks

The burning of removed trunks isn't also effective. Reasoned by the high humidity of palms it's necessary to dry them under quarantine condition. Cutted and burned trees are biologic active up to more than 1 year after removing. We found also palm trunks which were burned but still active. Or with other words, some larvae and eggs survived. Also in this regard is bioacoustic able to tell whether the problem is under control or not. In addition to this working field, if an integrated pest management is preferred, bioacoustic methods can be used for efficiency control.

It's necessary to work out for every work place an individual strategy and management plan in due to the variability of access of the Red Palm Weevil and regional properties.

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