



Communication

A New Shallow-Water Species of the Rare Shrimp Genus *Bresilia* from Cabo Verde (Crustacea, Decapoda, Bresiliidae) †

Sammy De Grave ^{1,*} , Peter Wirtz ² and Arthur Anker ³¹ Oxford University Museum of Natural History, Parks Road, Oxford OX1 3PW, UK² Centro de Ciências do Mar do Algarve, Campus de Gambelas, PT-8000-117 Faro, Portugal; peterwirtz2004@yahoo.com³ Departamento de Ecologia, Zoologia e Genética, Instituto de Biologia, Campus Universitário Capão do Leão, Universidade Federal de Pelotas, Capão do Leão 96010-610, RS, Brazil; arthuranker7@gmail.com

* Correspondence: sammy.degrave@oum.ox.ac.uk

† Zoobank: urn:lsid:zoobank.org:pub:30AC21CC-C335-4919-815A-AC97FD4680B7.

Abstract: A new species of the rare shrimp genus *Bresilia* is described and illustrated from shallow-water lava tubes in Cabo Verde. Characteristics differentiating the new species from its three known Atlantic congeners are listed and discussed. Scanning electron images (SEM) are provided of the peculiar chela ornamentation of the first pereopod in the genus.

Keywords: *Bresilia*; Cabo Verde; lava tube; new species

1. Introduction

Calman in 1896 described a new shrimp genus *Bresilia*, based on a single specimen of a new species, *B. atlantica*, collected off Ireland from a depth of 1370 m [1]. Further, given the morphological features of the new genus, he also erected a new family, Bresiliidae, for the genus [1]. Kemp in 1910 reported upon a further four specimens of this species, dredged off the south-west coast of Ireland at water depths of 1208–1463 m [2]. No further specimens of this species have been found since, nor are any details of the habitat in which it occurs known. The second species in the genus, *B. corsicana*, was described by Forest and Cals in 1976, based on a single specimen obtained in 1961 from off Corsica, trawled on a deep-water scleractinian coral (*Madrepora oculata* Linnaeus, 1758) bottom at a depth of 450 m [3]. No further specimens of this species have since come to light. Bruce in 1990 described two species, *B. antipodarum* and *B. plumifera*, from the Tasman Sea (between Australia and New Zealand), again based on single type specimens, but with *B. plumifera* collected much shallower (133 m) than previous records of the genus including *B. antipodarum* (which came from 800 m depth) [4,5]. Bruce in 2004 recorded a further specimen of *B. antipodarum*, from a similar depth (770–830 m), but from further north, near New Caledonia [6]. In 2004, Calado, Chevaldonné and dos Santos described *B. saldanhai*, a shallow-water species (15 m depth) from a marine cave in Madeira [7]. This species was also the first (and only) for which a larger series of specimens was obtained, 12 in total. In 2005, Bruce described a further deeper-water (750–753 m) species from the Red Sea, *B. briankensleyi*, again from a single type specimen and with the habitat or any association unknown [8]. In the same year, Bruce described and illustrated a specimen, collected in 1995 from a depth of 26 m in Zanzibar, but left this taxon unnamed as the single specimen had been lost in the intervening years [9]. The first Japanese species, *B. gibbosa*, was described by Komai and Yamada in 2010, obtained from a marine cave in Okinawa at a depth of 30 m. The description of this species was based on two specimens, both of which were photographed in situ, providing the first colour photos for the genus [10]. A further new species, *B. rufiocus*, was described from Japanese waters by the same authors one year later, based on two photographed specimens, again from a shallow-water cave system (14–17 m depth) in the Ryukyus Islands [11]. The first



Citation: De Grave, S.; Wirtz, P.; Anker, A. A New Shallow-Water Species of the Rare Shrimp Genus *Bresilia* from Cabo Verde (Crustacea, Decapoda, Bresiliidae). *Arthropoda* **2023**, *1*, 451–459. <https://doi.org/10.3390/arthropoda1040020>

Academic Editor: Elena Anufrieva

Received: 1 October 2023

Revised: 30 October 2023

Accepted: 17 November 2023

Published: 22 November 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

eastern Pacific species, *B. pacifica*, was described in 2014 by Hendrickx, from off the western coast of Baja California, based on a holotype collected by benthic sledge at 1210–1245 m, and a much deeper collected paratype (2010–2046 m) [12]. The last species, *B. cinctus*, was described by Komai and Kohtsuka in 2017, the holotype (and only known specimen) of which was dredged in Sagami Bay, Japan, at a depth of 218–318 m [13].

In summary, the genus currently contains 10 species, most of which are rare and only known from their respective type series, and their ecology remains largely unknown. The genus, however, is geographically widespread, occurring in all oceans, and it can be safely assumed that their small body size plays a significant role in the lack of records, with more new species to be found in the future. Bathymetrically, most species of *Bresilia* are known from deeper water, possibly associated with deep-water corals [3,6], although two of the Japanese species, as well as the species from Madeira, inhabit shallow-water caves [7,10,11]. In the present contribution, a further new species of *Bresilia* is described from a shallow-water lava tube in Cabo Verde.

Type material is deposited in the collections of the Naturalis Biodiversity Center (formerly Rijksmuseum van Natuurlijke Historie, RMNH), Leiden, The Netherlands. Preparation for scanning electronic microscopy followed De Grave and Goulding [14].

2. Systematic Account

Order Decapoda Latreille, 1802.

Infraorder Caridea Dana, 1852.

Family Bresiliidae Calman, 1896.

Genus *Bresilia* Calman, 1896.

Bresilia scintilla sp. nov.

Figures 1, 2, 3 and 4d,e.

2.1. Material Examined

Holotype: ovigerous female (pocl 1.4 mm), dive site Palmeira 3, west coast of Sal Island, Republic of Cabo Verde; in crevice in rock wall of lava tube, 15 m, obtained by squirting diluted clove oil, leg. P. Wirtz, 26 September 2022 (RMNH.CRUS.D.59336). Paratype: ovigerous female (pocl 1.3 mm), dive site Palmeira 1, west coast of Sal Island, approx. 16.7569°–22.9875°, Republic of Cabo Verde; in crevice in rock wall of lava tube, 20 m, obtained by squirting diluted clove oil, leg. P. Wirtz, 6 September 2021 (both first pereopods present, but loose in vial; pereopods 2–5 lacking) (RMNH.CRUS.D.59337).

2.2. Description

Body (Figure 1a,e) moderately slender, subcylindrical, integument firm, tegumental scales present in semi-regular patterns (Figure 1b), but mostly represented by pits. Rostrum (Figure 1a–c) slender, straight, about 0.75–0.80 times carapace length, reaching to distal margin of second article of antennular peduncle; dorsal margin with 5–6 relatively small teeth, all anterior to orbital margin, posterior-most tooth basally articulated (in holotype only); ventral margin straight, armed with single subdistal, small tooth; lateral carina well developed, distinct from orbit throughout its length; suborbital lobe distinct, not protruding.

Thoracic sternum very narrow (not illustrated); sternite 3 with anteriorly directed, sharp tooth; sternite 4 with low median carina; sternite 5 with paired moderately well-developed teeth; sternite 6 with pair of long, slender, acute processes; sternite 7 with paired, moderately well-developed teeth; sternite 8 with slenderer, submedian process.

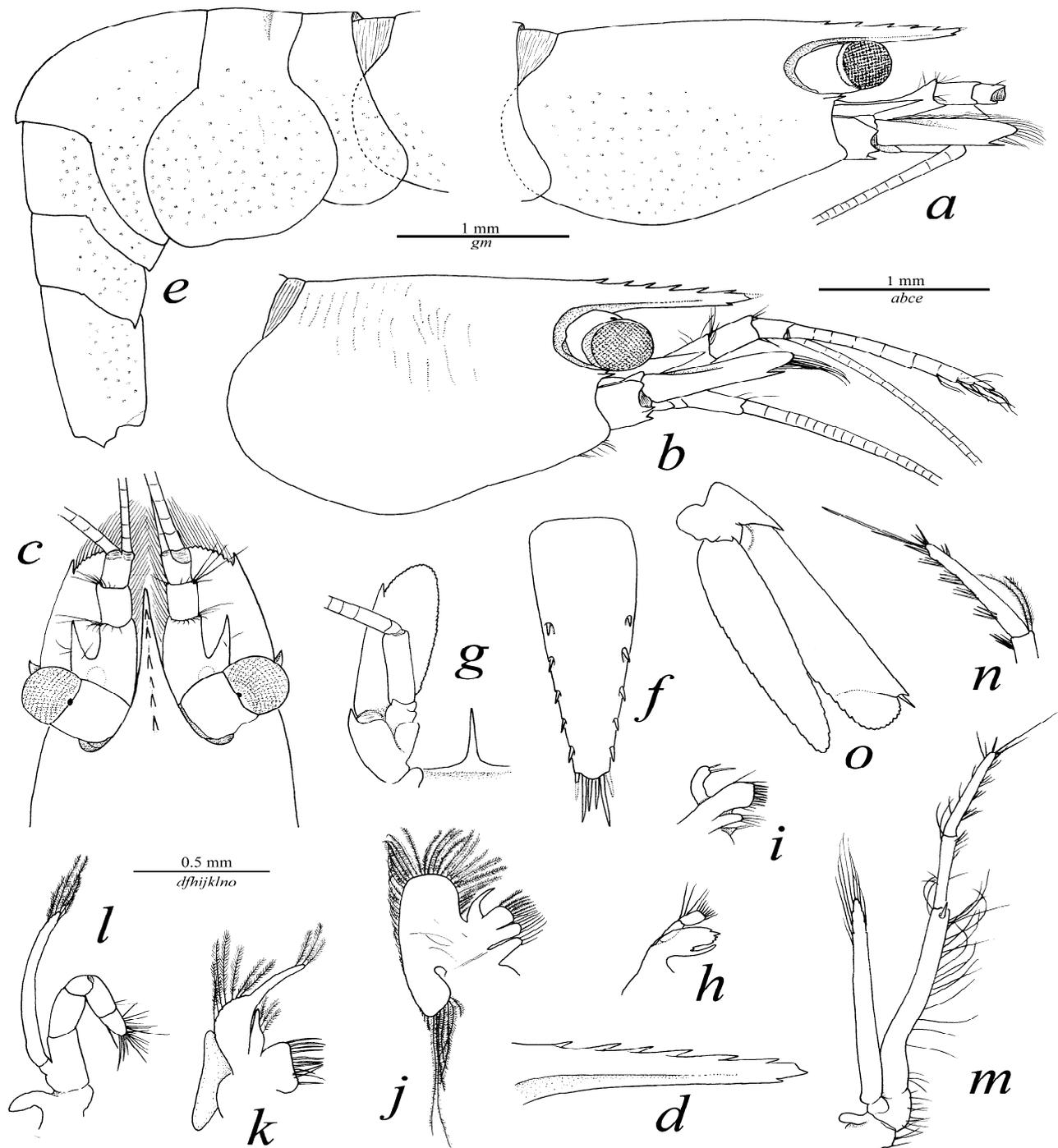


Figure 1. *Bresilia scintilla* sp. nov.; (a) carapace and frontal appendages, lateral view; (b) same; (c) frontal margin and appendages, dorsal view; (d) rostrum, lateral view; (e) abdomen, lateral view; (f) telson, dorsal; (g) epistome; (h) mandible, (i) maxillule, (j) maxilla; (k) first maxilliped; (l) second maxilliped; (m) third maxilliped; (n) same, distal segment; (o) uropod (a,e-o) (paratype, RMNH.CRUS.D.59337); (b-d) (holotype, RMNH.CRUS.D.59336).

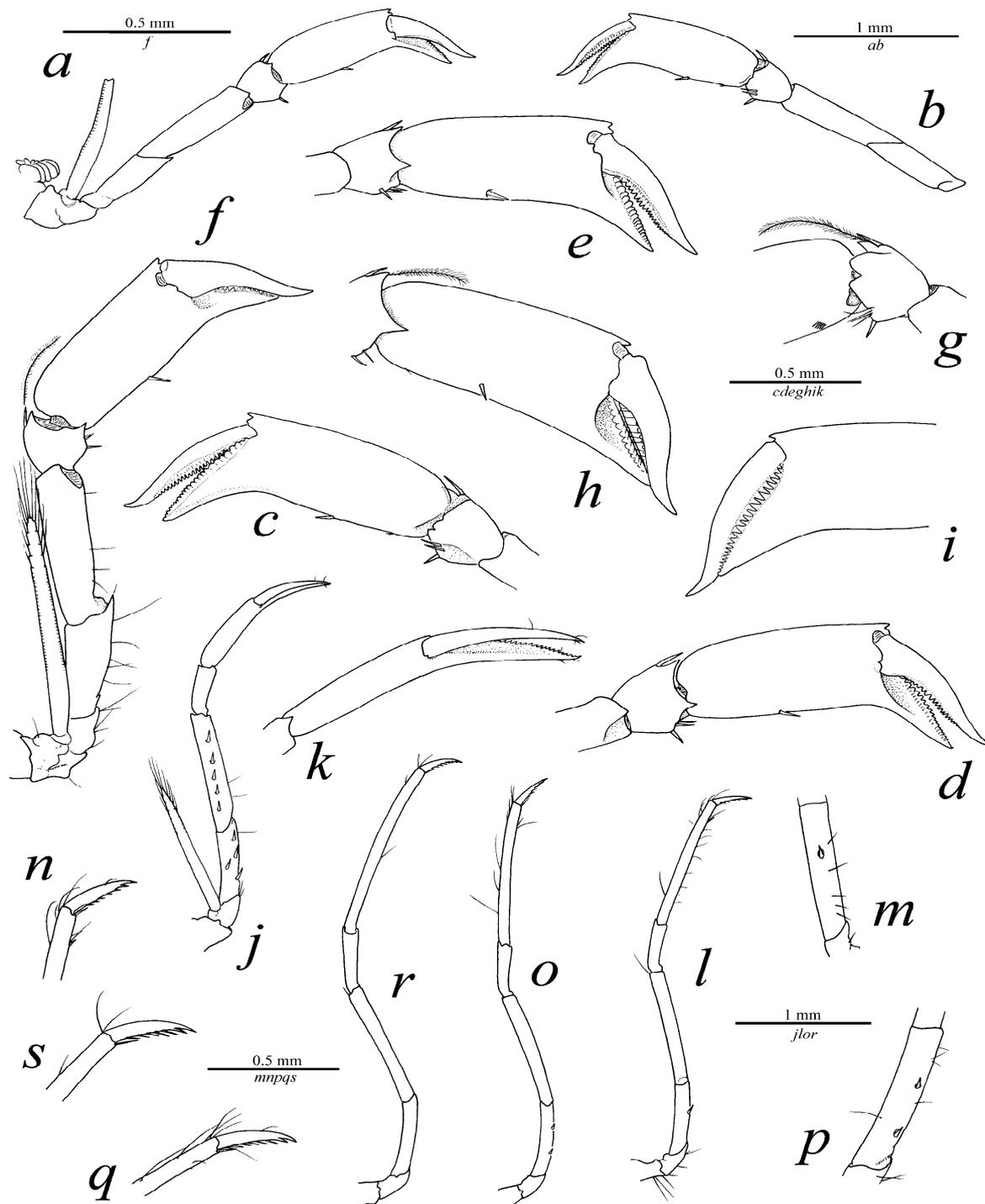


Figure 2. *Bresilia scintilla* sp. nov.; (a) right first pereiopod (paratype), lateral; (b) same, mesial; (c) same, chela, mesial; (d) same, chela, lateral; (e) same; (f) right first pereiopod (holotype), lateral; (g) same, carpus, mesial; (h) same, chela, lateral; (i) same, chela, distal, mesial; (j) right second pereiopod, lateral; (k) same, chela, lateral; (l) right third pereiopod, lateral; (m) same, ischium; (n) same, dactylus; (o) right fourth pereiopod; (p) same, ischium; (q) same, dactylus; (r) right fifth pereiopod; (s) same, dactylus; (a–e) (paratype, RMNH.CRUS.D.59337); (f–s) (holotype, RMNH.CRUS.D.59336).

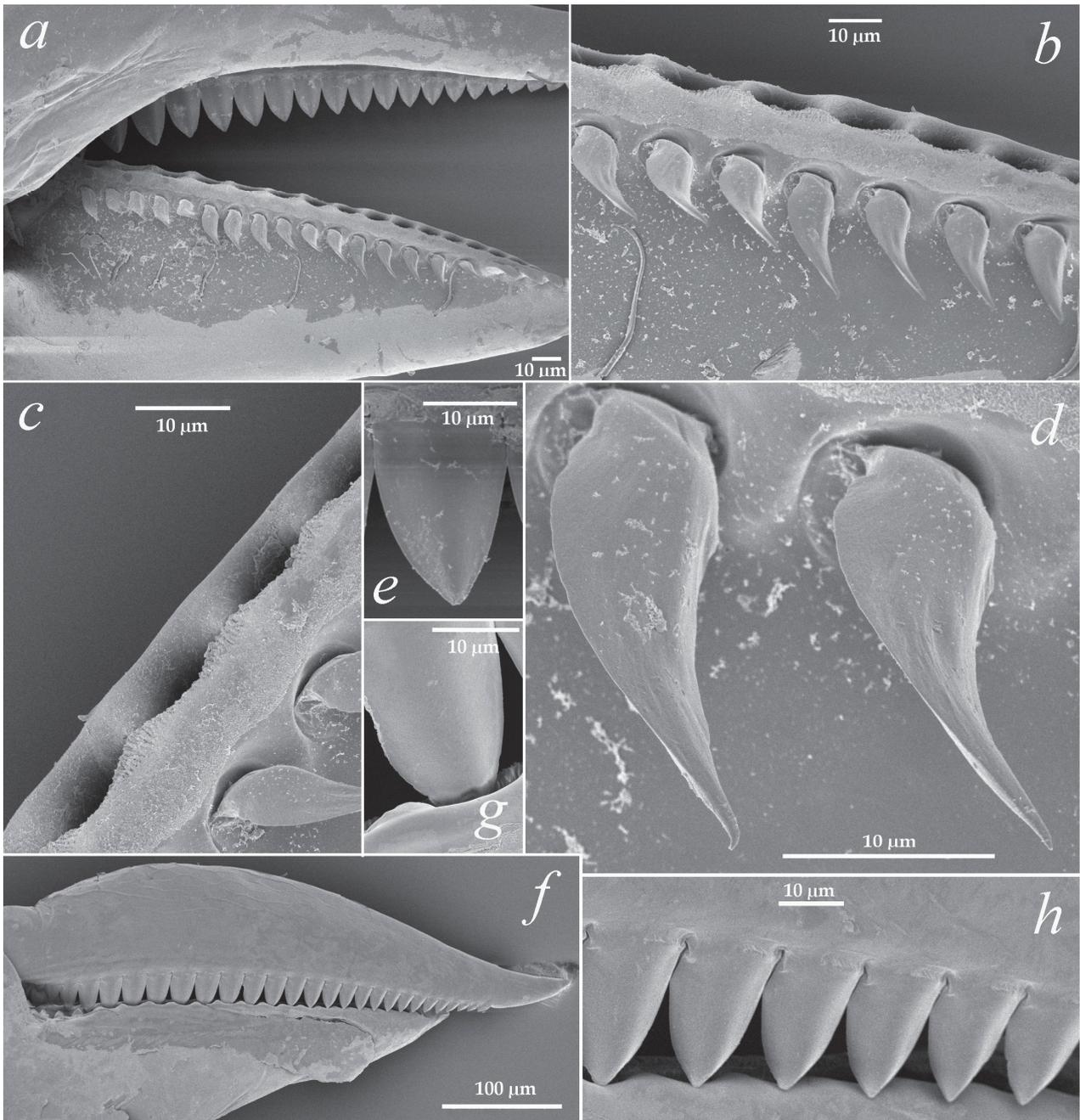


Figure 3. *Bresilia scintilla* sp. nov. SEM images, (a) right first pereopod, chela, lateral; (b) same, occluding margin; (c) same, detail of fossae; (d) same, recurved teeth on pollex; (e) same, compressed tooth on dactylus; (f) left first pereopod, chela, mesial; (g) same, detail; (h) same, compressed tooth on dactylus; all from paratype (RMNH.CRUS.D.59337).

Carapace with antennal tooth only, hepatic, branchiostegal and pterygostomial teeth absent; antennal tooth (Figure 1a,b) short, not merged with orbit; Pterygostomial angle semi-quadrangle, not developed into a tooth. Pleon (Figure 1e) smooth; third segment produced posteriorly, but not markedly elevated or crested; pleura 1–3 posteriorly broadly rounded, pleuron 4 with posteroventral angle quadrate; pleuron 5 with posteroventral angle produced into distinct tooth; pleuron 6 with polygonal lobe above articulation with uropod, posteromedian corner of lobe forming short, posteriorly directed tooth; ventrolateral corner of pleura angulate.

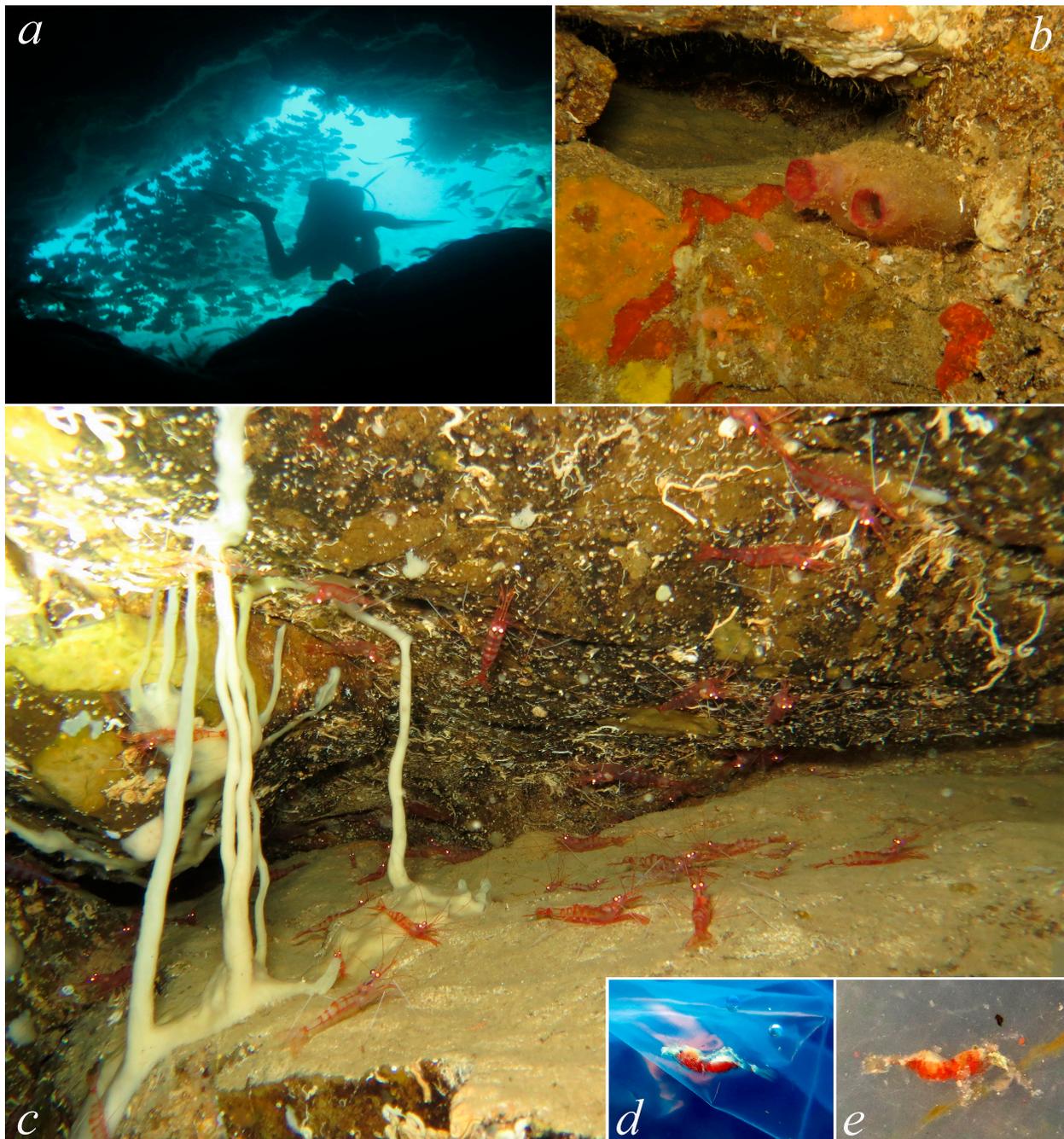


Figure 4. Habitat and colour pattern; (a) exit of lava tube “Palmeira 1”; (b) unidentified tunicates and sponges on wall of lava tube; (c) *Janicea antiguensis*, a common shrimp species in Cabo Verdean lava tubes; (d) live colour pattern of *Bresilia scintilla* sp. nov., shortly after capture (paratype, RMNH.CRUS.D.59337); (e) same (holotype, RMNH.CRUS.D.59336).

Telson (Figure 1f) about 3 times as long as wide, with 5 pairs of dorsolateral spiniform setae, all placed slightly submarginally; posterior margin slightly convex, furnished with 3 pairs of spiniform setae, lateral pair shortest, submedial pair longest. Epistome (Figure 1g) with long, slender median process. Eyestalk (Figure 1a–c) subpyriform, cornea not dilated, not wider than eyestalk, Nebenaugae present, small.

Antennular peduncle (Figure 1a–c) falling short of (paratype) or slightly over-reaching (holotype) scaphocerite; first article about same length as two distal segments combined; stylocerite not abutting, tapering to acute tip, reaching to distal margin of first article; outer flagellum uniramous, longer than peduncle, aesthetascs present on distal 2–3 subdivisions;

mesial flagellum much longer than and more slender than lateral flagellum. Antennal peduncle (Figure 1a,b,g) with stout basicerite, ventrolateral and ventrodorsal tooth present; carpopocerite stout; scaphocerite well developed, blade-like, about 2.5 times as long as maximal width, lateral margin straight, distolateral tooth slender, falling well short of distal margin of lamella; flagellum broken.

Mouthparts as illustrated (Figure 1h–n); without noteworthy features, as usual for genus.

First pereopod (Figure 2a–i) over-reaching distal margin of scaphocerite by majority of palm; articulation between basis and ischium distinct; ischium somewhat widening distally, distoventral angle produced into blunt tooth; merus subcylindrical, unarmed; carpus short, cup-like, ventro- and dorsomesial angles bluntly produced; dorsolaterally furnished with single, long, plumose seta; ventromedial margin with two spiniform seta; carpo-propodal brush poorly developed; chela slender, palm oval in cross-section, not increasing in depth distally, unadorned, single spiniform seta present at midpoint of flexor margin; fingers somewhat deflexed, forming deep cavity on lateral surface (Figure 3a), terminating in acute tips; cutting edge of fixed finger with distinct chitinous ridge (Figure 3b), provided with deep fossae (Figure 3b,c) to accommodate flattened teeth on cutting edge of dactylus (Figure 3g); submarginally furnished with series of squamate, closely abutted seta (Figure 3a,b,d); dactylus sinuous (Figure 2i), over-reaching fixed finger, tip upturned, cutting edge pectinate, consisting of flattened teeth; exopod flagellum-like, not reaching distal margin of merus.

Second pereopod (Figure 2j,k) slender, over-reaching distal margin of scaphocerite by length of chela; ischium with four elongated, spiniform setae on lateral face; merus distinctly longer than ischium, with linear row of five elongated, spiniform setae on lateral face; carpus about 0.35 times as long as chela, unarmed; chela elongate, palm subcylindrical, unadorned; fixed finger somewhat excavated on outer side, spinulate cutting edge; dactylus similar, more cylindrical; exopod flagellum-like, reaching to midlength of merus.

Third to fifth pereopods slender, similar in form, lacking exopods. Third pereopod (Figure 2l–n) over-reaching distal margin of scaphocerite by length of dactylus; ischium with single spinule on lateral surface ventrally; merus about 1.5 times as long as ischium, unarmed; carpus shorter than merus, cylindrical, unarmed; propodus about 3.2 times as long as carpus, single spinule along flexor margin in distal portion, single spinule present at distoventral corner; dactylus about 0.24 times as long as propodus, weakly curving, terminating in long unguis, furnished with 6 evenly distributed, accessory spinules on flexor margin. Fourth pereopod (Figure 2o–q) similar in proportions; ischium with two spinules; propodus unarmed; dactylus similar. Fifth pereopod (Figure 2r,s) similar in proportions; ischium and propodus unarmed.

Pleopods (not illustrated) without distinctive features, male pleopods unknown.

Uropods (Figure 1o) slightly over-reaching tip of telson; protopod posterolaterally sharply pointed; endopod slender, somewhat tapering distally; exopod of same length, diaeresis distinct in lateral part, with small posterolateral tooth and much longer, well-developed spinule mesial to tooth; distal lamella quadrate.

Eggs (about 25 in holotype) ovoid in shape, non-eyed, size approximately 0.3×0.5 mm.

2.3. Etymology

From the Latin for spark, *scintilla*, in reference to the sparkling chromatophores of the freshly deceased holotype when first observed under the microscope; used as a noun in apposition.

2.4. Habitat

The north-western coast of Sal Island (north of Palmeira harbour) consists of rock formed by lava. Vertical walls go down to 15 or 40 m in water depth. Numerous lava tubes end in these walls, with openings often more than 5 m wide. Seven of these tubes are regularly visited by the SCUBA diving bases of Sal Island. Most are straight tunnels with a circular diameter and entering the lava up to 200 m in length (“Palmeira 3”). One of them

("Palmeira 1") is semicircular (Figure 4a) and a further one ("Palmeira 4") runs parallel to the coast with several openings along its way. "Buracona" is the most famous one: the straight tube opens after about 50 m with a sinkhole to the surface, which is a local tourist attraction. The completely dark stretches of these tubes contain typical cave fauna, such as sponges and tunicates growing on the almost bare walls (Figure 4b), cave fish species like *Grammonus longhorsti* (Cohen, 1964) and *Epigonus constanciae* (Giglioli, 1880), which are not found outside these tubes, as well as abundant populations of the barbouriid shrimp species *Janicea antiguensis* (Chace, 1972) (Figure 4c).

2.5. Distribution

Currently only known from the type locality, near Palmeira, Sal Island, Republic of Cabo Verde (Cape Verde).

2.6. Colour Pattern

Semi-transparent to colourless on dorsal half of body; ventral part of body and egg mass red; egg mass red; first pereopods golden-yellow (Figure 4d,e).

3. Discussion

With the addition of the new species in *Bresilia*, there are now four species of this genus recorded in the Atlantic Ocean, namely *B. atlantica*, *B. corsicana*, *B. saldanhai* and *B. scintilla* sp. nov. [1,3,7]. Of these species, *B. saldanhai* is geographically closest and ecologically similar to the new species, occurring in a shallow-water cave in Madeira [7]. Nevertheless, these two species can easily be distinguished from each other, by the following morphological characters: (1) 10–13 dorsal rostral teeth in *B. saldanhai* (vs. 5–6 in *B. scintilla*); (2) pterygostomial angle developed into an acute tooth in *B. saldanhai* (vs. angular in *B. scintilla*); (3) tergum of third pleomere crested in *B. saldanhai* (vs. not crested in *B. scintilla*), as well as further differences in the shape of the scaphocerite and the armament on the fourth and fifth pleura, which are evident when comparing the illustrations in the present contribution with those in Calado et al. [7].

The deep-water *B. atlantica*, from off the coast of Ireland, can easily be separated from the new species by the non-pigmented cornea of that species (vs. pigmented in *B. scintilla*), the crested tergum of the third pleomere (vs. not crested in *B. scintilla*) and the lack of a posteroventral tooth on the fifth pleuron (vs. present in *B. scintilla*) [1]. The Mediterranean *B. corsicana* can easily be distinguished from the new species by the more numerous dorsal rostral dentition (10 vs. 5–6 in *B. scintilla*), the large pterygostomial tooth (vs. absent in *B. scintilla*) and the armature on the fourth and fifth pleuron [3].

Concerning the non-Atlantic species, three species, viz., *B. antipodarum*, *B. briankensleyi* and *B. plumifera*, have the tergum of the third pleomere highly carinate or crested [4,5,8], which is not the case in *B. scintilla*. The same character also differentiates the illustrated but unnamed species from Zanzibar [9] from *B. scintilla*. The large pterygostomial tooth of the eastern Pacific species, *B. pacifica*, easily distinguishes that species from *B. scintilla* [12]. The new species can easily be separated from the Japanese *B. gibbosa* by their rostral characteristics, with *B. gibbosa* harbouring 6 strong, dorsal teeth, of which 2 are post-orbital and 3 ventral teeth; in contrast, *B. scintilla* has 5–6 weakly developed teeth, all of which are anterior to the orbit, and with only a single ventral tooth. Additionally, the antennal tooth is much more developed in *B. gibbosa* (vs. short in *B. scintilla*), the tergum of the third pleomere is well developed in *B. gibbosa* (vs. weakly so in *B. scintilla*) and *B. gibbosa* has two posterolateral teeth on the fifth pleuron (vs. only one, posteroventral, in *B. scintilla*) [10]. A similar suite of characteristics easily separates the new species from the Japanese *B. rufioculus*, with that species having 10 well-developed dorsal rostral teeth, of which two are placed posterior to the orbit (vs. 5–6 weakly developed teeth in *B. scintilla*). Further, both species can be separated by the well-developed antennal tooth in *B. rufioculus* (vs. very short in *B. scintilla*), the presence of a posteroventral tooth on the fourth pleuron (vs. quadrate in *B. scintilla*), the presence of a posterolateral tooth on the fifth pleon

(vs. absent in *B. scintilla*), the absence of a posteroventral tooth on the fifth pleon (vs. present in *B. scintilla*) and the absence of a spiniform seta along the flexor margin of the palm of the first pereopod (vs. present in *B. scintilla*) [11].

Based solely on morphological grounds, *B. scintilla* appears to be most similar to the Japanese *B. cinctus*, with both species sharing several diagnostically important features [12]. However, the new species can be distinguished from *B. cinctus* by the distinct but poorly developed orbital lobe (vs. well developed in *B. cinctus*) and the outer occlusal margin of the dactylus of the first pereopod unarmed (vs. possessing a row of teeth in *B. cinctus*, called “chitinous spines” in [12]).

On the other hand, the colour pattern of *B. scintilla* (Figure 4d,e) is more similar to that of the cave species *B. rufiocolus* and especially *B. gibbosa* [11], and quite different from the colour pattern of *B. cinctus* [12]. The colour patterns of all other species of *Bresilia*, including the three Atlantic species, *B. atlantica*, *B. corsicana* and *B. saldanhai*, remain presently unknown.

Author Contributions: Specimen provision, P.W.; writing—original draft preparation, S.D.G.; writing—review and editing, A.A., P.W. and S.D.G.; visualization, A.A. All authors have read and agreed to the published version of the manuscript.

Funding: The second author is grateful to the Center of Marine Sciences (CCMAR) at the University of the Algarve for partly financing both trips, 2021 and 2022. This study received Portuguese national funds from FCT—Foundation for Science and Technology through projects UIDB/04326/2020, UIDP/04326/2020 and LA/P/0101/2020.

Acknowledgments: The second author would like to thank the diving base Ecodiveschool, in particular Dudu and Samba, for all their help before and during the dives in the lava tubes of Palmeira.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Calman, W.T. On deep-sea Crustacea from the South West of Ireland. *Trans. R. Ir. Acad.* **1896**, *31*, 1–22.
2. Kemp, S. The Decapoda Natantia of the coasts of Ireland. *Scient. Investig. Fish. Branch. Irel.* **1910**, *1*, 3–190.
3. Forest, J.; Cals, P. Une deuxième espèce du genre *Bresilia* Calman, *B. corsicana* sp. nov. Comparaison avec *B. atlantica* Calman (Crustacea Decapoda Bresiliidae). *Bull. Muséum Natl. D'histoire Nat.* **1977**, *453*, 549–565.
4. Bruce, A.J. Two deep-sea shrimps new to the Australian fauna, *Psathyrocaris hawaiiensis* Rathbun (Pasiphaeidae) and *Bresilia antipodarum*, sp. nov. (Bresiliidae), with remarks on *Encantada spinoculata* Wicksten (Bresiliidae). *Invertebr. Taxon.* **1990**, *4*, 847–866. [[CrossRef](#)]
5. Bruce, A.J. A second species of *Bresilia*, *B. plumifera* sp. nov., new to the Australian fauna (Crustacea: Decapoda: Bresiliidae). *Beagle* **1990**, *7*, 1–8.
6. Bruce, A.J. *Bresilia antipodarum* Bruce, 1990 (Crustacea: Decapoda: Bresiliidae), a new record from New Caledonian waters. *Cah. Biol. Mar.* **2004**, *45*, 365–372.
7. Calado, R.; Chevardonné, P.; dos Santos, A. A new species of the deep-sea genus *Bresilia* (Crustacea: Decapoda: Bresiliidae) discovered from a shallow-water cave in Madeira. *J. Mar. Biol. Assoc. UK* **2004**, *84*, 191–199. [[CrossRef](#)]
8. Bruce, A.J. Bresiliid shrimps from the Red Sea (Crustacea: Decapoda: Caridea) with description of a new species. *Proc. Biol. Soc. Wash.* **2005**, *118*, 176–182. [[CrossRef](#)]
9. Bruce, A.J. Note on a new species of *Bresilia* (Crustacea: Decapoda: Bresiliidae) from Zanzibar. *Mem. Qld. Mus.* **2005**, *51*, 385–390.
10. Komai, T.; Yamada, Y. A new species of the rare caridean genus *Bresilia* Calman (Crustacea: Decapoda: Bresiliidae) from the Ryukyu Islands, Japan, representing a family new to the North Pacific marine fauna. *Zootaxa* **2010**, *2450*, 41–52. [[CrossRef](#)]
11. Komai, T.; Yamada, Y. A new species of the caridean genus *Bresilia* Calman (Decapoda: Bresiliidae) discovered from a shallow-water submarine cave in Okinawa Islands, Japan. *Bull. Natl. Mus. Nat. Sci.* **2011**, *5*, 71–82.
12. Hendrickx, M.E. First record of the caridean shrimp genus *Bresilia* Calman, 1896 (Crustacea: Decapoda: Bresiliidae) from the East Pacific and description of a new species. *Zootaxa* **2014**, *3878*, 185–195. [[CrossRef](#)] [[PubMed](#)]
13. Komai, T.; Kohtsuka, H. A new deep-sea species of the caridean genus *Bresilia* Calman, 1896 (Crustacea: Decapoda: Bresiliidae) from Sagami Bay, central Japan. *Zootaxa* **2017**, *4299*, 405–414. [[CrossRef](#)]
14. De Grave, S.; Goulding, L.Y.D. Comparative morphology of the carpo-propodal brush in caridean shrimps. *Zool. Anz.* **2011**, *250*, 280–301. [[CrossRef](#)]

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.