Sudan University of Science and Technology

College of Graduate Studies and Scientific Research

Effect of Neem , Jimson weed and propolis Powder Against bug (*Phenacoccus solenopsis*) (Hemiptera :Pseudococcidae) infesting okra fruits

تاثير مسحوق أوراق النيم و السيكران و صمغ النحل(البروبوليس) في البق الدقيقي في ثمار البامية

A thesis submitted in partial fulfillment of the requirements for the M. Sc. degree in plant protection

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الآية

قال تعالى:

﴿ قُل لَّوْ كَانَ ٱلْبَحْرُ مِدَادًا لِّكَلِمَٰتِ رَبِّي لَنَفِدَ ٱلْبَحْرُ قَبْلَ أَن تَنفَدَ كَلِمَٰتُ رَبِّي وَلَوْ جِئْنَا بِمِثْلِهِۦ مَدَدًا ﴾

صدق الله العظيم

سورة الكهف(109)

Dedication

To my loved mother, father and brothers sisters

To my extended family

To all my teachers and friends with great regard and respect.

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All thanks are due to Almighty Allah (SWT) who gave me health and strength and helped me tremendously to produce this work. I would like to express my thanks to my supervisor Dr. Abdelbagi Esid Ali For helpful assistance, guidance, patience and keen interest and continuous participation throughout this study.

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Abstract

Laboratory experiments were conducted at the college of agricultural s of Sudan University of science and technology to evaluate the lethal effect of Neem *Azadirachta indica,* Jimson w*eed Datura innoxia* and Propolis on mealy bug *(phenacoccus solenopsis)* infesting okra fruit on this experiments three different weights from each powder were used (2.4.6gram).Were used in this study. The results showed that all weights of the plant leaves powder plants and propolis gave significantly higher mortality percentage of the mealy bug than the control after 24hours of exposure and also in infection percentage.

The high weight (6g) of powder Neem used in this study , caused mortality percentage 23,3% 36,6 % 53,3 % respective after 24 , 48 and 72 hours of exposure as for in infestation percentage can be 0% , 6,6% and 6,6% after 72 hours of exposure .

Gave high weigh from the leaves powder of jimson weed mortality percentage 26,6% 40% and 60 % after 24, 48 and 72 hours of exposure and high infestation percentage can be 10% after 72 hours of application.

The obtained results also revealed that the highest weight from the propolis gave mortality percentage 13,3% 16,6 % and 26,6% after 24, 48 and 72 hours of exposure and infected percentage can be 20% ,26,6% and 36,6% after 72 hours from exposure .

The high weight (6g) of powder mixed neem and jimson weed percentage (1:1) used in this study , caused mortality percentage 60% 63,3% and 73,3 % respective after 24 hours of exposure infected percentage there not infection through the three days of exposure .

ملخص البحث

اجريت تجارب معمليه بكليه الدراسات الزراعيه , بجامعة السودان للعلوم والتكنولوجيا لتقييم الاثر القاتل لنبات النيم ,السيكران وصمغ النحل ضد البق الدقيقي , تم استخدام ثلاثه اوزان في هذه الدراسه (2,4و6 جرام) .اوضحت النتائج المتحصل عليها ان كل الاوزان المختبره من النباتين وصمغ النحل اعطت نسب موت عاليه مقارنه بالشاهد بعد 24 ساعه من المعامله.

واعطي اعلي وزن (6 جرام) من بدرة اوراق النيم فقط نسبة موت 23,3 % 36,6 % 53,3 % علي التوالي بعد 24 ,48 و72 ساعه من المعامله ,اما نسبة الاصابه كانت 0 % 6,6% و6,6% بعد 72 ساعه من فترة التعريض.

وفي سياق متصل اوضحت اعلي وزن 6 جرام من بدرة اوراق السيكران نسب موت 26,6 % 40% و 60 % علي التوالي بعد24 , 48 و72 ساعه من فترة التعريض . واعطي اقل نسبة اصابه 10 % بعد 72 ساعه من التطبيق .

كما اوضحت النتائج المتحصل عليها ان اعلي وزن من بدرة صمغ النحل (6جرام) احدثت نسب موت 13,3 % ,16,6 % و26,6 % علي التوالي بعد 24‘ 48 و72 ساعه من المعامله. وكانت نسبة الاصابه 36,6% بعد 72 ساعه من المعامله

واظهرت اعلي وزن (6جرام) من خليط بدرة اوراق النيم والسيكران نسبة موت 60% 63,3 % 73,3% علي التوالي بعد 24 ,48 و72 ساعه من المعامله ,اما نسبة الاصابه كانت 0 % من 24 حتي 72 ساعه من المعامل.

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CHAPTER ONE

INTRODUCTION

Cotton is an important natural fiber crop cultivated in varying climatic Conditions of tropics as well sub-tropic regions of more than 83 countries All over the world. Cotton plays a key role in the National economy in Terms of generation of direct and indirect employment in the Agricultural and Industrial sectors. Due to ready availability of Bt-cotton seeds since 2002 and apparent advantages over non-Bt counterparts, it spread rapidly

in India within short span of time. Changes in insect pest complex were Evident with changed micro-climate. A new pest, mealy bug which was Hitherto not familiar earlier started destroying cotton crops caused Economic damage, reducing yields up to 40-50% in affected fields since 2006. Several parts of Gujarat which are located on the border of Pakistan which had recent history of Mealy bugs infestation was severely affected. Mealy bug infestation were recorded (Dhara Jothi et al., 2008) in 2006 on G. hirsutum in all the nine cotton-growing states of India, Punjab, Haryana, Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Tamil Nadu, Andhra Pradesh and Karnataka. Severe economic damage to G. hirsutum was reported in 2007 (Dhara Jothi et al., 2008) in four major cotton-growing districts (Bathinda, Muktsar, Faridkot and Ferozepur) of Punjab, two districts (Hisar and Sirsa) of Haryana, and low to moderate damage in parts of Maharashtra, Tamil Nadu and Andhra Pradesh. According to Goswami (2007), nearly 2000 acres of cotton crops were destroyed by the mealy bug by mid-July and over 100 acres of mealy bug-infested Bt cotton was uprooted in Raike-Kalan village in Bathinda. By the end of the Kharif season (June–October), the total damage in 2007 was estimated to range from US$400,000 to 500,000 in north India alone.

Apart from the yield losses, the pest infestation increased the cost of insecticide application by US$250–375 per acre in both India and Pakistan. In a survey conducted (Nagrare et al. 2009) over 47 locations in nine cotton-growing states of India showed that two mealy bug species, the solenopsis mealy bug, Phenacoccus solenopsis Tinsley, and the pink hibiscus mealy bug, Maconellicoccus hirsutus (Green), were found to infest cotton plants. However, P. solenopsis was found to be the predominant mealy bug species, now appears to be widespread on cotton in almost all cotton-growing states of the country. P. solenopsis is an exotic species that originated from USA . In due course of time the species was also reported on different crops of food, fiber, fruit, ornamental, plantation, vegetable and weeds..

The objectives of the study:

1-To evaluate the lethal effect and infectious percentage of leaves powder of Neem *Azadirachta indica and jimson weed Datura stramonium* against adult stage of mealy bug *Phenacoccus solenopsis.*

2- To evaluate the toxic effected and infectious percentage of powder propolis on the adult stage of mealy bug Phenacoccus *solenopsis*.

CHAPTER TWO

LITREATURE REVIEW

2.1 Cotton mealy bug (*Phenacoccus Solenopsis*)

2.1.1 Classificaiton

Domain: Eukaryota

Kingdom: Metazoa

Phylum: Arthropoda

Subphylum: Uniramia

Class: Insecta

Order: Hemiptera

Suborder: Sternorrhyncha

Superfamily: Coccoidea

Family: Pseudococcidae

Genus: Phenacoccus

Species*:* *Phenacoccus Solenopsis*

2.1.2Geographical distribution and pest status of *P. Solenopsis*

P. solenopsis has a wider geographical distribution with its origin in Central America (Williams & Granara de Willink, 1992) followed by reports of the Caribbean and Ecuador Chile (Larrain, 2002), Argentina (Granara de Willink, 2003), Brazil (Mark & Gullan, 2005). P. solenopsis has been described as a serious

invasive pest of cotton in Pakistan and India (Hodgson et al., 2008) and on Hibiscus

rosa-sinensis in Nigeria (Akintola & Ande, 2008). Latest report on the invasiveness of P. solenopsis has been from the Eastern region of Sri Lanka (Prishanthini & Laxmi,2009) on rnamentals, vegetable crops and weeds, and in China (Wang et al., 2009;

Wu & Zhang, 2009) on cotton. P. solenopsis appeared on cotton in Pakistan during 2005 and attained pest status in cotton growing areas of Punjab and Sindh provinces.In India, occurrence, severity and epidemic forecast of mealybugs on cotton were made at Gujarat in respect of 2004-05, 2005-06 and 2006-07 crop seasons, however the species identity got documented as P. solenopsis in a workshop at National Center

for Integrated Pest Management (NCIPM), New Delhi in anuary 2008 (Jhala &Bharpoda, 2008a) followed by its publication in Uttar Pradesh Journal of Zoology (Jhala et al., 2008). However, Bambawale (2008 a & b) reported the occurrence of

P. solenopsis a decade ago from non cotton growing areas of Uttar Pradesh, Madhya Pradesh and Karnataka States of India and described it as a non-invasive pest.An elaborate and comparative study of few species of Phenacoccus including the

Indian and Pakistan specimens, and details on the existence of seasonal morphological variations in P. solenopsis by Hodgson et al. (2008) provided strong footing and support on species identity of mealybugs in India. Widespread infestation of

P. solenopsis and economic damage to cotton across nine cotton growing States of the country viz., Punjab, Haryana, Rajasthan, Gujarat, Madhya Pradesh,

Maharashtra,Andhra Pradesh, Karnataka and Tamil Nadu during 2008-09 crop season necessitated a national level consultation at Central Institute for Cotton Research (CICR), Nagpur towards formulation of strategies for its management (Dharajyothi et al., 2008;Dhawan, 2008; Jhala & Bharpoda, 2008 b & c; Suresh & Kavitha, 2008). Survey across 47 locations of the country between months of late 2007 and early 2008 established the predominance of *P. solenopsis* (Nagrare et al., 2009) in India.

2.1.3 Description of stages

The female mealy bug is wingless with a 3-4 mm long oval shaped body which is covered with white hydrophobic (water repellent) mealy wax. There are dark bare spots on the thorax and abdomen, which appear as dark longitudinal lines. The adult male is about 1 mm long, with a grey body and a single pair of transparent wings. Two filaments of white wax project from the end of its abdomen. The adult male has reduced mouthparts and causes no damage. Mature females lay eggs in waxy pouches Called ovisac. Each ovisac contains eggs, the majority of which are females. The eggs hatch after three to nine days into nymphs called 'crawlers', which are very mobile. Vennila(2010).

Mealy bugs are sexually dimorphic: females appear as nymphs, exhibiting reduced morphology, and lack wings, although unlike many female scale insects, they often retain legs and can move. Males are smaller, gnat-like and have wings. Since mealy bugs (as well as all other Hemiptera) are hemimetabolous insects, they do not undergo complete metamorphosis in the true sense of the word. However, male mealy bugs do exhibit a radical change during their life cycle, changing from wingless, ovoid nymphs to wasp-like flying adults. Johnson, M.S. et al. (2001).Mealy bug females feed on plant sap, normally in roots or other crevices,

and in a few cases the bottoms of stored fruit. They attach themselves to the plant and secrete a powdery wax layer (hence the name mealy bug) used for protection while they suck the plant juices. In Asia, mango mealy bug is considered a major menace for the mango crop. The males on the other hand are short-lived as they do not feed at all as adults and only live to fertilize the females. Male citrus mealy bugs fly to the females and resemble fluffy gnats. Some species of mealy bug lay their eggs in the same waxy layer used for protection in quantities of 50–100; other species are born directly from the female.

The most serious pests are mealy bugs that feed on citrus; other species damage sugarcane, grapes, pineapple (Jahn et al. 2003), coffee trees, cassava, ferns, cacti, gardenias, papaya, mulberry, sunflower and orchids. Mealy bugs only tend to be serious pests in the presence of ants because the ants protect them from predators and parasites. Mealy bugs also infest some species of carnivorous plant such as *Sarracenia* (pitcher plants); in such cases it is difficult to eradicate them without repeated applications of insecticide such as diazinon. Small infestations may not inflict significant damage. In larger amounts though, they can induce leaf drop.

Fossil specimens of *Acropyga* genus ants have been recovered from the Burdigalian stage Dominican amber deposits and several individuals are preserved carrying the extinct mealy bug genus *Electromyr mococcus*. Johnson, M.S. et al. (2001). These fossils represent the oldest recorded record of the symbiosis between mealy bugs and *Acropyga* species ants. Johnson, M.S. et al. (2001).

2.1.4 Life history parameters

The developmental period of crawlers of P. solenopsis was shorter and similar for first and third instars (2-6 days), and longer for the second instars (2-11 days) .Mean developmental periods of first, second and third in stars were 3.9 ± 0.4, 5.1 ± 3.2 and 4.2 ± 0.6, respectively. Males had an additional instars and prepupal stage over 5-7 days of development with a mean of 5.5 ± 0.5 days. The mean total developmental period for crawlers with three instars, and four instars that developed into females and males, was 13.2 ± 1.8 and 18.7 ± 0.9, respectively. Females had awider range of developmental periods than males. While the survival of first and third instars was the same (71.4%), the second instars had only 45.5% survival, and females survived (92.7%) better than males (83.3%). Females after the final moult took about 2-8 days for reproduction with a mean pre reproductive period of 5.7 ± 1.7 days. Reproduction by P. solenopsis was parthenogenetic with 96.5 and 3.5% of Off spring produced as crawlers and eggs through ovoviviparity and oviparity, respectively. Under laboratory conditions the typical occurrence of an ovisac was Vennila (2010).

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while they suck the plant juices. In Asia, mango mealy bug is considered a major menace for the mango crop. The males on the other hand are short-lived as they do not feed at all as adults and only live to fertilize the females. Male citrus mealy bugs fly to the females and resemble fluffy gnats. Some species of mealy bug lay their eggs in the same waxy layer used for protection in quantities of 50–100; other species are born directly from the female.

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2.1.5 Diversity and abundance

Diversity of mealy bugs (Pseudococcidae: Hemiptera) in cotton production system of Central India indicated three species viz., Phenacoccus solenopsis Tinsley, Maconellicoccus hirsutus (Green), Nipaecoccus viridis New stead on cotton and four more species viz., Coccidohystrix insolita Green, Ferrisia virgata Cockrell, Drosicha mangiferae Green and Ferrisia malvastra (Mc Daniel) on pigeonpea,

guava, mango and a weed host Sonchus oleraceus, respectively. P. solenopsis was the dominant species among all mealybugs over large areas followed by M. hirsutus. The occurrence of N. viridis was sketchy and less frequent on cotton or any other plants including weeds. P. solenopsis attained pest status in pockets of cotton growing districts of Central India during 2007 with sporadic and limited incidence of M. hirsutus.

2.16 Host range

P. solenopsis is a polyphagous pest feeding and reproducing on a wide range of plants. Literature survey on pest status of P. solenopsis indicated severe economic damage to wide range of vegetables, horticultural and field crops. P. solenopsis infesting cotton and 29 other host plant species of 13 families were reported in the U.S (Fuchs et al., 1991). Twenty two host plants were studied for the prevalence of cotton mealy bug, P. Solenopsis between December 2006 to November 2007 in the area around Faisalabad (Aheer et al., 2009), and maximum prevalence of mealy bug was observed on china rose (Hibiscus chinensis) followed by okra (Abelmoschus esculentus). Arif et al. (2009) recorded 154 plant species belonging to 53 families with preference to plants from Malvaceaea, Solanaceae, Icoidae, Amaranthaceae, Asteraceae, Convolvulaceae, Euphorbiaceae, Verbanaceae and Zygophyllaceae as host plants of P. solenopsis from the cotton agrosystem of Punjab (Pakistan).Economical damage was observed on cotton, brinjal, okra, tomato, sesame, sunflower and china rose with plant death in severe conditions. P. solenopsis has been reported from a maximum of 183 plants in 52 families by Ben-Dov et al. (2009). A total of 55 host-plants in 18 families were reported by Abbas et al. (2010) from Punjab and Sindh regions of Pakistan. In Sri Lanka, primary host of P. solenopsis was reported to be shoe flower, Hibiscus rosa sinensis and other crops viz., okra, brinjal, tomato, chillies, amaranthus, sunflower, some ornamental

and weed hosts from home gardens also were reported as host plants (Prishanthini and Vinobaba, 2009). In India, although the economic damage was noticed on the dominantly cultivated up land cotton Gossypium hirsutum L. and its hybrids followed by desi cotton G. arboreum, P. solenopsis has several host plants belonging to various categories viz., cereals, pulses, oilseeds, vegetables, ornamentals, weeds and fruits. Gradual build up of population of an invasive/new insect largely on a specific host plant would indicate the insect species' feeding and breeding preference, and the plant host becomes the main host. However, accounts of P. solenopsis suddenly reaching damaging populations simultaneously on many fields of Northern cotton growing States, led us to investigate the alternate host plants for P. solenopsis within cotton production system of Central India. Since the study of host range and spatial and temporal preference for hosts constitute foundation for understanding the source and time of spread of the pest, instant emphasis was given to document the host range of P. solenopsis elaborately at Central India, despite its disjunctive occurrence as pest on cotton. Moreover, identification of the host plants of P. solenopsis playing a significant role in spread during growing season and carry-over during off season would guide to formulate cultural control strategies, such that the pest can be managed with minimum use of insecticides. The dominance of host plants in the agroecosystem was also measured in terms of nominal scale of vegetation viz., low, medium and high based on their presence in 10 sqm area surveyed randomly at ten different spots. Frequent occurrence of a host plant species with a mean of more than five plants per 100 sqm was categorised to have high vegetation. Number of plants of a host species ranging between two and five, and at least one among ten survey spots of 10 sqm constituted medium and low degree of vegetation, respectively. Stages of

host plants found on more than one occasion at successive time periods of survey alone were assessed for dominance in addition to severity due to mealy bugs.

2.1.7 Biology of *P. Solenopsis*

Knowledge on the biology of an insect at a given location with its environmental conditions on the crop of importance is necessary to understand the mode and degree of its population growth. Although the reports of occurrence and epidemics of *P. solenopsis* have been documented on cotton from several countries (Jhala and Bharpoda 2008b; Wang et al., 2009), details on biological parameters were not immediately explored due to the need for extensive standardization of the insect culture materials and methods. Since a study of the life history and pattern of biological activities are difficult under field conditions of cotton without interference of biotic and abiotic factors, laboratory studies have become essential. While sprouted potatoes were used as a food source to maintain the mealybug colony for taxonomic and bioassay studies (Nagrare et al. 2009), this system was not realistic for an investigation of the mealybug's life history. Preliminary studies conducted in the laboratory using cotton leaves placed in Petri plates with intensive observations of reproductive and developmental stages of P. solenopsis formed the basis for the present study. Cotton leaves collected from the same position on the plant from only one cultivar provided similar food source for developing mealy bugs, thus avoiding any variation in food quality. Since individual leaves could be placed in Petri plates, they were easily amenable to observations under the microscope. Vennila (2010).

2.1.8 Damage

The life cycle from egg to adult takes approximately 60 days, depending on temperature and host plant. The primary means by which mealy bug crawlers

disperse within a green house or interiorscape are wind or air currents, workers handling infested plants and inadvertently transferring mealy bugs to uninfested plants, watering equipment, plant leaves touching that allow crawlers to move among plants, introduction of infested plant material, and ants transporting crawlers among plants. The lateral waxy protrusions help protect mealy bugs from natural enemies (e.g., parasitoids and predators) and promote the spacing of individuals in a colony. Mealy bugs seem almost invisible during early stages of infestation, and then suddenly populations become noticeable, resulting in out-breaks. It is usually too late then to implement an effective management strategy.

Mealy bugs cause direct plant injury by feeding on plant fluids or sap in the vascular tissues—primarily the phloem or mesophyll or both—with their piercing-sucking mouthparts. They may also inject a toxin. This may cause leaf yellowing, plant stunting, and wilting. In addition, mealy bugs excrete a clear sticky liquid called honeydew, which serves as a growing medium for black sooty mold fungi. Mealy bugs are also capable of transmitting diseases, including viruses. Mealy bugs tend to congregate in large numbers at leaf junctures where the petiole meets the stem, on leaf undersides, on stem tips, and under the leaf sheaths of certain plants such as orchids and the prayer plant (*Maranta leuconeura*) Raymond(2011).

2.1.9 Scouting

Mealy bugs do not fly, except for the adult male, so they are not captured on yellow sticky cards. Visual plant inspections are the only way to detect early mealy bug infestations. Because of their cryptic behavior and small size, scouting via visual inspections is labor intensive and impractical. Scouting efforts should be focused on plant species highly susceptible to mealy bugs. This can be done by tagging a number of plants (five to 10 per plant species) and inspecting them regularly, which may help detect mealy bug populations early. Workers should

wear disposable rubber gloves when handling highly susceptible plants Raymond(2011).

2.1.10 Management

2.1.10.1 Cultural Management

This involves implementing practices such as weed removal, proper fertility, and old plant material disposal. Favorable environmental conditions (e.g., temperature) and plant growth may increase the mealy bug population. For example, plants irrigated frequently that receive high concentrations of a nitrogen-based fertilizer tend to be more susceptible to mealy bugs. Water-stressed plants may also be more susceptible to mealy bugs. Furthermore, mealy bug females feeding on plants receiving high concentrations of a nitrogen-based fertilizer may lay more eggs than usual. It is also important to immediately discard heavily infested plants, especially those that have been around for several years ("grandmother plants"), which tend to harbor mealy bug populations. If feasible, a forceful or high-pressure water spray, conducted regularly (e.g., twice per week) is effective in dislodging or removing all life stages (eggs, crawlers, and adults) quickly, thus preventing outbreaks from occurring. Raymond(2011).

2.1.10.2 Insecticide Management

Factors that may impact suppression of mealy bug populations with insecticides include: Mealy bugs have a cryptic behavior or clumped spatial distribution, and tend to aggregate or establish themselves in concealed /protected areas of plants.

Frequent overlapping generations with an age structure consisting of all the life stages present (eggs, crawlers, and adults) simultaneously. Hydrophobic (water-hating) waxy body covering repels hydrophilic (water-loving) insecticides.

The mealy bug life cycle and need to apply insecticides frequently increases the development of resistance.ertain insecticides may stimulate development and reproduction of mealy bugs. Many insecticides are not compatible with natural enemies (e.g., parasitoids and predators) and repeated insecticide use will kill existing natural enemies.(e.g., parasitoids and predators) and repeated insecticide use will kill existing natural enemies. The types of insecticide applications include foliar sprays and those directed toward the growing medium (drench or granule). Adult mealybugs are difficult to manage because they form a white, waxy protective covering that is nearly impervious to most insecticides. And because most insecticides have no activity on eggs (with the possible exception of petroleum-based or neem oils), at least two to three weekly applications usually are required to achieve satisfaction Eggs3 Tory suppression, especially when dealing with overlapping generations. The crawler stage, which does not possess a waxy covering, is most susceptible to insecticides including insect growth regulators (e.g., azadirachtin, buprofezin, and kinoprene), insecticidal soaps (potassium salts of fatty acids), horticultural oils (petroleum-based), and possibly insect-killing fungi (*Beauveria bassiana*). Although very few (if any) insecticides are able to penetrate the waxy covering of mealy bugs, those containing ethyl alcohol (ethanol), such as some oil-based insecticides, may allow the material to penetrate through the waxy covering, killing mealy bugs.

When applying high-volume sprays, thorough coverage is imperative, especially when using contact insecticides, because mealy bugs are commonly located in areas that are not easily accessible, such as the base of leaf petioles, leaf sheaths, and leaf undersides. Adding a spreader-sticker to a spray solution may be helpful in improving coverage and penetration. Table 1 lists insecticides that are registered for use on mealy bugs in both greenhouses and interiorscapes. For highly

susceptible plants, it may be prudent to routinely spray with either an insecticidal soap or horticultural oil to prevent mealy bug populations from reaching outbreak proportions. Also, it is essential to make multiple applications when crawlers are present because eggs will hatch (with the exception of the longtailed mealy bug) over an extended time period. Insect growth regulators, such as those listed in Table 1, are only directly active on the crawler stages, so timing of these materials is very important.

Systemic insecticides, those that move throughout plant parts, may also be used to protect plants from mealy bug infestations. Applications should be initiated early in the cropping cycle or before introducing plants into interiorscapes. Systemic insecticides may be applied as either a growing medium drench or granule. It is important to avoid overwatering plants afterward so roots can absorb the active ingredient. Systemic insecticides, depending on the type, may be less effective on mealy bugs than on aphids or whiteflies. This may be associated with mealy bugs not ingesting lethal concentrations of the active ingredient because they feed within the mesophyll tissues or on plant stems. Raymond(2011).

2.1.10.3 Biological Management

The use of biological control agents such as parasitoids and predators has been successful in managing mealy bugs, primarily citrus mealy bug, under specific crop production systems and interiorscapes. Biological control agents currently available for suppression of citrus mealy bug populations include the predatory ladybird beetle, *Cryptolaemus montrouzieri*, commonly referred to as the “mealy - bug destroyer, and the parasitoid, *Leptomastix dactylopii* . The larval stages of the mealy bug destroyer resemble mealy bug adults . *Leptomastix dactylopii* females only attack the third instar and young adult female life stages. Both natural enemies may be effective in suppressing or regulating citrus mealy bug

populations, and they can be used together under certain systems and situations. The waxy covering of later life stages may provide protection against these natural enemies. In addition, mealy bugs may encapsulate (smother) the eggs laid by the parasitoid, and the cryptic behavior of mealy bugs may allow them to elude natural enemies. It is important to manage ant populations because ants will protect mealy bugs from natural enemies. Ants perform several additional functions that are beneficial to mealy bugs, including removing honeydew and constructing shelters. In the presence of ants, mealy bugs tend to ingest more plant sap, resulting in greater plant damage. There are no commercially available parasitoids for the longtailed mealy bug. Contact your state's extension entomologist or biological control supplier for additional information about using natural enemies to deal with mealy bugs in greenhouses and interiorscapes Raymond(2011).

2.2 Okra(Abelmoschus esculentus)

2.2.1 Classification

Kingdom: Plantae

(unranked): Angiosperms

(unranked): Eudicots

(unranked): Rosids

Order: Malvales

Family: Malvaceae

Genus: *Abelmoschus*

Species: *esculentus*

Binomial name: *Abelmoschus esculentus* (L.) Moench

Okra (*Abelmoschus esculentus*), known in many English-speaking countries as ladies' fingers, bhindi, bamia, ochro or gumbo, is a flowering plant in the mallow family. It is valued for its edible green seed pods. The geographical origin of okra is disputed, with supporters of West African, Ethiopian, and South Asian origins. The plant is cultivated in tropical, subtropical and warm temperate regions around the world. National Research Council, N.R.C. (2006).

2.2.2 Structure and physiology

The species is an annual and perennial, growing to 2 m tall. It is related to such species as cotton, cocoa, and hibiscus. The leaves are 10–20 cm long and broad, palmately lobed with 5–7 lobes. The flowers are 4–8 cm in diameter, with five white to yellow petals, often with a red or purple spot at the base of each petal. The fruit is a capsule up to 18 cm long, containing numerous seeds. *Abelmoschus esculentus* is cultivated throughout the tropical and warm temperate regions of the world for its fibrous fruits or pods containing round, white seeds. It is among the most heat- and drought-tolerant vegetable species in the world and will tolerate soils with heavy clay and intermittent moisture, but frost can damage the pods. In compound farms in the rainforest of southeastern Nigeria (Okafor and Fernandes, 1986), farmers have developed a multi-crop system that provides a diversified and continuous production of food, combining species with different maturity periods such as yams, cassava, cocoyams, bananas, plantain, maize, okra, pumpkin, melon, leafy vegetables and a variety of trees and shrubs, 60 of which provide food products. This ensures a balanced diet but also reduces the need for storage in an area where post-harvest losses are high."Okra Seed" .Retrieved (2012).

In cultivation, the seeds are soaked overnight prior to planting to a depth of 1–2 cm. Germination occurs between six days (soaked seeds) and three weeks.

Seedlings require ample water. The seed pods rapidly become fibrous and woody, and, to be edible, must be harvested within a week of the fruit having been pollinated. The fruits are harvested when immature and eaten as a vegetable

The most common disease afflicting the okra plant is verticillium wilt, often causing a yellowing and wilting of the leaves. Other diseases include powdery mildew in dry tropical regions, leaf spots, and root-knot nematodes Queensland (2012).

Plate. 1 :Plant okra

2.2.3 Origin and distribution

Okra is an allopolyploid of uncertain parentage (proposed parents include *Abelmoschus ficulneus*, *A. tuberculatus* and a reported "diploid" form of okra). Truly wild (as opposed to naturalized) populations are not known with certainty and the species may be a cultigen. The geographical origin of okra is disputed, with supporters of South Asian, Ethiopian and West African origins. Supporters of a South Asian origin point to the presence of its proposed parents in that region.

Supporters of a West African origin point to the greater diversity of okra in that region. The Egyptians and Moors of the 12th and 13th centuries used the Arabic word for the plant, *bamya*, suggesting it had come from the east. The plant may have entered southwest Asia across the Red Sea or the Bab-el-Mandeb strait to the Arabian Peninsula, rather than north across the Sahara, or from India. One of the earliest accounts is by a Spanish Moor who visited Egypt in 1216 and described the plant under cultivation by the locals who ate the tender, young pods with meal Retrieved (2012). From Arabia, the plant spread around the shores of the Mediterranean Sea and eastward. The plant was introduced to the Americas by ships plying the Atlantic slave trade Milliken and Feniger (1996) by 1658, when its presence was recorded in Brazil. It was further documented in Suriname in 1686. Okra may have been introduced to southeastern North America from Africa in the early 18th century. By 1748, it was being grown as far north as Philadelphia. Thomas Jefferson noted the it was well established in Virginia by 1781. It was commonplace throughout the southern United States by 1800, and the first mention of different cultivars was in the products of the plant are mucilaginous, resulting in the characteristic "goo" or slime when the seed pods are cooked; the mucilage contains a usable form of soluble fiber. Some people cook okra this way, others prefer to minimize the sliminess; keeping the pods intact, and brief cooking, for example stir-frying, help to achieve this. Cooking with acidic ingredients such as a few drops of lemon juice, tomatoes, or vinegar may also help. Alternatively, the pods can be sliced thinly and cooked for a long time so the mucilage dissolves, as in gumbo. The immature pods may be pickled.

Okra leaves may be cooked in a similar way to the greens of beets or dandelions. Austin (1861) mention that since the entire plant is edible, the leaves are also

eaten raw in salads. Okra seeds may be roasted and ground to form a caffeine-free substitute for coffee. When importation of coffee was disrupted by the American Civil War in 1861, the *Austin State Gazette* said, "An acre of okra will produce seed enough to furnish a plantation of fifty negroes with coffee in every way equal to that imported from Rio. (Durauchelle , 2011). Okra is a popular health food due to its high fiber, vitamin C, and folate content. Okra is also known for being high in antioxidants. Okra is also a good source of calcium and potassium. Derlin (2015).

2.2.4 Propagation

Okra is typically propagated from seed. Soaking seeds in water overnight prior to planting helps the plants to germinate. In the home garden, seeds should be sown at a depth of 2.5 cm (1 in) leaving 25–45 cm (10–18 in) between rows only after the soil has reached a temperature of 18°C (65°F). In commercial okra production, seeds are planted in rows spaced 0.65–1.0 m (26–40 in) apart. Okra seed is commonly planted at a rate of 10 lb per acre but this quantity is vastly reduced by the use of precision planting methods. Seedlings are thinned to a final spacing of 15.0–22.5 cm (6–9 in) when they are 4–6 weeks old to produce the final plant stand.

2.2.5 Harvesting

Pods are usually ready for harvesting 2 months after planting. Okra pods are generally ready to harvest 4 to 6 days after flowering and pods should be harvested every 2–3 days when they have reached 7.6–15.2 cm (3–5 in) in length. Pods can be removed from the plant by cutting with a sharp knife or by snapping from the plant.

2.3 Glue bee (Propolis)

Propolis is a wax –like resinous substance collected by honey bees from tree buds or other botanical sources and used as cement to seal racks on open spaces in the hive its color varies from green to brown and reddish, depending od its botanical source . Honey bees use propolis to seal any gap inside the hive that smaller than 3/16 or 1/4 (5mm or 6mm) while they leave themselves a bee space or approximately 9.5mm or 38 larger spaces being filled with wax conib (Burdock, 1998) .Traditionally, beekeepers assumed that bees sealed the cracks and joints of the bee hive with propolis to protect the colony from the elements (like rain) and prevent draft during the winter time propolis is now thought to :

1- Reinforce the structural stability of the hive

2- Reduce vibration

3- Make the hive more defensible by sealing alternate entrances

4- Bees may also use it to prevent infection with disease and parasites in the hive.

2.3.1 Composition

The composition of propolis varies from hive to hive , district and from season to season . Bees are opportunists, and gather what they need from available sources. Occasionally, bees gather calking compounds of human manufacture, when the usual sources are more difficult to obtain. Therefore , the exact composition is never absolutely the same between any two areas , and various potential medical properties may be present in one hives propolis , and absent from anther , the properties of the propolis depend on the exact plant sources used by an individual hive , which the distributors of propolis products cannot control (a factor that may account for the many and varied claims as to its properties , and the difficulty of

replicating scientific studies investigating these claims) . Even propolis samples taken from a single colony can vary, making controlled clinical tcsts virtually impossible (Banskota et al, 2001 and Bankova , 2005) . The source of propolis varies with the latitude .In teraperate regions bees collect resins from trees , mostly poplars and to a lesser extent conifer the biological role of propolis in trees is seal wounds and defend against bacteria , fangi and insects . In tropical regions , bees gather propolis from flowers , especially clusia , that have adapted propolis and tropicals are different . poplar propolis is rich in flavanoids . Clusia propolis contains polyprenylated benzophenones . Typical propolis has approximately 50 costituents , primarily resins and vegetable balsams (50%) waxes (30%) , essential oils (10%) and pollea (5%) . Propolis is sticky at and above room temperature . At lower temperature it becomes hard and very brittle (Burdock,1998) .

2.3.2 Physical characteristics

The colour of propolis ranges drom yellow to dark brown depending on the origin of the resins .But , even transparent propolis has deported . At 25 to 45 c propolis is a soft , pliable and very sticky substance . At less than 15 c , and particularly when frozen or at near freezing it becomes hand and brittle .It remains brittle after such treatment even at higher temperature Above 45 c ., it becomes increasingly sticky and gaminy . Typically , propolis become liquid at 60 to 70 c but for some samples the melting point may be as high as 100 c . the most common solvents used for commercial extraction are ethanol (ethylalcohol) ether , giycol and water for chemical analysis a large variety of solvents may be used in other to extract the various fractions many of the bactericidal components are soluble in water or alcohol (Arvouet et al ,1993) .

2.3.3 Chemical characteristics

The composition of propolis varies with its geographic and plant source , as well as with the collection season (Bansdock , et ,al ,2001 and Bankova , 2005) .The alcohol extract of propolis is called propolis wax or tincture , with the insoluble residue know as propolis resin (Burdock , 1998) propolis contains 50% resin and vegetable balsam 30% wax , 0% essential and aromatic oils , 5% pollen , and 5% other substance including minerals such as magnesium , nickel , iron , calcium , and zinc (Castaldo and Capasso , 2002 and Burdock ,1998). Propolis contains flavonoids such as quereetin , pinoeembrin galangin , and pinobanksin , as well as hydroquinone , caffeic acid esters (Castablo and Capasso , 2002 and Burdock, 1998) A number of other compounds have been identified in propolis from specific geographic source (Popova et al , 2005).

2.3.4 Uses

Though there are various effects attributed to propolis many of the repos are based on preliminary studies. If clinical trails were conducted they were rarely based on large numbers of patients or rigorous test designs such as the double –blind placebo test. The majority of the studies were conducted in fast European Countries. Much practical work and research I also being done China, but information is difficult to obtain , because of the language barrier . Western European and north American medical research has largely ignored this source of milder and widely beneficial material . More detailed studies are warranted to determine the potential benefits from the medicinal use of propolis particularly for intestinal dermatological and applications.

2.3.4.1 Traditional uses

Propolis has been used as a medical agent since ancient times . It was used in folk medicine as early as 300 BC for cosmetic purposes, its anti-inflammatory

properties, and for wound healing . It has been used internally and externally, and is believed to posses antibacterial , antiviral , fungicidallocal anesthetic , antiulcer , anti-inflammatory , immunostimujant , hypotensive and cytostatic properties (Banskota et al .2001).

2.3.4.2 Medicinal uses

Propolis is marketed by health food stores as a traditional medicine , and for its claimed effect on human health . Holistic therapists often utilize propolis for the relief of various conditions including infalminations viral diseases , ulcers , superficial burns or scalds , sometimes based on traditions such as traditional Chinese medicine, syurvedaor homeopathy . Propolis is also believed to promote heart health and reduce chances of cataracts . Old beekeepers recommend a piece of propolis kept in the mouth as remedy for a sore throat .Claims have been made for its use in treating allergy . Propolis may cause severe allergic reactions if the user is sensitive to bees or bee products . Few of these folkloric claims have been clinically evaluated at the level of large randomize , double-blind studies . Some in-virto or rat model studies are available in published biomedical literature propolis may show powerful local antibiotic and antifungal properties . Studies indicate that it may be effective in treating skin burns .propolis also exhibits immunomodulatory effects . Propolis has also attracted the attention of the dental community .In-virto, animal and clinical and clinical studies suggest than propolis has a protective effect against caries and gingivitis , Propolis can also be used to treat canker sores , and its use in canal debridement for endodontic procedures has been explored in Brazil . Propolis is used by music instrument makers to bettershow the wood grain (Esanu , 1981).

2.3.4.2.1 Anti infective properties

Propolis has been used for wound-healing for thousands of years .During World wars 1 and 2 , also soldiers used propolis to prevent their wounds from becoming infected and to spced the healing process . The early research work on propolis was mostly done in eastern Europe and the former soviet Union , consisting of highly technical laboratory studies as well controlled clinical trials . Laboratory tests showed that propolis on its own is effective against over 20 kinds of bacteria (Hill , 1977) clinical studies from the former soviet union (Tsarev et al , 1985) and china Pang and Chen , 1985) demonstrated that propolis was effective against various kinds of bacterial fugnal and viral infections . Propolis was effective against sore throats and dry coughs in 90% of 260patients . A recent study serkedjicva et al . (1992) showed that the active ingredients in propolis significantly inhibited the Hong kong flu virus . Therefore propolis might be a good agent to prevent and treat the common cold and flu . Recent studies also show that propolis is effective against the Herpes simplex virus (Amoros et al , 1994and Dumitrescu et al 1992) . The antibacterial propolis of propolis appear to be due to multiple mechanisms (Takaisi and Schilcher , 1994) .

1- Inhibits bacterial growth by preventing cell division

2- Disorganize bacterial cytoplasm, cell membranes, and cell walls

3- Inhibits protein synthesis

No prescription antibiotic acts in so complex a manner as propolis Additionally, a unique advantage of propolis is that it enbances the effectiveness of antibiotics such as penicillin and streptomycin (Hill, 1977 and Krol et al, 1993). The combination of propolis with antibiotics can reduce drug dosages, minimize deug side, and decrease chances of drug resistance.

2.3.4.2.2 Propolis and immune enhancement

Propolis also stimulates the bodys immune system healing mechanism is due not only to its antibacterialproperties and detoxifyin effects , but also to the increased defensive reaction of the organism . Propolis works by raising the bodys natural resistance to infections by stimulating ones own immune system , propolis significantly actives macrophages , which play an important role in infection prevention (Dim et al , 1992) . In addition it can significantly inhibit lipoxygenase activity , thereby inhibiting prostaglandin synthesis (Sudina et al ,1993) . Strehl et al , 1994) confirmed that propolis has anti-inflammatory effects . Propolis in the prevention and treatment of cancer. One of the most exciting recent finding on propolis is its efficacy in cancer prevention and treatment . Cafteic acid phenethyl ester (CAPE),one of the active ingredients in propolis , has been showed to prevent cancer inhibitory effects against several cancers (Rao et al ,1992 and Guraini et el 1992). Propolis inhibits cancer cell growth by increasing the process of apoptosis (programmed cell death) a process our bodies use to get rid of old useless cells (Su et al , 1995 and Chopra et al , 1995) . Propolis can significantly decrease the heart toxicity of doxorubicin , a chemotherapeutic agent used in cancer treatment (Chopra et al , 1995) .

2.3.4.3 Other uses

Propolis is also effective against ulers . In a clinical study involving 294 patients 90% of 108 ulcer patients given propolis were free of symptoms after two weeks , compared to only 55% of 186 conventionally treated patients (Jones , 1979) . Propolis also appears to be effective in the treatment of severe acne (Hill , 1977) .

Propolis is a wax –like resinous substance collected by honey bees from tree buds or other botanical sources and used as cement to seal racks on open spaces in the

hive its colour varies from green to brown and reddish, depending od its botanical source .

Honey bees use propolis to seal any gap inside the hive that smaller than 3/16 or 1/4 (5mm or 6mm) while they leave themselves a bee space or approximately 9.5mm or 38 larger spaces being filled with wax conib (Burdock, 1998) .

8.4.1 Neem Tree (*Azadirachta indica*)

Neem is versatile tree, it is considered to be one of the most promising trees of the 21 century. It has great potential in the pest management, environment protection and medicine. Also it has showing reappraise as potential fertilizer (Handady, 2010).

2.4.1 Classification

Kingdom: plantae

Division: magnoliophyta

Order: Rutales

Suborder: Rutinae

Family: Meliaceae

Subfamily: Melioideae

Genus: *Azadirachta*

Species: *indica*

2.4.2 Description

Azadirachta indica is a fast growing plant that usually reaches a height of 15-20 meters. *A indica* very favorable condition sup to approximately 35-40meters.it is on ever green plant that tolerate extreme circumstances such as long dry periods it might shed most or nearly all of it is leaves the branches spread widely. The fairly dense crown is roun dishevel and may reach a diameter of 15-20 meters on old trees. The trunk in relatively short the bark is hard, scaly and whitish to reddish when first exposed to their the red system consist of as strong top root and well lateral roots the lateral surface roots may reach over 18 meters (Gruber, 1991).

The exact origin of *A .indica* is not known. Some authors suggest that it may be in Myanmar (Burma) and other indicate Southern India (Troup, 1921). The great variability in the shape of it is leaves and other feats we support the hypothesis that the neem tree could have been originated in this region. Currently it is widely distribution in dry tropical and subtropical zones of Asia, Africa, America, Australia and the south pacific Islands. In the Sudan, neem which was introduced in 1921 is frequent in Kassala, in threats in towns and village along the blue and the White Nile irrigated areas of central Sudan and rain fed regions in Kordofan and Darfur (Schmutterer, 1995).

2.4.4 Neem Economic Importance

In traditional medicine, neem has been used in India as a household remedy for treatment of common ailments since times Immemorial- the green leaves used as a cure for epitasis, eye trouble and leprosy-the old leaves generally relieve and heal boils and skin ulcers. Flowers suppress bile and eliminate intestinal worms and phlegm. Young twigs relieve coughs, asthma, piles, and excess stomach gas. Unripe fruits are effective against flatus accumulation piles, intestinal worms and urinary troubles. Bark was an analgesic and curative of fever. Neem toddy (gum) is

a kind of juice flow from old trees when they are fully mature. This gum was used against skin diseases like scabies, wounds, ringworms, ulcers…etc (Sharma, 1991). However in modern medicine neem preparations have deem used to treat blood disorders, hepatitis, eye diseases, cancer, ulcers, constipation, diabetes, indigestion, sleeplessness, stomach ache, boils, burns, cholera, gingivitis, malaria hausea, snake bite rheumatism, and syphilis(Jacbson,1989). Ketkar (1976) reported an increase in the yield of cotton, sorghum, potato when crushed neem seed was used as manure with optimum application rates.

2.4.5 The Neem tree

During the last years the intensive search by many groups all over the world showed the plant family Maliaceae to be one of the most promising sources of compounds with in sect control properties in particular, one widely studied plant in this context in the neem tree. *Azadirachta indica* A .Juss it is used in traditional medicine , production of insecticides lamping and soap manufacturing using the mawgosa oil pressed from it is seed kernels which contains up to 4% oil (Siddig, 1991) neem seed kernel contain a number of chemical compound, most important of which are Azadirachtin and salan in triterpenoid fraction (Morgan,1987) .

2.4.6 Chemistry of Neem tree

All parts of *A. indica* tree have been examined by chemists which contains number of chemical compounds called, terpenes, or, limonoids. There are nearly 100 proto limonoids, limonids or tetranor triterpenoid, pentanor triterpenoids, hexanor triterpenoids and some none terpenoid (Janes, *et. al.*,1989). Limonoids occurring in neem are related to nine different basic structure groups such as the azadiron, amoorastanin, vepinin and vilasinin, and seco sestems related to gedunin, nimbin, nimbdinin and salanin and the azadirachtin group which in fact belong lasically to

the nimbolinin (Schumtterer,1995).the neem oil contains several terpenoids, steroids, alkaloids, flavonoids, glycosid and others (Anonymous,2001). The most important bioactive principle is Azadirachtin (Schmutterer, 1990). Azadirachtin is naturally found in neem kernel depending on the method of extraction (Anonymous, 1999b).

2.4.7 Neem Research in Sudan

Neem research in Sudan started in the 60; concentrating on it is use as pesticide. Currently three is extensive research, reported and projects published by the National Centre for Research (Khartoum, Sudan) NCR and many other universities (El-abjar, 1992).

2.4.8 Uses of Neem in pest and disease control

Neem is deemed very effective in the treatment of scabies although only preliminary scientific proof exists which still has to be corroborated, and is recommended for those who are sensitive to permethrin, a known insecticide which might be irritant. Also, the scabies mite has yet to become resistant to neem, so in persistent cases neem has been shown to be very effective. There is also anecdotal evidence of its effectiveness in treating infestations of head lice in humans. It is also very good for treating worms (Gahukar, 1995, John, 1992, Boa, 1992, Schmutterer, 1995, Tewari, 1992, Vietmeyer, 1992) and Jacobson, 1989). In the traditional medicine neem trees originated on the Indian sub continent. As a rule, it does not form a part of the forest but rather grown in the vicinity of human settlements. The medicinal properties medical writings (champagne, *et. al.*, 1992).The neem twig is natures tooth brush to over 500million people daily in India a lone, Herbal medicine is the oldest form of therapy practiced b mankind

and much of the oldest medicinal use of plants seems to have been based on highly developed ,dowsing instinct,(Grigs,1981).

2.5 Jimson weed (*Datura innoxia*)

2.5.1 Classification

Kingdom: Plantae

(unranked): Angiosperms

(unranked): Eudicots

(unranked): Asterids

Order: Solanales

Family: Solanaceae

Genus: *Datura*

Species: *innoxia*

Binomial name: *Datura innoxia*

Datura innoxia (thorn-apple, downy thorn-apple, Indian-apple, lovache, moonflower, nacazcul, toloatzin, tolguache or toloache) is a species in the family Solanaceae. It is rarely called sacred datura, but this name in fact refers to the related Datura wrightii. It is native to Central and South America, and introduced in Africa, Asia, Australia and Europe. The scientific name is often cited as *D. innoxia* Preissel et al (2002). When English botanist Philip Miller first described the species in 1768, he misspelled the Latin word *innoxia* (inoffensive) when naming it *D. inoxia*. The name *Datura meteloides* was for some time erroneously applied to some members of the species, but that name has now been abandoned.

2.5.2 Description

D. inoxia with ripe, split-open fruit. *Datura inoxia* is an annual shrubby plant that typically reaches a height of 0.6 to 1.5 metres Annapoorani (2013). Its stems and leaves are covered with short and soft grayish hairs, giving the whole plant a grayish appearance. It has elliptic entire-edged leaves with pinnate venation. All parts of the plant emit a foul odor similar to rancid peanut butter when crushed or bruised, although most people find the fragrance of the flowers to be quite pleasant when they bloom at night. The flowers are white, trumpet-shaped, 12–19 cm (4.75-7.5 in) long. Richard (1970) Retrieved (2007) they first grow upright, and later incline downward. It flowers from early summer until late fall. The fruit is an egg-shaped spiny capsule, about 5 cm in diameter. It splits open when ripe, dispersing the seeds. Another means of dispersal is by the fruit spines getting caught in the fur of animals, who then carry the fruit far from the mother plant. The seeds have hibernation capabilities, and can last for years in the soil. The seeds, as well as the entirety of this plant, act as deliriants, but have a high probability of overdose. Richard (1970).

2.5.3 Toxicity

All parts of *Datura* plants contain dangerous levels of poison and may be fatal if ingested by humans and other animals, including livestock and pets. In some places it is prohibited to b Richard (1970) uy, sell or cultivate *Datura* plants.

2.5.4 Cultivation

When cultivated, the plant is usually grown from seed, but its perennial rhizomes can be kept from freezing and planted in the spring of the following year. *Datura inoxia*, like other *Datura* species, contains the highly toxic alkaloids atropine, hyoscine (scopolamine), and hyoscyamine. The Aztecs called the plant *toloatzin*

Richard (1970).Similar species*Datura inoxia* is quite similar to *Datura metel*, to the point of being confused with it in early scientific literature. *D. metel* is a closely related Old World plant for which similar effects were described by Avicenna in eleventh century Persia. The closely related *Datura stramonium* differs in having smaller flowers and tooth-edged leaves, and *Datura wrightii* in having wider, 5-toothed (instead of 10-toothed) flowers. Datura inoxia differs from *D. stramonium*, *D. metel* & *D.fastuosa* in having about 7 to 10 secondary veins on either side of the midrib of the leaf which anastomose by arches at about 1 to 3 mm. from the margin. No anastomosis of the secondary veins are seen in the other 4 major species of Datura.

2.5.5 Traditional uses

Datura innoxia, or toloache, is the most ethnopharmacologically important of all thorn apple species in the Americas. Excavations dating to 1200 C.E. have shown that the prehistoric Pueblo Indians of the Southwest used the seeds in rituals (Litzinger 1981). The plant has also clearly been used in Mexico since the prehistoric period. It has been suggested that Aztec sacrificial victims were given Datura preparations in order to prepare them for death. At present, toloache is still used in Mexico for medicinal, ritual and aphrodisiac purposes (Ratsch 1998). In the Yucatan, D. innoxia is regularly cultivated as an ornamental and an entheogen. Shamans smoke cigars rolled from D. innoxia leaves or eat the seeds in order to do divinations with quartz crystals. Tarot cards are also sometimes used. The datura is said to allow the shaman to gain insight he would not have been able to discover otherwise. The flowers are used as offerings for the gods in ritual, as well (Ratsch 1998).

In modern Mexican witchcraft, or *brujeria*, toloache has a connection to dark practices and a reputation for causing insanity and death. It is said to give the user dark power. The Huichol regard D. innoxia as a 'bad plant of the gods' and associate it with sorcery (Ratsch 1998). D. innoxia is sacred to the Navajo, who use it in healing ceremonies. During one ceremony known as the Beautyway, D. innoxia preparations are consumed to produce visions. The plant is also used as a medicine to treat hallucinations. The Navajo take small amounts of D. innoxia to protect themselves from the attacks of dark sorcerers, and utilize the plant in divination and love magic. The Navajo *Ajilee* ceremony is one in which the practitioner is transformed into the Datura spirit and is able to gain power over women he desires and game he wishes to hunt. The ritual is also used to heal individuals who are suffering from sexual excess, and women who have been forced into prostitution (Brugge 1982). The Apache use powdered D. innoxia root in secret ceremonies as a plant medicine. Hopi medicine men chew the roots to induce visions that allow them to diagnose diseases (Ratsch 1998).D. innoxia was introduced to Pakistan from the Americas and now grows wild there. A few crushed seeds or a dried leaf mixed with tobacco (Nicotiana tabacum) is used as an aphrodisiac and inebriant (Goodman & Gharfoor 1992 cited in Ratsch 1998). In India, D. innoxia is used in the same way as D. metel.

2.5.6 Traditional preparation

The dried leaves and flowers of D. innoxia may be smoked alone or with other herbs in a smoking blend. Yucatec Maya shamans combine the leaves with tobacco to make cigars that they call *chamal*. One leaf of each plant is used to make one *chamal*. The shaman smokes until he reaches the state of consciousness he desires. The amount needed varies considerably from person to person. The seeds and

leaves of D. innoxia may be crushed and fermented to make an alcoholic beverage. The roots are sometimes added to *pulque*, beer, or *chicha* (Ratsch 1998). The Yaqui tribe add crushed seeds and leaves of D. innoxia to lard and rub this ointment on to the abdomen in order to induce visions. Fresh roots may be crushed and applied externally, chewed, or dried and powdered. However, dosage information regarding the roots is not available (Ratsch 1998).Four leaves is an appropriate dose for smoking if one wants to receive the aphrodisiac effects of the plant. Working with the plant in this way prevents overdose, as well. Tea made from the leaves should be consumed carefully – just one small leaf can cause very intense hallucinations. Alkaloid concentration will vary widely from plant to plant, and individuals can react very differently to tropane alkaloids, so detailed dose information is difficult to provide. 30-40 seeds is considered a strong visionary dosage, but as few as 10 seeds can result in significant perceptual changes. In Pakistan, 150 grams of leaves, fruits, or flowers is considered to be a lethal dose, but even significantly less than this can cause death in some individuals (Goodman & Ghafoor 1992 cited in Ratsch 1998).

2.5.7 Medicinal uses

In Mexico, toloache is used as a remedy for many disorders and symptoms, particularly fevers. The Apache use the juice of the flowers and roots to disinfect wounds. Dew drops that have collected in the flowers are used as an eye wash (Ratsch 1998).The Aztecs used thorn apple leaves to treat broken bones and swollen joints. Leaves that had been warmed in a steam bath were placed directly on to the affected areas. Toloache is one of the most important aphrodisiacs and sedatives in Mexican folk medicine. It is given during childbirth to help with pain. In Israel, a decoction of the leaves is consumed to treat diarrhea, and a paste of the

leaves is applied externally to treat pain (Dafni & Yaniz 1994). In many parts of the world, the leaves of D. innoxia have been smoked, alone or in blends, as a most effective treatment for asthma (Ratsch 1998).

2.5.8 Traditional effects

The entire D. innoxia plant is rich in tropane alkaloids, particularly scopolamine and hyoscyamine. Some plants produce significantly more scopolamine than others. The effects of D. innoxia are dependent on dosage and method of preparation. The American Indians say that a mild dosage produces medicinal, healing effects, a moderate dosage produces aphrodisiac effects, and high doses produce shamanic visions (Ratsch 1998).Shamanic doses of D. innoxia cause profound visions and hallucination and delirium. Overdose may begin with excitation, an urge to dance and fits of laughter, and end in acute hallucinosis and death through respiratory paralysis. In Mexico, peyote is used as an antidote for toloache overdose (Nadler 1991 cited in Ratsch 1998).

CHAPTER THREE

MATERIALS AND METHODS

This study was conducted under laboratory conditions at plant protection Department , College of Agricultural studies Shambat Sudan university of science and Technology (SUST)with in the period December to March 2015 to study the Proplis powder .Neem and - Jimson weed leaves powder effect against the adult stage of mealy bug (*Phenacoccus solenopsis*)

The materials and methods used in the present study are mentioned below:-

3.1 Materials

1-Okra fruits s 2-Infested okra fruits

3- Neem leaves 4- Jimson weed

5- Proplis 6- Soap

7-Bricht(standard insecticides)

3.2 Equipments

1-Plastic cages 2-Brush

3-Hand lens 4-Gloves

5- Face masks 6-Marker pen

7-pencil 8- Sensitive balance

9-Camera 10-Thermo-Hygrometer

11-Plastic sac 12-Electric blender

13-Alomonium foil 14-Scissor

3.3 Identification of insect

According to the description and taxonomic identification key by Nagrareet *et al.,* (2011) the insect pest was indentified as the cotton mealy bug *phenacoccus solenopsis* Tinsley (Hemiptera Pseudococcidae) (Agricultural Research corporation 2015) . insects samples were collected from okra , cotton and Abutilon *spp* and sanded to California Department of Food and Agriculture ,(Plant Pest Diagnosis Center , Sacramento, CA , USA) who confirmed the identification of the species.

3.4 Rearing methods

3.4.1 Collation of target insect

Adults of the mealy bug were collected from unsprayed okra plants grown in Shambat area Khartoum north and brought to the laboratory For rearing

3.3.2 Adult rearing

Okra pods infested by mealy bug were collected from the local area Shambat, Sudan and brought to the Entomology laboratory at the college of Agricultural studies , Sudan University of Science and Technology . infested pods Collected were introduced in to plastic containers 31*20*19cm in size and covered with light cloth netting materials for ventilation. The rearing of the newly emerged adults continued for 23- 29 days . The mealy bug during okra fruits fed on rearing was which changed successively after every 48 hours.Temperature in the laboratory was between 27+- 2 c and relative humidity (RH) was between 30+- 5% during the rearing period the cages were continuously supplemented with additional okra pods every and this was continued for 23-29 days.

3.5 Collection and preprinting of plant materials

Jimson weed *Datura stramonium* leaves and Neem *(Azadirachta indica)* leaves were collected from jimson weeds and neem trees growing in the field of the College of Agricultural Studies , Sudan University of Science and Technology . Plant materials were brought to the laboratory of the Entomology where they were dried . After complete dryness the plant samples were crushed separately by an electric blender to obtain the powder for the preparation different weights required for bioassay.

3.6 Preparation of the weights

Preparation of the weights required for the treatments. Three different weights 2g, 4g and 6g were prepared from Datura and Neem leaves powder respectively and mixture from the tow powder at the ratio 1:1 was also prepared.

3.7 Bioassay procedure

Adult stage of the mealy bug *phenacoccus solenopsis* was used in this study. Three fruits of okra were placed into plastic bag and the powder understudy was added to thim . then added to them certain weight from powder to be treated . and shaking the plastic bag until it was good fogging each fruits. And put three fruits in all cage. The cage plastic containing ten insect of full phase to mealy bug for each treatment of the Jimson weed ,Neem and Poropolis , and each treatment was replicated three times, and treatment mixed between jimson weed and neem mix ratio of (1:1), and adult stage were treated with the recommended dose of bricht 25% E.C. (40-60 ml / 20 liter water / feddan) as standard. Also, adult stage were used as a control in which only pure fruits of okra untreated with anything was administered, All treated adult stage was kept in cage plastic cm in diameter at

temperature range between 27-32 °c. During treatment period the adults were fed on fresh okra. The mortality and infection counts were recorded after 24, 48 and 72 hours after application.

3.8 Experiment design

These experiments were a wanged in the laboratory a Complete Randomized Design (CRD).

3.9 Statistical analysis

The obtained data was statistically analyzed according to analysis of variance (ANOVA); Duncan's Multiple Range Test was used for separation mean

CHAPTER FOUR

RESULTS

As seen in Table (1), Figure (1) and Appendices (1), (2) and (3) all weights of the leaves powder of jimson weed 2g gave significantly lowest infection percentage than the control after 24hrs of exposure. Additionally, all the increments in the weight powder were accompanied with a decrease infection percentage. The infection caused by the low weight used in this study (2gram) were comparable and significantly different than the infection caused by the recommended dose of Bright even after 24 , 48 and 72 hrs of exposure. The infection results obtained after 24hrs of exposure to 2 and 4 gram of weights jimson weed remained the sim after 48 and 72 hrs of exposure. The results exhibited in Table (2), Figure (2) and Appendices (4), (5) and (6) showed that each weight of the leaves powder of neem gave significantly highest and lowest infection percentage after 24 .48 and 72 hrs of application, all weights of leaves powder of neem generated low infection percentages which were not significantly different from that obtained by standard bright.

Table. 1: Effect of powder of jimson weed on the infectious of adult stage of mealy bug on okra

Jimson weed Weights	infectious percentage in 3 day		
	Exposure time (hrs)		
	24h	48h	72h
2g	13.3%(3.233)B	23.3%(4.167)B	26.6%(5.000)B
4g	0%(0.7000)C	0%(0.7000)C	6.6%(1.533)C
6g	6.6%(1.533)BC	10%(2.800)BC	10%(2.800)BC
Bricht	3.3%(1.533)BC	3.3%(1.533)BC	6.6%(1.533)C
Control	80%(8.900)A	83.3%(9.100)A	86.6%(9.300)A
CV%	35.78%	38.78%	29.54%
LSD	2.486	3.162	2.650
SE	0.85	0.88	0.81

Means followed by the same letter (s) are not significantly different at (P< 0.05).
Means between brackets are transformed according to $\sqrt{X + 0.5}$

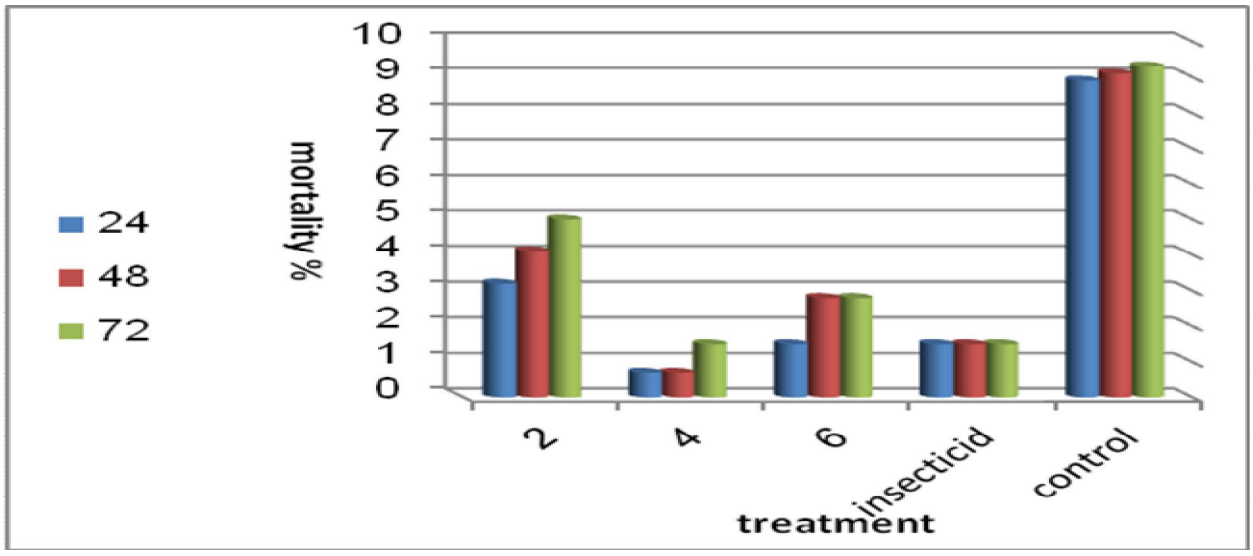

Fig. 1: Effect of leaves powder of jimson weed on the infection of adult stage mealy bug on okra

Table. 2 : Effect of powder of Neem on infectious of adult stage of mealy bug on okra.

Neem Weights	infectious percentage in 3 day		
	Exposure time (hrs)		
	24h	48h	72h
2g	0%(0.7000)B	6.6%(1.967)B	6.6%(1.967)B
4g	6.6%(1.533)B	6.6%(2.367)B	6.6%(2.367)B
6g	0%(0.7000)B	6.6%(1.967)B	6.6%(1.967)B
Bricht	3.3%(1.533)B	3.3(1.533)B	6.6%(1.533)B
Control	60%(7.700)A	86.6%(9.300)A	90%(9.500)A
CV%	39.10	48.68%	47.91%
LSD	1.731	3.055	3.022
SE	0.74	0.87	0.89

Means followed by the same letter (s) are not significantly different at (P< 0.05).
Means between brackets are transformed according to $\sqrt{X + 0.5}$

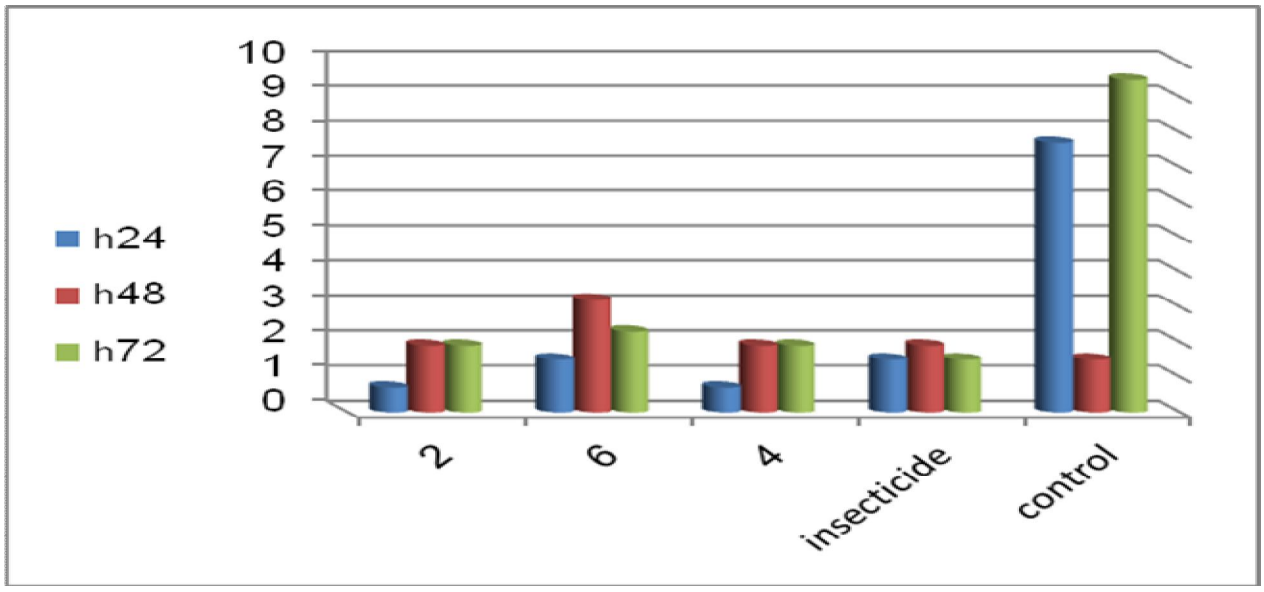

Fig. 2 : Effect of leaves powder of Neem on the infection of adult stage the mealy bug in okra.

As seen in Table Figure (3), Figure (3) and Appendices (7), (8) and (9) all weights of leaves powder of mixed between neem and jimson weed percentage (1:1) gave significantly lower infection percentage than the control after 24, 48 and 72hrs of exposure. It can also be noted that all the increments in the weight of powder mixture resulted in an increase in infection percentage. Results after 72 hours of mixture , showed that bright generated 6.6 % increase infection, whereas the highest weight (6gram) of powder mix generated 0% infection percentage. The data presented in Table (4), Figure (4) and Appendices (10), (11) and (12) revealed that two weights (4,6gram) of the powder of propolis gave not significantly higher infection percentage after 24 and 72hrs of application period. But after 72hrs of exposures to all weights not significant different between them. Then no significant different between all treatment.

Table. 3Table 3: effect of powder of mixture jimson weed and Neem on the infectious of adult a stage on mealy bug

Mixed Weights	infectious percentage in 3 day		
	Exposure time (hrs)		
	24h	48h	72h
2g	0%”(0.7000)B	6.6%(2.367)B	10%(2.800)B
4g	0%(0.7000)B	3.3%(1.533)B	3.3%(1.533)B
6g	0%(0.7000)B	0%(0.7000)B	0%(0.7000)B
Bricht	3.3%(1.533)B	3.3(1.533)B	6.6%(2.367)B
Control	80%(8.900)A	83.3%(9.100)A	90%(9.500)A
CV%	27.89%	33.95%	37.18%
LSD	1.272	1.845	2.286
SE	0.87	0.86	0.88

Means followed by the same letter (s) are not significantly different at (P< 0.05).
Means between brackets are transformed according to $\sqrt{X + 0.5}$

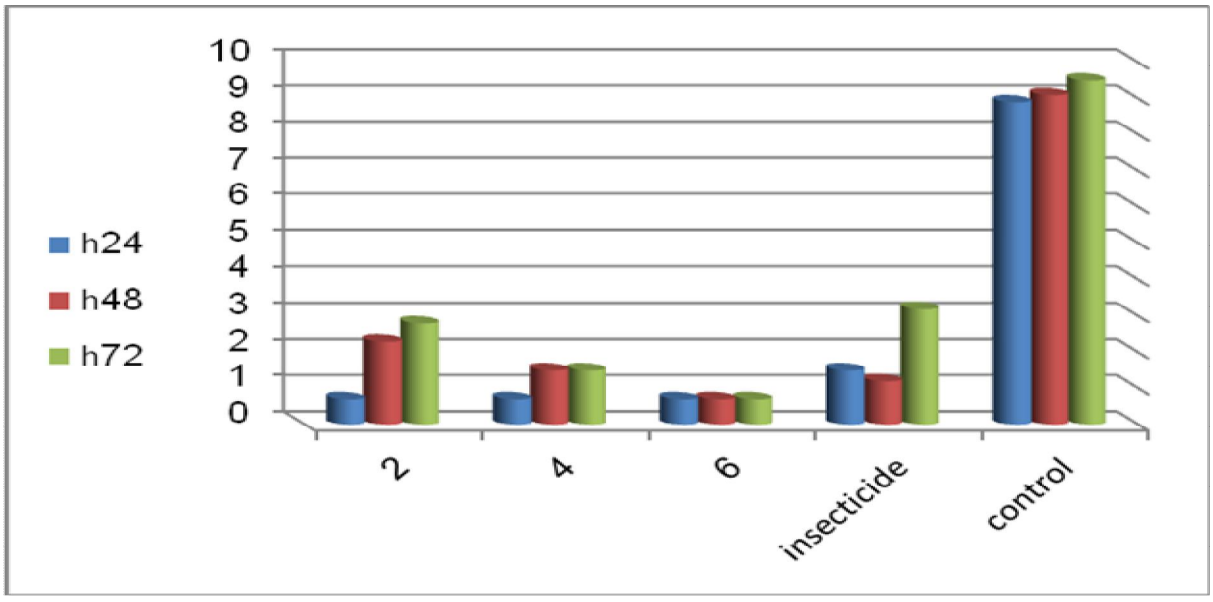

Fig. 3: Effect of leaves powder of mixed of jimson weed and Neem on the infection of adult stage the mealy bug on okra.

Table. 4 : Effect of powder Propolis on the infectious of adult stage of mealy bug on okra.

Propolis Weights	infectious percentage in 3 day		
	Exposure time (hrs)		
	24h	48h	72h
2g	36.6%(6.033)B	43.3%(6.567)B	46.6%(6.833)B
4g	30%(5.433)BC	33.3%(5.767)BC	40%(6.300)B
6g	20%(4.400)C	26.6%(5.167)C	36.6%(6.033)B
Bricht	3.3%(1.533)A	3.3%(1.533)A	6.6%(2.367)A
Control	76.6%(8.700)D	80%(8.900)D	86.6(9.267)D
CV%	11.95%	7.97%	ss7.31
LSD	1.454	1.029	1.015
SE	0.51	0.45	0.43

Means followed by the same letter (s) are not significantly different at (P< 0.05).
Means between brackets are transformed according to $\sqrt{X + 0.5}$

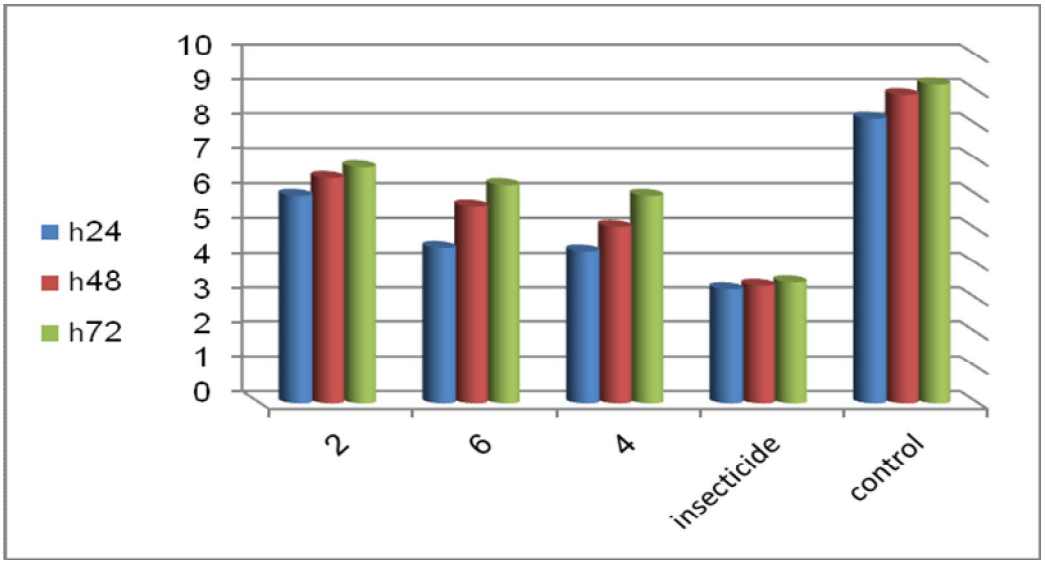

Fig. 4: Effect of powder poropolis on the infection of adult stage of the mealy bug on okra.

As seen in Table figure (5), Figure (5) and Appendices (13), (14) and (15) all weights of the leaves powder jimson weed gave significantly difference mortality percentage than the control after 24hrs of exposure. Additionally,. The mortality caused by the one highest weight used in this study (6gram) were comparable and significantly different than the mortality caused by the recommended dose of bright even after 24 .48 and 72 hrs of exposure. The mortality results obtained after 24 hrs of exposure of to all weights of leaves powder of jimson weed remain the same. Similarly the mortality percentage was scored by the lowest weight (2gram). The results exhibited in Table (6), Figure (6) and Appendices (16), (17) and (18) showed that each weight of the leaves powder of Neem gave significantly higher mortality percentage after 24hrs of exposure than control even after 72 hrs of application, all weights of the leaves powder cased high mortality percentages which were significantly different from that obtained by standard bright.

Table. 5 : Effect of leaf powder of jimson weed on the mortality of adult stage of mealy bug on okra.

Jimson weed Weights	Mortality percentage in 3 day %		
	Exposure time (hrs)		
	24h	48h	72h
2g	13.3%(3.633) B	26.6%(5.100) C	33.3%(5.700) C
4g	16.6%(4.067) B	26.6%(5.167) C	36.6%(6.033)C
6g	26.6(5.167) B	40%(6.300) B	60%(7.700) B
Bricht	80%(8.900)A	83.3%(9.100) A	93.3%(9.667) A
Control	0.0%(0.7000) D	0.0%(0.7000) D	0.0%s(0.7000)D
CV%	14.80%	9.53%	9.45%
LSD	1.238	1.120	1.254
SE	0.68	0.74	0.81

Means followed by the same letter (s) are not significantly different at (P< 0.05).

Means between brackets are transformed according to $\sqrt{X+0.5}$

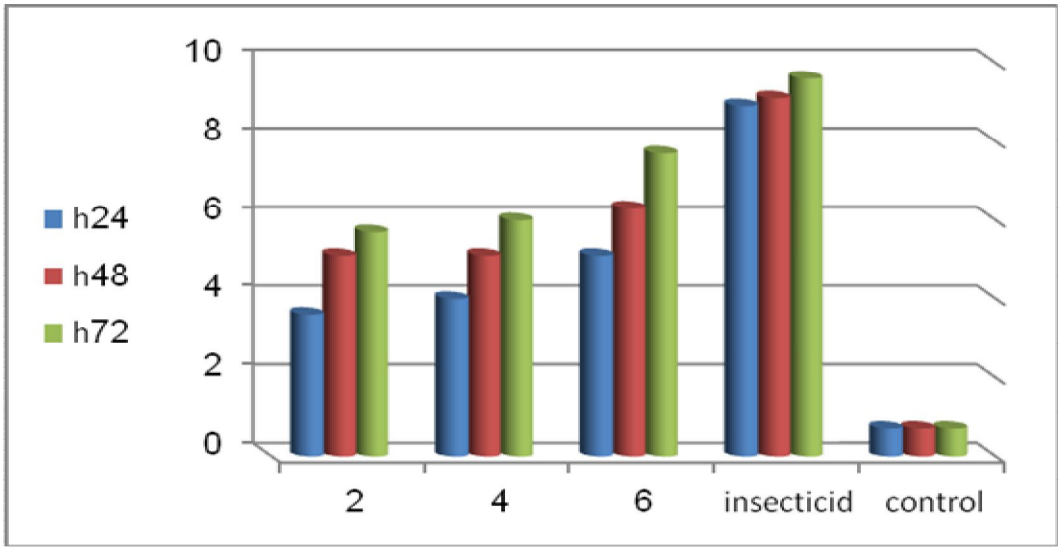

Fig. 5 : Effect of leaves powder of jimson weed on the mortality of adult stage of the mealy bug on okra.

Table. 6 : Effect of leaves powder of Neem on the mortality of adult stage of mealy bug on okra.

Neem Weights	Mortality percentage in 3 day %		
	Exposure time (hrs)		
	24h	48h	72h
2g	10%(3.200) C	20%(4.500) C	23.3%(4.833) D
4g	16.6%(4.067)BC	36.6%(6.033)B	40%(6.300) C
6g	23.3%(4.833) B	36.6%(6.033) B	53.3%(7.300) B
Bricht	80%(8.900) A	83.3%(9.100)A	93.3%(9.667) A
Control	0.0%(0.7000) D	0.0%(0.7000) D	0.0%(0.7000)E
CV%	11.55%	10.55%	8.428%
LSD	0.9115	1.011	0.8819
SE	0.72	0.74	0.84

Means followed by the same letter (s) are not significantly different at (P< 0.05).

Means between brackets are transformed according to $\sqrt{X + 0.5}$

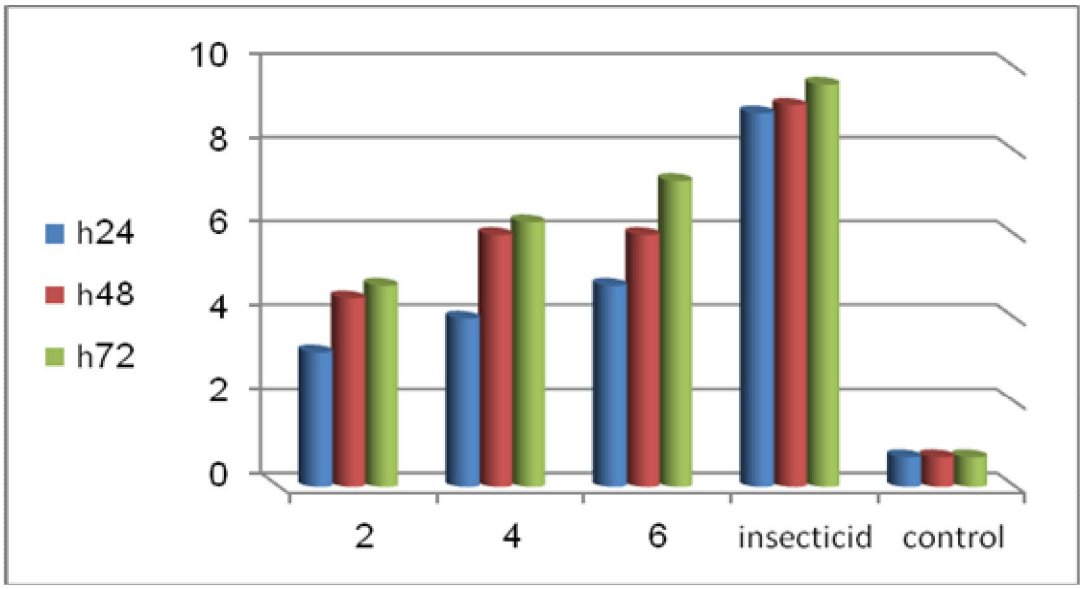

Fig. 6 : Effect of leaves powder of Neem on the mortality of adult stage of mealy bug on okra.

As seen in Table (7), Figure (7) and Appendices (19), (20) and (21) all weights of leaves powder of mixed Neem and jimson weed gave significantly higher mortality percentage than the control after 24hrs of exposure even 72hrs. It can also be that all the increments in the weights of powder resulted in an increase in mortality percentage. Results after 72 hours of exposure, showed that bright generated 93,3% mortality, where as the highest weight (6gram) of powder mixed of Neem generated only73,3% mortality. The data presented in Table (8), Figure (8) and Appendices (22), (23) and (24) revealed that each weights of the powder propolis gave significantly mortality percentage after 24, 48 and 72hrs of exposure than the control. The stander bright caused high mortality percentage 80% ,83,3% and 93,3% comparable to high weight of the powder propolis gave 13,3 % ,16,6% and 26,6% mortality.

Table. 7 : Effect of leaves powder of mixture between jimson weed and Neem on the mortality of adult stage of mealy bug on okra.

mixed Weights	Mortality percentage in 3 day %		
	Exposure time(hrs)		
	24h	48h	72h
2g	16.6%(4.067)D	23.3%(4.833) D	26.6%(5.167) D
4g	33.3%(5.767) C	43.3%(6.567) C	50%(7.033) C
6g	60%(7.700) B	63.3%(7.900) B	73.3%(8.500)B
Bricht	80%(8.900) A	83.3(9.100) A	93.3%(9.667) A
Control	0.0%(0.7000) E	0.0%(0.7000) E	0.0%s(0.7000)E
CV%	10.08%	8.23%	7.30%
LSD	0.9948	0.8706	0.8819
SE	0.87	0.89	0.88

Means followed by the same letter (s) are not significantly different at (P< 0.05).

Means between brackets are transformed according to $\sqrt{X+0.5}$

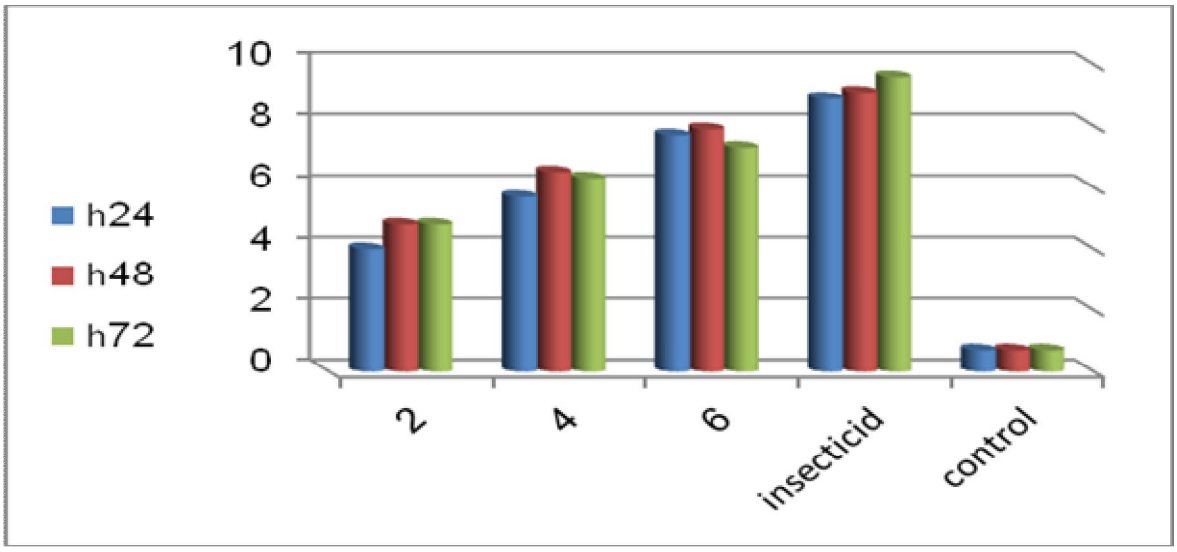

Fig. 7 : Effect of leaves powder of mixture of jimson weed and Neem on the mortality of adult stage of mealy bug on okra.

Table. 8 : Effect of porpolis powder on the mortality of adult stage of mealy bug on okra.

Followed by the same letter (s) are not significantly different at (P< 0.05).

Propolis / Weights	Mortality percentage in 3 day		
	Exposure time (hrs)		
	24h	48h	72h
2g	3.3%(1.533)C	6.6%(2.367) C	13.3%(3.633)C
4g	10%(3.200) B	13.3%(3.633) BC	23.3%(4.833) B
6g	13.3%(3.633) B	16.6%(4.067) B	26.6%(5.167) B
Bricht	80%(8.900)A	83.3%(9.100) A	93.3%(9.667) A
Control	0.0%(0.7000) C	0.0%(0.7000)B	0.0%(0.7000) D
CV%	21.58%	21.62%	10.68%
LSD	1.410	1.563	0.9330S
SE	0.78	0.78	0.78

Means between brackets are transformed according to $\sqrt{X + 0.5}$

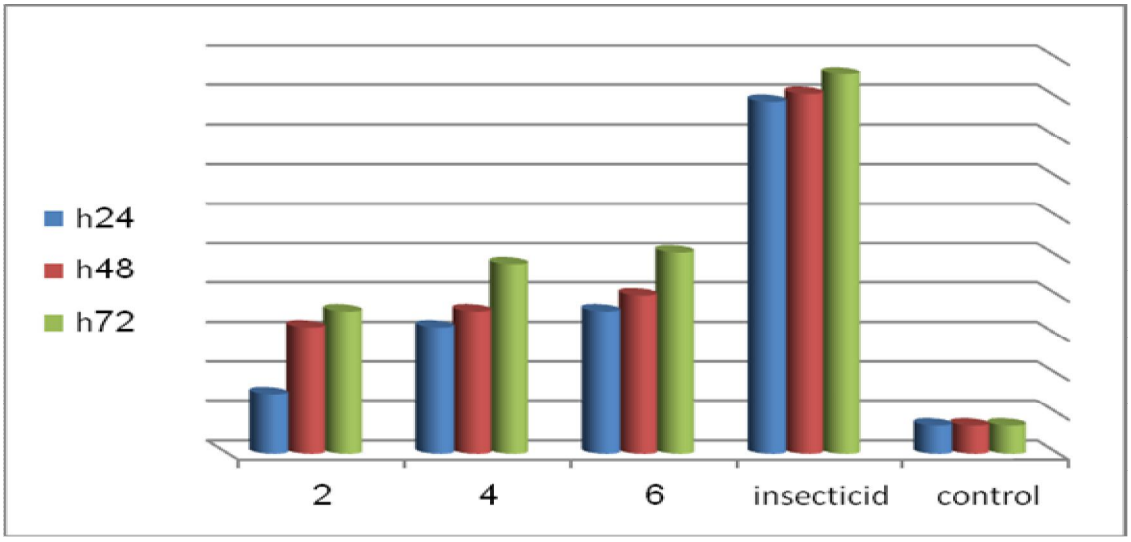

Fig. 8: Effect of porpolis powder on the mortality of adult stage the mealy bug in okra.

CHAPTER FIVE

DISCUSSION

Pest control strategies are needed to be properly regulated in the interest of human health and environment. In recent years there has been considerable pressure on consumers to reduce or eliminate chemical fungicide in the food .there is increased in the public awareness over the level of pesticide residue in food. This concern encouraged researchers to look for alternative solutions to synthetic pesticides (Sharma and Meshram, 2006) .A number of control strategies were presented to combat this mealy bug (Kairo et al., 2000; Mani, 1989; Persad and Khan, 2000 and Anitha *et al.*, 1999).

This study is aimed to investigate effect of leaves powder jimson weed, (***Datura innoxia)***, leaves powder of Neem **(***Azadirachta indica***),** , mixture of leaves powder of (Neem + jimson weed) and powder propolis against the cotton mealy bug (*Phenacoccus solenopsis*) mortality and ability to infestation. The highest weight (6grams) of leaves powder of jimson weed gave a high mean mortality percentage 60% and low mean infection percentage 10% after 72 hours of exposure, and after 24and 48 hours showed results 16,6% and 40% mean mortality percentage, and percentage infection of 6,6% and 10%. The results showed that, the leaves powder of these plants mostly contain active compounds which are capable of controlling adult mealy bug and act as repellant to mealy bug.

This study also aimed to evaluate the effect of leaves powder of neem against the adult mealy bug dusting application methods of biopesticides and insecticides.

Results of dusting application in this study showed high efficiency of the plant powder against the adult of mealy bug and high significantly different compared to the control. With up to (53 and 3% mortality). In addition the infestation testes against the adult mealy bug showed efficiency of the powder with up to 6, 6% and this was agreed with prishanthini, M. and vinobaba, M. (2014). Whom they study at of some botanical extracts on cotton mealy bug. The efficacy of mixture leaves powder between jimson weed and neem as botanical pesticides at different weights was evaluated against cotton mealy bug. The results revealed that the treatments are significantly differing among themselves in they caused mortality 60%, 63,3% and 73,3% at 6gram after 24, 48 and 72 hours respectively and infestation 0% was obtain with 6 gm respectively in 6gram after 72 hours of application. Mortality rates increased with increasing weights for both botanicals. Powder propolis was effective against the adult cotton mealy bug, and gave mortality percentage compared to plant other powder plants in tested study. These agree with Mohamed, (2015) who stated that, powder propolis , was effective in controlling the larva khapra beetle *Trogoderma granarium* (Coleoptera :Dermestidae). The results of dusting treatment in this study showed high efficiency of the powder propolis against the adult of cotton mealy bug and significantly different with control. Which reach up 6.6 to 26, 6% mortality. The infestations against the adult mealy bug showed efficiency of the powder with up to 36, 6%. When we compared between propolis and natural plant products in all weights in these tests, the plant products were found to more active than the propolis powder against adult used in different weight mealy bug. Finally neem and jimson leaves powder was found to give effective control result against the mealy bug than Proplis.

CONCLUSION AND RECOMMENDATIONS

This study clearly demonstrates that both tested plants have a lethal effect on the adult mealy bug. However, leaves powder of *Azadirachta indica* and *Datura innoxia* seems to be much more toxic than the propolis powder.

Based on the above mentioned results, leaves powder of *Azadirachta indica* and *Datura innoxia* mixture can be recommended to be used as a control agent for *pheonccus solenopsis*. However, further comparative studies should be conducted to evaluate the effects of these leaves with other organic solvents and also against other insect pests. Finally, a comprehensive study should be conducted to specify the active ingredients found in these plant .

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APPENDICES

Appendix. 1 : Effect of Leaves powder of Jimson weed on infestation percentage of adult stage of mealy bug after 24 hours.

Weights G	Infestation (%)			
	R1	R2	R3	Mean
2	0 (0.7)	20 (4.5)	20 (4.5)	13.3
4	0 (0.7)	0 (0.7)	0 (0.7)	0
6	10(3.2)	0 (0.7)	10(3.2)	6.6
Bricht	0 (0.7)	10(3.2)	0 (0.7)	3.3
Control	70 (8.3)	90 (9.5)	80 (8.9)	80

Appendix. 2 : Effect of Leaves powder of Jimson weed on infestation percentage of adult stage of mealy bug after 48 hours.

Weights G	Infestation (%)			
	R1	R2	R3	Mean
2	0 (0.7)	30 (5.5)	40 (6.4)	6.6
4	0 (0.7)	0 (0.7)	0 (0.7)	3.3
6	10(3.2)	0 (0.7)	20 (4.5)	0
Bricht	0 (0.7)	10(3.2)	0 (0.7)	3.3
Control	80 (8.9)	80 (8.9)	90 (9.5)	3.3 8

Appendix. 3 : Effect of Leaves powder o Jimson weed on infestation percentage of adult stage of mealy bug after7 2 hours.

Weights G	Infestation (%)			
	R1	R2	R3	Mean
2	10(3.2)	30 (5.5)	40 (6.4)	26.6
4	0 (0.7)	10(3.2)	0 (0.7)	6.6
6	10(3.2)	0 (0.7)	20 (4.5)	10
Bricht	0 (0.7)	10(3.2)	10(3.2)	6.6
Control	90 (9.5)	90 (9.5)	90 (9.5)	86.6

Appendix. 4: Effect of Leaves powder of Neem on the infestation percentage of adult stage of mealy bug after 24 hours.

Weights G	Infestation (%)			
	R1	R2	R3	Mean
2	0 (0.7)	0 (0.7)	0 (0.7)	0
4	0 (0.7)	10(3.2)	0 (0.7)	6.6
6	0 (0.7)	0 (0.7)	0 (0.7)	0
Bricht	0 (0.7)	10(3.2)	0 (0.7)	3.3
Control	60 (7.7)	70 (8.3)	50 (7.1)	60

Appendix. 5 : Effect of Leaves powder of Neem on the infestation percentage of adult stage of mealy bug after 48 hours.

Weights G	Infestation (%)			
	R1	R2	R3	Mean
2	0 (0.7)	0 (0.7)	20 (4.5)	6.6
4	10(3.2)	10(3.2)	0 (0.7)	6.6
6	0 (0.7)	0 (0.7)	20 (4.5)	6.6
Bricht	0 (0.7)	10(3.2)	0 (0.7)	3.3
Control	90 (9.5)	90 (9.5)	80 (8.9)	86.6

Appendix. 6 : Effect of Leaves powder of Neem on the infestation of adult stage of mealy bug after 72 hours.

Weights G	Infestation (%)			
	R1	R2	R3	Mean
2	0 (0.7)	0 (0.7)	20 (4.5)	6.6
4	10(3.2)	10(3.2)	0 (0.7)	6.6
6	0 (0.7)	10(3.2)	10(3.2)	6.6
Bricht	0 (0.7)	10(3.2)	10(3.2)	6.6
Control	90 (9.5)	90 (9.5)	90 (9.5)	9 0

Appendix. 7 : Effect of mixed Leaves powder of Neem and Jimson weed on the infestation percentage of adult stage of mealy bug after 24 hours.

Weights G	Infestation (%)			
	R1	R2	R3	Mean
2	0 (0.7)	0 (0.7)	0 (0.7)	0
4	0 (0.7)	0 (0.7)	0 (0.7)	0
6	0 (0.7)	0 (0.7)	0 (0.7)	0
Bricht	0 (0.7)	10(3.2)	0 (0.7)	3.3
Control	80 (8.9)	70 (8.3)	90 (9.5)	80

Appendix. 8 : Effect of mixed Leaves powder of Neem and Jimson weed on the infestation of adult stage of mealy bug after 48 hours.

Weights G	Infestation (%)			
	R1	R2	R3	Mean
2	10(3.2)	0 (0.7)	10(3.2)	6.6
4	10(3.2)	0 (0.7)	0 (0.7)	3.3
6	0 (0.7)	0 (0.7)	0 (0.7)	0
Bricht	0 (0.7)	0 (0.7)	0 (0.7)	3.3
Control	80 (8.9)	80 (8.9)	90 (9.5)	83.3

Appendix. 9 : Effect of Mixed Leaves powder of Jimson weed and Neem on the Infestation of adult stage of mealy bug after 72 hours.

Weights G	Infestation (%)			
	R1	R2	R3	Mean
2	20 (4.5)	0 (0.7)	10(3.2)	10
4	10(3.2)	0 (0.7)	0 (0.7)	3.3
6	0 (0.7)	0 (0.7)	0 (0.7)	0
Bricht	0 (0.7)	10(3.2)	10(3.2)	6.6
Control	90 (9.5)	90 (9.5)	90 (9.5)	90

Appendix. 10 : Effect of Propolis powder on the infestation percentage of adult stage of mealy bug after 24 hours.

Weights G	Infestation (%)			
	R1	R2	R3	Mean
2	40 (6.4)	30 (5.5)	40 (6.4)	36 . 6
4	30 (5.5)	40 (6.4)	20 (4.5)	30
6	20 (4.5))	10(3.2)	30 (5.5)	20
Bricht	0 (0.7)	10(3.2)	10(3.2)	3.3
Control	70 (8.3)	70 (8.3)	90 (9.5)	76.6

Appendix. 11 : Effect of Propolis powder on the infestation of adult stage of mealy bug after 48 hours.

Weights G	Infestation (%)			
	R1	R2	R3	Mean
2	40 (6.4)	50 (7.1)	20 (4.5)	43.3
4	30 (5.5)	40 (6.4)	30 (5.5)	33 .3
6	20 (4.5)	30 (5.5)	30 (5.5)	26.6
Bricht	0 (0.7)	10(3.2)	10(3.2)	6.6
Control	80 (8.9)	70 (8.3)	90 (9.5)	80

Appendix. 12 : Effect of Propolis powder on the infestation percentage of adult stage of mealy bug after 72 hours.

Weights G	Infestation (%)			
	R1	R2	R3	Mean
2	50 (7.1)	50 (7.1)	40 (6.4)	46.6
4	40 (6.4)	40 (6.4)	40 (6.4)	40
6	30 (5.5)	50 (7.1)	30 (5.5)	36.6
Bricht	0 (0.7)	10(3.2)	10(3.2)	6.6
Control	80 (8.9)	80 (8.9)	100 (10.0)	86.6

Appendix. 13 : Effect of Leaves powder of Jimson weed on the mortality of adult stage of mealy bug after 24 hours.

Weights G	Mortality (%)			
	R1	R2	R3	Mean
2	(3.2) 10	10 (2.3)	20 (4.5)	13.3
4	20 (4.5)	10 (2.4)	20 (4.5)	16.6
6	30 (5.5)	20 (4.5)	30 (5.5)	26.6
Bricht	70 (8.3)	80 (8.9)	90 (9.5)	80
Control	0 (0.7)	0 (0.7)	0 (0.7)	0

Appendix. 14 : Effect of Leaves powder of Jimson weed on the mortality of adult stage of mealy bug after48 hours.

Weights G	Mortality (%)			
	R1	R2	R3	Mean
2	20 (4.5)	20 (4.5)	40 (6.4)	26.6
4	30 (5.5)	20 (4.5)	30 (5.5)	26.6
6	40 (6.4)	40 (6.4)	40 (6.4)	40
Bricht	90 (9.5)	90 (9.5)	70 (8.3)	83.3
Control	0 (0.7)	0 (0.7)	0 (0.7)	0

Appendix. 15 : Effect of Leaves powder of Jimson weed on the mortality of adult stage of mealy bug after 72 hours.

Weights G	Mortality (%)			
	R1	R2	R3	Mean
2	30 (5.5)	20 (4.5)	50 (7.1)	33.3
4	40 (6.4)	30 (5.5)	40 (6.4)	36.6
6	60 (7.7)	50 (7.1)	70 (8.3)	60
Bricht	100 (10.0)	90 (9.5)	90 (9.5)	93.3
Control	0 (0.7)	0 (0.7)	0 (0.7)	0

Appendix. 16 : Effect of Leaves powder of Neem on the mortality of adult stage of mealy bug after 24 hours.

Weights G	Mortality (%)			
	R1	R2	R3	Mean
2	(3.2) 10	(3.2) 10	(3.2) 10	10
4	20 (4.5)	(3.2) 10	20 (4.5)	16.6
6	20 (4.5)	20 (4.5)	30 (5.5)	23.3
Bricht	70 (8.3)	80 (8.9)	90 (9.5)	80
Control	0 (0.7)	0 (0.7)	0 (0.7)	0

Appendix. 17 : Effect of Leaves powder of Neem on the mortality of adult stage of mealy bug after 48 hours.

Weights G	Mortality (%)			
	R1	R2	R3	Mean
2	20 (4.5)	20 (4.5)	20 (4.5)	20
4	30 (5.5)	30 (5.5)	50 (7.1)	36.6
6	40 (6.4)	30 (5.5)	40 (6.4)	36.6
Bricht	90 (9.5)	90 (9.5)	70 (8.3)	83.3
Control	0 (0.7)	0 (0.7)	0 (0.7)	0

Appendix. 18 : Effect of Leaves powder of Neem on the mortality of adult stage of mealy bug after 72 hours.

Weights G	Mortality (%)			
	R1	R2	R3	Mean
2	20 (4.5)	30 (5.5)	20 (4.5)	23.3
4	40 (6.4)	30 (5.5)	50 (7.1)	40
6	50 (7.1)	50 (7.1)	60 (7.7)	53.3
Bricht	100 (9.5)	90 (9.5)	90 (9.5)	93.3
Control	0 (0.7)	0 (0.7)	0 (0.7)	0

Appendix. 19 : Effect of Mixed Leaves powder of Jimson weed and Neem on the mortality of adult stage of mealy bug after 24 hours.

Weights G	Mortality (%)			
	R1	R2	R3	Mean
2	20 (4.5)	(3.2)	20 (4.5)	16.6
4	30 (5.5)	30 (5.5)	40 (6.4)	33.3
6	60 (7.7)	70 (9.5)	50 (7.1)	60
Bricht	70 (9.5)	80 (9.5)	90 (9.5)	80
Control	0 (0.7)	0 (0.7)	0 (0.7)	0

Appendix. 20 : Effect of Mixed Leaves powder of Neem and Jimson weed on the mortality of adult stage of mealy bug after 48 hours.

Weights G	Mortality (%)			
	R1	R2	R3	Mean
2	30 (5.5)	30 (5.5)	20 (4.5)	23.3 (1.5)
4	40 (6.4)	50 (7.1)	60 (7.7)	43.3 (4.8)
6	70 (9.5)	70 (9.5)	80 (9.5)	63.3
Bricht	100 (10.0)	90 (9.5)	90 (9.5)	83.3
Control	0 (0.7)	0 (0.7)	0 (0.7)	0

Appendix. 21 : Effect of Mixed Leaves powder of Neem and Jimson weed on the mortality of adult stage of mealy bug after 72 hours.

Weights G	Mortality (%)			
	R1	R2	R3	Mean
2	(3.2)	0 (0.7)	0 (0.7)	20
4	20 (4.5)	20 (4.5)	30 (5.5)	60
6	40 (6.4)	30 (5.5)	40 (6.4)	80
Bricht	90 (9.5)	90 (9.5)	90 (9.5)	93.3
Control	90 (9.5)	100 (10.0)		0

Appendix. 22 : Effect of Propolis powder on the mortality of adult stage of mealy bug after 24 hours.

Weights G	Mortality (%)			
	R1	R2	R3	Mean
2	0 (0.7)	0 (0.7)	(3.2) 10	3.3
4	(3.2) 10	(3.2) 10	(3.2) 10	10
6	20 (4.5)	(3.2) 10	(3.2) 10	13.3
Bricht	70 (9.5)	80 (9.5)	90 (9.5)	80
Control	0 (0.7)	0 (0.7)	0 (0.7)	0

Appendix. 23 : Effect of Propolis powder on the mortality of adult stage of mealy bug after 48 hours.

Weights G	Mortality (%)			
	R1	R2	R3	Mean
2	(3.2) 10	0 (0.7)	(3.2) 10	6.6
4	20 (4.5)	(3.2) 10	(3.2) 10	13.3
6	20 (4.5)	(3.2) 10	20 (4.5)	16.6
Bricht	90 (9.5)	90 (9.5)	70 (9.5)	83.3
Control	0 (0.7)	0 (0.7)	0 (0.7)	0

Appendix. 24 : Effect of Propolis powder on the mortality of adult stage of mealy bug after 72 hours.

Weights G	Mortality (%)			
	R1	R2	R3	Mean
2	20 (4.5)	(3.2) 10	(3.2) 10	13.3
4	30 (5.5)	20 (4.5)	20 (4.5)	23.3
6	30 (5.5)	30 (5.5)	20 (4.5)	26.6
Bricht	100 (10.0)	90 (9.5)	90 (9.5)	93.3
Control	0 (0.7)	0 (0.7)	0 (0.7)	0

Plate 2.

Plate. 3

Plate . 4

Plate .5

Plate . 6