

MALADENODISCUS ACANTHINUS, A NEW GENUS AND SPECIES
OF FOSSIL FLOWER IN BALTIC AMBER

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ABSTRACT

A post-anthesis fossil flower in Eocene Baltic amber is described as **Maladenodiscus acanthinus** gen. et sp. nov., a dicotyledon of uncertain taxonomic affinity. Its distinctive floral characteristics include a calyx of 4 revolute sepals that are connate for about half their length, a prominent, tuberculate, glandular and probably nectariferous disc on the calyx cup, and a single superior ovary with numerous spinose projections. A ring of filament scars at the base of the pistil indicates the earlier presence of ca. 40 stamens, but petals were probably lacking. It is unclear to what modern plant family the fossil should be assigned.

RESUMEN

Se describe una flor fósil en post-antesis del Eoceno del ámbar Báltico como **Maladenodiscus acanthinus** gen. et sp. nov., una dicotiledónea de afinidad taxonómica incierta. Sus características florales distintivas incluyen un cáliz de 4 sépalos revolutos que están connados sobre la mitad de su longitud, un disco prominente, tuberculado, glandular y probablemente nectarífero en la copa del cáliz, y un ovario súpero simple con numerosas proyecciones espinosas. Un anillo de cicatrices de filamentos en la base del pistilo indica la presencia previa de ca. 40 estambres, pero los pétalos probablemente faltaban. No está claro a que familia moderna debería asignarse la planta fósil.

INTRODUCTION

The fossil flower described here, *Maladenodiscus acanthinus* gen. et sp. nov., is past anthesis and has a revolute calyx of 4 sepals that are triangular, thick, and united in their lower half to form an arching calyx cup. This fused portion of the calyx is covered by a tuberculate, glandular, pitted disc (Figs. 1, 2). The pedicel of the flower is long and stout. The ovary of the superior pistil is ovoid in shape and has a minutely puberulous surface that is ornamented with numerous smooth, conical spines. The style is smooth, stout, and tapered to a stigmatic tip with 2 or 3 inconspicuous lobes (Fig. 1, 3). The stamens are missing, but at an earlier stage they formed a single ring at the base of the ovary (Fig. 3). Their exact number cannot be determined, but from the visible filament scars, there appear to have been at least 40. No vestiges of a corolla are present, and it is likely that the flower was apetalous.

Considering the age of the fossil (35–55 Ma, see following section), it may not be possible to fit its unusual combination of floral features easily into a modern family of dicotyledons. Spinose fruits from a superior ovary are found, inter alia, in Achariaceae (Flacourtiaceae, see Discussion section) (*Buchnerodendron*, *Caloncoba*, *Lindackeria*, *Mayna*), Elaecarpaceae (*Sloanea*), Fabaceae (*Mucuna*, *Centrolobium*), Malvaceae subfamily Brownlowioideae (*Jarandersonia*), subfamily Byttnerioideae (*Ayenia*, *Byttneria*), and subfamily Grewioideae (*Apeiba*, *Triumfetta*), and Phytolaccaceae (*Microtea*). Other characteristics of the fossil, especially the well-developed nectariferous disc on the calyx cup, could seldom be found in combination with a spinose ovary in these or other genera examined, and our preference is for the familial placement of *Maladenodiscus* to remain indefinite at present.

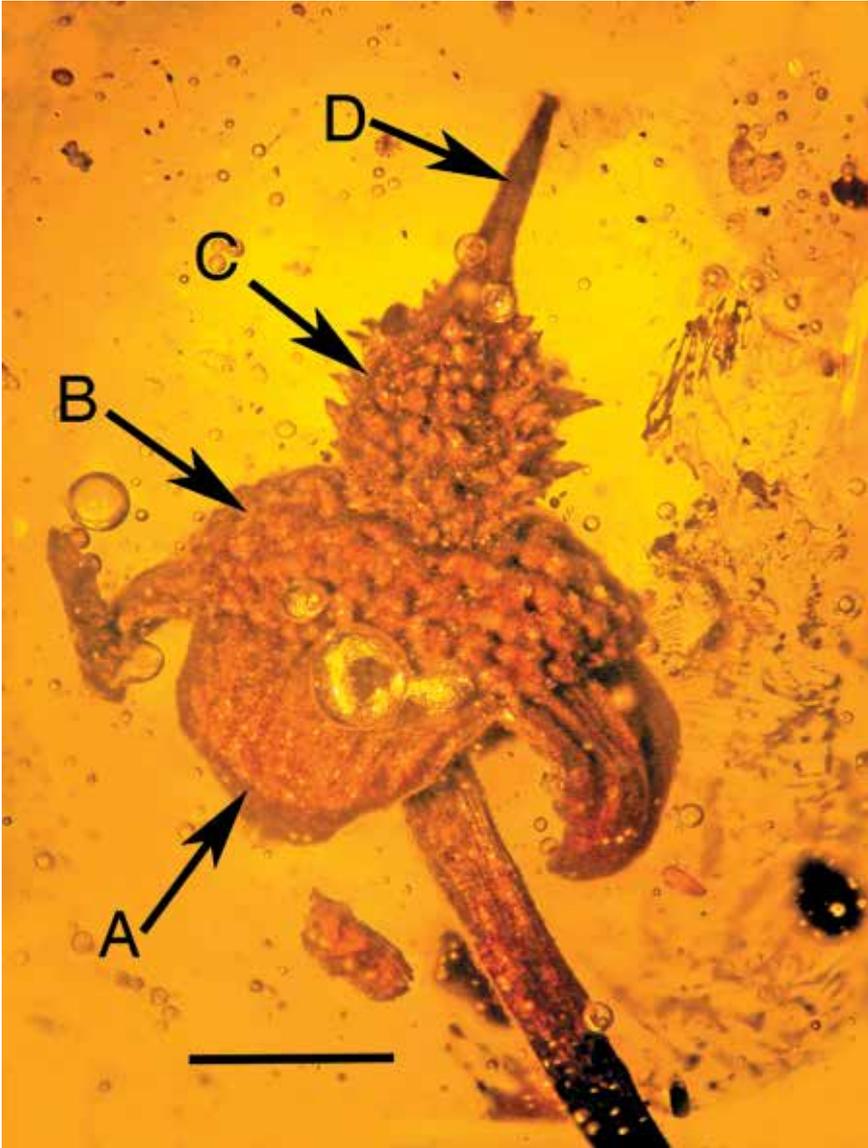


FIG. 1. *Maladenodiscus acanthinus* in Baltic amber. A. Sepal lobe. B. Calyx cup with tuberculate disc. C. Ovary showing spinose surface. D. Style. Scale bar = 2.4 mm.

MATERIALS AND METHODS

Baltic amber was formed in forests that grew in a tropical or subtropical climate over a large part of northern Europe for some 10 million years in the Early Tertiary. The amber can be found in various sedimentary deposits in a number of temperate European countries. However, most fossiliferous amber originates from the Samland Peninsula in the Kalinin District of the Russian Federation. Here it has been redeposited in marine sediment layers in the Baltic Sea that are referred to as the “blue earth” layers. In past centuries, the amber was loosened from these submarine deposits by wave action and deposited on the beach. Now most of the amber is

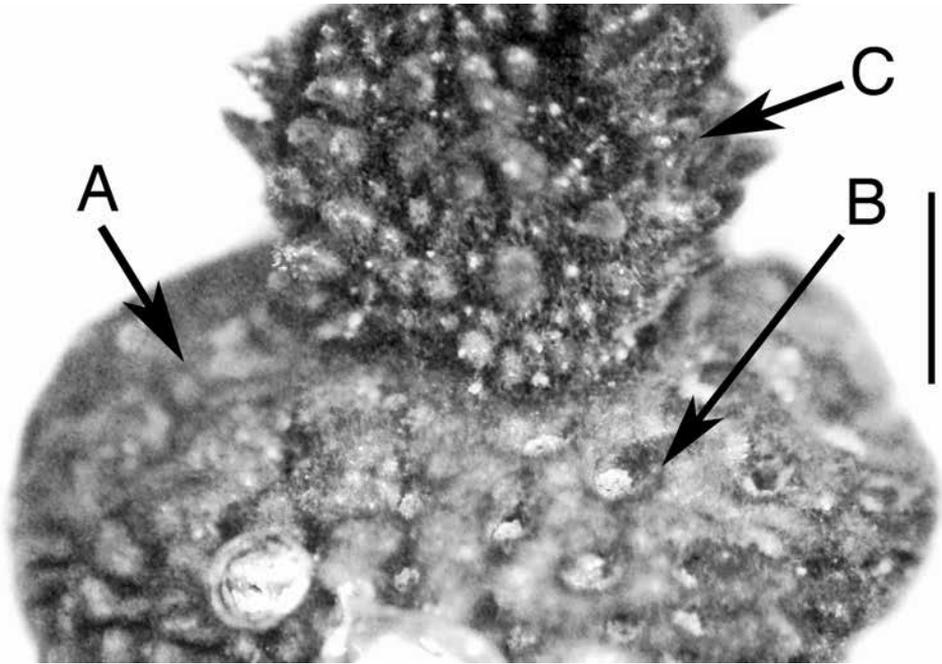


FIG. 2. *Maladenodiscus acanthinus* in Baltic amber. Detail of tuberculate, pitted calyx cup (A) and spinose ovary. B. Pit. Note drop of possible secretion from nectar gland. C. Ovary. Scale bar = 1.5 mm.

recovered by mining operations. Analyses of index fossils such as graptolites, ammonites, and foraminifera in the sediments provide ages ranging from 55 Ma (Early Eocene) to 35 Ma (Late Eocene). Morphological and anatomical examination of plant material in such amber indicates that it originated from a pine-like resin-forming plant, and chemical studies of the amber show that the producing tree was an *Agathis*-like araucarian (Poinar 1992, Weitschat & Wichard 2002).

Observations and photographs were made with a Nikon SMZ-10 R stereoscopic microscope and Nikon Optiphot compound microscope with magnification up to 800X. Helicon Focus Pro X64 was used to stack photos for better clarity and depth of field.

DESCRIPTION

Maladenodiscus Poinar, K.L. Chambers, & A.E. Brown, gen. nov. (Figs. 1–3).

Flower perfect, radially symmetrical, past anthesis, calyx fleshy, revolute, the lower half fused to form a cup, sepal lobes 4, triangular, arched downward, glabrous, calyx cup adaxially covered by a thickened, densely tuberculate, glandular-pitted, probably nectariferous disc (Figs. 1, 2), petals 0(?), stamens ca. 40, deciduous, represented by a ring of scars where filaments were attached at base of ovary (Fig. 3), pistil superior, ovary ovoid, epidermis minutely puberulous,

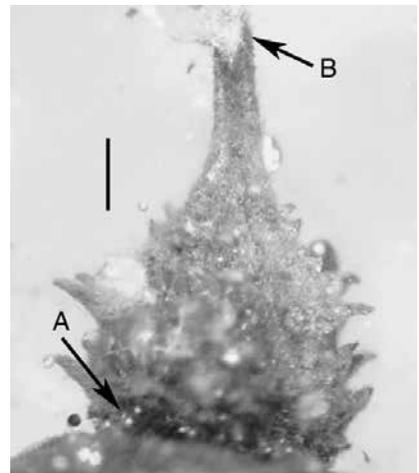


FIG. 3. *Maladenodiscus acanthinus* in Baltic amber. Enlarged view of reverse side of ovary. A. Scar at point of detachment of stamen filament. B. Stigmatic lobe. Tip of style partially obscured by exudate. Scale bar = 1.0 mm.

bearing numerous smooth, conical, spinose projections (Figs. 1, 2), style stout, tapering, stigmatic lobes 2–3, erect (Fig. 3), pedicel stout, glabrous.

Etymology.—From Greek “mala,” very much, “aden,” gland, and “discos,” plate or disc.

Maladenodiscus acanthinus Poinar, K.L. Chambers, & A.E. Brown, sp. nov. TYPE: RUSSIAN FEDERATION: Kalinin district near Kaliningrad, amber mines along the Baltic Sea, 1998, *unknown amber miner s.n.* (HOLOTYPE: Cat. No. Sd-9-199, deposited in the Poinar amber collection (PAC) maintained at Oregon State University, Corvallis, Oregon 97331, U.S.A.).

Flower 7.4 mm in diameter, 10 mm long, calyx lobes 4.3 mm long, 3.8 mm wide at base, nectariferous disc 2.4 mm wide, 5.9 mm in diameter, pistil 5.5 mm long, ovary 3.1 mm high, 2.8 mm in diameter, style 2.4 mm long, pedicel 13.8 mm long.

Etymology.—From Greek “akanthinos,” thorny.

DISCUSSION

In searching for the possible connection of *Maladenodiscus* with a modern genus, considerable attention was paid to the traditional family Flacourtiaceae, using the cited references Gilg (1925), Kiger (2001), Robyns (1968), Sleumer (1980), and Smith et al. (2004). In the newer classification of the family (Stevens 2001 onwards), the genera of interest because of their spinose fruits are transferred to family Achariaceae, tribe Lindacherieae (Chase et al. 2002). These are *Buchnerodendron*, *Caloncoba*, *Lindackeria*, and *Mayna*. The first 2 are limited to tropical Africa, the third is found in both Africa and South America, and the last is in the New World only (Sleumer 1980). In *Mayna* the flowers are unisexual, petals are present, and the pistil has usually 3–4 short styles (Sleumer 1980). Thus despite the fruits being covered with bristles, its other characteristics do not match the amber fossil. In *Lindackeria*, another genus with sometimes echinate fruits, the flowers are bisexual but the sepals are 3 and caducous, 6–12 petals are present, stamens are indefinite in number, and the style is filiform rather than stout and tapering as in the fossil (Sleumer 1980). *Caloncoba* and *Buchnerodendron* both have 3 sepals, 6–8(–12) petals, and very numerous stamens. The spines on their fruits, as illustrated by Gilg (1925, pp. 403, 406) are structurally different and more numerous than in *Maladenodiscus*.

In the modern classification of Malvales (Stevens 2001 onwards, Bayer & Kubitzki 2003), genera formerly assigned to Sterculiaceae and Tiliaceae (e.g. Schumann b, c 1895; Fryxell 2001) are placed in subfamilies and tribes of Malvaceae. Spinose fruits are found in the family but rarely in combination with the united sepals and nectariferous disc of *Maladenodiscus*. Genera that were examined, as mentioned above, include *Jarandersonia* of subfamily Brownlowioideae, a group described as having usually 5 petals, with sepals fused into a sometimes campanulate 3–5-fid calyx, often with an annular nectary inside at the base (Bayer & Kubitzki op. cit., p. 257). In *Jarandersonia*, a Bornean genus, the fruit is covered with slender spines that are setose or lepidote, thus differing from the short, stout, smooth spines of the fossil. Malvaceous genera of subfamilies Byttnerioideae and Grewioideae with spinose fruits include *Ayenia*, *Byttneria*, *Apeiba*, and *Triumfetta*. These are unlike the Baltic amber fossil in having free or almost free sepals and lacking a conspicuous disc on the calyx. The New World genus *Ayenia* possesses petals as well as a long androgynophore, while the pantropical *Byttneria* has petals but lacks an androgynophore. In both genera, the fruit at maturity breaks into 1-seeded mericarps, thus differing from the probably nut- or berry-like fruit of the fossil. *Apeiba* and *Triumfetta* of subfamily Grewioideae, with bristly, spinose, or tuberculate fruits, are unlike *Maladenodiscus* in other floral features such as the presence of petals, the absence of a calyx cup, and the differing form of their nectar glands, if present (Bayer & Kubitzki op. cit.).

Sloanea, of the Elaeocarpaceae, is another genus of interest with spinose or bristly fruits. In this taxon, the sepals are 4 but are seldom united. There are no petals, and the numerous stamens occupy pits in a cushion-shaped disc (Schumann 1895a). The fruit is a dehiscent capsule, thus differing, as mentioned, from the fossil. These floral features probably exclude *Sloanea* from consideration as a relative of the Baltic amber fossil. Other spinose-fruited genera mentioned in the Introduction likewise vary from the fossil in significant floral characteristics, and along with those discussed above, are not similar in enough respects to *Maladenodiscus* to alter our suggestion that this genus not be assigned, at present, to a modern family.

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