THE FLORAL ANATOMY OF THE RARE APOSTASIAS: 
APOSTASIA SPECIES

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ABSTRACT

Apostasia, one of the 3 genera of the interesting family Apostasiaceae, has altogether 4 species, but two of them A. parvula Schltr. and A. nipponica Masamune are of very limited distribution, the former being confined to certain parts of Borneo, and the latter being, endemic to Ryukyus. Of the two remaining species, A. wallichii R. Br. was studied by the present author earlier (Rao, 1969). This paper deals with the floral vasculature of A. odorata Bl., and makes a comparison with that of A. wallichii. Except for the fact that two of the petal traces bear the traces for the functional stamens, the former are unbranched. The overlapping margins of both sepals and petals are supplied by branching lateral traces of the sepal strands. There is a staminode which gets its vascular supply as a branch from one of the sepal traces. The androecium is represented by two functional stamens and a staminode. The latter belongs to the outer whorl while the stamens belong to the inner whorl of the androecium.

INTRODUCTION

Apostasia Bl. is one of the 3 genera of Apostasiaceae, a family of monocotyledons usually kept near the Orchidaceae. In this genus, the pedicels cannot be clearly distinguished externally from the inferior ovary. There are 3 sepals and 3 petals. The ovary is tricarpellary and trilocular, with many ovules on axile placentas. Above the ovary, there is a short column which bears at its upper end the constituent floral parts. There are two anterolateral functional stamens and an anterior staminode. For some length, the filaments are adnate to the style. Except for its tip portion which is free, the staminode is adnate to the style. The stamens become free at a much lower lever than the staminodal tip.
This genus has 4 species, of which *A. wallichii* R. Br. was studied by the author earlier (Rao, 1969). The present paper deals with the floral vasculature of *A. odorata* Bl., material of which was kindly supplied by Dr. de Vogel, the monographer of the family Apostasiaceae.

The customary methods of studying serial microtome sections and cleared entire flowers, were followed for this work.

**Observations**

The pedicel has 6 bundles of equal size which run into the ovary wall (Figs. 1 and 2). Three of these are sepal-carpellary dorsal cords running opposite the loculi. They represent the fusion product of a sepal median trace and the dorsal bundle of a carpel. The other 3 bundles run on the septal radii. In the basal part of the ovary, each of the latter sends into the axile zone a composite ventral bundle which divides into two ventral bundles of different adjacent carpels (Figs. 2 and 3). These bear placental branches which supply the ovules. In the ovuliferous zone of the ovary, the axile portion has a prominent canal in the centre (Fig. 3) but higher up, 3 strands of transmitting tissue make their appearance opposite the loculi. The ventral bundles are exhausted in supplying the ovules, and at this level, only the same 6 bundles that have originally entered the ovary wall remain (Fig. 4). In the column above the ovary, the 3 strands of transmitting tissue merge together to form a single strand that runs throughout the style.

Above the ovary, the 6 bundles start dividing, their branches merge with one another for a very short distance forming a thin, indefinite plexus, but definite bundles for the various floral parts emerge again. The 3 dorsal bundles of the carpels (marked ‘D’ in Fig. 5) separate from the sepal traces with which they were fused in the ovary region, and run inwards to take up a position just to the outside of the strands of transmitting tissue. The anterior sepal cord sends inwards a trace for the staminode (Staminodal trace is marked ‘S’ and the sepal trace is marked ‘K’ in Fig. 5). All the 3 sepal traces (marked ‘K’ in same figure) bear lateral branches which supply overlapping margins of both sepals and petals. The 3 bundles which were running on septal radii within the ovary wall alternate in position with the sepal traces. The posterior one of these is only a petal trace, running unbranched into a petal. The two antero-lateral ones are petal-stamen cords dividing into a petal trace (marked ‘C’ in Fig. 5) and a stamen trace (marked ‘A’ in same figure). In a transverse section through the upper end of the column one can thus see the sepal traces, their branches and the petal traces.
Fig. 1. Pyrrhotite, etched with chromic acid, exhibits monoclinic (darkly etched areas) and hexagonal (lightly etched areas) phases. Lamellae of monoclinic phase have different Orientations in different grains.

Fig. 2. Sphalerite (Sp) developed structure when etched with chromic acid but the associated Pyrrhotite grains (Po) are unaffected thus indicating their hexagonal nature.
Fig. 1-8, *Apostasia odorata*. Fig. 1. T.s. pedicel. Fig. 2. T.s. basal part of ovary. Fig. 3. T.s. ovary, placentiferous level. Fig. 4. T.s. ovary above the level of the placentas. Fig. 5. T.s. column above ovary. Fig. 6. T.s. of the structure formed by the fusion of the style, filaments of the functional stamens and the staminode. Fig. 7. T.s. flower at level of anthers, showing sepals, petals, two anthers and the style and staminode still fused together. Fig. 8. Staminode separate from the style. (Magnification: Fig. 7, × 25. All the rest, × 50.)

A, Trace of the functional stamen; C, Petal trace; D, Dorsal bundle of the carpel; K, Sepal trace; S, Trace of the staminode
as an outer ring, the two stamen traces and the staminodal trace on an inner circumference, and the 3 dorsal bundles of the carpels as an innermost ring. Although technically the staminodal trace should be on an outer circumference, than the one on which the staminal traces are present, this distinction cannot be usually made out in sections on account of a quick change in the positions of the traces. After all, in *Apostasia*, the functional stamens and the staminode, all become adnate to the style, coming to lie on the same circumference. At the upper end of the column, the sepals and petals separate from a central structure which represents the fusion products of the style, stamens and the staminode. On this structure, the filaments of the functional stamens appear as wings, while the staminode appears as a prominent ridge (Fig. 6). The vascular bundle of the staminode is almost as large as that of the stamens. Higher up, the two filaments, each bearing a large anther, separate from the style while the staminode continues to be attached to the style for a considerable distance upwards (Fig. 7). The tip of the staminode becomes free from the style (Fig. 8).

The midrib of the petals is a thick prominent ridge clearly demarcated from the lateral regions, while that of the sepals merely merges gradually into the marginal area (Fig. 7). Although de Vogel (1969) described both sepals and petals of this species as 5-nerved, the lateral veins sometimes branch once again, giving altogether 7 veins. But the vein near either margin is very small, and its presence cannot be detected by an external examination.

**DISCUSSION**

There are a few differences between the floral vasculature of *A. wallichii* and that of *A. odorata*. In both the species, the top of the pedicel has 6 bundles, but in *A. wallichii* they bear prominent but short inward branches near the base of the ovary. Clear-cut ventral bundles are also not recognizable in that species. In *A. odorata* there are no such inward branches, but prominent ventral bundles are seen. At the top of the ovary of *A. wallichii* the 6 bundles extend laterally, branch and fuse forming a prominent plexus which breaks up into (1) the 3 dorsal bundles of the carpels, (2) a middle ring of many strands, and (3) an outer ring of three sepal traces. Three bundles of the middle ring are petal traces while the rest supply overlapping margins of sepals and petals. The floral vasculature in *A. odorata* is basically similar, but the sepal traces, their branches, which supply the margins of sepals and petals, and the petal traces, are almost on the same circumference at the corresponding level. The origin and behaviour of
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the two stamen traces and the staminodal trace is identical in both the species. In *A. wallichii* the filaments of the functional stamens are fused with the style for a much greater length than in *A. odorata*.

It is noteworthy that in *Apostasia,* the petal traces are unbranched except for the fact that two of the petal strands bear each a staminal trace. The margins of the petals are vascularized by branches of the sepal traces.

The staminode of *Apostasia* is opposite the anterior sepal, and its trace is also fused at its base with the trace of that sepal. The two functional stamens are opposite the antero-lateral petals and their traces are also fused at the base with the traces of those petals. The bundle of the posterior petal does not bear any branch at all. Thus, the ancestral condition of the androecium in *Apostasia* must be of two whorls, with 3 members in each whorl. The outer whorl must be antesepalous while the inner one must be antepetalous. In the present day the outer whorl is represented by the staminode only, which is anterior in position. The inner whorl is represented by the two antero-lateral stamens only. There is no indication, either externally or internally, either of the two postero-lateral members of the outer whorl or of the posterior member of the inner whorl, of the ancestral androecium. There is absolutely no evidence for the conservatism of the vascular bundles in this case.

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**References**

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