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TWO LEAF MORPHOTYPES OF THE *PAGIOPHYLLUM PEREGRINUM* (LINDLEY ET HUTTON) SCHENK EMEND. KENDALL FROM THE MECSEK MOUNTAINS, HUNGARY

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ABSTRACT. Two morphotypes (the usual form and a larger one) of the *Pagiophyllum peregrinum* were collected from the Hungarian Lower Liassic (Hettangian). The shape of the leaves, as well as their cuticular structure are the same, the difference regards only the size of the leaves. The large form is twice as long and wide as the usual form, but undoubtedly it belongs to the same species. The large form is discussed, giving a tentative interpretation of its occurrence together with the usual form. This paper gives the first description of *Pagiophyllum peregrinum* from Hungary.

KEY WORDS: Gymnosperms, Liassic, Hungary, *Pagiophyllum peregrinum*, heterophylly

INTRODUCTION

The conifers from the Early Liassic of the Mecsek Mountains (Southern Hungary, the region of Komló) are represented mainly by *Podozamites, Palissya* (Nagy 1961) and *Hirmeriella* (Barbacka 1991), and the as yet unpublished *Elatocladus*, *Brachyphyllum*, and *Pagiophyllum.*[*)]

Over the past few years two morphotypes of the *Pagiophyllum* leaves were collected: the usual size leaves and a large form. In regard to their macro- and micromorphology, both of them can be attributed to the *Pagiophyllum peregrinum* (Lindley and Hutton) Schenk emend et Kendall (1948).

Remains of *Pagiophyllum peregrinum* were first described from the Lower Liassic of Lyme Regis, Dorset, Great Britain; the type specimen (n° J.925) is located in the Philipot collection of the Oxford Museum (Kendall, 1948).

MATERIAL

All material is housed in the palaeobotanical collection of the Botanical Department of the Hungarian Natural History Museum, is labelled with “BP” and numbered.

The usual size leaves are represented by 90 specimens and the large leaves by 7 specimens.

The material contains dispersed leaves and leafy twigs. The preservation of the leaves is sufficient for cuticular examination through light – and scanning electron microscopes. Unfortunately, the cuticles are often pyritized and oxydated so the view of the cuticle is sometimes unclear.

SYSTEMATICAL DESCRIPTION

Division: SPERMATOPHYTA

Class: CONIFEROPSIDA

Order: CONIFERALES

Family: CHEIROLEPIDIACEAE

Genus: ***Pagiophyllum*** Heer

Pagiophyllum peregrinum
(Lindley et Hutton) Schenk

Selected synonyms:

1826. ‘Plants’ de la Beche, p. 29, pl. IV, fig. 7.
1833. *Araucaria peregrina*, Lindley et Hutton, p. 19, pl. 88.
1838. *Araucarites peregrinus*, Presl. in Sternberg, p. 204.
1849. *Brachyphyllum peregrinum*, Brongniart, p. 104.
1870. *Pachyphyllum peregrinum* (L. et H.), Schimper, p. 250.
1884. *Cheirolepis escheri*, Saporta, p. 48, pl. 193, fig. 1–8.
1884. *Pagiophyllum peregrinum* (L. et H.), Schenk in Zittel, p. 216, fig. 191.
1948. *Pagiophyllum peregrinum* (L. and H.) Schenk emend Kendall, Kendall, p. 83, figs 4, 5.

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Normal form (Pl. 1, 2)

The leaves are spirally arranged with a 2/5 or 3/8 phyllotaxy, depending on the twig diameter. The entire leaves are oblong, pyramidal in shape, rhomboidal in section, with a more or less acute apex. The free part of the leaf is stiff, usually 3–8 mm long and 2–4 mm wide. The lateral margins are curved to form the sides of the decurrent leaf base cushion. Both surfaces are convex but the adaxial surface (without a keel) is generally more convex than the upper one. The leaf margins are scarcely scarious (Pl. 1, figs 1–2; Fig. 1).

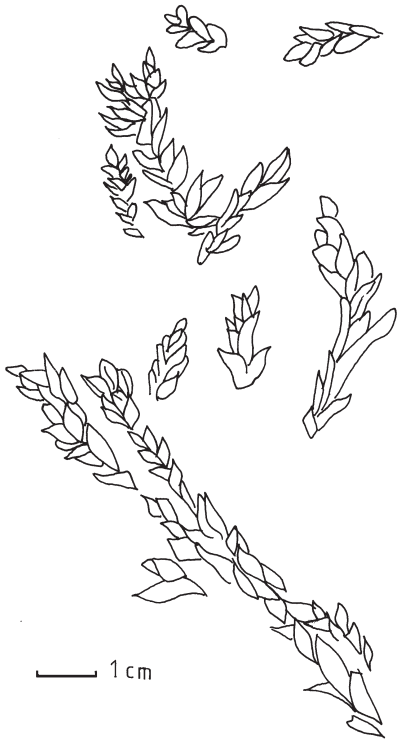

Fig. 1. Branch fragments with the usual leaves from the Mecsek Mts., No BP 98.51.1

The upper and lower cuticles are thick, from 6 µm to 8 µm. The epidermal cells are more or less arranged in longitudinal rows. They are 30–80 µm long and 20–40 µm wide. The anticlinal walls are thick (generally 2–5 µm). The ordinary epidermal cells of both surfaces have no papillae but sometimes a rounded thin area arises in the middle of the periclinal wall. Hypodermic cells and trichomes have never been observed on this material. The leaves are amphistomatic. The stomata are scattered on the adaxial cuticle but they are distributed in more or less well-marked longitudinal files on the abaxial surface, except at the base of the leaf cushion (Pl. 1, figs 2, 3; Pl. 2, fig. 1). The stomata are less numerous at the apex, near the margins and at the base. The aperture of the stomata is randomly orientated. 4 to 6 subsidiary cells form a regular ring surrounding the stomatal aperture. The anticlinal walls are about 2 µm wide. The periclinal walls of the subsidiary cells are thick and adnate, forming a continuous cutinized rim surrounding the stomatal aperture in external view. Encircling cells have not been clearly observed on this material (Pl. 1, figs 5–6; Pl. 2, figs 2–4).

The large form (Pl. 3)

This form of *P. peregrinum* corresponds in all characteristics with the usual form, except in leaf size, which reaches 20 mm (length) and 8 mm (width) in well-developed leaves (Pl. 3, figs 1–7; Fig. 2:1–2). The twigs with large leaves were found separate from the twigs with normal leaves, but on two specimens both types of twigs were found near each other. Five fragments (without a branch top) are composed only of large leaves; there are a few (4–5 visible) normal size leaves which are always grouped together (Fig. 2:3–5) on three fragments among the large leaves. Each of these twigs (they are between 30–80 mm long) has one group of normal leaves.

Fig. 2. Branch fragments with the large leaves from the Mecsek Mts. 1 – No BP 98.514.1, 2 – BP 98.516.1, 3 – BP 98.892.1., 4 – BP 98.893.1, 5 – BP 98.894.1

DISCUSSION

The usual form of the *P. peregrinum* from the Mecsek Mts. corresponds in all features with *P. peregrinum* from Mende in France (Pl. 4, figs 1–4).

The Hungarian material was also compared with some other species of the *Pagiophyllum* from the Liassic of Italy, *P. rotzoanum* (Massalongo) Wesley 1956 (Monte Carpini, Italy) and *P. valdassense* Wesley 1956 (Val d'Assa, Italy). The Italian species differ from the Hungarian material in that their leaves are more decurrent at the base.

The large specimens from the Mecsek Mts. look like the *Pagiophyllum maculosum* Kendall 1948 from the Bajocian of Yorkshire (Great Britain). They are similar in size (*P. maculosum* from Yorkshire is up to 10 mm x 5 mm large). However, their macro- and micromorphological structures differ in details. *P. maculosum* has leaves mainly appressed to the stem, not diverging like in *P. peregrinum*, sometimes with keel. The margins of leaves are not scarious like in *P. peregrinum* and its cuticle is also different. In *P. maculosum* the hypodermal cells were often observed when in *P. peregrinum* they are always lacking. The distribution of stomata is also different, in *P. maculosum* they are more frequent at the apex of the leaf, while in *P. peregrinum* they are less numerous. Also the encircling cells were observed in *P. maculosum* (Harris 1979).

Two other species of the *Pagiophyllum* (*sewardii* and *connivens*) are easily distinguished from *P. peregrinum* because of the papillae bearing their subsidiary cells.

As mentioned by Kendall (1948) and according to Lindley and Hutton's description, the type specimen was a large form ('upward of a foot long') but the authors have not specified the leaf size. Nevertheless, the cuticle of this specimen agrees with those from the other specimens from Lyme Regis.

P. peregrinum was also mentioned by de la Beche (1826), Brongniart (1849) and Schimper (1870), but named differently (see selected references). According to them, the size of the free part of the leaves varied from 5 to 8 mm in length and from 3 to 6 mm in width.

Kendall (1948) revised the Great Britain collections of *Pagiophyllum peregrinum* and gave approximately the same dimensions for the leaves (5–10 mm long, mean 8 mm, 3–6 mm wide, mean 4 mm).

From the south of France, Saporta (1884) described some new specimens under the name *Cheirolepis escheri*. The size of the free part of the leaves he mentioned, never exceeds 9 mm long or 6 mm wide.

More recently, seven new outcrops have been discovered in the Causses Basin (south of France) (Thévenard 1992, 1995) yielding *Pagiophyllum peregrinum*. Numerous examples of isolated leaves and twigs were collected and studied. Leaves of various shapes (rounded to lanceolate) have been described but nevertheless, the size of the free part of the leaves never exceeds 9 mm long and 7 mm wide.

The normal form of the *P. peregrinum* from Hungary (from the same locality Mecsek Mts., near Komló) collected in 1989, 1994 and 1996 corresponds in size with the leaves from the other localities. Nevertheless, the heterophylly of the *P. peregrinum* was observed recently at the French locality near Talmont-Saint-Hilaire as well (Thévenard, unpublished data) and the relation between the numbers of large and small forms is the same as in Hungary. The same has been observed by van Konijnenburg-van Cittert in the Liassic sediments from the Bayreuth area (pers. comm.). The mentioned specimen ("Grube Lautner" near Bayreuth, No. 11103 – the palaeobotanical collection of the State University in Utrecht) has acute leaves 16–17 mm long and 3–4 mm wide at the base.

Because of the low number of specimens and the small size of the fragments we cannot fully interprete the leaf heterophylly of Hungarian *P. peregrinum*. In our opinion there are some possible explanations for these size differences.

Micro- and macromorphological study of leaves from the French localities belonging to different genera (*Pachypteris, Eretmophyllum, Brachyphyllum, Hirmeriella* and *Pagiophyllum*) suggests seasonal climatic periods in this area during the Lower Jurassic (alternating wet and dry seasons). In general, the heterophylly in conifers might be caused by seasonal changes of the climate. For this interpretation we have a too low number of twigs with large leaves. Only seven specimens with 17 fragments of twigs with large leaves have been collected in the same locality, compared a large number (ninety) of specimens with normal leaves. Only four fragments have a few normal size leaves among their large ones, but it was not possible to observe a regularity in the arrangement of different size leaves to confirm the hypothesis about climatic periods.

Alternatively, the various leaf sizes might be caused by their different position on the trees. In conifers, the leaves are usually longer near the trunk and on the main branches (Fig. 2:5). However, in the case of the discussed specimens the branch fragments bearing the large leaves are not wider than those with the usual forms which disagrees with this point of view.

The large size of leaves might have been caused by local (proper) soil conditions and this hypothesis might explain the occasional finding of this unusual form.

Considering to the available data we are inclined to agree with the third hypothesis, while leaving the question open.

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Claude Bernard Lyon 1, of Hungarian material – in Eötvös Lorand University in Budapest, by dr. Károly Bóka.

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PLATES

Plate 1

1–6. Specimens with normal leaves from the Mecsek Mts., Hungary:

1. No. BP 89.413.1

2. No. BP 98.51.1

3–5. Light microscope, details of cuticles:

3. Abaxial cuticle showing stomatal rows (specimen No. BP 89.439.1.A, slide 881)

4. Adaxial cuticle with more scattered stomata. (specimen No. BP 89.439.1.A, slide 881)

5–6. Details of stomata (specimen No. BP 94.432.1, slide 836)

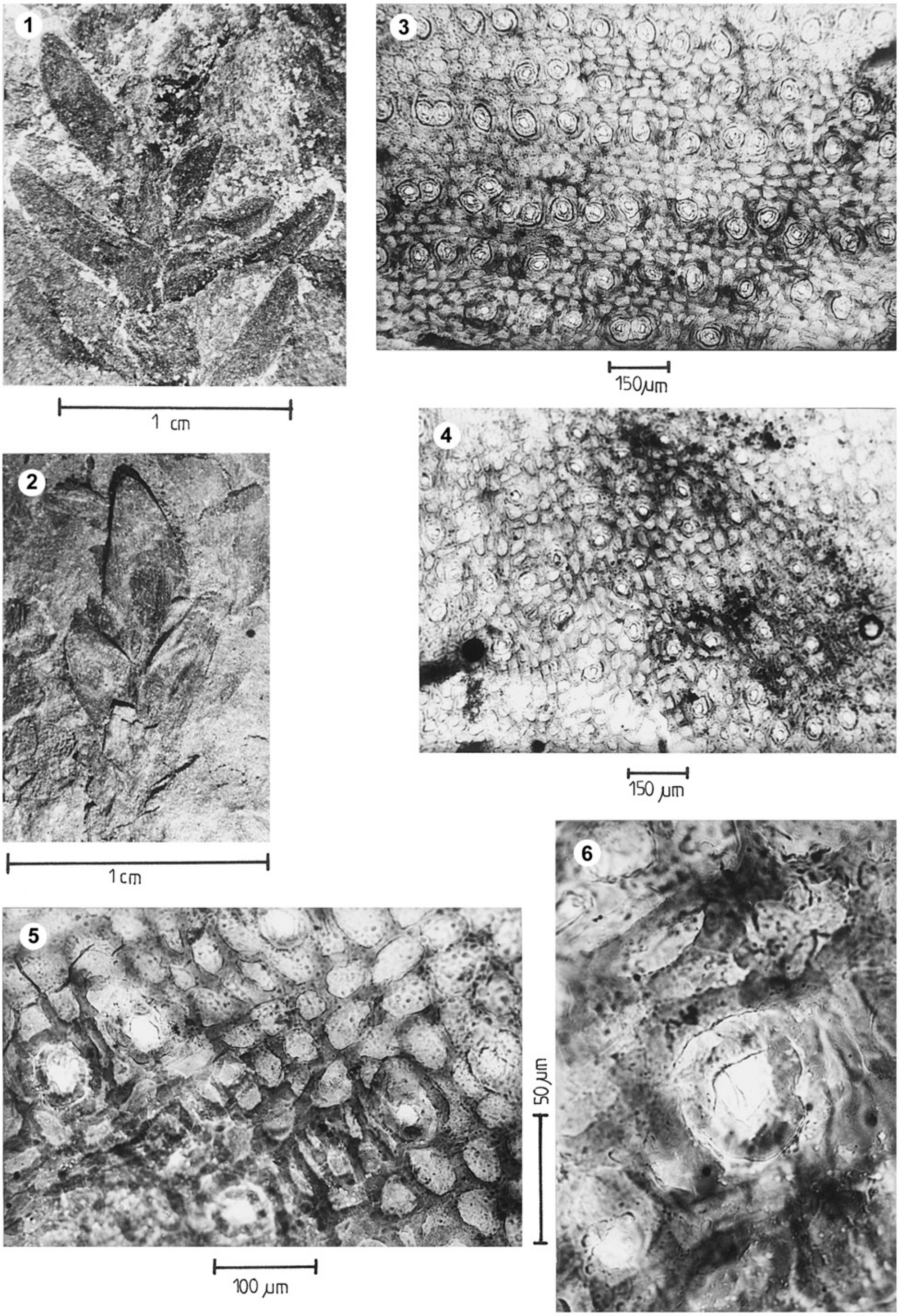

1
1 cm
2
1cm
3
150µm
4
150 µm
5
100 µm
6
50 µm

Plate 2

1–4. SEM pictures (all from the specimen No. BP 98.413.1):

1. Outer view of the abaxial cuticle

2. Inner view of the abaxial surface showing stomatal rows

3–4. Stomata

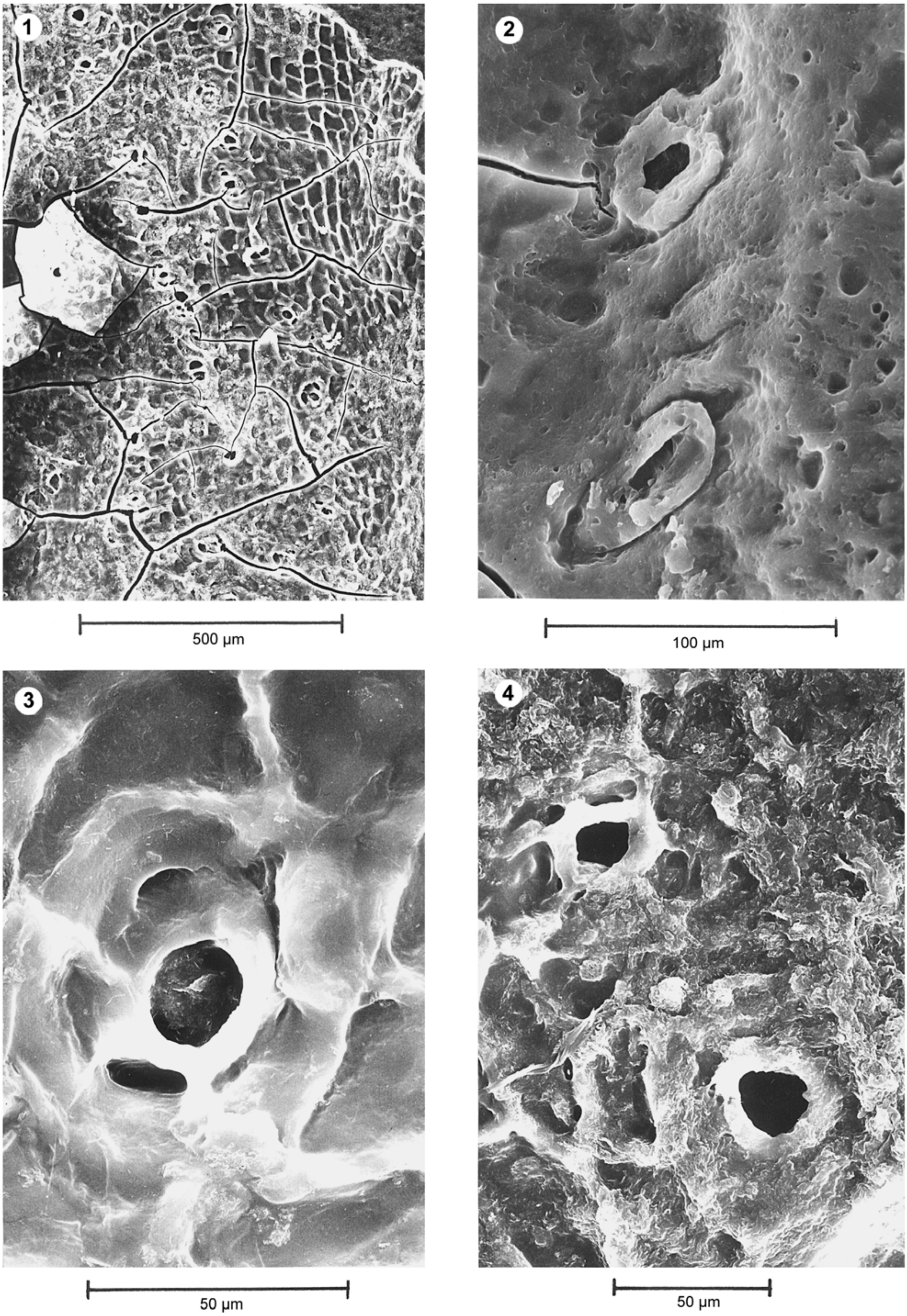

1
2
500 µm
100 µm
3
4
50 µm
50 µm

Plate 3

1–7. Specimens with large leaves from the Mecsek Mts., Hungary

1–3. Details of the branches

4. Light microscope picture of the abaxial cuticle (specimen No. 96.516.1, slide 882)

5. Stoma (slide as above)

6–7. SEM pictures, the outer view of the abaxial cuticle (all pictures from the specimen No. 96.514.1)

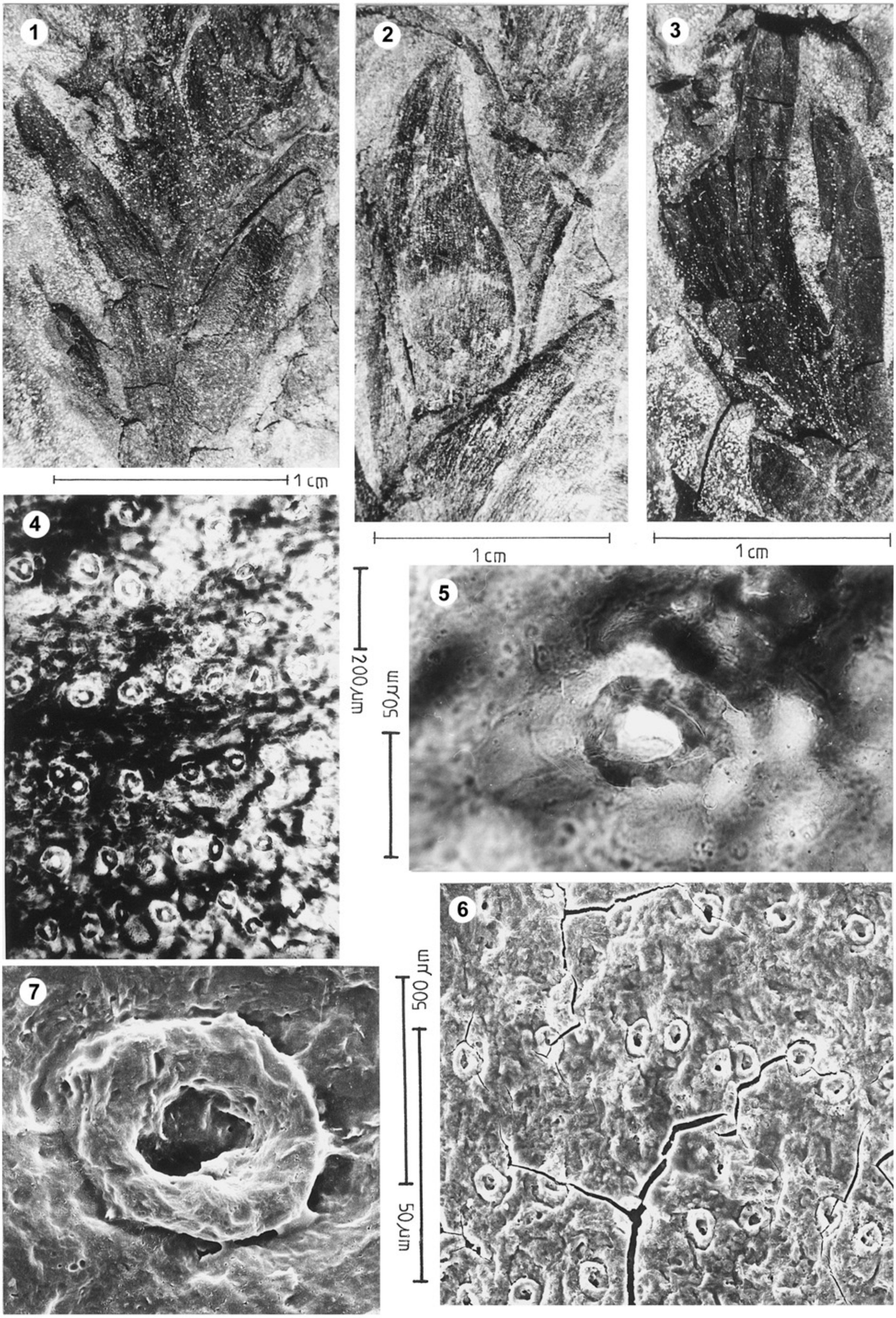
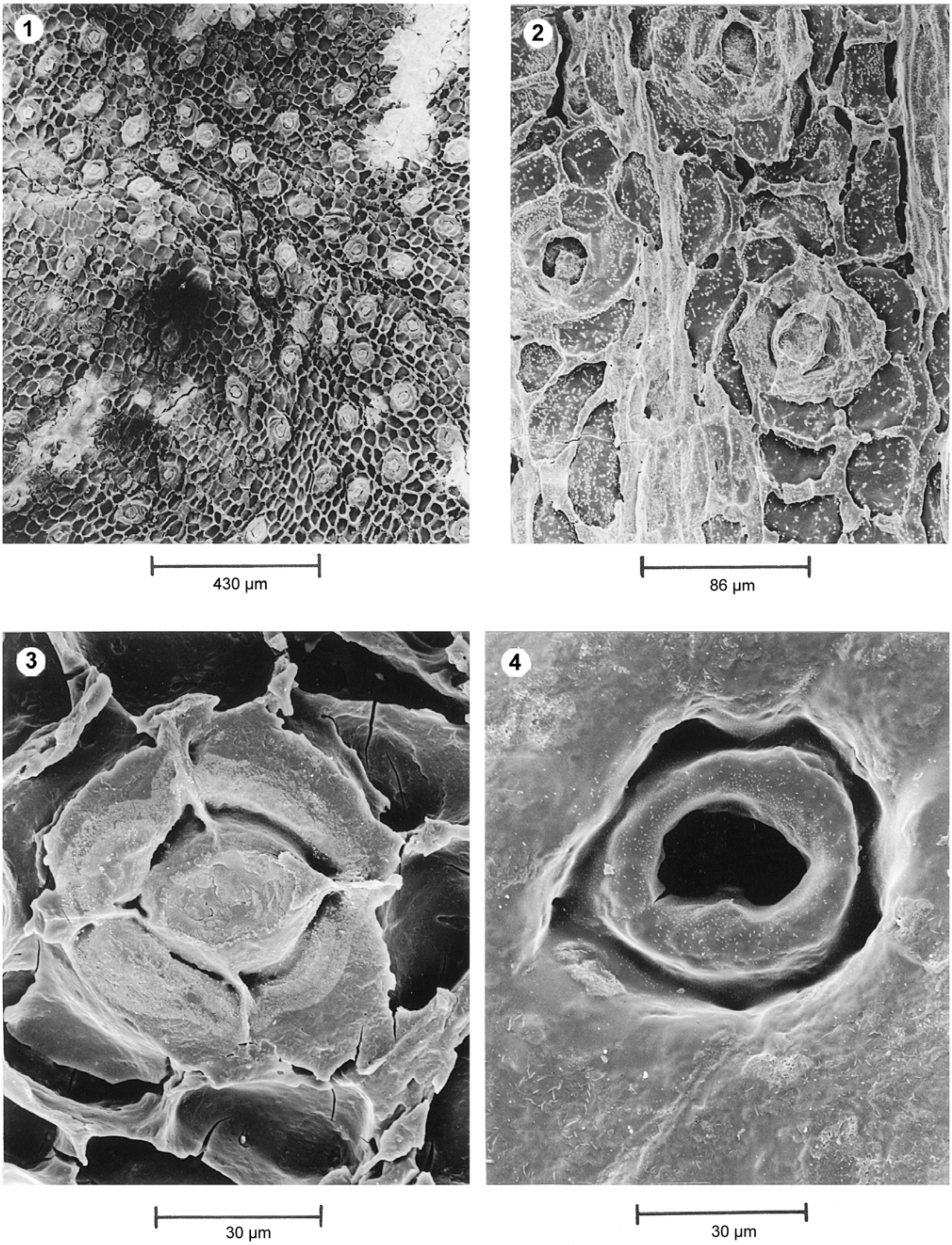

1
2
3
1 cm
1 cm
1 cm
4
5
6
7
200 µm
50 µm
500 µm
50 µm

Plate 4

Specimens with the usual leaves from Mende (France), SEM pictures

1–2. Details of the adaxial surface in inner view

3–4. Details of a stoma in outer (3) and inner (4) view


1
430 μm
2
86 μm
3
30 μm
4
30 μm