



## Feeding deterrent effect of *Cleistanthus collinus* leaf extract against *Spodoptera litura* Fab.

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### Abstract

Feeding deterrent effect of acetone and chloroform extract of *Cleistanthus collinus* (Roxb.) Benth. ex. Hook. f. leaf was studied against third instar *Spodoptera litura* Fab. at various concentrations (1, 5, 10, 30, 50, 70, 90, and 100 %). Maximum feeding deterrence of 88.20 and 84.59 percent were noticed in chloroform and acetone extract at cent percent concentration respectively. The minimum feeding deterrent effect of 48.20 and 61.31 percent leaf area protection over absolute control was recorded at one percent concentration of acetone and chloroform extract respectively. The feeding deterrence activity was found to increase with increasing concentration of the plant extracts.

**Keywords:** *Cleistanthus collinus* (Roxb.) benth., feeding deterrent, *Spodoptera litura* Fab

### Introduction

Insect pests cause significant crop damage, and there is a pressing need to manage these indomitable enemies (Kiran *et al.*, 2007) [6]. Farmers have long utilized plant extracts against insect pests. However, with the advent and over-reliance on synthetic insecticides, insects have developed resistance, posing threat to the environment and human health (Ciccio *et al.*, 2009; Han *et al.*, 2006) [4, 5]. Hence, pest management professionals refocus their research priorities toward botanicals.

The range of insects being managed and their spectrum of action like insecticidal, repellent, and growth-disrupting activities make Phyto-insecticides an effective alternative (Laxmikanta *et al.*, 2009) [7]. *Cleistanthus collinus* (Roxb.) Benth., (Fam.: Euphorbiaceae) is a small, wild deciduous tree found in India, Malaysia, and Africa. Ramesh *et al.* (2003) [9] isolated cleistanone, cleisanthins A, C, and D, as well as aryl naphthalene lignan, from aerial portions of *C. collinus*. Ahirwar *et al.* (2011) [11] discovered that the 50 percent concentration of *C. collinus* decoction effectively controlled Rice caseworm. Selvamuthukumaran and Arivudainambi (2010) [10] identified that the active ingredient lactone glycoside possesses various anti-insect properties *viz.*, insecticidal, antifeedant, and insect growth regulatory activities. In this paper, the feeding deterrent property of leaf extracts of *C. collinus* has been studied as part of the exploration for a new and novel bio-active formulation.

### Methods

#### Collection of leaves and extract preparation

The *C. collinus* leaves were collected from Nagalkuzhi (11.27042°N and 79.30637°E), Ariyalur district, Tamilnadu, India and was shade dried for a week. The shade-dried leaves were ground into powder using a mixer. The powder

(50 g) was immersed in 250 ml of acetone: chloroform mixture (1:5 ratio) for three days at room temperature separately and stirred for 30 minutes in a magnetic stirrer (Remi® make), allowed to settle, decanted, and filtered. The filtrate was then evaporated in a rotary flash vacuum evaporator (Lab-Sil instruments®). Extractive was collected in glass vials, and preserved in a deep freezer at -20 °C.

#### Rearing of test insect

Egg masses of *Spodoptera litura* Fab. obtained from the fields in and around Annamalainagar were used for initiating a continuous culture under 25 ± 2° C temperature, 70 ± 5% relative humidity, and 16L: 8D photoperiod using Bengal gram flour-based semi-synthetic diet. Cotton dipped in honey served as adult food, and *Nerium oleander* twig acted as an oviposition substrate. Eggs were treated with a 0.05% sodium hypochlorite solution and a continuous culture was maintained.

#### Evaluation of feeding deterrent effect of *C. collinus* against *S. litura*

The effect of *C. collinus* leaf acetone and chloroform extract was evaluated at 1, 5, 10, 30, 50, 70, 90, and 100 percent concentrations prepared by dissolving varying volumes of the extract with emulsified water. The leaf disc (3 cm dia.) was smeared with the prepared concentrations separately on both adaxial and abaxial surfaces and air dried for 10 minutes. The treated leaf disc was placed inside a Petri plate (9cm dia.) and three third instar larvae pre-starved for 4h were released. Solvent control and untreated absolute control were maintained. The experimental setup was replicated three times. Unfed leaf area was calculated six hours after treatment using a leaf area meter. The leaf area protected over control was measured using the formula,

$$\text{Percent leaf area protection over control} = \frac{\text{Per cent protected area in treatment} - \text{per cent protected area in control}}{100 - \text{per cent protected area in control}} \times 100$$

The feeding deterrent effect was rated as per the scale given

**Table 1**

| Scale (%feeding deterrent) | Rate          |
|----------------------------|---------------|
| >80                        | Strong        |
| 50-80                      | Medium        |
| 20-50                      | Weak          |
| < 20                       | Insignificant |

### Result and discussion

*C. collinus* leaf chloroform extract performed better with increased feeding deterrent activity than the acetone extract. The activity was dose-dependent as the concentration increased the activity increased. The maximum feeding deterrence was observed at 100 percent concentration of both the extracts recording 88.20 and 84.59 percent leaf area protection over absolute control respectively. This was followed by 90 percent concentration with 86.99 and 81.42 percent leaf area protection over absolute control. The minimum feeding deterrent effect noticed was at one percent concentration with 48.20 and 61.31 percent leaf area protection over absolute control respectively.

According to Bagde *et al.* (2013) [3], *C. collinus* leaf extract had a maximum mortality rate compared to bark extract. Pinho and Kijoa (2007) further confirmed that *C. collinus* contained aryl naphthalide lignans. Arivudainambi and Baskaran (2004) [2] found that *S. litura* larvae treated with *C. collinus* extract exhibited hyperexcitation, ataxia, tremors, and uneven walking. They observed cent percent leaf area protection at 1 and 3 percent concentrations of *C. collinus* acetone extract.

### Conclusion

The study revealed the supremacy of chloroform extract over acetone extract in imparting feeding deterrence.

**Table 1:** Feeding deterrent effect of *C. collinus* extract on *S. litura* larvae

| Concentration    | Percent leaf area protected over absolute control |                             |
|------------------|---|-----------------------------|
|                  | Acetone extract                                   | Chloroform extract          |
| 1 %              | 48.20 (43.94) <sup>f</sup>                        | 61.31 (51.5) <sup>e</sup>   |
| 5%               | 50.71 (45.38) <sup>f</sup>                        | 63.28 (52.68) <sup>de</sup> |
| 10 %             | 63.72 (52.94) <sup>e</sup>                        | 65.46 (53.98) <sup>d</sup>  |
| 30 %             | 64.48 (53.39) <sup>e</sup>                        | 66.78 (54.78) <sup>d</sup>  |
| 50 %             | 69.40 (56.40) <sup>d</sup>                        | 71.04 (57.44) <sup>c</sup>  |
| 70 %             | 75.30 (60.17) <sup>c</sup>                        | 77.81 (61.92) <sup>b</sup>  |
| 90 %             | 81.42 (64.47) <sup>b</sup>                        | 86.99 (68.85) <sup>a</sup>  |
| 100 %            | 84.59 (66.86) <sup>a</sup>                        | 88.20 (69.88) <sup>a</sup>  |
| Solvent control  | 17.49 (24.70) <sup>g</sup>                        | 16.39 (23.87) <sup>f</sup>  |
| Absolute control | 0.00 (0.00) <sup>h</sup>                          | 0.00 (0.00) <sup>g</sup>    |
| SE(d)            | 0.83  | 1.07                        |
| CD(p=0.05)       | 1.73  | 2.23                        |

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