

## The seedling of *Syneilesis* (Asteraceae-Senecioneae),

does it possess cotyledons ?

By

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**Summary:** TEPPNER H. 2001. The seedling of *Syneilesis* (Asteraceae-Senecioneae), does it possess cotyledons ? – *Fritschiana* (Graz) **26**: 49–54. – ISSN 1024-0306.

The supposed single cotyledon of *Syneilesis* possesses a petiole and a rounded blade, and it shows all characteristics of normal foliage leaves. On the basis of comparison with other *Compositae* it is concluded that *Syneilesis* is acotylous, and that the first leaf of the embryo and the seedling is a normal foliage leaf.

**Zusammenfassung:** TEPPNER H. 2001. Besitzt der Sämling von *Syneilesis* (Asteraceae-Senecioneae) Kotyledonen ? – *Fritschiana* (Graz) **26**: 49–54. – ISSN 1024-0306.

Der angebliche eine Kotyledon von *Syneilesis* besitzt einen Blattstiel und eine rundliche Spreite, er zeigt alle Charakteristika der normalen Laubblätter. Aus dem Vergleich mit anderen Compositen wird geschlossen, daß *Syneilesis* akotyl ist und daß das erste Blatt an Embryo und Sämling ein normales Laubblatt darstellt.

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Cotyledons are not only a fascinating but also a physiologically, ecologically and taxonomically important structure in angiosperms. It was discussed for a long time, if members of monocots with two cotyledons exist, which would demonstrate a link to the dicots (*Tamus*, *Dioscorea*: for a summary of these views see AYENSU 1972: 24–25; *Poaceae* with Epiblast, *Commelinaceae* p.p.). At least since TILLICH 1985, 1995 it is clear that "All extant monocotyledons are monocotylous" (TILLICH 1995: 304). This in turn provoked much attention to all deviations from the condition of two cotyledons in the dicots. The abundant, more or less teratological cases in variation of cotyledon numbers are not considered here (compare HASKELL 1954). It is interesting to note that one of the living fossils under the angiosperms, *Idiospermum australiense* (*Idiosperma-ceae* or *Calycanthaceae-Idiospermoideae*) has four or three cotyledons (ENDRESS 1983). For other cases of polycotily see for e.g., EAMES 1961: 343–344, for some *Pittosporum* species see STEBBINS 1974:17–19.

Much debated are the monocotylous dicots, where it is important to distinguish between monocotily due to abortion of one cotyledon (e.g. *Ranunculus ficaria*: WINKLER 1926, METCALFE 1936, *Claytonia virginica*: HACCIUS

1954, *Corydalis* p.p.: RYBERG 1959: 41, 45–46, 61, 81, 90–95, 98, 99) and monocotly due to lateral fusion of the blade of two cotyledons resulting in one flat organ (lateral syncotyly) as most probably in the monocotylous *Apiaceae* (HACCIUS 1952). Unfortunately, there is much confusion in terminology, because some authors use the term syncotyly for the condition, where the cotyledonar stalks are fused (petiolar syncotyly), but the two normal, opposite cotyledonar blades being free [the stalks forming a tube, e.g. in *Eranthis* and *Anemone* (*Ranunculaceae*), *Podophyllum* (*Podophyllaceae*), *Marah* (*Cucurbitaceae*; SCHLISING 1969), *Berardia subacaulis* (*Asteraceae-Cardueae*; MARKGRAF & ENDRESS 1967) or a solid structure as in *Leonticeae*; TERABAYASHI 1987], without sufficient discrimination against lateral syncotyly.

Anisocotyly is also of interest in this connection as one of the possible steps towards monocotyly [e.g., in GOEBEL 1932: 1419–1420, FRITSCH 1920 and HILL 1938; some further examples: *Dentaria enneaphyllos* (*Brassicaceae*): KARRER 1993, *Desmaria mutabilis* (*Loranthaceae*): KUIJT 1985: 127, *Idertia* p.p. (*Ochnaceae*): FARRON 1985: 61, some very impressive examples in *Dipterocarpaceae*]. The term anisocotyly is used here – as usual – in a modified and much wider sense than the inventor (FRITSCH 1904: 116; 1920) of the term intended it.

Remarkable are the experiments with morphogenetic active substances on fresh seeds with undifferentiated embryos of *Eranthis hyemalis* by HACCIUS & TROMPETER 1960 and HACCIUS 1960, which resulted, among others, in seedlings without the stalk tube (choricotylous), in laterally syncotylyous, anisocotylyous, monocotylyous and acotylyous (the first leaf is a foliage leaf) seedlings.

The best summary on the relationships of early ontogenetic stages of the embryos of the dicots and monocots is given in NATESH & RAU 1984: 398–400.

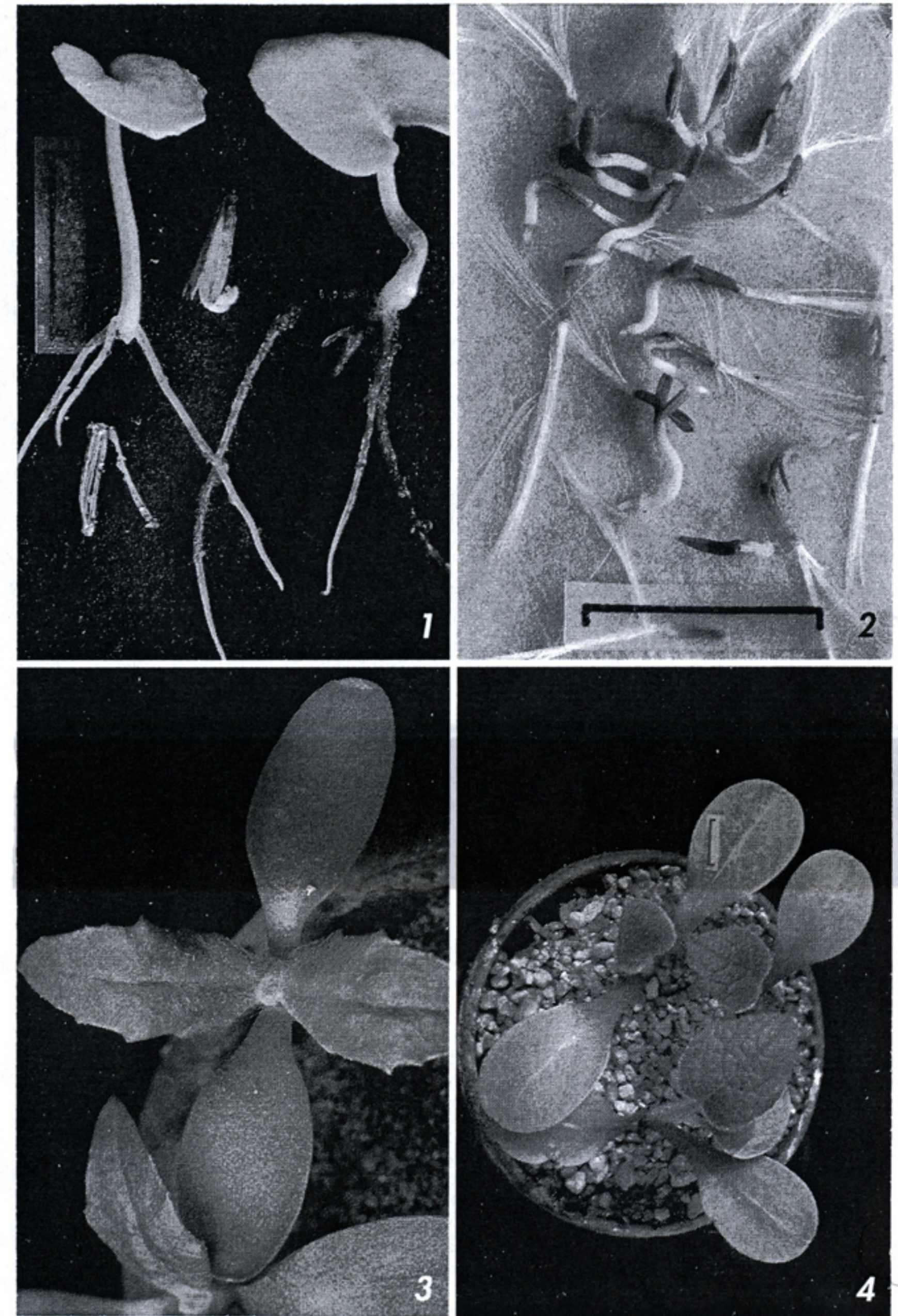


Fig. 1. Seedlings of *Syneilesis palmata*. Two with the full-developed first leaf, the right one with remnants of the withered primary root. In the middle a germinating achene; the place within the achene wall is filled completely by the enrolled blade of the first leaf.

Fig. 2. *Tussilago farfara* L. seedlings on filter paper, 48 hours after wetting of the achenes. The cotyledons have started to expand.

Fig. 3. Seedling of *Onoseris albicans* (D. DON) FERREYRA (*Mutisieae*). Peru, Dep. Lima, Valley of the Río Rimac, ca. 9 km below San Mateo, ca. 2800 m, 8 August 1981, leg. H. TEPPNER 81/13 & K. KEPLINGER. – Sown September 1981, phot. 17 October 1981, Bot. Garden Inst. Bot. Univ. Graz.

Fig. 4. Seedlings of *Saussurea costus* (FALC.) LIPSCHITZ (*Cardueae*). – Achenes received from the Tokyo Metrop. Medic. Plant Garden, seed exchange list 1998–1999: 560. – Sown 10 March 1999, germination March 2000, phot. 13 April 2000, Bot. Garden Inst. Bot. Univ. Graz.

Scale bars equal 1 cm. The bar in Fig. 1 is also valid for Fig. 3.

*Syneilesis* MAXIM. of *Asteraceae-Senecioneae* fits quite well in this complicated matter. Seven species of this genus occur in Eastern Asia (China, Korea, Japan and Taiwan). This genus is related to *Parasenecio*, *Ligularia*, *Tussilago* and others. Apparently, the anatomy of the fruit wall is also important for the delimitation of these genera (JEFFREY & CHEN 1984). Since its description by MAXIMOVICZ 1859: 165 (cit. after HOFFMANN 1892) it is known that *Syneilesis* embryos have only one cotyledon, which is rolled up in the achene (HOFFMANN 1892: 296, OHWI 1965:887, ROBINSON & BRETTELL 1973: 269–270, JEFFREY & CHEN 1984: 210, BREMER 1994:519). Naturally, this provoked me to examine this with my own eyes.

In the seedlings of *Syneilesis* (Fig. 1) the first leaf has a long petiole and a rounded blade, cordate at the base and with some teeth on the margin. The main root degenerates soon and is replaced by adventitious roots. In the achene the petiole is very short and the blade is rolled up longitudinally; one half of the blade is hidden by the other half (supervolute in the sense of Fig. 369 in STEARN 1973: 344).

The alleged cotyledon has all the characteristics of a normal leaf, being principally not different from the foliage leaves.

This is very astonishing, because in *Compositae* the cotyledons differ markedly from the foliage leaves, as to be seen in every *Helianthus* or *Tagetes* seedling and many others (Fig. 3 and 4). As a further example, cotyledons of a related species, *Tussilago farfara*, which is notorious for its quick germination, is illustrated in Fig. 2. No organ comparable to the cotyledons of other *Compositae* is present in *Syneilesis*. The only interpretation can be, that *Syneilesis* does not possess any cotyledons. So to say, the seedlings are acotylous and the function of the cotyledons, as storage organs and as first assimilatory organs, are taken over by the first foliage leaf. The cotyledons are either aborted completely or degenerate at an early stage in the embryo development. This could easily be proved with the help of an ontogenetic study.

The idea, that seedlings can lack cotyledons is not new, but the list of such seedlings in WINKLER 1885: 30–31 is not conclusive because many of the examples enumerated there clearly possess cotyledon(s) or are seedlings of derived parasites. But it also contains *Cyclamen* and this leads us to the next problem.

The interpretations of the seedlings of *Cyclamen* are also highly controversial. Since a long time they are supposed to be monocotylous (last HAGEMANN 1959: 15–18, 54–55, 58), whereas others see two cotyledons, of which the second appears later, after the germination (HILL 1920, HACCIIUS 1952: 483–484; developing after germination: HAGEMANN 1959: 54, 58). The first two leaves show little differences from the foliage leaves (HILL 1920). Therefore a reinvestigation of the seedlings of *Cyclamen* species and its relatives taking acotylous into consideration seems to be desirable.

Material: *Syneilesis palmata* (THUNB.) MAXIM. from S. Korea. – Achenes received from the Bot. Garden Tartu (Estonia), Index seminum 1998: 77. – Sown 10 February 2000, phot. 15 April 2000, Bot. Garden Inst. Bot. Univ. Graz.

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