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Insecticidal Activity of Chewing Tobacco (*Nicotiana glauca*) Against Cotton Mealy Bug (*Phenacoccus solenopsis*) (Homoptera: Pseudococcidae)

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Abstract

The experiments were conducted in the Laboratory of Entomology and Agricultural Zoology, Department of Plant Protection, College of Agricultural Studies (Shambat), Sudan University of Science and Technology (SUST).The aim of this study is to investigate the activity of chewing tobacco *Nicotiana glauca* against cotton mealy bug (*Phenacoccus solenopsis*) under laboratory condition. In this experiment four different concentrations (2.5 %, 5 %, 7.5% and 10 %) were used. Three treatments were evaluated; tobacco water extract alone, tobacco extract+ Agral® (Alkyl Phenol ethylene oxide) and tobacco extract+ sesame oil. Each concentration was replicated four times and the mortality % was recorded after 1day, 2 days, and 3days post treatment.

The results showed that tobacco botanical extract posed insecticidal activity against cotton mealy bug especially when mixed with Agral® and sesame oil. The mortality (%) increased from 50% in case of tobacco extract alone and reached (93.3% and 90%) when mixed with Agral® and sesame oil, respectively after three days post treatment. These results proved that sesame oil and Agral® substance have a synergistic action. Therefore this botanical extract can be considered as promising bio-insecticide against mealy bug.

Keywords: *Cotton Mealy bug, Phenacoccus solenopsis, Nicotiana glauca.,Sesame oil and Agral®*

1. Introduction:

The mealy bugs are mostly polyphagous insects, affecting huge number of economically important horticultural crops including vegetables, fruits and ornamentals [1]. More than 160 mealy bug species have been identified as pests worldwide and most of them are invasive species [2]. They are sucking insect pests with a short period of 30 days lifecycle in tropical areas [3] and often have ability to build populations observed in shoots and apexes and become difficult to control with foliar application of pesticide because of having waxy secretions on their body surface. Mealy bugs do not only destroy the host plant by depleting the plant sap but they are also responsible for transmitting viral diseases [4]. Furthermore, their excreted honeydew on plant surfaces provides medium for growth of black sooty mold [3] which also disturb the photosynthesis process of the plant. In Sudan mealy bugs in the past were classified as minor pest, but recently many species of mealy bugs were found to be serious pests of many valuable corps.

Plants produce secondary metabolites which possess insecticidal properties, therefore can be used as alternatives to synthetic insecticides. Accordingly scientists made a lot of efforts to find an alternative control measures such as botanicals to manage agricultural and medical insect pests.

Nicotiana glauca is a species of wild tobacco known by the common name chewing tobacco. It is naturalized in Australia, warmer parts of Europe, sub-Saharan Africa, temperate Asia, New Zealand, USA, Mexico and Hawaii [5]. Dried tobacco leaves are mainly used for smoking in cigarettes, cigars, pipe tobacco, also be consumed as snuff. Tobacco use is a risk factor for many diseases, especially those affecting the heart, liver, and lungs, as well as much cancer. In 2008, the world Health organization named tobacco as the world's single greatest preventable cause of death [5].

Tobacco contains the alkaloid nicotine up to 3 % of the dry weight. Also contains other compounds such as germacrene and anabasine and other pipssseridine alkaloids varying between species [6]. Nicotine mimics the endogenous neurotransmitter acetylcholine and exhibits agonistic effects on most nicotinic acetylcholine receptors. Also it has been used as a synthetic insecticide and is the archetype for the large range of neonicotinoid insecticides [7].

The objective of this study is to investigate through laboratory screening the activity of chewing tobacco (*Nicotiana glauca*) water extracts against the cotton mealy bug (*Phenacoccus solenopsis*).

2. Materials and methods:

2.1. Study location

The experiments were conducted in the Laboratory of Entomology and Agricultural Zoology, Department of Plant Protection, College of Agricultural Studies (Shambat), Sudan University of Science and Technology (SUST), during May to August, 2018.The average temperature is between 27- 30°C and relative humidity (RH) is between 30 to 35 %.

2.2. Insect collection and rearing

The mealy bug (*P. solenopsis*.) was collected from infested okra plants grown in experimental farm, Agricultural Research Corporation (ARC), Shambat, North Khartoum, Sudan. . The insects were reared in plastic containers covered with muslin cloth.The insects were fed on untreated okra fruits. The food was continuously replaced by a fresh one every 48 hours. The culture was kept under laboratory condition as stock culture for running the organized experiments.

2. 3. Collection of plant materials

The leaves of the *Nicotiana glauca* were collected from The Northern Darfur State, West of the Sudan. The leaves of plants were washed and dried under shade for 5-7 days under room condition, and then powdered by using electrical blender. The prepared powder of each plant was kept safe in plastic bags until used.

2.4. Preparation and extraction method

Ten grams of powder of Tobacco (*Nicotiana glauca)* were mixed with 100 ml of water to obtain 10% concentration; also other concentrations (7.5%, 5% and 2.5%) were prepared by diluting the stock solution. The mixture was left for 24 hrs and then filtered and kept in plastic containers used for conducting the required treatments.

2.5. Bioassay tests

Four concentrations (2.5 %, 5 %, 7.5% and 10 %) of tobacco plant extract were used in this experiment. Small okra fruits were soaked in each concentration for one minute and left on filter paper for 10 minutes. Ten adults of *P. solenopsis* were placed inside plastic cups containing three pieces of treated okra fruits.

In the second treatment tobacco plant extraction plus one drop of sesame oil (0.01ml) in addition of one drop of liquid soap (0.01ml) as surfactant were tested against cotton mealy bug. In the third treatment sesame oil was replaced by surfactant material (Agral® - Alkyl Phenol ethylene oxide) according to recommended dose 200ml\100L. Each treatment was replicated four times and contains set of untreated control. One day post treatment the insects provided with fresh okra fruits for feeding. The mortality data were recorded after 1day, 2 days, and 3days. Four plastic cups each contains 10 adults were used as untreated control.

2.6. Statistical analysis

The experiments were designed in a Complete Randomized Design (CRD) and the data were statistically analyzed according to analysis of variance (ANOVA) using Statistic 8.0 program. LSD test was used for means separation.

3. Results:

3.1. Mortality (%) among cotton mealy bug *(Phenacoccus solenopsis*) treated with Tobacco tree (*Nicotiana glauca*) water extract alone.

Results in table (1) showed that tobacco water extract alone has a little effect against cotton mealy bug. The highest concentrations (7.5% and 10%) gave only (33.3% and 50%) mortality after three days post treatment. The statistical analysis showed that there are no significant difference between two lower concentrations (2.5% and 5%) and the control, while there are a significant different in the highest ones (7.5% and 10%).

3.2. Mortality (%) among cotton mealy bug *(Phenacoccus solenopsis*) treated with Tobacco tree (*Nicotiana glauca*) water extract plus Agral® substance.

Results in table (2) showed that tobacco water extract plus Agral® substance was effective against cotton mealy bug, where the highest concentration (10%) caused 93% mortality three days post treatment. The mortality (%) was gradually increased by increasing of concentration and exposure time. The statistical analysis showed that there are no significant difference between the three lowest concentrations and the control, while the highest concentration (10%) showed a significant different when compared to control.

3.3. Mortality (%) among cotton mealy bug *(Phenacoccus solenopsis*) treated with Tobacco tree (*Nicotiana glauca*) water extraction plus one drop of sesame oil.

Results in table (3) showed that tobacco water extract plus one drop of sesame oil was very effective against cotton mealy bug. The mortality (%) ranged from 43.3 and 63.3 after only one day post treatment at concentrations of 2.5% and 10% respectively. The highest concentrations (7.5% and10%) caused mortality 86.7% and 90% after three days post treatment. The mortality (%) was gradually increased by increasing of concentration and exposure time. The statistical analysis showed that there is a significant difference between all concentration used in this experiment and control.

4. Discussion:

Many plants contain important phytochemicals which serve as a source of degradable bio-pesticides. Those compounds fall into several groups, including toxins, anti-feedants, repellents, and growth regulators [8].

The above mentioned results showed that, tobacco extracts have insecticidal activity against mealy bug, especially when mixed with other additive materials such as Agral®, sesame oil and etc., therefore other studies can be made to identify the synergistic action of other different oils and additive materials to improve and increase the efficacy of tobacco extracts against other insect pests.

These results agreed with [9] who reported that alkaloid nicotine found in *N. glauca* is very toxic to insects and effect their nervous system and also various studies have been reported that *N. glauca* have insecticidal effect.

Also [10] reported that *N. glauca* extract was highly toxic against mosquito larvae, the high rates of larval mortality observed at 62.4 g/l within 24 hours with LC50 value 26.87 g/l.

5. Conclusion:

The results revealed that tobacco botanical extract posed insecticidal activity against cotton mealy bug (*Phenacoccus solenopsis*) and proved that sesame oil and Agral® substance have a synergistic action. Therefore this botanical extract can be considered as promising bio-insecticide against this pest.

Table 1: Mortality(%) among cotton mealy bug(*Phenacoccus solenopsis*) treated with Tobacco (*Nicotiana glauca*) water extract alone.

Concentration (%)	*Exposure Period (days)*		
	1st	**2nd**	**3rd**
2.5	6.7^{B}	6.7^{B}	6.7^{B}
5	6.7^{B}	10.0^{B}	10.0^{B}
7.5	20.0^{AB}	33.3^{A}	33.3^{A}
10	33.3^{A}	50.0^{A}	50.0^{A}
Control	0.0^{B}	0.0^{B}	0.0^{B}
CV%	3.48	3.2	4.2
SE±	10.0	8.8	8.8
LSD	23.1	20.3	20.3

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

Table 2: Mortality (%) among cotton mealy bug (*Phenacoccus solenopsis*) treated with Tobacco (*Nicotiana glauca*) water extract plus Agral® substance.

Concentration (%)	**Exposure Period (days)**		
	1st	**2nd**	**3rd**
2.5	13.3^{C}	30.0^{B}	30.0^{B}
5	23.3^{BC}	30.0^{B}	30.0^{B}
7.5	53.3^{B}	63.3^{AB}	63.3^{AB}
10	86.7^{A}	90.0^{A}	93.3^{A}

Control	0.0^{C}	6.7^{C}	6.7^{C}
CV%	9.76	5.06	8.67
SE±	13.1	16.0	15.1
LSD	30.3	36.9	34.8

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

Table 3:Mortality (%) among cotton mealy bug *(Phenacoccus solenopsis*) treated with Tobacco (*Nicotiana glauca*) water extract plus one drop of sesame oil.

Concentration (%)	**Exposure Period (days)**		
	1st	**2nd**	**3rd**
2.5	43.3^{A}	66.7^{A}	80^{A}
5	43.3^{A}	80^{A}	80^{A}
7.5	46.7^{A}	80^{A}	86.7^{A}
10	63.3^{A}	83.3^{A}	90^{A}
Control	13.3^{B}	13.3^{B}	13.3^{B}
CV%	5.3	16.7	12.1
SE±	16.997	10.541	8.5
LSD	39.195	24.3	19.6

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

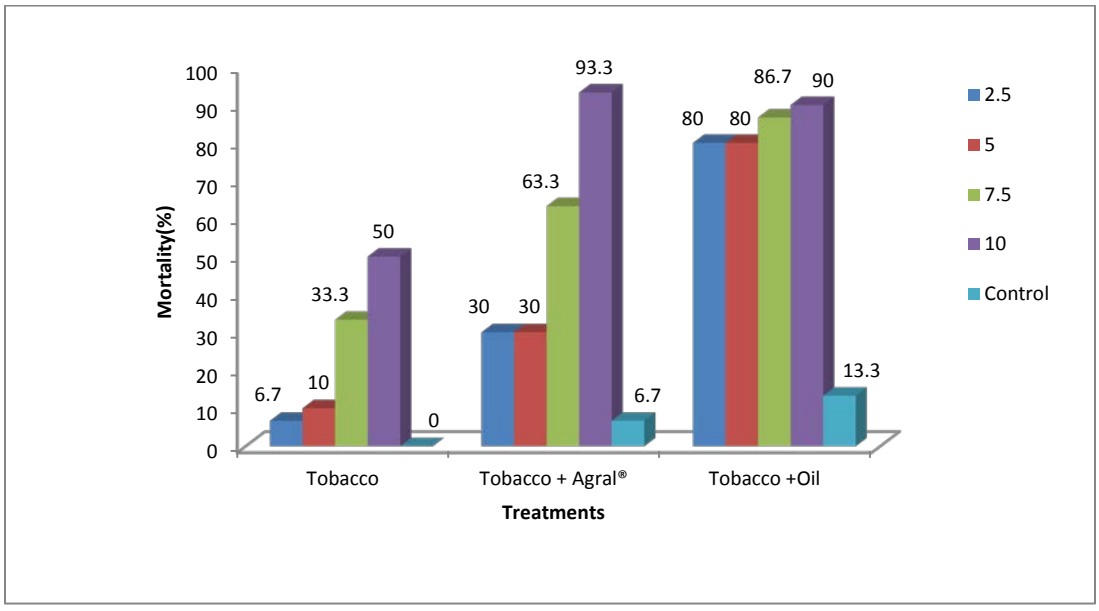

Figure 1: Comparison between the mortality (%) caused by tobacco water extract alone, tobacco plus Agral® and tobacco plus sesame oil against cotton mealy bug after three days post treatment.

6. References:

[1] A. Sinacori. Bio-ethological observations on *Phenacoccus madeirensis* Green (Coccoidae: Pseudococcidae) in Sicily. Israel Journal of Entomology, 29,1995,179-182.

[2] D.R. Miller and G.L. Miller. Redescription of *Paracoccus marginatus* Williams and Granara de Willink (Hemiptera: Coccoidea: Pseudococcidae) including descriptions of the immature stages and adult male. Proceedings Entomological Society of Washington, 2002, 1-15.

[3] E. Buss and J. Turner. Scale insects and mealy bugs on ornamental plants. EENY-323. Featured Creatures. Entomology and Nematology Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Society. University Florida, Gainesville, FL, 2006,1-6.

[4] S. Bertin, V. Cavalieri, C. Graziano, and D. Bosco. Survey of mealy bug (Hemiptera: Pseudococcidae) vectors of Ampelovirus and Vitivirus in vineyards of north western Italy. Phytoparasitica, 38(4), 2010, 401-409.

[5] L. Henderson. Weeds and invasive plants. A complete guide to declared weeds and invaders in South Africa. Plant Protection Research Institute Handbook , 12,2001, 300pp.

[6] L. Gilman. Smoke: A Global History of Smoking. Reaktion Books, 2004. ISBN 978-1-86189-200-3.

[7] I. J. Buerge, M. Kahle, H. R. Buser, M. D. Muller and T. Poiger. Nicotine derivatives in wastewater and surface waters: Application as chemical markers for domestic wastewater. Environmental Science & Technology, 42, 2008, 6354-6360.

[8] M.F. Maia and S.J. Moore. Plant-based insect repellents: a review of their efficacy, development and testing. Malaria J., 10(Suppl. 1), 2011, 11.

[9] P.A. Steenkamp, F.R. Van Heerden and B.E. Van Wyk. Accidental fatal poisoning by *Nicotiana glauca*: identification of anabasine by high performance liquid chromatography/photodiode array/mass spectrometry, Forensic Science International, 127 (3), 2002, 208-217.

[10] S. Benhissen et al. Bioactivity of *Nicotiana glauca* Graham (Solanaceae) and its toxic effects on *Culiseta longiareolata* (Diptera; Culicidae). Int. J. Res. Ayurveda Pharm., 9 (1), 2018, 123-126.