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A glimpse on Insect capturing glandular hairs of *Plumbago zeylanica* Linn. and *Plumbago auriculata* Lam.

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ABSTRACT

Two species of plant Plumbago (family Plumbaginaceae) viz., Plumbago zeylanica and Plumbago auriculata have calyx covered with glandular trichomes. These structures entrap insects which are then gradually killed. This is most probably for protection, pollination, seed setting or protocarnivorous mode of nutrition. Besides various other morphological characters were studied to differentiate the species. The glandular trichomes were further studied under Stereo microscope and SEM.

Key words: *Plumbago zeylanica* Linn., *Plumbago auriculata* Lam., calyx, glandular trichomes, protocarnivory

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INTRODUCTION

The genus Plumbago belongs to the family Plumbaginaceae. Two species- Plumbago zeylanica Linn. and Plumbago auriculata Lam.(= P.capensis Thunb.) were chosen for the study. Morphological variations were observed at the peak of blooming among the species in features like length of the inflorescence, colour of the calyx, size and number of trichomes born on the calyx. Most plants have trichomes commonly called as ' epidermal appendages' or 'hairs' on their surfaces that serve a number of functions such as secretion of various substances like salt solution, sugar solutions (nectar), terpenes, gums (polysaccharides) etc. The morphology of these structures can vary greatly with species [1].The leaves, fruits and stems of many plants are beset with small hairs, hooks, spines, or scales [2, 3]. These could be quite rough and prickly to touch and can cause irritation to herbivores. Some are quite sticky due to secretions and can entrap and kill insect predators like caterpillars and winged insects. Most of the insects that are found stuck to the hairs of the calyx are tiny and very rarely big. Insects that are found stuck to the trichomes of these Plumbago plants especially *P.zeylanica* are physically deterred during the struggle to come out of the sticky resin. The more these insects struggle, more is the coating of the resin-like exudates around their body and they fail to come out of it and eventually die.

MATERIALS AND METHODS

Plant Materials: The Plumbago species in general is a multi branched shrub growing 0.5-2m tall. The leaves are spirally arranged, simple, entire with tapered base and often with a hairy margin. The inflorescence is a raceme. The corolla is blue / purple or white having a tubular base and a limb of five lobes. For the study, two species of Plumbago viz: *P. zeylanica* and *P.auricualata* were collected from FRLHT-IHST, Bangalore and grown under maximum day length condition in a green house. Observations were made throughout the year.

Study of morphological characters: The time of blooming, size of the inflorescence, colour of the calyx and size and number of trichomes borne on the calyx were recorded. Morphological parameters chosen were found to be quite helpful in the distinction between the species.

Microscopic studies: Fresh plant material was photographed using Stereo Microscope (magnification ×6.4 to × 64). Plant parts were dehydrated in absolute ethanol; air dried and gold coated [4] and viewed under Scanning Electron Microscope.

Tests for insect entrapment: The method designed by Thomas Eisner *et al* [5] was used, with slight modifications, to measure the degree of entrapment of the winged insects on Plumbago plants. Groups of them (numbering 15 adults) were collected from other Plumbago plants and released into minutely perforated plastic cover of (22 x12.5cm) Three week matured inflorescence was then covered with this. The insects were observed every 15-20 mins per hr (1hr each in the morning, afternoon and evening) for a period of 5 days. After 3 days, half the number of insects was found to get struck to the trichomes and was killed and the other half by the 5th day (Table 2 & graph 2). The insect carcass was then subjected to SEM study for observing the rate of degradation (fig1 A & D).

RESULTS AND DISCUSSION

Field Observation: what is so interesting about Plumbago species is that the sticky trichomes are borne on the calyx which traps insects. The trichomes produce transparent extremely sticky resin-like exudates which traps winged insects as though caught in a cobweb.

Table 1: Comparative study on the morphological characters of Plumbago species with Standard Deviation (SD) and standard error (SE)

Sl no	Morphological characters	*P.zeylanica*	Mean	SD	SE	*P.auriculata*	Mean	SD	SE
1	Length of inflorescence at maturity(cm)	8-16	11.6	±2.875	0.909	4-7	5.9	±1.100	0.348
2	Length of the matured calyx(cm)	1.3-1.5	1.35	±0.070	0.022	0.9-1.2	1.02	±0.091	0.029
3	Diameter of the calyx (cm)	5.9-6.1	5.98	±0.078	0.024	3.8- 4.0	3.91	±0.087	0.027

Graph 1: Showing comparative study on number of calyx and trichomes between Plumbago species

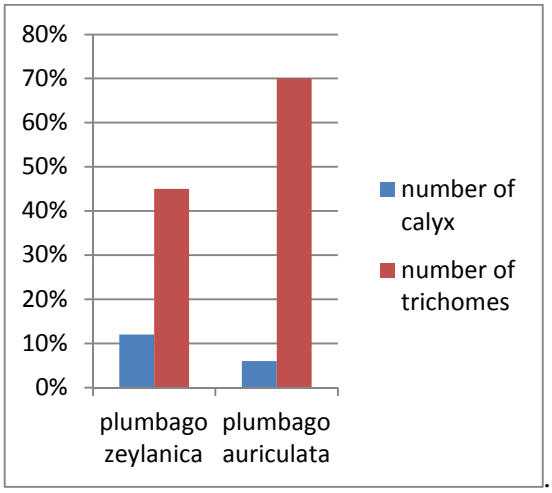


Table 2: Showing degree of entrapment of insects in *Plumbago zeylanica* and *Plumbago auriculata*

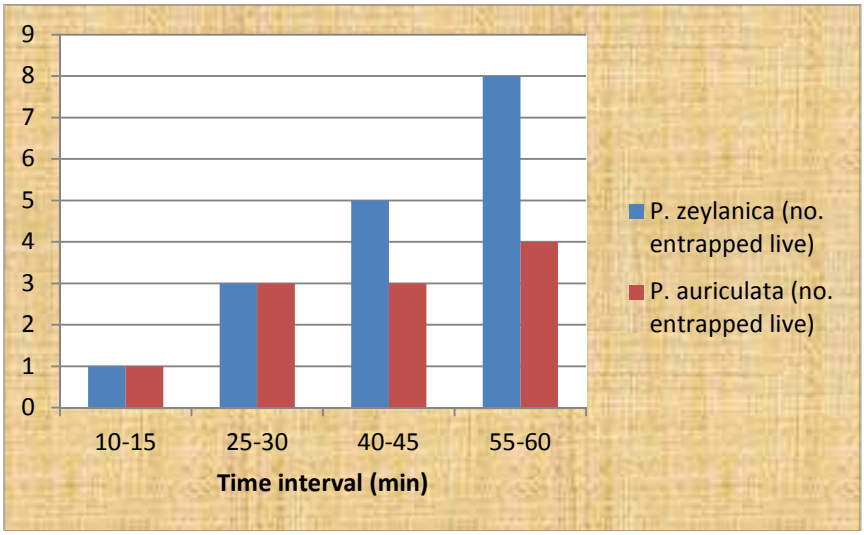
Sl no	Parameters	*Plumbago zeylanica*	*Plumbago auriculata*
1	Number of inflorescence used	10	10
2	Trap material used	Perforated plastic cover (22 x12.5cm)	Perforated plastic cover (22 x12.5cm)
3	Number of insects released	15 (adult *T.iridipennis)*	15 (adult *T.iridipennis)*
4	No. of hrs of observation	Every 15-20 mins per hr for a period of 5 days	Every 15-20 mins per hr for a period of 5 days
5	Number of insects killed in 3 days	half	4
6	Number of insects killed in 5 days	all	7

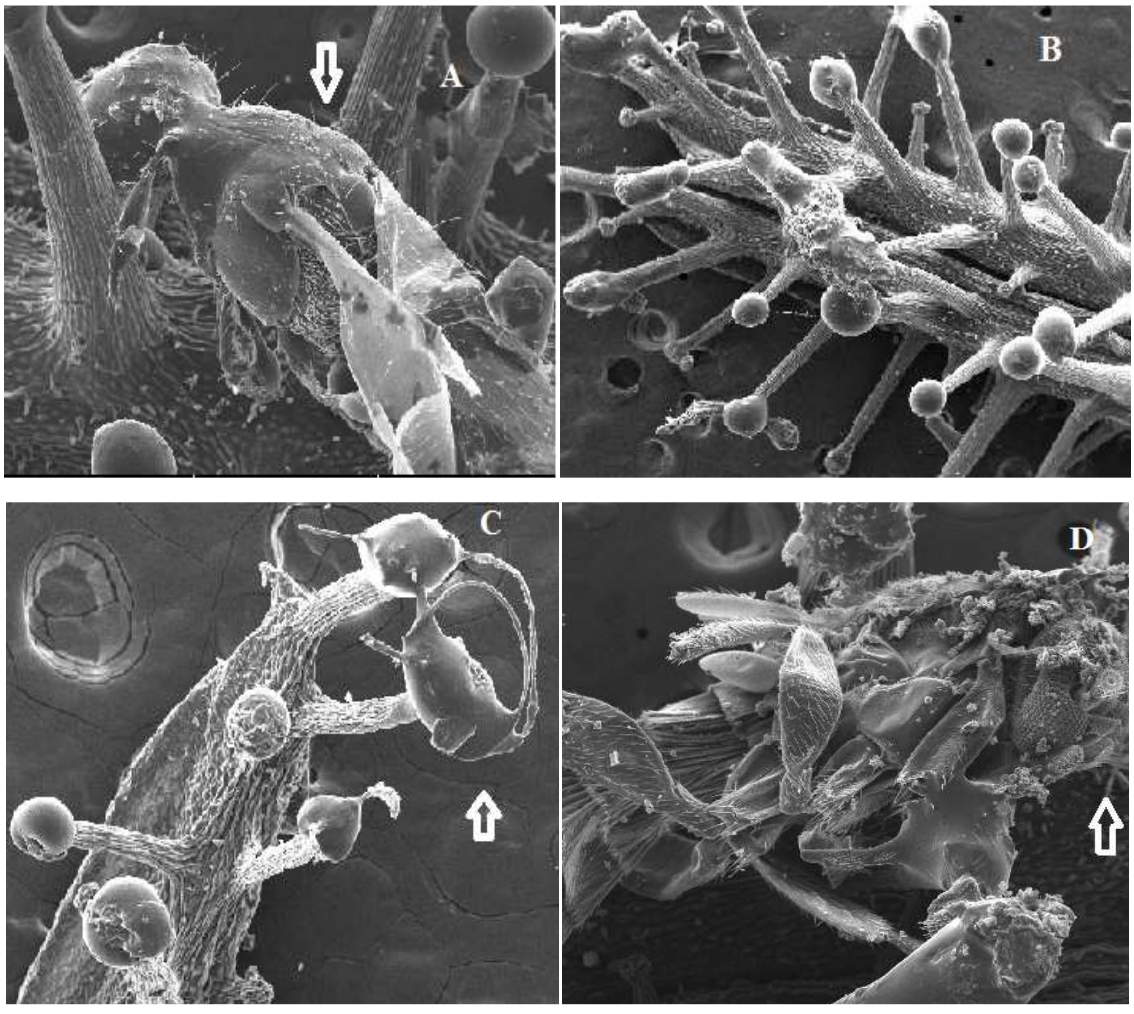
Comparative morphological analysis: Both the species bloom throughout the year. However they differ with respect to their fruits- fruit setting is quite common in *P.zeylanica* whereas the flowers wither away within about a week after blooming. Colour of the calyx in *P.auriculata* is pale green on maturity while the colour of the calyx in *P.zeylanica* is dark green. Comparative analysis of the morphological characters of Plumbago species is presented in Table 1.

Nature of the Trichome: Plumbago plants have trichomes which are stalked glandular hairs. The density of trichomes, their lengths and stickiness of the exudates vary from species to species. *P.zeylanica* has more number of trichomes compared to *P. auriculata* (Graph 1). The length of the trichomes also varies (118µm in *P. zeylanica* and 112µm in *P. auriculata*) and the exudates of the former is stickier as well .The transparent exudates turn brown at

the fruiting stage in *P.zeylanica* and become stickier in nature thereby capturing more insects (fig 2 E); however, the fruiting stage is not observed in *P. auriculata.* There are also small sub sessile glandular hairs found on the surface of the calyx as well as bracts in *P.zeylanica* whereas short slender non-glandular hairs in *P. auriculata*.

Graph 2: Rate of entrapment of *T.iridipennis* monitored at 15 min interval for 1hr in *P.zeylanica* and *P .auriculata*





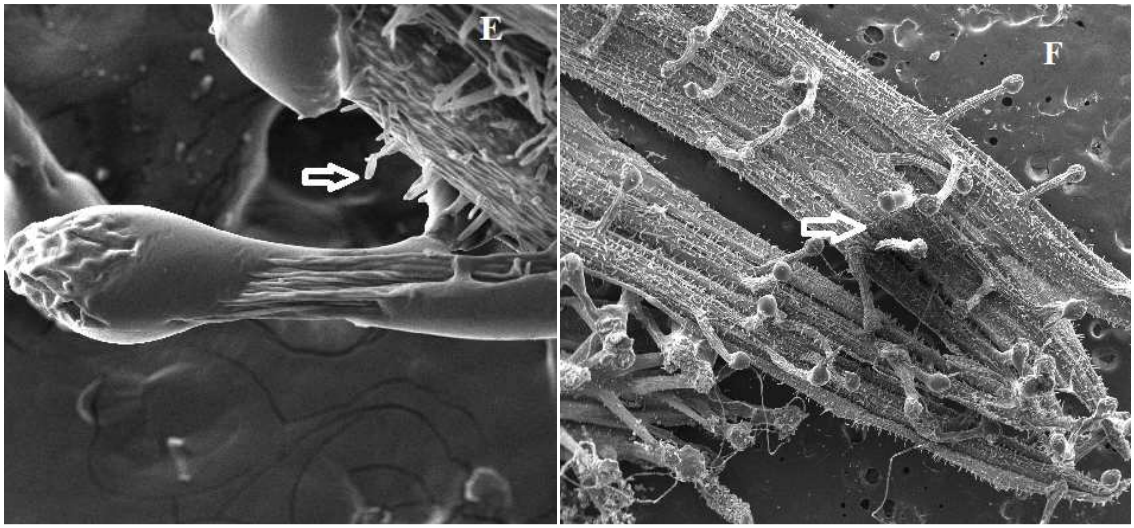


Fig.1. SEM study A) Dead *Tetragonula iridipennis* between the trichomes of *P. zeylanica* (100x magnification) B) Sticky trichomes of *P. auriculata* (40x magnification) C) sparse sticky trichomes of *P.auriculata* (100x magnification) D) 4 day old insect carcass in trichomes of *P. zeylanica* (100x magnification) E) Single trichome of *P.auriculata* with surrounding non glandular trichomes of *P.auriculata* (160x magnification) F) matured trichomes of *P.auriculata* (25x magnification)

Insects found trapped on Plumbago species: Most common types of the plant- trapped insects, irrespective of the species, were winged stingless bees, flea beetles, thrips and aphids.

Winged stingless bees: *Tetragonula iridipennis* (order Hymenoptera) are tiny pollinators, a species of bee, belonging to family Apidae were found to be the most abundant in both the plant species. Flea beetles and aphids are accidental pollinators where aphid is a pest and flea beetle is a scavenger (fig. 2 F).

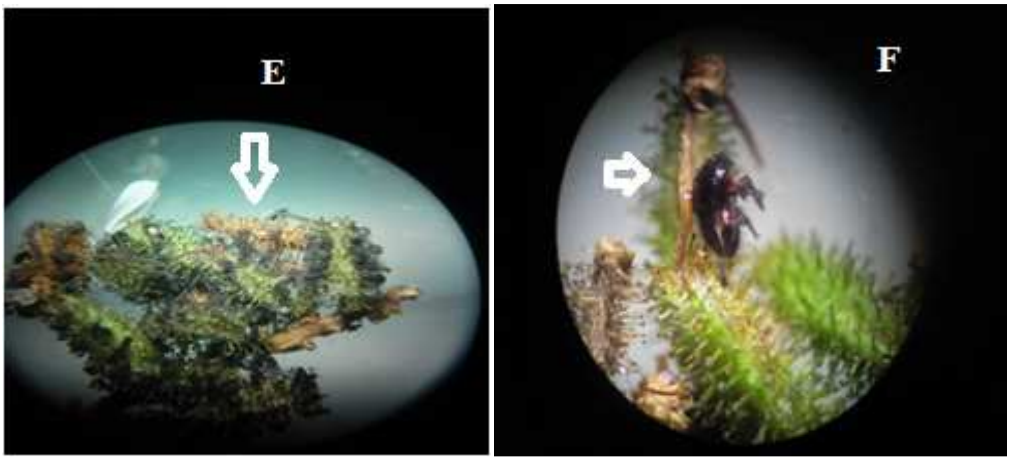


Fig.2 Stereo microscope study (magnification ×6.4 to × 64) A) Inflorescence in *P.auriculata.* B) Inflorescence in *P. zeylanica* .C) *Tetragonula iridipennis* between the trichomes of *P. auriculata.* D) *Tetragonula iridipennis* between the trichomes of *P. zeylanica.* E) Cluster of *Tetragonula iridipennis* stuck between the trichomes of *P. zeylanica* . F) A dead flea beetle in *P. zeylanica*

CONCLUSION

Two species of Plumbago under study- *P. zeylanica* and *P. auriculata* -showed wide variation in some of the morphological characters , especially the inflorescence and floral ones, which appear hitherto unexplored. Glandular trichomes are present in both the species. However they differ vastly in the density, length and stickiness of the exudates. The present study has thus helped in providing an additional set of morphological features for the segregation of the two species.

The glandular trichomes secrete transparent exudates that turns into brown on maturity. Insects were found to be trapped in the calyx trichomes of the mature inflorescence of both the species and more so in *P. zeylanica*, may be due to the larger number of trichomes and stickier exudates secreted by them. The trapped insects struggle to escape but are killed in the course of this struggle. The insects that are trapped commonly include winged stingless bees, aphids, flea beetles and thrips.
Actual role of the glandular trichomes is not yet clearly understood. Further studies are in progress that may throw some light on this peculiar behaviour of the Plumbago species.

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REFERENCES

[1] G. J. Wagner, Rev. Plant Physiology, **1991**, 96, 675-679.
[2] Rodriquez E, Healey, P.L, Mehta I, *Biology and chemistry of plant trichomes Plenum*, New York, **1984**.
[3] Levin, D.A. - Q. Rev. Bio., **1973**, 48, 3-15.
[4] Dawes, C.J, Biological techniques for Transmission and Scanning Electron Microscopy Ladd Research Industries, Burlington, VT, **1979**, R614–R624.
[5] Thomas Eisner., Maria Eisner & E. Richard Hoebeke, *Proc.Natl.Acad.Sci.Usa*, **1998**.