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Studies on insecticidal properties of citronella grass (lemon grass) essential oils against gram pod borer (*Helicoverpa armigera*)

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Abstract
The present investigation was carried out with the aim of estimation of *Citronella* oil from the Lemon grass and to check the insecticidal effects of *citronella* as essential oil on the Gram pod borer (*H. armigera*) as a antifeedants or repellants. The one test with control and second test with 1% *Citronella* oil was carried out in Laboratory condition with 40 Larva per test. Among those in control condition in normal feeding the 4 Larva (10%) were dead up to 5 days due to some infection. But up to 90% population was be survived. In second test pods treated with *Citronella* oil used as feeding material. In that test up to 100% population were killed due to the antifeeding and repellent property of the *Citronella* within 5 days. The mortality percentages at first to 5th days were recorded. Upon that data it was concluded that in future *citronella* oil is the best way to control the insect population of gram pod borers.

Keywords: citronella oil, gram pod borer, helicoverpa armigera, lemon grass

Introduction
Lemon grass oil, used as a pesticide and preservative, is put on the ancient palm-leaf manuscripts found in India as a preservative (Adams R.P., 2007). *Citronella* grass (*Cymbopogon nardus* and *Cymbopogon winterianus*) grow to about 2 m (6.6 ft) and have magenta-colored base stems. These species are used for the production of *Citronella* oil, which is used in soaps, as an insect repellent (especially mosquitoes) in insect sprays and candles, and in aromatherapy, which is famous in Bintan Island, Indonesia, and the Philippines. Lemon grass it has medicinal properties and is used extensively in Ayurvedic medicine. It is supposed to help with relieving cough and nasal congestion.*Citronella* oil also having a higher insecticidal property as repellent as well as antifeedent agent (Abbott W.S., 1925) [1].

Helicoverpa armigera is a polyphagous pest attacked number of crop plants. They damages to the plants by leaf feeding and by fruit boring. The sever attack of these pest reduced the final yield loss up to 60-70%. (Broza *et. al*. 1986) [2].The number of types insecticides (Chemical and Biological) were developed to control those harmful pest. But they develop an resistance against such insecticides. In present investigation we extract the essential oils from plants such as *Citronella* by steam distillation. This extracted oil further used for experiment. We use the oils as aantifeedants as well as repellent (Ibrahim *et al*., 2001) [4]. In the light of above facts, the present experiments were envisaged to fulfill following objectives: To extract the essential oils from lemon grass and To check the insecticidal property of those extracted essential oil as repellents and antifeedants.

Material and Methods
In the present investigation, experiments related to "Studies on insecticidal properties of *Citronella* Grass (Lemon Grass) essential oils against Gram pod borer (*Helicoverpa armigera*)" were carried out in the 'Mahatma Gandhi College of Agricultural Biotechnology, Pokharni, Nanded' affiliated to 'Vasantrao Naik Marathwada Agricultural University, Parbhani, Maharashtra'. Details of the protocols are given below

Plant material acquisition
Fresh leaves of *C. winterianus* were collected from Medicinal and aromatic plants garden, Department of plant physiology, Dr. Panjabrao Deshmukh KrishiVidyapeeth, Akola.

Collection of Insects Larva
The collections of larva of Gram pod borer (*Helicoverpa armigera*) were done at the Farm of Krishi Vigyan Kendra, Pokharni, Nanded.

Extraction of the essential oil
A sample of fresh plant material (300 g) was transferred to a distillation flask containing distilled water (2 L). The flask was attached to a Clevenger apparatus,which was attached to the condenser. Steam distillation continued for 2 h after initial boiling. The organic phase was collected by liquid-liquid extraction of the hydrolate (100 ml) with pentane (30 ml). An excess amount of anhydrous sodium sulfate was added to remove water from the sample, which was then filtered. The yield was calculated using the amount of essential oil (g) obtained relative to the fresh weight (g) of the leaves.

Acquisition and rearing of insects

The collected larval insects were maintained in a laboratory at 25 ± 1ºC, relative humidity of 70 ± 10% and photoperiod of 12 h in plastic cages with a square base. Moistened filter paper was placed in the bottom of the cage to maintain humidity. Every two days green pods of Gram (*Cicer aerientinum*) were provided to feed the Larva. These green pods were collected and washed distilled water to maintain turgidity as well as remove soil and dust particle with residual effects of previously used insecticides. The cages were sealed with plastic wrap containing small holes. Every two days the Cages were cleaned 70% alcohol and the filter paper and leaf discs were exchanged, while the insects were transferred with the aid of a bristle brush. After proper and equal growth and development these larva were used to study the effects of *Citronella* oil.

Insecticide activity test

Test solution was prepared by dissolving 1.5 g of *Citronella* grass essential oil in a mixture of acetone (3 ml) and Tween 80® (15 µL). The volume was completed to 150 ml with distilled water for a mixture with essential oil at 1% (wv^{-1}). A 150 ml solution with this same composition, but lacking essential oil, was used as a control. *H. armigera* larvas of approximately third instar having length of above 1cm were used for bioassay purpose. Each larva placed in a single chamber.The test solutions containing essential oil were sprayed on green pods and used for feeding to larva.The cages were sealed with plastic wrap containing six pin holes to allow gas and moisture exchange.The bioassay was carried out after two days of feeding. Plates were maintained in a chamber at 25 ± 1ºC, relative humidity of 70 ± 10% and photoperiod of 12 h. Pods were exchanged on the second day and as needed. Mortality was assessed until the fifth day.

Fig 1: Citronella Grass collected from Akola university

Fig 2: Clevenger apparatus

Fig 3: Oil of *Citronella*

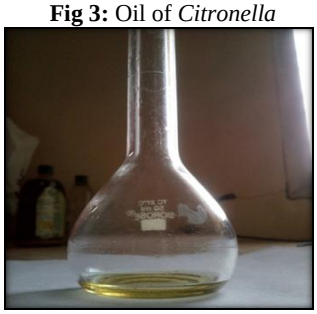

Fig 4: Oil extracted from Java

Fig 5: Oil extracted from citronella grass

Results and Discussion

Insecticide activity test

The *Citronella* grass essential oil at a concentration of 1% (wv-1) was toxic to pests evaluated;however up to 100 % mortality would be occurred in larval population. The insecticidal activity of *C. winterianus* essential oil (500µg/L) was evaluated against Gram pod borer (*H. armigera*) larvas and presented 100% mortality after 120. Furthermore, the acaricide action of the principal components of the essential oil of *C. winterianus* was evaluated as compared to control where mortality only 10%.In addition to mortality, essential oils can cause deformations in different stages of insect development,repellence and deterrence. When essential oils interact with the integument of insects, it may affect digestive and neurological enzymes (Isman M.B., 2006) [3].

Table 1: Effect of Spraying of Citronella oil on Larval Population

Test	No. of Larva killed per day/ 40 Larva				
	1 day	2 day	3 day	4 day	5 day
Control (Normal feedings)	0	0	1	2	1
Pods treated with *Citronella* oils	24	8	4	2	2

Fig 6: Live larva

Fig 7: Larva Dead after spraying of Citronella oil

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