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POLLENMORPHOLOGY of the ACHATOCARPACEAE (Centrospermae)

von

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Synopsis:

The pollenmorphological investigations of the Achatocarpaceae proved the family completely uniform in respect to its pollenmorphology, but it has to be excluded from the closer relationship of the Phytolaccaceae. According to the pollen form, the structure and sculpture of the exine the Achatocarpaceae with its two genera – *Achatocarpus* and *Phaulothamnus* – should be placed within the vicinity of the Chenopodiaceae/ Amaranthaceae.

Zusammenfassung: Die pollenmorphologische Untersuchung der Achatocarpaceae hat ergeben, daß diese Familie pollenmorphologisch völlig einheitlich ist, aber aus der näheren Verwandtschaft der Phytolaccaceae herausgenommen werden muß. Nach der Pollenform, der Struktur und Skulptur der Exine wäre diese Familie mit ihren beiden Gattungen – *Achatocarpus* und *Phaulothamnus* – in die Nähe der Chenopodiaceae/ Amaranthaceae zu stellen.

TAXONOMY: H. WALTER 1909 in ENGLERS Pflanzenreich (IV. 83 Phytolaccaceae, p. 134-141); A. HEIMERL (1934) in ENGLERS Pflanzenfamilien (16 c Centrospermae p. 174-178); HUTCHINSON I (1959) (p. 210-211); SYLLABUS II, 1964 (p. 84).

POLLEN: H. WALTER (1909) in ENGLERS Pflanzenreich (IV. 83 Phytolaccaceae p. 17); A. HEIMERL (1934) in ENGLERS Pflanzenfamilien (16 c Centrospermae p. 174); ERDTMAN (1966) (p. 34).

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COMPREHENSIVE POLLEN DIAGNOSIS:

Pollen grains sphaeroidal hexa-pantoporate – medium (18-32 my). Sexine pertecte, scabrate, infrabaculate.- NPC 664. Apertures more or less isodiametric (4,3-8,7 my) with blurred limit and operculum. The operculum has the same structure (somewhat lower) and the same sculpture (somewhat coarser) than the rest of the exine.

Exine about 1-1,5 my thick. The tectum consists of a thin layer (less than 0,3 my) sometimes showing clefts. Upon this layer are microverrucae with one or several micro-echini. Tectum supported by bacula (0,4-0,6 my long and 0,1-0,3 my broad). Distance between the bacula once or twice the diameter, Nexine rough, 0,2-0,4 my thick.

MATERIAL AND METHODS:

The polliniferous material has been acetolysed (ERDTMAN 1966, 1969). The REM micrographs were made at the Zoological insitute of the University of Salzburg (Head Prof. Adam), and at the Center of Electron-Microscopy, Technische Hochschule Graz (Head Dr. Grasenik). About the preparation see J. BLAHA and S. BORTENSCHLAGER (1972).

TAXA INVESTIGATED:

1. ACHATOCARPUS TRIANA:

A. balanse SCHINZ et AUTRAN. – Paraguay, Caagua-zú, HASSLER 1878, (H. WALT. bearbeitet); B.

+) *A. bicornutus* SCHINZ ET AUTRAN. – Paraguay, prope Conception, E. HASSLER 1901/2; det. HEIMERL; G.

+) *A. brevipedicellatus* H. WALT. – Paraguay, Cordillera centrales, Y-aca-Fluß, HASSLER 1900, det. HEIMERL; G.

+) *A. gracilis* H. WALT. – Michoacan u. Guerrero, Petatlan, Langlassé, 23. 12. 1898; G.

A. hasslerianus HEIM. –Paraguay, Caagua-zú, E. HASSLER 1905; G.

+) *A. mexicanus* H. WALT. – Gebirge bei Vera Cruz, leg. Galeotti in Herb. Delessert; G.

+) *A. microcarpus* SCHINZ ET AUTRAN. – Paraguay prope Conception, E. HASSLER 1901/2; det. H. WALTER; G.

+) *A. mollis* H. WALT. – Ecuador, bei Hacienda El Recreo, EGGERS 14935, (H. WALTER bearbeitet); B.

A. nigricans TRIANA. – El Salvador, Hacienda San Roman near Lake Olomega, J. M. TUCKER, 30. 10. 1942; G.

A. obovatus SCHINZ ET AUTRAN. – Paraguay, anno 1878, det. HEIMERL; G.

A. praecox GRISEB. – Argentina, Jujuy, Dept. Pedro, W. J. EYERDAM et A. A. BEETLE, 1938; G.

A. spinulousus GRISEB. – Paraguay, HASSLER 12236; K.

A. praecox GRISEB. – Argentina, Ricone de Cabrera, T. M. PETERSON, 4636, 24. 9. 1957; TEX.

A. mexicanus H. WALT. – Mexico, Tamaulipas, Palmillas, J. CRUTCHFI-LD et M. C. JOHNSTON 5387, 29. 4. 1960; TEX.

2. PHAULOTHAMNUS A. GRAY:

P. spinescens A. GRAY. – Texas, ZAPATA CO. JACKSON, B. C. THARP & M. C. JOHNSTON 54196, 10. 10. 1954; TEX.

+) In his monography H. WALTER has worked on the same material which, however, was kept at Berlin.

TAXA NOT INVESTIGATED: *Achatocarpus oaxacanus* STANDLEY and *A. brasiliensis* H. WALT. From *A. brasiliensis* H. WALT. are only female individuals known.

MEASUREMENTS:

LIST OF MEASUREMENTS:

Achatocarpus TRIANA	Size	Aperture	Nexine	Bacula H x ϕ	Tectum
A. balanse SCHINZ et AUTR.	21,9 - **23,7** - 24,8	5,8 - 8,7	0,2 - 0,3	0,4 - 0,5 x 0,1 - 0,2	0,4 - 0,5
A. bicornutus SCHINZ et AUTR.	27,7 - **29,2** - 30,6	4,3 - 8,7	0,3 - 0,4	0,4 - 0,6 x 0,2 - 0,3	0,4 - 0,6
A. brevipedicellatus H. WALT.	23,3 - **25,2** - 27,7	4,5 - 8,5	0,3 - 0,4	0,4 - 0,6 x 0,2 - 0,3	0,4 - 0,5
A. gracilis H. WALTER	21,9 - **24,9** - 26,2	5,8 - 8,5	0,3 - 0,4	0,4 - 0,6 x 0,2 - 0,3	0,4 - 0,5
A. hasslerianus HEIM.	24,8 - **26,4** - 29,2	5,8 - 8,5	0,3 - 0,4	0,4 - 0,6 x 0,2 - 0,3	0,4 - 0,5
A. mexicanus H. WALTER	23,3 - **24,3** - 26,2	6,5 - 7,3	0,2 - 0,3	0,4 - 0,5 x 0,1 - 0,3	0,4 - 0,5
A. microcarpus SCHINZ et AUTR.	26,2 - **27,7** - 29,2	7,2 - 8,5	0,2 - 0,4	0,4 - 0,6 x 0,2 - 0,3	0,4 - 0,5
A. mollis H. WALTER	18,9 - **25,5** - 26,2 +)	5,8 - 8,5 +)	0,2 - 0,3	0,5 - 0,6 x 0,2 - 0,3	0,4 - 0,5
A. nigricans TRIANA	20,4 - **23,2** - 24,8	5,5 - 7,2	0,2 - 0,3	0,4 - 0,5 x 0,1 - 0,3	0,4 - 0,6
A. obovatus SCHINZ et AUTR.	27,7 - **30,1** - 30,6	5,5 - 8,7	0,3 - 0,4	0,4 - 0,6 x 0,1 - 0,3	0,4 - 0,5
A. praecox GRISEB.	24,8 - **27,1** - 30,6	4,5 - 7,5	0,2 - 0,4	0,5 - 0,6 x 0,2 - 0,3	0,4 - 0,6
A. spinulosus GRISEB.	27,7 - **29,6** - 32,1	5,5 - 8,5	0,2 - 0,4	0,4 - 0,6 x 0,1 - 0,3	0,4 - 0,6
Phaulothamnus A. GRAY					
A. spinescens A. GRAY	27,7 - **30,3** - 33,5	7,2 - 9,5	0,2 - 0,4	0,5 - 0,6 x 0,2 - 0,3	0,4 - 0,6

+) these measurements are for pantoporate forms only!

Archatocarpus mollis has normal pollen grains as mentoined in the main diagnosis but in addition to these also pollen grains of the tricolpate type which makes up about 30 % of the investigated material. Between the two pollen types there are various transitory forms, always two pores fusing and than forming a long wide colpus delimited not by a sharp but an undulate line. Because of that fusion the pollen grain becomes depressed, oval, subangular, sphaeroidal to suboblate. Pollen grain 18,9 - **22,5** - 26,2 x 21,9 - **25,8** - 30,6 my, Apocolpium 11,6 - 13,1 my, Colpus 14,6 - 17,5 x 5,8 - 8,7 my. The sexine shows the same measurements and forms as the normal pollen type as indicated in the list.

PALYNOLOGICAL COMMENTS ON TAXONOMY AND REALATIONSHIP:

The genera *Achatocarpus* and *Phaulothamnus* which H. WALTER (1909) includes in his monography of the Phytolaccaceae as „genera anomala" in addition to the genus *Microtes* are identical in respect to their pollenmorphology. Having pantoporate pollen grains like *Microtea* and the monotypic Australien genus *Monococcus, Achatocarpus,* and *Phaulothamnus* do not fit into the list of the other Phytolaccaceae where only tricolpate and pantocolpate pollen grains are represented.

In his treatise of the Phytolaccaceae A. HEIMERL (1934) excludes not only *Achatocarpus* but also the Gyrostemonaceae from the Phytolaccaceae in order to represent the Phytolaccaceae as a well characterized division. Reason for the elimination of *Achatocarpus* from the Phytolaccaceae and establishing the new family, Achatocarpaceae, are the following morphological characteristic: Regular occurance of of oxalic crystals, normal secondary growth, secundary phloem with sclerotic elements, limited inflorenscences, an ovarium consisting of two carpels. The elimination of *Achatocarpus* from the Phytolaccaceae is supported by pollenmorphological aspects. According to the pollenmorphological characteristics *Achatocarpus* should be even taken out from the closer relationship of the Phytolaccaceae as H. FRIEDRICH (1959) performed. H. WALTER (1909) uses for both genera – *Achatocarpus* and *Phaulothamnus* – the term „genus *Chenopodiaceis accendens*".

ERDTMAN (1966) represents the opinion that the pollenmorphological characteristics of these two genera cannot be used in taxonomy. It seems that this opinion is based upon the fact that H. WALTER (1909) states that *Phaulothamnus posses* „3-furchige" (3-colpate) pollen grains whereas *Achatocarpus* possesses „Porenpollen" (pantoporate pollen grains). Because of the difference in their pollen morphology it is doubtful if *Achatocarpus* and *Phaulothamnus* is closely related.

The present investigation proved that both genera have pollen grains of the same aperture type, structure, and sculpture. It is therefore justified that these two genera belong to the same family. CRONQUIST (1968) places the Achatocarpaceae within the Phytolaccaceae in his system as suggested by H. WALTER. In contradiction to that statement J. HUTCHINSON (1959) places the woody Achatocarpaceae to the Bixales together with Cistaceae and Flacourtiaceae, the latter building the basic group for the Passiflorales. There are, however, doubts from the pollenmorphological viewpoint, as almost all families of the Bixales are more or less a uniform group with tricolporate and hexacolporate pollen grains whereas the Achatocarpaceae possess pantoporate pollen grains. There do not exist any pollen morphological datas so far from the Lacistamaceae which also belong to the Bixales.

The elimination of the Achatocarpaceae from the Phytolaccaceae by HEIMERL (1934) is justified from the pollen morphological point of view in respect to the apertures, structures, and sculptures of the pollen grains. These characteristics would even suggest that this family belongs rather in the relationship of the Chenopodiaceae or even Amaranthaceae as already indicated by G. BENTHAM et J. D. HOOKER (1880) as well as by H. WALTER (1909) and as already performed by H. FRIEDRICH (1956, 1959).

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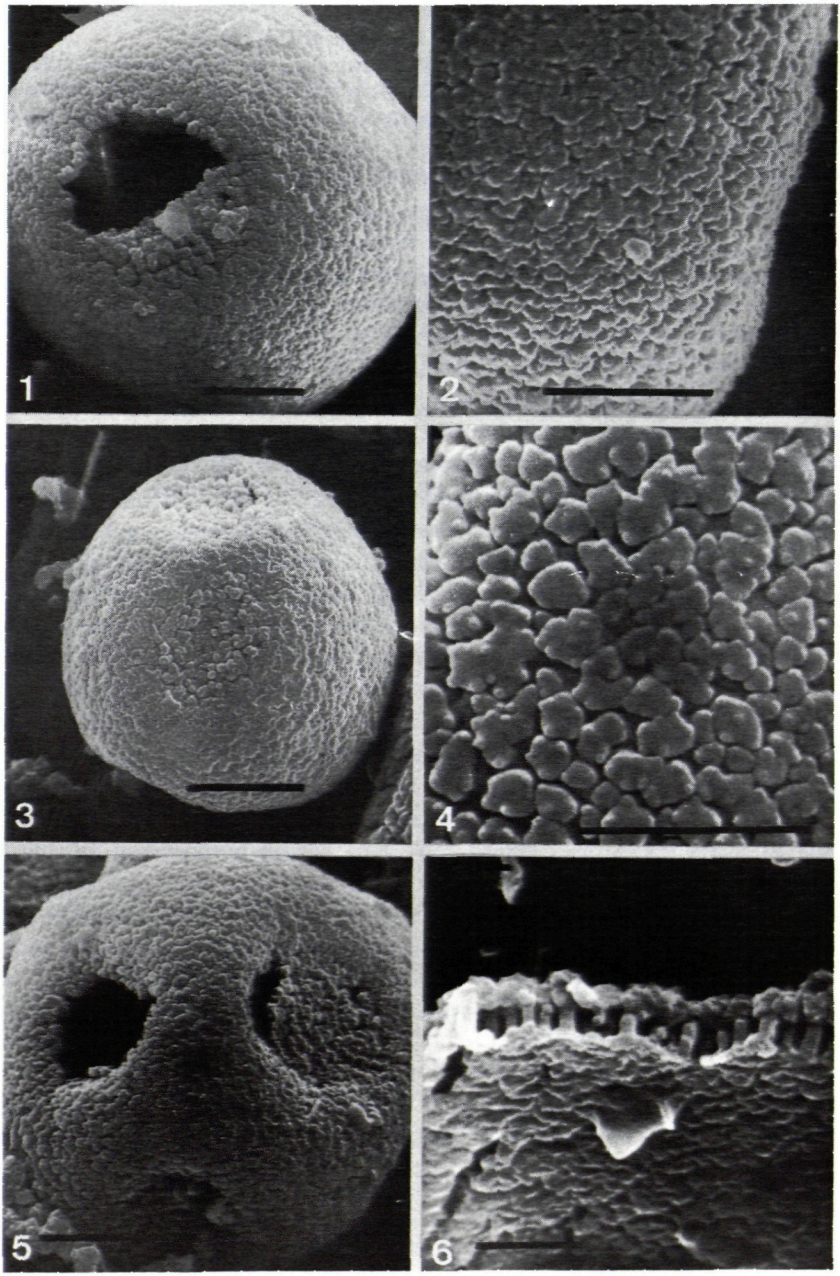
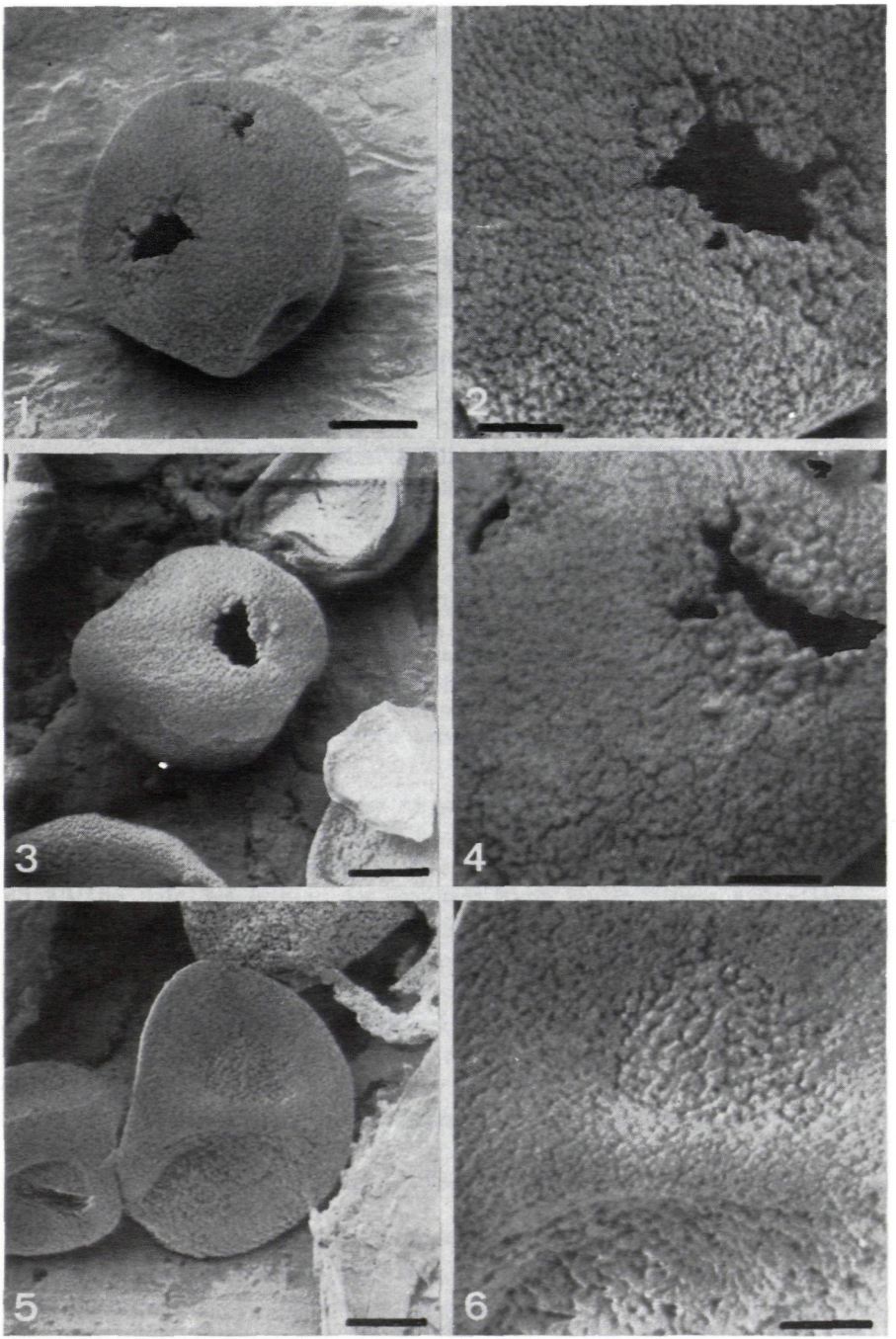
Tafel 1



1 - 2. Achatocarpus spinulosus
3. A. brevipedicellatus
4. A. nigricans
5 - 6. Phaulothamnus spinescens (Line: 1,3,5-5 my, 2,4,6-2,5 my)

Tafel 2



1 - 3. Achatocarpus praecox
4 - 6. A. hasslerianus (Line: 1,3,5-5 my, 2,4,6-2,5 my)