

FOSSIL POLLEN OF *SABICEA* (RUBIACEAE) FROM THE LOWER MIOCENE CULEBRA FORMATION OF PANAMA¹

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ABSTRACT

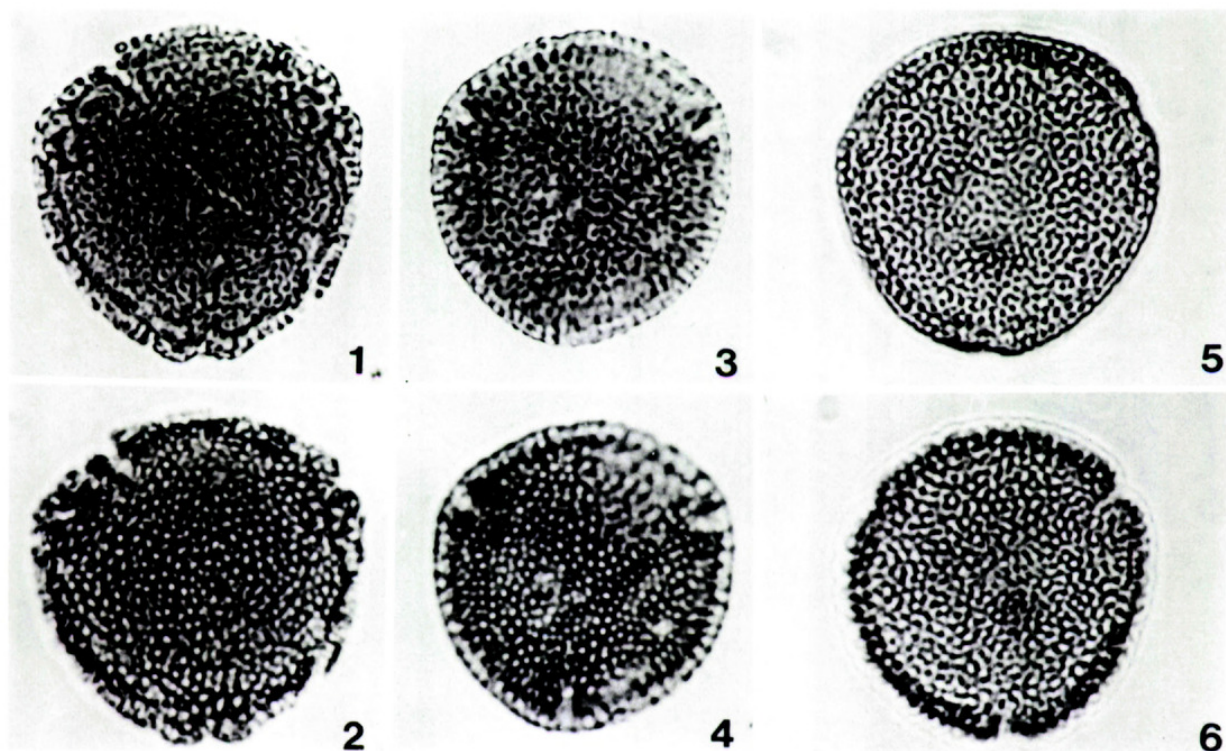
Fossil pollen of *Sabicea* (Rubiaceae) has been recovered from the lower Miocene Culebra Formation of Panama. The genus is presently widely distributed in Central and northern South America; it is well represented in the tropical moist and premontane wet forests of Panama. In the lower Miocene it was part of the low- to moderate-altitude insular vegetation characterizing the landscape between southern Mexico and northern Colombia. Its association with other members of the Culebra assemblage indicates tropical paleoclimates similar to those of the present. The genus has not been reported previously in the fossil record.

During studies on Tertiary vegetational history of the Gulf/Caribbean region, pollen and spores are frequently encountered representing genera with no previous fossil record, or whose stratigraphic and/or geographic range is considerably extended by the new records. Examples include *Pelliceria* (Theaceae/Pelliceriaceae; Graham, 1977), *Mortoni dendron* (Tiliaceae) and

Sphaeropteris/Trichipteris (Cyatheaceae; Graham, 1979), *Micractinium* (Chlorophyta; Graham, 1981), and *Lisianthus* (Gentianaceae; Graham, 1984). Fossil pollen of *Sabicea* (Rubiaceae; Figs. 1–4) has recently been recovered from the lower Miocene Culebra formation of Panama, representing its first known occurrence in the geologic record.

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FIGURES 1–6. Fossil and modern pollen of *Sabicea* (Rubiaceae).—1, 2. Fossil pollen, Pan core 456, slide 1, ESF coordinates D-17.—3, 4. Fossil pollen, Pan core 470.6, slide 3a, ESF coordinates U-31.3.—5, 6. Modern pollen of *S. colombiana*. All taken at 400 \times , actual size in μm given in text. Fossil specimens and modern reference material are deposited in the palynology collections, Kent State University, Kent, Ohio.

TABLE 1. Modern Rubiaceae pollen examined.

Taxon	Country	Voucher Collection	Herbarium where Voucher Deposited
<i>Amphidaysa ambigua</i> (Standley) Standley	Panama	<i>Busey 385</i>	MO
<i>Coccocypselum guianense</i> (Aublet) Schum.	Honduras	<i>Nelson & Romero 4263</i>	MO
<i>C. herbaceum</i> Lam.	Panama	<i>D'Arcy & D'Arcy 6731</i>	MO
<i>C. lanceolatum</i> (Ruiz & Pavón) Pers.	Panama	<i>Antonio 1425</i>	MO
<i>Didymochlamys connellii</i> N. E. Br.	Guyana	<i>Maguire et al. 32362</i>	MO
<i>Gonzalagunia brenesii</i> Standley	Costa Rica	<i>Croat 26591</i>	MO
<i>G. bunchosioides</i> Standley	Peru	<i>Ferreyra 1660</i>	US
<i>G. panamensis</i> (Cav.) Schum.	Panama	<i>Johnston 76</i>	GH
	Honduras	<i>N. Mex. exch.</i>	MO
<i>G. rosea</i> Standley	Panama	<i>White 7</i>	GH
<i>Hippotis mollis</i> Standley	Colombia	<i>Lawrence 505</i>	MO
<i>H. tubiflora</i> Spruce	Peru	<i>Klug 3084</i>	MO
<i>Isertia deamii</i> Bartlett	Guatemala	<i>Deam 6016</i>	MO
<i>I. haenkeana</i> A. DC.		<i>Harvard exch.</i>	GH
<i>I. hypoleuca</i> Benth.	Guyana	<i>Shell Oil exch.</i>	
	Costa Rica	<i>Jiménez 4127</i>	MO
	Panama	<i>Stimson 5062</i>	MO
<i>I. pittieri</i> (Standley) Standley	Colombia	<i>St. George Exped. 337</i>	US
<i>Pentagonia brachyotis</i> (Standley) Standley	Panama	<i>Dwyer 1385</i>	MO
<i>P. macrophylla</i> Benth.	Panama	<i>STRI exch.</i>	MO
	Panama	<i>Croat 4646</i>	MO
<i>P. pubescens</i> Standley	Panama	<i>Croat 4685</i>	MO
<i>P. wendlandii</i> Hook.	Panama	<i>von Wedel 2018</i>	GH
<i>Raritebe palicoureaoides</i> Wernham subsp. <i>dwyerianum</i> Kirkb.	Panama	<i>Mori et al. 6617</i>	MO
<i>Sabicea brasiliensis</i> Wernham	Brazil	<i>Irwin et al. 24943</i>	MO
<i>S. colombiana</i> Wernham	Colombia	<i>Uribe 3041</i>	US
	Colombia	<i>Gentry et al. 47975</i>	MO
<i>S. panamensis</i> Wernham	Panama	<i>Dwyer 1831</i>	MO
<i>S. paranensis</i> (Schum.) Wernham	Peru	<i>Schunke V. 10548</i>	MO
<i>S. villosa</i> var. <i>adpressa</i> (Wernham) Standley		<i>Harvard exch.</i>	GH
<i>S. villosa</i> Rose & Standley var. <i>villosa</i>	Panama	<i>Luteyn et al. 1798</i>	MO
	Panama	<i>von Wedel 2889</i>	GH
	Panama	<i>Tyson 3437A</i>	MO
<i>Schradera blumii</i> Dwyer & Hayden	Panama	<i>Mori et al. 6625</i>	MO
<i>Sommeria grandis</i> (Bartlett) Standley	Panama	<i>Allen 1575</i>	GH
	Panama	<i>Gentry et al. 13581</i>	MO

THE COLLECTING LOCALITY

In 1958 the Engineering and Construction Bureau of the Panama Canal Commission drilled a well through the Culebra Formation in front of Gold Hill on the west side of the Canal at latitude 9°02'N, longitude 79°38'W (Hole No. GH-9). Fifty-seven samples were taken from along the 124-meter core, and 21 contained well-preserved pollen and spores. The specimens of *Sabicea* were isolated from samples at the 456- and 470.6-foot depths. Other details on the Culebra Formation

are provided by Graham et al. (1985) and Stewart & Stewart (1980). The materials and methods were as described in Graham (1985).

DESCRIPTION

Pollen oblate, amb oval-triangular to nearly circular; tricolpate/porate (apertures short, slit-like, ca. 2 : 1 length:width ratio), 4–6 × 2–3 μm, equatorially arranged, meridionally elongated, equidistant, inner margin faintly dentate (due to overlying sculpture elements), faint costae colpi;



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