

THE SYSTEMATIC POSITION OF THE GENUS BOSEA L. (AMARANTHACEAE)

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RESUMEN

Este estudio considera la posición taxonómica del discutido género *Bosea* L. (Amaranthaceae) usando datos palinológicos y anatómicos. Como quiera que la morfología del polen y la anatomía del tallo de *Bosea* así como su inflorescencia y morfología floral son típicas de la familia Amaranthaceae, la reciente propuesta de separarla en una nueva familia monotípica Boseaceae no parece tener ningún base fundamental taxonómicamente y por consiguiente debiera ser rechazada.

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INTRODUCTION

The systematic position of the small, disjunctly distributed, woody genus *Bosea* L. originally caused taxonomists some problems and various 19th century botanists placed it in different families (Salsolaceae, Chenopodiaceae, Amaranthaceae). Its position was reviewed in 1893 by Schinz & Autran who considered it to be a member of the Amaranthaceae where it had first been placed by Bentham & Hooker (1880). Later Schinz (1934) and Airy-Shaw (1973) have confirmed this view of its position.

In 1972, however, Kunkel proposed the segregation of *Bosea* into a separate and new family, Boseaceae, but did not, at the time, give any taxonomic reasons for doing so. The proposal was surprisi-

singly taken up by Eriksson, Hansen & Sunding (1974) in their important new checklist of the vascular plants of the Macaronesian region. Later Kunkel (1975) returned to the theme of the family Boseaceae thus "this family was proposed by the author (*Monogr. Biol. Canar.* 3: 31; 1972) but was never validly published because of certain disagreement with colleagues (sic!) especially concerning other genera to be placed within this segregated family. Being convinced that this genus (*Bosea*) is nearer related to the Anacardiaceae than to (as currently placed) the Amaranthaceae, I wish some specialist would take up this matter for further discussion". Again, apart from the vague reference to a relationship with the family Anacardiaceae, any sort of reason for the separation of the family Boseaceae is not, unfortunately, presented.

We are currently, therefore, left with the very unsatisfactory situation that an invalidly published new family name proposed without any indication of the taxonomic reason for its separation has been taken up in a new floristic publication of considerable importance. The only information which might possibly be considered as being of taxonomic value, the suggested relationship with the Anacardiaceae, implies a major shift in the position of the genus from the Order Caryophyllales sub-class Caryophyllidae (Takhtajan 1969), where it has always been undisputedly placed, to the Order Rurales sub-class Rosidae. Because of the implications of this interesting proposed change a study has been made of the relationships of the genus *Bosea*, especially the Canarian endemic type species *Bosea yervamora* L., with other members of the family Amaranthaceae and also with members of the Anacardiaceae.

MATERIALS AND METHODS

All the material studied has been obtained from the living plant collections cultivated in the Jardín Botánico Canario "Viera y Clavijo". Fresh pollen for scanning electron microscopy was prepared by coating in a Polaron sputter coater and examined by means of an ISI Mini-Sem microscope. Anatomical sections were cut free-hand and stained using standard techniques.

POLLEN RELATIONSHIPS

Both Bentham & Hooker (1880) and Schinz (1934), on traditional morphological grounds, placed *Bosea* in the Amaranthaceae near to the type genus *Amaranthus*, Bentham & Hooker in their *Euamarantheae* and Schinz in his *Amaranthoideae*.

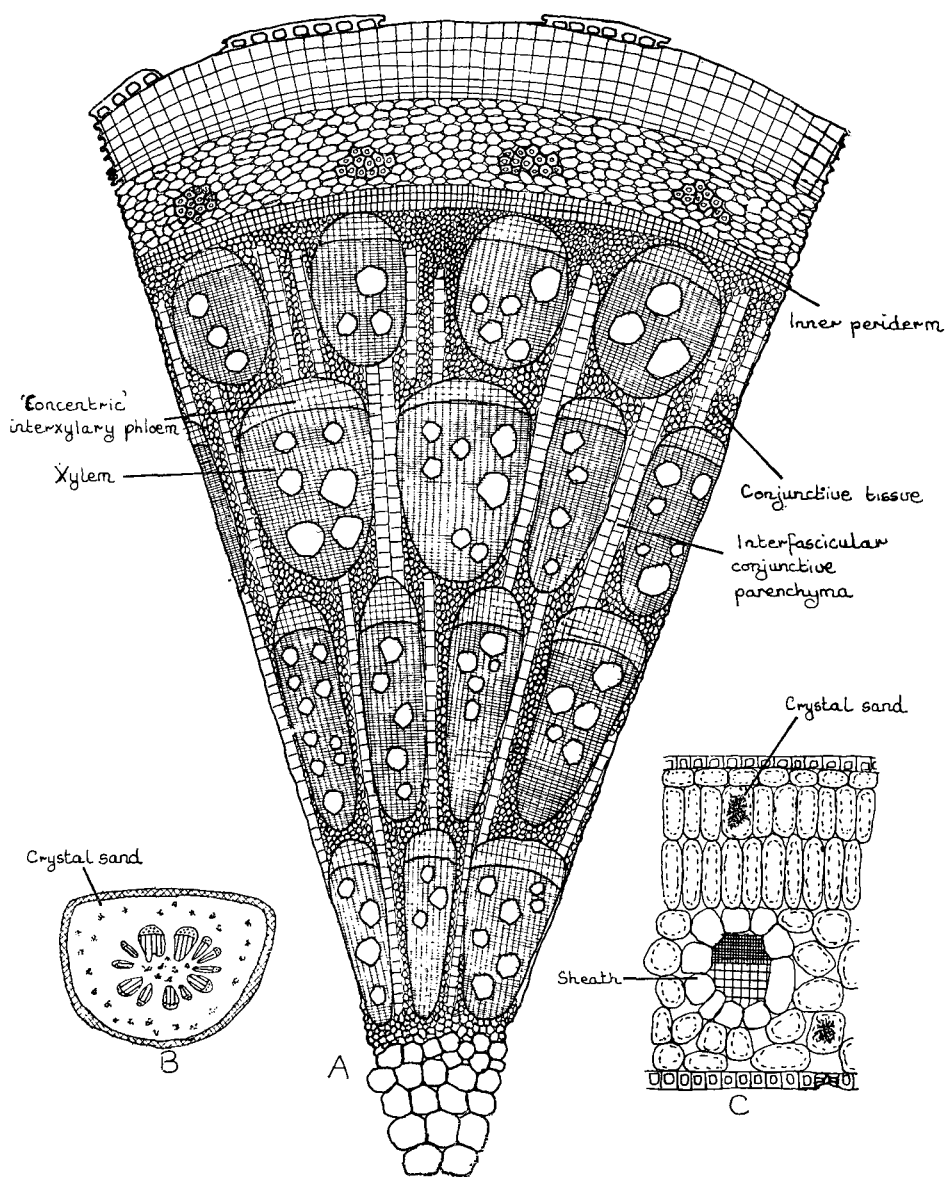


Fig. 1. Anatomical features of *Bosea yervamora* L. A. T.S. axis, showing anomalous secondary thickening. B. TS. mid-region of petiole, showing cylinder of separate bundles. C. TS. Leaf lamina, showing sheath of clear cells surrounding the vein.

The pollen morphology of *Amaranthaceae* has been described in considerable detail by Vishnu-Mittre (1963) and more recently numerous African members of the family have been studied by Riollot & Bonnefille (1976). In the present study the pollen of *Bosea yervamora* has, by means of SEM surveys, been compared with *Amaranthus* and *Achyranthes* and also with the description and illustrations of other genera given by Riollot & Bonnefille (1976). Results show that *Bosea* has the "Amaranthus-type" of pollen grain described by Erdtman (1971), that is spheroidal polyforate grains with a punctate-gillate sexine covered with scattered minute spinules. The principal difference between pollen grains of *Bosea* and those of *Amaranthus* is that the former have fewer foramina (Pl. I, 1-3). Very similar pollen grains also occur throughout the genera *Aerva* and *Celosia*.

The pollen morphology of the *Anacardiaceae* is considerably different. Erdtman (1971) comments on the very distinctive pollen of the genus *Pistacia* which he refers to as the "Pistacia-type" which is 6-7 aperturate or oligoforaminoidate with a coarsely reticulate sexine (Pl. I; 5). Other members of the family such as *Rhus* and *Schinus* (Pl. I; 6) have spheroidal to prolate, 3-colpate grains usually with longitudinal ora and a coarsely reticulate or striate sexine.

ANATOMICAL RELATIONSHIPS

The *Amaranthaceae* has several anatomical peculiarities which are of importance in considering whether or not the genus *Bosea* should be included in the family. The main ones are the anomalous growth in thickness in the axis which takes place by the development of a succession of collateral vascular bundles from rings or arcs of secondary meristematic tissue in the pericycle (Metcalf & Chalk, 1950) and the *Amaranthaceous* characteristic of a sheath of enlarged clear parenchymatous cells in the leaf lamina surrounding the vein.

Metcalf & Chalk (1950) clearly demonstrate that *Bosea* has the anomalous thickening character and this is confirmed in the present study (Fig. IA). The sheath of parenchymatous cells encircling the vascular tissue of leaf-veins does not appear to have been previously reported from *Bosea* but as shown in (Fig. IC) it is obviously present.

Other features of the general anatomy of *Bosea* help to confirm its affinity with other members of the Family *Amaranthaceae* including crystals secreted in the form of sand (Fig. I, B & C.), sub-epidermal origin of cork, the pericycle with small strands of fibres, absence of rays in the wood, vessel without spiral thickenings, trila-

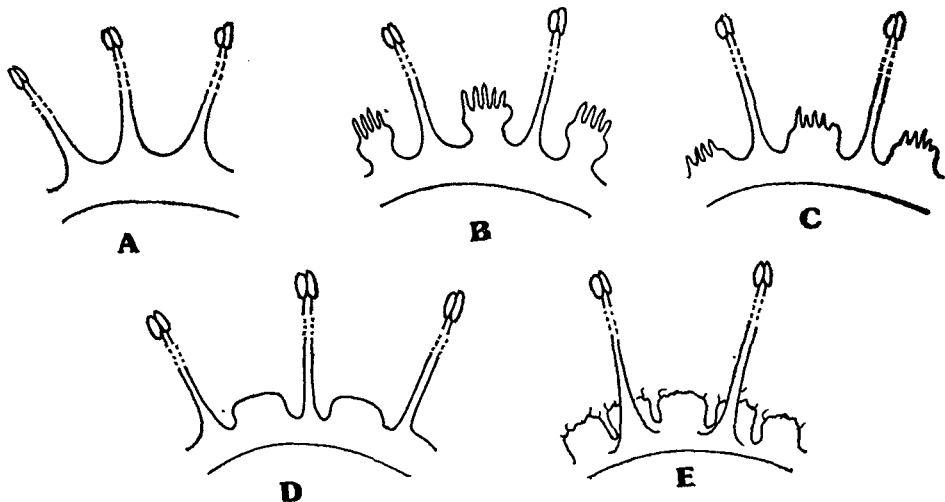


Fig. 2. Basal disc between filaments in various Amaranthaceae. o. *Alternanthera nodiflora*, b. *Achyranthes indica*, c. *Achyranthes aspera*, d. *Bosea cypria*, e. *Bosea yeravamora*.

cunar-pentalacunar nodes etc. In contrast, the presence of most of these characters in *Bosea* indicate little affinity with the family Anacardiaceae which has normal secondary thickening, resin canals in the phloem (absent in *Bosea*), a superficial origin for the cork layer, rays in the wood, vessels sometimes with spiral thickening, unilacunar nodes etc.

These is, therefore, no anatomical evidence for the separation of *Bosea* into a new family outside the Amaranthaceae.

CONCLUSIONS

The taxonomic position assigned by Bentham & Hooker (1880) to the genus *Bosea* on the basis of floral morphology and filaments with a basal cup or united by a crenate membrane (Fig 2) and the presence of inflorescence bracteoles is clearly confirmed by anatomical and palynological evidence. There is, however, no evidence to support the recent proposal to separate *Bosea* from the Amaranthaceae and create a new family Boseaceae and also absolutely no evidence in favour of the transfer of *Bosea* from the Caryophyllales to a position near the Anacardiaceae in the Rutales.

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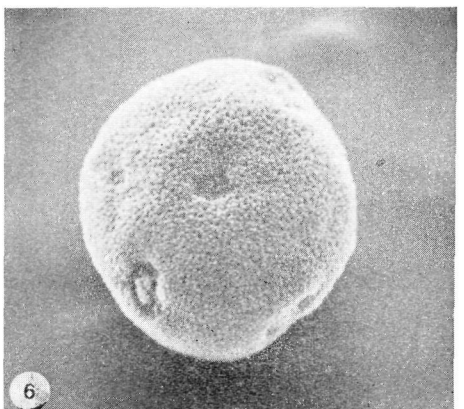
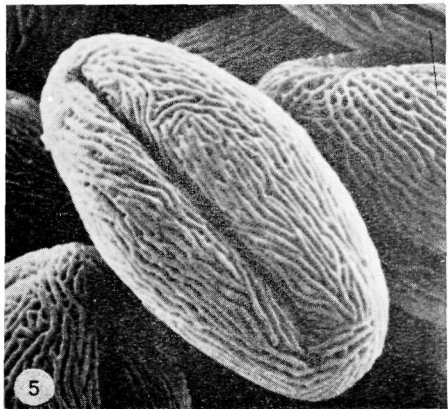
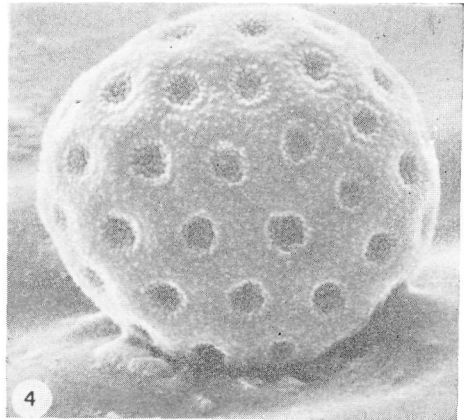
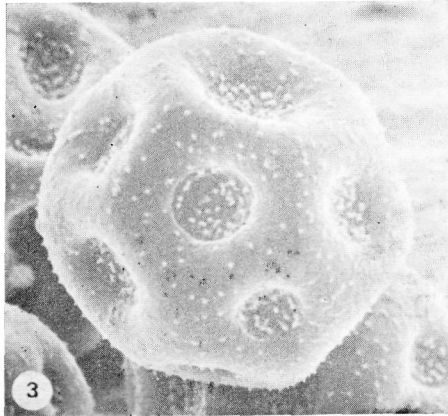
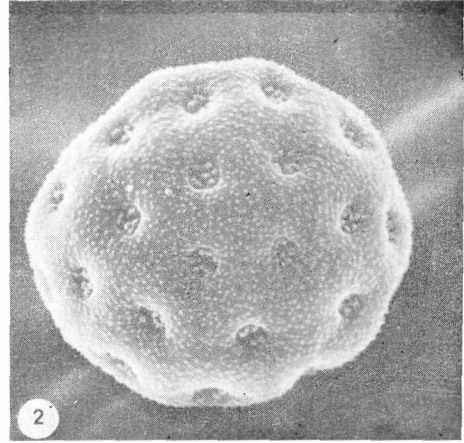
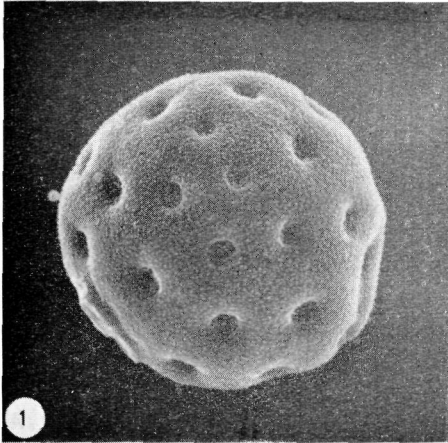


Plate I. Pollen grains of Amaranthaceae: 1. *Amaranthus lividus*, 2. *Amaranthus hybridus*, 3. *Bosea yervamora*, 4. *Achyranthes aspera*, and Anacardiaceae: 5. *Schinus molle*, 6. *Pistacia lentiscus*.