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On the Importance of Pollen Morphology in Classification of Chenopodiaceae in Mongolia

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On the importance of pollen morphology in classification of Chenopodiaceae in Mongolia

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Abstract

The pollen morphology of 18 species from 12 genera of Chenopodiaceae native to Mongolia was studied. Plants were collected during field courses and research projects on useful plants and are deposited in the Herbarium of the Mongolian State University of Education. Chemical preparation was carried out in the Palynological Laboratories at the School of Natural Sciences of the Mongolian State University of Education and the Department of Palynology and Climate Dynamics of the University of Göttingen in Germany. The results show, that all investigated species are distinguishable in terms of pollen morphology bases on their pollen grain sizes, exine thickness and number of pores.

Key words: Chenopodiaceae, pollen morphology, Mongolia

Introduction

The family of Chenopodiaceae VENT. (*Amaranthaceae,* according to APG 1998) is one of the rich families in species of Mongolia. GRUBOV (1982) recorded some 88 species in 25 genera in this family. ULZIIHUTAG (1985) recorded up to some 100 species in 23 genera. In 1996, GUBANOV recorded some 90 species in 25 genera in the family of Chenopodiaceae. The species of Chenopodiaceae are mostly spread in deserts, semi-deserts and desert steppe regions well adapted to arid and salty conditions. Some species grow in the steppe and mountain steppe of the Khangai region as weeds.

Current studies have considered that pollen of Chenopodiaceae is mostly not distinguishable from species to species like from *Chenopodium album* to *Amaranthus retroflexus*. From the studies on the pollen grains of Chenopodiaceae it is well known that the grains are in general circular and polyporate. Palynological study has to be carried out in detail on the level of species. Only this can offer a way to note the part that pollen morphology can play in systematic classification and identification of Chenopodiaceae on species level by microscopy. Such analyses have not been done in Mongolia until now. Here we present some first results of an ongoing project.

Material and methods

Specimen plants and floral samples were collected during field courses of the School of Natural Sciences of Mongolian State University of Education and the research project on the useful plants and are deposited in the Herbarium of the University. Dried plant material of mature flowers was used for the analysis.

Some in Mongolia common 18 species from 12 genera of Chenopodiaceae were selected. Pollen preparation is based on acetolysis described by ERDTMAN (1960) and on the method by PUNSALPAAMUU (2001) and was carried out in the Palynological Laboratory of the School of Natural Sciences of the Mongolian State University of Education and in the laboratory of the Department of Palynology and Climate Dynamics in Germany. Slides as well as the recent pollen material are kept in the palynological laboratories of the Mongolian State University of Education and the University of Göttingen. The pollen grain size was measured in frequency of 25 to 30 for each species. Quantitative analysis on the grain size is done with average of size, range and errors (table 1).

Results

Each of the 18 species has been determined and recorded in detail for pollen morphology (table 1, 2.). Pollen morphological records are based on the grain size, aperture, number of pores, surface and the exine of pollen grain.

Pollen of each species have been described in characteristics of a size, aperture, pores and exine and documented with pictures on x 400 magnification of microscopy (fig. 1–18).

Table 1: Size of pollen grain of common Mongolian species of Chenopodiaceae

Species	Grain size (µm)	Medium size (µm)
Bassia dasyphylla (Fisch. & C.A. Mey.) O. Kuntze	24.75 - 31.35	27.6 ± 2.5
Chenopodium album L.	28.05 - 31.35	30.9 ± 0.44
Chenopodium glaucum L.	19.8 - 21.45	20.5 ± 0.2
Chenopodium acuminatum Willd.	19.8 - 23.1	21 ± 0.2
Chenopodium hybridum L.	19.8 - 23.1	21.1 ± 0.15
Chenopodium prostratum Bge.	21.6 - 24.75	23 ± 0.25
Eurotia ceratoides (L.) C.A. Meyer.	21.6 - 24.75	22.6 ± 0.31
Kochia prostrata (L.) Schrad.	26.4 - 31.35	28.1 ± 0.34
Corispermum mongolicum Iljin.	19.8 - 23.1	20.8 ± 0.28
Corispermum patellforme Iljin.	19.8 - 23.17	21.7 ± 0.32
Agriophyllum pungens (Vahl) Link ex. A. Dietr.	19.4 - 24.75	21.8 ± 0.38
Suaeda corniculata (C.A. M.) Bge.	24.4 - 28.05	26.1 ± 0.3
Salsola passerine Bge.	16.5 - 23.1	19.6 ± 4.62
Salsola collina Pall.	21.45 - 24.7	23.1 ± 0.9
Anabasis brevifolia C.A. Mey.	21.45 - 24.7	23.1 ± 0.9
Atriplex laevis Ledeb.	23.1 - 24.7	23.1 ± 0.2
Amaranthus retroflexus L.	26.4 - 29.7	28.2 ± 0.2
Micropeplis arachnoidea (Moq.) Bunge.	23.1 - 26.4	24.3 ± 0.3

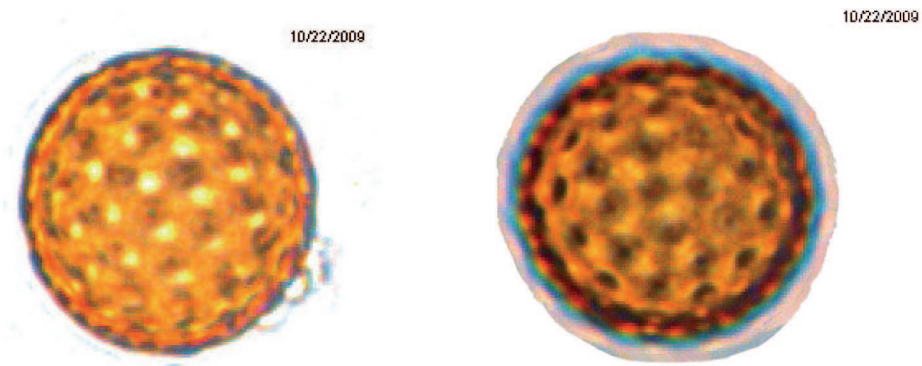

Fig. 1: *Bassia dasyphylla* (FISCH. & C.A. MEY.) O. KUNTZE.

The grains of these species of Chenopodiaceae are in polar and equatorial view circular and poly-pantoporate having a psilate to scabrate surface. The exine is tectate without any perforations. The thickness of the exine was measured from 1.5 to 3.8 µm. The grain sizes are between 16.5 and 31.3 µm. Pores are usually circular with edges or perhaps with a band. Size of pores is 1.3 to 4.9 µm. Each porus is with a differentiated area around it e.g. an annulus. Numbers of pores are between 14 and 66.

Table 2: Exine and aperture of common species of Chenopodiaceae

Species	Exine (µm)	Porus (µm)	Numbers of porus
Bassia dasyphylla (Fisch. & C.A. Mey.) O. Kuntze	2.9	1.66 - 2.31	44 - 46 (45)
Chenopodium album L.	2.97	2.22 - 2.64	48 - 60 (50)
Chenopodium glaucum L.	1.5	1.66 - 1.98	32 - 44 (38)
Chenopodium acuminatum Willd.	1.65	1.65 - 1.66	32 - 36 (32)
Chenopodium hybridum L.	1.65	1.98 - 2.22	28 - 30 (30)
Chenopodium prostratum Bge.	1.32	1.32 - 1.66	32 - 42 (36)
Eurotia ceratoides (L.) C.A. Meyer.	1.98	2.22 - 2.31	32 - 40 (33)
Kochia prostrata (L.) Schrad.	1.65	2.25 - 2.31	56 - 66 (59)
Corispermum mongolicum Iljin.	1.65	2.22 - 2.64	26 - 38 (32)
Corispermum patellforme Iljin.	1.51	1.32 - 1.66	22 - 26 (23)
Agriophyllum pungens (Vahl) Link ex. A. Dietr.	2.64	2.22 - 2.31	34 - 42 (37)
Suaeda corniculata (C.A. M.) Bge.	2.31	1.65 - 1.66	32 - 40 (34)
Salsola passerine Bge.	3.3	4.44 - 4.95	14 - 18 (16)
Salsola collina Pall.	3.82	2.22 - 2.31	20 - 24 (22)
Anabasis brevifolia C.A. Mey.	2.31	2.22 - 2.31	12 - 14 (12)
Atriplex laevis Ledeb.	1.98	2.20 - 2.31	46 - 50 (47)
Amaranthus retroflexus L.	1.32	2.25 - 2.64	24 - 34 (28)
Micropeplis arachnoidea (Moq.) Bunge.	1.65	1.66 - 2.31	38 - 44 (41)

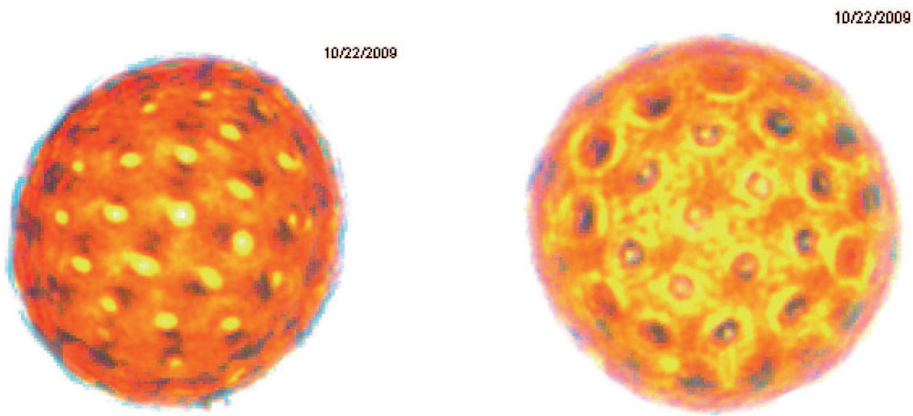

Fig. 2: *Chenopodium album* L.

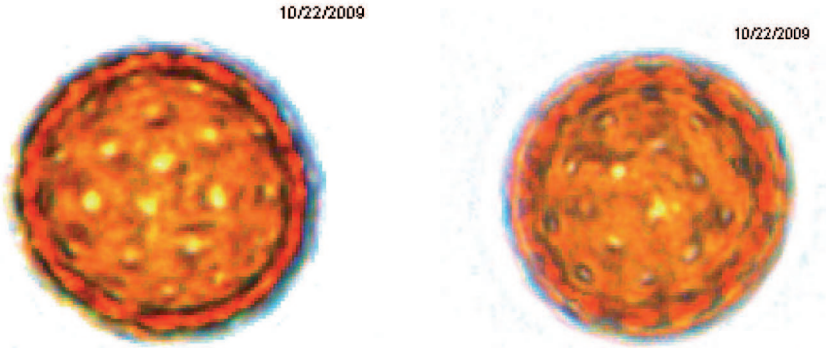

Fig. 3: *Chenopodium glaucum* L.

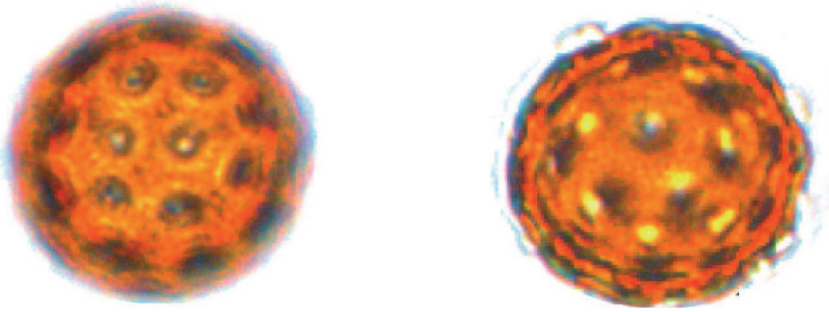

Fig. 4: *Chenopodium acuminatum* WILLD.

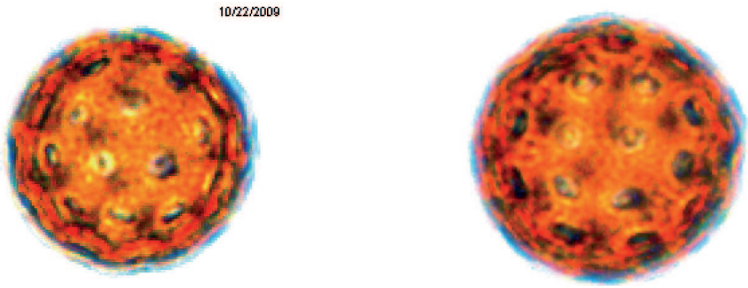

Fig. 5: *Chenopodium hybridum* L.

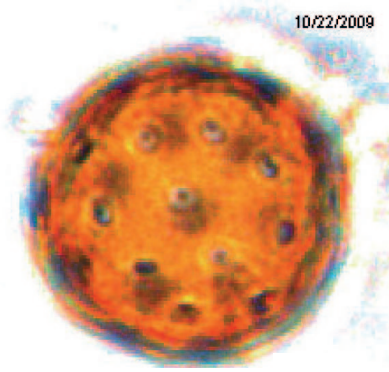

Fig. 6: *Chenopodium prostratum* BGE.

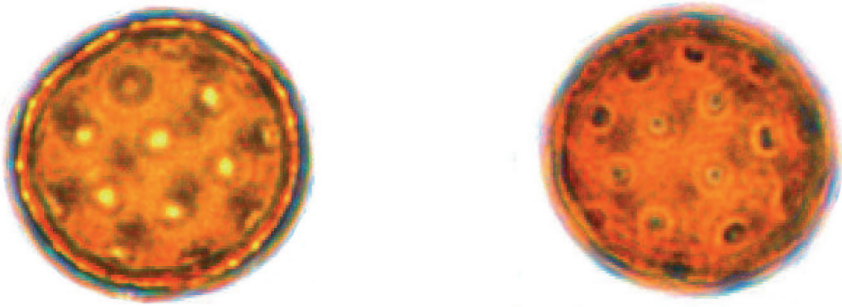

Fig. 7: *Eurotia ceratoides* (L.) C.A. MEYER.

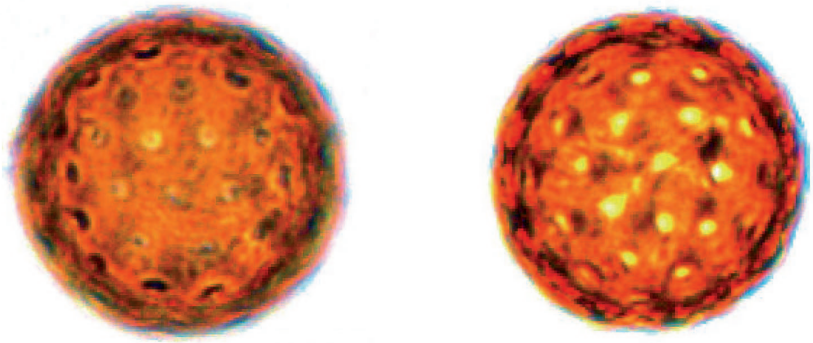

Fig. 8: *Kochia prostrata* (L.) SCHRAD.

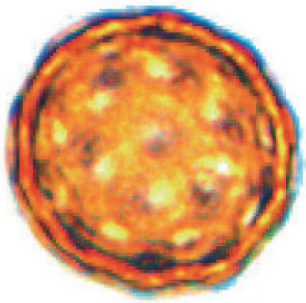

Fig. 9: *Corispermum mongolicum* ILJIN.

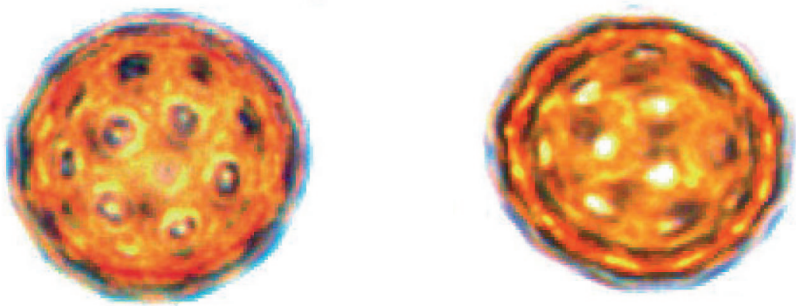

Fig. 10: *Corispermum patellforme* ILJIN.

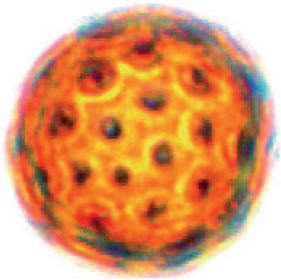

Fig. 11: *Agriophyllum pungens* (VAHL) LINK ex. A. DIETR.

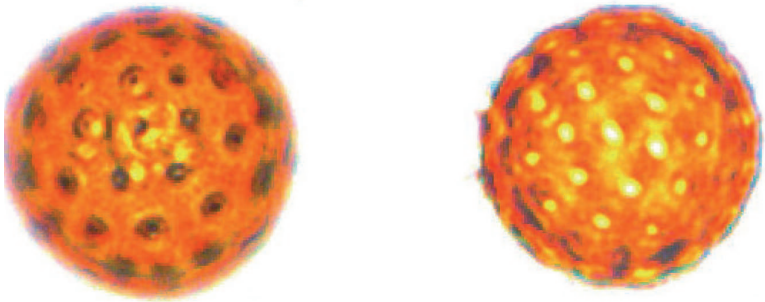

Fig. 12: *Suaeda corniculata* (C.A.M.) BGE.

Fig. 13: *Salsola passerine* BGE.

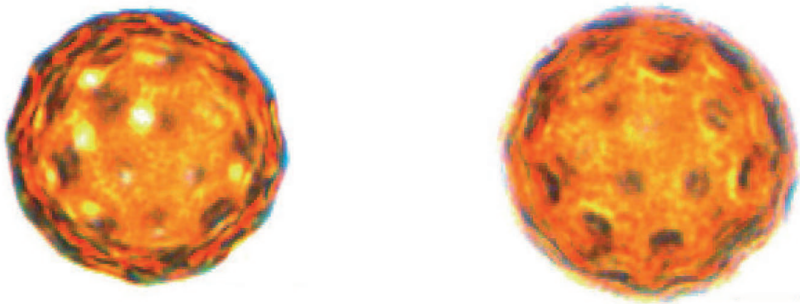

Fig.14: *Salsola collina* PALL.

Conclusion

Pollen morphological records show that some species of Chenopodiaceae can be distinguished by the grain sizes and the numbers of pores. Pollen grains of *Salsola passerine* are the smallest of the studied species with a medium size of 19.6 µm and *Chenopodium album* pollen is the biggest with a medium size of 30.9 µm. After BEUG (2004), the medium size of pollen of *Chenopo-*

dium album in the middle Europe is 27.8 µm. In the other species, the grain size measures mostly less than 25 µm: *Chenopodium glaucum, Ch. acuminatum, Ch. hybridum, Ch. prostratum, Eurotia ceratoides, Corispermum mongolicum, C. patellforme, Agriophyllum pungens*, *Salsola collina, Anabasis brevifolia, Atriplex laevis* and *Micropeplis arachnoidea*. In the study of BEUG (2004) pollen of *Eurotia ceratoides* was measured as 27.0 µm (medium). The differences of the size may point to a differentiation in this Eurasian wide appearing species.

The exine of the grains is psilate, sometimes scabrate (with *Corispermum mongolicum, C. patellforme, Salsola passerine, S. collina*). The thickness of the exine is between 1.5 and 2.5 µm. However, as for *Bassia dasyphylla, Chenopodium album, Salsola passerine,* it is between 2.9 and 3.3 µm. Pollen of *Salsola collina* has the thickest exine with 3.8 µm.

Pollen grains of the above mentioned species of Chenopodiaceae are with 12 (*Anabasis brevifolia*) to 66 (*Kochia prostrate*) pores. The past studies said pores are usually less than 40 (MOOR et al. 1991). As for *Kochia prostrate*, the pores were counted following the method of BEUG (2004) giving numbers of 80 to 100. Pollen of *Corispermum patellforme* have 22 to 26 pores and *C. mongolicum* 26 to 38. The *Corispermum* pollen type could have 40 to 60 pores (BEUG 2004).

The pore sizes were between 1.3 and 2.6 µm. But as for *Salsola passerine*, it was measured as quite big as 4.4 to 4.9 µm.

According to pollen morphological records, the above discussed 18 species can be distinguished to some degree from each other by based on pollen morphology. To confirm this state, we have to research more species of Chenopodiaceae to define further pollen types.

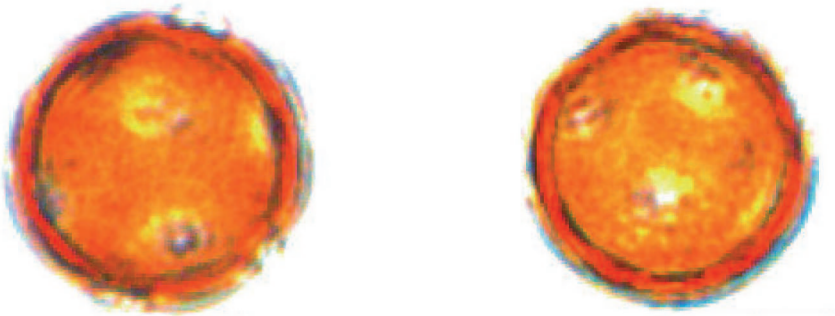

Fig. 15: *Anabasis brevifolia* C.A.MEY.

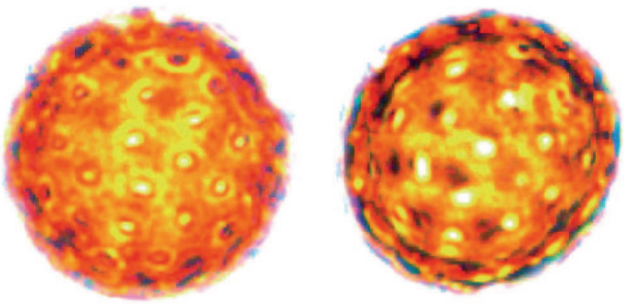

Fig. 16: *Atriplex laevis* LEDEB.

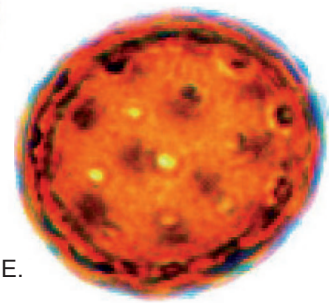

Fig. 17: *Micropeplis arachnoidea* (MOQ.) BUNGE.

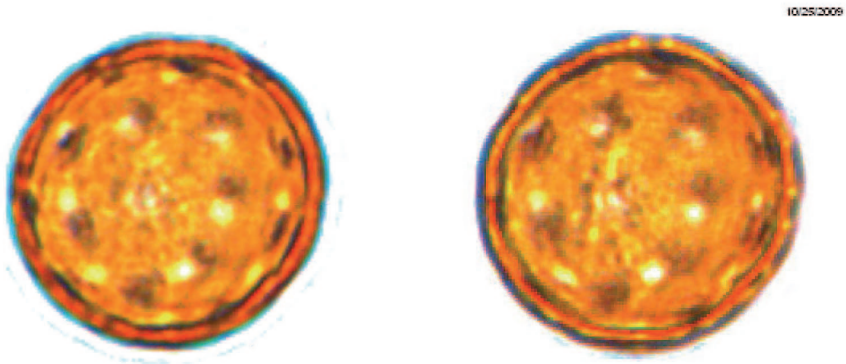

Fig. 18: *Amaranthus retroflexus* L.

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