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New cycadalean leaves from the Anfiteatro de Ticó Formation, Early Aptian, Patagonia, Argentina

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Abstract

Two new species of cycadalean leaves belonging to *Mesosingeria* and *Ticoa* are described using conventional light and electron microscopy techniques (LM, SEM and TEM). The cuticles were found in the Anfiteatro de Ticó Formation, Baqueró Group (Early Aptian) of Santa Cruz Province, Argentina. Cycadalean leaves in this formation are represented by six genera: *Almargemia* Florin, *Mesodescolea* Archangelsky, *Mesosingeria* Archangelsky, *Pseudoctenis* Seward, *Sueria* Menéndez and *Ticoa* Archangelsky. *Mesosingeria oblonga* sp. nov. and *Ticoa lanceolata* sp. nov. extend the list of species represented. Comparison of all described cycadalean species found in this unit indicates that species are segregated by broad differences in the anatomy of trichomes, storage cells, stomata and epistomatal chamber protections, together with their density and distribution. However, the ultrastructural characters of the leaf cuticles are very similar, only differing in their thickness.

Keywords: Cycadales; Cuticles; Early Aptian; Anfiteatro de Ticó Formation; Santa Cruz Province; Argentina

1. Introduction

The Cycadales include both living and fossil species whose origin can be traced back to the Late Carboniferous. They reached maximum diversity during the Mesozoic. There are 300 extant cycad species in 11 genera (Walters et al., 2004). The Cycadales had a worldwide distribution in the Mesozoic. In Argentina they are well represented by fossil leaves, microsporophylls and stems. However, modern cycads are restricted to South Africa, India, Japan, Australia, Mexico, Central America and some northern regions of South America.

Eight genera of cycadalean leaves are known from Triassic–Cretaceous sediments of Argentina: *Almargemia* Florin, 1933, *Ctenis* Lindley and Hutton, 1834, *Kurtziana* Frenguelli, 1942, *Mesodescolea* Archangelsky, 1963a, *Mesosingeria* Archangelsky, 1963a, *Pseudoctenis* Seward, 1911, *Sueria* Menéndez, 1965 and *Ticoa* Archangelsky, 1963a. Six of these have been recorded from the Cretaceous Baqueró Group, viz. *Almargemia*, *Mesodescolea*, *Mesosingeria*, *Pseudoctenis*, *Sueria* and *Ticoa*.

In the 1960s, Archangelsky (1963a,b, 1966, 1967) and Menéndez (1965) first described cycadalean leaves from this group using light microscopy and established *Mesodescolea*, *Mesosingeria* and *Ticoa* (Archangelsky, 1963a), and *Sueria* (Menéndez, 1965). In 1972, Archangelsky and Baldoni described two new species of *Pseudoctenis* using the new technique of scanning electron microscopy. In the past two decades Archangelsky et al. (1986), Artabe and Archangelsky (1992), A. Archangelsky et al. (1995) and Villar de Seoane

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(1997) have used transmission electron microscopy in the study of several species (Fig. 1).

This paper describes the cuticle of two new species of *Mesosingeria* and *Ticoa* using light microscopy (LM), and scanning and transmission electron microscopy (SEM and TEM).

2. Material and methods

The material was recovered from two exposures of the Anfiteatro de Ticó Formation: Estancia Bajo Grande and Anfiteatro de Ticó. This formation is exposed at 48°30′33″S and 69°14′11″W. It belongs to the Baqueró Group (Cladera et al., 2002) that crops out in the centre of the Deseado Massif, Santa Cruz Province, and is Early Aptian in age (120 Ma; Archangelsky, 1967).

The specimens are very well preserved. Cuticular fragments were prepared for both light and electron microscopy. The material was easily separated from the matrix and cleaned with dilute sodium hypochlorite. The preparations were mounted in glycerine jelly for observation by LM, or directly on circular stubs and coated with gold–palladium for SEM. Observations were made on a Philips XL30 TMP at the Electron Microscopy Service of the Argentine Museum of Natural Sciences "Bernardino Rivadavia". For TEM the cuticle fragments were treated with OsO_4 and embedded in Spurr low viscosity resin (Spurr, 1969). Transverse sections (TSs) of the cuticles were cut with a diamond knife on an SORVAL manual ultramicrotome, and mounted on single hole grids coated with Formvar, stained with $KMnO_4$ (5–10 min) and Uranyl acetate (30 s). Observations were made on a Zeiss EM 109 microscope at the Electron Microscopy Service of the Cellular Biology Department, Faculty of Medicine, Buenos Aires University.

The specimens are deposited in the Palaeobotanical Collection of the Argentine Museum of Natural Sciences "Bernardino Rivadavia" (BA Pb). The terminology of Holloway (1982) and Lyshede (1978, 1982) was used with reference to the ultrastructural analysis.

3. Systematic palaeontology

Order: Cycadales
Genus *Mesosingeria* Archangelsky, 1963a

Type species. *Mesosingeria coriacea* Archangelsky, 1963a, pp. 62–65, pl. 3, fig. 10; pl. 5, figs. 22, 23; text-figs. 29–33, 37, 38; Lower Cretaceous, Baqueró Group.

Mesosingeria oblonga sp. nov.
Figs. 2A–F, 3A–D

Derivation of name. Refers to the oblong shape of the pinnule.

Holotype. BA Pb 12921; BA Pb Pm 463; BA Pb MEB 215; BA Pb MET 211.

Type locality and stratigraphic horizon. Estancia Bajo Grande, Santa Cruz Province, Argentina; Anfiteatro de Ticó Formation, Baqueró Group, Early Aptian.

Diagnosis. Pinnate leaf. Oblong, alternate pinnules 0.9 cm long and 0.4 cm wide, with rounded apex, entire margins and narrow base; 7–8 veins, central veins forking once. Thick cuticle. Adaxial epidermis with rectangular cells. Abaxial epidermis with rectangular to

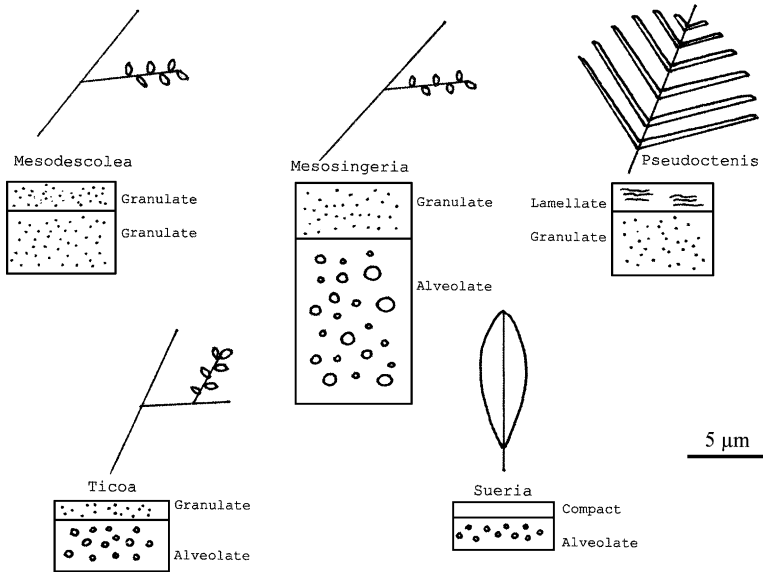

Fig. 1. Schematic representation of the morphology and cuticular membrane of cycadalean leaves from the Baqueró Group.