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Use of *Nicotiana sylvestris* (Speg. and Comes) in Field Control of Locust on African Basil

Chinyerum Gloria Ikechi-Nwogu and Nwachukwu Eunice Oluchi
Department of Plant Science and Biotechnology, Faculty of Science, University of Port Harcourt, Port Harcourt 500001, Rivers State, Nigeria

ABSTRACT

Background and Objective: The protection of crops from harmful insects, has continued to be a major concern in agriculture. Insects like oriental longheaded locusts, cause extensive and devastating damage to field crops. In order to protect crops against locust boom while preserving the environment, aqueous extracts of *Nicotiana sylvestris* were tested for their insecticidal potential against longheaded locusts on *Ocimum gratissimum*. **Materials and Methods:** Six different *Ocimum gratissimum* plants were planted 10 m apart in the garden. Three days after foliage production, plants pots labeled A, B and C were treated twice daily for one month with different concentrations (57.5, 115 and 230 g) of *Nicotiana sylvestris* extract in a 236 mL spray bottle, while pot D, E and F, were treated with sterile water as the control experiment. **Results:** The tested extract has an insecticidal effect based on the punctured leaves of the control experiment. The experiment also revealed that *Nicotiana sylvestris* was effective as a field protectant in protecting the leaves of *Ocimum gratissimum* against longheaded locust attacks. **Conclusion:** The potential of *Nicotiana sylvestris* was revealed as a natural insecticide in protecting *Ocimum gratissimum* (scent leaf) against grasshoppers (oriental longheaded locust) attacks.

KEYWORDS

Plant protection, biodegradable, biological control, flowering tobacco, locust, *Ocimum gratissimum*

INTRODUCTION

Ocimum gratissimum is a tropical, herbaceous plant that is native to India and other tropical regions. It can be found along the shore and in the Savannah in Nigeria[1]. It is commonly known as African basil or scent leaves and belongs to the Labiatae family[2]. It is used in traditional medicine like in epilepsy treatment, as researcher[3-6].

Ocimum gratissimum is also an antiseptic[7,8] anti-inflammatory herb that expels internal parasites and lowers fevers. Their leaves and stems are used internally in the treatment of headaches, impotency, diarrhea, pneumonia[1], dysentery, post-partum problems and colds, especially chest colds[6]. In traditional medicine, it is used to treat bacterial infections and anemia[9]. It can also be used in the management of the baby's cord[10]. Gulumian *et al.*[11], also reported that the leaves are applied externally to treat rheumatism and lumbago. The essential oil from their leaves shows antibacterial activities[12]. The leaves are robbed against the palms to release some liquids which are inhaled as a treatment for blocked nostrils[13].

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This plant plays an important role in the diets and traditional medications of Africans. However, they are subject to attacks by insects, of which grasshopper-oriental longheaded locust (*Acrida cinerea*) is the chief.

Grasshoppers are chewing, herbivorous[8], destructive insects that cause damage to garden plants. Insecticides are used to control and stop damages caused by insects like grasshoppers nevertheless using artificial insecticides to prevent these damages, can have adverse effects on beneficial insects like honeybees[14] and other garden plants. So natural insecticides can be an effective substitute for garden plant protection since they contain little or no toxins that cause no harm to the environment and beneficial insects.

Insect control using natural or plant-based insecticides has been widely used in traditional practices in recent years[15] since the global trend is towards the consumption of food produced using natural products and due to the fact that there are residues of hazardous chemical insecticides in foods. The importance of botanical insecticides is attributed to their toxicity, biodegradability and quick decomposition, present no residue problems and are safer for humans and the environment.

A good example of a botanical insecticide is *Nicotiana sylvestris* commonly known as flowering tobacco, woodland tobacco, or white shooting stars. It is cultivated as an ornamental plant and belongs to the Solanaceae family[16]. It is a strong plant that usually grows 3-5′ tall and features pendant clusters of long-tubed, trumpet-shaped, white flowers that resemble shooting stars. They have coarse, oblong spatulate basal leaves to 15″ long.

The aim of this study was to reveal the efficiency of *Nicotiana sylvestris* plants as natural insecticides in protecting *Ocimum gratissimum* (scent leaf) against grasshoppers (oriental longheaded locust).

MATERIALS AND METHODS

Study environment: This study was carried out in the dry season in the year, 2019 for 28 days to ascertain the level of damage caused by the hoppers since they cause the most damage during dry seasons. *Nicotiana sylvestris* was collected at flowering time (June 2019) from the Rukpokwu community located in Obio/Akpor Local Government Area, Rivers State, Nigeria. The scents of the plants are strong at night so harvesting was done in the evening by 7:00 pm as recommended by Ayanoglu *et al.*[2].

Test organism: Oriental longheaded locust is scientifically known as *Acrida cinerea* (Thunberg) (Fig. 1). found chewing and destroying African basil or scent leaves in the garden, was the test organism.

Plant preparation and extraction: Harvesting of plants for extraction, was done by plucking the leaves individually to encourage future growth while giving enough material for extraction. To achieve a suitable concentration of the active ingredient contained in *Nicotiana sylvestris* (Fig. 2). Infusion and maceration techniques were carried out. The fresh plant parts were ground using mortar and pestle, immersed in boiling water, allowed to stand for 15 min and filtered through a filter. As 57.5, 115 and 230 g of fresh *N. sylvestris* in 100 mL of sterile water was used to prepare the extract.

Field treatment using *Nicotiana sylvestris* plant on African basil or scent leaves: Green African basil leaves growing in the field, were sprayed with different concentrations of *N. sylvestris* extract (57.5, 115 and 230 g) using a small 236 mL hand-held sprayer. Three days after foliage production, the plants were sprayed twice daily in the morning by 7:00 am and in the evening by 7:00 pm for 4 weeks.

Statistical analysis: The data obtained from all the treatments were subjected to analysis using one-way ANOVA at a significance level ($p>0.05$).

Fig. 1: Oriental longheaded locust (*Acrida cinerea*)

Fig. 2: Young *Nicotiana sylvestris* plant

RESULTS AND DISCUSSION

From the observation made, the longheaded locust attacked the basil plant and started puncturing the leaves from day 4 after germination causing damage to the foliage.

The damage that the oriental longheaded locust caused appeared as round to ragged holes in the leaves. After the potted plants germinated and foliage formed, the treated pots were not invaded by longheaded locusts, instead, the leaves of the scent leave plants flourished as shown in (Fig. 3a). While longheaded locusts attacked the control pot that had water as the treatment, causing damage to the foliage as shown in (Fig. 3b). The untreated scent leaves the plant distressed and it resulted in malnutrition since the leaves are needed to produce food for plants. From the results, the formulated bio-insecticide, aided to keep away field pests such as grasshoppers from causing damage to the treated scent leaf plant.

The results were assayed weekly by counting the number of punctured leaves for 4 weeks (28 days) as shown in Table 1.

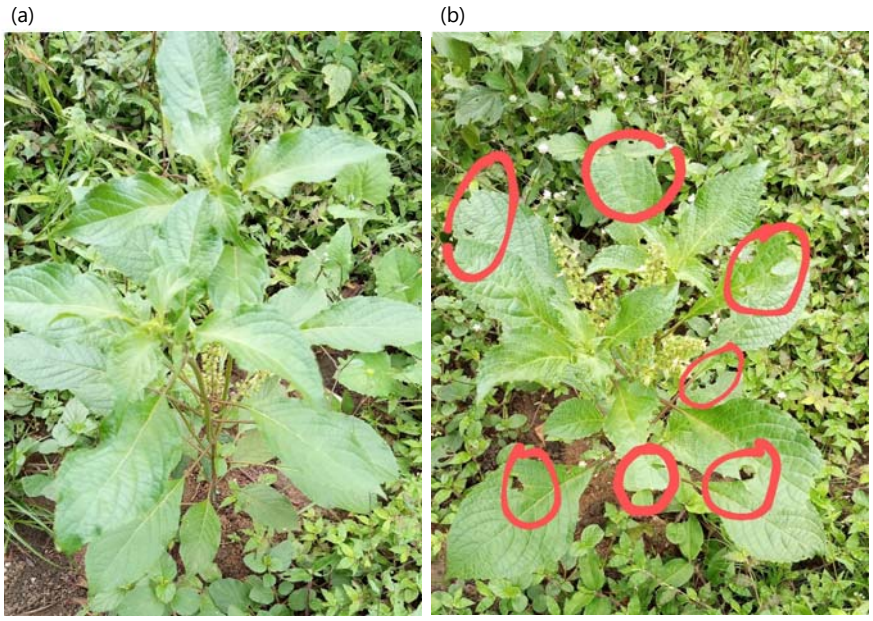

Fig. 3(a-b): (a) Treated African basil leaves and (b) Untreated African basil leaves

Table 1: Effect of different insecticidal plant treatments

	Number of round-ragged holes											
Treatments	57.5 g treated plants pots			115 g treated plants pots			230 g treated plants pots			Control plants pots		
Pot labels	A	B	C	A	B	C	A	B	C	A	B	C
Day 1-7 (Week 1)	1^{c}	3^{a}	0^{c}	1^{c}	1^{c}	1^{c}	1^{a}	0^{a}	0^{a}	2^{bc}	3^{bc}	2^{b}
Day 8-14 (Week 2)	2^{bc}	3^{b}	1^{bc}	3^{bc}	4^{b}	3^{bc}	1^{a}	0^{a}	0^{a}	3^{bc}	4^{bc}	3^{b}
Day 15-21 (Week 3)	3^{b}	5^{b}	2^{b}	4^{a}	6^{a}	4^{a}	1^{a}	0^{a}	0^{a}	5^{abc}	6^{a}	8^{a}
Day 22-28 (Week 4)	5^{a}	5^{a}	4^{a}	6^{a}	7^{a}	6^{a}	1^{a}	0^{a}	0^{a}	6^{a}	7^{a}	9^{a}
LSD	1.92	1.3	1.92	2.34	2.92	2.34	0	0	0	2.05	2.05	3.95

it can be observed that *N. sylvestris* extracts had a significant effect. In all of the different concentrations, the highest effect occurred with the 230 g of *N. sylvestris* while the smallest effect was at 57.5 g. The increased concentration led to increased protection of the green African basil leaves. As shown in Table 1.

In this study, *N. sylvestris*, proved to be a botanical insecticide as it contains tannins, saponins, flavonoids, alkaloids, phenols and glycosides. This was also explained in the study carried out by Ikechi-Nwogu and Omeke[17] that the presence of tannins, saponins, flavonoids, alkaloids, phenols and glycosides in plants, protects them against attacks from insects.

Alkaloids, flavonoids and glycosides are an important group of natural substances isolated from various parts of the plant[18] and they have important insecticidal roles in protecting the plants against plant-feeding insects and herbivores[19-21]. *Nicotiana sylvestris* contains nicotine which is a chemical substance found in the leaves of tobacco plants and in nicotine-producing plants, nicotine functions as an anti-herbivory chemical[5]. In fact, nicotine was one of the first substances reported as a plant-derived agricultural insecticides. For the protection of crops and general well-being, it is viewed as a potential substitute for conventional insecticides[22].

According to Hikal *et al.*[23] botanical insecticides are extracted from plants with insecticidal properties. To avoid the negative effects of synthetic pesticides resulting from its misuses, these botanical insecticides are excellent alternatives for crop protection because they will cut down losses during food production.

Several conclusions have to be drawn from research results about botanical insecticides. However, none of these works have investigated the effects of *N. sylvestris* application on field crop performance.

Ayilara *et al*.[24] in their study, reported that botanical pesticides have various modes of action against insects, fungi, bacteria, nematodes and viruses because of the bioactive compounds they possess. These modes of action include inhibition, repellence and denaturation of proteins. They also have chemosterilants, toxicants, attractants modes of action and feeding deterrents/antifeedants.

Based on this, *N. sylvestris* was effective as a field protectant as it repelled chewing, herbivorous, destructive insects that could cause damage to the African basil plants. *Nicotiana sylvestris* belongs to the Solanaceae family. It is a plant family reported by Akara *et al*.[9] to contain bioactive compounds with activity against important crop pests. It contains nicotine[19] which is a very effective biodegradable insecticide[25].

The current study was in agreement with the work of Mishra *et al*.[26] that nicotine has been used as an insecticide since colonial times and one outstanding advantage of using nicotine in the garden is that its effectiveness is short-lived, but powerful[25]. It is advised that farmers use bio-pesticides since they kill pests[25] while preserving the environment's natural balance.

This implies that *N. sylvestris* can accumulate alkaloids on the shoots of the plant it is sprayed on for it to be effective. Therefore, the applications of *Nicotiana sylvestris* should be in small quantity although nicotine is extremely poisonous to insects, it has a stimulating effect on people when consumed in small amounts. The study was limited to the use of *Nicotiana sylvestris* (Speg. and Comes) in field control of locusts on African basil.

CONCLUSION

From this study, extract from *Nicotiana sylvestris* is useful as an insecticide. It is recommended that growers who grow scent leaves, make use of *N. sylvestris* as insecticidal sprays in order to protect crops against locust boom while preserving the environment. A "green" pesticide industry based on *N. sylvestris* could provide additional income for farmers, as well as a new eco-friendly pest-control agent. *Nicotiana sylvestris* planted around human habitation not only acts as an insecticide. It is also used to drive snakes away from the neighborhood.

SIGNIFICANCE STATEMENT

Biopesticide production, is faced with numerous challenges and despite these challenges, they can substitute conventional pesticides. This study is aimed at revealing the efficiency of *Nicotiana sylvestris* plants as natural insecticides in protecting *Ocimum gratissimum* (scent leaf) against grasshoppers (oriental longheaded locust) attacks. From the results, *Nicotiana sylvestris* as a field protectant protected *Ocimum gratissimum* against longheaded locusts while preserving the environment. This paper provides information on the importance of biopesticides and their utility in plant protection that would lead to their commercial acceptance since sources of biopesticides are accessible, biodegraded, exhibit various modes of action, inexpensive and low in toxicity to humans and non-target organisms. This study will help promote the knowledge of *Nicotiana sylvestris* as a biopesticide.

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