

FURROWED BLISTER PODS STRANDED ON NORTHERN ATLANTIC OCEAN
COASTS REPRESENT AN UNDESCRIBED *SACOGLOTTIS* (HUMIRIACEAE)
ENDOCARP MOST SIMILAR TO THE FOSSIL *SACOGLOTTIS COSTATA*

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ABSTRACT

Ten distinctly furrowed endocarps stranded on coasts along the northern Atlantic Ocean (including Gulf of Mexico and North Sea) have so far eluded identification. The endocarps resemble the blister pod, a common “sea-bean” originating from the fruit of *Sacoglottis amazonica* (Humiriaceae), but they are larger and show deep furrows. The furrowed blister pods should be classified in the genus *Sacoglottis* sensu lato (*Sacoglottis* and *Schistostemon* together). They represent an undescribed endocarp most similar to the fossil *Sacoglottis costata* Reid from the Tertiary of Colombia, South America. The recent specimens are best denoted as *Sacoglottis* cf. *costata*. Presumably, they do not belong to one of a few *Sacoglottis* species known only from flowering collections. Therefore, it is expected that an undescribed species, producing *costata*-like endocarps, occurs somewhere in northeastern South America.

RESUMEN

Diez endocarpos claramente surcados de las costas del norte del océano Atlántico (incluyendo el Golfo de México y Mar del Norte) habían eludido su identificación. Los endocarpos semejan a una vaina con ampollas, una “sea-bean” común originada del fruto de *Sacoglottis amazonica* (Humiriaceae), pero son más grandes y muestran surcos profundos. Las vainas sulcadas suelen clasificarse en el género *Sacoglottis* sensu lato (*Sacoglottis* y *Schistostemon* juntos). Representan un endocarpo no descrito muy similar al del fósil *Sacoglottis costata* Reid del Terciario de Colombia, Sudamérica. Los recientes especímenes están mejor denominados como *Sacoglottis* cf. *costata*. Presumiblemente, no pertenecen a una o unas pocas especies de *Sacoglottis* conocidas solo de colecciones de flores. Sin embargo, se espera que una especie no descrita, que produce endocarpos semejantes a los de *S. costata*, se de en alguna parte de noreste de Sudamérica.

INTRODUCTION

Sea-beans are “seeds and fruits that are carried to the ocean, often by freshwater streams and rivers, then drift with the ocean currents and (hopefully!) wash ashore” (www.seabean.com 2014). About 2007, a conspicuously furrowed sea-bean (Fig. 1A–D) was found among debris from the North Sea coast in the Netherlands, and brought to the attention of the first author at the end of 2012. This sea-bean closely matched a drawing in the *World Guide to Tropical Drift Seeds and Fruits* (Gunn & Dennis 1976, Fig. 71B;

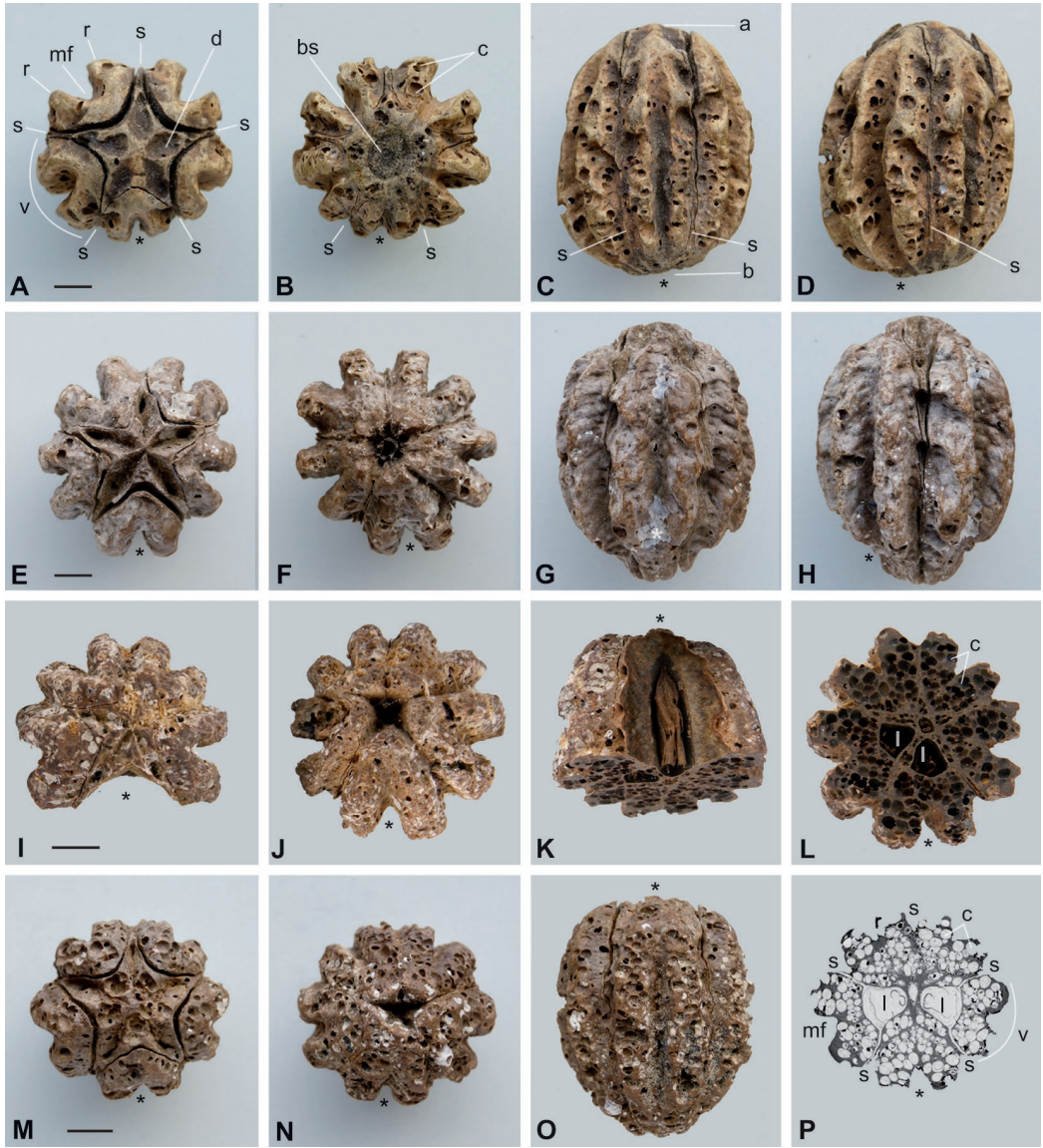


FIG. 1. Endocarps of *Sacoglottis* cf. *costata* (Humiriaceae). First column (A, E, I, M): view of apex; second column (B, F, J, N): view of base; third column (C, G, K, O): view of median furrow on valve (C, G, O) or seed remains (K); fourth column: view of septum (D, H) or section (L, P). Corresponding valves in different photographs of the same specimen are indicated with an asterisk (*). a = apex, b = base, bs = basal scar, d = one of five depressions around apex, i = locule, mf = median furrow on valve, r = one of two ridges on valve, c = cavity, s = septum, v = valve. Scale bar = 10 mm. A–D, Specimen #5, from Yerseke, Netherlands. E–H, Specimen #4, from Palm Beach County, Florida, U.S.A. I–L, Specimen #7, from Bermuda, U.K. (photographed by Bob & Helle Patterson). This specimen is cross-sectioned, with one valve removed from upper half of endocarp (Fig. 1I) showing seed remains (Fig. 1K). Fig. 1L represents the lower half, showing two adjacent fertile locules and many small cavities (compare with Fig. 1P, 3D). M–P, Specimen #9, from South Padre Island, Texas, U.S.A. Fig. 1P shows a micro-CT cross-section showing two opposite fertile locules and many small cavities (compare with Fig. 1L, 3D).

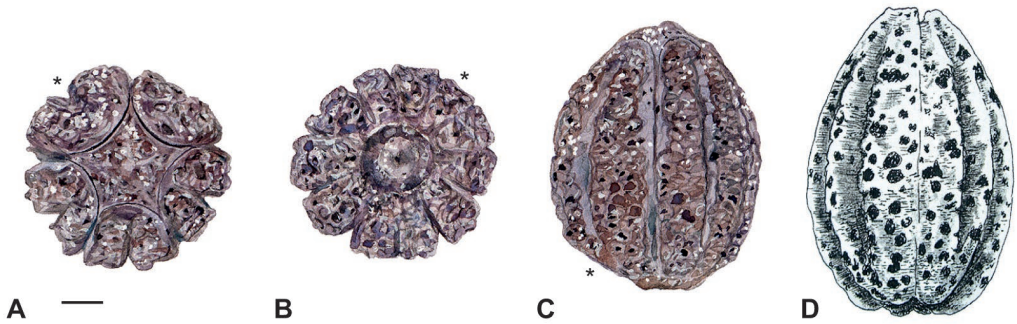


FIG. 2. Endocarps of *Sacoglottis* cf. *costata* (Humiriaceae). Scale bar = 10 mm. A–C, Specimen #2, painted by Izumi Hanno, from unknown location. Corresponding valves are indicated with an asterisk (*). A, view of apex. B, view of base. C, view of septum (compare with Fig. 1D, 1H, 2D). D, Specimen #1, from SE coast of Florida, U.S.A. (from Gunn & Dennis 1976; drawing by Pamela J. Paradine), view of septum (compare with Fig. 1D, 1H, 2C).

Fig. 2D in present paper). This drawing was included in a plate illustrating disseminules of mahogany (*Swietenia mahagoni* (L.) Jacq., Meliaceae) from the southeastern coast of Florida, U.S.A. However, after checking mahogany fruits it was learned that neither the drawing nor the sea-bean from the Netherlands could possibly be this species or any other species of the family Meliaceae.

After some research, the sea-bean was identified as an endocarp¹ from a fruit of a Humiriaceae species. A well-known sea-bean from this almost completely Neotropical family is the blister pod: *Sacoglottis amazonica* Mart. (Fig. 3A–D). This endocarp, with crowded large globular cavities (blisters), is “one of the most common tropical drift seeds found on Florida east coast beaches” (Perry & Dennis 2003:79). It is found on beaches all around the North Atlantic Ocean and has occasionally also been collected in northwestern Europe (Devon, Ireland, Scotland; Guppy 1917; Nelson 2000). However, the unknown, distinctly furrowed endocarp does not resemble the endocarp of *S. amazonica*: the latter is small, its cavities are large, and its surface is bullate with only shallow and irregular furrows (Fig. 3A–D). The endocarp of *Vantanea guianensis* Aubl. (Humiriaceae), mentioned by Gunn and Dennis (1976) as being “not found too far beyond their northern South America homeland,” does not compare either. The unknown endocarp was provisionally assigned to the genus *Duckesia* Cuatrec. (Humiriaceae), on the basis of the large size, the (supposed) presence of foramina (holes) in the septa near the apex and medium-sized cavities visible at the surface of the valves, and comparison with material published by Herrera et al. (2010). Fabiany Herrera (pers. comm. 2012) agreed, but advised to section the endocarp in order to confirm this affinity. Consulting “sea-beaner” Ed Perry prompted the reply “This is *Sacoglottis gabonensis*! ... related to blister pod ..., but much rarer in drift.” Following the accompanying link to *Sacoglottis gabonensis* on the website www.seabean.com provided photographs of two furrowed, undoubtedly conspecific endocarps from Florida, one from Palm Beach County (Fig. 1E–H), the other from Lignumvitae Key. A photograph of an additional specimen (Fig. 1I–L) from Bermuda was sent with Ed’s reply. The African *Sacoglottis gabonensis* (Baill.) Urb. is the only non-American species of Humiriaceae. Endocarps of this locally common species are often found floating in rivers and on sea shores in the western part of tropical Africa (Cuatrecasas 1961). *S. gabonensis* might be closely related to *S. amazonica* (see also Renner 2004) and produces similar though smaller and more globular endocarps, which differ from the unknown endocarp. A request by Ed Perry via Facebook (“Sea Beans” group) generated donations of two more specimens of the unknown endocarp, one from Volusia County, Florida, and one (Fig. 1M–P) found stranded on South Padre Island, Texas, U.S.A. In 2011 coauthor Izumi Hanno painted an unidentified sea-bean in the Gunn/Dennis collection. This specimen (Fig. 2A–C) clearly represents the unknown

¹ An endocarp is the woody (“stony”) inner layer of the fruit wall of a drupe, together with the mesocarp (middle layer) and exocarp (outer layer, also called epicarp) making up the entire fruit wall.

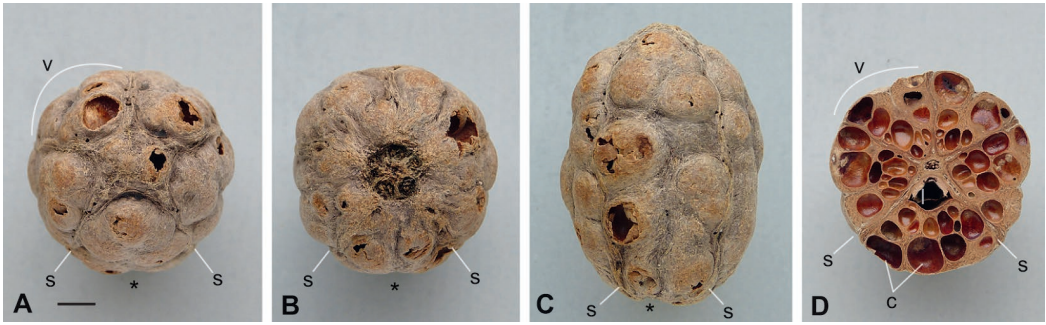


FIG. 3. Endocarp of *Sacoglottis amazonica* Mart. (Humiriaceae) from unknown location (#133, carpological collection of the Utrecht herbarium in Naturalis Biodiversity Center, Leiden, Netherlands). Corresponding valves are indicated with an asterisk (*). l = locule, c = cavities, s = septum, v = valve. Scale bar = 10 mm. **A**, view of apex. **B**, view of base. **C**, view of valve (compare with Fig. 1C, 1G, 10). **D**, cross-section showing one fertile locule and relatively few large cavities (compare with Fig. 1L, 1P).

endocarp but deviates in size, shape, and details from the one depicted in Gunn and Dennis (1976, Fig. 71B; Fig. 2D in present paper). Therefore, it is assumed that two specimens might be or have been present in the Gunn/Dennis collection². In 2014 a specimen was reported by Jenifer Mina. She found it (without data) on the 'sharing table' during the Nineteenth Annual International Sea-Bean Symposium and Beachcombers' Festival in October 2014 at Cocoa Beach, Florida. According to Ed Perry, it might have been collected in Texas by George Wolf (Pasadena, Texas), who donated so much to put on the sharing table. Correspondence with the collectors/owners of the furrowed endocarps led to enthusiastic response and cooperation, so that (data of) ten specimens are now available. The purpose of the present paper is to describe them and to assess their status within the Humiriaceae.

MATERIAL AND METHODS

Ten specimens of the furrowed endocarp are known (Table 1, Fig. 4), of which one (#3) is probably lost (collection Cathie Katz, died 2001; seen by Ed Perry; no further data available). The present location of the other specimens is cited in Table 1 in the column "collection."

The CT image (Fig. 1P) was made with a Bruker SkyScan1172 high-resolution microCT (Naturalis Biodiversity Center, Leiden, Netherlands).

RESULTS

The furrowed endocarps available for further study (#4–10; Table 1, Fig. 1A–P) are 54–72 mm long, 40–62 mm wide (avg. 63.4 and 50.0 mm) and have an ovoid, ellipsoid to almost globular, or obovoid shape (length/width ratio 1.02–1.42, avg. 1.28). Some specimens (especially #4 and #5) are slightly asymmetrical due to the larger size of the valves covering fertile locules. The base contains a depressed, circular to pentagonal innervation scar, while the apex shows a bulging, 5-rayed star (= top of axis with radiating septa) with a 2–6 mm deep, radially oblong depression in each septum. At the surface of the endocarp, the five septa extend towards the base as 0.3 to ca. 1 mm wide irregular ridges, each at the bottom of an oblong, up to 5 mm deep, and 15 mm wide furrow (Fig. 1C, D). Above the base, the septa diverge into the area around the basal innervation scar. The valves range from oblong to elliptical in longitudinal view, slightly shorter than the endocarp itself and up to 30 mm wide at the equator. Valves covering fertile locules are slightly larger than those on the infertile ones. Only the basal part of each valve is connected with

² The Gunn/Dennis collection contains the material that was the basis for the records in Gunn and Dennis (1976). At present, the collection is in the possession of coauthor Izumi Hanno. It is in storage (Jacksonville, FL, USA) and temporarily inaccessible.

TABLE 1. List of specimens, collection data and features of the furrowed endocarp (*Sacoglottis* cf. *costata*).

#	locality	year	source/collector	collection	L × W (mm)	shape	Fig.
1	SE coast of Florida, U.S.A.	≤ 1976	Gunn & Dennis (1976)	Hanno	ca. 60 × 40	ovoid	2D
2	?	?	Gunn/Dennis collection	Hanno	c. 64 × 49	ovoid	2A–C
3	?	≤ 2000	Cathie Katz / Ed Perry	lost?	?	?	-
4	Palm Beach County, FL, U.S.A.	ca. 2003	Paul Mikkelsen	L	67 × 54	ellipsoid	1E–H
5	Yerseke*, Netherlands	ca. 2007	Theo Lambrechts	L	62 × 47	ovoid	1A–D
6	Lignumvitae Key, FL, U.S.A.	2009	Mike Romance	Romance	63 × 62	± globular	-
7	Bermuda, U.K.	"some y. ago"	Bob Patterson	Patterson	64 × 45	ellipsoid	1I–L
8	Volusia County, FL, U.S.A.	2013	Kim Lincicome	FLAS	62 × 46	ellipsoid	-
9	South Padre Island, TX, U.S.A.	2013	Linda Butcher	BRIT	54 × 45	obovoid	1M–P
10	Texas?, U.S.A.	≤ 2014	George Wolf? / Jennifer Mina	L	72 × 51	obovoid	-

Note. The specimens are listed more or less in order of collecting. Collection: BRIT = Botanical Research Institute of Texas, Fort Worth, Texas, U.S.A.; FLAS = University of Florida Herbarium, Florida Museum of Natural History, Gainesville, Florida, U.S.A.; L = Naturalis Biodiversity Center, Leiden, Netherlands. Collections Hanno, Patterson and Romance: see author addresses. L = length, W = Width. * Specimen #5 was found in Yerseke, Netherlands, among material dredged from the Middeldiep, along the nearby North Sea coast.

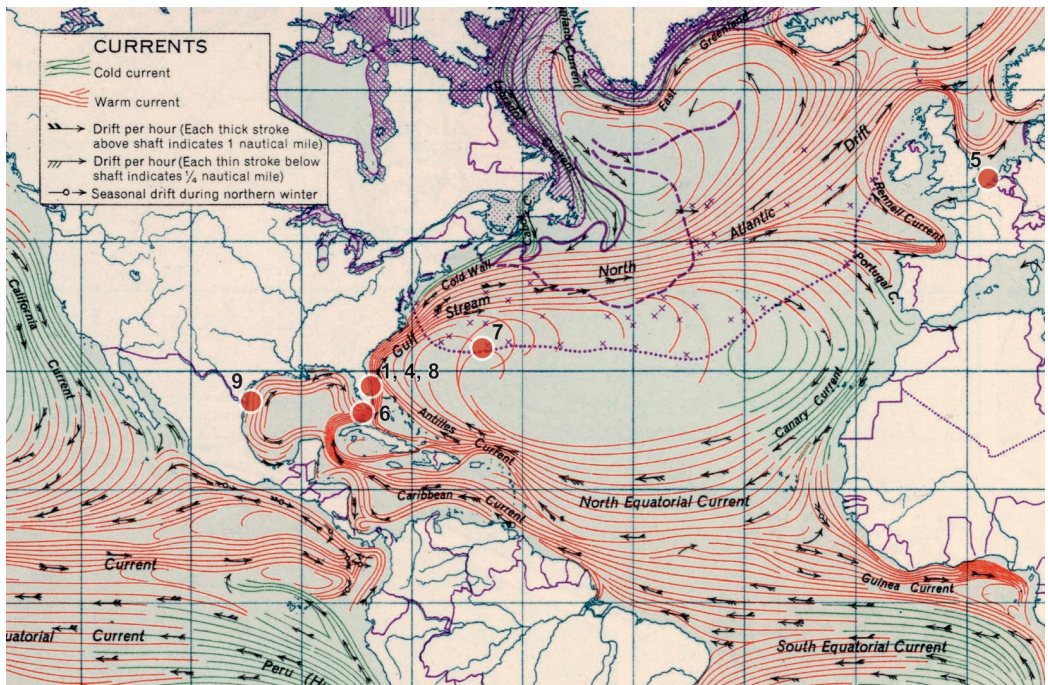


FIG. 4. Map showing localities of stranded specimens of *Sacoglottis* cf. *costata* (Humiriaceae). #1: SE coast of Florida, U.S.A.; #4: Palm Beach County, Florida, U.S.A.; #5: Yerseke, Netherlands; #6: Lignumvitae Key, Florida, U.S.A.; #7: Bermuda, U.K.; #8: Volusia County, Florida, U.S.A.; #9: South Padre Island, Texas, U.S.A. Localities of #2, #3, and #10 unknown. The localities are plotted on a map originally compiled to show cold and warm sea currents and the extent of sea ice in the North Atlantic Ocean (United States Army 1943).

the axis of the endocarp (Fig. 1A–C). Each valve shows a median furrow up to 10 mm deep and 10 mm wide at the equator. Thus a total of ten distinct longitudinal furrows mark the surface of the endocarp from base to apex. Alternatively, the surface may be described as beset with ten wide conspicuous ribs (two on each valve). Cross-sections of three endocarps are available: a physical section of specimen #7 (Fig. 1L) and micro-CT scans of specimens #5 and #9 (Fig. 1P). All sections show a 5-radiating axial

structure with septa narrowing outwards. Specimens #5 and #9 contain two opposite fertile locules, while specimen #7 has two adjacent fertile locules, which are more or less obtusely triangular in cross-section, each containing the remains of an oblong seed. Septa and valves contain many globular cavities, up to 4 mm in diameter. There are no traces remaining of the exocarp and mesocarp.

Some specimens are worn, especially #5. Specimens #2 and #4–10 are sparsely to densely covered with marine epibionts, including barnacles, small bivalves, bryozoans, calcareous tube worms, foraminifers, hydroids, and coralline red algae.

DISCUSSION

Comparison with the family Humiriaceae

The family Humiriaceae belongs to the order Malpighiales and comprises eight genera (*Duckesia* Cuatrec., *Endopleura* Cuatrec., *Humiria* Aubl., *Humirastrum* (Urb.) Cuatrec., *Hylocarpa* Cuatrec., *Sacoglottis* Mart., *Schistostemon* (Urb.) Cuatrec., and *Vantanea* Aubl.) with about 50 species. The gynoecium in Humiriaceae is syncarpous and usually 5-merous. The fruit is a pea-sized to mango-sized drupe with a single, multi-seeded woody endocarp, which is very distinctive and one of the outstanding features of the family (Cuatrecasas 1961; Herrera et al. 2010). The endocarp shows five septa and five valves (up to 8 and 10 in *Vantanea* and *Humiria*), but most with only one or two locules, in each of which a single seed develops, except in the genus *Humiria* that has two seeds per locule. The septa radiate from the axis of the endocarp. Together, the axis and septa make up a rigid and resistant frame from which the valves of the fertile locules separate during germination. The endocarps of *Duckesia*, *Humirastrum* (partially), *Sacoglottis*, and *Schistostemon* contain large (up to 7 mm), globular, ± empty cavities in their septa and valves. Intergeneric differences occur in the relative width of the septa and valves at the surface, the length of the valves, and the surface sculpture of the septa and valves (see below). The features mentioned above and combined with the resistant nature of the endocarps, make the fruits of Humiriaceae readily identifiable objects in dispersed state (e.g., fossils, sea-beans). The woody endocarps of species that occur on river banks and in temporarily flooded forests (e.g., *S. amazonica*, *S. gabonensis*) have a good chance of being dispersed by water because the cavities provide them with extra buoyancy.

In most Humiriaceae endocarps, valve width at the surface (measured at the equator) is equal to or smaller than that of the septa (Cuatrecasas 1961; Herrera et al. 2010). In *Humirastrum*, valve width is occasionally larger than septum width, but in this genus the valves are only up to half as long as the endocarp and are located near the apex of the endocarp. In *Sacoglottis* and *Schistostemon* the valves are nearly as long as the endocarp and the septa are very thin or hardly or not visible at the surface, so that the valves are very wide, sometimes even adjacent. This exact condition is present in the furrowed endocarps analyzed in this study. *Sacoglottis* and *Schistostemon* are differentiated from each other by a flower character (stamen number: 10 and 20, respectively), but their endocarps are indistinguishable (Cuatrecasas 1961). In their morphological cladistic analysis, Herrera et al. (2010) found that *Sacoglottis* and *Schistostemon* are sister groups, and they consider that the genera should be reduced to subgenera of the genus *Sacoglottis*. Isolated endocarps with very thin septa, including the furrowed endocarps described in the present study, might then be identified as belonging to *Sacoglottis* s.l. (sensu lato, in broad sense: *Sacoglottis* and *Schistostemon* together). Additional features supporting the assignment of the furrowed endocarps to *Sacoglottis* s.l. are the presence of up to 4 mm large cavities throughout the endocarp and the absence of apical foramina (holes) in the septa. Cavities occur also in *Duckesia* and *Humirastrum* (partially), but they are only a little larger than 0.7 mm at most (pers. comm. Fabiany Herrera 2012). Apical foramina are also absent in *Hylocarpa* and *Vantanea*, but endocarps of these genera are very different from the furrowed endocarps (e.g., valves equal or narrower than septa). Sometimes, apical foramina seem to be present in the furrowed endocarps (e.g., in specimen #4; Fig. 1E), but actually these holes represent cavities surfacing in the depressions near the apex.

Comparison with extant *Sacoglottis* s.l.

Sacoglottis s.l. comprises 20 species (Cuatrecasas 1961, 1972, 1990; Sabatier 1987; Burger & Zamora Villalobos 1991, Zamora Villalobos 2007). All known endocarps of *Sacoglottis* s.l. species are not or are only inconspicuously furrowed. Although inclusion of the furrowed endocarps in *Sacoglottis* s.l. is well-supported, matching them with any of the known endocarps of the species in this group is therefore impossible. Furthermore, the furrowed endocarps are relatively large: 54–72 mm (avg. 63.4) long. Only *Schistostemon retusum* (Ducke) Cuatr. has larger endocarps: 70–80 mm long (Lorenzi 2002)³. *Sacoglottis amazonica* (Fig. 3A–D) produces the next largest endocarps: 20–60 mm long (Gunn & Dennis 1976), but normal-sized specimens are about 40 mm long (Perry & Dennis 2003).

A few rare species are known from flowering material only: *Sacoglottis maguirei* Cuatrec. and *Schistostemon auyantepuiense* Cuatrec. *Sacoglottis maguirei* is a xeromorphic endemic from Venezuela (Amazonas, frequent at top of Cerro Yapacana, 1200 m alt.; Cuatrecasas 1961). The single known specimen of *S. maguirei* has flowers and very young fruits (see also Cuatrecasas & Huber 1999, Fig. 540). Theoretically (by lack of data), the furrowed endocarps might belong to *S. maguirei*. Cerro Yapacana is adjacent to the Orinoco, so transport of endocarps by that river to the Caribbean Sea might occur. Mature fruits of *S. maguirei* might still be collected in the Yapacana National Park. For the time being, some evidence is provided by *Sacoglottis* sp. A (Zamora Villalobos 2007), an endemic from Costa Rica (Cordillera de Talamanca, 440 m alt.). This species is known from one fruiting collection, bearing globular to ellipsoid, ca. 35 × 29 mm large fruits. *Sacoglottis* sp. A is possibly related to *S. maguirei* (Zamora Villalobos 2007). If related, the small size of its fruits would separate the furrowed endocarps from *S. maguirei*.

Schistostemon auyantepuiense is an endemic from Venezuela (Bolívar, near Guayaraca, 900–1100 m alt.). It is a xeromorphic species very similar to *Schistostemon fernandezii* Cuatrec. from the same area (according to Cuatrecasas & Huber 1999 even questionably different) and closely related to *Schistostemon reticulatum* (Cuatrecasas 1961). Fruits of *S. reticulatum* measure about 30 mm (pers. comm., Pedro Jordano 2014). If *S. auyantepuiense* is indeed closely related to *S. fernandezii*, it is expected to have fruits like those of *S. fernandezii* (see Cuatrecasas & Huber 1999, Fig. 544, and Herrera et al. 2010, Fig. 2O), i.e., with a small, hardly or not furrowed endocarp. Therefore, conspecificity of the furrowed endocarps with *S. auyantepuiense* and/or *S. reticulatum* is less probable.

Comparison with fossil *Sacoglottis* s.l.

Herrera et al. (2010, 2014) have revised the fossil record of the family Humiriaceae, especially that of its resistant endocarps. They combined several fossil species into *Sacoglottis tertiaria* Berry emend. Herrera, which is now known from Oligocene, Miocene, Pliocene, and Pleistocene deposits in Bolivia, Colombia, Costa Rica, and Panama (see also Lott et al. 2011). Most of the included fossils very much resemble the *Sacoglottis* s.l. endocarps as described above. Their surface is described as slightly bullate. However, the single specimen on which the included *Sacoglottis costata* Reid from the Tertiary of Colombia was based shows five radial depressions around the apex and 15 longitudinal ridges between base and apex. Five ridges are thin and represent the five septa. The remaining ten ridges are arranged in pairs, each pair flanking a deep median furrow on a valve (Reid 1933, plate 14, Figs. 1, 1a, 2, 2a; Fig. 5A–D in present paper). Herrera et al. (2010) interpreted the furrows as the result of abrasion or erosion, but originally the fossil was described as a “beautiful specimen.” The wear noticed by Reid refers only to the lack of cellular surface details (Reid 1933). The differences between *S. costata* and the endocarps of extant species of *Sacoglottis* s.l. (especially *S. amazonica*), mentioned and adequately illustrated by Reid (1933), correspond very well with the unusual features of the furrowed endocarp (compare Fig. 1A–P, Fig. 3A–D,

³ The material described and illustrated by Lorenzi (2002) originates from the coastal region of southern Bahia (Brazil). Material from Amazonas (Brazil), Colombia and Venezuela described by Ducke (1938, Fig. 2d), Cuatrecasas (1961, Fig. 31j) and Herrera et al. (2010, Fig. 2D) contained much smaller, though apparently mature endocarps (globular, 26–34 mm diameter). The endocarps illustrated by Lorenzi (2002) do not show any characteristics of *Sacoglottis* s.l. or even Humiriaceae (valves, septa, cavities), but this may be due to their freshly peeled state.

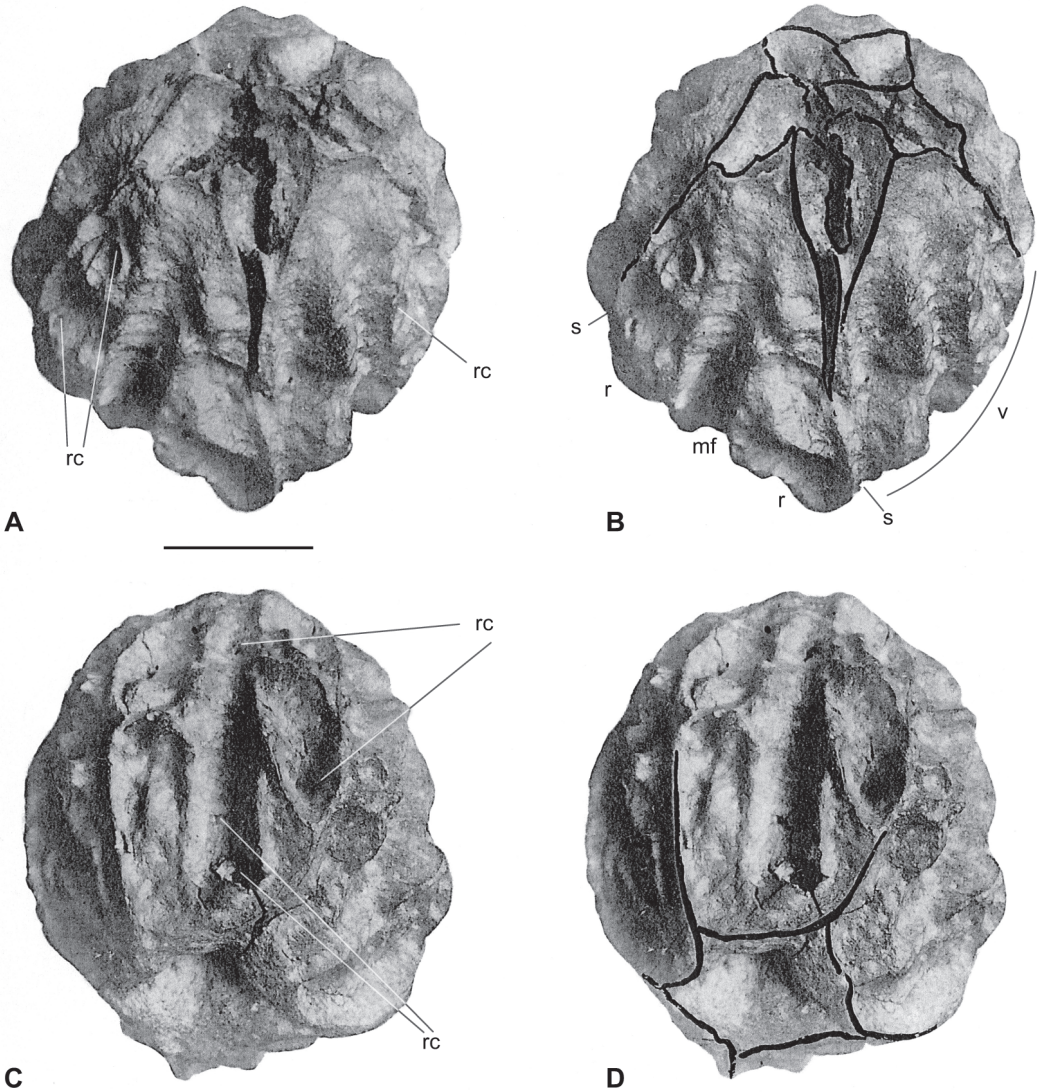


FIG. 5. Only known specimen of the fossil endocarp *Sacoglottis costata* Reid (original figure from Reid 1933; symbols added in B). mf = median furrow on valve, r = one of two ridges on valve, rc = (resin) cavity, s = septum, v = valve. Scale bar = 10 mm. A, oblique view of apex. B, as A, with lines accentuating the position of septa (boundaries of valves) around the apex. C, oblique view of base. D, as C, with lines accentuating the position of septa (boundaries of valves) around the base.

and Fig. 5). The only remaining difference is size: the fossil measures 30 × 26 mm, which is about half as large. Incidentally, the size of *S. amazonica* endocarps shows a wide range: from 20 to 60 mm long (Gunn & Dennis 1976). Of course, the state of preservation also distinguishes the fossil from the recent furrowed endocarps. The size difference may partly be explained by the fossilization process, e.g., shrinkage by coalification. The state of the fossil was characterized as “highly carbonized, close, hard and glossy in texture, and quite black” and said to “break with a conchoidal fracture.” This was regarded by Reid (1933) as pointing to considerable antiquity, but the actual age of the fossil is unknown. Unfortunately,

the specimen could not be traced in the Reid collections in the Natural History Museum in London (pers. comm. Peta Hayes 2014).

The ribbed fossil endocarps from the Neogene of Colombia described by Wijninga (1996) as type T295 (*Humiriastrum*) are small (10–21 × 8–18 mm) and their septa are wider than the valves and therefore do not resemble the furrowed endocarp. According to Herrera et al. (2010) the fossils represent the genus *Duckesia*.

Origin

The furrowed endocarp described here is not the first sea-bean known earlier than its producer. An endocarp of *S. amazonica* (blister pod) was described and illustrated by Clusius (1605, libr. II:45, as *Fructus I. Iac. Plateau*). It was given to him by Jacques Plateau, an apothecary from Tournai (Doornik) in Belgium, who also provided Clusius with data of armadillos (Egmond 2009; Mason 2009). Thus, Plateau had links with the Neotropics, and according to Nelson (2000) Clusius' blister pod was not a European sea-bean. Sloane (1696:214) did mention *S. amazonica* as a sea-bean (*Fructus exoticus cinereus, cum lineis & tuberculis duris*) from Jamaica and also from Jamaica and Europe (Sloane 1725:186): "This is frequently cast up on the Shores of this Island by the Waves, and is one of those Fruits thrown on the Northwest Islands of Scotland, by the Seas". However, *S. amazonica* as a botanical species was described much later by Martius (1827), while its stranded endocarps from Jamaica were identified as *S. amazonica* only in 1889 (Guppy 1917; Cuatrecasas 1961).

It is possible to speculate about the origin of the furrowed endocarps. The five specimens stranded in Florida indicate that the Caribbean Current might have been the way of transport (Fig. 4). This would imply that the parent species of the furrowed endocarp, like *Sacoglottis amazonica*, grows somewhere in northeastern South America, within the reach of river systems like the Amazon, Orinoco, Magdalena, and Atrato Rivers. Transport from the Caribbean Current into the Gulf of Mexico to Bermuda and via the Gulf Stream and the North Atlantic Drift to Europe is possible. Wherever occurring, the producer of the furrowed endocarps might be rare and threatened. In earlier times, its fruits might have been dispersed by a presently extinct megafauna, as described by Jordano (2004) and Guimaraes et al. (2008) for several other large-fruited Neotropical species, including the humiriaceous *Duckesia verrucosa* (Ducke) Cuatr. and *Endopleura uchi* (Huber) Cuatr. In Africa, large mammals (e.g., elephants) are still known to forage for fruits of *Sacoglottis gabonensis* (White 1994; Morgan 2009).

CONCLUSIONS

The furrowed endocarps described herein are allocated to *Sacoglottis* s.l. (sensu lato, in broad sense: *Sacoglottis* and *Schistostemon* together).

The furrowed endocarps show a unique feature (distinct furrows) and cannot be matched with any described endocarp of an extant *Sacoglottis* s.l. species. Theoretically, they might belong to *Sacoglottis maguirei* or *Schistostemon auyantepuiense*, two rare species of which fruits are unknown. However, endocarps of (possibly) related species (*Sacoglottis* sp. A and *Schistostemon fernandezii*, respectively) are different from the furrowed endocarps. Therefore, the endocarps of *S. maguirei* and *S. auyantepuiense* are suspected to be different from the furrowed endocarps too. This should be checked in the field.

The furrowed endocarps are most similar to the fossil *Sacoglottis costata*, which is based on a single specimen of unspecified Tertiary age from Colombia. *Sacoglottis costata* is distinct from the fossil species *S. tertiaria*. Apart from the state of preservation and the size difference, it is difficult to define a distinguishing characteristic difference between the extant furrowed endocarps and the fossil *S. costata*. Therefore, we do not erect a new species, but prefer to indicate the furrowed endocarps as *Sacoglottis* cf. *costata*. It is stressed that the resemblance between *Sacoglottis* cf. *costata* and *S. costata* is based on surface characters; knowledge of the internal structure of the *S. costata* specimen might support affinity.

If the furrowed endocarps (*Sacoglottis* cf. *costata*) do not belong to one of the incompletely known

species of *Sacoglottis* s.l., we believe that an undescribed species, producing *costata*-like endocarps, exists somewhere in northern South America. In view of the unusual morphology of the endocarps, this species is expected to deviate distinctly from the species of *Sacoglottis* s.l. known at present. As common name of *Sacoglottis* cf. *costata*, “furrowed blister pod” is proposed.

ACKNOWLEDGMENTS

We thank Gerhard Cadée (Royal Netherlands Institute for Sea Research, NIOZ, Texel, Netherlands), René Cappers (Universiteit of Groningen, Netherlands), Antoine Cleef (University of Amsterdam, Netherlands), Nicky Desvoyes (Saint Nom La Bretèche, France), Fabiany Herrera (Chicago Botanic Garden, Glencoe, Illinois, U.S.A.), Steven Manchester (University of Florida, Gainesville, Florida, U.S.A.), Lisa Green and Helle Patterson (Bermuda, U.K.), Peta Hayes (Natural History Museum, London, U.K.), Pedro Jordano (Estación Biológica de Doñana CSIC, Sevilla, Spain), Paul & Hiltje Maas and Willem Prud’homme van Reine (Naturalis Biodiversity Center, Leiden, Netherlands), Robbie Smith (Bermuda, U.K.), and Vincent Wijninga (Amsterdam, Netherlands) for advice and help; George Wolf (Pasadena, Texas, U.S.A.), who might have put furrowed blister pod #10 on the ‘sharing table’ during the Nineteenth Annual International Sea-Bean Symposium and Beachcombers’ Festival at Cocoa Beach, Florida (see Introduction); Dirk van der Marel and Willem Renema (Naturalis Biodiversity Center, Leiden, Netherlands) for micro-CT scanning; Connie Baak and Niko Korenhof (Naturalis Biodiversity Center, Leiden, Netherlands) for editing the figures, and Gerhard Cadée and Fabiany Herrera for reviewing and improving the manuscript.

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