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Review

Insect Pests of Date palm (*Phoenix dactylifera* L.) and Potentials of Botanical Insecticides for their Control in the Tropics: A Review.

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Date palm (*Phoenix dactylifera* L.) is one of the oldest crops cultivated by man. Its center of origin is believed to be the Arabian Gulf Region. The crop was introduced into Nigeria through the Trans-Saharan trade by pilgrims. Because of the suitable environmental condition of Northern part of Nigeria as well as the introduction of early maturing varieties, date palm cultivation is gaining popularity among farmers. It has now become a source of income to these farmers. However, cultivation of this crop comes with a lot of problems, among which are the insect pests that attack different parts of the crop. Insect pests, such as Red palm weevil (*Rhynchophorus ferrugineus*), rhinoceros beetle (*Oryctes rhinoceros*) and termites are very common in Nigerian orchards. Although chemical insecticides are used to control these insect pests, there is the need to give more emphasis on the use of botanicals instead. This is because of their low persistence and less harmful to man and the environment. Plants, such as neem (*Azadiracta indica* J), ginger (*Zingiber officinale*), lemon grass, (*Eucalyptus citrodora*), castor (*Ricinus communis* L), chamfer (*Foeniculum vulgare*) and hellebore (*Elettaria cardamomum*) were found to be a source of botanical insecticides against these pests. Therefore more tropical plants need to be evaluated for their efficacy against insect pests of date palm.

Keywords: Botanicals, Date palm, *Rhinoceros* beetle, Red palm weevil, Termites

INTRODUCTION

The date palm tree (*Phoenix dactylifera* L.) is one of the earliest crop plants that had been cultivated for its fruit for at least 5000 years BC. (Khalid, *et al*, 2010). It is the most common and widely cultivated in the arid regions of the Middle East and North Africa. It is believed to have been introduced into Nigeria in the early seventeenth century

(17th) through the Trans-Saharan trade route from North Africa and the middle East by traders and Muslim pilgrims on pilgrimage to the Holy Cities of Mecca and Medina. Since then, date palm cultivation has remained restricted within compounds, homesteads and orchards in the Northern parts of the country. In the Southern part it is mainly planted for aesthetic purposes. (Omati and Okolo, 2000)

In many areas date palm fruits have provided the staple carbohydrate food of local people since long time ago. Date palm is a multi-purpose tree, being highly regarded

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as a national heritage in many countries. In provides foods shelter, tumber products and all parts of the palm can be used. For several decades date palm groves have been in decline because of pest and disease problems (Erskine *et al.*, 2004)

Despite success in controlling insect pests using synthetic insecticides, there have been several setbacks such as high mammalian toxicity, high level of persistence in the environment, health hazards, toxic residues on food, adverse effects on non-target organisms and pest resistance as well as toxic effect to the users (Ileke & Oni 2011). These issues have necessitated the use of other control measures with little or no negative impacts on the environment and not toxic to mammals (Ileke 2008). One solution would be to replace synthetic chemicals with compounds that occur naturally in plants (Adedire & Lajide 2003; Ileke *et al.* 2012). Vegetable oils, plant powders and extracts have been used to reduce post-harvest losses of cereals and grain legumes (Ofuya *et al.* 2007; Nwaubani & Fasoranti 2008). Plant extracts are capable of producing multiple effects in insects such as antifeedancy, growth regulation fecundity suppression, sterilization, ovipositional changes, repellency or attractancy and change in the biological fitness like reduced life span, loss of flying ability, low absorption of nutrients, high mortality, immune depression, enzyme inhibition and disruption of biological synthesis (Samidurai *et al.*, 2009). Botanicals are reported to be safer than synthetic insecticides, easily degradable, environmentally safe, broad spectrum in action non-persistent and easily processed (Solsoloy and Solsoloy, 1995; Talukadar

and Howse, 1995). Thus, the botanicals offer desirable alternatives to use of synthetic chemicals in the agro ecosystem where protection of the environment and preservation of beneficial organism are important (Weathersbee and Tang, 2002). More than 2000 plant species have been

known to produce chemical factors and metabolites of value in pest control programme (Ahmed, 1984; Emara *et al.*, 2002; Talukader, 2006). The work is aimed at presenting previous research works on major insect pests of date palm and the use of botanicals for their management. It will therefore give some basis of further researches on exploiting the potentials of other local plants as botanical insecticides against insect pests of date palm.

Green pit Scale Insect (*Asterolicanium phoenicis* Rao.).

The insect attacks the leaflets, leaf rachis and fruits. It causes chlorosis, degeneration of the leaves and malformation of fruits before maturity, leading to losses in production in range of 30-50 kg per palm (Ali *et al.*, 1993; Idris *et al.*, 2006). Khaled *et al.* (2010) used the powders of argel (*Solenostemma argel* Del. Hyne.) and usher

(*Calotropis procera* Ait.), two desert plants to control the insect pests. They found that there was an increase in the mortality of the insect as well as yield of date palm.

Red Palm Weevil (*Rhynchophorus ferrugineus*)

Recently, red palm weevil, *Rhynchophorus ferrugineus* Olivier, (Coleoptera, Curculionidae) is widely accepted as one of the most destructive insect pest of date. The pest was first discovered in Egypt at the end of November 1992 in Sharkya northeastern governorate (Cox, 1993). Red palm weevil, borers into the leaf bases at the top of the trunk causing the entire crown to wither and die. Major constraints include low quality palm cultivars.

The damage to the palm is caused by the grubs. These grubs make tunnels in the trunk and feed on the tissues of the palm. Decay of the tissues results in the production of a foul smell. While feeding, the grubs make gnawing sound which is often audible. At the point of attack, thick reddish-brown fluid is putrid and gives a strong acrid odour. At a later stage of attack, chewed up fibers are also exuded from this hole. The oozing fluid and/or the presence of these plant fibers

provide external evidence of attack by the RPW (Abdallah and Al-Khatri, 2000). The antifeedant activity of three EOs extracted from two plants of Asteraceae family, namely, crofton weed, *Eupatorium adenophorum* Spreng. (flowers and leaves) and Indian wormwood, *Artemisia nilagirica* (C.B. Clarke) where evaluated by Praj *et al.* (2012). The essential oils were found to be effective against the weevil. Several workers (Bream *et al.*, 2001; Ghoneim *et al.*, 2001; Nassar and Abdulah, 2001; Bream, 2002; Faleiro, 2006; Abuhussain, 2008) had also reported the efficacy of neem extracts against the weevil.

White scale (*Parlatoria blanchardii* T): white date palm scale *Parlatoria blanchardii* (Targ.) is one of the most destructive pests. Female lays its eggs under the shield. Adults and nymphs of this insect feed on leaves sap. High level of infestation causes significant damage, resulting in early dropping of leaves and yield reduction. In addition *Parlatoria blanchardii* (Targ.) secretes toxic saliva that causes malformed leaf and shoot growth, low photosynthesis and respiration rate, which leads to curling, yellowing and dropping of leaves, dwarfing of plant, decreasing or destroying chlorophyll. *P. blanchardii* affects photosynthetic pigments (chlorophyll-a, chlorophyll-b and carotenoids), leaflet area, moisture percentage, dry weight and wax contents (Mousaa *et al.*, 2012)

This subsequent damage leads to considerable quality and quantity yield losses and also marketing value of the fruits. It reduces the production 30-50 kg per palm. Sometimes it reaches to 85-90 % losses depending on, varietal tolerance, severity of infestation and orchard management (Ahmed, 2004; EL Sherif, 2006) Scales

insects are effectively controlled in some gardens by using neem products, especially neem oils (Gills, 1993).

Termites: Termites or white ants particularly the species *Odontotermes smeathmani* (Full) are important pests of date palm. Damage to date palm has been recorded since 1920 and has been recognized as a serious problem by several authorities, (Logan, 1993). Termites primarily attack the dry plant parts at the soil surface and can go up as high as 20–30 feet along the stem of some palms, Severe termite infestation may gradually weaken the stem and result in complete destruction (Ahmed, 2014).

Manzoor *et al.*, 2011, found that *Curcuma longa* plant extract was found to be more efficient in soil treatments to protect food substrate against termites. *Capparis deciduas* and its combinatorial mixtures were evaluated to observe the anti-termite efficacy against Indian white termite *Odontotermes obesus*

Plant materials of *Lantana camara*, *Rhazya stricta*, *Ruta chalepensis* and *Heliotropium bacciferum* were (Abdullah *et al* (2014) Many plants have been recognized to have anti-termite activities (Sakasegawa *et al.*, 2003, Park & Shin, 2005, Jembere *et al.*, 2005, Cheng *et al.*, 2007, Ding & Hu, 2010, Supriadi and Ismanto, 2010) or repellent to the termites i.e., *Eucalyptus globules*, lemongrass, *Eucalyptus citrodora*, cedar wood, clove bud and vetiver grass (Zhu *et al.*, 2001a, b), *Taiwania cryptomerioides* Hayat (Chang *et al.*, 2001), *Dodonaea viscosa* (Purple hop bush) a termite resistant shrub (Anonymous, 2001), *Ocimum basilicum* L., *Cymbopogon winterianus* Jowitt, *Cinamomum camphora*, *Rosmarinus officinalis* (Sbeghen *et al.*, 2002) Leaf extracts of *D. viscosa* *D. ajacis* and *N. oleander* can be the good candidates for further process of isolation, and characterization of active compounds in the extracts. (Sohail *et al* , 2011).

Rhinoceros beetle (*Oryctes rhinoceros*). The beetle has caused major problems to plantations in many parts of Peninsula India and other Asian countries. The adult beetle bores into the unopened fronds and inflorescence of the palm (Sreeletha and Geetha, 2011). It eats into young leaves, unopened spathes, and the soft tissues of the growing point. In addition to primary damage, secondary rots may develop. Young trees are especially subject to attack. The rhinoceros beetle does not fly far from its breeding grounds in dead and rotting vegetable and animal waste. It bore into the stem, leaves or flowers of date palm leaving a characteristic chewed frass at their point of entry. If the pest is not noticed and removed on time, it end up eating up the central spear of the plant, making it dried and can easily be pulled off. When this happened, the palm die or it may take two or more years for it to regenerate (Aisagbonhi and Oehleschlager, (2006).

The extracts from neem was found to be effective against both the larva and adult of the beetle (Chandica *et al*, 2001). The *Clerodendron infortunatum* leaf powder

[5,10 and 20% (w/w)] was thoroughly mixed with cow dung and fed to third instar grubs of *Oryctes rhinoceros* and grub and pupal mortality, deformities and fat body of adults were observed (Sreeletha and Geetha, 2011). Sreeletha and Geetha (2012) also observed an increase in mortality of the beetle after using the leaves of *Annona squamosa* L.

Saw tooth beetle (*Oryzaephilus surinamensis* L.) It attacked date palm fruit in the store, thereby reducing its market value. The insect (adult stage and larvae stages eats the date by digging tunnels between the peel and the content. Date of low wet content and that do not have tops or that have wounds and cracks are the most infected by this insect (A- Hafidh *et al.*, 1987). This beetle can be controlled by using dry powders of ginger (*Zingiber officinale*), hail (*Elettaria cardamomum*) and shammar (*Foeniculum vulgare*). Al-Qahtani *et al* (2012).

Dubas Bug, (*Ommatissus lybicus*) It is a very serious sucking pest on date palm. Both nymphs and adults suck the sap and produce honeydew in copious amount over the leaf surface and fruits which gathers dust and leads to the growth of sooty mold. This reduces the photosynthetic activity of the leaves which results in reduction of the yield of the palm lowering of the grade of the crop and making the fruits unfit for human (Salim, 2009). Neem extracts and neem oil were found to be effective against the bug (Anonymous (2014).

Date moths (*Ectomyelois ceratoniae* Zeller) represents a serious pest to stored products because of its rapid development under storage conditions; it is also the most significant phytosanitary problem of date production. Date infestations, at all levels, field, packing and storage houses, enormously depreciates the marketable quality of dates and risks to compromise exports in particular those of 'Deglet Nour' (Zouba *et al.*, 2009).

The essential oils of *Thymus capitatus* Hoffmanns, *Rosmarinus officinalis* L. . were analyzed by gas chromatograph possess high insecticidal activity and therefore, can be used in biotechnological application as natural preservative in stored dates and could be useful in managing populations of *E. ceratoniae* in field. (Ismail *et al* , 2014). Also extracts from neem were evaluated and found to be effective against the moth (Anonymous, 2014).

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