The occurrence of *Pseudosimnia vanhyningi* and *Spiculata bijuri* in the northeastern Brazil, with comments on their taxonomy (Caenogastropoda, Ovulidae).

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Abstract

This paper deals with two ovulid species collected at Canopus Bank, off Fortaleza, Ceará, Brazil: *Pseudosimnia vanhyningi* (M. Smith, 1940) and *Spiculata bijuri* Cate, 1976. The samples consist of empty shells. This is the first time both have been reported on the northeastern Brazilian coast, therefore this is the southernmost record of them. Their taxonomy is revised based on the analysis of some variants of the shell that have been attributed to other species and genera. *Aperiovula juanjosensii* Perez & Gomez, 1997, and *S. advena* Cate, 1978, are proposed to be new synonyms of *S. bijuri*.

Key words: Ovulidae, *Pseudosimnia vanhyningi*, *Spiculata bijuri,* new occurrence, Ceará, Brazil.

Resumo

Este artigo reporta duas espécies de ovulídeos coletadas no Banco de Canopus, ao largo de Fortaleza, CE. As amostras são constituídas de conchas vazias. Ambas são reportadas pela primeira vez no litoral nordeste brasileiro, sendo o registro mais sulino destas. As espécies são *Pseudosimnia vanhyningi* (M. Smith, 1940) e *Spiculata bijuri* Cate, 1976. A taxonomia destas é revisada baseada em variantes de concha que podem ser atribuídas a outras espécies e gêneros. *Aperiovula juanjosensii* Perez & Gomez, 1997 e *S. advena* Cate, 1978, são propostos como novos sinônimos de *S. bijuri*.

Palavras-chave: Ovulidae, *Pseudosimnia vanhyningi*, *Spiculata bijuri*, nova ocorrência, Ceará, Brasil.

Introduction

Pseudosimnia vanhyningi (M. Smith, 1940), a deep water Ovulidae, is known from the Caribbean Sea, from Florida to Barbados. Samples belonging to this species have been collected at Canopus Bank, off Fortaleza, Ceará, the northeastern Brazilian coast; this record fills a large gap in the geographic distribution of the species, which has also been reported off the south Brazilian coast (Rios, 1994). The samples are not abundant, but they are sufficient to confirm the record of that geographic area for the first time.

The systematics of the ovulids had a great improvement with the revision by Cate (1973). Some variants of the *Pseudosimnia vanhyningi* have been described as species in that paper, later synonymyzed (e.g., Rosenberg, 2006) and commented in synonymy below. This demonstrates how variable this species is.

The genus *Spiculata* Cate, 1973 [type species *Ovula loebbeckeana* Weinkauff, 1881, OD, California) is characterized by narrow-ovate, elongate shells, broader centrally, anterior and posterior ends somewhat pointed. Two species have been reported in the West Atlantic, *S. bijuri* Cate, 1976 and *S. advena* Cate, 1978, both described from Florida. An analysis of shell characteristics revealed certain variations and the possibility some variants intergrading with other species previously considered valid. They are here proposed as synonyms of *S. bijuri*.

As no living specimens of either species were collected, no additional information beyond the shell is available. However, the available material was considered sufficient for a taxonomical analysis, including generic level.

The abbreviations of institutions are: FMNH: Field Museum of Natural History, Chicago, USA. FSM: Florida State Museum, Gainesville, Florida, USA; LACM: Natural History Museum of Los Angeles County, California, USA; MZSP: Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil; USNM: National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA.

Systematics

Genus *Pseudosimnia* Schilder, 1927
(Type species *Bulla carnea* Poiret, 1789, OD, from Mediterranean)

Pseudosimnia vanhyningi (M. Smith, 1940)
(Figs. 1-8)

Primovula (Pseudosimnia) vanhyningi M. Smith, 1940: 46 (pl. 2, fig.8) [off Boynton Beach, Florida; 91 m]; Rios, 1994: 76 (pl. 25, fig. 291).
Pseudosimnia (Pseudosimnia) vanhyningi: Cate, 1973: 25 (fig, 46, holotype).

Pseudosimnia (Pseudosimnia) sphoni Cate, 1973: 25-26 (fig. 47) [Key West, Florida (Eolis sta. 344), 183 m].
Pseudosimnia (Pseudosimnia) pyrifera Cate, 1973: 26 (fig. 48) [Barbados (off Telegraph sta. 437; S.U.I. Exp. 1918), 176 m].
Primovula (Adamantia) solemi Cate, 1973: 44-45 (figs. 91, 91a) [Lake Worth, Florida; 183-731 m].
Primovula carnea: Abbott, 1974: 151 (fig. 1655) (non Poiret, 1789).
Pseudosimnia vanhyningi: Rosenberg, 2006.

Types: *P. vanhyningi* holotype FSM UF11079. *P. sphoni* holotype USNM 418078 (Figs. 5-6). *P. pyrifera* holotype USNM 460466 (Figs. 7-8). *P. solemi* holotype FMNH 78278.

Description

Shell: (Figs 1-8). About 15 mm in length. Color white. Width 60-70% of length (Figs 1, 3, 5). Wider region located between middle and superior thirds (Figs 2, 4), being rounded, lacking transversal carina. Inner lip (Figs 1, 3, 6, 8) smooth, lacking callus; bulged region in base of anal siphon, extending about 17% of aperture length. Outer lip about 1.5 times longer than spiral region, equally extending towards anterior and posterior; about 20 teeth in inner edge, each tooth with about ¼ of outer lip thickness, superior 4-5 teeth slightly narrower and well separated from each other; teeth of middle and interior regions wider and close to each other. Siphonal and anal canals similar sized, anal canal slightly curved to left. Other details in Cate (1973: 25-26, 44-45).

Measurements: (in mm). MZSP 69851: 15.4 by 8.6. MZSP 70281: 8.8 by 5.4.

Distribution: The type locality is off Boynton Beach, Florida, in 91 m. Beyond waters off Florida, it has been reported also to Barbados (Cate, 1973) with two records to south and southwest Brazil (Rios, 1994).

Habitat: From 46 to 183 m depth (Rosenberg, 2006), no other data about its host.

Material examined: *P. sphoni* holotype USNM 418078 (Figs. 5-6). *P. pyrifera* holotype USNM 460466 (Figs. 7-8). *P. solemi* holotype FMNH 78278. BRAZIL. **Ceará:** off Fortaleza, Canopus Bank, 02º14'S 38º22'W; 120 m depth, MZSP 69851, 1 shell, MZSP 70281, 2 shells (J. Coltro col. xi/2005).

Discussion: *Pseudosimnia vanhyningi* has been cited in Brazilian waters by Rios (1994) with two records: Santos (São Paulo State) and off Mostardas (Rio Grande do Sul State). The corresponding specimens were not found, but these records at least show that the species is widely distributed from Florida to Rio Grande do Sul, in southern Brazil. However, no report from the northeastern Brazilian coast had been published.

Despite the fact that samples of this species are not common, a certain degree of shell variation was detected (Figs. 1-4). Specimens with wider range of some shell characteristics were collected, as, e.g., the size, with adult specimens ranging from 8 to 16 mm. The shell size was one of the main characteristics used by Cate (1973) to differentiate *Pseudosimnia sphoni* (Figs 5-6) from *P. vanhyningi*. The shell can bear a more developed carina (Fig. 2), or the profile can be rounded (Figs. 4, 5). The degree of thickness of the outer lip varies with the age of the specimen; this parameter and the length of the anterior and posterior ends can be due to the wider deposition at aperture, this is the main characteristic differentiating *P. pyrifera* (Figs 7-8). The dentition at the aperture is also variable. In some specimens, for example, no tooth in the left side of the canal is detectable (Figs 1, 6), while they are present on others (Figs 3, 8). This variation in apertural teeth also precludes the differentiation with *P. pyrifera* and *Primovula solemi*. Some of the mentioned synonyms were proposed by Rosenberg (2006) and are here maintained.

Abbott (1974) showed a bathymetric distribution in the depths of 45 to 366 m, while Cate (1973) reported a range from 183-731 m depth to *P. solemi*. However, Rosenberg (2006) gives as deepest range 183 m. The specimens studied here were collected at about 120 m.

Genus *Spiculata* Cate, 1973
(Type species: *Ovula loebbeckeana* Weinkauff, 1881, OD, from Baja California)

Spiculata bijuri Cate, 1976
(Figs 9-23)

Spiculata bijuri Cate, 1976: 384 (fig. 1); Rosenberg, 2006.
Spiculata advena Cate, 1978: 164 (fig. 6); Rosenberg, 2006 (new synonym).
Aperiovula juanjosensii Perez & Gómez, 1987: 231 (figs. A, B); Oliveiro & Villa, 1998: 56 (figs. 13, 14); Fehse, 2003: 272-273 (figs. 5-9); Beck et al., 2006: 73 (fig.) (new synonym).
Primovula (Adamantia) bellocqae Cardin, 1997: 24-25 (figs. 1-2); Fehse, 2003: 272 (in synonymy).

Type: Holotype LACM 1708 (48 km SE of Key West, 24°33'S 81°47'W, Monroe Co., Florida, USA; i/1970) (Figs 19-21).

Description

Shell: (Figs 9-22). About 7 mm in length, elongated (length about two times width), biconical, pointed in anterior and posterior sides. Color pure white, semi-transparent. Surface glossy. Wider region located between middle and superior thirds; normally rounded, rarely forming a blunt carina (Figs. 12, 17, 18). Aperture elongated, narrow, with about 1.5 times length of spiral portion; aperture with about 8% of the total shell width in middle region, being somewhat wider in both ends, especially in siphonal end; apertural extension in both (anterior and posterior) ends somewhat equivalent with each other. Inner lip smooth, thin, callus absent. Bulged region in base of anal siphon, along about 1/8 of aperture length. Outer lip thick, about 20% of shell width in middle region; from 8 to 15 low teeth in inner edge, each tooth similar and close to each other, width about half of outer lip width, more evident in middle region of superior half of lip, sometimes reaching middle region of inferior half of lip, absent close to siphon. Incurrent siphon turned anteriorly, anterior edge with cutting edge; width about 1/5 of wider region of shell; weakly narrower than preceding region of aperture. Anal siphon similar to incurrent siphon in size, somewhat more pointed and with thicker edges than it; inner space narrow, mainly compressed by upper described budged region.

Measurements: (in mm) MZSP 81896 = 5.7 by 2.5 mm.

Distribution: Middle and north Atlantic.

Habitat: About 120 m depth. Host unknown.

Material examined. UNITED STATES OF AMERICA; **Florida**; Monroe County, SE of Key West, 24°33'N 81°47'W, 48 m depth, LACM 1708, holotype of *Spiculata bijuri* (i/1970). BRAZIL; **Ceará**; off Fortaleza, Canopus Bank, 02º14'S 38º22'W; 120 m depth, MZSP 81896, 1 shell, MZSP 70288, 12 shells (J. Coltro col. xi/2005).

Discussion: There is considerable variation in the shell of *Spiculata bijuri*. Some of variants could easily be considered as different species if a complete gradation between both extremes could not be found. The better preserved shells are glossy and semi-transparent (Figs. 9-11, 14-16, 22), while the shell becomes white and opaque in eroded specimens (Figs. 12, 13, 17, 18). The outline is elongated in some specimens (e.g., Fig. 13, with width about 36% of length), while others are not so extended (e.g., Figs. 12 and 17, with width about 53% of length). Normally the wider region of the shell is rounded (Figs. 9, 13, 14), and sometimes is bluntly carinate (Fig. 12), with some intermediaries (Figs. 17, 18). The wider region is sometimes placed superiorly in some specimens (Figs. 9, 13, 14, 22), and sometimes it is closer to middle region of the shell (Figs. 12, 17-19). The bulged region of the anal siphon base is always present, but it can vary from low (Figs 11, 22) to ventrally taller (Fig. 16). The anal siphon varies from sharply pointed (Figs. 9, 10, 17) to blunt (Figs. 12, 15, 16). The outer lip has normally uniform thickness along its length (Figs. 9, 13, 14, 17), but it can possess a wider region in middle level (Figs. 12, 18). The incurrent siphon can bears cutting anterior edges (Fig. 11) or rounded edges (Fig. 16). The specimen of the Fig. 13 is virtually identical to the holotype of *S. bijuri* (Figs. 19-21), while those in Figs. 14-18 can be perfectly identified as *A. juanjosensii*. The specimens in Fig. 13 could be also identified as *S. advena*, differing only in the thicker outer lip of a more mature specimen. Analyzing the material examined by previous authors, it is possible to perceive that they had few or single specimens to observe. In that scenario, it is recognized that the best way is to describe variants as distinct species. However, analyzing the above mentioned variation, which is based on a wider set of specimens, it is possible to observe that all them are variations of a single species. This is based on the overlapping states of each character.

Another synonym of *Spiculata bijuri* is *Primovula bellocqae* Cardin, 1997 (Fehse, 2003: 272), from W. Morocco, NW Africa. Despite the wider shell width of *P. bellocqae* holotype, it appears to be an extreme of variation, in such an intermediary specimen is that of the Fig. 12.

The analysis of the geographic distribution (Fig. 23) shows that the species is anphi-Atlantic, occurring in the northeastern Atlantic off Portugal, in the Gulf of Mexico off Florida, and off Ceará, in the middle-west Atlantic.

Spiculata bijuri resembles the type species of the genus *Primovula* Thiele, 1925, from South Africa, *P. beckeri* (Sowerby, 1900); differs by more pointed anterior and posterior ends, smoother surface, narrower canal, and teeth of outer lip wider and fewer. *S. bijuri* also bears a resemblance to *P. habui* Cate, 1973 (from Japan) and *P. heleneae* Cate, 1973 (from South Australia); it differs from *P. habui* in having narrower pre-siphonal aperture, less developed transversal carina and smoother shell surface; it differs from *P. heleneae* by weakly wider aperture, more pointed ends, more developed teeth in outer lip and in being less elongated (*P. heleneae* is about 3 times longer than wider, while *S. bijuri* is about 2 times).

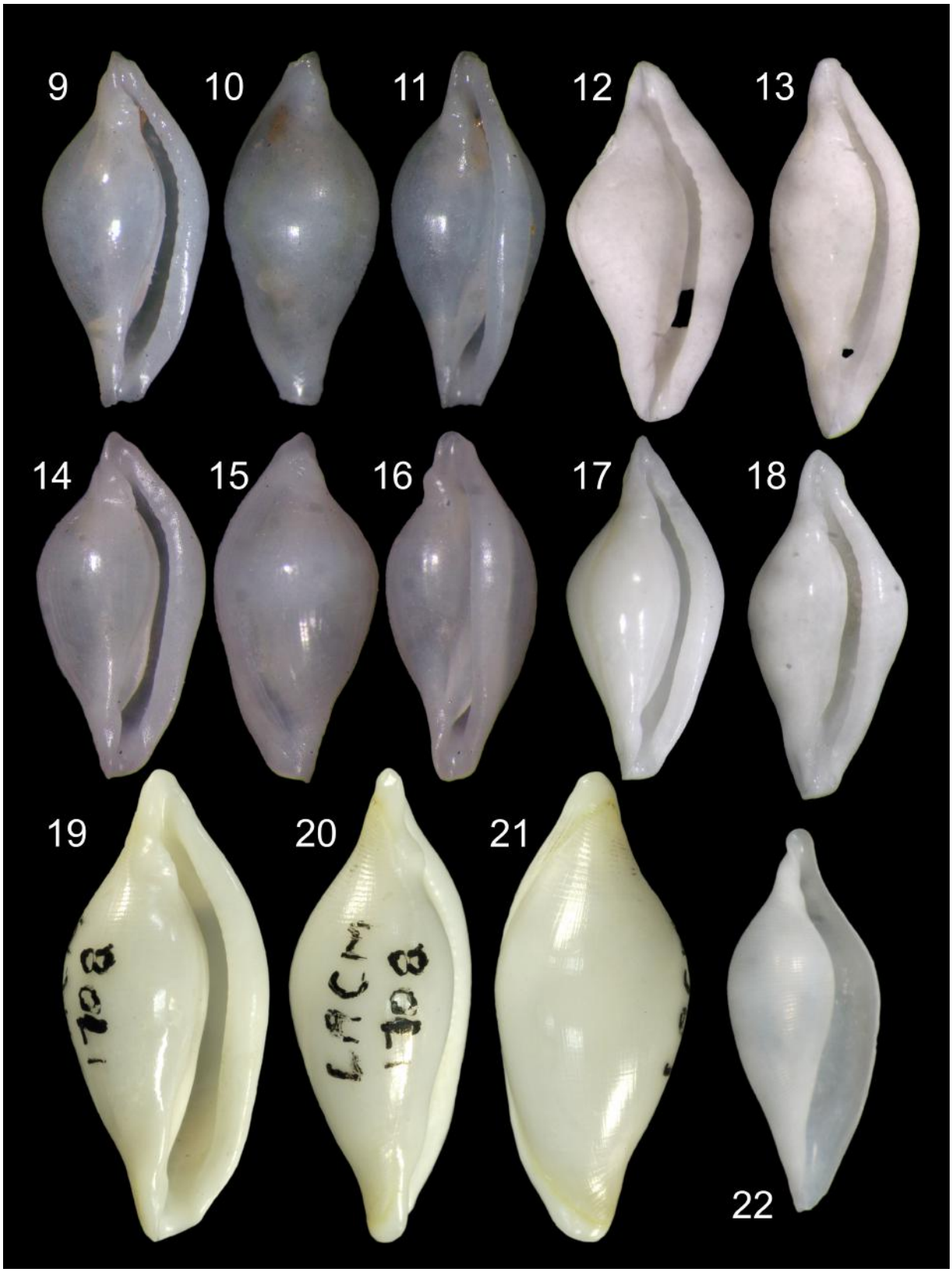
Spiculata bijuri can be easily differentiated from the sympatric *Pseudosimnia vanhyningi* by the smaller size, narrower outline, less developed transversal carina and by longer and more pointed anterior and posterior ends.

Figs. 1-8, *Pseudosimnia vanhyningi*; 1-4, specimens from Canopus Bank, Ceará, Brazil; 1-2, MZSP 69851, apertural and right views, length = 15.4 mm; 3-4, Vanin collection, apertural and dorsal views, length = 11 mm; 5-6, Holotype of *Pseudosimnia sphoni*, USNM 418078, dorsal and apertural views, length = 13.8 mm; 7-8, Holotype of *Pseudosimnia pyrifera*, USNM 460466, dorsal and apertural views, length = 9.5 mm. (5-8, courtesy USNM.)

Discussion

The ovulids are normally associated with gorgonians. Although remains of gorgonians are found in the Canopus debris collected in the dredges, no clear association between them and the ovulids studied herein was found. Additionally, no living specimens were collected. This would be important to investigate at least the mantle color patterns, which are important to the ovulid classification. The presence of a bulged portion in the anal siphon base, which is more developed in *Spiculata bijuri*, but is also present in *Pseudosimnia vanhyningi* (Figs. 1, 3), is an interesting goal for investigation, as it could correspond to an anatomical character. A strong muscular region of the mantle lobes (retractor) is found in the homologous region of the shell in other ovulids (Simone, 2004), and could be more developed in both species. This bulged region is more weak developed in younger specimens (Fig. 22).

The analysis of the shells revealed a considerable degree of variation. If each specimen in the variation series were analyzed separately, it could be interpreted as different species. However, a complete gradation can be found if a wider study is performed with more specimens [Figs 9-22, and see Simone 2004, color figs. 88, 89 of *Pseudocyphoma intermedium* (Sowerby, 1828) and *Simnialena uniplicata* (Sowerby, 1848)]. This demonstrates the importance of associating the anatomy in the ovulid systematics, mainly if closely-related species are



Figs. 9-22, *Spiculata bijuri*; 9-11, MZSP 81896, apertural, dorsal and right-slightly apertural views respectively, length = 5.7 mm; 12-18, MZSP 70288; 12, apertural view, length = 6.8 mm; 13, apertural view, length = 6.3 mm; 14-16, apertural, dorsal and right-slightly apertural views respectively, length = 5.2 mm; 17, apertural view, length = 5.3 mm; 18, apertural view,

considered, as it has a considerably smaller amount of variation. In the present paper, and despite this, the analysis of the shells is sufficient to allow the given results, however this is not usual. This is an inference of other studied Cypraeoidea (Simone, 2004) where a relative high degree of shell variation was found with relatively uniform soft parts anatomy (Simone, 2004: 95). Based on this, the shell morphs found in the examined samples, and in the literature, decode variation of single species.

In the ovulid literature of the last decades, there often is no comparison to the species that the newly described species can be confused with. An example is the description of *Spiculata advena* Cate, 1978, which is only compared with the reasonably different *Simnialena marferula* Cate, 1973; no comparison is performed with the sympatric congener *Spiculata bijuri*.

The synonyms of the above mentioned specimens cross several valid genera. *Pseudosimnia vanhyningi* has also been referred to *Primovula* and *Adamantia* Cate, 1973. *Spiculata bijuri* has also been placed at the genera *Aperiovula* Cate, 1973, *Primovula*, and *Adamantia*. This is an indication that the definition of the ovulid genera is relatively poor. Actually, it is difficult to analyze how different the genera are, as they appear to overlap in characteristics. Deep discussion and further investigation beyond the conchology have never been performed. With these facts in mind, a conservative approach is followed here, retaining the species in the last considered genera. However, it is recognized that the matter merits further studies.

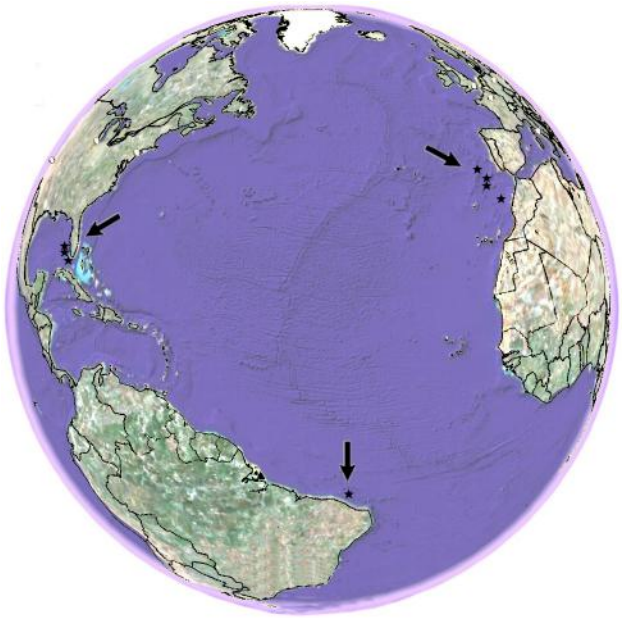


Fig. 23. Distribution of *Spiculata bijuri* in the Atlantic (black stars) indicated by black arrows (modified from Google Earth).

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