SBORNÍK NÁRODNÍHO MUZEA V PRAZE

ACTA MUSEI NATIONALIS PRAGAE

Volumen XXXI B (1975), No. 3 - 5

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REPRESENTATIVES OF THE FAMILY MASTIXIACEAE CALESTANI 1905 IN THE BOHEMIAN TERTIARY

V českých hnědouhelných pánvích — s výjimkou severočeské podkrušnohorské pánve — byly zjištěny plody zástupců čeledi *Mastixiaceae:* 5 rodů (z nich 4 vymřelé) celkem s 9 druhy. Taxonomická a stratigrafická data jsou zřejmá z tabulky v textu. Mimo hnědouhlené pánve byly plody rodu *Mastixia* velmi vzácně zjištěny v oligocénu (neovulkanity Českého středohoří a Doupovských hor). Hromadný výskyt plodů *Mastiiacei* je důležitým paleoklimatickým indikátorem: jejich producenty pokládáme za elementy mimořádně klimaticky náročných subtropických až tropických lesů: vstupují též do společenstev smíšených mezofytních horských lesů. Od oligocénu do miocénu lze u nás takto zjistit alespoň 4 pozitivní klimatické výkyvy, zvláště výrazné v ottnangu a dále v karpatu až badenu. V práci byly podrobeny kritice veškeré dosavadní nálezy, jež byly k dispozici jsou zahrnuty do detailní popisné statě. Tato kapitola obsahuje popisy 9 druhů, dále mimo jiné doplňky a opravy starších diagnóz a také opravy taxonomické i nomenklatorické. Nálezy mastixioidních květen umožňují korelaci příslušných hnědouhelných slojí ve střední Evropě.

The present paper deals with fossil fruits of the family *Mastixaceae* from the Bohemian Oligocene and Miocene. The overall characteristics of the family and the general informations about the importance of the family in the Tertiary floras are given. The all hitherto finds are analysed critically and their localities too. The following species are proved: *Mastixia amygdalaeformis, Mastixia lusatica, Mastixia thomsonii, Retinomastixia schultei, Mastixicarpum limnophilum, Tectocarya elliptica, cf. Tectocarya robusta, Eomastixia hildegardis, Eomastixia saxonica.* The finds mostly originate from sandy or micaceous sediments; they are extremely rare in volcanic ashes. Fruits of *Mastixiaceae* demonstrate perhaps four warm phases in the Upper Oligocene, Lower and Middle Miocene.

INTRODUCTION

The discovery of the representatives of the family *Mastixiaceae* in the European Tertiary was an important and impulsive factor for palaeocarpological research in general and especially for the investigation of Tertiary living conditions. Many different localities as well as of specimens, interesting variability of fruits, a lot of taxa, a long stratigraphic span and — after all — plenty of errors and confusions — all these facts call attention to the necessity of a summarizing and critical work. The present paper includes a discussion of all species and genera hitherto found in the territory of Bohemia. The purpose of it is to summarize critically all untill now scattered finds from this region. With exception of UNGER'S type-specimens and KIRCHHEIMER'S original material all other specimens are deposited in the collection of the *Palaeontological Dept., National Museum Prague, Mus. Nat. Hist..*

FAMILY MASTIXIACEAE CALESTANI 1905; PALAEOBOTANICAL CHARACTERISTICS

The similarity of several fossil fruits to the living *Mastixia* were recognized during the first decade of the 20th century (C. REID, E. M. REID 1910; MENZEL 1913). In the thirties (CHANDLER, REID et CHANDLER, KIRCHHEIMER) there was described a number of extinct genera (with the exception of the living *Mastixia* BLUME): *Beckettia* E. M. REID et CHANDLER 1933, *Eomastixia* CHANDLER 1925, *Lafrancia* E. M. REID et CHANDLER 1933, *Langtonia* E. M. REID et CHANDLER 1933, *Diplomastixia* KIRCHHEIMER 1935, *Ganitrocera* KIRCHHEIMER 1935, *Mastixicarpum* CHANDLER 1926, *Mastixiopsis* KIRCHHEIMER 1936, *Platymastixia* KIRCH-HEIMER 1935, *Plexiplica* KIRCHHEIMER 1936, *Portnallia* CHANDLER 1961, *Retinomastixia* KIRCHHEIMER 1938. These taxa were considered formerly as the representatives of various families (*Anonanceae, Cornaceae, Cyperaceae, Juglandaceae, Myristicaceae, Palmae, Rhamnaceae, Rosaceae, Tiliaceae*).

The family *Mastixiceae* CALESTANI is represented by one living genus only (*Mastixia* BLUME 1825, with 9 to 30 species). The taxonomists mostly put it into the fam. *Cornaceae* only as a sect. *Mastixioideae:* but the whole group of extinct genera described hitherto (on the base of well-defined characters of fruits) supports its separation as an independent family:

Characteristics of *Mastixiaceae* fruits:

1. Middle-sized fruits, one- to four-loculed, usually with well developed endo- and epicarp.

2. Endocarp woody, solid and resistent; epicarp thinner, softer, woody to leathery; resin-ducts sometimes present; outer surface almost smooth-rugged, rugose or ribbed.

3. Locule characteristically C- to U-shaped on the cross section: dorsal side of fruit-wall makes a longitudinal infold passing through the whole length of the fruit forming the inner face of a large germination valve (usually with corresponding surface sulcus).

4. Seed with ventral rafe, thin testa; tegmen resistent, formed of transverse rows of cells.

Present distribution of the only one living genus *Mastixia* is confined to Indo-Malaya; *Mastixia* is the inhabitant of everygen rain forests grow-

ing between latitudes ca 10° S. to 25° N. While on the one hand, it is never met in subtropical *lauroid* forests in southern China, it is known on the other hand from the nearest neighbourhood of rivers in mistmoutain forests of savannah regions. In mountain forests (northern periphery of the *Mastixia* area) this genus appears in the vegetation of temperate semi-deciduous forests. Also the extinct genera (especially in the Lower Tertiary) occur together with climatically sensitive elements. With respect to the fact pointed out, the genera of the family *Mastixiaceae* are to be regarded as important climatic and stratigraphic indicators. (MAI 1964).

CHANDLER and KIRCHHEIMER above all regarded this taxon from this point of view. Moreover KIRCHHEIMER defined a term *Mastixiodeen Flora*": roughly it can be identified with other terms of similar content (but defined from the distinct standpoints — stratigraphic, palaeogeographic, phytogeographic) like: *London Clay Flora* (REID, CHANDLER 1933), *Lower Tertiary Flora* (CHANDLER 1961), *Poltavian Flora* (KRISH-TOFOVICH 1955), *Tethyan Flora* (REID, CHANDLER 1933; SZAFER 1961), *Indo-Malayan Flora* (REID, CHANDLER 1933).

KIRCHHEIMER (1938) regarded the "Mastixioideen Flora" as a palaeofloristic "association" (=taphocenosis, especially palaeocarpological) among others represented by *Mastixiaceae*-fruits. KIRCHHEIMER supposed that the *Mastixiaceae* did not survive the Uppermost Oligocene. Recently MAI (1964 etc.) proved the restitution of the *Mastixiaceae* flora during the Lower and Middle Miocene; MAI revised a large number of Tertiary genera and species — an inheritance of the last 30 years (a manuscript). The occurence of *Mastixiaceae* in the Neogene was proved also by other palaeobotanists (THOMSON 1958, SCHÜRMANN 1961, SZA-FER 1961, LANCUCKA-ŚRODONIOWA 1963, CZECZOTT, SKIRGIELLO 1975, GREGOR 1975).

A CRITICAL VIEW OF MASTIXIACEAE FOSSILS RECORDED FROM BOHEMIA

Although there is only fragmentary evidence left of the rich Tertiaryvegetation, the work of several generations of palaeobotanists enables us to follow the traces of ancient floras up to the remarkable synthesis. Less than one and half century ago PRESL (in STERNBERG 1838) described a very interesting fruit from the Bohemian Tertiary *Carpolithes venosus* (from the loc. Počerny) [2]*).

After having studied HAIDINGER'S finds [5] from the Cheb basin UNGER (1850, 1864, 1866) ascertained almond-stone shaped fruits and described them under the names *Amygdalus persicoides* and *Amygdalus hildegardis*, the next one compared with the jujube stones and was named Ziziphus pistacinus.

UNGER and his contemporaries did not indicate precisely the locality and so brought confusions into future investigation: HAIDINGER deter-

^{*)} Numbers in square brackets agree with the numbers of localities on the synoptic table p. 129.

mined it like "zwischen Sorg und Klausen bei Franzensbad", UNGER spoke about "Braunkohlenlager bei Franzensbrunn bei Eger", REUSS (1852) and JOKÉLY (1857) informed us about "... Versuchschachte zwischen Sorg und Klausen ... grauliche, beinahe ganz aus zusammengeschwemmtem Glimmer bestehende Schieferton...", a sediment similar to that from Arzberg, without brown coal, but with wery rich carbonaceous fruits; there is a note about Sorg-Meierhof too. Also KREJČÍ (1879) noted the fruits from Sorg and Meierhof near Cheb. KIRCHHEIMER (1939) tried to reconstruct the locality and described it as: deep beds of a Cypris-complex, rich in mica, near Liebenstein (= Libá), in the environs of Klausenhof, Sorghof (=Lužná) and Höflas-Meierhof (=Dvoreček) near Cheb and Františkovy lázně. HURNÍK and KNOBLOCH (1966) completed the confusion by reconstructing and placing the locality N.E. of Františkovy Lázně (Sorgen, Starost, farm house).

From the geological point of view we must realize the following facts: the area mentioned by KIRCHHEIMER is situated in a cristalline region; S. E. and not far from it is a presumed radial tectonic border of the Tertiary of the Cheb basin. As the new geological map shows (KOPECKÝ 1974), there is the Pliocene overlying the Miocene Cypris-complex there; but we must not exclude entirely its position like contingent tectonic relic. The locality reconstructed by HURNÍK and KNOBLOCH is situated nearly into the middle of the basin and even there the Pliocene sediments cover the Miocene Cypris-complex. Apparently we are not able to clarify the situation without new finds. Provisionally we can accept the designation of the locality "environs of Cheb and Františkovy Lázně, Cypris-complex".

Some aditional material helped us to explain this stratigraphical position. F. M. ZIPPE, a curator of mineralogy (1824—1849) in the National Museum Prague (as STERNBERG'S and PRESL'S contemporary) also collected geological samples in the Bohemian Tertiary. Among the samples of volcanic rocks and brown coal with a label bearing ZIPPE'S characteristic handwriting (,,...? s dem Versuch Schurf Schacht an dem S. O. Abhang des...? ... bei Eger") the author has discovered a small fruitcollection (Carya, Cornus, Mastixia, Eomastixia, Tectocarya) [5]. All fruits are strongly flattened bearing the remains of micaceous clay on their surface. It shows quite good similarity to the data given above.

Another box contains the same species of *Tectocarya* and *Eomastixia* with ZIPPE'S label "Aus dem Braunkohle des Elbogener Kreises". Because the historical district of Loket (=Elbogen) was very wide, we may only admit the possibility of the provenance of this material from the Sokolov basin [6]. After all, the mode of preservation of fruits is almost indistinguishable from the former material from the Cheb basin [5]. In the author's opinion, there are no carpological remains known from the brown coal seam Antonín: only from its underlying sands and "blätterkohle" only and from the overlying Cypris-complex; the fruits from the sands are well preserved, but those from the Cypris clays are mostly much compressed and the clays also rarely include the layers rich in mica.

Now it is necessary to elucidate the problem of PRESL'S locality bearing his *Carpolithes venosus* [2]. The locality indicated by him is "Altsattel prope Cubitum", i.e. Staré Sedlo. The associated palaeobotanical remains, the mode of preservation as well as the rock matrix (tuffitic iron sandstone) prove its origin from the famous locality Počerny (near Karlovy Vary) [2]. This locality (Oligocene) is a typical source of errors. It used to be called: Altsattel (Staré Sedlo, Eocene), Perutz (Peruc, Cretaceous), Putschirn, Pučírny (Počerny, Oligocene), Tuchorzitz (Tuchořice, Miocene).

Next we have to examine the occurrence of the *Mastixiaceae* — fruits in the Basal complex (Eocene): from this point of view the author has inspected in detail all accessible samples (Žitenice, Staré Sedlo, Svatava — Kamenitý, Na pískách, Český Chloumek) without finding any remains of such fruits. KIRCHHEIMER'S data (1941, pp. 611—615 tec.) are quite confused: he never described in detail nor figured what he called "...undeutliche Abdrücke mehrerer Mastixia — Steinkerne...", nor correctly determined his *Tectocarya* from "... Nordböhmischer Braunkohlensandstein..." (KIRCHHEIMER 1941, p. 612, text fig. 5; see bellow in *Tectocarya elliptica*!).

ENGELHARDT (1876, p. 411, pl. 27, fig. 29) described from the quartzit (loc. Žitenice, Eocene) a questionable fragment of a "fruit" cast. KIRCH-HEIMER (1941, p. 612, textfig. 4a—d) figured other remains determinating them as *Mastixia pistacina* (UNG.) KIRCHH. At present the impressions are not available for study, but in the collection of the Palaeontological Department of the National Museum, Prague, there are specimens labelled as *Equisetum sp.*, completely identical with those described by KIRCHHEIMER (see our pl. 1, fig. 40), in any case it has nothing to do with *Mastixia* (see below in *Mastixia amygdalaeformis!*). Another cast (l.c., textfig. 4d) is referable for instance to an impression of a *datepalm* fruit (a cast of the endocarp): the author has seen those in Dr. BÜŽEK'S collection from the loc. Tuchořice (Miocene). ENGELHARDT'S drawing (see above l.c.) could be refered to *Equisetum*.

The find of a fragmentary impression of *Mastixia* fruit preserved in diatomite from Suletice (formerly Sulloditz) is unusually rare [1] (Suletice, village Homole near Velké Březno, České středohoří Mts.). It was collected at the beginning of the 20th century by B. Brabenec. The rarity of *Mastixiaceae* in volcanic sediments appears to be caused by edaphic factors.

The next find, so far unpublished, was PETRBOK'S discovery of florula with *Mastixiaceae* — fruits from the newly dug municipal well on the border of the town Hluboká nad Vltavou, about 1 km on the left side of the road to the town Protivín [7]. In his short letter to NĚMEJC PETRBOK described this geological section: the granit on the bottom of the basin is overlain by a Neogene complex about 35 m thick: on its base there are sands with xyllits; above them there is a lignitic coal seam, covered by claish beds containing the fruits.

The most recent locality (damaged today) is brown coal pit Kristina, N. of Hrádek nad Nisou (Zittau basin, Miocene), on the bank of the Nisa river, Č.S.S.R. — G.D.R. boundary [4]. This exposure has yilded abundant fruits: *Mastixiaceae* — *flora* originates from the sandy — clayish beds in the uppermost part of the so-called Upper brown coal seam complex. The author has been collecting several years there. Unfortunately after the exhausting of lignite seam there is no more opportunity for collecting.

The detailed indications of all discussed localities see table p. 129.

Analytic key of Mastixiaceae — genera occuring in the Bohemian Tertiary

- 1 Fruits 1- to 2-loculed, with more or les conspicuous longitudinal furrows, ribs or ledges
 - **11** Fruits 1-loculed, slenderer, fusiform, ovate to oval with ribs, grooves or short and fine ridges
 - **111** Fruits fusiform to ovate, 13-(19)-28 mm long, rounded on cross section; dorsal side straight with sulcus; ventral side bent; ribs sharp or rounded . . . *Mastixia* (p. 130)
 - **112** Fruits mostly flattened, elongate suboval to elongate obovate; 18—33mm long; with conspicuous longitudinal sulcus; surface with lacunose longitudinally elongate net of fine ribs, ridges... *Tectocarya* (endocarps) (pp. 136, 138)
 - 12 Fruits 1- to 2-loculed, rounded, subovate, broadly spindle-shaped; 9-(25)-42 mm long; conspicuous longitudinal ribs, rugae, ledges broken up into winged processes and protuberances; conspicuous dorsal sulcus . . . *Eomastixia* (p. 138)
- 2 Fruits 1-loculed, surface \pm smooth or quite slightly grooved, ribed
 - 21 Fruits thick-walled, ovate to oblong; 21—32 mm; endocarp closely invested by epicarp; smooth or with very indistinct rugose network, sometimes with 9 longitudinal grooves; dorsal sulcus absent . . . *Mastixicarpum* (p. 134)
 - 22 Fruits <u>+</u> mostly flattened, elongate suboval to elongate subovate; 18-32 mm long; mostly compressed thick epicarp built of parenchymous tissue, closely joined endocarp; apex with perianth disc, base with pit ... *Tectocarya* (p. 136)
 - **23** Fruits suboval, oval, subovate; 13-24 mm long; surface nearly smooth or with very fine longitudinal lines; locule enveloped in lacunous resin-tissue . . . *Retinomastixia* (p. 134)

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Table to show the critical occurrence of the Mastixiaceae fruits in the Bohemian Tertiary

No.	locality	nearer localization	local stratigraphy	geological age	Mastixia sp.	Mastixia thomsonii	Mastixia lusatica	Mastixia amygdalaeformis	Mastixicarpum limnophilum	Retinomastixia schultei	Eomastixia saxonica	Eomastixia hildegardis	Tectocarya elliptica	cf. Tectocarya robusta
1.	Suletice	village Homole near Velké Březno, distr. Ústí/L.	Volcanogenic Complex	Oligocene	+									
2.	Počerny	near Stará Role 5 km W. from Karlovy Vary	Volcanogenic Complex	Oligocene				+						
3.	Nové Bukovany	5 km S.W. from Soko- lov, brown coal pit Dukla (Gustav)	sand intercalating brown coal seams "Anežka" — "Antonín"	Eggerian ?		+							+	
4.	Hrádek nad Nisou	brown coal pit Kristina Zittau basin	Upper brown coal seam complex, sand and clay overlying the seam	Ottnangian			+		+	+	+		+	+
5.	Cheb — Františ- kovy Lázně	Cheb basin ?vicinty of both towns	Overlynig complex — Cypris-complex	Karpatian— — Badenian				+				+	+	
6.	"Loket district"	area of Sokolov basin	Overlying complex, Cypris-complex	Karpatian— — Badenian								+	+	
7.	Hluboká nad Vltavou	municipal well on the road to Protivín, South Bohemian basin	Mydlovary- c omplex, overlying of the lignite	Karpatian— — Badenian				+				+	+	

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SYSTEMATIC DESCRIPTIONS

MASTIXIA BLUME 1825

Fruits of this genus (the only one still living out of all Tertiary representatives of the family) occur abundantly and are known in detail. The following descriptions of species conform MAI'S taxonomy of the fossil *Mastixia* fruits (1970, pp. 462—470). The diagram of dimensions of individual species of the fossil *Mastixias* (textfig. 3) ilustrates some basic specific differences.

Mastixia amygdalaeformis (SCHLOTHEIM 1822) KIRCHHEIMER 1957 (Pl. 1, figs. 1-8)

- 1822 Carpolithus amygdalaeformis SCHLOTH.; SCHLOTHEIM, p. 98, pl. 21, fig. 7.
- 1838 *Carpolithus venosus* PRESL in STERNBERG; STERNBERG, p. 208, pl. 58, figs. 18-20.
- 1850 Ziziphus pistacina UNGER; UNGER, p. 463.
- 1864 Ziziphus pistacina UNGER; UNGER, p. 16, pl. III, fig. 38.
- 1935b Mastixia pistacina (UNG.) KIRCHH.; KIRCHHEIMER, p. 292, fig. 13.
- 1939a Mastixia pistacina (UNG.) KIRCHH.; KIRCHHEIMER, pp. 748-749, fig. 2a-c.
- 1957 Mastixia amygdalaeformis (SCHLOTH.) KIRCHH.; KIRCHHEIMER, pp. 223—224, 549—550 (p.p.) e. g. loc.: "Franzensbrunn", Orsberg, Seussen, Offenbach.
- 1970 Mastixia amygdalaeformis (SCHLOTH.) KIRCHH. em. MAI; MAI, pp. 467-470, pl. LXIV, fig. 11, pl. LXV, fig. 1-13.
- 1975 Mastixia amygdalaeformis (SCHLOTH.) KIRCHH.; CZECZOTT. SKIRGIELLO, pp. 33, 34, 36, pl. IX, fig. 1.

Occurence: Počerný [2], Cheb-Františkovy Lázně [5], Hluboká nad Vltavou [7].

Stratigraphy: Upper Oligocene; Karpatian to Badenian (lower?). Material: 6 specimens of carbonaceous fruits, 1 mould.

Description: Fruits 13.5-17 mm long, 7-9 mm broad (modal value $15.4 \times 7.7 \text{ mm}$); L:B ratio*): 1.9; 2.2; 2.4; 2.8; 3.1; 3.2; outline spindle-shaped, narrowing towards the ends (base sometimes suddenly tapering), apex often obconical; 14-18 thin and sharp longitudinal ribs (in the lower third mostly broken into little protuberances); apical conus often grooved with 8 fine ribs, base smooth or with little irregular protuberances; the ribs separated by very narrow, deep grooves; the wall about 0.7 mm thick; the longitudinal infold thin-walled, germinate valve extremly broad.

Remarks-affinities: Specific identity undoubtable. The specimens from the Cheb basin are very flattened, the one from Hluboká n. V.

 *) L:B ratio is an abbreviation used in this paper: it means the fraction length: breadth of dimensions of fruits.

is much better preserved. Diagram (textfig. 1) showing the relation of L:B ratio (y) and breadth (x) z=y/x illustrates very well the differences in the form of our *Mastixia amygdalaeformis* and *Mastixia lusatica;* the next diagram (textfig. 2) shows an apparent difference of absolute dimensions of both species. Very similar fruits were described by CZE-CZOTT and SKIRGIELLO (1975) from the pit Babina (Muźakow): their shape is in general the same as in our specimens, only they are somewhat larger; even both authoresses are of the opinion that it is another species than that from Turów (see below).

Note: KIRCHHEIMER (1941, p. 612, fig. 4a-d; 1957, pl. 1, fig. 6) described the problematic fossils from the locality Žitenice as *Mastixia amygdalaeformis*, resp. *Mastixia pistacina*; after detailed revision of similar topological (though not original) material the author has stated it is only the cast of a sharp ribbed inside of a thin-walled plant remain. Partly there is visible a remain of a similarly built mould; between the both impressions originate from freshwater limestones from Valeč too (Palaeogene, Volcanogenic complex, Doupovské hory Hts.). (See photograph pl. 1, fig. 40. The author considers all those remains to be in fact the impressions of *Equisetum* internods.

Mastixia lusatica MAI 1970

(Pl. 1, figs 20-39)

- 1957 Mastixia amygdalaeformis (SCHLOTH.) KIRCHH.; KIRCHHEIMER, pp. 223-224, 549-550 p.p., pl. 39, fig. 155d.
- 1964 Mastixia amygdalaeformis (SCHLOTH.) KIRCHH.; MAI, pp. 42–43, 63, 81, 90, 97, 114, pl. VII, fig. 3, pl. VIII, fig. 12, pl. XI, figs. 6, 7, pl. XII, figs. 16,17, pl. XV, figs. 15, 16.
- 1964 Mastixia amygdalaeformis (SCHLOTH.) KIRCHH.; HOLÝ, p. 219.
- 1970 Mastixia lusatica MAI; MAI, pp. 466—467, pl. LXIV, figs. 1—10. 1975 Mastixia amygdalaeformis (SCHLOTH.) KIRCHH.; CZECZOTT,
- SKIRGIELLO, pp. 31—36 p.p., pl. IX, figs. 2, 3.
- 1975 Mastixia lusatice MAI; GREGOR, p. 173.

Occurence: Hrádek nad Nisou [4].

Stratigraphy: Ottnangian.

Maeerial: Hundreds of carbonaceous fruits.

Description: Fruits (13)—16—29 mm long and 5—9 mm broad (modal value 23.5×6.5 mm), L:B ratio (1.7)—2.5—3.1—(4.7); often abraded; thick, the shape mostly fusiform (sometimes sub-cylindrical or subovate); base tapering, apex often elongate tapering: it is difficult to identify both ends of the fruit; dorsal side usually more convex, the ventral one moreover straight, more flat; germinal valve builds the essential part of the dorsal side (more than 1/2 of its breadth); the sharp, deep and usually narrow sulcus on the infold always remarkable; both inner leaves of the infold are pressed closely together; angular to rounded ribs (often anastomosing) cover the whole surface; instead of ribs sometimes the rows of longitudinal rugosities and protuberances; the wall about 2 mm thick. Remarks-affinities: KIRCHHEIMER (1938, p. 342) was the first to point the morphological diversities of some populations of his *Mastixia amygdalaeformis* (SCHLOTH.) KIRCHH. s. lss.. After a detailed investigation MAI (1970) decided to separate them into two species. Our finds are almost identical with the compared specimens from Wiesa b. Kamenz (G.D.R.) and very similar to those figured and described by CZECZOTT and SKIRGIELLO (1975) from Turów (Poland). Both populations are characterized by somewhat larger, more thickset specimens. The specimens described by GREGOR (1975) seem to match best with our fruits from Hrádek nad Nisou. All interspecifical differences are given in our diagrams (textfig. 1, 2, 3).



Textfig. 1: Mastixia lusatica MAI from Hrádek nad Nisou: variation of L:B ratio (in %, left); relation between L:B ratio (Y) and the breadth (X); the size of rings increases proportionally to the number of individuals; $\Box = Mastixia \ amyg$ dalaeformis (SCHLOTH.) KIRCHH. from Bohemia. (317 specimens of Mastixia lusatica).

Textfig. 2: Mastixia lusatica MAI from Hrádek nad Nisou: isolines expressing numbers of specimens of the same absolute dimensions; X =length, Y = breadth, 1-5--10-15-20 = numbers of cases; X = Mastixia amygdalaeformis (SCHLOTH.) KIRCHH. from Bohemia. [317 specimens of Mastixia lusatica). Textfig. 3: Mastixia lusatica MAI: schematic range of dimensions (explanations see textfig. 5); X=length, Y=breadth, dotted=Mastixia amygdalaeformis (SCHLOTH.) KIRCHH. from Bohemia, vertical hatching=Mastixia thomsonii MAI from Nové Bukovany.



Mastixia thomsonii MAI 1970

(Pl. 1, figs 9—19)

1970 Mastixia thomsonii MAI; MAI, p. 465, pl. LXIII, figs. 4-13, textfig. 9b, h.

Occurence: Nové Bukovany [3].

Stratigraphy:? Eggerian.

Material: 7 almost complete specimens, a lot of fragments.

Description: Fruits 14-22 mm long and 9-10 mm broad; broadly spindleshaped to broadly ovate, with rounded or rounded-narrowed base; apex suddenly narrowed, obtusely apiculated (to rounded); 12-16 massive rounded ribs on the surface, the grooves between them shallow and only a little sharp; sometimes 12 very fine ribs converging to the narrowed apex; the wall thickness about 2 mm, on the rib to 2.5 mm; L:B ratio: 1.4; 1.5; 1.9; 2.1;2.2; 2.4.

Remarks-affinities: This locality was relatively very rich in well preserved *Mastixia* fruits. Unfortunately, however, there was no medium to keep the whole not destroyed fruits in. MAI (after the autopsy of the outcrop) was of the opinion that we have to detail with *Mastixia amygdalaeformis* (s. s. MAI 1970). But, after the evoluation of all characteristics we must find the nearest possible determination of these fruits in accordance with MAI'S diagnosis of *Mastixia thomsonii*. The general ovate or rounded ovate shape differs conspicuously from fusiform *Mastixia amygdalaeformis* and *M. lusatica*. The difference in dimensions is less striking (see diagram textfig. 3), but the thickness of the fruit wall and the form of ribbing of our *Mastixia thomsonii* differ obviously from the two foregoing species.

Mastixia sp.

(Pl. 1, fig. 41)

Occurence: Suletice [1]. Stratigraphy: Oligocene. Material: Single fragmentary impression.

Description: A fragment — impression — of the fruit surface; lateral part with characteristic ribs preserved only; base and apex absent dorsal sulcus not visible; no further particulars in description. Remarks-affinities: A precise determination is excluded for the lack of important characteristics. This evidence of *Mastixia* in the Volcanogenic complex is valuable, but extremily rare. The volcanic substratum — extraordinarily rich in nutriments — perhaps had not been a suitable factor for *Mastixiacae* — forests.

RETINOMASTIXIA KIRCHHEIMER 1937

Retinomastixia schultei KIRCHHEIMER 1937

(Pl. 4, figs. 27-32)

- 1937b Retinomastixia schultei KIRCHH.; KIRCHHEIMER, pp. 915-916, textfig. 9, 23.
- 1964 Retinomastixia schultei KIRCHH.; MAI, p. 43, pl. VI, figs. 6, 7.
- 1966 cf. Retinomastixia sp.; HOLÝ (in BÛŽEK, HOLÝ, KVAČEK), p. 257.
- 1975 *Retinomastixia schultei* KIRCHH.; CZECZOTT, SKIRGIELLO, pp. 41-42, pl. X, fig. 1.
- 1975 Retinomastixia schultei KIRCHH.; GREGOR, pp. 177–179.

Occurence: Hrádek nad Nisou [4].

Stratigraphy: Ottnangian.

Material: More than 30 carbonaceous fruits and a lot of fragments. Description: Fruits 13-24 mm long and about 5-15.5 mm broad; elongate ovate, oval, suboval in outline; as the state of preservation allows to examine the dorsal side seems to be somewhat flatter, the ventral one convex; base provided with fine rounded pit, apex acuminated; surface nearly smooth, on the epicarp (if preserved) fine vascular ducts or about 9-11 (or more?) tiny longitudinal lines; dorsal sulcus absent on the surface; both leaves of the infold closed narrowly together; the wall between locule and epicarp formed by lacunous resin tissue; epicarp probably 0,7-1,2 mm thick.

Remarks and affinities: Fruit mostly abraded and pitted by sand. Owing the expansion of the resin tissue layer during the time of drying the fruits burst and split into longitudinal pieces. Even before the drying it is advisable to dissolve the resin in alcohol or acetone. This very rare species is known only from Niederpleis bei Siegburg, Salzhausen, Wackersdorf (F.R.G.), Wiesa bei Kamenz (G.D.R.) and Turów (Poland). More detailed investigation and comparison of our finds are impossible because of poor preservation.

MASTIXICARPUM CHANDLER 1926

Diagnosis: Fruit ovoid to ellipsoid; endocarp woody, 1-loculed, closely invested by the epicarp; longitudinal infold projecting into the inner cavity, but without corresponding external sulcus; associated, however, with a large, longitudinal germination valve extending along the whole length of the endocarp; locule C- or U-shaped on cross section; radial excrescences of its sclerenchymous tissue irregularly penetrating the softer woody tissue of epicarp, presenting sometimes an implication of an external network-ornamentation.

Mastixicarpum limnophilum (UNGER 1850) KIRCHHEIMER 1941 (Pl. 2, figs. 1-16)

Basonym:

1850a Quercus limnophila UNG.; UNGER, p. 319, pl. 35, figs. 1, 2.

- 1938 *Xylomastixia lusatica* KIRCHH.; KIRCHHEIMER, pp. 348-350, pl. 7, figs. 1-6.
- 1941 Mastixicarpum limnophilum (UNG.) KIRCHH.; KIRCHHEIMER, pp. 614—616, figs. 7—8.
- 1957 Mastixicarpum limnophilum (UNG.) KIRCHH.; KIRCHHEIMER, pp. 225—226, 552, pl. 1, fig. 9.
- 1964 *Mastixicarpum lusaticum* MAI; MAI, pp. 44, 81, 90, 115, pl. VIII, fig. 12, pl. XV, fig. 17.
- 1966 Mastixicarpum lusaticum MAI; CZECZOTT et SKIRGIELLO, pp. 36-38, pl. IX, figs. 6-18, pl. X, fig. 7; (p.p.).
- 1975 Mastixicarpum limnophilum (UNG.) KIRCHH.; GREGOR, p. 174.

Diagnosis emenend.: Fruits 21—40 mm, rarely to 45 mm long, 16—26 mm broad; oval or oblong oval in outline; base rounded, mucronate apex narrowly rounded; median infold U-shaped in cross section, its leaves compressed closely together; surface smooth or with longitudinally aranged network; sometimes with about 9 longitudinal furrows.

Occurence: Hrádek nad Nisou [4].

Stratigraphy: Ottnangian.

Material: About 30 carbonaceous fruits.

Description: Fruits 21.5—32 mm long, 16—21 mm broad (modal value 23.5×17.4 mm); oval or suboval in outline, mostly slightly compressed; dorsal side rarely somewhat flattened on the germination valve; base rounded, apex narrowly rounded, mucronate. *Epicarp* mostly smooth or indistinctly ornamented by longitudinally arragned network, as well well as by about 9 longitudinal furrows; not too thick, but compact.

Endocarp: very closely invested by the epicarp; if the latter is somewhat abraded, then very rich anastomosing strips or bands of radial sclerenchym appear (separating the parenchymous nests) on the external surface; about 5—6 (exceptionally 10) grooves with vascular bands and resin ducts diverging from the centre of the base; also the infold sometimes leads out to the base by means of a short narrowed, funnel-shaped channel; the protruding apical mucro is in fact a woody stylar-base remain; it is bordered by 8—12 fine pits (sometimes the pairs of them connected into horseshoe- or heart-shaped forms); another time the whole mucro ornamented by radiating tear-drop-shaped pits; the probable perianth disc indicated by a ring of about 12—16 pits (? indications of vascular bands of perianth); locule U-shaped in cross section, occupies about 1/3 to1/2 of the diameter of endocarp.

R e m a r k s a n d a f f i n i t i e s: KIRCHHEIMER (1957, p. 552) discussed the taxonomical problems as regards to this genus, but still he placed the related fruits into *Xylamastixia lusatica* (though he admitted the affinity of *Xylomastixia lusatica* KIRCHH. to *Mastixicarpum limnophilum* (UNG.) KIRCHH.). MAI (1964, p. 44) settled the generic taxonomy. An autopsy of UNGER'S type specimen from Wieliczka convinces us about the only one possibility — to join *Xylomastixia lusatica* KIRCHH. with the older UNGER'S species (MAI's manuscript; GREGOR 1975, p. 174). Our specimens could seem to be identical with those described by CZECZOTT and SKIRGIELLO (1975, pp. 36—38) from Turów. The details appear to be very similar, the material, however, is not described thoroughly; the photographs often are not orientated in the natural position of fruits, so that it is difficult to recognize the differences between apex and base of fruits.



Textfig. 4: Mastixicarpum limnophilum (UNG.) KIRCHH.: schematic ranges of dimensions of fruits from Hrádek nad Nisou and Turów (explan. see textfig. 5).

TECTOCARYA KIRCHHEIMER 1934

Tectocarya elliptica (UNGER 1866) comb. n.

(Pl. 2, figs. 17-31)

Basonym:

1850b Anona elliptica UNG.; UNGER, p. 442.

- 1866 Anona elliptica UNG.; UNGER, p. 43, pl. XIV, fig. 2.
- 1866 Anona cacaoides POPPE; POPPE, pp. 55-56, pl. 1, figs. 13,14.
- 1934 Tectocarya lusatica KIRCHH.; KIRCHHEIMER, p. 774, figs. 15, 16.
- 1957 *Tectocarya lusatica* KIRCHH.; KIRCHHEIMER, pp. 322—323, 556— 557, pl. 42, fig. 164.
- 1964 Tectocarya lusatica KIRCHH.; HOLÝ, p. 219.
- 1964 Tectocarya lusatica KIRCHH.; MAI, pp. 44-45, 82, 89, 98, 115, pl. IV, fig. 1, pl. VIII, figs. 8-10, pl. XI, fig. 5, pl. XII, figs. 18, 19, pl. XV, fig. 17.
- 1975 Tectocarya lusatica KIRCHH.; CZECZOTT et SKIRGIELLO, pp. 42-43, pl. X, fig. 2.

1975 *Tectocarya lusatica* KIRCHH.; GREGOR, pp. 178–179. ?

Occurence: Nové Bukovany [3], Hrádek nad Nisou [4], Cheb—Františkovy Lázně [5], "Loket district" [6].

Stratigraphy: Eggerian (?) to Badenian (?lower)

Material: About 40 specimens of carbonaceous fruits.

Description: Much compresed fruits (flattened), 18-32 mm long, 9-20 mm broad, elongate obovate to suboval, elongate suboval, elliptic in the outline. *Epicarp*: of the same shape; thick but formed of parenchymous tissue, easily deformable and abradable, though closely joining the endocarp; apex narrowly rounded, provided with a broad perianth disc, finely mucronate at umbo (a remain after stylar base); base rounded (sometimes slightly narrowed) with a conspicuous pit at its centre; surface with 8-10 longitudinal strands of thin fibres.

Endocarp: 1-loculed, with conspicuous longitudinal sulcus (often squeezed through the epicarp up to the surface); not very thick; its sclerenchymous radial beams pass gently into epicarp, forming a net of slightly longitudinally elongated lacunas (bordered with low ridges). Remarks-affinities: KIRCHHEIMER (1934) describing a new genus ommitted the older UNGER'S species: thus his epitheton (*lusatica*) became illegitimate. There is no doubt that UNGER (1866) described under the name *Anona elliptica sp. n.* a quite typical fruit of *Tectocarya* (from the loc. Radoboj) with all proper attbibutes (elongate-obovate outline in general, basal pit, characteristical apex as well as the nature of its surface): this pictures on the whole recalls fruits from the Cheb- (So-kolov-) and Zittau-basins.

A comparison has been made even with the material from the Upper Lusatia (G.D.R.): our fruits differ from those in somewhat smaller dimensions (diagram textfig. 5); otherwise they resemble in all characteristics. Especially the fruits from the Cheb-basin are small ($18-22\times11-15$ mm). We obtain the same result when comparing them with Tectocarya from Turów (statistics of CZECZOTT and SKIRGIEŁŁO 1975) and especially from Wackersdorf (Oberpfalz, F. R. G.).

Tectocarya rhenana KIRCHH. differs from our species in its larger dimensions, oblonger outline, more blunted apex, conspicuous longitudinal ribs etc.

KIRCHHEIMER (1941, p. 612) mentioned as nicht sicher bestimmbar..." impression of *Tectocarya lusatica* in the matrix of PRESL'S type specimen of *Carpolithus venosus*; in reality this mould (like several other similar cavities in tuffitic sandstone from the loc, Počerny) is the outer impression of the nutt of *Juglans (Caryojuglans?*): The next KIRCH-HEIMER'S evidence [1. c. textfig. 5] seems to be more probable: that cast of fruit strongly recalls *Tectocarya*; KIRCHHEIMER gives its locality as "Nordböhmischer Braunkohlensandstein unbekannten Fundortes". Probably it could be a sandstone with carbonaceous or ferrous substance: such a mode of preservation is expectable in sandstones of the Overlying complex in Northbohemian basin, as well as in Basal complex (Staré Sedlo. Žitenice etc.) or in deposits from Počerny. Let us train to explain a presumable origin of this fossil: we must consider it as a free sandstone cast. separated from the mould by a distinct very thinn gap; such a fossil could originate as a cast of an inner cavity (perhaps a substitute of disintegrate soft tissue), separated originally from the matrix by a resisting tissue layer. Such a mode of preservation can be hardly expect in Tectocarya.

> , 30mm 25 20 15 40 10 15 20 25 30 35 45mm 40 - b ----C d a

Textfig. 5: Tectocarya elliptica (UNG.) comb. n.: schematic ranges of dimensions of fruits from various localities (a=Hrádek nad Nisou, b=Turów, c=Wiesa bei Kamenz, d= Wackersdorf, X=length, Y=breadth).

cf. Tectocarya robusta KIRCHHEIMER 1934 (Pl. 4, figs. 20-26)

1934 Tectocarya robusta KIRCHH.; KIRCHHEIMER, pp. 67–68, pl. 8, figs. 24a–f.

Occurence: Hrádek nad Nisou [4].

Stratigraphy: Ottnangian.

Material: 10 carbonaceous endocarps.

Description: *Endocarp* quite flattened, compresed, 1-loculed, 28-33 mm long and 15-21 mm broad (modal value $30.5 \times 18.1 \text{ mm}$); oval to elongate ovate in outline; base and apex rounded; secondarily compressed, but thick-walled; more than 6 grooves diverging from the base longitudinally upwards; surface with longitudinally elongated lacunae, with anastomosing small ridges; longitudinal infold followed by a narrow sulcus; neither apical discus nor basal pit have been observed.

Remarks-affinities: Described fruits might remind extremly flattened fruits of *Mastixicarpum*; but by their lacunose surface and visible sulcus they are more related to *Tectocarya*. KIRCHHEIMER (l. c. above) described such big endocarps (occuring separately of their fruits) and named them *Tectocarya robusta*; at last he annexed them to *Tectocarya lusatica*. According to KIRCHHEIMER they can attain the dimensions up to 32×16 mm.

EOMASTIXIA CHANDLER 1926

EMEND. DIAGN. (CHANDLER 1962, p. 124):

"Fruits belonging to the section *Mastixioideae* of the family *Cornaceae*; endocarps two- or more loculed, syncarpous, germinating by dorsal valves which extend to the whole length of the locule. Valves bearing on the internal surface a median longitudinal infold which corresponds with a groove on the external surface."

Diagnosae addenda em.: Endocarps 1- to 4 loculed; more or less conspicuously ribbed, rugose; with resin ducts on the surface; epicarp smooth on the surface, thin or thick, detachable of woody endocarp to a various extent.

R e m a r k s: KIRCHHEIMER did not demarcate the boundaries between the genera *Diplomastixia, Plexiplica, Ganitrocera* and *Eomastixia* well enough. After the comparison of their diagnoses (as far as they exist) the author suggests to unite those genera into the only one legitimate well defined genus *Eomastixia*. This way is proposed by MAI (manuscript), (see also: CHANDLER 1962, p. 125, GREGOR 1975, p. 170). CZECZOTT and SKIRGIEŁŁO (1975, p. 40) consider *Eomastixia* from England to be probably *Ganitrocera*.

Eomastixia hildegardis (UNGER 1866) comb. n.

(Pl. 4, figs. 1-19)

Basonym:

1850b Amygdalus hildegardis UNG.; UNGER, pp. 482-483.

1850b Amygdalus persicoides UNG.; UNGER, pp. 483.

1866 Amygdalus hildegardis UNG.; UNGER, pp. 63-64, pl. XIX, fig. 19.

1866 Amygdalus persicoides UNG.; UNGER, p. 63, pl. XIX, figs. 16-18.

1935b Diplomastixia arzbergiana KIRCH.; KIRCHHEIMER, pp. 292—293, fig. 15.

- 1936 Diplomastixia arzberigana KIRCHH.; KIRCHHEIMER, pp. 293—294, pl. 8, figs. 4, 5.
- 1939b Ganitrocera torulosa KIRCHH.; KIRCHHEIMER, pp. 3-4 (sep.), figs 3, 4.

Occurence: Cheb—Františkovy Lázně [5], "Loket district" [6], Hluboká nad Vltavou [7].

Stratigraphy: Karpatian — Badenian (? lower)

Material: 10+1+5 carbonaceous specimens.

Diagnosis: Fruits often 1- or 2-loculed, 9.0-29.5 mm long, 8.0-16.0 mm broad (modal value $20 \times 11 \text{ mm}$); L:B ratio (1.7)-1.9-(2.1); elongate ovate to broadly spindle in outline; with about 14-18 longitudinal ledges, ribs or rows of ledge shaped excressences and protube-rances.

Description: *Endocarps:* (in addition to diagnosis) mostly flattened, often evidently asymetrical, slightly bent; L:B ratio 1.7-2.1, with extremities 1.3-2.5; wall-thickness about 1 mm; base rounded, apex obconically narrowed (sometimes rounded, blunt), with 7-8 (-14) very fine ribs, ending sometimes into 2-3 mm long apical cone; 4-8 thick ribs of endocarp diverge from the base breaking up into 14-18 thin longitudinal ledges or rows of ledge-shaped excrescences, protuberances; germinating valve very broad.

Epicarp: very thin, leathery; rarely preserved thin meridional vascular bands; very fine resine grains lay under the surface; fruits with preserved epicarp seem to be more flattened and elongate ovate to oval in outline. R e m a r k s a n d a f f i n i t i e s: Endocarps conspicuously smaller and slender than in *Eomastixia saxonica* (MENZEL) comb. n. (see lower); both species are of different L : B ratio — in *Eomastixia hildegardis* differs from 1.7 to 2.1, while in *Eomastixia saxonica* mostly reaches 1.3 to 1.9. Also the absolute dimensions of the fruits differ considerably (diagram textfig. 6): *E. hildegardis* 9–29.5×8–16 mm, *E. saxonica* 17–42 ×11–30 mm. The diagram of the relation between L : B ratio and the breadth of the fruits (textfig. 7) is very illustrative: the general shape and dimensions of the fruits in both species are expressed by various and shifted hyperbolical segments $y = \frac{x}{a}$, a = L:B ratio, x = breadth.

Also *Eomastixia rugosa* (ZENKER) CHANDLER has small dimensions $(9.5-15\times5.5-8.5)$; it differs especially in its rugose surface, number of locules (2-4), C-shaped cross section of the inner cavity and in oval outline (CHANDLER 1960, p. 234).

KIRCHHEIMER (1934) mentions the fruits are mostly 1-loculed: in fact the one-loculed fruits are very common; most characteristic is the longitudinal bending of fruits. Probably it is caused by its unequal riping: often one locula riped only, while the second one is dwarfed. Endocarps from Cheb — Františkovy Lázně (10 specimens) are 14.5—26.5 mm long and 9.7—16 mm broad, specimen from "Loket district" 22.8×12 mm, 5 specimens from Hluboká nad Vltavou are 18—23 mm long and 12—15 mm broad. The fruits are preserved in various stages of abrasion. UNGER (1866) describing such fruits from Františkovy Lázně named them *Amygdalus persicoides* and *Amygdalus hildegardis*. He figured smaller, relatively fine-sculptured and narrow, characteristically slightly longitudinally bent fruits. Only his fig. 19 could be somewhat disputable. That is why KIRCHHEIMER (1939) supposed UNGER had described smooth fruits as *Amygdalus hildegardis* "...fast glatte Reste...".



Textfig. 6: *Eomastixia saxonica* (MENZEL) comb. n. from Hrádek nad Nisou: variation of dimensions; the size of rings increases proportionally to the number of individuals; E=specimens with remains of epicarp; x=Eomastixia hildegardis (UNG.) comb. n.; X=length; Y=breadth. (224 specimens of Eomastixia saxonica).

But UNGER'S drawings (pl. XIX, figs. 19, 20) are doubtless the specimens with removed germinating valve. KIRCHHEIMER described very similar fruits as *Diplomastixia arzberziana* from Seussen bei Arzberg (F.R.G., 1935) and from Františkovy Lázně (Liebenstein bei Eger, 1939) as *Ganitrocera torulosa*. At last he grouped these genera and species together with others creating a large species *Ganitrocera persicoides* (UNG.) KIRCHH., while he regarded the individual former species only as different forms and modes of preservation.

After a detailed study of KIRCHHEIMER'S type specimens, of the next collection in the Z.G.I. Berlin and of our material, after comparison with

literary data it seemed to be suitable to establish the described forms as independent species. The choice of the best epitheton, however, brings some difficulties: the most acceptable one would be UNGER'S epitheton *persicoides;* but KIRCHHEIMER used this one legitimately for his combination of the largest collective species *Ganitrocera perosicoides* (UNG.) KIRCHH. In this way this epitheton coud become a source of errors and confusions. The author suggested to accept the second Unger's epitheton *hildegardis* — though less suitable but yet the only one legitimate.



Textfig. 7: *Eomastixia saxonica* (UNG.) comb. n.: variation of L:B ratio (in %, left); relation between L:B ratio (Y) and the breadth (X); the size of rings increases proportionally to the number of individuas; $\Box = Eomastixia \ hildegardis$ (UNG.) comb. n. (224 specimens of E. saxonica).



Textfig. 8: Eomastixia saxonica (MENZEL) comb. n. from Hrádek nad Nisou: isolines expressing numbers of specimens of the same absolute dimensions; X=length, Y=breadth, 1-5-10-15-...-40= numbers of cases. (224 specimens of Eomastixia saxonica).

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Eomastixia saxonica (MENZEL 1933) comb. n.

(Pl. 3, figs. 1-19)

Basonym:

- 1933 *Elaeocarpus saxonicus* MENZEL; MENZEL (in MENZEL et GOT-HAN et SAPPER), p. 26, p. 6, fig. 9.
- 1934 Ganitrocera saxonica (MENZEL) KIRCHH.; KIRCHHEIMER, p. 773, fig. 12.
- 1934 Ganitrocera juglandoides KIRCHH.; KIRCHHEIMER, p. 773, f. 13.
- 1935a Ganitrocera torulosa KIRCHH.; KIRCHHEIMER, p. 60, pl. 5, figs. 19a, c, 21c, f, g.
- 1936 Ganitrocera torulosa KIRCHH.; KIRCHHEIMER, p. 113, figs. 17a, c.
- 1937a Ganitrocera torulosa KIRCHH.; KIRCHHEIMER, p. 899, fig. 8.
- 1938 Ganitrocera torulosa KIRCHH.; KIRCHHEIMER, pp. 343—346, pl. 6, figs. 1, 3, 14.
- 1940 Ganitrocera torulosa KIRCHH.; KIRCHHEIMER, pp. 284–285, fig. 3a.
- 1957 Ganitrocera persicoides (UNG.) KIRCHH.; KIRCHHEIMER, pp. 179, 180, 155, pl. 41, figs. 162a—i.
- 1964 Ganitrocera persicoides (UNG.) KIRCHH;. MAI, pp. 44, 81, 89, 97, 115, pl. VIII, fig. 7, pl. XI, figs. 8, 9, pl. XII, figs. 20-22, pl. XV. fig. 18.
- 1966 Ganitrocera persicoides (UNG.) KIRCHH.; HOLÝ (in: BÛŽEK et HOLÝ et KVAČEK), p. 257.
- 1975 Ganitrocera persicoides (UNG.) KIRCHH.; CZECZOTT et SKIR-GIELLO, pp. 38-40, pl. X, figs. 4-15, pl. XI, figs. 15-20.
- 1975 Eomastixia persicoides (UNG.) GREGOR; GREGOR, p. 170-172.

Occurence: Hrádek nad Nisou [4].

Stratigraphy: Ottnangian.

Material: About 250 specimens of carbonaceous fruits.

Diagnosis em.: Fruits 2-loculed unfrequently 1-loculed, thick-walled, 17-42 mm long, 11-30 mm broad, modal value $28 \times 16 \text{ mm}$; L:B ratio 1.1-2.6, mostly 1.3-1.9; broadly ovate to suboval in outline; endocarp with more than 16 conspicuous ridges, ledges or longitudinal rows of ledge segments. Epicarp soft, with resin ducts.

Description: *Epicarp* rounded, broadly oval, ovate, not very thick (sometimes preserved between endocarp ribs); resin ducts on the surface of the endocarp, in the grooves between endocarp-wings running longitudinally; fruits with epicarp-remains often more compressed.

Endocarp: broadly ovate, ovate, elongate-ovate, 1-loculed specimens often to spindle-shaped in outline; 2-loculed fruits mostly straight, 1-loculed (7%) always bent longitudinally; dimensions: length 20—40 mm, breadth 11—30 mm; often flattened, variously abraded; 4 wings diverging upwards from the rounded base ramify into 16 or more conspicuous wing shaped ridges, ledges, often irregularly broken into isolated excrescences; apex obconic, narrowed, with grooved apical cone; pseudo-1-loculed specimens usually conspicuously bent: the concave side is that one with an abortive ovule; germination valve occupies the vhole dorsal side; locule of C- or horseshoe-shaped on cross section; infold very deep, closing a bag-shaped cavity.

R e m a r k s and affinities: The species *Ganitrocera persicoides* (UNG.) KIRCHH. sensu amplissimo is to be corrected after removing of the foregoing species. All arguments are given in "Remarks and affinities" in *Eomastixia hildegardis* (UNG.) comb. n.. There is no reason to deal with such a great species in the Neogene. This species known from the Lower and Upper Lusatia (G.D.R., Poland), Wackersdorf (F.R.G.) is an independent one (compare textfig. diagr. 9). Though the individual populations often somewhat differ, the ranges of their variability coincide with more than their extremities only. The oldest available and legitimate name for such a defined species is MENZEL'S epitheton *saxonica* (1933).



Textfig. 9: Diagram of schematic ranges of dimensions of *Eomastixia* hildegardis (UNG.) comb. n. (1-4), *E. saxonica* (MENZEL) comb. n. (5-9) and *Ganitrocera (Eomastixia)* holzapfelii (MENZEL) KIRCHH.; X=length, Y=breadth, 1=KIRCHHEIMER 1939 Liebenstein, 2= KIRCHHEIMER 1939 Arzberg—Seussen, 3=Cheb — Františkovy Lázně, 4=Arzberg, material from Z.G.I. Berlin, 5=Hrádek nad Nisou, 6= Wackersdorf, 7=Merka, 8=Wiesa, 9=KIRCHHEIMER 1957, ×*O□= modal values.

A very similar species *Elaeocarpus* (e.g. *Eomastixia*) holzapfelii MEN-ZEL (1913, pp. 46—47, pl. 4, figs. 31—33) was reffered by KIRCHHEIMER to *Gantrocera saxonica* (MENZEL) KIRCHH. (1934, p. 771, figs. 5, 6) or to *Ganitrocera menzelii* KIRCHH. (1944, p. 16, figs. 2a—d): it differs from our species in larger dimensions $(26-55\times25-40 \text{ mm})$, sharply and conspicuously ramified ribs and ledges, thick epicarp, very thick and often 3-loculed endocarp. Specimens from Turów (Czeczott and Skirgiello 1975) and the whole Lusatia are identical.

CONCLUSIVE SUMMARY

Present critical conspectus of the *Mastixiae* fruits is the first step compensating the debts in the Tertiary carpological floras of the Bohemia. The basal results of the research are to be expressed in following items:

- A After the revision of all localities we have to summarize:
 - A1 *Mastixiae* fruits were found in the all main Tertiary basins with exception of the North Bohemian one.
 - A2 In Cheb Basin they originate probably from the Cypris-complex.
 - A3 In Sokolov Basin they were found between brown coal seams "Anežka" and "Antonín", then perhaps in the Cypris-complex.
 - A4 In the South Bohemian Basin they were discovered in the Mydlovary Formation over the lignite.
 - A5 In Hrádek nad Nisou, Zittau Basin, this flora was found in deposits of the Upper brown-coal complex.
 - A6 The finds in the Neovolcanics are extremly rare (Počery, Suletice), probably for edaphic reasons.
 - A7 The older finds in the Basal complex (Eocene) were not verified newly; the older data are partly questionable, partly untrue and above all without material documentation.
- B There were described 5 genera with 9 species from about 7 localities: *Mastixia, Mastixicarpum, Retinomastixia, Eomastixia* and *Tectocarya* (1 still living, 4 extinct). From their taxonomical investigation follows:
 - B1 The oldest finds (Neovolcanics, Oligocene) are hardly determinable (*Mastixia amugdalaeformis*, *Mastixia sp.*).
 - B2 The youngest finds (Františkovy Lázně Cheb?, "Loket district"?, Hluboká nad Vltavou) were collected probably in one stratigraphical position overlying of the brown coal seam; florula from basal beds of the Cypris complex (*Limnocarpus sp., Hartziella cf. rosenkjaeri, Caricoidea trebovensis* etc.) testifies that the age of this complex is very young (Karpatian to Badenian).
 - B3 The large flora from the Upper brown-coal complex at Hrádek nad Nisou resembles to those from Turów, Hartau, Kummersberg, Sandförstgen, Merka, Schmeckwitz, Wiesa and Wackersdorf; the presumed age of it is the Ottnangian.
 - B4 The flora found between the brown-coal seams "Anežka" and "Antonín" at Nové Bukovany is to be evaluated in future. The Mastixiaceae florula is not comparable stratigraphically now.
- C The occurence of the Mastixiaceae-fruits from the Bohemian Tertiary prove the positive climatic phases in the Lower and Middle Miocene, an extreme amelioration of our clima: epecially in the Ottnangian and the Karpatian to Badenian.

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EXPLANATIONS OF PLATES

PLATE 1

Mastixia amygdalaeformis (SCHLOTH.) KIRCHH.: figs. 1-8.

1—8: mostly flattened fruits: 1, 3, 6: dorsal view; 2, 4, 5, 7: ventral or lateral view; 8: latex cast of well preserved outprint. Cheb — Františkovy Lázně: 1,2-G 4216, 3,4-G 4217, 5-G 4218; Hluboká nad Vltavou: 6,7-G 4219; Počerny: 8-E 196; ca. x 1.9. Mastixia thomsonii MAI: figs. 9—19.

9-19: Fruits and their fragments or cross-sections, very well preserved. Nové Bukovany: 9, 17, 19 - G 4220, 10 - G 4221, 11, 14 - G 4222, 12, 15 - G 4223, 13, 18 - G 4224, 16 - G 4225; ca. x 1.9.

Mastixia lusatica MAI: figs. 20-39.

20, 21, 25, 29, 31, 32, 35, 37: dorsal view; 22, 23, 24, 26, 27, 28, 30, 33, 34, 36: ventral or dorsiventral view; 38, 39: cross-section. Hrádek nad Nisou: 20-G2288, 21-G2338, 23-G2443, 24-G2371, 25-G4226, 26-G2345, 27-G2431, 28-G4181, 29-G2310, 30-G2429, 31-G2314, 32, 33-G4182, 34-G2299, 35-G2285, 36-G4180, 37-G2443, 38, 39-G4183; ca. x 1.9.

Equisetum sp.: fig. 40.

40 — cast of a internode in quartzite; Žitenice; G 4227; x 1.4.

Mastixia sp.: fig. 41.

41 : outprint in diatomite from Suletice: G4185; ca. x 1,9.

PLATE 2

Mastixicarpum limnophilum (UNGER) KIRCHH.: figs. 1-16.

1-7: fruits in lateral view, mostly with stylar bases and perianth discs on their apexes; ca. x 1.3.

8, 9: details of apex with perianth disc; ca. x 1.7.

10: apical view with perianth disc: ca. x 1.9.

11-13: basal view showing a funnel-shaped channel leading from the infold (11, 13) or grooves radiating from top of the base [12]; ca. x 1.7.

14-16: cross-section with a big, U-shaped infold, thick wall of endocarp and branching strips of radial sclerenchym separating the parenchymous nests; ca. x 1.7.

Hrådek nad Nisou: 1-G4228, 2, 8-G4229, 3-G4230, 4, 9-G4231, 5, 12-G4232, 6, 11-G4233, 7, 10-G4234, 13, 14-G4235, 15-G4236, 16-G4237.

Tectocarya eliptica (UNG.) comb. n.: figs. 17-31.

Mostly more or less flattened fruits in various modes of preservation.

17-22, 25-29: fruits with preserved epicarp, mostly with perianth discs, sometimes with longitudnal strands of vascular bands (21, 22);

23, 24, 30: endocarps, the last with gapping sulcus of the infold;

31: cross-section showing a thin-walled infold; "Loket district": 17-G4207, 18-G4206; ca. x 1.4.

Cheb — Františkovy Lázně: 19-G4238, ca. x 1.3, 20-G4239, 21-G4240, 22-G4241; ca. x 1.9. Hrádek nad Nisou: 23-G4199, 24-G4201, 25-G4194, 26-G4200, 27-G4192, 28-G4203, 29-G4202, 30-G4205; ca. x 1.4. 31-G4195; ca. x 1.7.

PLATE 3

Eomastixia saxonica (MENZEL) comb. n.: figs. 1-19.

Fruits in various modes of preservation and the cross-sections:

3, 4, 7, 8, 13, 18: fruits with partly preserved epicarp, 7: with artifically partly abraded epicarp.

The others variously abraded.

2, 4, 14, 15: one-loculed fruits; the others are two-loculed.

2, 4, 11, 12: fruits somewhat bent (if one locula abortived).

9: fruit with gapping germination around the germination valve.

10: locule without detached germination valve.

1, 5, 6, 11: fruits with a short apical cone.

14-19: cross-section showing a various abrasion of epi- or endocarp as well as a C- or horseshoe-shaped locule-cavity.

Hrádek nad Nisou: 1-G4170, 2-G4144, 3-G4242, 4-G4137, 5-G4124, 6-G4122, 7-G3076, 8-G4179, 9-G4129, 10-4169, 11-G4127, 12-G4145, 13-G4154, 14-G4174, 15-G4124, 16-G4172, 17-G3077, 18-4170, 19-G4171; ca. x 1.5, cross-sections ca. x 1.9.

PLATE 4

Eomastixia hildegardis [UNG.] comb. n.: figs. 1-19.

Endocarps with partly preserved-epicarp (1, 11, 12, 18).

3, 7, 9, 11, 15, 17: one loculed and slightly bent fruits.

5, 6, 7, 14: fruits with gapping infold sulcus.

8: endocarp with detached germinal valve.

1, 3, 7, 10, 13-18: endocarp with blunt, relatively large, ribbed apical cone. "Loket district": 1-G4208.

Hluboká nad Vltavou: 2-G4243, 3-G4244, 4, 6-G4245, 5-G4246, 12-G4247.

Cheb - Františkovy Lázně: 7-G4248, 8-G4249, 9-G4250, 10-G4251, 11-G4252, 13, 14-G4253, 15-G4254, 16-G4248, 17-G4256, 18-G4254, 19-G4255; ca. x 1.4; 19 - ca. x 1.9.

cf. Tectocarya robusta KIRCHH.: figs. 20-26.

Mostly flattened endocarps; 26: with median sulcus.

Hrádek nad Nisou: 20-G4187, 21-G4189, 22-G4188, 23-G4186, 24-G4190, 25-G4184, 26-G4191; ca, x 1.4.

Retinomastixia schultei KIRCHH.: figs. 27-32.

Epicarps with more or less well preserved vascular bands on its surface [30-32], fruits with more or less widely gapping dorsal sulcus (27, 28, 30, 32).

Hrádek nad Nisou: 27-G4259, 28-G4260, 29-G4261, 30-G4262, 31-G4257, 32-G4258, 27, 30, 31- ca. x 1.9; 28, 29, 32- ca. x 1.4.



F. Holý: Representatives of the family Mastixiaceae . . . [123–147]

Pl. I.



F. Holý: Representatives of the family Mastixiaceae . . . (123-147) Pl. II.



F. Holý: Representatives of the family Mastixiaceae . . . (123-147) Pl. III.



F. Holý: Representatives of the family Mastixiaceae . . . (123-147) Pl. IV.