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Calotropis Procera And Annona Squamosa Ethanol Extracts' Insecticidal Efficacy Against Musca Domestica

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Abstract

In the current work, larvicidal properties against Musca domestica were tested for in crude ethanol extracts of Calotropis procera and Annona squamosa leaves. The housefly larvae of the third instar were exposed to various doses of both extracts using the dipping method for 48 hours. A. squamosa and C. procera leaf extracts were found to have LC50 values of 282.5 and 550 mgl-1, respectively. These extracts' phytochemical examination indicated that alkaloids were the main ingredient. To assess their impact on metamorphosis, nucleic acid content, and protein content at various developmental stages, the larvae were subjected to 5 and 10% concentrations of the LC50 value of each extract along with respective control sets.

In terms of insecticidal potential, the leaf extract of C. procera was shown to be more effective. The data suggest that the leaf extracts of these plants could be used as likely candidates for the creation of bioinsecticides to manage the population of Musca domestica as more effective and affordable substitutes for synthetic insecticides.

Keywords:
Musca domestica, Calotropis procera, Annona squamosa, Bioinsecticide, LC50 are some of the terms used.

Introduction

There has been an urgent need to investigate viable alternative products for pest management as a result of a better knowledge of the risks associated with the usage of synthetic organic insecticides. One strategy in the hunt for new biological pesticides is to screen plant extracts for harmful effects on insects [1]. Numerous plants have been shown to be insecticidal against a variety of insects [2, 3]. A number of plants' seeds and foliar extracts have been found to have potent growth-reducing and poisonous effects on insects [4]. Plant extracts or pure natural or synthetic substances can have a negative impact on insects in a number of ways, including through toxicity, mortality, antifeedance, growth inhibitory effects, inhibition of reproductive behaviour, and decreased fecundity and fertility.

Animals exposed to harmful substances might experience alterations even at the molecular level. As the primary regulators of the many activities of cells, nucleic acids (DNA and RNA) and protein concentration are recognised as significant biomarkers of the metabolic potential of cells. It is possible to determine whether hazardous chemicals have an impact on cellular proliferation and cell death by observing changes in the amount of nucleic acid [5,6,7].

The common housefly Musca domestica (Diptera:Muscidae) plays a significant mechanical role in the transmission of a number of bacterial and animal and human pathogens [8]. Recent findings claim that houseflies have become resistant to chemical pesticides like spinasod [9], diflubenzuron [10], and synthetic insecticides [11] after being exposed to them for an extended period of time.

Calotropis procera, a shrub found in large quantities in West Africa, Asia, and other tropical regions, belongs to the Asclepiadaceae plant family. The plant is perennial, erect, tall, broad, branching, and covered in milky latex. Its green sections make it simple to harvest a significant amount of latex [12]. It is successfully used by locals to treat several cutaneous fungal infections. The concept that the plant created and accumulated latex as a defence mechanism against creatures like viruses, fungi, and insects is supported by the amount of latex (containing alkaloids) in the green sections of the plant [13]. Other plants' latex secretion has been noted to contain proteins associated to plant defence, such as hevein, an alpha-amylase inhibitor [14].

With roughly 130 genera and 2300 species, the Annonaceae (Custard-apple family) is a sizable family of mostly tropical trees and shrubs. This family of plants includes those that have historically been employed as insecticides [15]. For instance, Annona species' powdered seeds and leaf juices are used to get rid of head and body lice, and Goniothalamus macrophyllus' bark extract works as a mosquito repellent.
Pesticide and/or insect antifeedant characteristics can be found in anonaceous acetogenins that are derived from tree leaves, bark, and seeds [16]. But there is no evidence that Annona squamosa extract has insecticidal properties against houseflies.

Resources and Procedures:

Rearing approach:

Sweep nets were used to collect adult house flies from the neighbourhood, which were then raised in a lab at 26°C, 60 RH, and 12:12 photoperiod (L:D). In the current investigation, the rearing technique outlined by Kristensen and Jespersen [10] was used. In a nutshell, milk and dried sugar were offered to M. domestica adults. A 1:3 weight ratio of wheat flour to milk was made, and 35g of this combination was put on a Petri dish with wet cotton acting as an oviposition site.

Gathering and preparation of a sample of plants:

Fresh leaves of C. procera and A. squamosa were gathered from the University of Allahabad Botanical Garden. After being thoroughly washed, the leaves were shade dried for 5-7 days at 32-35°C and 50-60% relative humidity. Using a commercial electrical stainless steel blender, the dried leaves were mechanically ground into powder (Remi Anupam Mixie Ltd., India). For further analysis, the samples were kept in airtight containers at room temperature in the dark.

Extracting plant materials:

The method described by Mishra et al. was used to extract the dried leaves of C. procera and A. squamosa in a Soxhlet apparatus (Borosil, India) .[17] At 50°C, the extracts were concentrated, and the residue was collected and kept at 4°C.

Analysis of the extract's phytochemistry:

The Mishra et al. method [17] was used to perform a qualitative phytochemical study on the leaf extracts of C. procera and A. squamosa. The following was qualitatively determined for the phytochemicals, including tannins, alkaloids, saponins, flavonoids, terpenoids, and phenols/polyphenols:

Tannins:

In 2 ml of distilled water, 20 mg of extract was dissolved, then filtered. After two ml of $FeCl3$ were added to the filtrate, a blue-black precipitate showed that tannins were present.

Alkaloids:

In 2 ml of distilled water, 20 mg of the extract was dissolved, then filtered. 2-4 drops of 1% HCl were added to the filter, and steam was then poured through it. The Wagner's reagent was added in 6 drops to the 1 ml of this solution. Alkaloids were present as evidenced by the brownish-red precipitate.

Saponins:

0.5 ml of the filtrate from the alkaloids test was mixed with 5 ml of distilled water. The presence of saponins was shown by persistent foaming.

Flavonoids:

After being dissolved in 10 ml of ethanol and filtered, 20 mg of extract was used. To 2ml of filtrate, HCl and magnesium ribbon were added. Flavonoids were present, as evidenced by the development of a pink-tomato red tint.

Terpenoids:

A little amount of the extract solution was used to conduct the Salkovski test. 5 drops of concentrated H2 SO4 and 1 ml of chloroform were added to this solution. Terpenoids were present when the yellow colour turned crimson.

Phenols/polyphenols

A little amount of the substance was extracted in ethanol and dried by evaporation. After the residue had been dissolved in distilled water, 0.5 ml of the Folinciocalteau reagent and 2 ml of 20% Na2 CO3 solution were added. Phenols were present as evidenced by the development of a bluish tint.

Preparation of experimental concentrations: Because the Calotropis extract does not dissolve in water, a stock solution was made by dissolving 5 mg of extract in 10 ml of ethanol. Further dilutions were created using this solution. Following tests with various extract concentrations, the various extract concentrations, such as 100, 200, 300, 400, and 500 ppm, were employed for future research. The extract concentrations for A. squamosa were 200, 400, 600, 800, and 1000 ppm.

Discussion

The ethanol extracts from the leaves of the plants C. procera and A. squamosa in the current investigation were very effective at killing off housefly larvae. These extracts had a significant, dose-dependent impact on pupation and adult emergence from pupae. According to earlier research on annonaceous acetogenin, the bioactive component of the Annonaceae plant family, it may have pesticidal or antifeedant characteristics [22, 23]. According to reports, A. squamosa seed oil reduces the survival of the leaf hopper Nephotettix virescens (Hemiptera: Cicadellidae) and the spread of the virus that causes rice tungro [24, 25].

There are reports of C. procera extract's nematicidal [26], antibacterial and antihelminthic [27] properties as well as its usage in the treatment of toothaches, coughs, and subcutaneous illnesses [28].
the LC50 for the alcoholic leaf extract of C. procera against M. domestica in any way. It has been proven in a laboratory investigation that C. procera leaf extract has larvicidal activities against mosquito larvae [29]. The antifeedant function of the Calotropis extract is shown by the results of the current investigation, which may be because the extract contains a variety of chemicals with various bioactivities.

The effects of treating the plant extracts on the rate of pupation and adult emergence were dose-dependent. This might be as a result of some active components in the extracts that have the potential to interfere with the insects' regular metabolism [30].

Alkaloids, phenols, flavonoids, and tarpenoids were found in A. squamosa. The insecticidal properties of the extracts may be due to these compounds. Several flavonoids [31] and a tetrahydroisoquinoline alkaloid with cardiotonic action [32] have previously been identified from the leaves of A. squamosa. Aqueous leaf extract from A. squamosa has been shown to contain partially purified flavonoids that exhibit antibacterial and insecticidal activity [33]. Similar to this, it has been established that the alkaloids claimed to be found in the latex of C. procera possess insecticidal effects [13].

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