

COMMENTS ON *ASCARINA ALTICOLA* SCHLECHTER

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Ascarina alticola Schlechter was contrasted with other species of the genus as being characterised by the possession of a brown-tomentose inflorescence and of a very large female flower (Schlechter, 1906). However, the author added a note of warning to the effect that since the male flower, in spite of ardent search, had not been found, the question still remains open whether here we are not dealing with a representative, perhaps to be credited to another genus. In the course of a taxonomic revision of the genus *Ascarina* Korst. (Chloranthaceae), which is under preparation, *A. alticola* was found to exhibit several significant characters besides those mentioned by Schlechter that lie clearly outside the limits of those possessed by the genus as a whole. Subsequent detailed anatomical studies of the xylem, node, leaf, and flower of this species have contributed additional information to substantiate Schlechter's doubts and also have provided valid arguments to exclude the species not only from the genus, but also from the family. A critical evaluation of the data on hand towards the true identity of the species in question is presented in this paper.

Schlechter recognised *A. alticola* on the basis of a herbarium specimen bearing No. 15326, collected by himself from Mount Humboldt in South-Bezirk, New Caledonia. A duplicate specimen bearing the same number and collector's name in the herbarium of the Arnold Arboretum, Harvard University, has formed the material for the present study.

VEGETATIVE CHARACTERS.

The conspicuously coriaceous leaves of *Ascarina alticola* are arranged on the stem in verticils or sub-verticils in contrast to the relatively thin leaves and decussate phyllotaxy of other species of *Ascarina*. The petiolar bases of opposite leaves in the latter category fuse with each other to form a vaginate structure sheathing the node; and denticular emergences of stipular nature arise from the free margin of the sheath. These features are absent in *A. alticola*, and the exstipular and clearly petiolate leaves are attached directly to the stem.

The stomata in the leaves of *A. alticola* are confined to the lower epidermis and are of the 'haplocheilic' type, i.e., each stoma is surrounded by four or five ordinary epidermal cells (Fig. 5). Although *A. alticola* resembles other species of *Ascarina* in these respects, the walls of the guard cells towards the mesophyll show a conspicuous thickening (Fig. 6), a feature that is absent in other species of *Ascarina*. The internal structure of the leaf of *A. alticola* reflects certain characteristics that recall relatively xerophytic modifications. Thus, the upper epidermis is covered over by a conspicuously thick cuticle; two or three well developed and compactly arranged layers of palisade cells are aligned beneath the epidermis; and, the mesophyll consists of small spherical cells, two or three layers next to the lower epidermis being arranged very compactly (Plate I, Fig. 4). In other species of *Ascarina*, the cuticular coating on the upper epidermis is very thin; a morphologically typical palisade layer is wanting, its place being occupied by loosely arranged, armed

parenchymatous cells; and, the mesophyll consists of irregularly shaped cells with conspicuous inter-cellular spaces. 'Ethereal oil cells' of the ranalian type that so characteristically occur in all species of *Ascarina* is totally absent in *A. alticola*.

The node of *A. alticola* is typically trilacunar, the median vascular strand of the leaf being larger than the laterals in contrast to the stereotyped situation in other species of *Ascarina*, where two strands of equal size are related to a single 'gap'.

The relatively thick bark of young twigs of *A. alticola* shows two distinct zones,—an outer, well-developed cork cylinder of radially seriate cells and an inner, more or less homogeneous appearing zone made up largely of parenchyma amidst which are scattered isolated sclereids and crystalliferous cells (Plate I, Fig. 3). The comparatively thin bark in corresponding samples of other species of *Ascarina* is characterised by the absence of cork formation and by the presence of sclerenchymatous sheaths confronting the fascicular parts of xylem; furthermore, the vascular rays undergo excessive widening in the bark, a feature that is wanting in *A. alticola*.

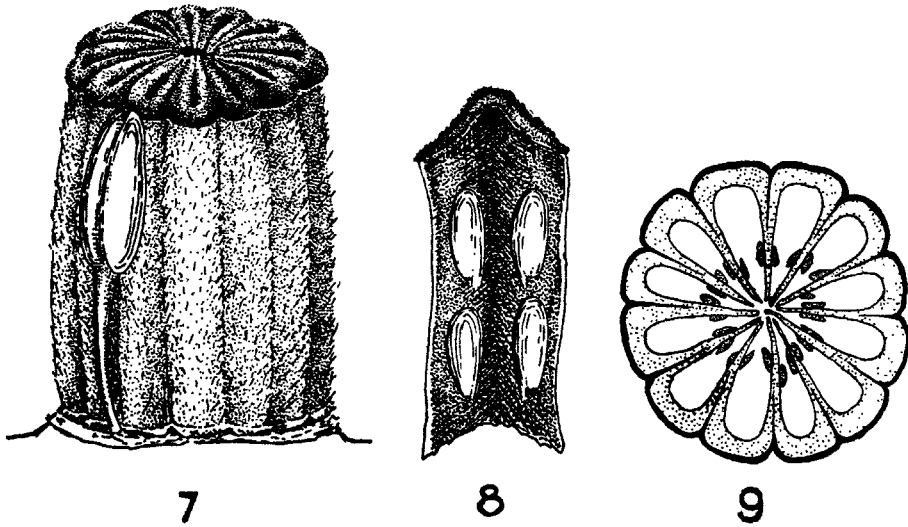
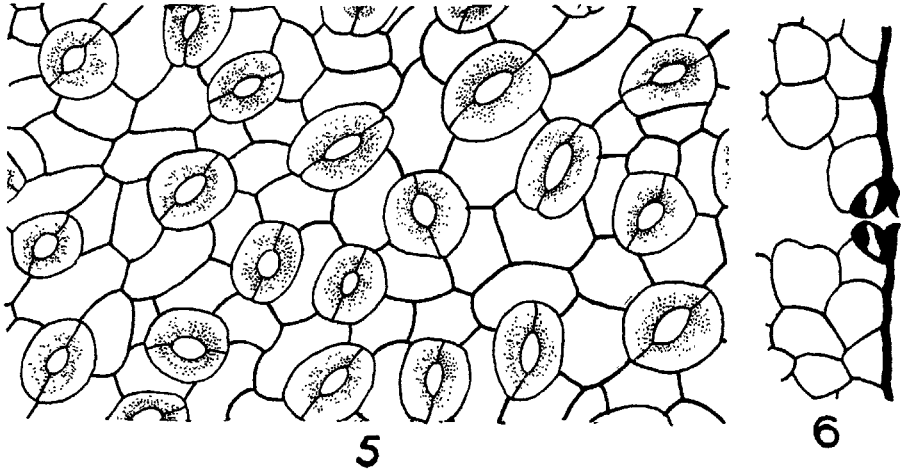
The early formed secondary xylem of *A. alticola* simulates in some points the situation seen in other species of the genus. The vessels are relatively long with steeply inclined perforated facets bearing numerous scalariform openings. However, the average number of bars in *A. alticola* is 50 whereas in other species of the genus it is 130. As seen in a transverse section, the wood is diffuse porous although at times the pores exhibit a tendency for arranging themselves in short radially oriented chains (Plate I, Fig. 1). The inter-vascular pitting in species of *Ascarina* and also in *A. alticola* fluctuates from scalariform and transitional stages to opposite and opposite arrangements; so also the vessel-ray and vessel-parenchyma pits. Species of *Ascarina* possess a heterogeneous type of ray structure, the multiseriate rays originating from the inter-fascicular parts, and uniseriate rays radiating from the fascicular parts. On the other hand, *A. alticola* appears to exhibit a conspicuous tendency towards the total elimination of the multiseriate rays leaving only the uniseriate ones (Plate I, Fig. 1). Thus, as seen in tangential sections (Plate I, Fig. 2) the wood contains uniseriate rays alone, although a few of them may be partly biseriate. In the older wood specimens of *Ascarina* the multiseriate rays (10 to 12 cells wide) predominate due partly to the widening of the primary uniseriate rays and partly to the splitting of the primary multiseriate rays into shorter ones; the secondary rays also exhibit a similar ontogenetic modification. In contrast, the mature wood of *A. alticola* maintains a dominating proportion of uniseriate rays, the multiseriate ones (3 to 4 cells wide) occurring rather occasionally. As in *Ascarina*, the xylery parenchyma in *A. alticola* is apotracheal and is distributed in diffuse-in-aggregate patterns as seen in transverse sections (Plate I, Fig. 1). The imperforate tracheary cells of species of *Ascarina*, as also of *A. alticola*, possess relatively thick walls and the pitting shows transitions from large oval or circular bordered pits with included apertures to those with reduced borders with slightly extended apertures.

FLORAL CHARACTERS.

The inflorescence and floral parts of the genus *Ascarina* are glabrous, whereas in *A. alticola* they are covered with a brown tomentum, the hairs being unicellular. In *Ascarina* the plants are dioecious. Schlechter presumed that *A. alticola* also had the same type of sex expression, but a careful re-examination has revealed that this species bears bisexual flowers.

In *Ascarina* the flowers are completely devoid of a perianth, the monocarpellary gynoecium or the single stamen being subtended directly by one or three bracts depending upon the particular species in question; the ovary is globose or ovoid containing a single orthotropous ovule; the sessile stigma is unequally two-lipped, the adaxial lip protuberant, being surrounded at its base by the crescent-

shaped abaxial lip; the stamen is somewhat cylindrical, sessile, the 'connective' slightly projecting distally beyond the thecae in the form of a blunt, dorsiventrally flattened cone. The pollen grains are typically monocolpate. *A. alticola* presents totally contrasting characters in all these respects. The flower has a perianth whorl of two imbricate lobes that are, however, caducous, which feature obviously led Schlechter to use the designation 'floribus femineis nudis'. The androecium consists of a whorl of 8-12 stamens. The stamen shows a clear distinction into



TEXT-FIGS. 5-9.

'filament' and anther, the latter being basifixed on the former; and the 'connective' does not project beyond the thecae (Fig. 7). The pollen grains are typically tricolpate. The gynoecium is barrel-shaped (Fig. 7) and consists of 8-12 conduplicate carpels, the individual carpels conjoined laterally (Fig. 9). The true margins of carpels appear to be fused with one another and also perhaps with the axial tissue in part at lower levels, but are almost free at the ovule-bearing part (Fig. 9) and

apex. Each carpel lodges four anatropous ovules (Fig. 8). The stigma is sessile and conduplicate.

DISCUSSION.

It is evident from the preceding comparison of morphological and anatomical characters of the species of *Ascarina* on the one hand, and of *Ascarina alticola* on the other, that the two categories exhibit remarkably contrasting sets of characters that are indicative of highly divergent trends in evolutionary modifications. A summation of these characters clearly negate the inclusion of *A. alticola* in the genus *Ascarina* Forst. Furthermore, data (unpublished) obtained through comparative morphological and anatomical studies on the Chloranthaceae as a whole demonstrate that *A. alticola* does not bear any relationship to this family either. What then could be the probable affinities of *A. alticola* ?

The combination of exomorphic and anatomical characters of *A. alticola* appears to suggest a general relationship to certain of the trilacunar families included in the order Parietales as conceived in the Englerian system. In fact, the plant bears in every detail unmistakable duplication of the anatomical features found in *Paracryphia* (Baker, 1921) of the Eucryphiaceae; and the morphological characters of *A. alticola* compare with those of *Paracryphia* to such a close degree that one is led to merge the former species in the latter genus. It is a matter of gratification to a student of comparative anatomy to find that a leading plant taxonomist, Dr. van Steenis, working independently, has arrived at a similar conclusion very recently (1950) and has proposed the necessary new combination, *Paracryphia alticola* (Schlechter) Steen.

In his 'Revision of the Eucryphiaceae' Bausch (1938) questions the inclusion of *Paracryphia* in this family. According to him, *Paracryphia* differs from *Eucryphia* in the 'subcalyptate, caducous perianth segments, character of inflorescence, sessile stigmas, small number of stamens, absence of the shortly tubular effigurations of the thalamus, verticillate leaves, uniseriate ovules, etc.' He furthermore suggests that 'possible allies could be the Winteraceae (*Drimys*, *Illicium*) and Trochodendraceae'. It is yet to be determined through intensive comparative investigations of the various tissues and structures of the representatives of the Eucryphiaceae to realise how far these dissimilar characters between *Paracryphia* and *Eucryphia* are of significance in excluding the former genus from the family. But with reference to the suggested alliance of *Paracryphia* with either the Winteraceae, Illiciaceae, or Trochodendraceae, it must be plainly stated that the information on hand about these families (Bailey and Nast, 1945a, b; 1948; Nast and Bailey, 1945) only serves to negate such relationship quite emphatically.

SUMMARY.

A critical re-examination of *Ascarina alticola* Schlechter from anatomical and morphological points of view and a comparison of the data obtained therefrom with other species of the genus *Ascarina* and also with other representatives of the Chloranthaceae indicates that the species under consideration exhibits numerous significant differences that necessitate its exclusion not only from the genus *Ascarina*, but also from the family. On the other hand, the species proves to be congeneric with *Paracryphia* of the Eucryphiaceae.

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LEGEND TO FIGURES.

PLATE I. *Paracryphia alticola* (= *Ascarina alticola*) Fig. 1. Transection of young secondary xylem, $\times 176$. Fig. 2. Tangi-longisection of the same, $\times 84$. Fig. 3. Transection of young bark, $\times 53$. Fig. 4. Transection of leaf, $\times 104$.

TEXT-FIGURES 5-9. *Paracryphia alticola* (= *Ascarina alticola*) Fig. 5. Surface view of lower epidermis of leaf showing the nature and distribution of stomata, $\times 180$. Fig. 6. Transection of a stoma, $\times 180$. Fig. 7. Gynoecium after removal of perianth and all stamens excepting one, $\times 50$. Fig. 8. An isolated carpel split open along the ventral 'suture' to expose the interior showing four ovules, $\times 50$. Fig. 9. Transection of gynoecium at the level of ovule-bearing region, $\times 50$.

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