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***PSEUDOTORELLIA TENUIS* SP. NOV. (GINKGOALES)
FROM THE JURASSIC OF THE KRAKÓW REGION**

Pseudotorellia tenuis sp. nov. (Ginkgoales) z jury okolic Krakowa

ABSTRACT. *Pseudotorellia* is a genus of linear, not forking leaves which are attributed to the *Ginkgoales* because of their forking venation and cuticle structure. The leaf is shed by abscission at the leaf base. The Kraków Jurassic flora contains several species of *Pseudotorellia*, one of which is described in the present paper. In the form of the stomata it resembles most *P. grojecensis* from the same flora but it is considerably narrower and differs from *P. grojecensis* in other characters of cuticle. When investigated with SEM the stomata show a complicated structure which is not fully understood. The leaf is placed in *Pseudotorellia tenuis* sp. nov.

INTRODUCTION

Investigations of the Jurassic flora from the Kraków region, started by Raciborski (1889a, b) a hundred years ago have been continued since the sixties of this century thanks to the initiative of the late Professor Władysław Szafer. In this flora quite frequent are long undivided leaves of the genus *Pseudotorellia* (*Ginkgoales*). The genus had been instituted in 1936 by Florin who attributed it to *Ginkgoales* incertae sedis. A good example of the genus is *P. ephela* described by Harris (1935) from the Rhaeto-Liassic of Greenland. The leaves of this species show such characters as forking veins, leaves shed without short shoots and also cuticle structure which point to affinity with the *Ginkgoales*. The first species from the Jurassic of Poland, *P. grojecensis* had been described from Grojec, one of Raciborski's localities in the Kraków region (Reymanówna 1963).

In the present paper are described leaves which are attributed to the genus *Pseudotorellia* because of their morphology and cuticle structure, but which differ from all so far described species. In the structure of stomata they are similar to *P. grojecensis*, but the leaves are considerably narrower and differ from *P. grojecensis* in other characters of cuticle structure. Therefore the leaf is attributed to *Pseudotorellia tenuis* sp. nov.

MATERIAL AND METHODS

The described leaves were found in grey Middle Jurassic Grojec Clays from the bore-hole Zabierzów together with leaves of *Bilsdalea dura* (Wcisło-Luraniec 1985). It is interesting to note that the leaves of the two plants are similar in size

and shape which might indicate segregation during not distant transport by water. Another interesting character shared by both species is the thinning cuticle and then no cuticle at all at the leaf apex which might indicate secretion at leaf apex.

The leaves were macerated with nitric acid in the usual way, some cuticles were coated with gold and studied in the SEM.

SYSTEMATIC DESCRIPTION

Order *Ginkgoales*
Genus *Pseudotorellia* Florin 1936
Pseudotorellia tenuis sp. nov.
Pl. I, figs. 1—4, Fig. 1A—L

DIAGNOSIS. Leaves (preserved as fragments about 1 cm long but estimated to reach length of at least 25 mm) about 2 mm wide, entire, linear, straight or falcate; apex rounded, obtuse, usually incomplete, lower part of leaf gradually narrowing towards a base about 0.5 mm wide. Veins inconspicuous (in macerated specimens nonstomatal strips taken to indicate course of veins) parallel, forking near leaf base. Two to three filiform resin ducts present usually below stomatal strips. Cuticle thin on both sides, upper cuticle composed of longitudinal rows of elongated quadrangular cells approximately 20 μm wide and 130 μm (60—180) μm long, cells about 3—9 times as long as wide. Periclinal walls showing delicate longitudinal striation, about three striae to cell width. Striation continuing over surface of several cells in the same row. Papillae and trichomes absent.

Lower cuticle as a rule with two ill defined stomatal strips consisting of (2)3—4(10) short longitudinal files or stomata scattered; stomata orientated longitudinally, approximately 120—180 μm long and 40—60 μm wide, consisting of two guard cells sunken below subsidiary cells and as a rule four subsidiary cells differentiated into polar and lateral ones. Guard cells distinct thanks to thickly cutinised outer walls, also walls facing aperture thickly cutinised. Stomatal aperture from the outside in the form of a narrow slit with a narrow cutinised border, from the inside elliptical and shorter; polar ends of guard cells distinct, overhung. Lateral subsidiary cells distinctly less cutinised than remaining epidermal cells, elongated in the form of an arc, with acute ends. Polar subsidiary cells separated from those of neighbouring stomata usually by 1—2 ordinary epidermal cells. Neighbouring files of stomata separated by 0—1 epidermal cells. Nonstomatal strips consisting of cells similar to those of upper cuticle.

Holotype. Microscopic slide IB PAN PM S916a.

Locus typicus. Zabierzów.

Stratum typicum. Grojec clays (glinki grojeckie). Middle Jurassic.

Derivatio nominis. The specific name *tenuis* is from the Latin "tenuis" thin, fine, slender and refers to the slender form of the leaf and its thin cuticle.

DISCUSSION

Variability. *P. tenuis* shows a considerable variability in the width of leaves and the arrangement, size and number of stomata. In this respect there can be distinguished two types of leaves. In type A the leaves are narrow and very delicate, with two, occasionally three stomatal strips, each showing 2(3) irregular files of

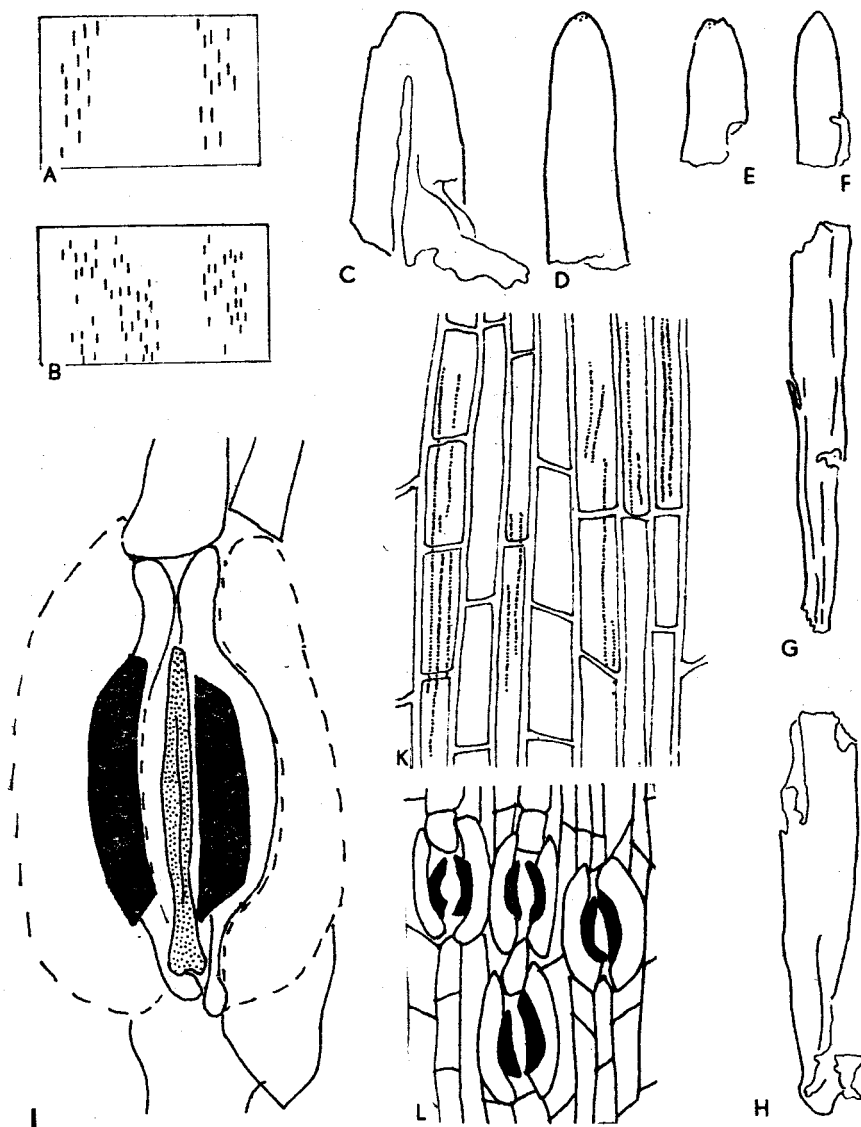


Fig. 1. *Pseudotorellia tenuis* sp. nov. A — distribution of stomata on lower cuticle of leaf type A, IB PAN PM S919, $\times 40$; B — distribution of stomata on lower cuticle of leaf type B, IB PAN PM S920, $\times 40$; C, D, E, F — leaf apices, IB PAN PM S918 a—d, $\times 6$; G — leaf base, IB PAN PM S917 b, $\times 6$; H — Holotype, IB PAN PM S916 a, $\times 6$; I — stoma, outer lamellae of guard cells marked black, cutinised walls facing aperture stippled, IB PAN PM S919, $\times 1300$; K — upper cuticle showing striation, IB PAN PM S922, $\times 400$; L — lower cuticle showing stomata with cutinised outer lamellae of guard cells (in black); IB PAN PM S921, $\times 400$

stomata. The stomata are distinct and large, about $100 \times 60 \mu\text{m}$. The leaves of type B are much wider and their cuticle thicker than in type A. The stomata are scattered over a wider area and stomatal strips may be difficult to distinguish. Stomata are smaller, about $70 \times 50 \mu\text{m}$. If stomatal strips are present they are

usually two with numerous (6—10) stomatal files. Nevertheless, both types of leaves are included into one species *P. tenuis*, because there occur intermediate forms.

Structure of stoma. The stomata of *P. tenuis* have a complicated structure which is not fully understood although it was studied with the SEM. The epidermal and particularly the subsidiary cells are thinly cutinised and the strongly cutinised outer walls of the guard cells protrude through them.

The walls between the guard cells and lateral subsidiary cells are also thickly cutinised and the stomatal slit is surrounded by cutinised lamellae. The slit is narrow on the outer surface of the stoma and widens inwards, so that its inner opening is much shorter and wider. There may also be visible an additional perforated lamella when the stoma is seen from the inside. In the same leaf stomata show differences in the degree of cutinisation.

Determination. Several species of *Pseudotorellia* were described since Florin instituted this genus (cf. Florin 1936, Harris 1935, Harris et al. 1974, Lundblad 1957, 1968, Vachrameev & Doludenko 1961, Manum 1968).

Out of them *P. tenuis* seems closest to *P. grojecensis* (Reymanówna 1963) because of similar stomata showing subsidiary cells without papillae and a tendency, at least in narrow leaves, to form delimited stomatal strips. In addition, the subsidiary cells in both species have much thinner periclinal walls than the remaining epidermal cells. *P. tenuis*, however, is different from *P. grojecensis* in having much narrower leaves and in not showing the characteristic cell pattern on the upper side. *P. tenuis* differs from other species with narrow leaves such as *P. minuta* (Lundblad 1957), *P. angustifolia* (Vachrameev & Doludenko 1961, Krassilov 1970), *P. tibia* (Harris et al. 1974) in not showing papillae on subsidiary cells. Therefore it is attributed to a new species.

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Plate I

***Pseudotorellia tenuis* sp. nov.**

1. Lower cuticle showing two stomatal strips, IB PAN PM S919, LM \times 150
2. Two stomata showing thinly cutinised subsidiary cells and thickly cutinised outer walls of guard cells, IB PAN PM S919, LM \times 540
3. Stoma from above showing stomatal slit and protruding guard cells partly covered by lateral subsidiary cells. IB PAN PM S923, SEM \times 1000
4. Stoma from below, visible subsidiary cells, lateral walls of guard cells and the inwards widened stomatal slit. IB PAN PM S923, SEM \times 1000

