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Antifeedant efficacy of methanolic leaf extracts of *Wrightia tinctoria, Murraya koenigii,* and *Prosopis juliflora* against the Teak Leaf Skeletonizer, *Eutectona Machaeralis*

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Abstract
Experiments were conducted to investigate the antifeedant activity of leaf extracts of *Wrightia tinctoria*, *Murraya koenigii*, *and Prosopis juliflora* against teak leaf skeletonizer, Eutectona *machaeralis* Walk. The study was carried out from August 2021 to July 2022 in the Zoology laboratory of Tara Government Degree and PG College, Sangareddy (latitude 17.603666° and longitude 78.077221°) above the sea level of 496 meters. In this experiment, 1% methanol extracts of *Wrightia tinctoria Murraya koenigii* leaves and *Prosopis juliflora* leaves were used. Third instar larvae of *Eutectona machaeralis* were collected from the Teak plants in the college garden and reared in the laboratory. No choice method was followed. Among the plant extracts tested, *Murraya koenigii* showed the highest Antifeedant Index value (90.64 %). AFI values for *Wrightia tinctoria* and *Prosopis juliflora* were 38.22% and 42.28 % respectively. The experiment indicates that Leaf extracts of *Murraya koenigii* have high AFI values.

Keywords: *Tectona grandis*, *Wrightia tinctoria, Murraya koenigii*, *Prosopis juliflora*, Teak leaf skeletonizer, *Eutectona machaeralis,* Antifeedant activity.

Introduction

Tropical Southeast Asian nations are home to the significant hardwood plant *Tectona grandis*, also known as teak. It is planted across the tropics for its premium wood. Teak plants are infested by a variety of insect pests, including stem borers and leaf feeders (Beeson, 1941 [1]; Mathur and Sigh, 1960) [11]. In India, teak plants are a food source for more than 187 insect pests, according to Hutacharern and Tubtim (1995) [7]. A significant pest of teak is *Eutectona machaeralis* (Walker), commonly known as Teak leaf skeletonizer (Lepidoptera: Pyralidae) (Tewari, 1992) [23]. The larvae of *E. machaeralis* eat on the green leaf tissue while leaving the veins unharmed, giving teak leaves a skeletonized look. The plant keeps the leaves that have been harmed by *E. machaeralis* for an exceptionally long time. From a distance, this makes the afflicted trees appear dry and burnt (Myint, 2016) [15]. According to Roychoudhury *et al*. (2011) [20], in addition to defoliating the leaves, they also consume inflorescence, which impairs the teak's ability to produce seeds and sets them up during epidemic periods.

Synthetic insecticides have gained widespread acceptance for the control of agricultural pests since the Green Revolution began. Although these insecticides help us boost agricultural output, they can have deadly side effects on creatures that are not their intended targets (Gunstone, *et al*., 2021) [6]. Pest outbreaks are the outcome of insect pests developing resistance to insecticides. This is a result of pesticides being used carelessly. Toxic residues in food, water, air, and soil are additional side effects of the indiscriminate use of chemical pesticides that have an impact on human health (Arivoli and Tennyson, 2013) [1]. Because they are organic, biodegradable, and less hazardous to beneficial organisms than synthetic pesticides, botanical pesticides or biopesticides are essential alternatives to synthetic pesticides.

One category of biopesticides is antifeedants. Any compound that prevents insect pests from feeding is considered an antifeedant. Many antifeedants do not actually kill the pests. For several days, they prevent the insects from feeding, which causes the pests to starve to death (Pavunraj, *et al*., 2012) [17]. There have been numerous reports of experiments on the control of *E. machaeralis* (Beeson, 1941 [1]; Mathur, 1960 [12]; Nair, 1988) [16]. *Aloe Vera* leaf extracts with a 0.5% methanol concentration were discovered to be the most potent and effective against third-instar larvae by Meshram *et al*. in 1994 [14]. Out of 32 various medical and natural remedies, Meshram (1995) [13] found that the extract of *Calotropis procera* was the most strong and effective antifeedant against this pest.

Few other plant extracts were tested against different pests and were successful. *Azadirachta indica* kernel extract was reported to be beneficial against the soybean pest *Diacrisia obliqua* (w) (Javaregowda and Naik, 2007) [8]; leaf extract of *Annona squamosa* was also found to be effective (Varma, *et al*., 2010) [24]. According to research by Jeyasankar *et al*. (2008) [9], the brinjal pest *Henosepilachna vigintioctopunctata*'s fourth instar larva was more resistant to an ethanol extract of *Achyranthes aspera*. Datta and Saxena (1997) [4] examined the antifeedant activity of Azadirachtin-A and Parthenin against *Spodoptera litura*. Antifeedancy was significantly more easily induced by Azadirachtin-A than by Parthenin.

Wrightia tinctoria leaf extracts have been shown to have strong antimicrobial effects against dermatophytic bacteria, such as E. coli and MRSA (Deventhiran *et al*., 2016 [5]; Manokari and Meenu, 2017) [10]. *Prosopis juliflora* extracts have been shown by *In vitro* and in vivo research to have antioxidant, antibacterial, analgesic, anticancer, cardioprotective, and antiplasmodial properties, according to Sharifi-Rad *et al*. (2019) [22]. In 2020, Zerihun and Ele assessed the insecticidal efficacy of various *P. juliflora* extracts against groundnut aphids (*Aphis craccivora*). Dahlia, *et al*. (2017) [3] assessed the antioxidant qualities of *Murraya koenigii*. The antifeedant and oviposition deterrent efficacy of *M. koenigii* leaf extract against *S. litura* fourth instar larvae and gravid females was investigated by A. Senrung *et al*. in 2014 [21].

The current study was carried out from August 2021 to July 2022 in the Zoology laboratory of Tara Government Degree and PG College, Sangareddy, Telangana State, India (latitude 17.603666° and longitude 78.077221°) above the sea level of 496 meters. The study aimed to address this issue because little research has been done on the antifeedant action of *W. tinctoria, M. koenigii*, and *P. juliflora* leaf extracts.

Materials and methods

Required plant materials collection.

W. tinctoria, M. koenigii, and *P. juliflora* leaves have been gathered from Sangareddy town's neighboring villages. They were then shade-dried and electrically ground into a powder before being stored separately in airtight containers.

Method of leaf extract preparation

The powdered plant samples were immersed in the methanol in a 1:3 ratio for three days at a time. Throughout these three days, they were frequently rattled. After that, Whatman's filter paper No. 1 was used to filter the mixtures. In different vials, the obtained crude extracts were kept. The crude extracts were diluted to 1% using distilled water before to the experiment.

Test insects' collection

E. machaeralis larvae (Figure 1) in their fourth instar were gathered from the teak trees on the college grounds. To help them get used to the lab environment, they were raised there for two days. Ten hours before the experiment began, the food supply was interrupted so that the starved larvae would be ready for release to devour the treated leaves.

Antifeedant Bioassay

From the college grounds, fresh teak leaves were procured, which were subsequently washed in running water. The leaves were chopped into discs with an approximate 8 cm diameter (50 sq cm). Sprays of 1% crude extracts of *W. tinctoria, M. koenigii,* and *P. juliflora* were applied to five leaf discs each separately. Methanol was sprayed on the control leaf discs. The dried leaf discs were separated onto individual Petri plates. On each disc, a single equal-sized fourth instar larva that had been pre-starved was released. The leaf area that the larvae had consumed after being released for 24 hours was determined and documented using the graph sheet approach. The same experiment was repeated five times, and the results were recorded. The following formula was used to determine the Antifeedant Index.

AFI = C-T / C+T x100

AFI stands for the antifeedant index.

C = The portion of the leaf disc that is protected.

T = The protected area of the leaf disc.

Results and discussion

The results of the present study are given in Table 1 and Figures 2 and 3. According to statistics based on the percentage of leaf area consumed, *M. koenigii*'s crude extract was the most successful treatment out of the five, with a reduction in leaf consumption of 1.76% (3.54 sq cm), compared to the control's 30.83% (61.66 sq cm). *W. tinctoria* and *P. juliflora* treatments' average leaf consumptions were 13.78% (27.56 sq cm) and 12.50% (25.01 sq cm), respectively. *M. koenigii* is therefore effective in reducing the harm brought on by *E. machaeralis*. Teak damage caused by *E. machaeralis* larvae can be reduced and controlled with the use of *P. juliflora* and *W. tinctoria*.

M. koenigii was efficient in preventing the feeding by the larvae of *E. machaeralis* with an AFI of 90.64% when compared to control insects. *W. tinctoria* and *P. juliflora* were not that efficient as they showed AFI values of 38.22% and 42.28%, respectively.

The results of the present study are in line with previous studies. Several phenolic compounds are abundant in the plant extracts of *P. juliflora* and *M. koenigii* (Rodriguez, *et al*., 2019 [19]; Perez, *et al*., 2014 [18]; Vasile, *et al*., 2019 [25]; Dahlia *et al*., 2017) [3]. The therapeutic and antioxidant activities of *M. koenigii, W. tinctoria*, and *P. juliflora* have been the subject of much research. In the present study, the efficient antifeedant activity of the methanolic extracts of *M. koenigii* might be due to the presence of secondary metabolites in these plant extracts.

Conclusion

The current study results demonstrate that *M. koenigii* leaf extracts possess effective antifeedant properties against teak skeletonizer, *E. machaeralis.* Which specific compounds of *M. koenigii* leaf extracts are responsible for this antifeedant property needs to be further explored.

Table 1: Results of Antifeedant Bioassays. Leaf area consumed in square cm.

Name of the plant	R 1	R 2	R 3	R 4	R 5	Mean	AFI
W. tinctoria	28.20	27.60	29.12	26.70	26.18	27.56	38.22
M. koenigii	3.25	4.82	3.62	2.40	3.60	3.538	90.64
P. juliflora	25.12	24.80	24.62	25.82	24.72	25.016	42.28
Control	65.12	62.19	63.29	59.28	58.45	61.666	

Fig 1: Teak leaf skeletonizer larva

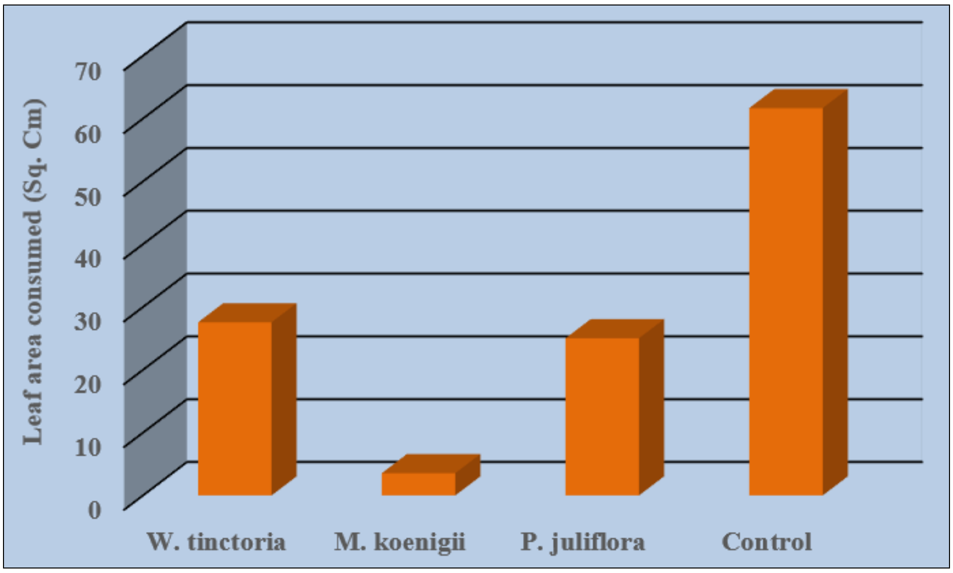

Fig 2: Leaf area consumed against different test plant extracts.

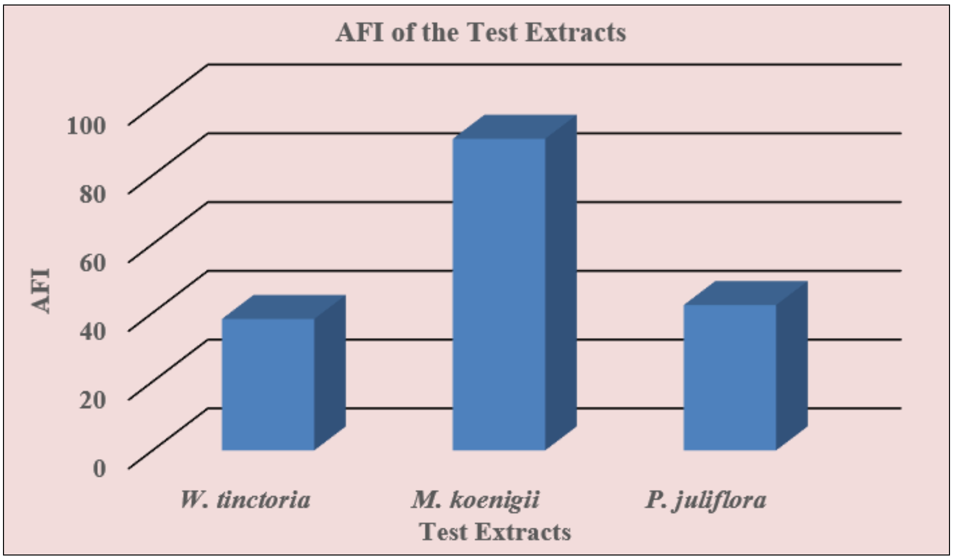

Fig 3: AFI of the tested plant extracts

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