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Embryological Study of *Senecio ambiguus* and *S. gibbosus (Asteraceae)*

By

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With 3 Figures on 1 Plate

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Summary

GRAMUGLIO G., ARENA M., VILLARI R. & ROSSITTO M. 1983. Embryological study of *Senecio ambiguus* and *S. gibbosus* (*Asteraceae*). — Phyton (Austria) 23 (1): 39—42, 3 figures. — English with German summary.

Embryological observations on *Senecio ambiguus* (BIV.) DC. and *S. gibbosus* (GUSS.) DC. (*S.* sect. *Incanae*) are reported. The development of the embryo sac in the two species follows the *Polygonum* type. The gametophyte in *S. gibbosus* develops from the chalazal megaspore, while in *S. ambiguus* it can develop from one of the four megaspores. The synergids of *S. ambiguus* have a filiform apparatus and an indentation. Polyantipody is present: the number of cells increases to 6 in *S. gibbosus* and to 12 in *S. ambiguus*. The hypostase is present.

Zusammenfassung

GRAMUGLIO G., ARENA M., VILLARI R. & ROSSITTO M. 1983. Embryologische Studien an *Senecio ambiguus* und *S. gibbosus* (*Asteraceae*). — Phyton (Austria) 23 (1): 39—42, 3 Abbildungen. — Englisch mit deutscher Zusammenfassung.

Die Embryosackentwicklung bei *Senecio ambiguus* (BIV.) DC. und *S. gibbosus* (GUSS.) DC (*S.* sect. *Incanae*) folgt dem *Polygonum*-Typus. Der Gametophyt entwickelt sich bei *S. gibbosus* aus der chalazalen Megaspore, während er bei *S. ambiguus* aus einer beliebigen der 4 Megasporen entstehen kann. Die Synergiden der letztgenannten Art besitzen einen Fadenapparat und eine Einschnürung. Die Antipodenzellen werden vermehrt; ihre Zahl

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steigt bis auf 6 bei *S. gibbosus*, bis auf 12 bei *S. ambiguus*. Eine Hypostase ist im Nuzellus vorhanden.

Introduction

Since AFZELIUS' 1924 thorough treatment of the embryology of the genus *Senecio* (*Asteraceae*), the embryological literature concerning this genus appears to be rather scanty. The authors proposed to make a further contribution to the embryology of the genus *Senecio*. They investigated with particular attention the species of *S.* sect. *Incanae*, about whose systematic position disagreements exist (CHARTER & WALTERS 1976, ZANGHERI 1976, PIGNATTI, in press).

In a previous paper (ARENA *et al.* 1979) the authors were concerned with the embryology of *S. candidus* (*S.* sect. *Incanae*), endemic of the Madonie Mountains (Sicily). The present work reports on the study of two other species of the same section: *Senecio ambiguus* (BIV.) DC. and *S. gibbosus* (GUSS.) DC. On the basis of the "Flora d'Italia" by PIGNATTI they are two endemic species, the former found only in the eastern part of Sicily, the second endemic to Sicily and Calabria.

In Sicily, *S. ambiguus* is found on Mount Etna to a height of 1100 m (FIORI 1927); it was observed also at 1700 m by POLI 1965. Along the northen coast it occurs in the province of Messina: between Milazzo and Capo d'Orlando (FIORI 1927); it was observed at Capo Tindari by RAIMONDO & ROSSITTO 1978; we saw it near the Torre delle Ciavole between Gioiosa Marea and Brolo, were is grows in considerable abundance; it was observed recently by GRAMUGLIO at Mongiove, beyond Capo Tindari and a little way past Castel di Tusa, near the western boundary of the province of Messina.

S. gibbosus is a species endemic in Sicily and Calabria, which grows around the Straits of Messina and also was found at Milazzo where it has been noted by various authors (GUSSONE 1843, NICOTRA 1878, LOJACONO 1902, FIORI 1927). NICOTRA reports it for Messina at Faro, at Annunziata at S. Michele, at Campo. In Calabria it has been noted at Bagnara and Scilla (FIORI 1927), but it is also found along the coast south of Scilla.

Materials and Methods

The materials of *S. ambiguus* were collected near the Torre delle Ciavole and materials of *S. gibbosus* at Scilla in Calabria. Flower heads of various stages of developement were fixed in formalin-acetic acid-alcohol. The sections were 8—10 microns in thickness and were stained in HEIDENHAIN's haematoxylin. More than 150 ovules were sectioned for each species.

Results and Discussion

Megasporogenesis

The ovule of *S. ambiguus* and *S. gibbosus* is anatropous, unitegmic and tenuinucellate.

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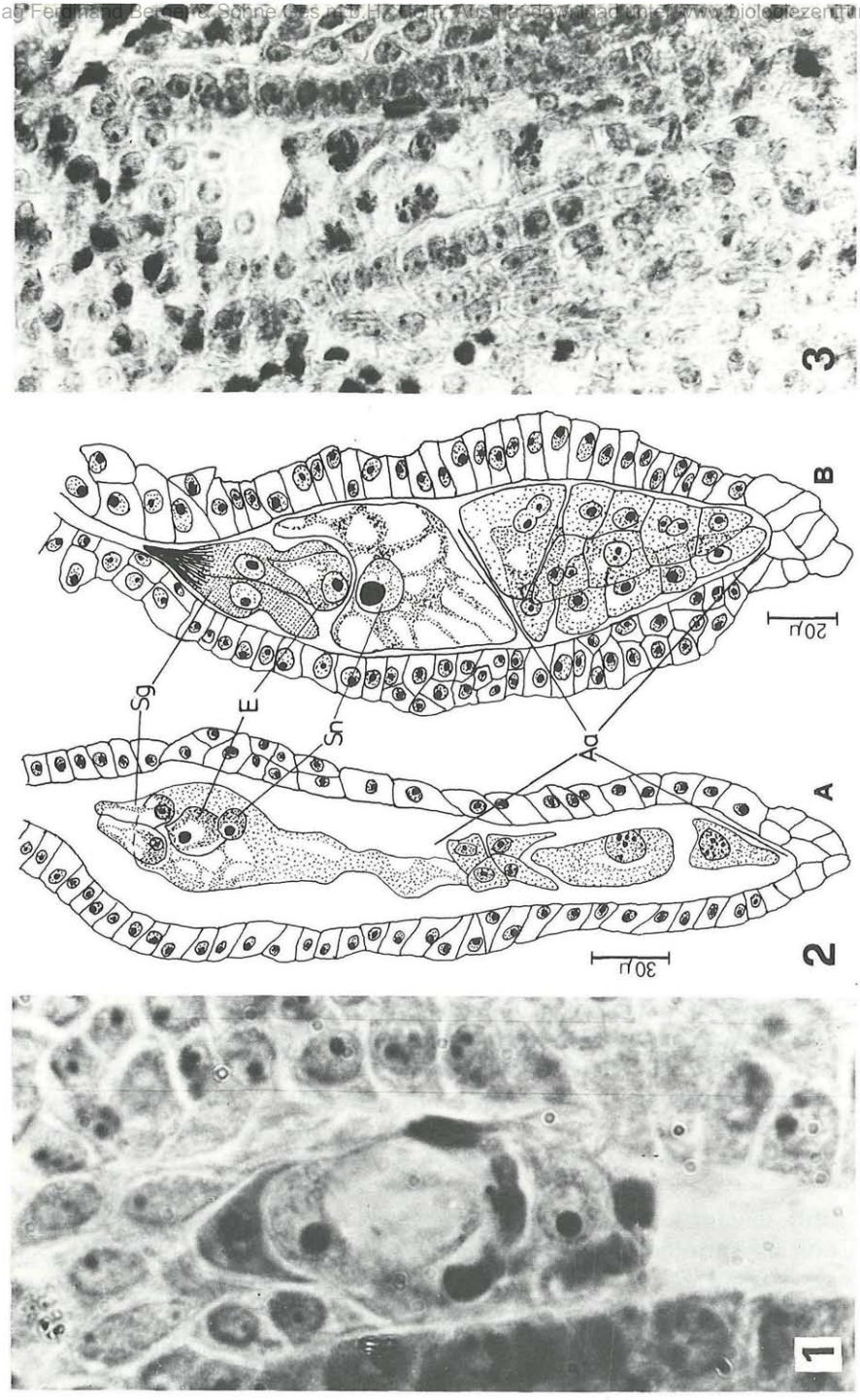

Fig. 1. *Senecio ambiguus*: linear tetrad with subchalazal fertile megaspore (×1280)

Fig. 2. Adult gametophyte. Antipodal apparatus consisted of 6 cells in *S. gibbosus* (A) and of 12 cells in *S. ambiguus* (B). Sg = synergid, E = egg, Sn = secondary nucleus, Aa = antipodal apparatus

Fig. 3. Polyvalent antipodal cells in *S. ambiguus* (×512)

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There is a single subepidermic archesporial cell which functions as the gonotokont cell. During megasporogenesis the endothelium appears, which is biseriate in *S. gibbosus* and uniseriate in *S. ambiguus*.

The megaspore tetrad is usually linear: on rare occasion, however, ⊤- or ⊥-shaped tetrads have been found in *S. ambiguus* and there was one case of a decussate tetrad with the two median megaspores juxtaposed in *S. gibbosus*. The variability in the disposition of the spores does not appear to be frequent in the genus *Senecio*: apart from the linear tetrad, we have found notes of a ⊤-shaped tetrad in *S. heritieri* and a decussate tetrad in *S. abrotanifolius* (Afzelius 1924).

The long vitality of the four megaspores is highly interesting. They tend to grow simultaneously and so for some time they compete among themselves for fertility. In *S. gibbosus*, however, it is always the chalazal one which develops first into a fertile megaspore and which gives rise to the gametophyte. Instead in *S. ambiguus* the gametophyte may develop from any one of the megaspores (Fig. 1) or, more rarely, two megaspores may give rise to two gametophytes, only one of which becomes dominant after both of them, in parallel fashion, have reached the tetranucleate state.

Such observations about the genus are not new. In his report, Afzelius indicated in several species the growth of more than one megaspore or of a single megaspore different from the chalazal one.

Female Gametophyte

The gametophyte develops from a single spore but when mature it is different from the *Polygonum* type as it has an antipodal apparatus consisting of a maximum of 6 cells in *S. gibbosus* (Fig. 2A) and of 12 in *S. ambiguus* (Fig. 2B) resulting from the division of the three original antipodes. Normally the antipodal cells occupy about half the embryo sac.

Besides Afzelius, cases of cellular polyantipody have been noted by Carano 1915 in *S. vulgaris* and by ourselves in *S. candidus*. Cellular polyantipody is therefore a characteristic which is present and recurrent in the genus *Senecio* and other *Asteraceae* (Rutishauser 1969: 31). This is therefore contrary to Beruti 1961 who states that there are always only three antipodal cells with polyvalent nuclei.

Polynucleate antipodes with polyvalent tendencies are common in *S. ambiguus* and *S. gibbosus* (Fig. 3).

The hypertrophic aspect, the long persistence and coexistence with the endosperm reveal the trophic function of the antipodes during the first stages of the embryogenesis. Contrary, however, to what happens in *S. candidus* (Arena *et al.* 1979), haustorial processes were not observed.

The synergids do not display any special characteristic except that in *S. ambiguus* there is a well developed filamentous apparatus with an indentation. In the same species the protrusion of the filamentous apparatus through the micropyle was sometimes observed.

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The hypostase, characterized by cells of scanty content, is highly developed. It is present from the time when the gametophyte is at the mononucleate stage. Its function in the two taxa under discussion is the same as that described in *S. candidus* (ARENA *et al.* 1979).

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