

The Planktonic Shrimp, *Lucifer chacei* sp. nov., (Sergestidae: Luciferinae),
the Pacific Twin of the Atlantic *Lucifer faxoni*

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ABSTRACT: *Lucifer chacei* sp. nov., closely related to the Atlantic *L. faxoni* and identified as the latter species by previous authors, is described and compared with *L. faxoni*. It is widely distributed in the tropical Pacific, and like *L. faxoni* inhabits coastal waters.

THE PLANKTONIC SHRIMP genus *Lucifer* (family Sergestidae) contains six currently recognized species, of which all have been reported from the Indo-Pacific, but only two, *L. typus* Milne Edwards and *L. faxoni* Borradaile, are known to occur in the Atlantic. An unpublished study which I recently completed on the distribution of the two Atlantic species off the southeastern coast of the United States shows that *L. faxoni* is essentially a coastal species. Since coastal plankters more often than not are restricted to one ocean, or even to a single coast of one ocean, it seemed advisable to re-examine the evidence for the occurrence in the Indo-Pacific of *L. faxoni*, the type locality of which is in the Atlantic, off Chesapeake Bay (restricted by Holthuis, 1959).

For this study Atlantic specimens of *L. faxoni* from Bloody Bay, Tobago, West Indies, were compared with Pacific specimens of *Lucifer* from Eniwetok, Marshall Islands, and from several of the Society Islands. Both Atlantic and Pacific specimens key out to *L. faxoni* in Hansen (1919), but they are specifically distinct, and a new species is established herein for the Pacific form.

Surprisingly, the common short-eyestalked Atlantic species, *L. faxoni*, has never been described and illustrated adequately (Hansen's drawings of *L. faxoni* in his 1919 monograph are actually of the new Pacific species); hence illustrations of taxonomically important features of *L. faxoni* are given herein.

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Lucifer chacei, new species

Figs. 1-4

Lucifer faxoni Borradaile.—Hansen, 1919: 61-63, pl. 5, figs. 3a-3i.—Edmondson, 1925:5.—Hiatt, 1947:241-242.—Chace, 1955:4.

Leucifer reynaudi H. Milne Edwards.—Edmondson, 1923:35.

MATERIAL EXAMINED: MARSHALL ISLANDS: Eniwetok Atoll; lagoon, 4.8 km west of Parry I., net tow at depth of approximately 3 m, 26-27 July 1960, 2435-0800 hours, by Woods Hole Oceanographic Institution, ♂ holotype (USNM 113327), ♀ allotype (USNM 113328) and 55 paratypes. Rongelap Atoll; 1 km off Yugui I., depth of water 24 m, dip net under night light, 30 July 1946, by Earl S. Herald, 3 ♂, in poor condition, reported as *L. faxoni* by Chace (1955). TUAMOTU ISLANDS: Tikahau Atoll; lagoon, south of deep water pass, net tow at depth of approximately 4 m, 12 April 1957, 2015-2030 hours, station 19 of Smithsonian Bredin 1957 Expedition, 43 specimens. SOCIETY ISLANDS (Smithsonian-Bredin 1957 Expedition stations): Tahiti: Papeete Harbor, dip net under night light, 4 May, 2100-2130 hours, station 99, 40+ specimens. Moorea: Opunohu Bay, east side, net tows, 9 May, 1530 hours, station 114, 43 juveniles. Bora Bora: East of Farepiti Point, dip net under night light, 24 April, 2000-2030 hours, station 52, 50+ specimens; off Teraia Point, depth of water 30 m, net tows, 25 April, 0900-1100 hours, station 55, 24 specimens; west of north end of Toopua I., depth of water 13 m, dip net under light, 25 April, 2030-2100 hours, station 63, 30+ specimens.

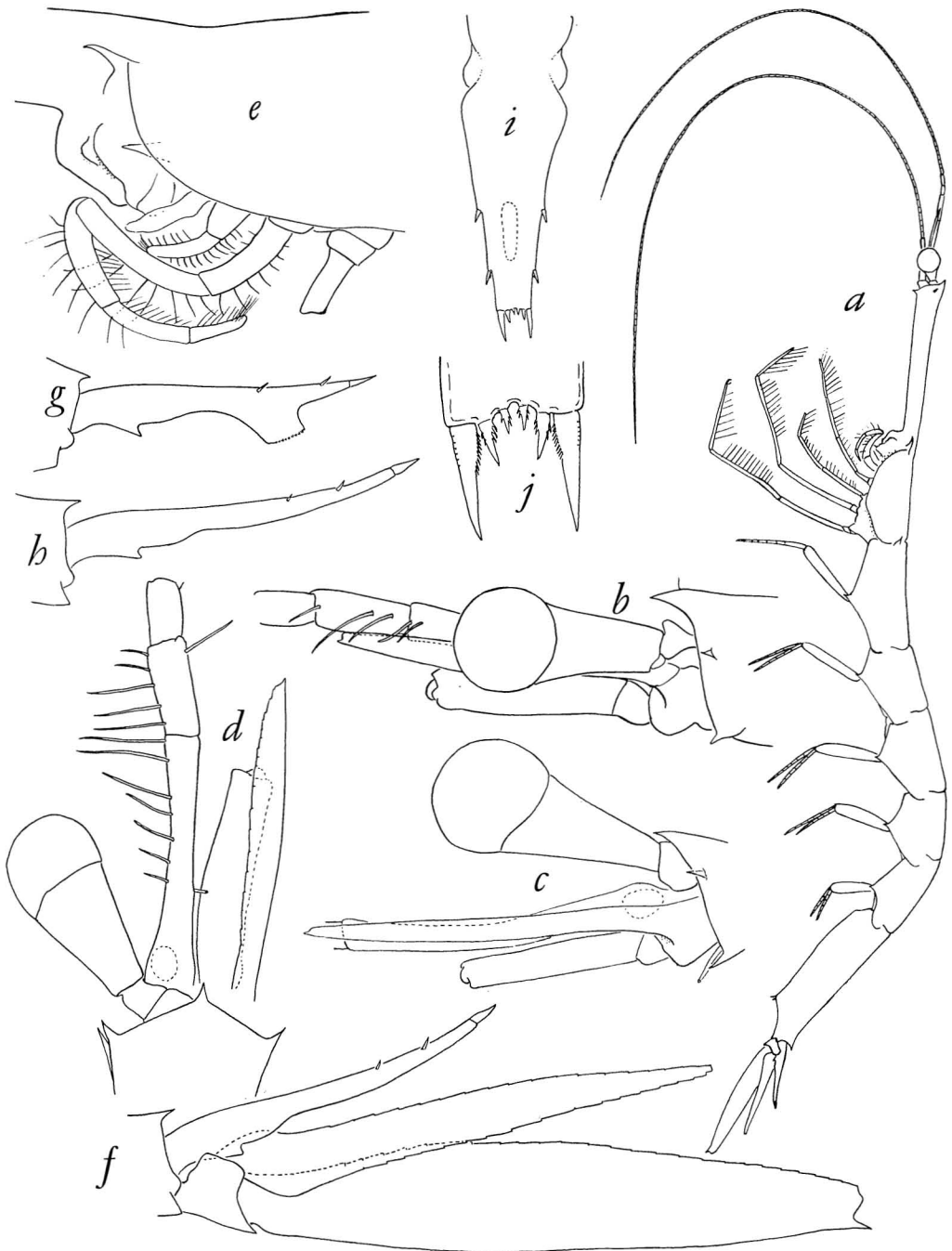


FIG. 1. *Lucifer chacei*: a, female, lateral; b, anterior end of male head, lateral; c, anterior end of female head, lateral; d, anterior end of male head, dorsal; e, male posterior head and anterior pereon, lateral; f, female uropod and telson, lateral; g, male telson, lateral; h, female telson, lateral; i, male telson, dorsal; j, apex of male telson, dorsal.

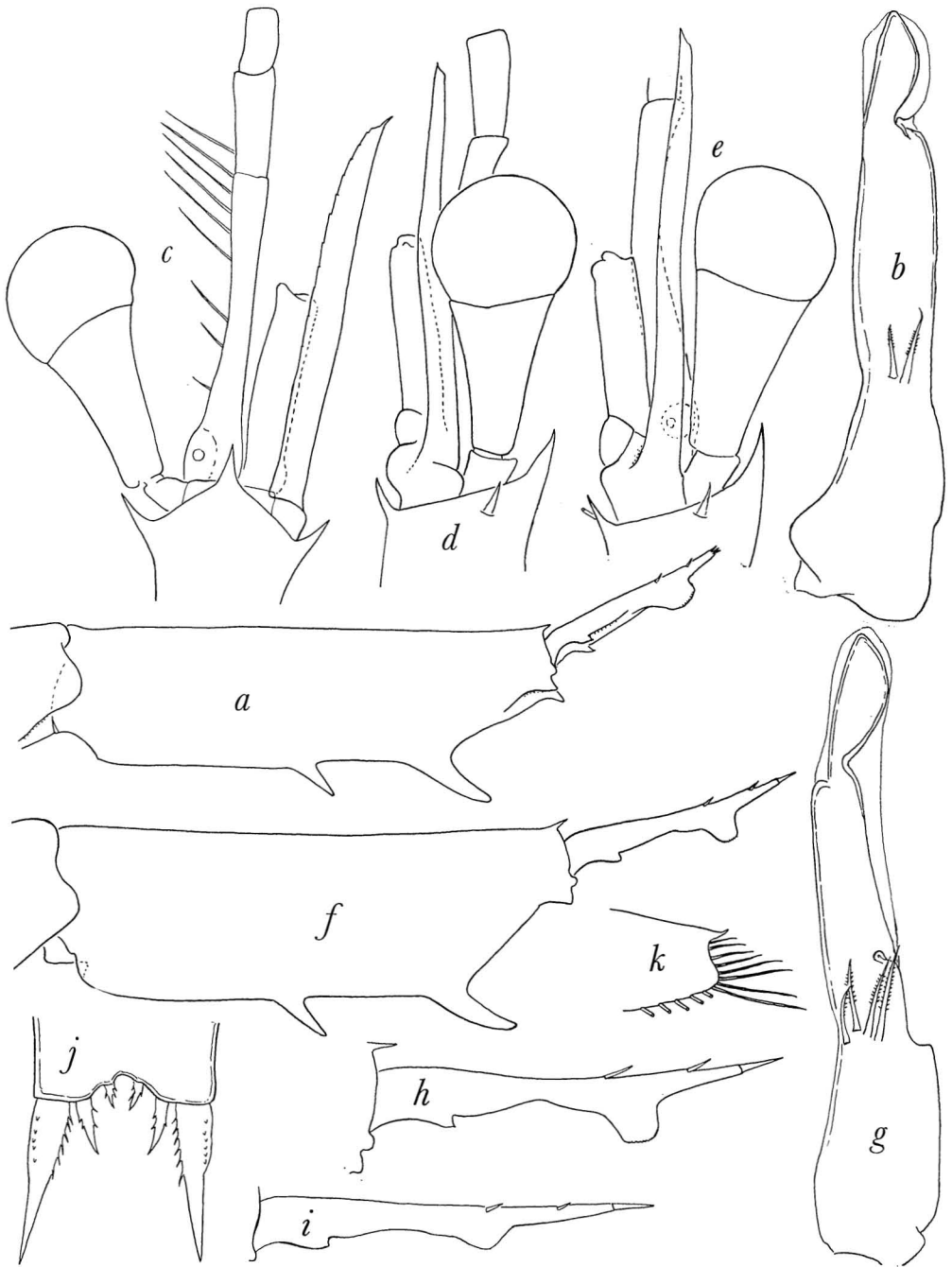


FIG. 2. *a-b*, *Lucifer chacei*: *a*, male 6th abdominal somite and telson, lateral; *b*, endopod of left male 2nd pleopod, anterior. *c-k*, *Lucifer faxoni*: *c*, anterior end of male head, dorsal; *d*, same, lateral; *e*, anterior end of female head, lateral; *f*, male 6th abdominal somite and telson, lateral; *g*, endopod of left male 2nd pleopod, anterior; *h*, male telson, lateral; *i*, immature male telson, lateral; *j*, apex of male telson, dorsal; *k*, apex of exopod of male uropod, dorsal.

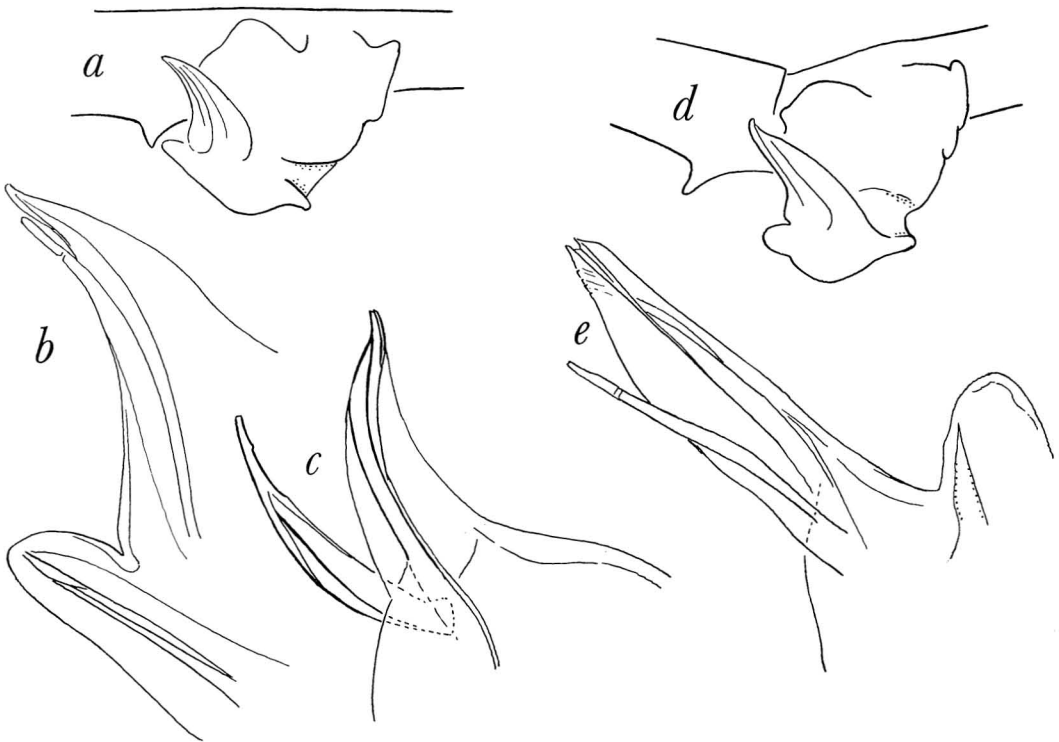


FIG. 3. *a-c*, *Lucifer chacei*: *a*, petasma *in situ*, medial; *b*, petasma sheath with its processus ventralis, and proximal lobe at base of sheath; *c*, petasma sheath of another male, with processus ventralis displaced. *d-e*, *Lucifer faxoni*: *d*, petasma *in situ*, medial; *e*, petasma sheath with processus ventralis displaced.

DIAGNOSIS: A Pacific species belonging to Hansen's (1919) "Group B" (species with short eyestalks), closely resembling the western Atlantic *L. faxoni* in having the apex of the petasma acute, without transverse lines or protruding plates or scabrousness, and in having a slender processus ventralis with acute apex.

The diagnostic features of *L. chacei* in comparison with *L. faxoni* are shown in Table 1.

The new species is named for my colleague, Fenner A. Chace, Jr., in recognition of his many contributions to decapod crustacean taxonomy.

REMARKS: Of the remaining species of *Lucifer*, only *L. hanseni* Nobili agrees with *L. faxoni* and *L. chacei* in having a slender, acutely ending processus ventralis. However, *L. hanseni* can be identified immediately by the uniquely shaped uropodal exopod, in which the outer tooth is located considerably proximad of the distal margin.

Previous workers reporting *L. faxoni* from the Pacific naturally based their identifications

on Hansen's (1919) monograph. None had reason to suspect that Hansen's description and illustrations dealt with an undescribed species. Although Hansen stated that the Copenhagen Museum possessed several samples of Atlantic *L. faxoni*, he could not have compared them carefully with his Siboga material. I cannot believe that the distinguished Danish carcinologist would have overlooked the differences separating the two species.

L. chacei is so similar to *L. faxoni* that it is possible that their genetic divergence is at the subspecific rather than the specific level. They probably have been derived from a common ancestor. The actual level of divergence from this ancestor cannot be ascertained from available collections, and, since the two forms are completely isolated from one another, there is no possibility of gene flow between them at present. If plans for a sea level canal connecting the Caribbean Sea and the Pacific Ocean are carried out, the picture may change drastically.

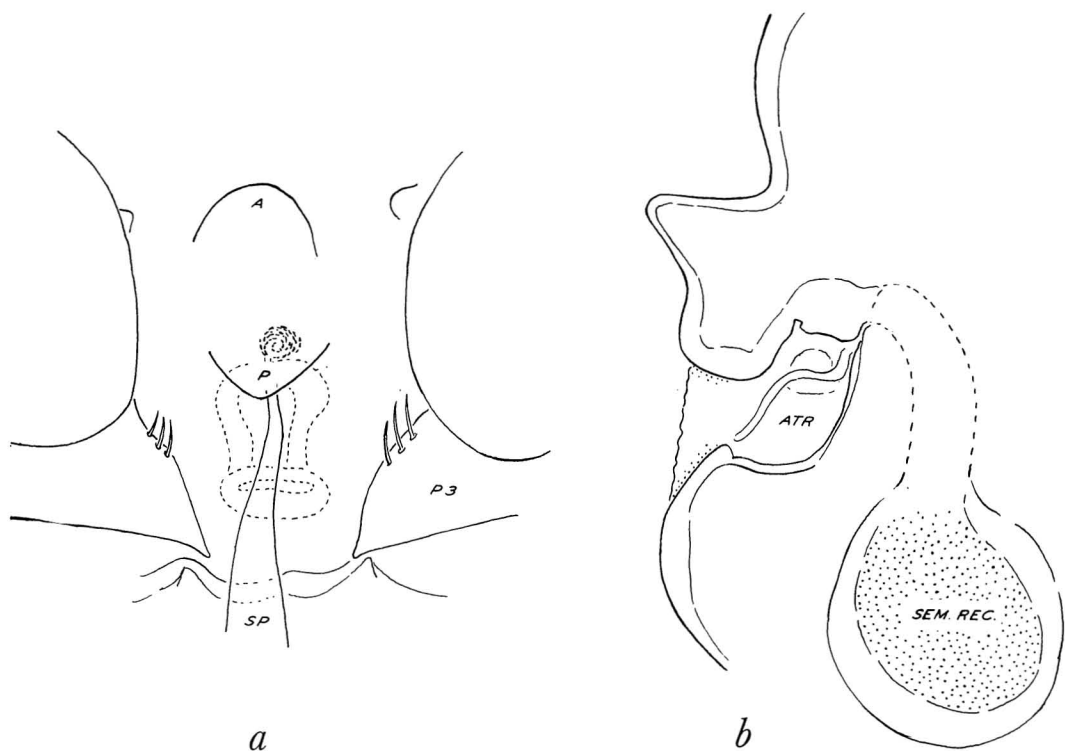


FIG. 4. *Lucifer chacei*, female, thelycum: *a*, ventral, *b*, lateral. *A*, *P*, Anterior and posterior margins of ventral process; *P3*, base of 3rd pereopod; *SP*, spermatophore; *ATR*, atrium; *SEM. REC.*, seminal receptacle.

DISTRIBUTION OF *L. chacei*: EAST INDIES: many localities (Hansen, 1919). HAWAIIAN ISLANDS: Oahu, Molokai (Hiatt, 1947). LINE ISLANDS: Fanning Island (Edmondson, 1923). TUAMOTU ISLANDS: Tikahau Atoll. SOCIETY ISLANDS: Tahiti (Papeete Harbor); Moorea (Paopao Bay); Bora Bora (south of Farepiti Pt., off Tereia Pt., west of Toopua I.). MAR-

SHALL ISLANDS: Rongelap Atoll (off Yugui I.); Eniwetok Atoll (west of Parry I.). It is probably widespread in the tropical Pacific, and, like its Atlantic counterpart, *L. faxoni*, is probably a coastal species. Along the east coast of Australia it is replaced by *L. penicillifer* Hansen (Gordon, 1956).

REPRODUCTION: I have examined the female

TABLE 1

DIAGNOSTIC FEATURES OF *L. chacei* COMPARED WITH *L. faxoni*

<i>Lucifer chacei</i> , NEW SPECIES	<i>Lucifer faxoni</i> BORRADAILE
1. Last segment of peduncle of ant. 2 in ♂ reaches beyond eye and nearly to distal margin of 1st segment of ant. 1 peduncle, in ♀ reaches beyond middle of cornea and to distal third of 1st segment of ant. 1 peduncle.	1. Last segment of peduncle of ant. 2 in ♂ reaches middle of cornea and distal third of 1st segment of ant. 1 peduncle, in ♀ reaches proximal margin of cornea and to distal third of 1st segment of ant. 1 peduncle.
2. Rostrum reaches proximal border of statocyst.	2. Rostrum reaches almost to distal end of statocyst.
3. Ventral cushion of ♂ telson much broader than its posterior height.	3. Ventral cushion of ♂ telson about as broad as its posterior height.
4. Sheath of petasma curved.	4. Sheath of petasma straight.

external reproductive system in specimens cleared in lactic acid. The thelycum consists of a conical median ventral process between the bases of the third pereopods, behind which is a longitudinal slit leading into the atrium, a sclerotized pouch formed by a median depression of the sternum. When present, the spermatophore neck is inserted into the atrium through the slit. The large paired seminal receptacles lie posterior and lateral to the atrium. In my cleared material it was evident that the seminal receptacles connect by ducts to the atrium, but the nature of the ducts was not clear. I could not detect the female genital openings, which Burkenroad (1934) and Gordon (1956) found on the coxae of the third pereopods. The entire system is rather complex and, as Gordon pointed out, is in need of critical study using histological techniques.

Several females from Bora Bora had clusters of eggs attached by short stalks to the ischia of the third pereopods. The eggs were probably about ready to hatch, for well-developed nauplii could be seen through the egg membranes. Because of the ease with which eggs become detached from the third pereopods in preserved specimens, Gordon (1956) doubts that they stay attached until the nauplii emerge, a period of more than 36 hours according to Brooks (1882). The Bora Bora specimens prove that at least some of the eggs remain attached until eclosion.

REFERENCES

- BROOKS, W. K. 1882. *Lucifer*, a study in morphology. Phil. Trans. Roy. Soc. London 173: 57-137, pls. 1-11.
- BURKENROAD, MARTIN D. 1934. The Penaeidea of Louisiana with a discussion of their world relationships. Bull. Am. Mus. Nat. Hist. 68 (art. 2):61-143.
- CHACE, FENNER A., JR. 1955. Notes on shrimps from the Marshall Islands. Proc. U. S. Natl. Mus. 105(3349):1-22.
- EDMONDSON, CHARLES H. 1923. Crustacea from Palmrya and Fanning Islands. B. P. Bishop Mus. Bull. 5:1-43, pls. 1-2.
- 1925. Crustacea, pp. 3-62. In: C. H. Edmondson, W. K. Fisher, H. L. Clark, A. L. Treadwell, and J. A. Cushman, Marine Zoology of Tropical Central Pacific. B. P. Bishop Mus. Bull. 27:i-ii, 3-148, pls. 1-11.
- GORDON, ISABELLA. 1956. The Sergestidae of the Great Barrier Reef Expedition. Great Barrier Reef Exped. Sci. Rept. 6(5):323-333.
- HANSEN, H. J. 1919. The Sergestidae of the Siboga Expedition. Siboga-Expeditie, Monograph 38, 65 pp., 5 pls.
- HIATT, ROBERT W. 1947. Ghost prawns (subfamily Luciferinae) in Hawaii. Pacif. Sci. 1 (4):241-242.
- HOLTHUIS, LIPKE K. 1959. The Crustacea Decapoda of Suriname (Dutch Guiana). Zool. Verh., Leiden, no. 44, 296 pp., 16 pls.