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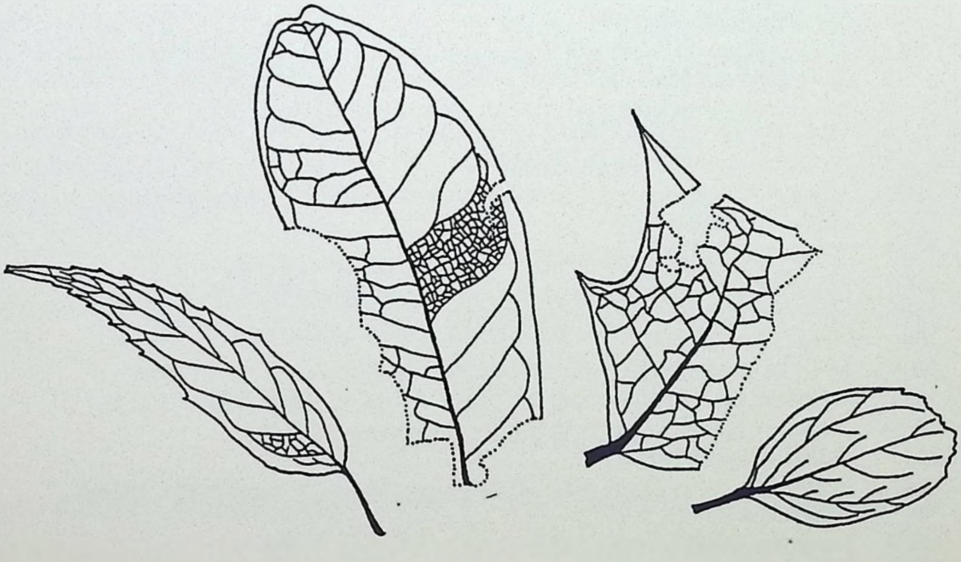

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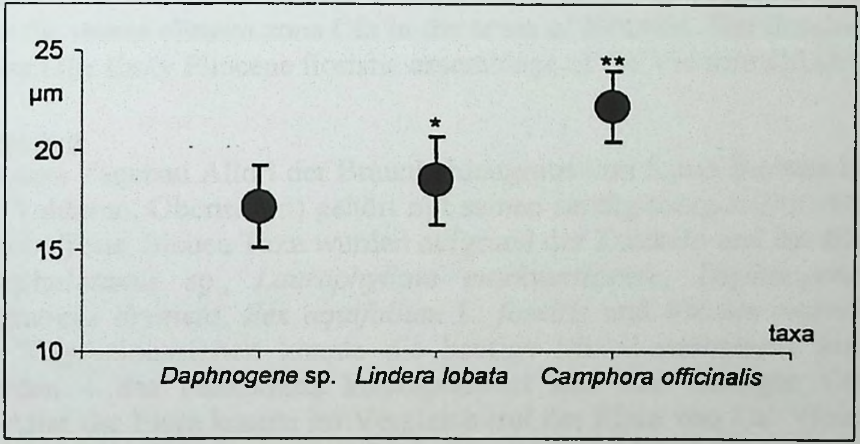
FLORA TERTIARIA MEDITERRANEA V.9

A new Pliocene leaf flora from the Meleto Clay in the opencast mine Santa Barbara, Upper Valdarno (Central Tuscany, Italy)



V. TEODORIDIS & H.-J. GREGOR

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A new Pliocene leaf flora from the Meleto Clay in the opencast mine Santa Barbara, Upper Valdarno (Central Tuscany, Italy)

V. TEODORIDIS & H.-J. GREGOR

Abstract

The flora of the Allori open cast mine (Santa Barbara) is bound to sandy-clayey sediments, which belong to the upper part of the Meleto Clay. It includes 7 taxa of conifers and angiosperms, i. e., *Cephalotaxus* sp., *Laurophyllum markvarticense*, *Daphnogene polymorpha*, *Ocotea* sp., *Quercus drymeja*, *Ilex aquifolium* L. *fossilis* and *Viscum miquelii*, determined on the basis of leaf morphology and epidermal structure. Reconstructed vegetation is well comparable to the recent Mixed Mesophytic Forest. The probable climatic character corresponds to the recent climate zone Cfa in the sense of KÖPPEN. The flora of Santa Barbara is correlated with the Early Pliocene floristic assemblage of Ca'Viettone (MARTINETTO 1995).

Zusammenfassung

Die Flora aus dem Tagebau Allori der Braunkohlengrube von Santa Barbara bei Castelnuovo dei Sabbioni (Valdarno, Oberitalien) gehört mit seinen sandig-tonigen Schichten in die obere Partie der Meleto Tone. Sieben Taxa wurden aufgrund der Kutikeln und der Blattmorphologie bestimmt: *Cephalotaxus* sp., *Laurophyllum markvarticense*, *Daphnogene polymorpha*, *Ocotea* sp., *Quercus drymeja*, *Ilex aquifolium* L. *fossilis* und *Viscum miquelii*. Als damals vergleichbare Vegetationseinheit konnte die heutige Mixed-mesophytic Forest Formation gefunden werden – das Paläoklima korrespondiert mit dem heutigen Cfa-Klima sensu KÖPPEN. Als Alter der Flora konnte im Vergleich mit der Flora von Ca' Viettone das Untere Pliozän benannt werden (MARTINETTO 1995).

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1. Introduction

The Upper Valdarno Basin is a typical palaeontological area, which has been long known by numerous studies of plant and vertebrate fossils. First geological and palaeobotanical research was done by GAUDIN and STROZZI (1858, 1859, 1862) and RISTORI (1885). Recently, the Upper Valdarno Basin is studied in detail mainly from sedimentological, palaeozoological, palynological and palaeomagnetical point of view (e. g., AZZAROLI et al. 1986, ALBIANELLI et al. 1997, BERTINI 1994). No modern monographs dealing with leaf macrofossils are available, except some sporadic papers (i.e., FISCHER & BUTZMANN 2000). This paper tries to partly fill up this gap.

2. Location and geological setting

The investigated leaf material was collected by the second author in the open cast mine Allori of the opencast mine area Santa Barbara at Castelnuovo dei Sabbioni, South of Florence, which belongs to the Upper Valdarno Basin (see text-fig. 1). The fossiliferous horizon, i. e., sandy-clayey fluvial sediments, belongs to upper part of the Meleto Clay. The Upper Valdarno Basin is filled of fluvio-lacustrine deposits, which are divided into three main stages. The first sedimentary stage is named Castelnuovo, the deposits are situated mainly in the area of Castelnuovo dei Sabbioni. The second stage is named Montevarchi and it represents lacustrine and fan-delta deposits in the central part of the basin. The last stage is Monticello, which is represented by fluvial sediments and alluvial fan deposits – see in detail, e. g., BILLI et al. (1991), BERTINI (1994). The Castelnuovo sequence consists of the basal alluvial and fluvio-deltaic Spedalino Sand and Gravel (thickness 50 m), grading upwards into the lacustrine Meleto Clay with two basal lignite seams (thickness 150 m) and the overlying delta San Donato Sand (thickness 80 m) – text-fig. 2.

3. Dating

According to palaeozological investigations in the lower part of the Meleto Clay (e. g., AZZAROLI et al. 1986) it is possible to correlate the basal part of the Meleto Clay (lignite seams) with the oldest Villafranchian faunal unit, i. e., Trivesta faunal unit, which corresponds to mammalian zone MN 16a (3.0-3.3 Ma). Besides, the palaeomagnetical records show similar dating. According to ALBIANELLI et al. 1997, the Kaena Subchron, i. e., reversed polarity in Gauss chron, occurs in the lower section of the Meleto Clay (near the basal lignite), which is dated to 3.11 to 3.04 Ma. The end of the Gauss chron has been determined at 2.58 Ma, which corresponds approximately to the middle part of the San Donato Sand.

4. Material and methods

A binocular magnifying glass was used for observations and studies of fossil material in morphological point of view. Currently accepted terminology and applied methods of cuticular preparation for description of macroscopic parts of leaf lamina and cuticles are included in the publications of HICKEY (1973) and KVAČEK (1985, personal communication). The fossil material is predominantly in a form of carbonised compressions. This type of preservation permits to use cuticular analysis and detailed leaf morphology. Hydrofluoric acid was applied to clean inorganic particles in all samples. The chosen fragments were macerated in a drop of Schulze solution (thickly cutinized) or in a drop of 10% solution of H_2O_2 (thinly cutinized elements) directly on the slide. After reaching the required oxidation, the oxidative reagent was removed by filter paper or by fine tissue. The epidermal samples were rinsed with several water drops, before adding 5% solution of KOH. The carbonized mesophyll tissue dissolved in the latter solution, and the adaxial and abaxial cuticles were separated mechanicly with needles. Most of the thickly cutinized samples were stained by safranine. The resulting cuticles were placed on the slide into a drop of glycerine, then covered with the cover glass and sealed with Canada balsam or nail polish. The cuticles were studied in the optical microscope in normal transmitted or in interference light. The statistic counting has been done by two-sample T- test (significance level 0.1 and 0.05). The investigated fossil material will be transferred to the National History Museum Augsburg. The recent comparative cuticular material is housed in the Institute of Geology and Palaeontology, Faculty of Science, Charles University, Prague.

5. Systematic part
5.1 Gymnospermae

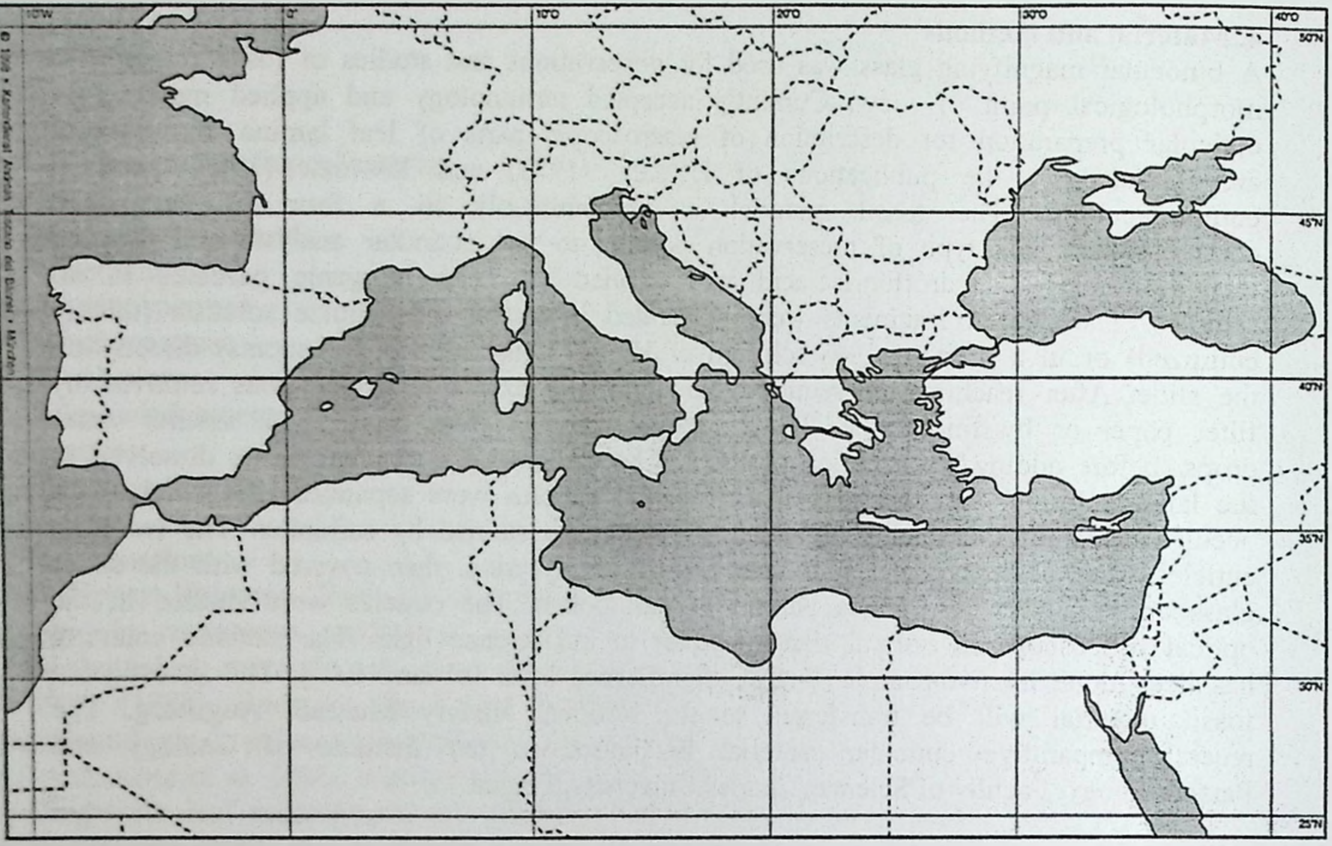
Cephalotaxaceae
Cephalotaxus SIEB. et ZUCC.

***Cephalotaxus* sp.**
pl. 2, figs 4, 6; pl. 3, figs 12-15; text-fig. 7/9

Material: 1 fragment of needle (SB-19).

Description: Needle leaf incomplete, linear, 23 mm long and 3 mm broad, base incomplete, apex mucronate, margin entire, midrib distinct, strong, curved, macroscopically obvious two stomatal bands along the midrib including 11 and 12 continuous stomatal rows per band, partly widely spaced.

Leaf hypostomatic, adaxial epidermis medium cutinized, outer surface of epidermal cells smooth, ordinary cells irregular, polygonal, 23-50 (32) x 8-21 (16) µm, with straight anticlinal walls. Abaxial epidermis medium cutinized, outer surface of epidermis smooth or with very faint narrow cutin ridges, ordinary cells irregular, polygonal, 40-59 (48) x 14-23 (18) µm, with straight anticlinal walls, elongate in non stomatal zones. Stomata 47-56 (52) x 38-47 (46) µm in size, amphicyclic, longitudinally oriented in rows, guard cells sunken, number of subsidiary cells 5 to 7, lateral cells half-moon shaped, darker stained, polar cells often common for adjacent stomata, stomatal slit linear to fusiform, framed by distinct stomatal ledges and T-pieces of polar thickenings. Asterosclereids variously oriented in the hypodermis.



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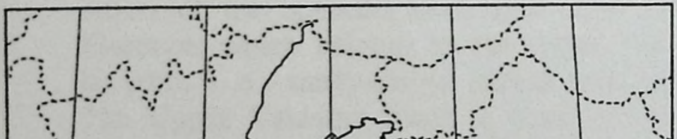

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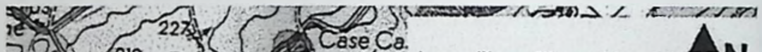
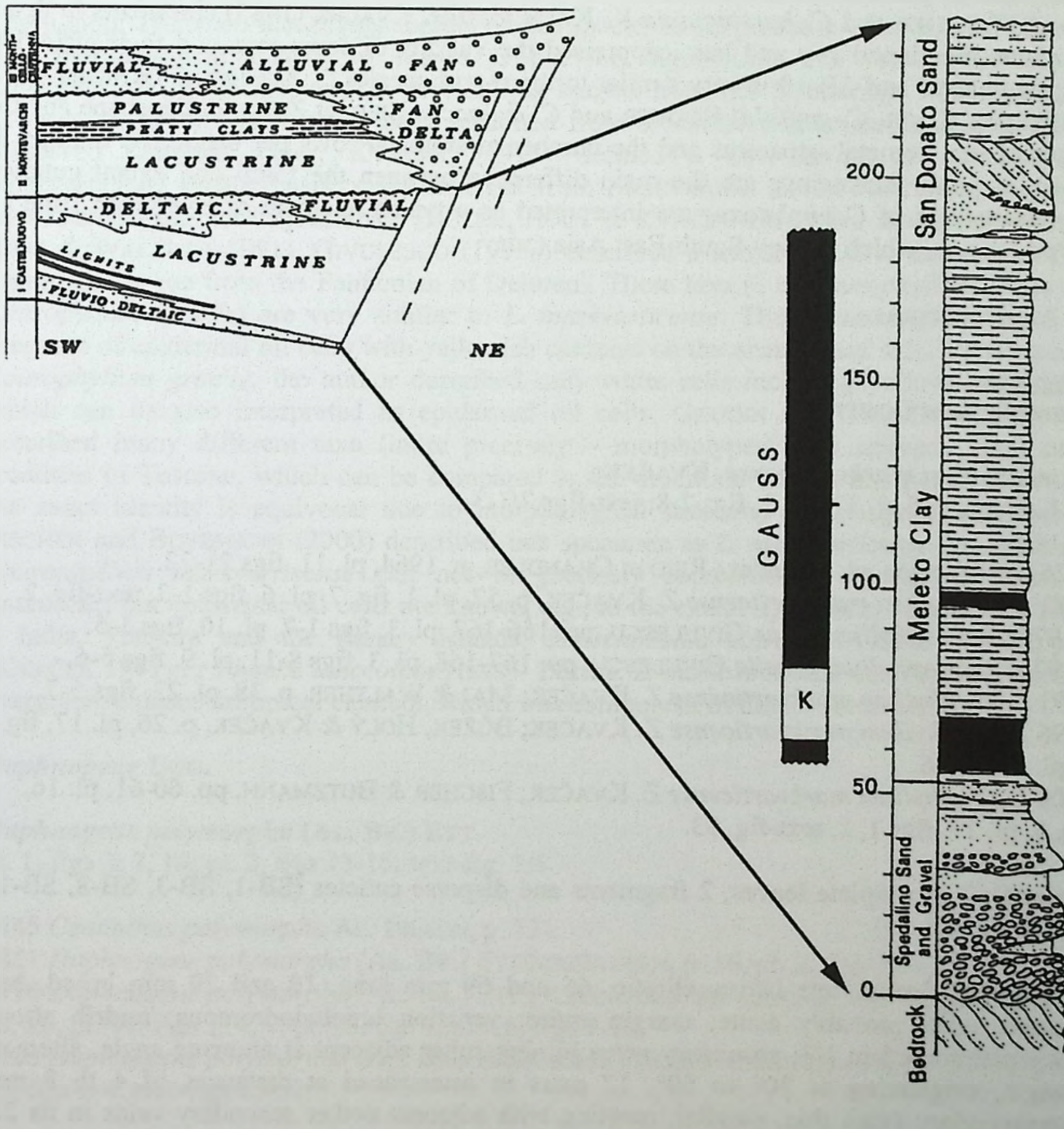


■ the open pit mine Allori of the opencast mine Santa Barbara at Castelnuovo dei Sabbioni

● Santa Barbara

C

Text-fig. 1 (left):
Location of the open pit mine Allori of the opencast mine Santa Barbara at Castelnuovo dei Sabbioni, Upper Italy (A = Map of the mediterranean area, B = map of Italy and C = special map S. Barbara, all with signature of the area under research)



Text-fig. 2: Schematic stratigraphy of the Valdarno Basin fill and composite stratigraphical profile of the whole Castelnuovo sequence (thickness in meters), including palaeomagnetic polarity of this sequence. Modified after ALBIANELLI et al. (1997).

Discussion: The above-described incomplete needle from Santa Barbara is very similar in its epidermal structure with *C. pliocaenica* MÄDLER, which is based on the Pliocene leaf material from Frankfurt u. M. (MÄDLER 1939). Cuticles of either record are similar mainly in the shape, the numbers of lateral subsidiary cells and the number of stomatal rows and the identical stomatal type and form. The main difference from the type specimen from Frankfurt u. M. is in presence of asterosclereids in the hypodermis. Therefore, a direct identification to this species would not be correct in all respect. KVAČEK (1984, 1985) described a leaf material from the locality Plesná, which shows the same epidermal pattern including asterosclereids, but the numbers of stomatal rows vary from 6 to 8. MAI and WALTHER (1978, p. 32) composed a species key of fossil *Cephalotaxus*, which shows significant differences of 6 species in the epidermal structure, i.e. *C. cretacea* SAMYLINA, *C. europaea* MAI et WALTHER, *C. pliocaenica* MÄDLER, *C. multiserialis* (WLD.) MAI et WALTHER, *C. eigensis* MAI et WALTHER and *C. harringtonia* K. KOCH *fossilis*. KVAČEK (1985) comments in detail the above-mentioned key and has reappraised the validity of some taxa and their affinities. The incomplete leaf SB-19 is very similar to the recent species *C. harrigtonii* (KNIGHT ex. J. FORBES) K. KOCH, *C. griffithii* HOOKER and *C. drupacea* SIEB. et ZUCC. in the shape and the length of the stomatal apparatus and the number of stomatal rows per band. The distinct T-pieces of polar thickenings are the main difference between the fossil and extant cuticles. Representatives of *Cephalotaxus* are interpreted as a typical element of Evergreen Broad – leaved Forests, which occupy South-East Asia today.

5.2 Angiospermae

Lauraceae
***Laurophyllum* GOEPP.**

***Laurophyllum markvarticense* KVAČEK**
pl. 1, figs 1, 4, 5, 8, 11; pl. 2, figs 7-8; text-figs 7/1-3

1926 *Cuticles* gen. et. sp. indet.; REID et CHANDLER, p. 1964, pl. 11, figs 21-22.
1971 *Laurohyllum markvarticense* Z. KVAČEK, p. 52, pl. 1, fig. 7, pl. 6, figs 1-3, text-fig. 2.
? 1975a *Laurophyllum liviae* GIVULESCU, pp. 166-167, pl. 3, figs 1-7, pl. 10, figs 1-5.
? 1975a *Laurophyllum gracile* GIVULESCU, pp. 167-168, pl. 3, figs 8-11, pl. 9, figs 5-6.
1991 *Laurophyllum markvarticense* Z. KVAČEK; MAI & WALTHER, p. 38, pl. 23, figs 5-7.
1996 *Laurophyllum markvarticense* Z. KVAČEK; BŮŽEK, HOLÝ & KVAČEK, p. 26, pl. 17, fig. 4, pl. 19, fig. 6.
2000 *Laurophyllum markvarticense* Z. KVAČEK; FISCHER & BUTZMANN, pp. 60-61, pl. 16, fig. 5, pl. 17, figs 1, 2, text-fig. 93.

Material: 2 incomplete leaves, 2 fragments and disperse cuticles (SB-1, SB-3, SB-8, SB-16, SB-18 and SB-20).

Description: Incomplete leaves elliptic, 46 and 69 mm long, 19 and 29 mm broad, base cuneate, apex probably acute; margin entire; venation brochidodromous; midrib strong, moderate, curved in 1/3; secondary veins joining super adjacent at an acute angle, alternate, straight, originating at 30° to 50°, 12 pairs in interspaced at distances of 4 to 8 mm; intersecondary veins thin, parallel, meeting with adjacent nether secondary veins in its 2/3, creating loops; tertiary veins perpendicular, distinct; quaternary and quinternary veins thin, orthogonal, veinlets none; areoles well developed, randomly oriented, polygonal; marginal ultimate venation looping in arches of higher orders.

Leaves hypostomatic, adaxial epidermis thickly cutinized, outer surface of epidermal cells smooth with corrosion of pyrite, ordinary cells irregular, polygonal, 15-30 (21) x 13-18 (15) µm, with straight or slightly curved anticlinal walls. Abaxial thickly cutinized, outer surface of epidermis smooth, ordinary cells irregular, polygonal, 15-28 (20) x 12-18 (15) µm, with straight or slightly curved anticlinal walls. Stomata 15-22 (18) x 22-30 (25) µm in size, paracytic, randomly orientated and distributed, guard cells partly sunken, subsidiary cells narrow, darker stained, distinct stomatal ledges, outer cavity linear to fusiform. Epidermal oil cells oval to rounded, randomly distributed, observed on abaxial (more distinct) and adaxial cuticules as thin transparent spots.

SI = 7.32 %; SD = 372 stomata per mm^2

Discussion: The main identifying feature of this species is the presence of epidermal oil cells. The morphological pattern of leaves is not too significant. The first occurrence of *Laurophyllum markvarticense* Z. KVAČEK is known from the Bembridge Marls (REID & CHANDLER 1926). The authors have refrained from a precise determination due to poorly preserved material. Later, KVAČEK (1971) defined a new taxon as *Laurophyllum markvarticense* on the basis of the material from Markvartice. *L. markvarticense* has been also known from the Cypris Shale (BŮŽEK, HOLÝ & KVAČEK 1996) and also from Witznitz (MAI & WALTHER 1991). GIVULESCU (1975a) described a leaf material as new taxa of the family Lauraceae from the Pannonian of Delureni. These taxa (i. e. *Laurophyllum liviae* and *Lauropyllum gracile*) are very similar to *L. markvarticense*. The connecting feature is the presence of epidermal oil cells with yellowish contents on the abaxial leaf side. In the case of *Laurophyllum gracile*, the author described only white cells including yellowish contents, which can be also interpreted as epidermal oil cells. GAUDIN and STROZZI (1858-1862) described many different taxa (more precisely – morphotypes) of Lauraceae from other localities of Toscana, which can be compared to the described taxa in this paper. However, the exact identity is equivocal due to morphological similarity of foliage in this family. FISCHER and BUTZMANN (2000) described one specimen as *L. markvarticense* from Meleto. *Laurophyllum markvarticense* can not be precisely compared to any living taxon of Lauraceae, but epidermal oil cells are known, e.g., in the extant *Apollonias canariensis* NEES – India, Madeira and the Canary Islands, *Beilschmiedia cairocan* VIDAL – Philippine (KVAČEK 1971) or *Phoebe lanceolata* NEES – Burma. *L. markvarticense* can be interpreted as evergreen, palaeosubtropical element, which was component of the E3 forest storey.

Daphnogene UNG.

Daphnogene polymorpha (AL. BR.) ETT.

pl. 1, figs 3, 7, 12; pl. 2, figs 13-15; text-fig. 7/5

1845 *Ceanothus polymorpha* AL. BRAUN, p. 171.
1851 *Daphnogene polymorpha* (AL. BR.) ETTINGSHAUSEN, p. 16, pl. 2, figs 23 - 25.
1976 *Daphnogene polymorpha* (AL. BR.) ETT., Knobloch & KVAČEK, pp. 52-53, pl. 12, figs 18, 20, pl. 19, figs 3, 4, 7, pl. 23, fig. 7, pl. 26, figs 9-12.
2000 *Daphnogene polymorpha* (AL. BR.) HEER sensu FISCHER et BUTZMANN, pp. 57-58, pl. 15, figs 1-4, text-figs 85-91.

Material: Complete leaf (SB-13).

Description: Complete leaf oblong, 30 mm long and 16 mm broad, apex probably obtuse, base slightly asymmetric, cuneate with petiole (8 mm long); margin entire; venation suprabasal reticulate actinodromous; midrib strong, moderate, straight; lateral veins opposite, straight, originating at 60° angle, running along margin in apical part; secondary veins, thin, looping towards apex and margin; tertiary veins thin, often perpendicular, rarely forked; quaternary and quinternary veins thin, relatively randomly oriented, veinlets none; areoles imperfect, random, polygonal; marginal ultimate venation looped in arches of higher orders.

Leaf hypostomatic, adaxial epidermis, medium cutinized, outer surface of epidermis shagrenate, ordinary cells irregular, polygonal 13-22 (15) x 10-18 (13) µm, with straight anticlinal walls with bead-shaped thickenings. Abaxial epidermis, thinly cutinized, outer surface of epidermis shagrenate, ordinary cells irregular, polygonal, 10-25 (15) x 7-15 (10) µm, with straight anticlinal walls with fewer thickenings. Stomata 17-23 (20) x 13-18 (15) µm in size, paracytic, guard cells sunken, subsidary cells rounded, stomatal ledges distinct, thin, forming linear outer cavity.

SI = 12.82 %; SD = 1248 stomata per mm^2

Discussion: The above-described incomplete leaf is morphologically identical to the leaves from Meleto, which were described in a new sense of *Daphnogene polymorpha* (AL. BR.) HEER by FISHER and BUTZMANN (2000). However, the authors do not define their new conception. The leaves form Santa Barbara and Meleto differ in originating of lateral veins from common representatives of *Daphnogene polymorpha* – complex (e.g., KVAČEK & WALTHER 1974, KNOBLOCH & KVAČEK 1976). The epidermal structure of the leaf from Santa Barbara is comparable to cuticles of *Daphnogene polymorpha* (KVAČEK 1985) and epidermal data from Meleto are not at disposal due to poor preservation. The structure of the abaxial and the adaxial epidermis, i.e., straight anticlines of ordinary cells and absence of bead-like thickenings, correspond to the cuticles, which are typical of "sun" leaves. However, the lack or low density of trichome bases correspond to "shade" leaves. Therefore, the leaf material from Santa Barbara can be interpreted as a transitional form of both extremes. KVAČEK and KNOBLOCH (1967) described *Daphnogene pannonica* Z. KVAČEK et KNOBLOCH from the Pannonian of Moravská Nová Ves. Characters of the cuticular structure (i.e., extremely thin abaxial epidermis with wavy or fine undulate anticlines) is apparantly due to changing of climate during Late Miocene. The affinity of *D. polymorpha* to the recent genus *Camphora* FABR. (KVAČEK personal communication) is based on co-occurrence of similar fruits, which are connected to extant *Camphora officinalis* STEUD. /syn. *Cinnamomum camphora* (L.) PRESL/ from South China, South Japan, Taiwan, South Africa and Sri Lanka (KRÜSSMANN 1976). On the basis of epidermal analysis, *D. polymorpha* shows an affinity to some species of the genus *Lindera* THUNB. The material from Santa Barbara matches best to *L. triloba* BLUME – Japan, which shows a very similar epidermal pattern. However, it does not corespond morphologically.

No statistically significant difference between the mentioned taxa has been found in respect of maximal stomatal length (see text-fig. 3). *Daphnogene* is a typical mesophytic element (E3) of evergreen oak-laurel and Mixed Mesophytic forests of the European Tertiary.

***Ocotea* AUBL.**

***Ocotea* sp.**
pl. 1, figs 2, 9; pl. 2, fig. 16; pl. 3, figs 1-3; text-fig. 7/6

Material: Leaf fragment (SB-2).

Description: Fragmentary elliptic leaf, 25 mm long and 9 mm broad, base assymetric, cuneate, apex not preserved; margin entire; venation perfect suprabasal acrodromous; medial vein strong, moderate, straight, lateral veins thinner, alternate, running along margin, originating at acute angles; secondary veins perpendicular to mid-vein, forminig intramarginal vein; tertiary veins perpendicular; quaternary and quinternary veins thin, orthogonal, veinlets none; areoles well developed, oriented, polygonal; marginal ultimate venation looped over intramarginal vein, distinct 2 glands in axils of the lateral veins.

Leaf hypostomatic, adaxial epidermis medium cutinized, outer surface of epidermis shagrenate, ordinary cells irregular, polygonal, 15-23 (21) x 10-17 (15) µm, with straight or slightly curved anticlinal walls with slight thickenings in sinuses, more elongated above the veins, trichome bases simple, rounded to oval. Abaxial epidermis medium cutinized, outer surface of epidermis shagrenate, ordinary cells irregular, polygonal, 14-22 (20) x 10-18 (16) µm, with straight or slightly curved anticlinal walls with slight thickenings in sinuses, more elongated above the veins, trichome bases simple, rounded to oval, thickly cutinized, randomly distributed in higher frequency above the veins. Stomata 12-17 (15) x 20-28 (23) µm in size, paracytic, randomly oriented and distributed, guard cells sunken, subsidiary cells half-moon shaped, thin stomatal ledges, forming linear outer cavity.

SI = 9.38 %; SD = 1211 stomata per mm^2

Discussion: The fossil material is assigned to *Ocotea* sp. on the basis of the leaf morphology. The determination is based mainly on the pair of distinct glands in the axils of the lateral primary veins. The other described morphological features are not unequivocal and match other taxa of Lauraceae (e.g., *Daphnogene* UNG., *Laurophyllum* GOEPP.). BŮŽEK, HOLÝ and KVAČEK (1996) described leaves from the Cypris Shale as *Ocotea hradekensis* (Z. KVAČEK et BŮŽEK) Z. KVAČEK. This material has a typical epidermal structure (partly sunken paracytic stomata with rather broad and short stomatal ledges, oval to rhomboidal in outline), which is obviously related to recent *Ocotea foetens* (AIT) BAILL of the Canary Islands. *O. hradekensis* has also been described from Meleto (FISCHER & BUTZMANN 2000) and probably from the Upper Pannonian of Romania (GUIVILESCU 1975b). As dispersed cuticles, it has been known from the Sarmatian sediments of northwest Bulgaria (Uzunova & STOJANOVA 1999). These authors described it as a new combination, i.e., *O. pseudoprinceps*, *O. undulata* and *O. macrostoma*. The definitions of these new taxa are based only on epidermal structures and included also older material, which was assigned to the genus *Laurophyllum* GOEPP. (e.g., WEYLAND & KLIPPER 1963, KVAČEK 1971 etc.). The lack of complete samples and cuticular resemblance with the recent species of the genus *Ocotea* AUBL. do not suffice to re-assign this taxon, because of similar epidermal patterns in other Lauraceae. UZUNOVA and STOJANOVA (1999) defined also the original "sun" and "shade" forms (e.g., KVAČEK 1971, FERGUSON 1971) as new species due to a detailed analysis of cuticles. This eventuality is possible, but the interpretation as forms, which are adapted to different ecological condition of one plant, is also probable. The problem of a precise definition is in problematic relations between specific and intra-specific variation of plants. The above described incomplete leaf from Santa Barbara is compared to the recent species *O. acutifolia* MEZ., *O. amoena* (NEES) HERTER (both South America) on the basis of the similar form of the stomatal apparatus and the presence of trichome bases on both cuticles. However, a statistical comparison of the stomatal length of the extant and the fossil species shows considerable differences (see text-fig. 4). Ecological interpretation and the growth habit within forest storeys is analogous to the above-described taxa of Lauraceae.

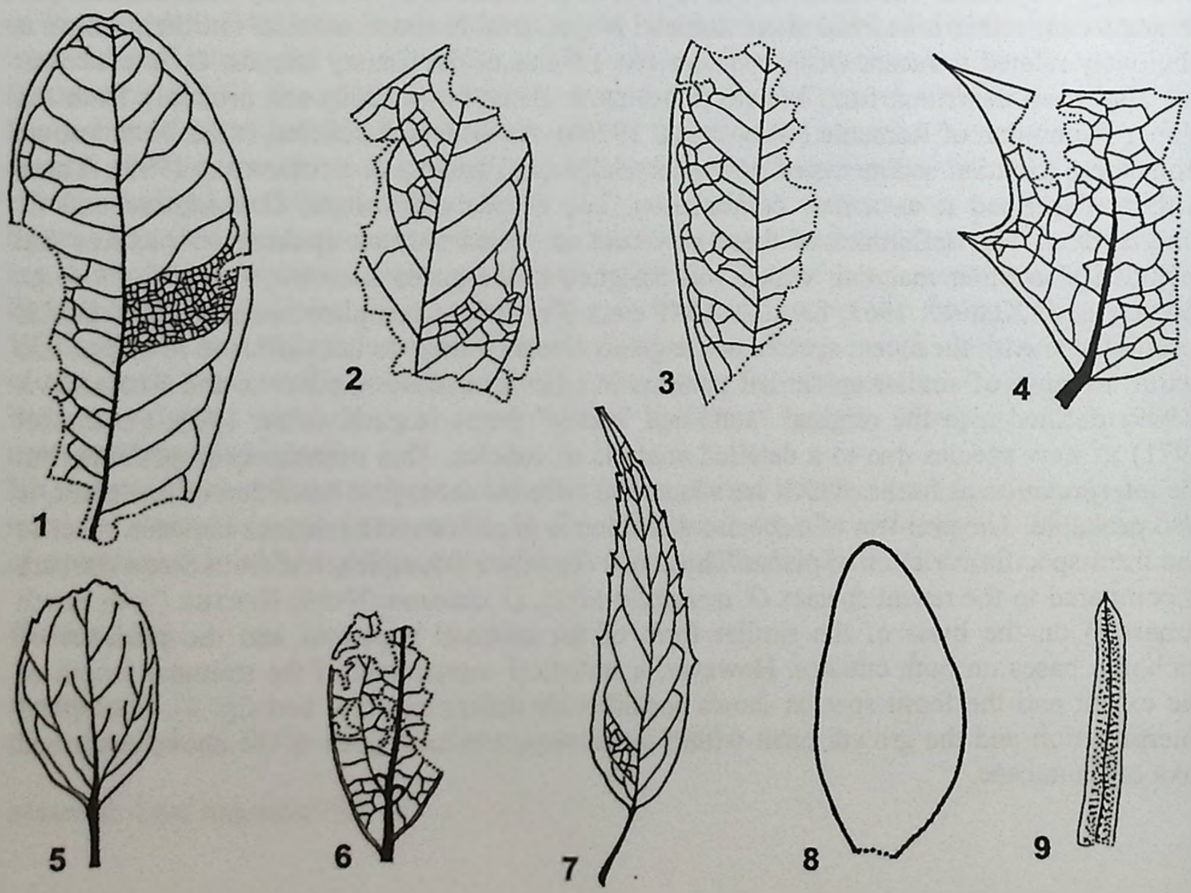
Text-fig. 3 (right): Means of maximal stomatal length of fossil *Daphnogene polymorpha* (AL. BR.) HEER, and extant *Lindera triloba* and *Camphora officinalis* (vertical lines – standard deviations, symbols * and ** – means of maximal stomatal length by recent species is statistically significant different from fossil species at alpha = 0,1 and 0,01).

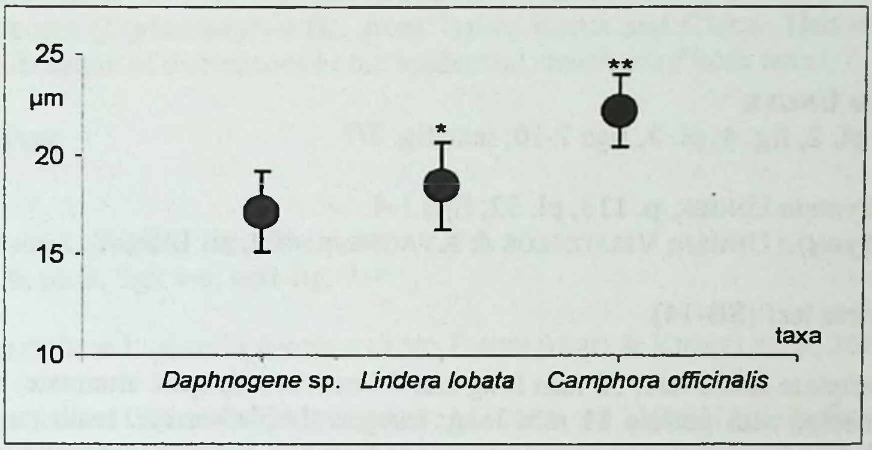
Text-fig. 4 (right): Means of maximal stomatal length of fossil *Ocotea* sp. and extant *Ocotea acutifolia* and *Ocotea amoena* (vertical lines – standard deviations, symbols ** – means of maximal stomatal length by recent species is statistically significant different from fossil species at alpha = 0,01).

Text-fig. 5 (right): Means of maximal stomatal length of fossil *Ilex aquifolium* L. *fossilis* ENGLHARDT and extant *Ilex krugiana*, *Ilex aquifolium* and *Ilex rugosa* (vertical lines – standard deviations, symbols * and ** – means of maximal stomatal length by recent species is statistically significant different from fossil species at alpha = 0,1 and 0,01).

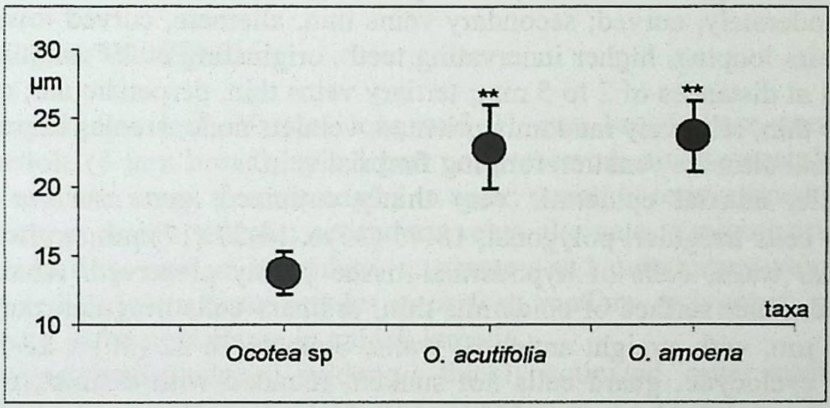
Text-fig. 6 (right): Means of maximal stomatal length of fossil *Viscum miquelii* and extant *Phoradendron caneum*, *Phoradendron forestrieae* and *Viscum austriacum* (vertical lines – standard deviations, symbols ** – means of maximal stomatal length by recent species is statistically significant different from fossil one at alpha 0,01).

Text-fig. 7 (below): 1. *Laurohyllum markvarticense* Z. KVAČEK, SB-8, x1; 2. *Laurohyllum markvarticense* Z. KVAČEK, SB-3, x1; 3. *Laurohyllum markvarticense* Z. KVAČEK, SB-1, x1; 4. *Ilex aquifolium* L. *fossilis* ENGLHARDT, SB-9, x1; 5. *Daphnogene polymorpha* (AL. Br.) HEER, SB-13, x1; 6. *Ocotea* sp., SB-2, x1; 7. *Quercus drymeja* UNGER, SB-14, x1; 8. *Viscum miquelii* (GEYL et KINK.) CZECZOTT, SB-10, x1, 9. *Cephalotaxus* sp., SB-19, x1.5.

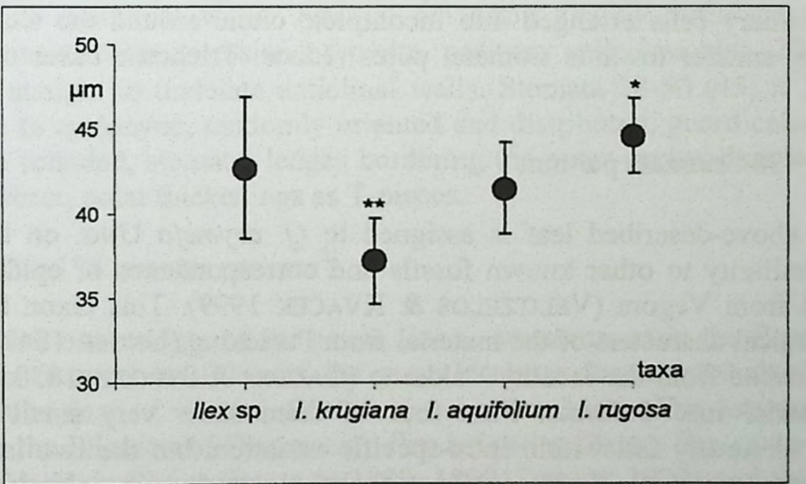



25
µm
20
15
10
taxa
*
**
Daphnogene sp.
Lindera lobata
Camphora officinalis

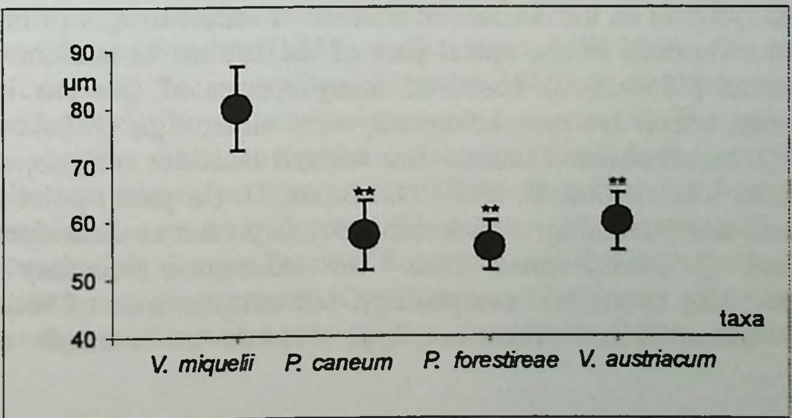
3


30
µm
25
20
15
10
taxa
**
**
Ocotea sp
O. acutifolia
O. amoena

4


50
µm
45
40
35
30
taxa
**
*
Ilex sp
I. krugiana
I. aquifolium
I. rugosa

5


90
µm
80
70
60
50
40
taxa
**
**
**
V. miquelii
P. caneum
P. forestireae
V. austriacum

6

Fagaceae
***Quercus* L.**

***Quercus drymeja* UNGER**
pl. 1, figs 6, 10; pl. 2, fig. 4; pl. 3, figs 7-10; text-fig. 7/7

1847 *Quercus drymeja* UNGER, p. 113, pl. 32, figs 1-4.
1999 *Quercus drymeja* UNGER; VELITZELOS & KVACEK, p. 420, pl. 1, fig. 2.

Material: Complete leaf (SB-14).

Description: Complete leaf ovate, 55 mm long and 12 mm broad, apex attenuate, base slightly asymmetric, cuneate, with petiole 11 mm long; margin simple serrate, teeth convex, apices attenuate, 1 to 2 mm long; venation simple craspedodromous, brochidodromous in basal part; midrib strong, moderately, curved; secondary veins thin, alternate, curved towards apex and margin, first 4 pairs looping, higher innervating teeth, originating at 30° to 50° angles, in 13 pairs, interspaced at distances of 2 to 5 mm; tertiary veins thin, perpendicular; quaternary and quinternary veins thin, relatively randomly oriented, veinlets none; areoles imperfect, random, polygonal; marginal ultimate venation forming fimbrial vein.
Leaf hypostomatic, adaxial epidermis very thinly cutinized, outer surface of epidermis smooth, ordinary cells irregular, polygonal, 18-46 (35) x 14-27 (17) µm, with wavy to finely undulate anticlinal walls, cells of hypodermal tissue poorly preserved. Abaxial epidermis medium cutinized, outer surface of epidermis thin, ordinary cells irregular, polygonal, 12-20 (15) x 7-12 (10) µm, with straight anticlinal walls. Stomata 26-32 (30) x 23-25 (24) µm in size, incomplete cyclocytic, guard cells not sunken, rounded with distinct, relatively thick stomatal ledges, forming linear stomatal slit, polar thickenings T-pieces or I-pieces (level of maceration), subsidiary cells arranged into incomplete circle around the stoma, polygonal, different in shape, smaller towards stomatal poles reduce. Trichome bases oval to rounded thickly cutinized.

SI = 7.41 %; SD = 384 stomata per mm^2

Discussion: The above-described leaf is assigned to *Q. drymeja* UNG. on the basis of its morphological similarity to other known fossils and correspondence of epidermal structure with the material from Vegora (VELITZELOS & KVAČEK 1999). This taxon has been based only on morphological characters of the material from Parschlug (UNGER 1847). Similarly, *Q. drymeja* was described from the locality Valdarno (GAUDIN & STROZZI 1858, 1859). Gaudin divided this material into 6 forms. First four of them show very small differences in morphology and obviously fall within intra-specific variation, but the two latter forms (i.e. *Q.d.* var *paucidentata* and *Q. d.* var *integra*) probably match some slender leaf types of Lauraceae (e.g., pl. 7, fig. 1) on the account of absence of serrate margin (often not preserved) and camptodromous venation in the apical part of the lamina. In addition to *Q. drymeja*, GAUDIN and STROZZI (1858-1862) described many species of *Quercus* L. from various localities of Toscany, which are morphologically very close, e.g., *Q. laharpii* GAUDIN, *Q. gmelini* AL. BR., *Q. mandraliscae* GAUDIN. But without cuticular analysis, a re-assigning is impossible. KVAČEK, VELITZELOS, E. and VELITZELOS, D. (in press) point out several leaf forms from Vegora and Parschlug, which can be interpreted as transitional forms of *Q. drymeja* UNG. and *Q. mediterranea* UNG. The taxonomic boundary is not clearly distinguishable according to the leaf morphology, but independence of both taxa is clearly seen in cuticular characteristics. Therefore, typical forms are example of intra-specific variation. According to FISCHER and BUTZMANN (2000), it is possible to correlated *Q. drymeja* to recent *Q. glandulifera* BL. from Japan, Korea and China. This correlation is not corroborated because of differences in the epidermal structure of both taxa.

Aquilafoliaceae
***Ilex* L.**

***Ilex aquifolium* L. *fossilis* ENGELHARDT**
pl. 2, figs 2, 6; pl. 3, figs 4-6; text-fig. 7/4

1908 *Ilex aquifolium* L. *fossilis* ENGELHARDT; ENGELHARD & KINKELIN, p. 266, pl. 33, figs 3a-g, 5a-b.
1939 *Ilex aquifolium* L. *fossilis* ENGELHARDT; MÄDLER, pp 110-111, pl. 8, fig. 35, pl. 13, fig. 3.

Material: Incomplete leaf (SB-9).

Description: Incomplete leaf, 39 mm long and 31 mm broad, base cuneate with robust fragment of petiole (3 mm broad), apical part not preserved; margin coarsly simple dentate; teeth spiny (3 to 4 mm long) at acute angles to apex; venation semicraspedodromous; midrib strong, moderate, probably straight; secondary veins alternate, straight, originating at acute angles; distinct tertiary random reticulate, quaternary and quinternary veins thin, relatively randomly oriented, veinlets none; areoles imperfect, random, polygonal; marginal ultimate venation looped. Leaf margin frame in a thick lamella.

Leaf hypostomatic, adaxial epidermis thickly cutinized, outer surface of epidermis shagrenate with corrosion of pyrite, ordinary cells irregular, 32-43 (37) x 17-23 (20) µm, with coarsely undulate anticlinal walls. Abaxial epidermis thickly cutinized, outer surface of epidermis shagrenate with corrosion of pyrite, ordinary cells irregular, 27-55 (50) x 18-25 (20) µm, with straight to undulate anticlinal walls. Stomata 38-50 (45) x 32-45 (37) µm in size, anisocytic to cyclocytic, randomly oriented and distributed, guard cells pair not sunken, broadly oval to rounded, stomatal ledges bordering the outer cavity, darker stained, stomatal slit oval to fusiform, polar thickenings as T-pieces.

SI = 6.33 %; SD = 174 stomata per mm^2

Discussion: Fossil occurrences of the genus *Ilex* L. are common in the European Tertiary. In addition to more frequent fossil leaves, the genus has been documented also by occurrences of flowers and fruits (e.g., *I. minuta* CONW., *I. saxonica* MAI). The leaves have often been described from the Pliocene of France e.g., *Ilex balearica* DESF., *Ilex canariensis* POIR. from Thézieres and Vallé du Rhône (BOULAY 1889, 1890, DEPAPE 1922) and the latter mentioned taxon also from Méximieux (SAPORTA & MARION 1876). A similar fossil material was described by GAUDIN and STROZZI (1859) as *Ilex stenophylla* UNG., *Ilex theaefolia* GAUDIN, *Ilex vivianii* GAUDIN and *Ilex massalongi* (RISTORI 1885) from Valdarno. RISSTORI (1885) matched the fossil material from Valdarno to recent *I. opaca* AIL. The epidermal structure of this recent species is very similar to the above-described fossil from Santa Barbara. However, it differs in uniseriate trichomes. FERGUSON (1971) described the leaf material including epidermal structure as *Ilex* sp. from Kreuzau. This material is anatomically very similar to the leaves from Valea de Criş (Lower Pannon, Romania), which GIVULESCU (1982) has defined as a new taxon *Ilex pseudocanariensis* GIVULESCU on the basis of the morphological and epidermal comparison to the recent species *Ilex canariensis* WEBB. et BERTH. The material from Santa Barbara is not comparable with the above-mentioned taxa mainly on the basis of the leaf shape. ENGELHARDT and KINKELIN (1908), and later also MÄDLER (1939) described leaves and seeds as *Ilex aquifolium* L. *fossilis* ENGELHARDT from Frankfurt u. M, which is identical to the leaf from Santa Barbara in epidermal and morphological features (comfirmed by own observations of the topotypical material from Frankfurt u. M. – No. B12376). Similarly, in morphological point of view, the leaf from Santa Barbara is possible to compare with the leaf material from diatomites of Murat described as *Ilex* sp. aff. *I. cornuta* LINDEL. et PAXT. (ROIRON 1991). Its epidermal structure is very similar to that of the recent *Ilex aquifolium* L., *Ilex rugosa* SCHMIDT and *Ilex krugiana* LOES. The statistical analysis of the maximal stomatal length does not show any difference between *Ilex aquifolium* L. *fossilis* and *I. aquifolium* and between *Ilex aquifolium* L. *fossilis* and *I. rugosa* (alpha = 0.1). But in the case of alpha = 0.05, there is statistical significant difference between *Ilex* sp. and *I. rugosa*. The leaf morphology of *Ilex aquifolium* L. *fossilis* is also best comparable to the extant *I. aquifolium* (see text-fig. 5)

Recent *I. aquifolium* is distributed from West Europe through the Mediterranean to Persia (KRÜSSMANN 1977). Representatives of the genus *Ilex* are typical fruticose elements (E2), which are naturally distributed in moist biotopes of humid zones (BURGH 1987).

Viscaceae

Viscum L.

Viscum miquelii (GEYL. et KINK.) CZECZOTT

pl. 2, figs 1, 3, 10-12; text-fig. 7/8

1887 *Potamogeton miqueli* GEYLER et KINKELIN, p. 20. pl. 2, figs 4-5.
1908 *Viscophyllum miquelii* (GEYL et KINK.) ENGELH.; ENGELHARD & KINKELIN, p. 246, pl. 32, figs 5-8 (non fig. 6).
1939 *Viscophyllum miquelii* (GEYL et KINK.) ENGELH.; MÄDLER, p. 89, pl. 11, figs 4-5.
1961 *Viscum lusaticum* CZECZOTT, p. 113, pl. 22, figs 3 (fruit), 4-7, pl. 23, figs 1-5, text-figs 12 g, h.
1961 *Viscum miquelii* (ENGELH.) CZECZOTT, p. 115, pl. 22, fig. 8.

Material: 1 incomplete leaf and 2 leaf fragmnets (SB-10, SB-11 and SB-12).

Description: Fragments and an incomplete leaf ovate, 29 to 40 mm long and 15 to 19 mm broad, base probably cuneate, apex obtuse or retuse; margin entire; venation not preserved except short fragments of veins in lamina.

Leaves amphistomatic, adaxial epidermis thickly cutinized, outer surface of epidermis smooth, ordinary cells irregular, polygonal, 80-138 (112) x 37-88 (50) µm, with straight anticlinal walls, anticlins thickly cutinized, darker stained, outer periclinal walls with one central papilla. Abaxial epidermis thickly cutinized, outer surface of epidermis smooth, ordinary cells irregular, polygonal, 78-130 (120) x 40-88 (50) µm, with straight anticlinal walls, anticlinals thickly cutinized, darker stained, outer periclinal walls often with one central papilla. Stomata 75-100 (88) x 112-138 (125) µm in size, brachyparacytic, guard cells sunken, subsidary cells elongate, stomatal ledges distinct, forming fusiform outer cavity, often filled by fungal bodies.

SI = 7.1 %; SD = 29 stomata per mm^2

Discussion: The above described leaf material can be safely assigned to the families Loranthaceae and Viscaceae on the basis of the characteristic homogenous epidermal pattern of the amphistomatic leaf with relatively large brachyparacytic stomata. The specific determination is based on morphological features of leaves. CZEZOTT (1961) has defined *Viscum lusaticum* CZECZOTT as new taxon and *Viscum miquelii* (GEYL et KINK.) CZECZOTT as new combination from Turów near Bogatynia (Poland). Both taxa have relatively broader leaf form. The epidermal structure of *Viscum lusaticum* from Turów is very similar to the material from Santa Barbara. KNOBLOCH and KVAČEK (1976) partly revised the hitherto-known material of fossil Loranthaceae s. l. and created a new combination *Viscum morlotii* (UNG.) KNOBLOCH et Z. KVAČEK. This newly defined taxon has oblong to oval leaves (L/W index 4.5 to 2.25) and is typical of Miocene localities. More ovate leaves of *Viscum miquelii* (GEYL. et KINK.) CZECZOTT including *Viscum lusaticum* CZECZOTT (L/W index varies 2.4 to 1.2) are usually known from Pliocene localities (KNOBLOCH & KVAČEK 1976). The material from Santa Barbara is incomplete. Therefore, an assignment of L/W index is not precise. It varies from 1,66 to 2,1. GIVULESCU and BACIU (1994) described *Viscum miqueli* on the basis of leaf and twig cuticles from the locality Baita Sărăta (Middle Miocene, Romania) and enlarged the stratigraphic range of this taxon. A leaf fragment from Chiuzbaia (Miocene/Pliocene, Romania) has been described as *Viscophyllum pliocaenicum* (ENGELH.) MÄDLER by GIVULESCU (1981). This author compared it to the same-named material from the Pliocene of Frankfurt u. M. (MÄDLER 1939, p. 91, pl. 8, figs 8-9, pl. 11, fig. 5). GIVULESCU and BACIU (1994) have re-assigned the sample from Chiuzbaia to *Viscum miquelii*. This determination is not correct because the Mädler's material is narrow to linear in shape and corresponds better to *Viscum morlotii*. FISCHER and BUTZMANN (2000) described leaves as *Viscum* cf. *morlotii* from the locality Meleto, which they compared to extant *Viscum album* ssp. *japonica* from Japan and North China. CZECZOTT (1961) studied recent genera and species of Loranthaceae s. l. On the basis of her study, the leaf material from Turów corresponds best in morphological and anatomical features to the genus *Viscum* L., i.e. *Viscum papillosum* H. WINKL. and *Viscum orientale* WILD. KNOLL (1904) compared *Viscophyllum morloti* to the recent species *Phoradendron ensipholium* (POHL) NUTT. Contrary to this opinion, CZECZOTT (1961) has noticed differences of epidermal structure of both taxa (i.e., *Viscum* L. and *Phoradendron* NUTT.). The material from Santa Barbara is well comparable to extant species of *Viscum* and *Phoradendron*. Besides the form of stomatal apparatus, the presence of central papilae is the most important feature for a precise determination. The material from Santa Barbara matches best *V. album* spp. *austriacum* WIESB. – Europe, *P. caneum* URB. – Mexico and *P. forestierae* ROBINSON et GREEN. – Mexico. However, the statistical analysis of stomatal length of recent species does not correspond to the fossil *Viscum miquelii* (see text-fig. 6). Representatives of the family Loranthaceae and Viscaceae are typical small fruticose hemi-parasites (E3), which parasite by haustoria on trunks, branches and rarely roots of trees.

6. Conclusions:

The vegetation cover of Allori (Santa Barbara) is well comparable to the recent Mixed Mesophytic Forest basing on comparison of the fossil species with their living relatives. However, some of the elements belong to the Evergreen Broad-leaved and Mixed Mesophytic Forest (*Daphnogene polymorpha*, *Cephalotaxus* sp.) or Sclerophyllous Forest (*Quercus drymeja*). The probable climatic character matches to the recent climate zone Cfa (sensu KÖPPEN). According to BERTINI (1994), the palynological spectrum of the silty layer at the top of the Meleto Clay dominates pollen of Pinaceae and particularly that of mountain elements (*Pinus*, *Picea*, *Abies*). Deciduous forest elements (*Quercus*, *Carpinus*, *Ulmus*, etc.) indicative of warm-temperate and temperate climates have rarely occurred; subtropical and warm-temperate elements (*Taxodium*, Lauraceae) are absent. The thermophilous character of the Allori and the Meleto floras based on *Trigonobalanus*, *Rehderodendron*, *Ocotea*, Lauraceae etc. contrasts partly to the above-mentioned palynological results, which show a decrease of tropical-subtropical elements towards the uppermost levels of the Meleto Clay. This contrast is possible to explain by the absence laurel elements in pollen analyses due to preservation bias, which are very common macrofossils from Santa Barbara.

According to FISHER and BUTZMANN (2000), the Meleto flora is to be most probably correlated to those of Senigallia (MASSALONGO & SCARABELLI 1859), Coiron (GRANGEON 1958) and Gabbro (BERGER 1957) on the basis of correspondence in the floristic composition. The age of these mentioned floras is estimated for Late Miocene to Early Pliocene. The correlation is based on fossil material, which has not been hitherto revised. Therefore, the comparison and the age of the Meleto flora are equivocal in spite of general similarity in floristic composition. The exact palaeozoological and palaeomagnetical dating of the Meleto Clay does not correspond also to Butzman and Fisher's opinion. The carpological compositions of Meleto (Fisher & BUTZMANN 2000) and of Santa Barbara (GÜNTHER & GREGOR 1989, GREGOR in press) have affinity to the floristic assemblage of Ca'Viettone and the floristic assemblage of Stura, e.g., MAI (1995), MARTINETTO (1995). A rich and diversified record of „archaic" subtropical elements, which were relatively common in the Miocene of Middle Europe, characterizes the assemblage of Ca'Viettone. These floras belong to the floristic assemblage of Ca'Viettone covering the time interval from 4.7 to 3.6 Ma, which is linking to the thermic optimum of the Pliocene (ZUBAKOV & BORZENKOVA 1990, MARTINETTO 1995). Besides, the association of the floristic assemblage of the Stura includes subtropical elements as relics and new "cold" species, e.g., *Magnolia cor*, *Ranunculus sceleratus*, *Carex flagellata* or *Viola bergaensis*. According to Martinetto (1995), the florisitic assemblage of Stura is possible to correlate with the temperate phase of the Middle Pliocene preceeding the Arctic glaciations of 2.6 to 2.3 Ma. Therefore, the presence of common subtropical elements, e.g., *Magnolia lignita*, *M. allasoniae*, *Liquidambar magniloculata*, *Rehderodendron ehrembergii*, *Trigonobalanopsis exacantha* or *Symplocos schereri* and the lack of the above-mentioned temperate species, the floras of Meleto and Santa Barbara agree well to the floristic assemblage of Ca'Viettone, which corresponds also with the dating of Santa Barbara.

On the other hand many italian floras look like a bit older (Stirone etc.) and the problems of relic niches, stratigraphic units concerning megafloras, a computer approach of Tertiary Neogene floras and other ones will be discussed in further issues of the Flora Tertiaria Mediterranea (GREGOR, in prep). In respect to the Valdarno floras author Gregor prefers an imagination of somewhat older stratigraphic conditions, also for the browncoal and the Platanus-flora from the underlying horizons in Allori – that means Lower Pliocene (transition to the Uppermost Miocene). For the here mentiones flora that would mean a Lower Pliocene age, also in respect to the overlying Meleto Flora.

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Explanation to plates

Plate 1

Fig. 1: *Laurohyllum markvarticense* Z. KVAČEK, incomplete leaf (SB-8), x 1.5.
Fig. 2: *Ocotea* sp., incomplete leaf (SB-2), x 3.
Fig. 3: *Daphnogene polymorpha* (AL. BR.) HEER, complete leaf (SB-13), x 1.5.
Fig. 4: *Laurohyllum markvarticense* Z. KVAČEK, incomplete leaf (SB-3), x 1.5.
Fig. 5: *Laurohyllum markvarticense* Z. KVAČEK, detail of leaf margin (SB-1), x 16.
Fig. 6: *Quercus drymeja* UNGER, complete leaf (SB-14), x 1.5.
Fig. 7: *Daphnogene* sp., detail of leaf lamina (SB-13), x 16.
Fig. 8: *Laurohyllum markvarticense* Z. KVAČEK, detail of leaf lamina (SB-8), x 16.
Fig. 9: *Ocotea* sp. detail of leaf margin (SB-2), x 16.
Fig. 10: *Quercus drymeja* UNGER, detail of leaf margin (SB-14), x 6.
Fig. 11: *Laurohyllum markvarticense* Z. KVAČEK, detail of leaf lamina (SB-1), x 6.
Fig. 12: *Daphnogene polymorpha* (AL. BR.) HEER, detail of leaf lamina (SB-13), x 8.

Plate 1


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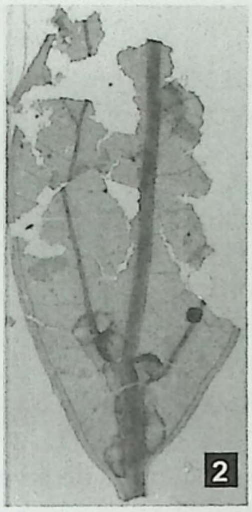
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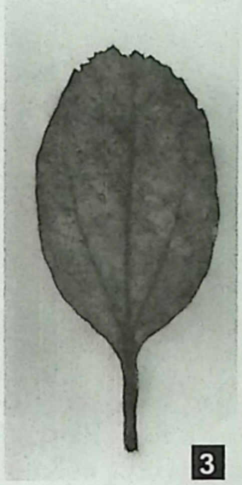
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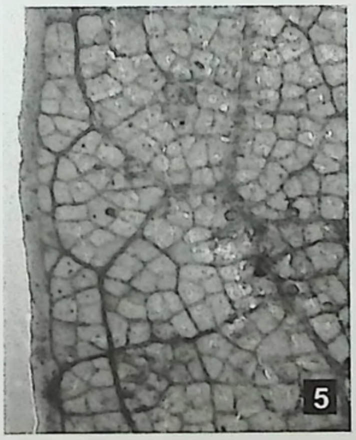
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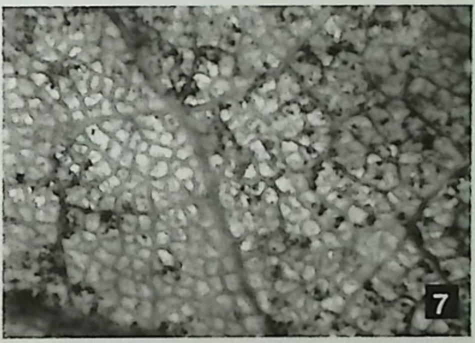
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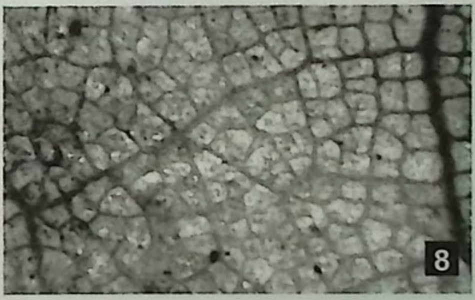
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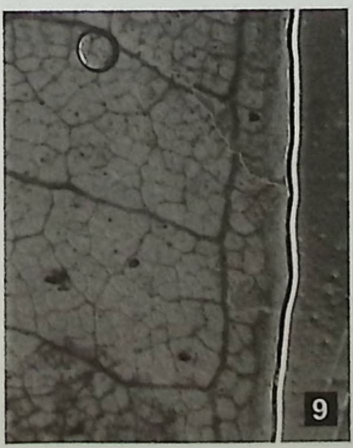
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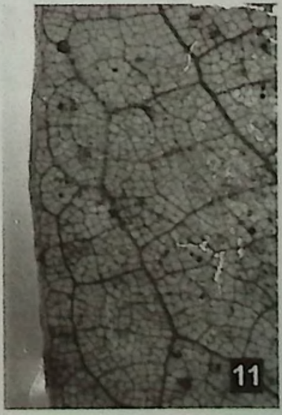
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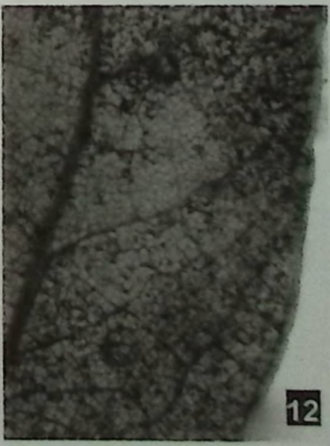
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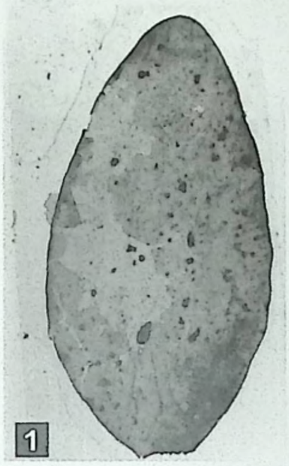
Plate 2

Fig. 1: *Viscum miquelii* (Geyl et Kink.) Czeczott, incomplete leaf (SB-10), x 1.5.
Fig. 2: *Ilex aquifolium* L. *fossilis* Englhardt, incomplete leaf (SB-9), x 1.5.
Fig. 3: *Viscum miquelii* (Geyl et Kink.) Czeczott, incomplete leaf (SB-12), x 1.5.
Fig. 4: *Cephalotaxus* sp., incomplete needle (SB-19), x 2.5.
Fig. 5: *Laurohyllum markvarticense* Z. Kvaček, detail of leaf lamina (SB-8), x 4.5.
Fig. 6: *Cephalotaxus* sp., detail of needle (SB-19), x 9.
Fig. 7: *Ilex aquifolium* L. *fossilis* Englhardt, detail of leaf margin and tooth (SB-9), x 4.5.
Fig. 8: *Laurohyllum markvarticense* Z. Kvaček, adaxial epidermis (SB-8), scale 50 µm.
Fig. 9: *Laurohyllum markvarticense* Z. Kvaček, abaxial epidermis (SB-8), scale 50 µm.
Fig. 10: *Laurohyllum markvarticense* Z. Kvaček, detail of stoma and epidermal oil cell, abaxial epidermis (SB-8), scale 25 µm.
Fig. 11: *Viscum miquelii* (Geyl et Kink.) Czeczott, detail of stoma and central papilae, adaxial epidermis (SB-12), scale 50 µm.
Fig. 12: *Viscum miquelii* (Geyl et Kink.) Czeczott, abaxial epidermis with stomata filled by fungal bodies (SB-12), scale 100 µm.
Fig. 13: *Viscum miquelii* (Geyl et Kink.) Czeczott, adaxial epidermal pattern (SB-12), scale 100 µm.
Fig. 14: *Daphnogene polymorpha* (Al. Br.) Heer, adaxial epidermis (SB-13), scale 50 µm.
Fig. 15: *Daphnogene polymorpha* (Al. Br.) Heer, abaxial epidermis (SB-13), scale 50 µm.
Fig. 16: *Daphnogene polymorpha* (Al. Br.) Heer, detail of stomata, abaxial epidermis, scale 25 µm.

Plate 2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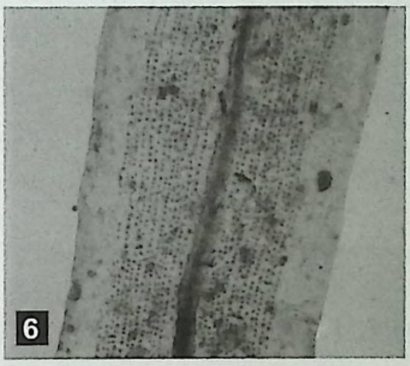
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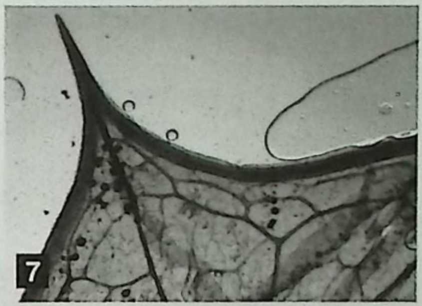
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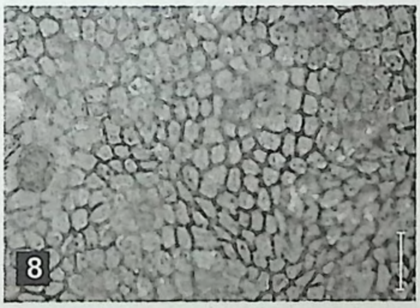
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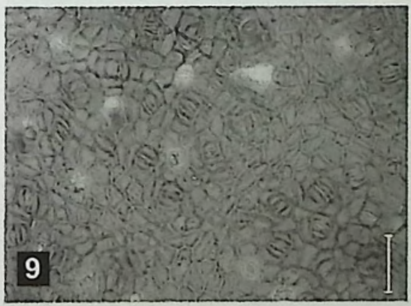
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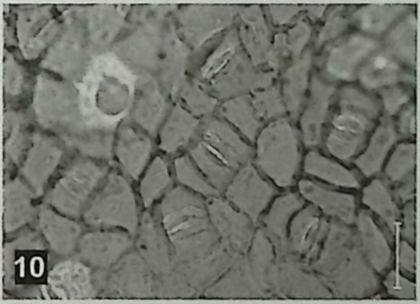
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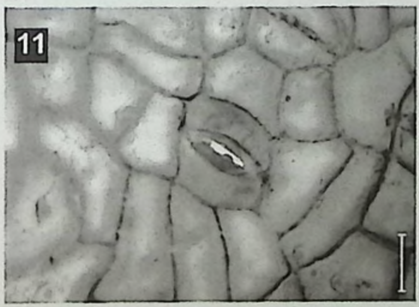
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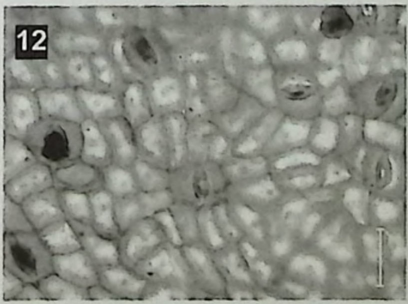
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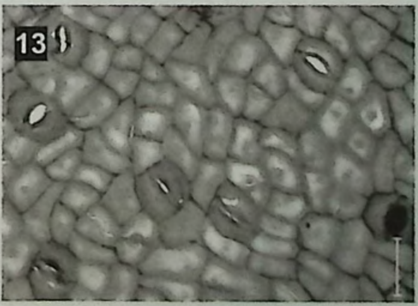
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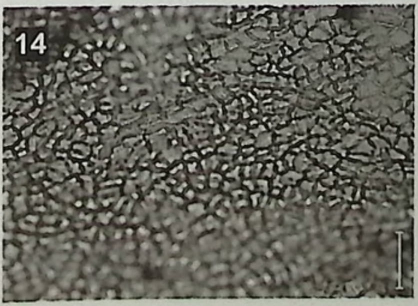
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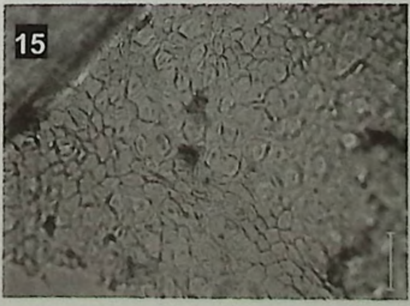
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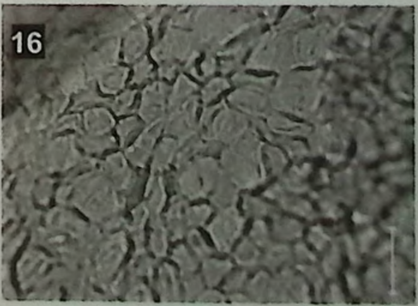
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Plate 3

Fig. 1: *Ocotea* sp., adaxial epidermis (SB-2), scale 50 µm.
Fig. 2: *Ocotea* sp., pattern of abaxial epidermis with higher frequency of trichome basis above vein (SB-2), scale 50 µm.
Fig. 3: *Ocotea* sp., abaxial epidermis (SB-2), scale 50 µm.
Fig. 4: *Ocotea* sp., detail of stomatal aparatus, abaxial epidermis (SB-2), scale 25 µm.
Fig. 5: *Ilex aquifolium* L. *fossilis* ENGLHARDT, adxial epidermis (SB-9), scale 50 µm.
Fig. 6: *Ilex aquifolium* L. *fossilis* ENGLHARDT, pattern of abaxial epidermis (SB-9), scale 50 µm.
Fig. 7: *Ilex aquifolium* L. *fossilis* ENGLHARDT, detail of stomal aparatus and corrosion, abaxial epidermis (SB-9), scale 25 µm.
Fig. 8: *Quercus drymeja* UNGER, adaxial epidermis (SB-14), scale 50 µm.
Fig. 9: *Quercus drymeja* UNGER, abaxial epidermis (SB-14), scale 0 µm.
Fig. 10: *Quercus drymeja* UNGER, detail of trichomal base, abaxial epidermis (SB-14), scale 25 µm.
Fig. 11: *Quercus drymeja* UNGER, detail of stomata, adaxial epidermis (SB-14), scale 25 µm.
Fig. 12: *Cephalotaxus* sp., asterosclereids, adaxial epidermis (SB-19), scale 50 µm.
Fig. 13: *Cephalotaxus* sp., abaxial epidermis (SB-19), scale 50 µm.
Fig. 14: *Cephalotaxus* sp., detail of stomata, abaxial epidermis (SB-19), scale 25 µm.
Fig. 15: *Apollonias canariensis* NEES, abaxial epidermis with epidermal oil cells (recent), scale 50 µm.
Fig. 16: *Phoebe lanceolata* NEES, abaxial epidermis with epidermal oil cells (recent), scale 50 µm.
Fig. 17: *Ocotea amoena* (NEES) HERTER, adaxial epidermis (recent), scale 50 µm.
Fig. 18: *Ocotea amoena* (NEES) HERTER, abaxial epidermis (recent), scale 50 µm.

Plate 3

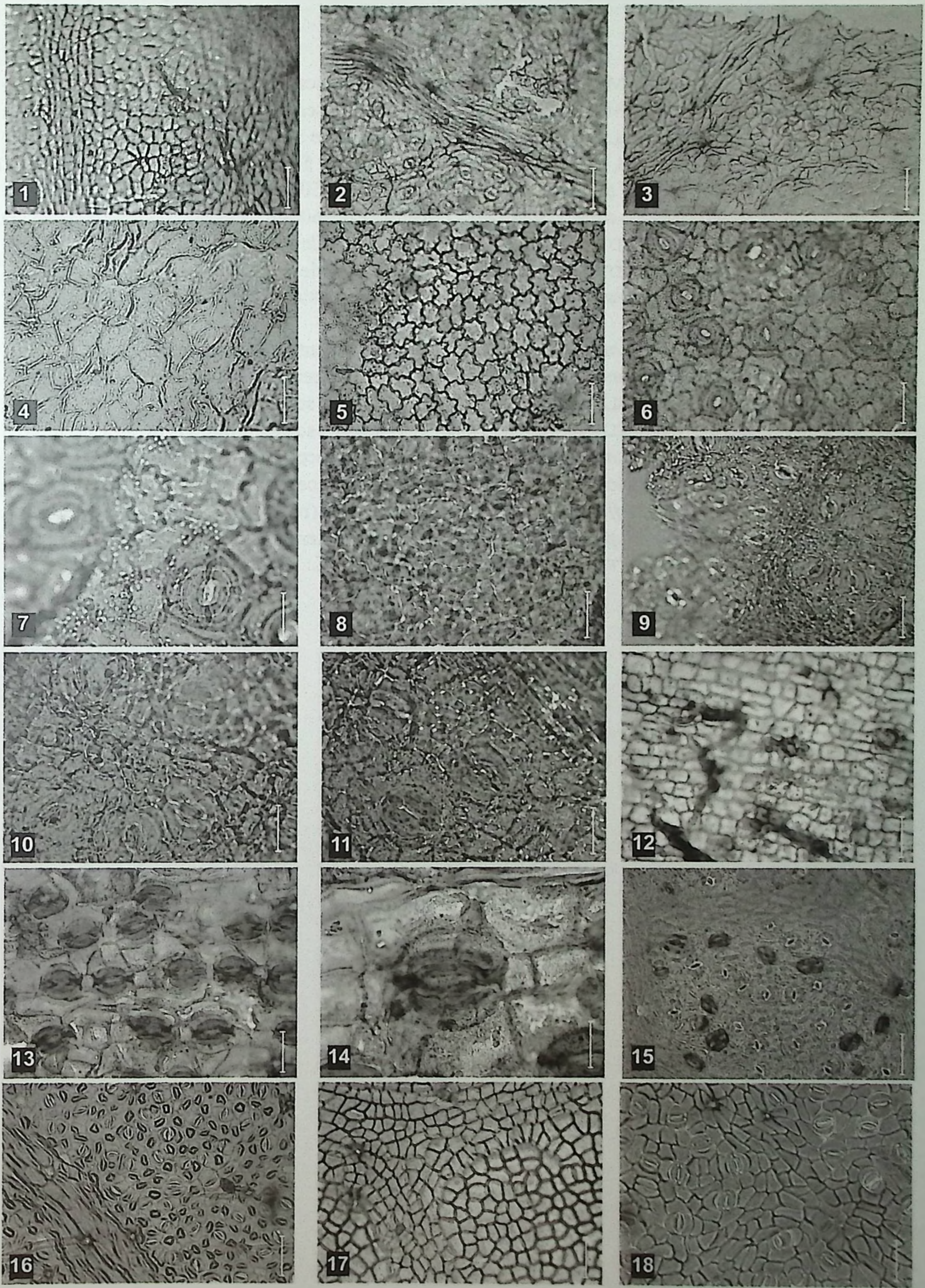
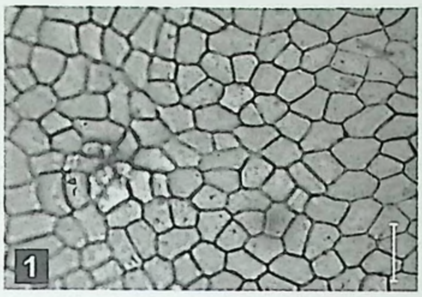


Plate 4

Fig. 1: *Ocotea acutifolia* MEZ., adaxial epidermis (recent), scale 50 µm.
Fig. 2: *Ocotea acutifolia* MEZ., abaxial epidermis (recent), scale 50 µm.
Fig. 3: *Ilex krugiana* LOES., adaxial epidermis (recent), scale 50 µm.
Fig. 4: *Ilex kruziana* LOES, abaxial epidermis (recent), scale 50 µm.
Fig. 5: *Ilex aquifolium* L., adaxial epidermis (recent), scale 50 µm.
Fig. 6: *Ilex aquifolium* L., abaxial epidermis (recent), scale 50 µm.
Fig. 7: *Ilex rugosa* SCHMIDT, adaxial epidermis (recent), scale 50 µm.
Fig. 8: *Ilex rugosa* SCHMIDT, abaxial epidermis (recent), scale 50 µm.
Fig. 9: *Phoradendron forestierae* ROBINSON et GREEN., abaxial epidermis (recent), scale 100 µm.
Fig. 10: *Viscum austriacum* WIESB., abaxial epidermis (recent), scale 100 µm.
Fig. 11: *Phoradendron caneum* URB., abaxial epidermis (recent), scale 100 µm.
Fig. 12: *Lindera triloba* BLUME, adaxial epidermis (recent), scale 50 µm.
Fig. 13: *Lindera triloba* BLUME, abaxial epidermis (recent), scale 50 µm.
Fig. 14: *Camphora officinalis* STEUD., adaxial epidermis (recent), scale 50 µm.
Fig. 15: *Camphora officinalis* STEUD., abaxial epidermis (recent), scale 50 µm.
Fig. 16: *Cephalotaxus griffithii* HOOKER, abaxial epidermis (recent), scale 50 µm.
Fig. 17: *Cephalotaxus drupacea* SIEB. et ZUCC, abaxial epidermis (recent), scale 50 µm.
Fig. 18: *Cephalotaxus harrigtonii* (KNIGHT ex. J. FORBES) K. KOCH, abaxial epidermis (recent), scale 50 µm.

Plate 4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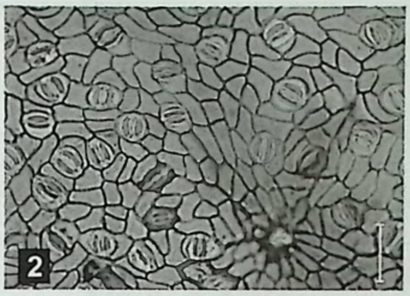
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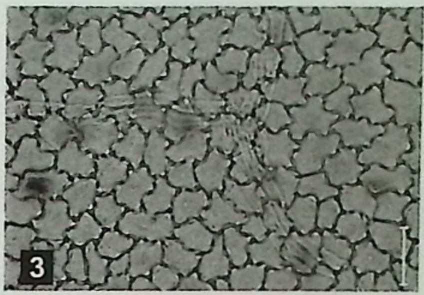
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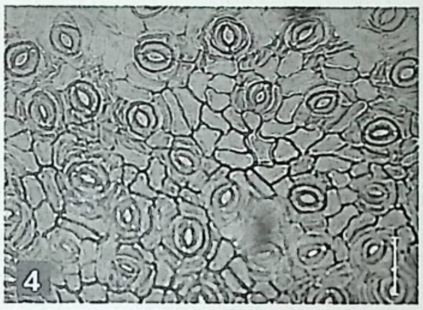
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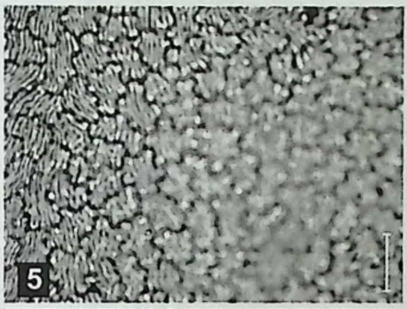
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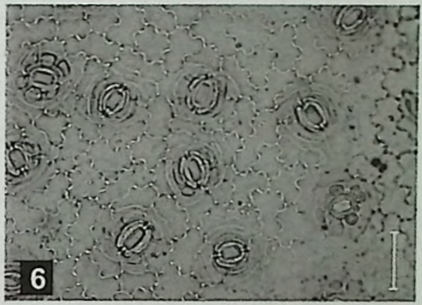
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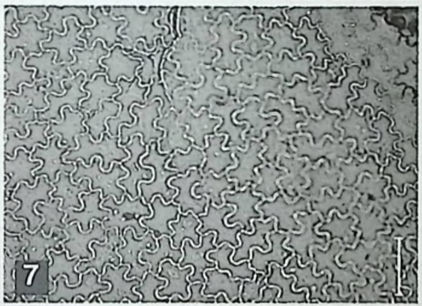
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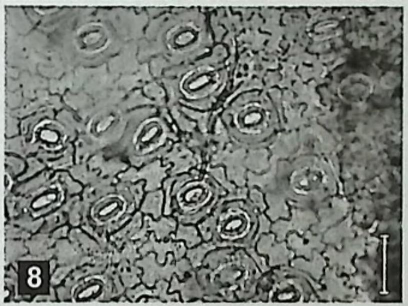
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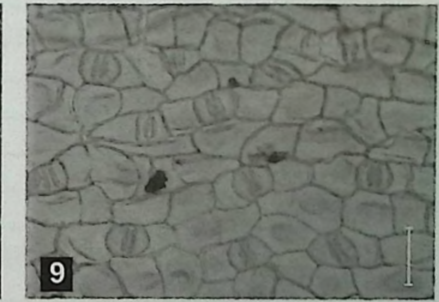
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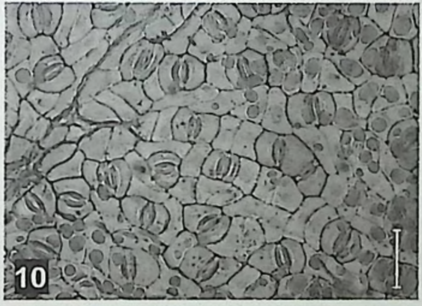
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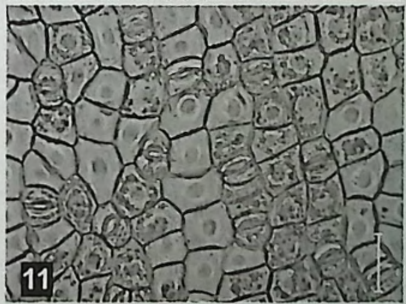
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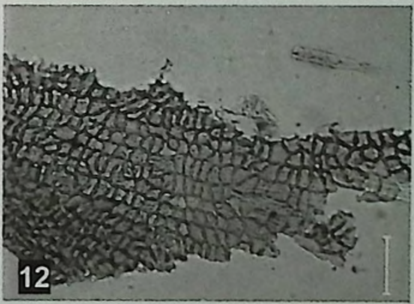
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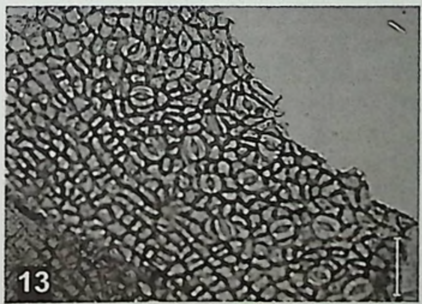
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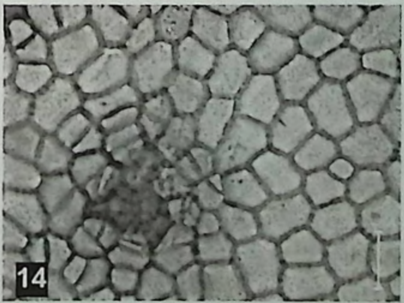
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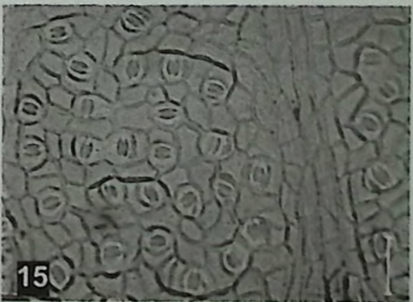
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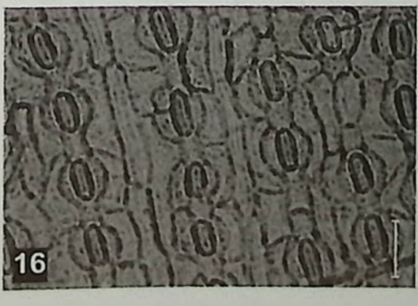
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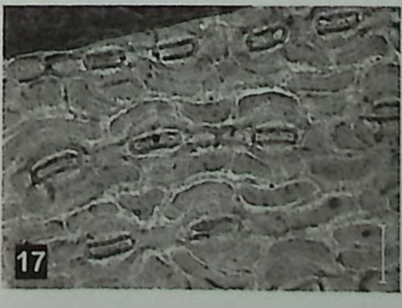
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Appendix

The described material will get the following inventary numbers, when it is housed in the NatureMuseum Augsburg

In this report mentioned number	New inventary number of the NatureMuseum Augsburg
SB 1	1999-900/1518
SB 2	1999-901/1518
SB 3	1999-902/1518
SB 4	1999-903/1518
SB 5	1999-904/1518
SB 6	1999-905/1518
SB 7	1999-906/1518
SB 8	1999-907/1518
SB 9	1999-908/1518
SB 10	1999-909/1518
SB 11	1999-910/1518
SB 12	1999-911/1518
SB 1 3	1999-912/1518
SB 14	1999-913/1518
SB 15	1999-914/1518
SB 1 6	1999-915/1518
SB 17	1999-916/1518
SB 18	1999-917/1518
SB 19	1999-918/1518