

## On the morphological differentiation between *Libinia spinosa* and *L. ferreirae* (Crustacea: Brachyura: Majoidea: Epialtidae)

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**ABSTRACT.** *Libinia spinosa* H. Milne Edwards in Guérin, 1832 and *L. ferreirae* Brito Capello, 1871, inhabit very similar environments, and their geographic and bathymetric distributions overlap for about 3000 km along the southwestern Atlantic. Both species are commonly caught in the same haul and differentiating between them can often be difficult. Traditionally, morphological differentiation between *L. spinosa* and *L. ferreirae* has been based exclusively on the number of spines along the median, longitudinal line of the carapace and the development of a process at the anterolateral angle of the basal segment of the antenna. Because *Libinia spinosa* and *L. ferreirae* share similar numbers of median spines (7 and 6, respectively), and the number of median spines of the carapace and the process at the anterolateral angle of the basal antennal segment are variable, they are of little value in separating these species. It is shown herein that unequivocal identification can be easily achieved based on features of the male and female thoracic sternum, pereopod dactyli, and infraorbital notch. A lectotype is designated for *L. spinosa* and its authorship and date are corrected. *Libinia gibbosa* A. Milne-Edwards, 1878, is demonstrated to be a junior synonym of *L. ferreirae*. The holotype of *L. gibbosa* is figured for the first time.

**KEY WORDS.** Decapoda; *Libinia gibbosa*; Pisinae; southwestern Atlantic; spider crabs.

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The spider crabs *Libinia spinosa* H. Milne Edwards in Guérin, 1832, and *L. ferreirae* Brito Capello, 1871, are two major components of the soft-bottom, invertebrate megafauna in the southwestern Atlantic (BOSCHI 1964, PIRES 1992, NEGREIROS-FRANZOZO & NAKAGAKI 1998, BERTINI & FRANZOZO 2004, BERTINI *et al.* 2004, BRAGA *et al.* 2005, DE LEO & PIRES-VANIN 2006, AMARAL *et al.* 2011). *Libinia spinosa* and *L. ferreirae* are commonly found in mud and sand bottoms at depths between the intertidal zone and 170 m (MELO 1996), and in some seasons, these species are locally abundant in fishermen's nets. Adults can reach a carapace length of about 89 mm with a leg span of about 568 mm (authors' personal observations), and their color in life ranges from whitish to dark yellow. *Libinia spinosa* is a generalist species feeding on algae, poriferans, cnidarians, mollusks, polychaetes, other crustaceans and small fishes (BARROS *et al.* 2008), and the same probably holds true for *L. ferreirae*. *Libinia spinosa* is restricted to the southwestern Atlantic, from Espírito Santo (Brazil) south to Uruguay and Argentina, whilst *L. ferreirae* has a much broader geographical range occurring along the Central and South American coast from Costa Rica to Uruguay (RATHBUN 1925, HOLTHUIS 1959, GUINOT-DUMORTIER 1960, RODRIGUEZ 1980, LEMAITRE 1981, TAKEDA 1983, MELO 1996, 2008).

Both species have been the focus of several studies, including larval development (BOSCHI & SCELZO 1968, ANGER *et al.* 1989, BAKKER *et al.* 1990, CLARK *et al.* 1998, HEREU & CALAZANS 2000), reproductive tract morphology and maturity (MOYANO *et al.* 2010, 2011), symbiotic associations (ACUNA *et al.* 2003, PEPATO *et al.* 2005, NOGUEIRA JUNIOR *et al.* 2006, WINTER & MASUNARI 2006, CORDEIRO & COSTA 2010, COSTA & NEGREIROS-FRANZOZO 2011), association with jellyfish (VAZ FERREIRA 1972, ZAMONI 2002, TUNBERG & REED 2004, NOGUEIRA JUNIOR & HADDAD 2005, SANTOS *et al.* 2008), feeding habitats (BARROS *et al.* 2008), and parasitism (SANTOS *et al.* 2006).

Historically, the morphological differentiation between *Libinia spinosa* and *L. ferreirae* has been based exclusively on the number of spines along the median longitudinal line of the carapace and the development of a process at the anterolateral angle of the basal segment of the antenna (H. MILNE EDWARDS 1834: 301, BRITO CAPELLO 1871: 262, RATHBUN 1925: 310, GUINOT-DUMORTIER 1960: 178, MELO 1996: 258, TAKEDA 1983: 137). However, both characters vary frequently, and reliable identification is, therefore, not always possible. Ongoing studies on the taxonomy of the genus *Libinia* prompted us to further explore the morphological differences between *L. spinosa* and *L.*

*ferreirae*. We show herein that unequivocal identification can be easily achieved based on features of the male and female thoracic sternum, pereopod dactyli, and infraorbital notch.

We follow NG *et al.* (2008) in the citation of the name of the French author Félix Édouard Guérin: simply Guérin for the works published before 1836; Guérin-Ménéville for the ones published after 1836 (for the rationale see EVENHUIS 2003: 16). Abbreviations are: cl, carapace length (from the rostral notch to the posterior margin of the carapace, unless otherwise noted); cw, carapace width (branchiostegal spines not included, unless otherwise noted); P1, cheliped; P2-P5, walking legs or pereopod 2 to pereopod 5.; stn, station. The material herein studied belongs to the collections of the Muséum national d'Histoire naturelle, Paris (MNHN), Museu de Zoologia, Universidade de São Paulo (MZUSP), and the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM).

## TAXONOMY

### Epialtidae MacLeay, 1838

#### *Libinia spinosa* H. Milne Edwards in Guérin, 1832

Figs 1, 4, 5, 8, 9, 12-17, 22-25

*Libinia spinosa* H. Milne Edwards in Guérin, 1832: pl. 9, figs 3, 3a, 3b.

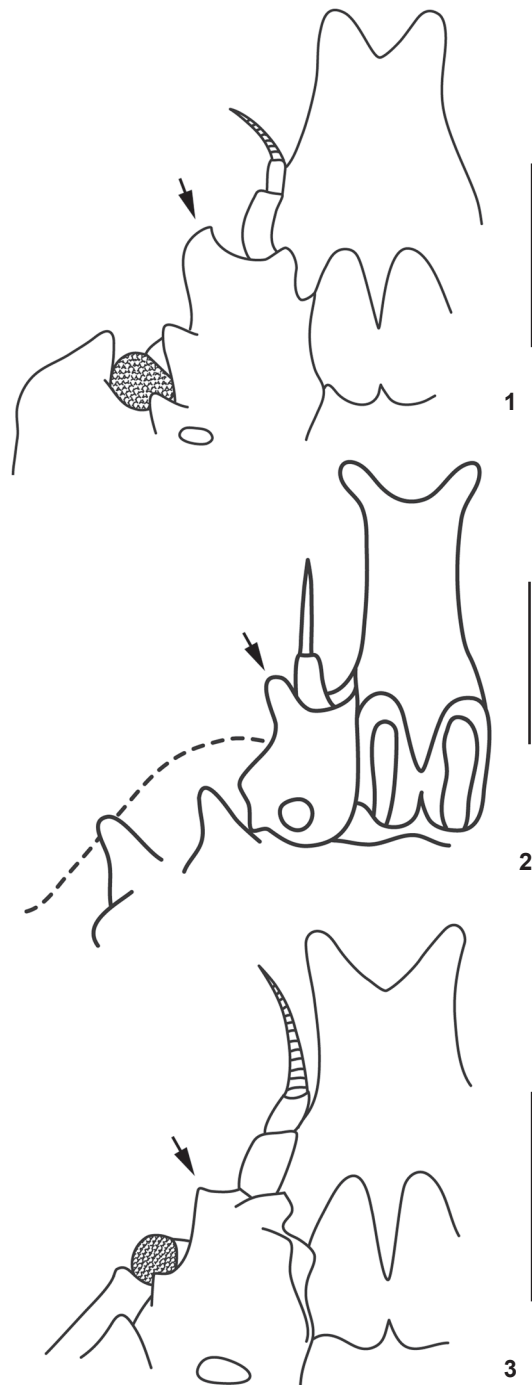
*Libinia spinosa*; H. Milne Edwards, 1834: 301 [type locality Brazil]; H. Milne Edwards & Lucas, 1843: 6; Guérin-Ménéville, 1844: 9, 10; Nicolet, 1849: 128; Heller, 1865: 1; Smith, 1870: 32; Miers, 1886: 73; Moreira, 1901: 64; Rathbun, 1925: 325, pls. 102-121; Garth, 1957: 31; Boschi, 1964: 34, pls. 1, 6, 9; 2000: 91; Hoffmann, 1964: 1; Coelho & Ramos, 1972: 213; Bordin, 1987: 10; Melo *et al.*, 1989: 7; Melo, 1990: 74; 1996: 261; 1998: 470; 1999: 439, fig. 23; 2008: 5; 2010: 44; Boschi *et al.* 1992: 61, fig. 66; Clark *et al.*, 1998: 145; Bertini *et al.*, 2004: 2195; Ng *et al.*, 2008: 104; Tavares & Santana, 2011: 64.

*Libidoclaea brasiliensis* Heller, 1865: 1 [type locality Rio de Janeiro, Brazil].

*Libinia brasiliensis*; Miers, 1886: 73 [junior synonym of *Libidoclaea brasiliensis* Heller, 1865].

*Libinia braziliensis* Moreira, 1901: 65 [unjustified emendation and junior objective synonym of *Libidoclaea brasiliensis* Heller, 1865].

Material examined. Brazil, *Rio de Janeiro*: Búzios (Praia dos Ossos), 2 males, 05.iv.1984, J.F. Almeida *leg.* (MZUSP 20279). Macaé (near Santana Archipelago, PITA stn 12 III), 2 male, 1 female (MZUSP 20271). Macaé (Cabiunas), 2 males, 24-25.iv.1993 (MZUSP 20282). *São Paulo*: 3 males, 1 ovigerous female, Ubatuba, 07.ii.1985 (MZUSP 12091). Caraguatatuba, 1 male, 3 ovigerous females, v.2002, A. Fransozo, *leg.* (MZUSP 14200). Ilha Vitória, 1 male, 1906, F. Gunther *leg.* (MZUSP 335). São Sebastião (Ilha de Búzios), 1 male, x.1963 (MZUSP 1687). Ilha de Alcatrazes, 5 males, v.1964, Instituto de Pesca *leg.* (MZUSP 1880); 2 males, 3 young females (MZUSP 1876); 1 male,



Figures 1-3. Left, ventral side of the anterior region of the cephalothorax: (1) *Libinia spinosa* male, cl 62 mm, cw 53 mm, MZUSP 20271; (2-3) *Libinia ferreirae*: male holotype partially redrawn from BRITO CAPELLO (1871: pl. 3, fig. 1a) and male cl 56 mm, cw 50 mm, MZUSP 379, respectively. Arrows indicate the processes projecting from the anterolateral angle of the basal segment of the antenna. Scale bars: 1, 3 = 5 mm, 2 = 9 mm.



Figures 4-7. Habitus, dorsal view: (5, 7) ventral view of the thoracic sternum; (4-5) *Libinia spinosa* male, cl 62 mm, cw 53 mm, MZUSP 20271; (6-7) *Libinia ferreirae* male, cl 56 mm, cw 50 mm, MZUSP 379. Arrows indicate the male thoracic episternites IV-VII armed with strong, posterolateral-projecting, broad tooth – note the absence of such teeth in *L. ferreirae*. Scale bars: 4, 6 = 30 mm; 5, 7 = 15 mm.

1 ovigerous female, viii.1965 (MZUSP 4362). *Rio Grande do Sul*: (Projeto GEDIP, stn 549, 30°59'S-49°59'W), 2 males, 1 ovigerous female, 7.iii.1969 (MZUSP 3930). Locality unknown, 1 male, 30.viii.1997 (MZUSP 17474). Uruguay (Projeto GEDIP, stn 1925, 34°04'S-53°29'W), 1 male, 30.x.1972 (MZUSP 4356). Argentina,

Provincia de Buenos Aires (Bahía Unión to Bahía Anegada), "La Uruguay", 1 ovigerous female, ii.1920 (USNM 92490).

Distribution. *Libinia spinosa* is known from the southwestern Atlantic, from Espírito Santo (Brazil), through Uruguay to Argentina (San Matías Gulf, Patagonia) (GARTH 1957, MELO

1996, 1998). *Libinia spinosa* was erroneously referred to Chile by MILNE EDWARDS & LUCAS (1843: 6). Subsequently, this record was incorporated into the literature (NICOLET 1849: 128, MOREIRA 1901, BERTINI *et al.* 2004, BRAGA *et al.* 2005), and latter corrected by GARTH (1957: 31).

Remarks. The name *Libinia spinosa* appeared for first time in a plate from Guérin's Iconographie du Règne Animal in association with the following illustrations: habitus, female abdomen, and ventral view of the cephalothorax (GUÉRIN 1832: pl. 9, figs 3, 3a, 3b). Guérin's Iconographie was issued in parts, the plates appeared in 1832, whereas the text was published in only 1844 (see COWAN 1971 for the dates of publication of Guérin's Iconographie). The publication of the name *Libinia spinosa* in Guérin's Iconographie meets the requirements of availability of the ICZN (1999: Art. 11, Art. 12.1 and Art. 12.2.7) and therefore the name was made available at this occasion and not in H. Milne Edwards' Histoire Naturelle des Crustacés as traditionally accepted (H. MILNE EDWARDS 1834). GUÉRIN (1832) clearly attributed the name *L. spinosa* to H. Milne Edwards, "*Libinia spinosa*. M. Edw.", and according to the provisions of the ICZN (1999: Art. 50.1.1) this name should be attributed to him and not to Guérin, namely *Libinia spinosa* H. Milne Edwards in Guérin, 1832.

The morphology of *Libinia spinosa* was first described by H. MILNE EDWARDS (1834: 301) and from his text it is clear (as it is from GUÉRIN'S 1832 figures, see below) that at least one male and female were examined: "Une épine médiane sur les deux premiers segments de l'abdomen du mâle; pates [sic] de la seconde paire ayant une fois et quart la longueur de la carapace, et notablement plus longues que celles de la première paire, même chez le mâle." H. Milne Edwards did not provide illustrations of the male of *L. spinosa* he described, but instead referred to Guérin's fig. 3, therefore suggesting that a male was depicted there: "*L. spinosa*. Edwards, Guérin, Icon. Cr. Pl. 9, fig. 3." GUÉRIN-MÉNEVILLE'S (1844: 9, 10) explanations for the figures published in GUÉRIN (1832: pl. 9, figs 3, 3a, 3b) made no references to the female: "3. *Libinia spinosa*. Edwards."; 2.a. [sic] La bouche et l'épistome; 3.b. Queue du mâle." [male abdomen]. However, GUÉRIN'S (1832: fig. 3b) illustration shows a female abdomen instead. Clearly, at least one male and one female were illustrated by GUÉRIN (1832), namely the male figured in Guérin's figure 3 (as stated by H. MILNE EDWARDS 1834: 301) and the female illustrated in Guérin's figure 3b. In accordance with the provisions of the ICZN (1999: Art. 73.2) the male and female specimens illustrated by GUÉRIN (1832: pl. 9, figs 3, 3a, 3b) are syntypes of *Libinia spinosa* H. Milne Edwards. The individual illustrated in GUÉRIN'S Iconographie (1832: fig. 3) is herein fixed as the lectotype. Whether or not this specimen subsists or can be traced does not of itself have any bearing on this designation (ICZN, 1999: Art. 74.4). The remaining type specimens are the paralectotypes. In the collections of the Muséum national d'Histoire naturelle, there is one dry male and female (MNHN-B4453) labeled "*Libinia spinosa* M. Edw., M. Freycinet, Brésil" (figs 22-25). Although neither of which served as the basis for

GUÉRIN'S (1832: figs 3, 3b) illustrations, they most certainly belong in the type series of *L. spinosa* and are herein regarded as paralectotypes. Indeed, the dry male has one double and one single spine on the left and right sides of the carapace, respectively (Fig. 22) and the abdomen of the dry female is wide and rounded (Fig. 25). Neither of GUÉRIN'S (1832: figs 3, 3b) illustrations show these characteristics. The dry specimens from the MNHN labeled "*Libinia spinosa* M. Edw., M. Freycinet, Brésil" were actually obtained in Rio de Janeiro. In 1817, the French government launched an expedition of circumnavigation and appointed Louis Claude de Saulses de Freycinet as Commander of the corvette "L'Uranie". Charles Gaudichaud-Beaupré, Jean René Constantin Quoy and Joseph Paul Gaimard embarked as naturalists and ship surgeons, respectively. "L'Uranie" departed from Toulon in 1817 arriving in Rio de Janeiro on 6 December 1817. The expedition stayed in Rio de Janeiro for two months, where Gaudichaud-Beaupré, Quoy and Gaimard gathered large collections. From Rio de Janeiro, they crossed back the Atlantic towards the Cape of Good Hope and then headed to Mauritius and New Zealand. The expedition lasted 3 years and two months, and on its way back to France, stayed in Rio de Janeiro again (the only port visited in Brazil). From there it sailed to Le Havre, where it arrived on 13 November 1820 (PAPAVERO 1971: 124, 125). No specimens that can be attributed as the ones used in GUÉRIN'S (1832) in his illustrations subsist in the collections of the MNHN, and thus the dry male and female (MNHN-B4453) might well be the only specimens left from an originally larger type series.

### *Libinia ferreirae* Brito Capello, 1871

Figs 2, 3, 6, 7, 10, 11, 18-21

- Libinia ferreirae* Brito Capello, 1871: 262, pl. 3 figs 1,1a [type locality Belém do Pará, Brazil]  
*Libinia gibbosa* A. Milne-Edwards, 1878: 131 [type locality Desterro (currently Florianópolis), Brazil]  
*Libinia gibbosa*; Miers, 1886: 73.  
*Libinia ferreirai* Moreira, 1901: 65 [unjustified emendation, junior objective synonym of *Libinia ferreirae* Brito Capello, 1871]  
*Libinia ferreirai*; Moreira, 1903: 123.  
*Libinia ferreirae*; Rathbun, 1925: 324, pls. 118-119, 245 figs 4-5; Holthuis, 1959: 187, pl. 5 fig. 1; Guinot-Dumortier, 1960:178, fig. 19a-c; Coelho, 1971: 140; Coelho & Ramos, 1972: 213; Rodriguez, 1980: 281; Lemaitre, 1981: 246; Takeda, 1983: 137; Melo *et al.*, 1989: 7; Bakker *et al.*, 1990: 90; Barreto *et al.*, 1993: 648; Melo, 1996: 260; 1998: 469; 2008: 5; 2010: 44; Le Loeuff & von Cosel, 2000: 25; Marcano & Bolaños, 2001: 73; Silva *et al.*, 2001: 87; Cruz Castaño & Campos, 2003: 267; Bertini *et al.*, 2004: 2195; Almeida *et al.*, 2007: 16; Almeida & Coelho, 2008: 197; Coelho *et al.*, 2008: 17; Ng *et al.*, 2008: 104; Tavares & Santana, 2011: 64.

Material examined. Brazil, *Alagoas*: (Lagoa Mundaú), 1 male, iii.1985, Cetesb leg. (MZUSP 6799). *Sergipe*: Pirambu, 2 females, 12.ii.1985, Cetesb leg. (MZUSP 6618). *Espírito Santo*:





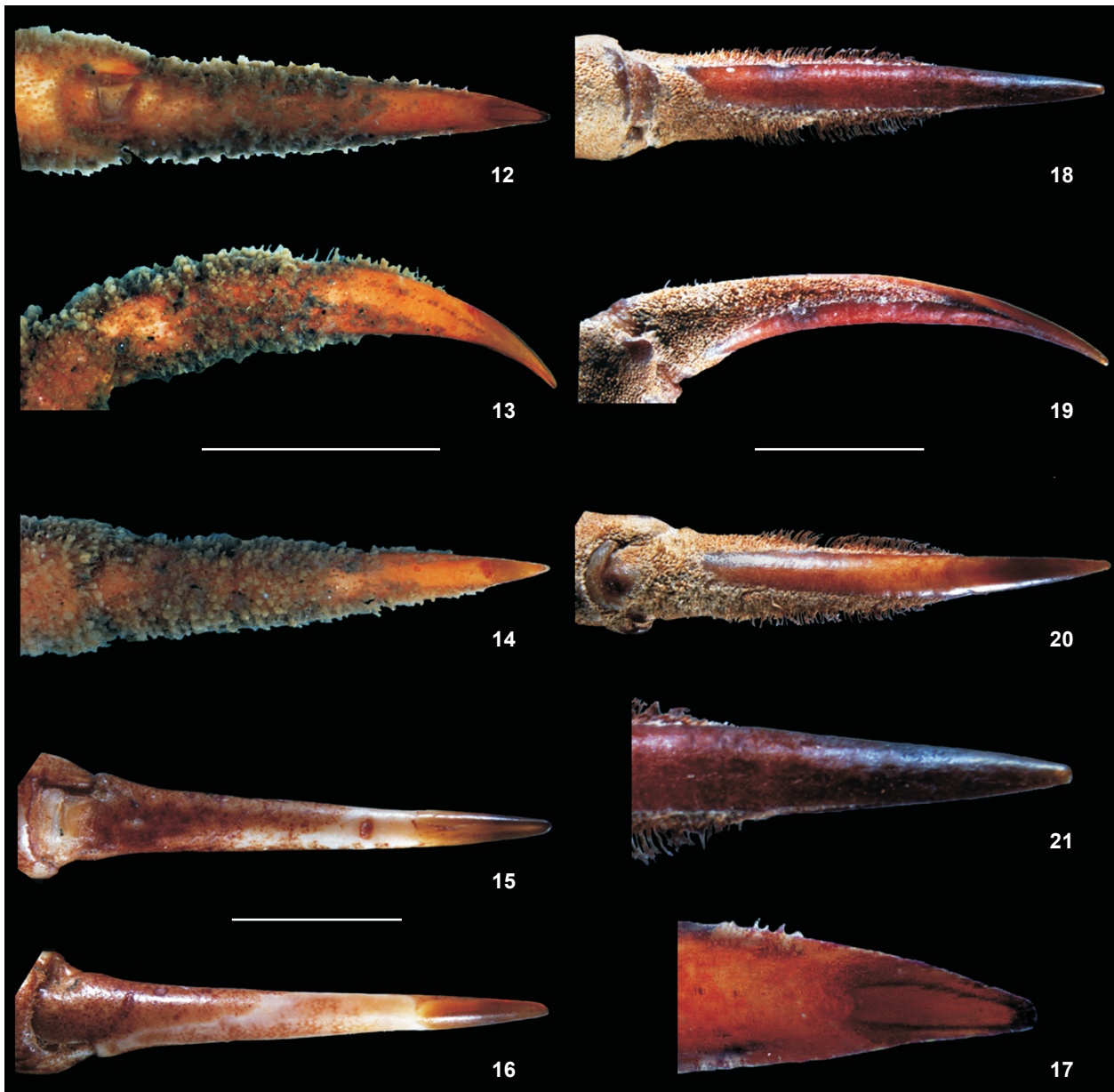
Figures 8-11. Habitus, dorsal view: (9, 11) ventral view of the thoracic sternum – coxo-sternal condyles of P1-P5 electronically removed in 9; (8-9) *Libinia spinosa* female, cl 59.5 mm, cw 51 mm, MZUSP 20271; (10-11) *Libinia ferreirae* female, cl 53 mm, cw 45.8 mm, MZUSP 24474. Arrows indicate the female thoracic episternites IV-VII armed with strong, posterolateral-projecting, broad tooth – note the absence of such teeth in *L. ferreirae*. Scale bars: 8, 10 = 30 mm, 9, 11 = 15 mm.

Itaúnas, 1 male, ii.2001, P.H.L. Van Der Ven *leg.* (MZUSP 20286); 1 ovigerous female (MZUSP 20285). *Rio de Janeiro*: Macaé, 1 male, i.1912, E. Garbe *leg.* (MZUSP 379); 1 female (USNM 47835). Ilha Grande(stn 229), 1 male, 10.vii.1966 (MZUSP 2802). *São Paulo*: Santos (Porto de Santos, 24°03.631'S-46°16.155'W, 21m), 1 female, 11.vii.2011, S. Santos *leg.* (MZUSP 24474). Ilha da Moela, 1 female, 17.v.1962, C. Jesus *leg.* (MZUSP 1676). Paraná: Shangrilá, 1 male, 13.xii.1998, R. Ennei *leg.*

(MZUSP 12964). Uruguay (Projeto GEDIP II, stn 1917, 35°30'S-53°46'W), 2 males, 29.x.1972 (MZUSP 14540).

**Distribution.** *Libinia ferreirae* has been found in Costa Rica (VARGAS & WEHRMANN 2009), Colombia (LEMAITRE 1981), Venezuela, Guyana, Brazil (from Amapá to Rio Grande do Sul) and Uruguay.

**Remarks.** Brito Capello's species was originally spelled *Libinia Ferreirae* (BRITO CAPELLO 1871: 262), later replaced with a



Figures 12-21. (12-17) *Libinia spinosa*: (12-14) P2 dactylus of male, cl 38.3 mm, cw 31.6 mm, MZUSP 17454. Note velvet-like setae all around dactylus tending to naked distally – pre-adult. (15-16) P4 dactylus of male, cl 62 mm, cw 53 mm, MZUSP 20271. Note P4 dactylus almost devoid of tomentum – adult. (17) Detail of 12 showing excavation at ventral, distal surface of dactylus – excavation absent in *L. ferreirae*, as shown in 18 and detailed in 21. (18-21) *Libinia ferreirae*: (18-20) P4 dactylus of male, cl 56.5 mm, cw 48.8 mm, MZUSP 20286. Note characteristic tomentum pattern. Scale bars: 12-14 = 5 mm, 15-16 = 6 mm, 18-20 = 5 mm.

lower-case letter, *ferreirae* (cf. ICZN 1999: Art. 32.5.2.5). Brito Capello stated that *Libinia ferreirae* was named after the Brazilian naturalist Alexandre Rodrigues Ferreira. As a result, MOREIRA (1901: 65) unjustifiably emended *ferreirae* to *ferreirai*. MOREIRA'S (1901) action was clearly intentional as again, in 1903, he referred three

times to this taxon as to *L. ferreirai* (MOREIRA 1903: 123). Although incorrectly formed under the provisions of the ICZN (1999: Art. 31.1.2) the original spelling *ferreirae* cannot be emended, as it does not meet the requirements of the article 32.5 (see also article 32.2). According to the ICZN (1999: article 33.2.3) the name

*Libinia ferreirae* Moreira, 1901, is an unjustified emendation and as such is available with its own author and date, and is an objective synonym of *Libinia ferreirae* Brito Capello, 1871.

Brazil is given as the type locality for *Libinia ferreirae* (BRITO CAPELLO 1871: 262). Brito Capello mentioned that the single male specimen available to him was probably sent from Brazil to Portugal by naturalist Alexandre Rodrigues Ferreira (1756-1815). Ferreira's nine-year expedition (1783-1793) to Brazil started and ended near the coast in Belém do Pará (CUNHA 1991). Otherwise, the expedition advanced eastward into the heart of the Amazon region and central Brazil, far away from marine waters. Therefore the type locality for *L. ferreirae* should be narrowed to Belém do Pará, Brazil.

*Libinia gibbosa* A. Milne-Edwards, 1878, was very briefly described in a footnote based on a single young specimen from Desterro, Brazil (currently Florianópolis) (A. MILNE-EDWARDS 1878: 131). According to the provisions of the ICZN (1999: Art. 73.1.2) that single specimen upon which A. MILNE-EDWARDS (1878) based his description is the holotype fixed by monotypy. In the collections of the MNHN, there is one young, dry female (MNHN-B385) labeled "M. F. Müller, Desterro (Brésil). Décrit dans une note de l'ouvrage du Mexique" (Figs 26, 27), which, therefore, is the holotype of *L. gibbosa* A. Milne-Edwards. No illustration of *L. gibbosa* has been published, nor has any additional description been made subsequent to A. MILNE-EDWARDS' (1878) footnote. RATHBUN (1925) synonymized *L. gibbosa* with *L. ferreirae*. She offered no reason for this synonymy probably because A. MILNE-EDWARDS (1878) compared *L. gibbosa* with *L. spinosa* only and made no references to *L. ferreirae*. Though RATHBUN (1925) mentioned that the type of *L. gibbosa* was in the MNHN, judging from her list of material examined she never saw it. Subsequent authors followed Rathbun in listing *L. gibbosa* under the synonymy of *L. ferreirae*. In the absence of illustrations of the only known specimen of *L. gibbosa* and from A. Milne Edwards' extremely brief notes alone, it is not possible to separate *L. gibbosa* from *L. ferreirae* or *L. spinosa*. Nevertheless, upon the examination of the illustrations of the holotype of *L. gibbosa* (Figs 26, 27), it is clear that the posterolateral margins of the thoracic episternites IV-VII are rounded and unarmed, leaving no doubt that *L. gibbosa* is indeed conspecific with *L. ferreirae*. Both specimens also are similar in regards the carapace and orbital ornamentation. Adult and young individuals of *L. ferreirae* look somewhat different from each other. In larger individuals the carapace is more globose (Figs 6, 10), whereas in young individuals it looks more pear shape (Fig. 26), the same applying to *L. spinosa*.

### Morphological differentiation between *Libinia spinosa* and *L. ferreirae*

*Libinia spinosa* and *L. ferreirae* inhabit very similar environments, and their geographic and bathymetric distributions overlap for about 3000 km along the southwestern Atlantic coast (from Espírito Santo, Brazil to Uruguay). Both species are commonly caught in the same haul and differentiating between

them can often be difficult. H. MILNE EDWARDS (1834: 300, 301) proposed to separate the species of *Libinia* known to him into two groups according to the development of a process projecting from the anterolateral angle of the basal segment of the antenna. According to him, *L. spinosa* falls into the group with the angle of the basal segment of the antenna spiniform (Fig. 1). However, in *L. spinosa* the anterolateral angle of the basal antennal segment is actually variable, being either spiny or toothed (e.g., RATHBUN 1925: 310, MELO 1996). BRITO CAPELLO (1871: 262, fig. 1, 1a) never described the antenna in *L. ferreirae*, but from his illustration of the holotype, partially redrawn here, it is clear that the anterolateral angle of the basal antennal segment is furnished with a prominent tooth (Fig. 2). In some individuals of *L. ferreirae*, however, the anterolateral angle of the basal antennal segment is very poorly projected (Fig. 3). The spinulation of the basal antennal segment led HELLER (1865) astray in describing a new species, *Libidoclaena brasiliensis* Heller, 1865, as previously mentioned, a junior synonym of *Libinia spinosa* H. Milne Edwards in Guérin, 1832. Heller's species was based upon the existence of an additional spine posterior to the outward projection of the anterolateral angle of the antennal basal segment (HELLER 1865: 1, table 1, fig. 1a). He was led amiss by GUÉRIN'S (1832: plate 9, fig. 3a) poor illustration of the anterior ventral region of the female holotype of *L. spinosa*, in which the posterolateral basal antennal spine is lacking. And yet, Guérin's illustration clearly shows that the anterolateral angle of the basal antennal segment is toothed on one side and spiny on the other side. The number of spines along the median, longitudinal line of the carapace has historically been used as well to differentiate between *Libinia spinosa*, with 7 median spines (Figs 4, 8, 22, 24), and *L. ferreirae* with 6 median spines (Figs 6, 10) (see HELLER 1865: plate 1, fig. 1 as *Libidoclaena brasiliensis*, BRITO CAPELLO 1871: figs 1, 1a, H. MILNE EDWARDS 1834, RATHBUN 1925, TAKEDA 1983: 137, MELO 1996). Nevertheless, the number of median spines of the carapace can vary and it is not uncommon to encounter either males or females of *L. spinosa* with 5, 8 or 10 median spines (e.g., MZUSP 7375, 12091 and 14197, and 20271, respectively). Also, in some specimens of *L. ferreirae* there is a tubercle between the two anterior most median spines (RODRIGUEZ 1980: 282). Because *Libinia spinosa* and *L. ferreirae* can have similar numbers of median spines (7 and 6, respectively) and the number of median spines of the carapace and the process at the anterolateral angle of the basal antennal segment are variable, they are both of little value in separating *L. spinosa* from *L. ferreirae*.

*Libinia spinosa* can, however, be easily separated from *L. ferreirae* in having: (i) male and female thoracic episternites IV-VII armed with strong, posterolateral-projecting, broad teeth, Figs 5, 9, 23, 25 (in *L. ferreirae* posterolateral margin of episternites IV-VII straight (male) or rounded (female), unarmed, Figs 7, 9, 27); (ii) male and female P2-P5 dactyli almost devoid of tomentum at maturity (Figs 15, 16), but sometimes with sparse tomentum all around near propodi, Figs 12-14 (adult





Figures 22-27. (22-25) Paralectotypes of *Libinia spinosa*: (22-23) male, cl 43 mm, rostral spine included, cw 42 mm, branchiostegal spine included, MNHN-B4453; (24-25) female, cl 42.6 mm, rostral spine included, cw 40.4 mm, branchiostegal spine included, MNHN-B4453; (26-27) Holotype female of *Libinia gibbosa*: cl 19.0 mm, cw 16.3 mm, MNHN-B385. In 23 and 27 arrows indicate the male and female thoracic episternites IV-VII armed with strong, posterolateral-projecting, broad tooth in *L. spinosa*. In 27, arrows indicate the absence of such teeth in *L. gibbosa*. Scale bars: 22-25 = 20 mm; 26-27 = 8 mm.

*L. ferreirae* with characteristic tomentum pattern: about 2/3 of lateral and mesial surfaces of P2-P5 dactyli and nearly 1/5 of its dorsal and ventral surfaces densely covered with tomentum proximally; dactyli otherwise naked, Figs 18-20) (this tomentum pattern is recognizable in the illustration of *L. ferreirae*

provided by HOLTUIS 1959: pl. V, fig. 1); (iii) pre-adults P2-P5 dactyli with velvet-like setae all around at about proximal half, tending to naked distally, Figs 12-14 (pre-adult *L. ferreirae* similar to the adult); (iv) ventral, distal surface of the P2-P5 dactyli distinctly excavated, Fig. 17 (in *L. ferreirae* ventral, distal sur-



face of P2-P5 dactyli not excavated, Fig. 21); (v) wide gap between lateral margin of basal antennal segment and infraorbital margin (see also H. MILNE EDWARDS 1834: 300-301, MIERS 1886: 73) (in *L. ferreirae* narrow notch separating basal antennal segment from infraorbital margin).

TAVARES & SANTANA (2011) transferred *Libinia rostrata* Bell, 1835, and *L. bellicosa* Oliveira, 1944, to the genus *Stratiolibinia* Tavares & Santana, 2011, and restricted the genus *Libinia* Leach, 1815 to the following ten species: *L. cavirostris* Chace, 1942; *L. dubia* H. Milne Edwards, 1834; *L. emarginata* Leach, 1815 (its type species); *L. erinacea* (A. Milne-Edwards, 1879); *L. ferreirae* Brito Capello, 1871; *L. mexicana* Rathbun, 1892; *L. peruana* Garth & Méndez, 1983; *L. rhomboidea* Streets, 1870; *L. setosa* Lockington, 1877; and *L. spinosa* H. Milne Edwards in Guérin, 1832, all from either the Atlantic or Pacific coasts of the Americas. The taxonomy of *L. spinosa* and *L. ferreirae* is fully resolved herein, but further studies are necessary to elaborate on the taxonomy of the remaining eight species of the genus, with special reference to *L. dubia*, *L. emarginata* and *L. erinacea*.

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