

A New Fossil Flower of the Genus *Vouarana* (Sapindaceae) in Amber from the Dominican Republic

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Abstract

Vouarana hispaniolae (Sapindaceae) is described as a new fossil flower in Dominican Republic amber. The flower is functionally staminate and is characterized by an actinomorphic corolla with 5 distinct, imbricate sepals that are ciliate on their margins, and closely appressed to surface of the receptacle; petals presumable 5, two partly visible are rhombic to triangular in shape; stamens 8, outstretched, filaments bearing thick setae at base; anthers square, basifixed, some retuse at apex, dehiscing via longitudinal slits, central pistillode short, setose; extra-nectary disc entire; pollen trigonous, glabrous and smooth. The fossil species differs from the two extant species of *Vouarana* that range from Costa Rica to northern Brazil by possessing a uniform covering of bristly setae over the entire receptacle, appressed sepals and square basifixed anthers. This specimen represents the first fossil flower of the Sapindaceae from the Neotropics.

Keywords: Hispaniola, Caribbean, mid-Tertiary, Dominican Republic, Paleobotany, fossilized resin

1. Introduction

Flowers in amber from the Dominican Republic reveal Neotropical species that existed in Hispaniola during the mid-Tertiary. Among these are representatives of the families Fabaceae, Arecaceae, Apocynaceae, Urticaceae, Bignoniaceae, Poaceae, Chrysobalanaceae, Lauraceae, Loasaceae, Meliaceae, Burseraceae, Myristicaceae, Rhamnaceae, Celastraceae, Commelinaceae, Loganaceae, Orchidaceae, and Ticodendraceae (Poinar, 2022). The present study describes the first fossil flower of the family Sapindaceae from the Neotropics.

The family Sapindaceae is worldwide however the systematics of the family have been in a state of flux. While genomic studies provided evidence that members of the families Aceraceae and Hippocastanaceae should be included in the Sapindaceae (Harrington et al., 2005), later studies resurrected the former two families, thus returning the Sapindaceae to its former status (Buerki et al., 2010). The fossil species from the Dominican Republic described below establishes a Cenozoic lineage of the Sapindaceae in Hispaniola.

2. Materials and Methods

The fossil flower originated from mines in the northern mountain range (Cordillera Septentrional) of the Dominican Republic between Puerto Plata and Santiago. Amber from mines in this region was produced by *Hymenaea protera* Poinar (1991) (Fabaceae) and based on the recovered biota, the original habitat was characterized as a tropical moist forest (Poinar & Poinar, 1999).

Dating of Dominican amber is controversial, ranging from 20-15 mya based on Foraminifera (Iturralde-Vinent and MacPhee, 1996) and 45-30 mya based on coccoliths (C pek in Schlee, 1990). These are minimum dates since most of the amber was secondarily deposited in turbiditic sandstones of the Upper Eocene to Lower Miocene Mamey Group (Draper et al., 1994). Dilcher et al. (1992) felt that the amber is older than the Miocene and quite possibly late Eocene. The discovery of Early Oligocene amber in Puerto Rico and Maastrichtian-Paleocene amber in Jamaica shows that amber was being deposited over a long time period in that part of the world (Iturralde-Vinent, 2001).

The well-preserved flower is complete. Observations and photographs were made with a Nikon SMZ-10 R stereoscopic microscope (Nippon Kogaku K.K., Tokyo, Japan) and Nikon Optiphot compound microscope (Nippon Kogaku K.K.) with magnifications up to 800 X. Helicon Focus Pro X64 was used to stack photos for better clarity and depth of field.

3. Description

Type genus: *Vouarana* Aubl., 1775; *Vouarana hispaniolae* Poinar, sp. nov. (Figs.1-3).

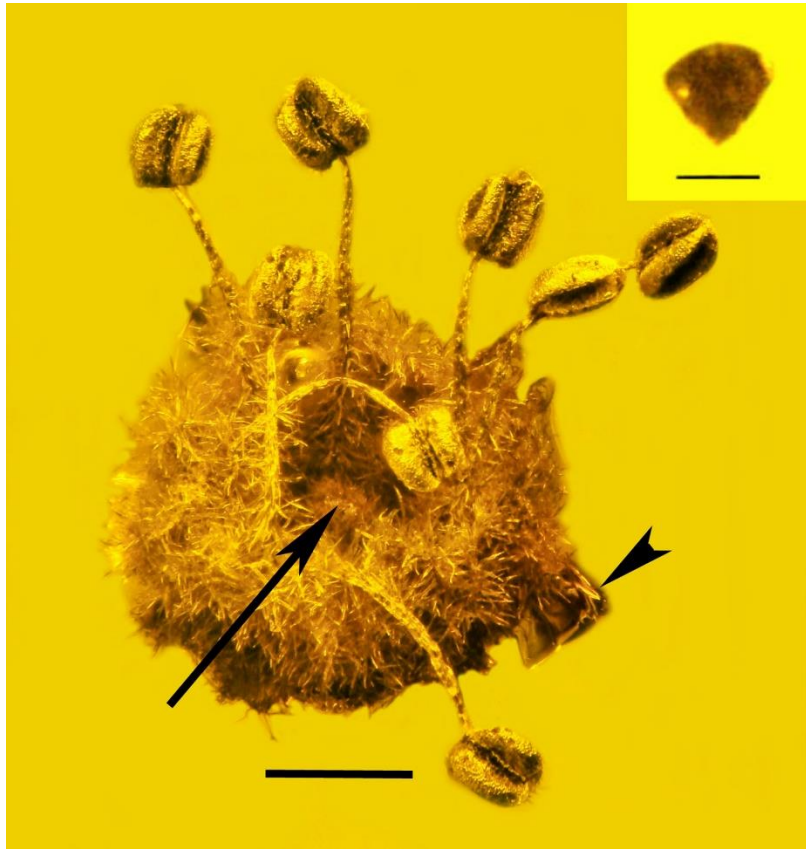


Figure 1. Apical view of holotype of *Vouarana hispaniolae* sp. nov. in Dominican amber
Arrow shows short pistilloid. Arrowhead shows petal. Note long filaments and squarish anthers. Scale bar = 2.6 mm. Inset shows obtusely trigonous pollen grain. Scale bar = 21 μ m.

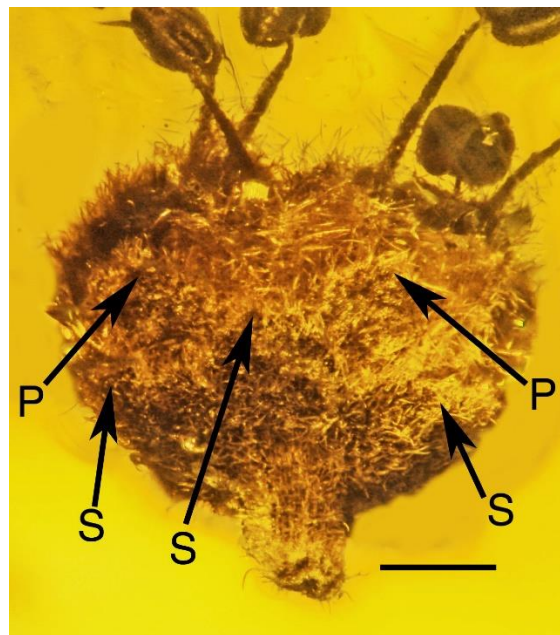


Figure 2. Lateral view of holotype of *Vouarana hispaniolae* sp. nov. in Dominican amber showing peduncle, terminal tip of three imbricate sepals (S) and two petals (P). Scale bar = 0.6 mm

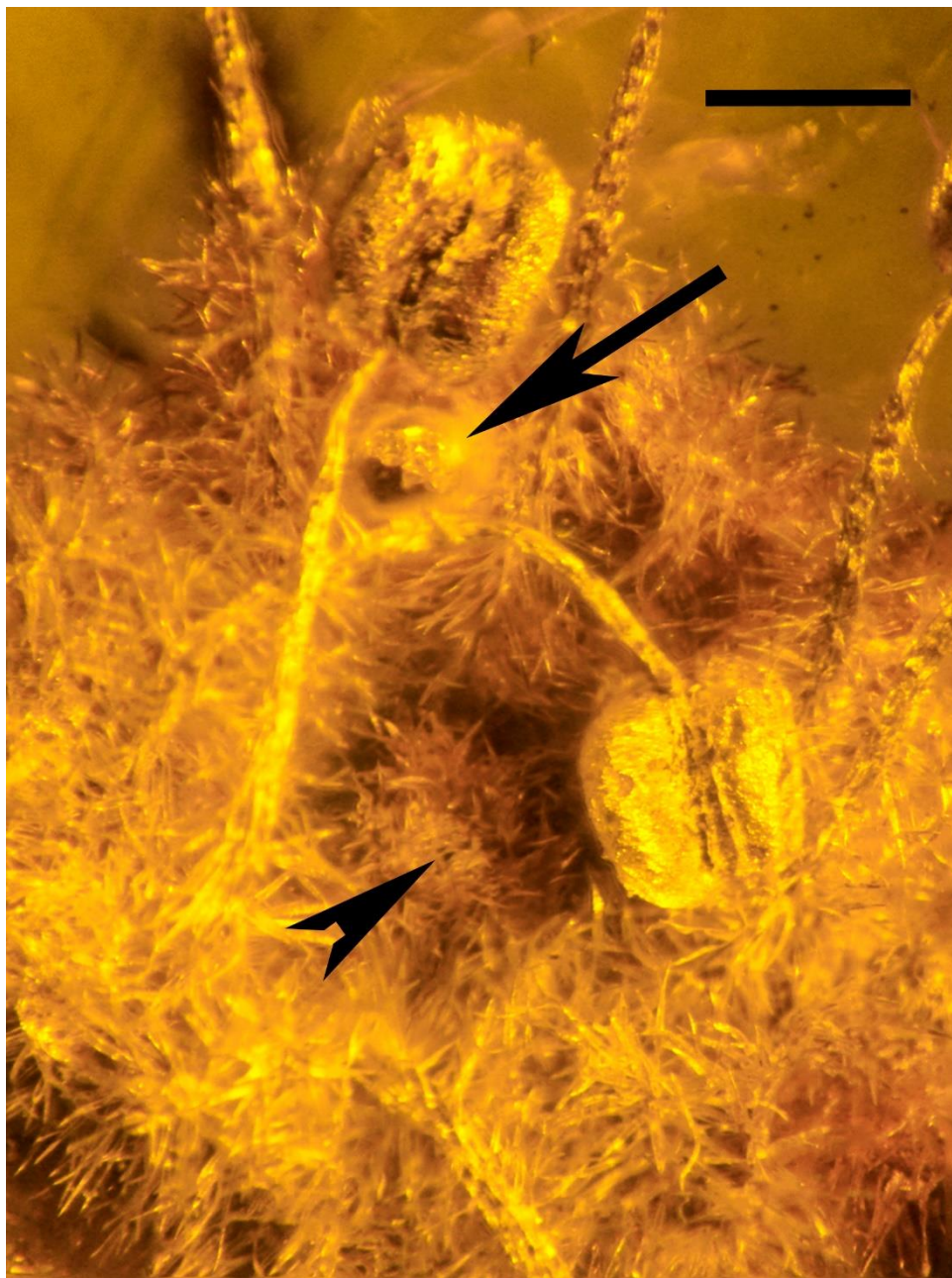


Figure 3. Pistillode (arrowhead) of holotype of *Vouarana hispaniolae* sp. nov. in Dominican amber
Arrow shows unknown structure. Scale bar = 0.5 mm

Flower (Holotype)(Fig.1) small, staminate, actinomorphic, covered with narrow, bristly, brown setae; flower width (without stamens), 2.8 mm; pedicel 0.5 mm long; sepals 5, (Fig.2) imbricate, margins ciliate, appressed to surface of receptacle, length sepals, 1.1-1.2 mm; petals presumable 5, two that are partly visible are rhombic to triangular in shape, exposed portions of petals, 0.6-0.8 mm; stamens 8, filaments 1.5- 1.8 mm long, bearing thick setae at base; anthers square, basifixed, some retrorse at apex, dehiscing via longitudinal slits, 0.5-0.6 mm in length; central pistillode short, setose (Fig.3); extra-nectary disc entire; pollen trigonous, glabrous and smooth, 26-32 μm in diameter. Determining the number of petals is difficult due to the long, dense setaceous covering on the receptacle. Setae also occur on the base of the filaments and on the anthers.

Type locality: Amber mine (La Búcara) in the northern mountain ranges (Cordillera Septentrional) of the Dominican Republic. DD latitude and longitude: 19.4, -70.4. **Holotype** (accession # Sd-9-101) deposited in the Poinar amber collection (PAC) maintained at Oregon State University, Corvallis.

Etymology: The specific epithet indicates the geographical location of the fossil.

4. Discussion

It is surprising that at the turn of the 20th Century, there were some 118 worldwide genera in the family Sapindaceae (Sargent, 1905). At that time many of the species in this family had practical uses. For instance, members of the genus *Sapindus*, widely distributed throughout the tropics, contains a cleansing compound that caused the pulp of the fruit to lather in water and was used as a substitute for soap. The bark was also used as a tonic. The seeds of several species were strung for chaplets and bracelets and the heavy, strong, close-grained, light brown wood of other *Sapindus* species were split into strips and used to make baskets for harvesting cotton (Sargent, 1905).

Most likely, *Vouarana hispaniolae* was a large tree similar to its extant co-species that occurs in the Guianas and Costa Rica. The actinomorphic corolla of the fossil is similar to that of male flowers of the two extant species of the genus *Vouarana* Aubl. (*V. anomala* (Steud.) Acev.-Rodr. and *V. guianensis* Aubl.) that range from Costa Rica to northern Brazil. However in *Vouarana hispaniolae* n. sp., the imbricate sepals are appressed to the receptacle instead of being free as in the extant species. Also the extant species have shorter filaments and dorsifixed (not basifixed) anther attachments (Acevedo-Rodríguez et al., 2011). While the pollen grains of the fossil are obtusely trigonous, glabrous and smooth, those of the extant species are wrinkled and grooved. The short filaments and longer than wide anthers of the extant species also differ from the mostly squarish anthers and long filaments of *Vouarana hispaniolae* n. sp. The presence of numerous pollen grains on and adjacent to the fossil show that it was in anthesis when it entered the resin. A curious structure along the edge of the fossil flower could not be identified (Fig.3).

The Sapindaceae is primarily a tropical- subtropical family with centers of diversity in tropical America and tropical Asia. In the Neotropics, most diversity occurs below 1500 meters in coastal, montane and Amazonian habitats. Some 34 genera and 968 species occur in the Western Hemisphere (Beck, 2004). The family has a long fossil history, with seeds and wood dating from the Cretaceous (Acevedo-Rodríguez et al., 2011; Manchester, 1999). While the present specimen is the first fossil flower of the Sapindaceae in Neotropical amber, sapindaceous flowers described as *Wehrwolfea striata* Erwin & Stocky (1990) were reported from middle Eocene sedimentary deposits of British Columbia.

The genus *Vouarana* does not occur in Hispaniola today (Acevedo-Rodríguez et al., 2011; Liogier 1985, 1988) and it is unknown when this lineage first appeared in Hispaniola. The ancestor may have migrated onto the Proto-Greater Antilles when it was still in contact with North and South America before it moved eastward and eventually formed the Greater Antilles (vicariance theory). Arriving by water or air (dispersion theory) is another way life forms could have arrived in the Caribbean (Poinar & Poinar, 1999). Another unknown is when and why this generic lineage disappeared not only from Hispaniola, but from the entire Greater Antilles (Acevedo-Rodríguez et al., 2011).

Several factors could have caused the extinction of the *Vouarana* clade. The first is the disappearance of pollinators, especially the extremely common stingless bees that also disappeared from Hispaniola. Plant diseases is another possibility. Also important is the global cooling event during the Pliocene and Pleistocene. This cooling event transfigured the Northern Hemisphere and extended into the tropics. The drop in temperature caused a migration of life to where the weather was similar to the original climate. Stenotopic forms were trapped by the island insularity (Poinar & Poinar, 1999).

Pollinators in Dominican amber that could have visited the flowers of *Vouarana* are various bees, butterflies, beetles and flies.

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Competing interests

The author has no known competing financial interest or personal relationships that could have appeared to influence the work reported in this paper.

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Obtained.

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The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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