

# *Dioscorea manchesteri* Kvaček, sp. nov., a new fossil species from the early Miocene flora of North Bohemia (Czech Republic)

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**ABSTRACT.** Using the morphology of fin-winged fruits and accompanying foliage, the author characterizes a new fossil species, *Dioscorea manchesteri* Kvaček, sp. nov. (Dioscoreaceae), recovered from early Miocene deposits of the Most Basin (North Bohemia, Czech Republic). *Dioscorea manchesteri* matches the extant *Dioscorea polystachya* Turcz. in its fruit and foliage morphology. This perennial climbing vine native to China now grows throughout East Asia (Japan, Korea, Kuril Islands, Vietnam) in warm temperate to subtropical climate. The record of *Dioscorea manchesteri* is the first record of this genus in the European Neogene.

**KEYWORDS:** macrofossils of *Dioscorea*, early Miocene, Czech Republic

## INTRODUCTION

Investigations of the early Miocene flora of the Most Basin in North Bohemia (Czech Republic) have produced a wealth of data on Neogene fossil plants, illustrated in Kvaček et al. (2004, 2019) and summarized by Teodoridis & Kvaček (2015). There are some novelties to be added when new collections gathered to date in the Bílina opencast mine have been studied. Fossils have been collected in this region by several generations of palaeobotanists, myself and collaborators among them. These fossils are an important source of information on the composition of the plant cover in Central Europe at that time. Newly recognized taxa not included in previous accounts are treated in a few short papers (e.g. Kvaček & Teodoridis 2019), including the present account devoted to a new monocot belonging to *Dioscorea manchesteri* Kvaček, sp. nov. (Dioscoreaceae), recognized by its fruits and co-occurring foliage.

## GEOLOGY AND TAPHONOMY

The record of this new fossil *Dioscorea* derives from extensive collecting over many decades in the Bilina open-cast mine in the Most Basin of North Bohemia. Stratigraphically it belongs within the Holešice Member of the Most Formation assigned to the early Miocene (Fejfar & Kvaček 1993). This part of the basin fill has been distinctly richer in plant macrofossils than the other portions of the North Bohemian Miocene. The floras are taxonomically uniform, with prevailing swamp elements and, more rarely, allochthonous elements (see Kvaček et al. 2004). As a whole, the Most Basin has been known as a rich source of palaeontological data or fossil plants since the 19th century (e.g. Unger 1841–1847). The plant described below is a rarity among the hundreds of plant fossils recovered there so far (Kvaček 1998).

## MATERIAL AND METHODS

The type material of *Dioscorea manchesteri* Kvaček, sp. nov. is housed at the National Museum in Prague. All specimens at hand are impressions, and their preservation allows their gross morphology to be compared with rare related plant fossils described from other parts of the Northern Hemisphere (Andreánszky 1959, Manchester 2001).

The specimens were studied by reflected light microscopy to reveal details of fruit and leaf morphology. An anatomical study was not possible, due to the highly oxidized state of the material.

## SYSTEMATIC PALAEOLOGY

### DIOSCOREACEAE

#### *Dioscorea* L.

#### *Dioscorea manchesteri* Kvaček, sp. nov.

Figs 1, 2

Holotype established here. NM G 12370 (National Museum, Prague) – fruit (Fig. 1).

Paratypes established here. Foliage from type horizon 36: NM G 12438 (Fig. 2), 12439, 12441, 12442a, b.

Additional material. A further fruit from the same site, horizon unknown: NM G 12413, incomplete, only one wing preserved, further foliage from adjacent horizons: horizon 72: NM G 12437, 12440; horizon 78: NM G 12436.

Repository. National Museum, Palaeontological Department, Václavské nám. 68, Praha 1, Czech Republic.

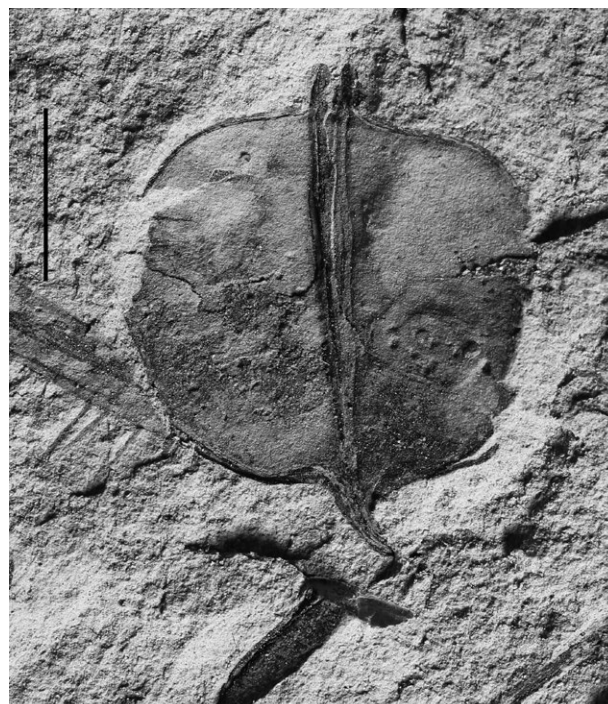
Locus typicus. Bílina, Holešice Member of the Most Formation, early Miocene.

Etymology. Named after Prof. S. R. Manchester (Gainesville), who recognized the affinity of the fruit.

Occurrence. In allochthonous silty deposits with abundant plant impressions covering the main lignite seam in North Bohemia, horizons no. 36, 72, 78 (for details of geology and sedimentary environments see Kvaček 1998).

Diagnosis. As in the description.

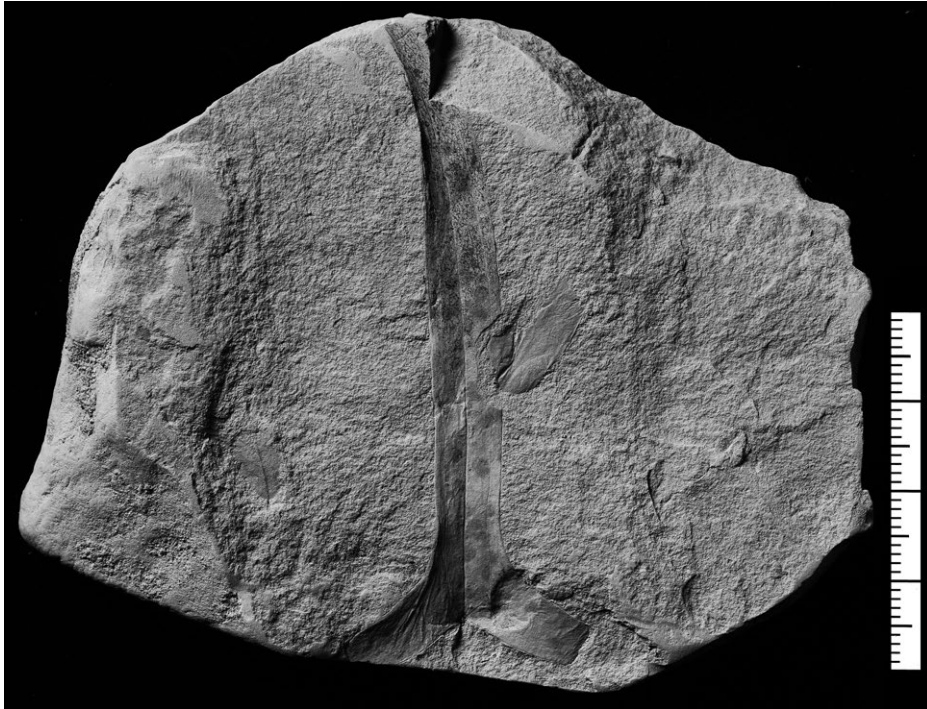
Description. Fruits capsulate, flat compressed, tri-winged, oblate, 7 mm long, 6.5 mm



**Fig. 1.** Fruit of *Dioscorea manchesteri* Kvaček, sp. nov., holotype established here, NM G 12370 (National Museum, Prague), early Miocene, Bílina opencast mine; scale bar = 3 mm

wide, with medial vein extending from base to apex, split, wings 0.7 mm wide, with faintly visible sub-horizontal striation; marginal suture slightly thickened, apical stigmatic projections 1 mm long, corresponding to perianth remains; pedicel rest on base incompletely preserved, curved, 2 mm long. Leaves (impressions and partly counter-impressions) partly without petiole, lamina basally 3-lobed, sagittate and auriculate, rarely truncate, 25–70 mm long, with base partly slightly cordate and lateral lobes rounded; apex narrow, long acuminate; venation 3–5(7)-palmate, midrib at first straight, slightly curved apically, leaf lamina thin, obviously herbaceous.

Discussion. The above-described co-occurring detached organs, fruits and foliage are assigned to the same fossil species because they have been repeatedly recovered together at several fossil horizons of the Bílina mine and clearly belong to the same plant. The foliage of *Dioscorea manchesteri* differs from any of the known fossil species of *Smilax* in the herbaceous lamina and morphology of leaves with a sagittate to auriculate base. *Smilax weberi* Wessel known from other parts of the Most Basin produced subcoriaceous foliage with a rounded to truncate base, and its epidermal structure corresponds to the topotypical material from Rott (Germany, late Oligocene).



**Fig. 2.** Leaf of *Dioscorea manchesteri* Kvaček, sp. nov., paratype established here, NM G 12319a (National Museum, Prague), early Miocene, Bilina opencast mine, scale in mm

In the European Cenozoic, similar cases of complex species such as *Taxodium dubium* (Kunzmann et al. 2009) or *Platanus neptuni* (Kvaček & Manchester 2004) are rare. Also, the detached organs used to be assigned to individual fossil species or even to living species.

Fossil records of the Dioscoreaceae are sparse (Raz 2017). The presently described plant remains of *Dioscorea manchesteri* from the early Miocene deposits of the Czech Republic are rare in this fossil flora. The detached leaves recovered en masse, accompanying the fruits and forming *Dioscorea manchesteri*, correspond to the foliage of the extant *Dioscorea polystachya* Turcz. (Fig. 3), a perennial climbing vine native to China (Anhui, Fujian, Yunnan) and now growing throughout East Asia (Japan, Korea, Kuril Islands, Vietnam).

It is easy to differentiate between *Dioscorea* and *Smilax* on the basis of reproductive organs – a capsule in *Dioscorea* versus a berry in *Smilax*. In gross morphology and in many other respects, the foliage is similar in the two genera. In general, *Dioscorea* produces leaves herbaceous in texture, while *Smilax* foliage is coriaceous to sub-coriaceous. That character may be responsible for the rarity of *Dioscorea* in fossil leaf assemblages. Indeed, the differentiation of these two genera may seem equivocal. Many leaf fossils assigned so far to *Smilax* may represent foliage of the

Dioscoreaceae. Convergent leaf morphology is exemplified by the living *Smilax auriculata* Walter, distributed in the USA (Florida, Georgia, North and South Carolina, Alabama, Mississippi, Louisiana); it is an evergreen climbing vine which grows on coastal sand dunes and on insolated sites in sandy woodland. It is similar in the form of the lamina to *Dioscorea* but differs mainly in its sub-coriaceous evergreen foliage.



**Fig. 3.** *Dioscorea polystachya* Turcz., foliage, extant, Taiwan

*Dioscorea* is a genus of over 600 species of climbing herbs of the family Dioscoreaceae, native throughout the world's tropical and warm temperate regions (Burkill 1960). The vast majority of the species are tropical, with only a few species extending into temperate regions. Among the living species with similar foliage we believe that *D. manchesteri* compares best with *Dioscorea polystachya* Turcz. (syn. *D. potaninii* Prain & Burkill), a perennial climbing vine native to China (Anhui, Fujian, Yunnan) and now growing throughout East Asia (Japan, Korea, Kuril Islands, Vietnam). Its leaves may vary from elongate to auriculate, partly very narrow (Fig. 3), exactly matching the fossil foliage of *Dioscorea manchesteri*, while its fruits are slightly larger (1.2–2 cm) than the fruit of *Dioscorea manchesteri*. More living species of the genus produce similar fruits (see Manchester & O'Leary 2010).

The fruits of *Dioscorea manchesteri* differ in being smaller and in having a less distinct locule than those of other fossil fruits of *Dioscorea* described so far, such as *Dioscorea* sp. from the late Eocene site of Florissant, USA (Manchester 2001) and *Dioscoreocarpum marginatum* Andreánszky from the Oligocene of Hungary (Andreánszky 1959). The latter fruits are accompanied by foliage ascribed to Dioscoreaceae by Andreánszky (1959, Hably & Szakaly 1989) and named *Dioscoreites giganteus* Andreánszky and *D. agriensis* Andreánszky & Cziffery, respectively, both of which widely differ in leaf morphology from *Dioscorea manchesteri* and whose affinity is somewhat doubtful (Raz 2017). Another doubtful record of the *Dioscorea* fruit was published by Kvaček & Teodoridis (2011) from the late Eocene diatomite of Kučlín in North Bohemia.

Fossil foliage similar to *Dioscorea manchesteri* was described and illustrated as *Smilacites sagittata* Unger (1841–47) from the Miocene site of Parschlug in Austria. The single type specimen of this taxon is missing (Kovar-Eder et al. 2004: 83, as *Smilax sagittifera* Heer emend. Hantke). The illustration (Unger 1841–47: 129, pl. 40, fig. 4) does not show details of gross morphology. Hence a reliable comparison with our material is not possible. To my knowledge, no other leaf fossils matching *Dioscorea manchesteri* have been recovered so far.

The fossil foliage called *Dioscoreophyllum* Kräusel & Weyland, nom. illegit. (non Endl., Menispermaceae), based on dispersed cuticles

from the European Neogene, cannot belong to the Dioscoreaceae (Kvaček & Wilde 2006, Worobiec & Kasiński 2009) and has no relation to *D. manchesteri*.

## CONCLUSIONS

The plant fossils described above (fruits, foliage) represent a monocotyledonous plant of the Dioscoreaceae previously unknown in the European Neogene. The resulting complex taxon *Dioscorea manchesteri* Kvaček, sp. nov. can be used in evaluating the relationships among hundreds of living representatives of *Dioscorea* distributed throughout tropical and subtropical regions of the world and having relatively few representatives in northern temperate areas (Zomlefer 1994). It fits well with the warm temperate character of the accompanying vegetation and shows clear affinities with *Dioscorea polystachya* Turcz. (syn. *D. potaninii* Prain & Burkill), a tuberous vine native to China, which is grown throughout East Asia for its edible tubers called yams.

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