

Exine structure in *Dasyphyllum brasiliense* (Spreng.) Cabrera (*Barnadesioideae* - *Asteraceae*): aspects of development for identifying the cavea

Bruna Palese Thies Lopes & João Marcelo Santos de Oliveira

Universidade Federal de Santa Maria, Departamento de Biologia, Avenida Roraima, 1000, CEP 97105-900, Santa Maria, Rio Grande do Sul, Brasil. brpalese@gmail.com

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ABSTRACT – Based on observations under light microscopy, the pollen grains in *Dasyphyllum brasiliense* (Spreng.) Cabrera were found to be tricolporate, with intercolpar depressions, a thick exine, microechinate and caveae. The cavea is identified when the ectexine pulls away from the footlayer, which depends on the pollen grain's stage of development or its degree of hydration, both related to changes in volume. Among the four species of *Dasyphyllum* that occur in Rio Grande do Sul, only *D. brasiliense* has caveae.

Key words: development, sporoderm, exine, pollen grain, taxonomy

RESUMO – **Estrutura da exina em *Dasyphyllum brasiliense* (Spreng.) Cabrera (*Barnadesioideae* - *Asteraceae*): aspectos do desenvolvimento para identificação da cava.** A partir da observação à microscopia de luz, constatou-se que os grãos de pólen em *Dasyphyllum brasiliense* (Spreng.) Cabrera são tricolporados, possuem depressões intercolpares, exina espessa, microequinada e cavada. A cava é identificada quando a ectexina afasta-se da camada basal, o que depende da fase do desenvolvimento em que o grão de pólen encontra-se ou do seu grau de hidratação, ambos relacionados a mudanças de volume. Dentre as quatro espécies de *Dasyphyllum* que ocorrem no Rio Grande do Sul, apenas *D. brasiliense* possui cavas.

Palavras-chave: desenvolvimento, esporoderme, exina, grão de pólen, taxonomia

INTRODUCTION

Dasyphyllum brasiliense (Spreng.) Cabrera is a scandent bush that occurs in Paraguay, the far North of Argentina and in southern Brazil (Cabrera 1959). In southern Brazil, it occurs in Rio Grande do Sul, being found in the regions of Alto Uruguai, Depressão Central, Missões and Planalto Médio (Mondin & Baptista 1996). There are 40 species of *Dasyphyllum*, 23 of them occurring in Brazil, among which four species occur in Rio Grande do Sul; *D. brasiliense*, *D. spinescens* (Less.) Cabrera, *D. synacanthum* (Baker) Cabr. and *D. tomentosum* (Spreng.) Cabr. (Cabrera 1959; Mondin & Baptista 1996). *Dasyphyllum* is one of nine genera of the

Barnadesioideae subfamily and is considered the most basal in *Asteraceae* (Stuessy *et al.* 2009).

The pollen grains in *Asteraceae* are usually tricolpate or triporate, having a thick exine, generally with echinate ornamentation, and may develop caveae (Cancelli *et al.* 2005; Skvarla *et al.* 1977; Salgado-Labouriau 1983). Urtubey & Tellería (1998) reported the pollen grains in *Barnadesioideae* to be tricolporate, with or without suprategal elements. In *Dasyphyllum*, the pollen grain may present intercolpar depressions, microechinate suprategal ornamentation, and, in addition, caveae are often present (Cabrera 1959; Cancelli *et al.* 2010, Skvarla *et al.* 1977, Urtubey & Tellería 1998). Cancelli *et al.* (2010) described palynological characteristics

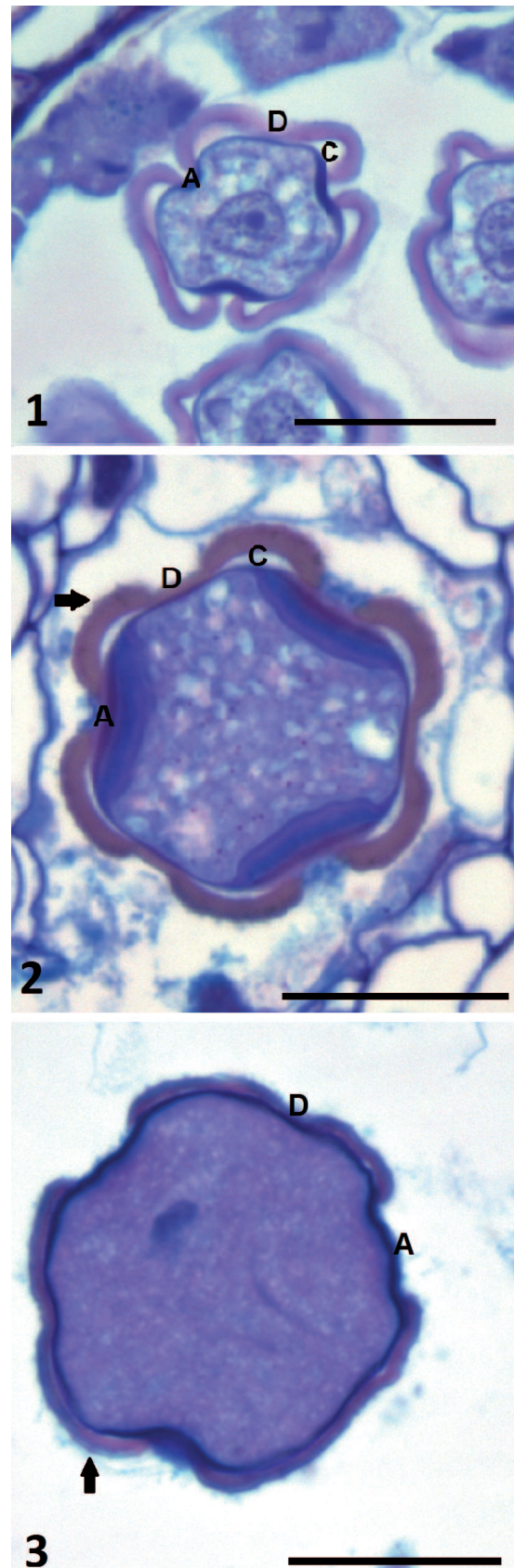
of *Dasyphyllum* species that occur in Rio Grande do Sul, except for *D. brasiliense*. The palynological characteristics among these species are very similar, except for the variable stratification of the exine and the occurrence of caveae (Cancelli *et al.* 2010, Urtubey & Tellería 1998), which is controversial because some authors have reported the presence of caveae, in *D. spinescens*, *D. synacanthum* and *D. tomentosum* (Urtubey & Tellería 1998), while others have reported these species to be non-caveate (Cancelli *et al.* 2010). Thus, the present study aims to present the general characteristics of the exine and, especially, to demonstrate the occurrence of caveae in *D. brasiliense*, as well as to discuss some developmental aspects that interfere in its observation.

MATERIAL AND METHODS

Inflorescences of *D. brasiliense* were collected in the city of São Pedro do Sul, RS, Brazil. The plant was deposited in the SMDB Herbarium, under registration number 12957. The flowers were fixed in a solution with 1% glutaraldehyde and 4% formaldehyde, in sodium phosphate buffer 0.1M pH 7.2 (McDowell & Trump 1976). Dehydration and embedding were performed in HEMA according to Hayat (1970). Sections were made in a Leica RM2245 rotary microtome, at a thickness of 3 μ m. Periodic Acid and Schiff reactive combined with aqueous Astra Blue and aqueous Basic Fuchsin were used for stain, according to Dettke & Santos (2011). The histological analysis was performed under a Leica DM2000 light microscope under magnification of 1000 x, followed by photomicrographic record using a Leica DFC 295 digital camera. The palynological terminology used is in accordance with Punt *et al.* (2007). The photomicrographs of pollen grains were presented as were analyzed in palynological slides.

RESULTS AND DISCUSSION

The pollen grains in *Dasyphyllum brasiliense* are tricolporate, with depressions in the intercolpium and an exine of approximately 2.5 μ m thickness, with microechinate suprategular ornamentation and six caveae (Figs.1-3). The caveae develop between the apertures and intercolpar depressions (Figs.1, 2). The appropriate phases for identifying the caveae are at the end of sporogenesis (Fig. 1) and the beginning of gametogenesis (Fig. 2), or when the pollen grains are dehydrated. During pollen presentation, the



Figs. 1-3. Light microscopy of pollen grains of *Dasyphyllum brasiliense* at different phases of development. **1.** Sporogenesis phase; **2.** Gametogenesis phase; **3.** Hydrated pollen grain in the first pollen presentation. C: cavea; D: intercolpar depression; A: aperture; Arrows: spinules. Bars = 20 μ m.

caveae are not observed or are difficult to observe (Fig. 3). The interpretation of the caveae depends on the developmental phase of the pollen grain and on its degree of hydration, since both factors imply variations in volume which lead to harmomegathy and, consequently, to variations in cavea expansion. The observations of this study are in accordance with Blackmore *et al.* (1984). Thus, under these conditions it is observed that the ectexine moves away from the footlayer, forming the cavity that constitutes the cavea (Figs. 1, 2).

The characteristics of this study are in accordance with previous descriptions for *Asteraceae*, especially for *Barnadesioideae* and *Dasyphyllum* (Cabrera 1959, Cancelli *et al.* 2005, 2010, Salgado-Labouriau 1983, Skvarla *et al.* 1977, Urtubey & Tellería 1998). However, the presence of caveae in *Dasyphyllum brasiliense* is in contrast to that found in the other three species of the genus that occur in Rio Grande do Sul, which do not present caveae (Cancelli *et al.* 2010). Considering the results of the present study, it would be important to analyze different stages of pollen development in the other three species of *Dasyphyllum* occurring in southern Brazil.

As there are only four species of *Dasyphyllum* in Rio Grande do Sul which are *D. brasiliense*, *D. spinescens*, *D. synacanthum* and *D. tomentosum* (Cabrera 1959, Mondin & Baptista 1996), the presence of caveae is important for the characterization and identification of *Dasyphyllum brasiliense*.

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