STINGING HAIRS IN *TRAGIA CANNABINA* L.f

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(Received for publication on November 27, 1950)

Introduction

Stinging hairs in plants, which are generally believed to be of a protective nature, occur in few species of Euphorbiaceæ, Hydroleaceæ, Loasaceæ and Urticaceæ. In South India among the many Euphorbiaceous plants, species of *Tragia* alone are characterised by the presence of such stinging hairs. *Tragia cannabina* L.f. (Syn. *T involucrata* L. var. *cannabina* Muel Arg.) is one of them. It is a trailing plant of frequent occurrence in black cotton soils. A study of the stinging hairs of this species is presented here.

The structure of the stinging hairs of *Tragia cissoides* Muel. Arg., an European species, has been described by Solereder (1908). Haberlandt (1914) cites the work of Knolls on *Dalechampia roezliana* Muel. Arg., another Euphorbiaceous plant, and describes the structural features displayed by the stinging hairs in general. Besides these early works, nothing more seems to have been attempted.

Observations

Tragia cannabina L.f. is characterised by a dense clothing of hairs of three types, *viz.*, the stinging hairs, the ordinary unicellular hairs and the multicellular ones. The last two are shorter than the stinging hairs and are more abundant on the younger portions of the shoot and along the veins on the lower surface of the leaves. The stinging hairs occupy the entire plant and vary from ·5 mm. to 1 mm. in length, reaching the maximum length and density on the calyx and ovary. As the shoot or fruit becomes dry, many of the stinging hairs also dry up and drop off. Those which persist lose their cell contents and the stinging property.

A thin peeling of the surface of the young fruit or a transverse section of the stem mounted in water is a suitable material for a detailed examination of the stinging hairs. This shows that the stinging hairs are mounted on a prominent pedestal (Figs. 1 and 2 *a*) of three columnar cells. The actual 'sting' is situated at the top of this column (Fig. 3).

The pedestal is a multicellular outgrowth and is sub-epidermal in origin. In the initial stages of development, it is not prominent and the stinging hair appears to arise directly from the epidermis (Fig. 2 *b*). The cells comprising the pedestal are slightly smaller than the cells of the cortex and are devoid of chloroplasts. The few crystals

found in these cells were identified by micro-chemical tests as calcium oxalate. Directly from the summit of the pedestal three columnar cells arise (Fig. 3, *c.c.*) which support the stinging cell at the top (Fig. 3, *s.c.*). These three columnar cells lie so contiguously that they give an appearance of a pillar In the early stages they contain plenty of protoplasm, but with age and desiccation the protoplasm is lost and the cells become empty

The actual stinging cell is conical in shape and placed at the top of the columnar cells. Its cell wall is of thin cellulose, and it has in the middle a sharp needle-like process. This is the calcium oxalate crystal (Fig. 3, *x*). This crystal rests firmly in the depression at the top of the rounded apices of the three columnar cells. Surrounding this needle, the stinging cell is full of sap.

The actual mechanism by which these stinging hairs operate is interesting. As any object brushes along these hairs, the fine points of the crystalline needles pierce the object; by the slight pressure created by the impact, the needles break off a little below the middle (Fig. 4, *a*) and the broken tips stick into the body Simultaneously with this the poisonous fluid in the cell oozes out and penetrates into the body through the pierced point and thus gives the 'sting' Examination of the affected skin with the binocular microscope reveals the broken pieces of these needles and small globules of poisonous exudation. The exact nature of the poison could not be determined by micro-chemical tests. That the 'sting or irritation is the result of the injection of a poison, however, is proved by the absence of such irritation in the case of persisting stinging hairs of the old dead or dry parts of the plant.

DISCUSSION

The sting or irritation caused by the hairs in *Mucuna* species is due to the penetration into the skin of minute tips of innumerable pointed hairs, which do not secrete any poison. In species of *Urtica* and *Laportea*, belonging to the family urticaceæ and in *Dalechampia*, *Jatropha* and *Tragia*, belonging to Euphorbiaceæ, the 'sting' is due to certain poisonous fluids injected by the piercing ends of stinging hairs. The morphology of these hairs and severity of their action are variable. While some cause only a minor irritation, the sting of a few like *Laportea crenulata* Gaud. is a serious matter. It has been reported to cause fever and sometimes even death. This species, found in the evergreen forests of the West Coast and Anamalais, is said to scare away even the wild elephants and hence is known as "Elephant Nettle" or "Devil or Fever Nettle".

In certain species of *Urtica*,. *Laportea gigas* Wedd. and *Loasa papaverifolia* H.B. and K., Haberlandt (*loc cit*,) records that the tips of the stinging hairs are provided with minute swollen heads. The head breaks on contact with any object leaving a spear-shaped sharp point which pierces the body Differing from this are *Dalechampia rœzlina* Muel. Arg. and *Tragia cissoides* Muel. Arg., where the stinging cells are conical with pointed piercing needle-like crystals.

T cannabina L.f., though similar in this respect, differs from them in the morphology of the whole hair and in the mode of breaking off of the sting. In *D rœzliana* Muel. Arg., there is no pedestal for the stinging hair. The axis of the stinging hair is a "central cell" which at the end has a tapering crystal and is "surrounded for three quarters of its length by a sheath of three or four peripheral cells" *T cissoides* Muel. Arg. has been shown to have two kinds of stinging hairs. One of these is simple and unicellular, while the other has a more complicated structure. In *Tragia cannabina* L.f., only the latter type of stinging hairs are present; these do not resemble in structure with those of *T. cissoides* Muel. Arg. In this species the terminal pointed cell is surmounted on "five contiguous cells of which one lies in the middle" (Solereder, 1908), but in *T. cannabina* L.f., there are only three such supporting columnar cells. These cells are full of cell sap. The poisonous fluid in the stinging cell must necessarily pass through these cells from below and hence they are not to be compared with the sheathing peripheral cells of *D. rœzliana* Muel. Arg., observed by Knolls (Haberlandt, *loc. cit*).

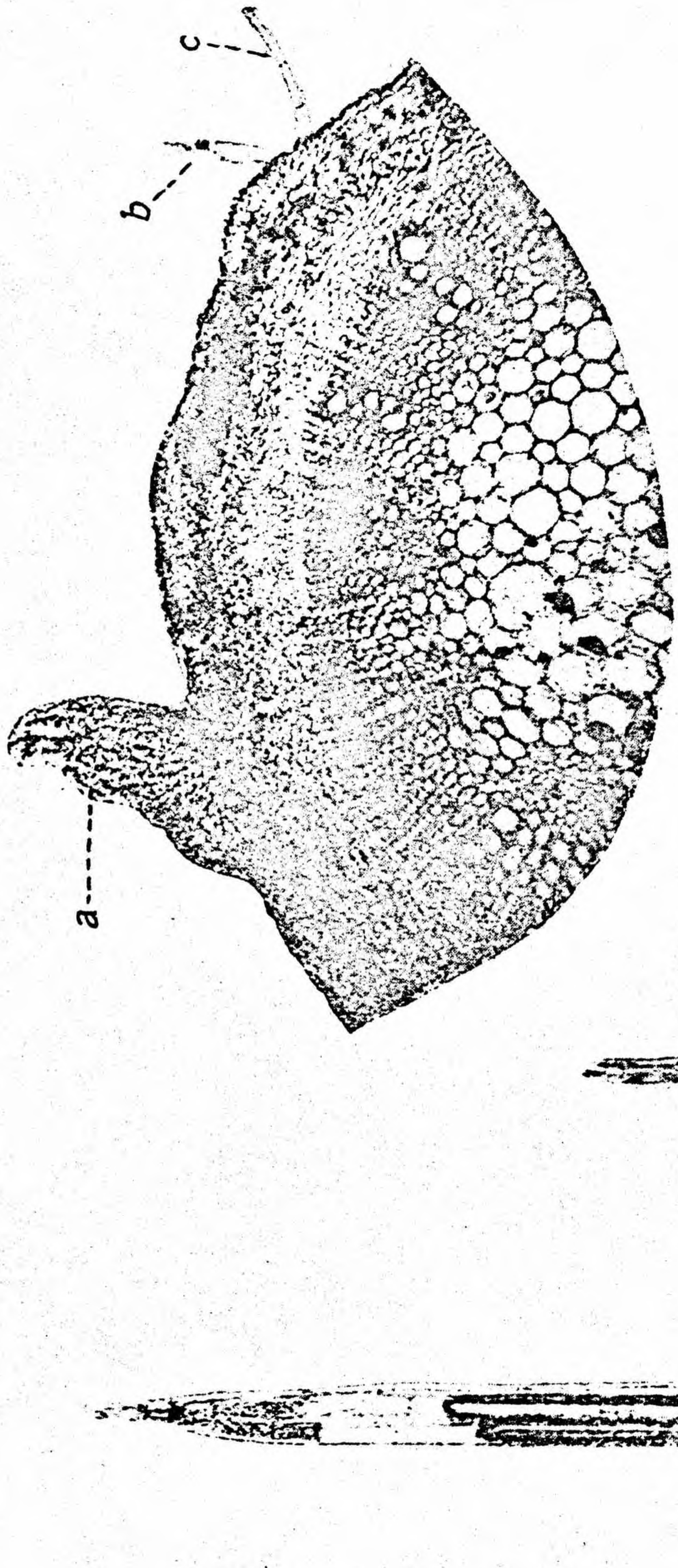
While the pedestal in *Urtica* species is a cup-shaped structure in which the basal ventricose portion of the hair is embedded, the pedestal in *T. cannabina* L.f. has a rounded summit from which the columnar cells arise. The cells comprising the pedestal are devoid of chloroplasts. While these cells must necessarily take active part in the production and transmission of the poisonous material to the actual stinging cell, they differ from the pedestal of *Urtica*, which due to the presence of chloroplasts is considered as a "photosynthetic apparatus pertaining to the hair" (Haberlandt). The cupular pedestal in *Urtica* is regarded as a mechanism for compressing the bladder-like base of the hair and inject the poisonous fluid into the wound (Fritsch and Salisbury, 1920). No such part is played by the pedestal in *T. cannabina* L.f.

Summary

The stinging hairs in *T. cannabina* L.f. consist of a multicellular, non-chlorophyllous pedestal supporting three columnar cells surmounted by the actual stinging cell. The 'sting' is the pointed needle-like arm of a calcium oxalate crystal in the centre of the stinging cell. The needle breaks off a little below the middle when contacted by any object and the poisonous exudate enters through the pierced point creating the irritation.

Acknowledgement

The authors express their thanks to Prof P S. Jivanna Rao, M.A., for suggesting the problem and continued interest in the investigation. They are also thankful to Sri. T S. Ramakrishnan, M.A., and Sri. T. R. Narayanan, M.A. (Cantab.), B.Sc. (Ag.), for helpful criticisms in the presentation of the paper.



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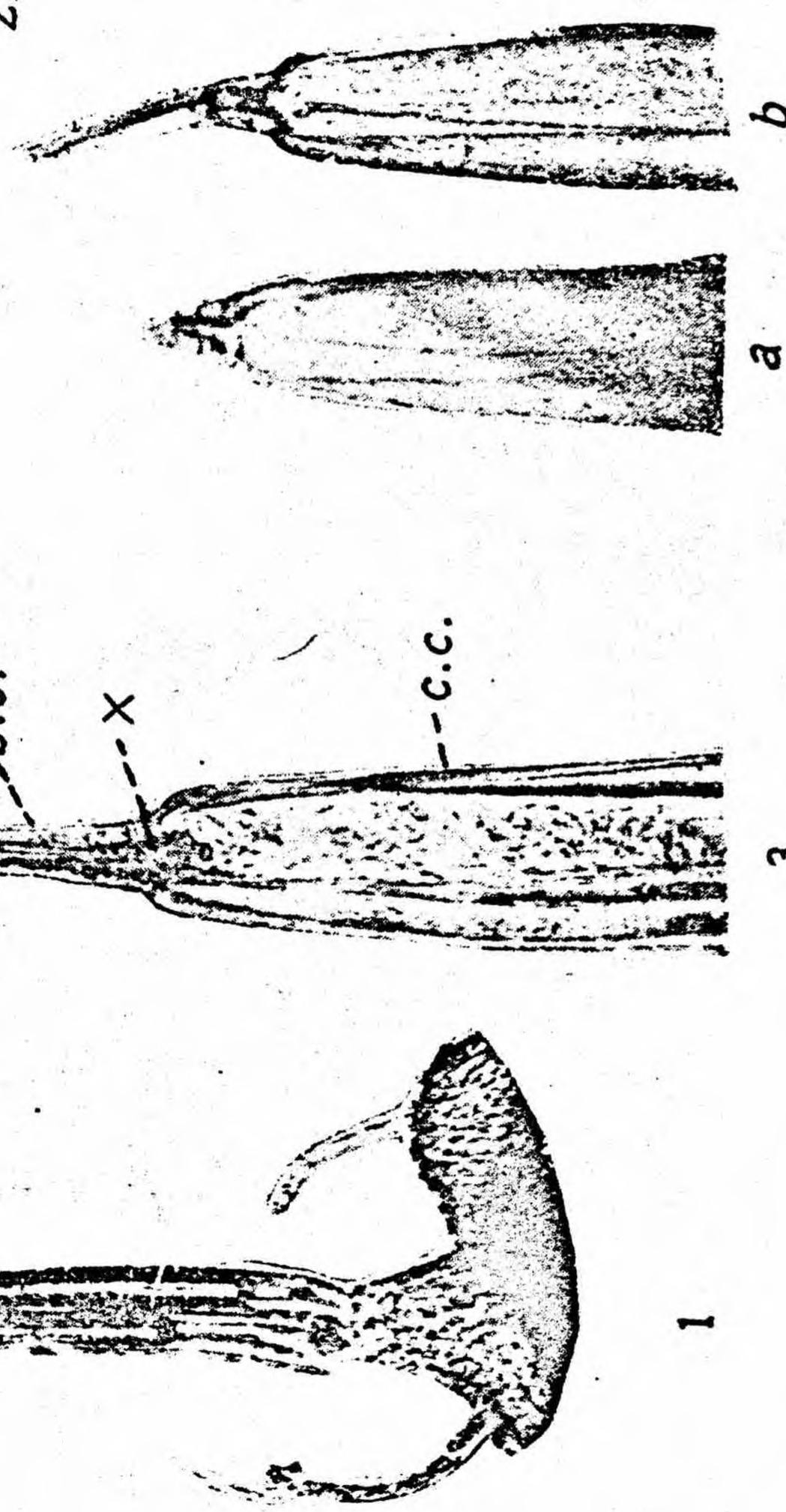

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Explanation of Figures

Figs. 1–4. *Tragia cannabina.*—A stinging hair mounted on the prominent pedestal. Note the short ordinary hairs by the side, ×240. Fig. 2. A transverse section of the stem showing (*a*) the naked pedestal, (*b*) a small and young stinging hair, arising directly from the epidermis and without a pedestal; and (*c*) multicellular ordinary hair, ×240. Fig. 3. The upper half of the stinging hair. 'X' is the base of the calcium oxalate crystal in the conical 'stinging cell' on the top of three columnar cells. ×450. Fig. 4. The stinging hairs, showing the breaking off of their tips. ×450.