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**HYDRANGEA L. (SAXIFRAGACEAE) AND SCHEFFLERA FORST.
(ARALIACEAE) IN THE TERTIARY OF POLAND**

Hydrangea L. (*Saxifragaceae*) i *Schefflera* Forst. (*Araliaceae*)
w trzeciorzędzie Polski

ABSTRACT

Seeds of *Hydrangea polonica* n.sp. and endocarps of *Schefflera dorofeevii* n.sp. have been found in Miocene deposits of southern Poland (Nowy Sącz, Chyżne and Lipnica Wielka in Orawa). Both these genera have hitherto been described from the Tertiary of Eurasia and America exclusively on the basis of leaves (*Schefflera*) or leaves and sterile flowers (*Hydrangea*).

INTRODUCTION

In the last years the Neogene deposits that fill the Nowy Sącz Basin have been the subject of resumed geological studies, this time in combination with palynological investigations (O s z c z y p k o, S t u c h l i k 1973). On the basis of their results the age of these deposits has been determined as the late Carpathian (hitherto the Upper Helvetian). Samples from two deep boreholes at Nowy Sącz also afforded a certain amount of macroscopic plant remains, chiefly fruits and seeds. In examining this flora, I managed to identify several interesting genera, new to the Tertiary of Poland.

They include, among others, seeds of the genus *Hydrangea* and endocarps of the genus *Schefflera*, the study of which is the subject of the present paper. Up to now, these genera have been described only from the

fossil leaf florae of Eurasia and America. The discovery of seeds and fruits confirms their occurrence in the Tertiary plant assemblages and, in addition, it is of consequence to the determination of the age of the deposits that fill the Nowy Sącz Basin, for the genera *Hydrangea* and *Schefflera* are known nearly exclusively from Oligocene and Miocene florae in Eurasia and America. *Hydrangea macrocalyx* Givul. from the Lower Pannonian of Rumania (Givulescu 1967) and leaves of the three fossil species of the genus *Schefflera* from the Pliocene of Kodor in the Caucasus Mts. (Kolakovsky 1964) are exceptions in this respect.

FAMILY SAXIFRAGACEAE

Genus *Hydrangea* L.

Hydrangea polonica n. sp.

Pl. I, Fig. 1—3; Text—fig. 2

Locality: Nowy Sącz II: samples 23 and 30 (at depths of 30 and 42 m).

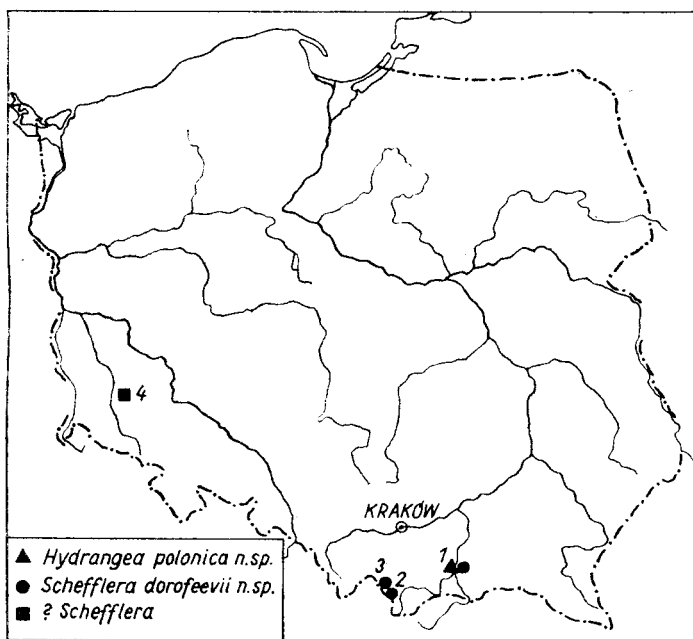
Material: 4 seeds (1 specimen lost, 3 specimens in the possession of the Palaeobotanic Museum, Institute of Botany, Polish Academy of Sciences, Cracow).

Description: Seeds 0.55—0.75 × 0.27—0.42 mm, bilaterally flattened, fusiform, tapering like a wedge and furnished with a short "beak" at the top, whereas at the base they taper still more and pass into an elongate membranous "leg". The overall length of a seed, including the membranes at both poles does not exceed 0.8 mm. A longitudinal ribbing, in the form of 4—5 projecting ridges on each side, is marked on the surface on the seeds. Neighbouring ridges are occasionally connected by obliquely extending fine walls. The seeds crack open in a characteristic manner along these ridges in the top portion (Text-fig. 2). They are brown in colour, some being even light brown, transparent and brightly shining.

Comparison: The genus *Hydrangea* (*Hortensia*), the species of which occur in Eastern Asia and North America and in the mountains of the tropical areas of south-eastern Asia, Central America and South America up to the Andies, has similar tiny seeds of a very characteristic structure. Its species are shrubs, sometimes lianes, rarely trees, growing on rich humus and alluvial soils. Many forms are grown in parks and gardens for their decorative properties. As many as 80 species of this genus are mentioned in earlier publications (Engler 1930), later about 35 (Derevyia i kustarniki SSSR, 1954; Rehder 1956). According to the

monographic work by McClintock from 1957, the genus *Hydrangea* includes 23 species (Krussmann 1962).

In the collections accessible to me I found two species with which the specimens from Nowy Sącz were comparable, i.e., the North-American species *H. quercifolia* Bart. (especially the specimens from the sample



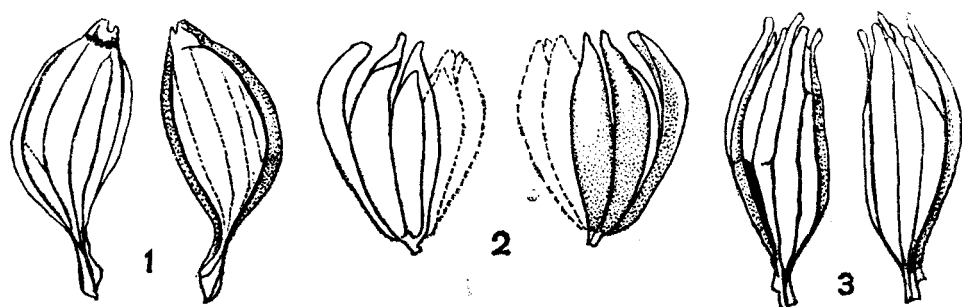
Text-fig. 1. Fossil localities of *Hydrangea* L. and *Schefflera* Forst. from the Tertiary of Poland: 1 — Nowy Sącz, 2 — Chyżne, 3 — Lipnica Wielka, 4 — Osieczów
Ryc. 1. Stanowiska kopalne rodzajów *Hydrangea* L. i *Schefflera* Forst. z trzeciorzędu Polski: 1 — Nowy Sącz, 2 — Chyżne, 3 — Lipnica Wielka, 4 — Osieczów

Nowy Sącz II: 30) and the Chinese *H. sargentiana* Rehd., now defined as *H. aspera* D. Don. ssp. *sargentiana* (Rehd.) McClintock. The specimen from the sample Nowy Sącz II: 23 resembles the seeds of this last taxon. However, the differences in the morphological structure of the seeds of the two contemporary species are small, and they are also hard to establish for the fossil seeds, which for this reason have been included in one species *H. polonica* n. sp.

Small seeds similar in structure occur also in other genera of the family *Saxifragaceae*, above all in the genus *Deutzia*. In most species of this genus they are however somewhat larger, stouter and less transparent. In addition, they have considerably more numerous, densely arranged longitudinal ridges. Individual ridges are frequently connected by oblique walls.

Occurrence: The genus *Hydrangea* has been described from the relatively rarely found impressions of leaves and more frequent sterile flowers in the Tertiary of Eurasia and America. No remains of this kind are known from the Tertiary of Poland; on the other hand, fossil *Hydrangea* seeds have never been described before.

The impressions of leaves preserved in Tertiary deposits have been used as the basis for distinguishing about 10 fossil species in the last 40 years; half of these species fall to the Oligocene and Miocene floras of America (Hu and Chaney 1940; Andrews 1970; Becker 1972) and the other half to the Miocene floras of Eurasia. These last include two species found in the Miocene of China by Hu and Chaney in



Text-fig. 2. Seeds of *Hydrangea polonica* n.sp. from the Miocene of the Nowy Sącz Basin: 1,2 — Nowy Sącz II, sample 30, 3 — Nowy Sącz II, sample 23, $\times 50$.

Ryc. 2. Nasiona *Hydrangea polonica* n.sp. z miocenu Kotliny Sądeckiej: 1,2 — Nowy Sącz II, próba 30, 3 — Nowy Sącz II, próba 23, $\times 50$.

1940: *H. lanceolimba* Hu et Chaney (similar to East Asiatic *H. umbellata* Rehd. and *H. paniculata* Sieb.) and *H. miobretschneideri* Hu and Chaney, which resembles *H. bretschneideri* Dipp. growing in China. From the Oligocene deposits of Bulgaria comes *H. palaeopirinica* (Palamarev, Petkova 1966). *H. cf. macrophylla* (Thunb.) DC., described by Abakov in 1967 (cf. Katalog iskopyayemykh rastyeniy Kavkaza 1973) comes from the Miocene of the Caucasus. Nowadays *H. macrophylla* (Thunb.) Ser. occurs in China, Himalayas and Japan. On the basis of the leaves and sterile flowers derived from the Miocene of West Siberia Gorbunov (1970) described *H. diversifolia* Gorb., which comes close to North American *H. quercifolia* Bart. This species deserves special attention, because the seeds from the Miocene of the Nowy Sącz Basin also bear a striking similarity to the seeds of *H. quercifolia* Bart.

FAMILY ARALIACEAE

Genus *Schefflera* Forst.*Schefflera dorofeevii* n. sp.

Pl. I, Fig. 10—13

Localities: Nowy Sącz I, samples 300 and 302 (at depths of 314—315 and 316·5—319 m); Chyżne, samples 2 and 4 (at depths of 0·8—0·95 and 1·25—1·35 m); Lipnica Wielka, sample from an exposure.

Material: 7 endocarps (specimens in the possession of the Palaeobotanic Museum, Institute of Botany, Polish Academy of Sciences, Cracow).

Description: Endocarps, 2·95—4·5 × 1·25—2·2 mm (most frequently 3·5 × ca 1·7 mm), elongated, rounded at base, tapering in a wedge-like manner or fairly broad and rounded at top. Ventral side even, with small micropyle at top, dorsal side convex. Endocarps strongly flattened and conspicuously thin-walled. The lateral surfaces are smooth, dull and with poorly marked longitudinal wrinkles in some places, especially so close to the dorsal side.

Comparison: The endocarps described have a typical morphological structure of the family *Araliaceae*, but they cannot be included in any of the genera distinguished on the basis of the structure of fossil endocarps. It has appeared that similar endocarps occur in the genus *Schefflera*, numerous species of which grow in tropical and subtropical regions of the Old and the New World. It should be added that many species now included in this genus were initially described under other generic designations, such as *Actinomorphe*, *Brassaia*, *Cussonia*, *Heptapleurum*, *Parapanax*, *Paratropis*, *Polyscias*, *Sciadophyllum* and *Aralia*.

The species of the genus *Schefflera* include rather low trees or shrubs with digitate compound leaves mostly of five elongated, more or less broad leaflets, which have usually fairly long petioles. It is an interesting fact that leaves similar in structure have been described from the Cretaceous and Palaeogene as the genus *Dewalquea* (Raniecka-Bobrowska 1962, p. 162).

It appeared impossible to determine the fossil remains in our possession more closely on the basis of modern materials, because the comparative collection that I had at my disposal contained fruits of 5 species only, whereas according to the data from 1942, the genus *Schefflera* numbers 300—400 species, of which Vietnam itself has as many as 26 (Grushvitzky, Skvortsova 1972). Nevertheless, even this small modern material permitted the investigation of the characteristic structural features of endocarps. They are distinctly thin-walled and have an almost

completely smooth surface, in which they differ essentially from the endocarps of the other genera of the family *Araliaceae*.

The similarity of the two *Araliaceae* endocarps from the Miocene of Nowy Sącz to the genus *Schefflera* was brought to my notice by dr P. I. Dorofeev during my sojourn in Leningrad in January 1971. He had determined the endocarps of this genus from the Oligocene deposits of Western Siberia and from the Miocene of Transcarpathia, but the results of his studies has not, as yet, been published. I wish to relate the newly described species of the genus *Schefflera* to the name of this scientist, whose studies have contributed so much to our knowledge of the Tertiary vegetation of Eurasia.

Occurrence: In palaeobotanic studies the genus *Schefflera* has hitherto been distinguished exclusively on the basis of leaves. At first they were described as the genera *Aralia*, ? *Sciadophyllum*, ? *Oreopanax* (Saporta 1863), later also as *Heptapleurum* (Kolakovsky 1959), *Rhododendron* (Kolakovsky 1957) or *Diospyros* (Katalog iskopyemykh rastyenyi Kavkaza 1973).

Rásky (1959) described several species of the genus *Schefflera* from leaves derived from the Oligocene of Hungary and several years later Raniecka-Bobrowska (1962) compared the impressions of three elongated leaves from the boundary between the Oligocene and Miocene at Osieczów with this genus. Kolakovsky (1964) distinguished three new fossil species on the basis of leaves from the Pliocene flora of Kodor in the Caucasus Mts. He compared them with the modern Chinese and Indian species. According to Kolakovsky, the Pliocene leaves from Kodor, described as *S. integrifolia* Kol., resemble the Chinese species *S. octophylla* (Lour.) Harms and the Chino-Indian form *S. venulosa* (Witt et Arn) Harms.

In the comparative collection of the Institute of Botany, Polish Academy of Sciences, there are fruits of *S. venulosa* var. *erythrostachys* from the Botanical Gardens at Coimbra (Portugal). These endocarps bear a great similarity to the Miocene remains from Nowy Sącz, Chyżne and Lipnica Wielka. They are equally thin-walled and have a smooth external surface.

Three layers can be distinguished in a transverse section of the endocarp of *S. venulosa* var. *erythrostachys*. The external layer (cuticle) is composed of a row of nearly isodiametric cells with not very thick walls and the middle layer consists of 1—3 rows of cells, elongated perpendicularly to the surface of the endocarp. These cells cling closely to each other and have their walls markedly and uniformly thickened. The number of rows of cells in this layer is variable; the most rows occur at both poles of the lenticularly flattened endocarp, whereas in the side walls there is sometimes only one row of such perpendicularly arranged cells. The internal layer is built of a row of somewhat smaller isodiametric

thick-walled cells with a very small cell lumen. Unfortunately, the details of their anatomic structure I was not able to study in fossil specimens.

The occurrence of the genus *Schefflera* in the Miocene of southern Poland has been confirmed by palynological studies. Tran Dinh Nghia (1974) found the presence of pollen grains of the genus *Schefflera* in the profile from Chyżne, from which two of the endocarps described in this paper were derived. This is the first determination of pollen grains of this genus from Tertiary deposits. The grains from the Miocene of Chyżne in Orawa are, in Tran Dinh Nghia's opinion, very similar to those of the South-East Asiatic species *S. octophylla* Harms. Unluckily, I had not at my disposal any fruits of this species, which are globular and 3—4 mm in diameter (Viguier in Lecomte 1923).

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STRESZCZENIE

HYDRANGEA L. (SAXIFRAGACEAE) i SCHEFFLERA FORST. (ARALIACEAE) W TRZECIORZĘDZIE POLSKI

W trakcie opracowywania flory owocowo-nasiennej, występującej w osadach miocenicznych Kotliny Sądeckiej, zostało znalezionych stosunkowo dużo interesujących szczątków, nowych dla trzeciorzędu Polski.

Należą do nich m. in. nasiona *Hydrangea polonica* n. sp. oraz endokarpy *Schefflera dorofeevii* n. sp. Rodzaje *Hydrangea* i *Schefflera* były do tej pory opisywane z trzeciorzędu Eurazji i Ameryki tylko na podstawie odcisków liści lub liści i sterylnych kwiatów w przypadku rodzaju *Hydrangea*. Odkrycie nasion i owoców potwierdza występowanie tych rodzajów w trzeciorzędowych zbiorowiskach roślin.

PLATE
TABLICA

Plate I
Tablica I

- 1,2. *Hydrangea polonica* n. sp., Nowy Sącz II, 30, × 48
3. *Hydrangea polonica* n. sp., Nowy Sącz II, 23, × 48
- 4—7. *Hydrangea quercifolia* Bart., recent (współczesne), × 40
- 8,9. *Hydrangea sargentiana* Rehd., recent (współczesne), × 40
10. *Schefflera dorofeevii* n. sp., Nowy Sącz I, 302, × 14
11. *Schefflera dorofeevii* n. sp., Nowy Sącz I, 300, × 15
12. *Schefflera dorofeevii* n. sp., Chyżne 4, × 14
13. *Schefflera dorofeevii* n. sp., Lipnica Wielka, × 14
14. *Schefflera venulosa* var. *erythrostachys*, recent (współczesne), × 14
15. *Schefflera pulchra* Ant., recent (współczesne), × 13
16. *Schefflera stuhlmannii* Harms, recent (współczesne), × 14
17. *Schefflera actinophylla* Harms, recent (współczesne), × 17

Phot. A. Pachonński

