

**A STUDY OF THE TRICHOMES OF SEVERAL FREQUENTLY CONFUSED
SPECIES OF CISSUS L. (VITACEAE)**

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SUMMARY

Scanning electron microscope studies of the indumentum of *Cissus adnata* Roxb., *C. assamica* (Laws.) Craib and *C. aristata* Blume, show that the structure of the trichomes varies between taxa but is consistent within each taxon. These three species are distinct and easily recognised by the nature and distribution of these trichomes although they have been frequently confused in the literature with respect to their circumscription and synonymy. *Cissus adnata*, which extends from India to Australia, has both multicellular, uniseriate and unicellular 2-armed trichomes on the abaxial leaf surface, glabrous stipules and pubescent ovary; *C. assamica* found from India to New Guinea has unicellular, 2-armed hairs sparsely distributed, glabrous stipules and ovary; *C. aristata* extending from Burma to Papua New Guinea has scattered unicellular, 2-armed hairs, pubescent stipules and glabrous ovary. There are 4 text-figures.

INTRODUCTION

This paper presents the results of scanning electron microscope studies of the trichomes of the leaves of *Cissus adnata* Roxb., *C. assamica* (Laws.) Craib and *C. aristata* Blume.

Considerable confusion has existed in the literature concerning the circumscription and synonymy of these species and the varieties that have been ascribed to them. Hutchinson, in 1916 (unpublished letter, Hooker Herb. Kew) and later Merrill and Perry (1941: 377), indicated that the identity of *C. adnata* was confused and they suggested that a re-examination of all type material should be made. Merrill and Perry (l.c.) stated that there 'are three entities as to types of pubescence' included amongst material that has at various times been distributed as *C. adnata*. The nature and distribution of the hairs on the leaves and their presence or absence on the summit of the ovary is important for distinguishing between these entities as indicated by Merrill and Perry (l.c.), as is their presence or absence on the stipules.

Cissus adnata as described by Roxburgh (1820: 405) has cordate leaf bases, bristle-serrate margins and the hairs on the lower surface are predominately associated with the veins. Although their structure is not described, the illustration in *Icones Rox-*

burghiana no. 1787 (K) of the petiolar and stem pubescence is of erect hairs. Roxburgh's type specimen was collected in the Dacca District, from which good material matching his description was collected: *Clarke 17224A* (K) and *Griffith 387, 391* (K). The hairs on these specimens are unbranched, multicellular and uniseriate and associated chiefly with the veins of the lower surface. Hairs are sparse in intercostal areas. Planchon (1887: 621) suggested that *C. indica* Willd. was possibly a synonym of *C. adnata*. Fragments of a leaf of *C. indica* from Herb. Willdenow, no. 3001 (B) were examined to determine if the trichomes on the leaf matched those on the plants collected by Clarke, no. 17224A. The hairs on these fragments were unicellular, twisted and 2-armed, rather than multicellular and uniseriate. I am unable to indicate any relationship with other species that this specimen may have without examining more material, however Suessenguth (1953: 264) regards it as a synonym of *C. assamica* as the ovary is glabrous. Merrill and Perry (1941: 376) suggested that *C. indica* Rottler may be a prior name of *C. adnata* Roxb., however a specimen marked *Cissus indica* in Rottler Herb. (K) has unicellular, 2-armed hairs on the leaf and the ovary is glabrous. This specimen corresponds with *C. repanda* Vahl. There is a specimen in the Linnean collection (LINN, *Vitis 281-4*) on which the word 'indica' has been written in ink and the word 'Cissus' has been written in pencil by a different hand. This does have multicellular, uniseriate hairs on the leaf and on the summit of the ovary. However, a description based on this specimen does not appear to have been validly published.

Cissus wightii Planch. (*Wight 496*, K) I consider to be a new synonym of *C. adnata* Roxb.

Cissus assamica (Laws.) Craib has also been collected in the same area as *C. adnata* (type: *Griffith 389*, K). This specimen has slightly cordate leaf bases, but the margins are not bristly-serrate and the sparse hairs are restricted to the main veins of the lower surface of the mature leaf. These hairs are unicellular and 2-armed and the slightly twisted arms are asymmetrical. The ovary is glabrous. Although Gagnepain (1909) recognised that there was a difference in hair types between these two specimens and that the pubescence on the ovary was different, confusion in the literature has continued.

Specimens examined of *C. assamica* (Laws.) Craib var. *pilosissima* Gagnepain (K, L, P) and *C. pyrrodasyis* Miq. (K, L) agree with the type material (L) of *C. aristata* Blume and with Blanco's (1837: 72) description of *C. simplex*. Merrill (1923: 7) considered these specimens to be synonyms of *C. simplex*. Unicellular, 2-armed trichomes, with much twisted arms are present on both surfaces of the mature leaf although the upper surface is often glabrous when old. They are present on the stipules but absent from the summit of the ovary.

Cissus adnata Roxb. var. *montana* Lauterb. from New Guinea is probably an undescribed species. Trichomes on the specimen collected by Schlechter, 16676 (K, L) are rusty-red, densely packed, unicellular and 2-armed. The arms of these hairs appear to be shorter and less twisted than those in either *C. assamica* or *C. aristata*. The stipules are large and glabrous.

METHODS

All specimens held in the following herbaria: BM, BRI, CANB, DNA, E, K, L, MO, NSW, P, PERTH and identified as being one of these three taxa were examined by light microscopy. Thus specimens covering the entire range of these species were examined for the presence or absence of trichomes on the various organs, as well the structure and distribution of these was noted. The only variation encountered within a species was trichome density. These decreased with age in all species, although in *C. aristata* some specimens were always less dense than others of a comparable age. Fragments from mature leaves of representative specimens were fixed in buffered 2.5% glutaraldehyde before being dehydrated in ethanol and then critical-point dried in CO₂. They were coated with gold before being scanned, in an ETEC auto-scan electron microscope using a secondary detector.

Representative specimens studied:

Cissus adnata Roxb. — India: Clarke 17224A; Griffith 387, 391; Wallich 5998; Wight 496; Philippines: Merrill 1219; Malaysia: Elbert 1909; Indonesia: Elbert 7667; Zollinger 813; Australia: Dunlop 4776, 5652; Gray 1258; Hyland 2100 qv; Jackes s.n.; Webb & Tracey 12197, 12222, 12643.

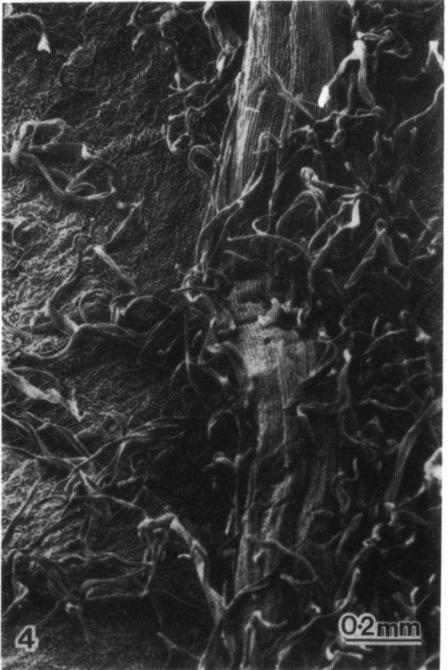
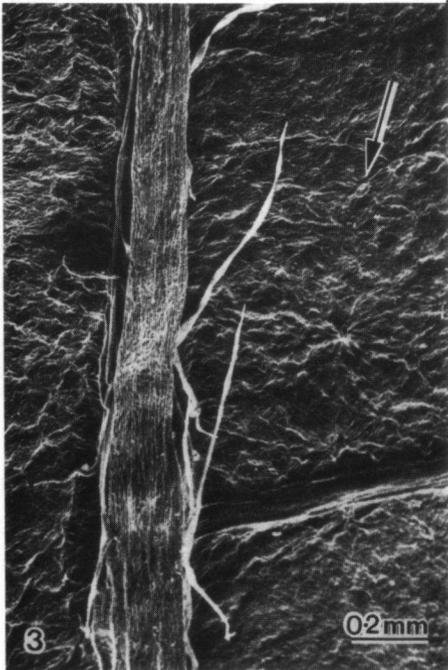
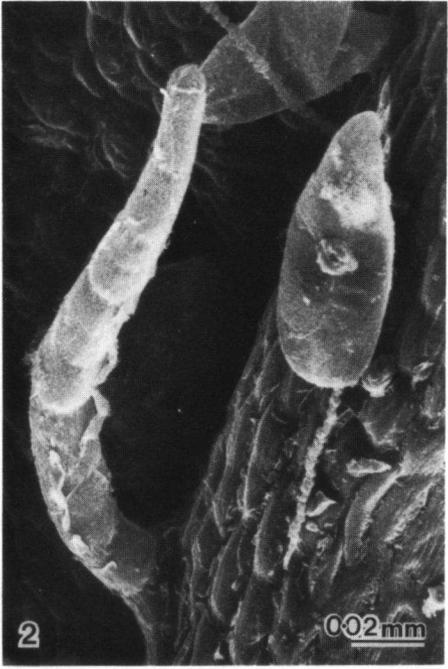
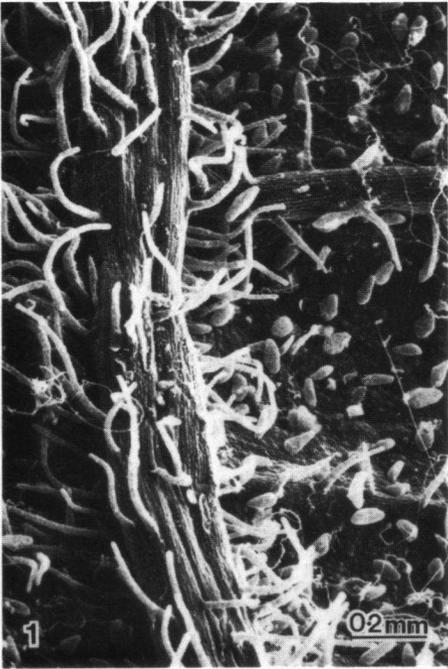
Cissus assamica (Laws.) Craib — India: Clarke 12385, 14202, 14209A, B; Griffith 389; Penang: Wallich 5990g; Indonesia: Elbert 4160, 4592.

Cissus aristata Blume — Philippines: Elmer 15588; Merrill 797 (*simplex*); Robinson s.n. (*adnata*); Borneo: Hallier 1033; Indonesia: Blume s.n.; Forbes 1036 (*assamica* var. *pilosissima*); Korthals s.n. (*pyrrhodasys*); Zollinger 1403 (*assamica* var. *pilosissima*); New Guinea: Brass 679 (*adnata*), 13064 (*assamica*); Kajewski 1811 (*assamica*); Schlechter 16832 (*adnata*); Vink BW 15216.

RESULTS AND DISCUSSION

Two basic type of trichomes were found: multicellular, uniseriate and unicellular, 2-armed. Different forms of the 2-armed hairs were found, which were consistent within a particular taxon. The pattern of distribution of the hairs on the leaves, stipules and the summit of the ovary permits easy recognition of these species. Whenever possible mature leaves should be used when making comparisons, although differences in the density of the trichomes will vary between specimens.

In *Cissus adnata* the trichomes on the lower surface are of two forms (figs. 1, 2); multicellular, uniseriate, unbranched hairs are confined predominately to the veins, whilst in the intercostal areas and to a lesser extent on the veins short, bulbous, unicellular, 2-armed hairs occur. *Cissus assamica* (fig. 3) has unicellular, 2-armed hairs which at maturity are usually only associated with the main veins. These arms are unequal in length, slightly twisted and often adpressed to the side of the vein. These hairs, which are sparsely distributed over the entire lower surface of the leaf when



young, may subsequently break off leaving a scar marking the point of attachment so that a very old leaf may be quite glabrous. In *C. aristata* (fig. 4) the 2-armed, much-twisted unicellular hairs are usually darker than in the preceding specimens and although the heaviest concentration is associated with the veins, they are distributed over the entire surface.

This information on the structure and distribution of the trichomes on the leaf, combined with their presence or absence on the stipules and ovary results in the clear distinction of these three taxa.

Readily observable differences between these species may be summarised as follows:

1. *Cissus adnata* — Leaf-base cordate; veins prominent. Trichomes on lower surface of the mature leaf are of two forms: multicellular, uniseriate, unbranched, predominately confined to the veins, and short unicellular, 2-armed hairs also present. Stipules glabrous, scarious. Summit of ovary pubescent.
2. *Cissus assamica* — Leaf-base somewhat cordate to rounded. Trichomes on lower surface sparse, pale, unicellular, 2-armed chiefly associated with the main veins. Stipules glabrous, scarious. Summit of ovary glabrous.
3. *Cissus aristata* — Leaf-base cordate. Trichomes on the lower surface, dark-coloured, unicellular, 2-armed, scattered over the entire surface sometimes dense. Stipules pubescent. Summit of ovary glabrous. Leaf often dries dark brown.

ACKNOWLEDGEMENTS

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Fig. 1–4. Indumentum on lower surface of the mature leaf, on and near the midrib. — 1: *Cissus adnata* Roxb., showing distribution of the hairs. — 2: *Ibid.*, showing a multicellular, uniseriate hair and a bulbous, unicellular, 2-armed hair. — 3: *C. assamica* (Laws.) Craib, showing unicellular 2-armed hairs associated with the midrib. — 4: *C. aristata* Blume, showing unicellular, 2-armed hairs with much twisted arms.