**Xiphonectes tuerkayi** sp.n. from the Indian Ocean with notes on *Xiphonectes longispinosus* Dana, 1852 (Crustacea: Decapoda: Portunidae)

**Xiphonectes tuerkayi** sp.n. из Индийского океана с замечаниями о *Xiphonectes longispinosus* Dana, 1852 (Crustacea: Decapoda: Portunidae)

**Vassily A. Spiridonov**
**В.А. Спиридонов**

P.P. Shirshov Institute of Oceanology of Russian Academy of Sciences, Nakhimovskyi Prospekt, 36, Moscow 117997, Russia. E-mail: vsspiridonov@ocean.ru

KEY WORDS: Species complex, *Xiphonectes*, *Portunus*, revision, characters, sympatry, upper and lower subtidal zone, Red Sea, Bab al Mandab, Gulf of Aden, Arabian Sea.

КЛЮЧЕВЫЕ СЛОВА: Комплекс видов, *Xiphonectes*, *Portunus*, ревизия, признаки, симпатрия, верхняя и нижняя сублитораль, Красное море, Баб эль Мандеб, Аденский залив, Аравийское море.

ABSTRACT. The *Xiphonectes longispinosus* complex which has been a continuing problematic issue of the Portunidae taxonomy is partly revised on the basis of information on the extant type specimen of *X. longispinosus* and the material from several European museums. A female collected by the US Exploring Expedition (1838–1842) and deposited in the Museum of Comparative Zoology of the Harvard University, the only remaining syntype of *Amphitrite longi-spinosa* Dana, 1852 is selected as a lectotype of this species. Two apparently different morphological forms belonging to the *X. longispinosus* complex were found in the Indian Ocean. One of them is considered as belonging to the intertidal — upper subtidal species *X. longispinosus* s.str., the other is described herein as *X. tuerkayi* sp.n. which occurs mostly on the shelf in the lower subtidal zone.

**ВВЕДЕНИЕ**. Комплекс видов *Xiphonectes longispinosus*, бывший серьезной проблемой для таксономии, частично ревизован на основе данных о сохранившемся типовом экземпляре *X. longispinosus* и коллекциях ряда европейских музеев. Самики из сборов Национальной Исследовательской экспедиции США (1838–1842), хранящаяся в Музеях сравнительной зоологии Гарвардского университета, единственная синтип *Amphitrite longi-spinosa* Dana, 1852. Этот экземпляр обозначен в качестве лектотипа данного вида. Две морфологически различные формы, относящиеся к комплексу *X. longispinosus* обнаружены в сборах из Индийского океана. Одна из них отнесена к верхней-сублиторальному — литоральному виду *X. longispinosus* s.str., а другая описана как *X. tuerkayi* sp.n., виду, преимущественно обитающему в нижней сублиторали.

**Introduction**

The Portunidae are one of the most diverse brachyuran crab families mostly occurring in the tropical waters [Ng et al., 2008; Spiridonov, 2013]. Portunid classification at the generic level has been relatively stable for long time since the studies of Stephenson [Stephenson, 1972 and references to earlier works of the 1950–60s herein] and Crosnier [1962] but recently it is in the process of revision [Ng et al., 2008; Schubart, Reuschel, 2009; Spiridonov, 2013; Spiridonov et al., 2014]. In particular, a large genus *Portunus* Weber, 1795 which previously encompassed portunids having nine anterolateral teeth with a broad carapace, and long and relatively narrow chelae [Stephenson, 1972; Ng et al., 2008] was proved to be heterogeneous and polyphyletic [Schubart, Reuschel, 2009; Spiridonov et al., 2014; Koch et al., in prep.]. Small species with spiny posterolateral angles of the carapace formerly included in *Portunus* are currently assigned to the genus *Xiphonectes* A. Milne-Edwards, 1873 which appears to be heterogenous itself [Spiridonov, 2013; Spiridonov et al., 2014; Koch et al., in prep.]. The status of several species of *Xiphonectes* remains unclear. One of the problematic species of the group is *X. longispinosus* (Dana, 1852) with a number of tentative and sometimes dubious identifications and records in the literature.
Taxonomical and nomenclature history of *Xiphonectes longispinosus*

When examining the collections of the US Exploring Expedition (1838–1842) Dana [1852a] described two small crab species and referred them to the genus *Amphitrite* de Haan, 1833 [preoccupied name, see Ng et al. 2008]. The first species, *Amphitrite longispinosus* was described from Ovalau, Fidji Archipelago, Polynesia, while the syntypes of second one, *Amphitrite vigilans* Dana, 1852 originated from the Hawaiian Islands and from Ovalau as well. Milne-Edwards [1873] established the genus *Xiphonectes* to accommodate Dana’s species and described *Xiphonectes leptocheles* A. Milne-Edwards, 1873 from New Caledonia. Paulson [1875] recorded and illustrated *X. longispinosus* from the northern Red Sea and synonymized *Xiphonectes vigilans* to this species. Later on and until the recent time the researchers of the Portunidae considered these species within the genus *Portunus* or *Neptunus* de Haan, 1833, the latter being the junior synonym of *Portunus* Weber, 1795 [i.e. Alcock, 1899; Rathbun, 1906; Sakai, 1939; Stephensen, 1945; Stephenson, Campbell, 1959; Crosnier, Thomassin, 1974; Apel, Spiridonov, 1998; Crosnier, 2002; Ng et al., 2008]. The synonymization of *X. longispinosus* and *X. vigilans* was followed by Rathbun (1906) and became generally accepted [Ng et al., 2008]. Subsequently Stephenson and Campbell [1959] also included *X. leptocheles* into the synonymy of *X. longispinosus*.

Many authors mentioned variability of the species. Alcock examined several specimens from the Andaman and Laccadive Islands, Mauritius and the Persian Gulf and noted significant variability: “the number of (anterolateral) teeth…varies from 6 in the young to 9 in the adult, though there are adults with less than 9”, “3 or 4 spines on the anterior border of arm” [Alcock, 1899: 41]. Crosnier [1962] and Stephenson and Rees [1967] discussed two forms of *Xiphonectes* (in their combination *Portunus*) *longispinosus*: the one with relatively short chelipeds, such as recorded by Rathbun [1906] from the Hawaiian Islands, and the one with long and slender chelipeds, such as recorded by Sakai [1939] from Japan. Spiridonov [1994] suggested to name *Xiphonectes longispinosus* sensu Sakai as forma *longimera* (exemplified by a specimen recorded by him from the Socotra I. area in the Arabian Sea). This name was introduced as a working infraspecific name with extension “forma” after 1960 and this did not make it available in the sense of International Code of Zoological Nomenclature (ICZN) [International Commission on Zoological Nomenclature, 1999: Article 15.2]. Apel and Spiridonov [1998] noticed that apparently more than one species was recorded under the name *longispinosus* in the Indian Ocean and preferred to identify their material from the Persian Gulf as cf. *longispinosus*. Furthermore Crosnier [2002] presented description of relatively deep living *Portunus* cf. *longispinosus* from Marquises which was apparently not conspecific to the shallow water specimens from the Persian Gulf. The situation became increasingly confusing and could not be resolved without examining the type material of *X. longispinosus*.

When studying the portunid crabs fauna of the Red Sea and the adjacent Arabian region I was challenged to clarify status of two apparently different forms belonging to the *X. longispinosus* complex. Fortunately it was possible to locate Dana’s syntype and revise the diagnosis of *X. longispinosus* s. str along with some of its records. Furthermore particular specimens from the Indian Ocean previously recorded under *X. longispinosus* have been recognized as a new species which description is presented herein.

**Material and methods**

The material used in the present study originates from several museum collections: Natural History Museum in London (NHM), Naturhistorisches Museum Wien (NHMW) in Vienna, Forschungsinstitut und Museum Senckenberg in Frankfurt on Main (SMF), Zoologisches Museum der Universität Göttingen (ZMG, in deposition in SMF), and Zoological Museum of Moscow University (ZMMU). Besides this I examined a photograph of the syntype specimen of *Amphitrite longispinosus* deposited in the Harvard Museum of Comparative Zoology of Harvard University (HMCZ) taken and kindly sent to me by Mr. Adam Baldinger, the curator of invertebrate collection.

The terminology for description follows Crosnier [1962], Apel and Spiridonov [1998], Ng et al. [2008], and Spiridonov et al. [2014]. The terms “pleon” and “pleonal” are used in favor of “abdomen” and “abdominal”. Ov is abbreviation for “ovigerous”, P1 to 5 is abbreviation for “pereiopod”. Measurements include carapace length (CL) along the midline, maximum carapace width (CWmax) between the tips of posterior anterolateral teeth. Other measurements: carapace width between bases of pre-posterior anterolateral teeth (CW0), length of pereopods 1–5 (P1–5). All sizes are given in mm.

**Taxonomy**

Order Decapoda Latreille, 1802
Infraorder Brachyura Linnaeus, 1758
Section Heterotremata Guinot, 1977
Superfamily Portunoidea Rafinesque, 1815
Family Portunidae Rafinesque, 1815
Genus *Xiphonectes* A. Milne-Edwards, 1873

**Diagnosis to the *Xiphonectes longispinosus* species group**

Carapace broad, more than twice as broad as long in males and about twice as broad as long in females; regions are better expressed in males than in females. Surface with granular patches and ridges but without
Xiphonectes longispinosus (Dana, 1852)

Figs 1A–E, 2A–F, 3A–D.

Amphitrite longi-spino-sa Dana, 1852a: 84.
Amphitrite longi-spinosa — Dana 1852b: 277, pl. 17 fig. 2.

Xiphonectes longispinosus — Paulson, 1875: 56, pl. 8, figs 4, 4a.


Xiphonectes longispinosus — Stephenson, Campbell, 1959: 104, fig 2F, 3F, pl. 2, fig. 2, pls 4F, 5F.


Portunus (Xiphonectes) longispinosus longispinus — Ng et al., 2008: 150.


Portunus longispinosus — Fishelson, 1971: 119 (misspelling). — Xiphonectes vigilans var. obtisidentatus Miers, 1884: 538, pl. XLVII, fig. A.

? Portunus longispinosus obtisidentatus — Ng et al., 2008: 150.


Not Portunus longispinosus forma longimera — Spiridonov, 1994: 136–138, fig. 5 (= Xiphonectes tuerkayi sp.n.).

Not Portunus longispinosus longispinus — Nagai, 1991: 27, pl. I A–D (= Xiphonectes cf. tuerkayi sp.n.)

Not Portunus cf. longispinosus — Crosnier 2002: 405–410, figs 1, 2 (= Xiphonectes cf. tuerkayi sp.n.).

MATERIAL. Syntype of Amphitrite longi-spinosa. 1 female (HMCZ 4290), Fiji (Fiji) Islands, US Exploring Expedition, J.D. Dana coll. (photo provided by A. Baldinger).

OTHER MATERIAL. 3 males, 3 females ov (ZMG 1102), Philippines, Panglao I. near Bohol I., 1876. C. Semper coll. 1 female (NHM 88.34), Andaman Sea, Burma, Gulf of Martaban, 1888, J.W. Oates coll. 1 female (SMF 24394), Persian Gulf, Saudi Arabia, Karan Island, 27°43′N 49°49′E, 10–13 m, 22.V.1995, M. Apel coll. 1 male (SMF 24395), Gulf of Oman, United Arab Emirates Fujairah, Al-Aqua, Sandy Beach Hotel, 25°30′N 56°22′E, 3–4 m, 4 VII.1995, M. Apel coll. 1 female ov (NHMW 2820), Red Sea, SMS “Pola Expedition. 1 male (NHMW 2821), Red Sea Saudi Arabia, Jeddah, SMS “Pola” Expedition, 8.11.1895. 1 male, 1 juv. (ZMMU Ma 3478), Red Sea, Egypt, off Hurghada, Shaab Sheer Reefs, sand, night dive, 10–12 m, 30.01.2000, V Spiridonov, D Zhadan coll. 3 males, 3 females, 1 juv (ZMMU Ma 3491), Red Sea, Egypt, off Hurghada, reefs Fanoose East, 10 m, sand, night dive, 31.01.2000, V. Spiridonov, D. Zhadan coll.


TYPE MATERIAL. Dana [1852a, b] did not mention the number of individuals studied by him. Important characters of his description are the following: “carapace areolate …; antero-lateral teeth five, minute, not contiguous, inter-antennary front four-toothed, the two median teeth minute, the other prominently triangular … arm with a single spine at the outer apex, and three on the inner margin, … The third joint of the outer maxillipeds is oblong, but nearly flat to its anterior margin, yet somewhat obliquely curved in its anterior part” [Dana 1852b: 277–278]. As the outer orbital lobe was not counted by Dana as an anterolateral tooth, the actual number of these teeth in the type specimen is seven, that is confirmed by the illustration of a male specimen [Dana, 1855: pl. 17, fig. 2a–2c].

Rathbun [1902: 131] wrote that “two types (male and female) of Dana’s Xiphonectes longispinosus are preserved in the Museum of Comparative Zoology”. However, subsequently Stephenson [1976] stated that Dana’s types were lost. According to the information received from the curator of the HMCZ invertebrate collection Adam Baldinger [pers. comm.], a male and a female were registered in the Catalogue of HMCZ with the following data: Catalogue number 4290; original number 165; name “Xiphonectes longispinosus (D.J.)”, later “Xiphonectes” was put in brackets and lined through, “Portunus” was written above it by other hand; sex “male and female”, locality “Fiji Islands”. The outer orbital lobe was not counted by Dana as an anterolateral tooth, the actual number of these teeth in the type specimen is seven, that is confirmed by the illustration of a male specimen [Dana, 1855: pl. 17, fig. 2a–2c].

Xiphonectes tuerkayi sp.n. from the Indian Ocean

The male syntype described and figured by Dana and the female syntype show dissimilarity apparently

Xiphonectes tuerkayi sp.n. from the Indian Ocean

359
not related to sex. In particular this is the number of anterolateral teeth (seven in the male, and nine in the female), and the number of spines on the anterior margin of cheliped merus (three in the male and four in the female). The frontal margins differ as well, the female has lower and more rounded lateral frontal lobes. While differences in the shape of the frontal margin may be related to accuracy of drawing, the number of spines in both cases is consistently documented in both the description and the illustration. Even though, there is still a possibility that the proximal spine on the anterior margin of cheliped merus (small in the female syntype, see Fig. 1C) has been overlooked in the male syntype and the number of anterolateral teeth varies within a species (see remarks on the Red Sea specimens below), it is possible that Dana’s type series is heterogenous. The male syntype is particularly close to *Xiphonectes iranjiae* (Crosnier, 1962) (compare to Crosnier, 2002: figs 4, 5) while the female fits the generally adopted concept of *X. longispinosus* (with 9 anterolateral teeth and 4 spines on the anterior margin of cheliped merus). In this situation, in order to provide stability of nomenclature I select the only known to be extant female syntype (HMCZ 4290) as a lectotype of *Amphitrite longi-spinosa* Dana, 1852.

**DIAGNOSIS.** Carapace with patches of moderate granules, posterolateral granular ridge relatively low, diffused (Figs 1A, 2A, C, E). Usually nine anterolateral teeth but the number may be reduced to 8–7 (Figs 1A, 2A, C, E). Lateral frontal lobes relatively low, often not reaching to level of inner infraorbital lobes, distinctly broader than long, terminally rounded in females (Figs 1A, 2A, 3B–D); median frontal lobes minute, broader than long, usually terminally rounded, separated from lateral lobes by a broad u-shaped gap (Figs 1A, 2A, E, 3B–D). Mesial corner of inner supraorbital lobe usually rounded (Figs 1A, 2C, E, 3A–D). Cheliped about 2.5 times or more longer than carapace in males but usually less in females; its merus 3 times as
Xiphonectes tuerkayi sp.n. from the Indian Ocean

Fig. 2. Xiphonectes longispinosus. A — male (ZMG 1102), Philippines, 9.0 × 22.8 mm, dorsal view; B — same specimen, ventral view; C — female (NHM 88.34), 6.5 × 16.5 mm, Gulf of Martaban, dorsal view; D — female ov (NHMW 2820), 6.5 × 16.5 mm, Red Sea, dorsal view; E — male, (ZMMU Ma 3478), 6.5 × 17.8 mm, Red Sea, dorsal view; F — same specimen, ventral view. Scale bar: 10 mm (A); 2 mm (C, D, E, F).

361

long as broad in males but usually less in females. Pleomere 3 of male lacks a distinct keel. Pleomere 6 of male broader than long with not markedly sinuous, converging lateral margins (Fig. 2B, F).

COLOURATION. Background colouration of the carapace white-grayish. Gastric region and granular ridges of carapace emarginated by greenish bands and small orange spots. Transverse greenish bands on pereopods (authors’s notes on live colouration made after collecting specimens ZMMU Ma 3478 and 3491 in the Red Sea).

VARIATION. Among the studied material the specimens from Philippines and the Gulf of Martaban are most similar to the lectotype; while females have the frontal margin resembling the lectotype, lateral and median lobes in males are more sharpened (Figs 2A,
This generally stands for sex related variation in the specimens from the Persian Gulf/ Gulf of Oman and the Red Sea. Some specimens from the Persian Gulf, in particular SMF 24394 have a reduced number of anterolateral teeth, i.e. 8 on the right side, while the specimen from the Gulf of Oman has a complete set of teeth. In the Red Sea specimens variation in the anterolateral teeth number was also recorded. In particular two largest males from Egypt with CL 6.3 and 6.9 mm have 8 teeth and a minute 5th tooth on the right side (Fig. 2F) and 7 teeth on the left side (ZMMU Ma 3478) (Fig. 2E), or 9 (ZMMU Ma 3491) teeth with minute the 6th tooth, respectively. Smaller males may also have either complete or incomplete and assymetric (up to 7 on one side and 8 on the other side) number of teeth. The ovigerous female from the Red Sea (NHWW 2820) has 7 anterolateral teeth on both sides. Throughout the studied sample no specimens with less than 4 spines on the anterior margin of cheliped merus were found although the male from the Persian Gulf, in particular SMF 24394 have a reduced number of anterolateral teeth, i.e. 8 on the right side, while the specimen from the Gulf of Oman has a complete set of teeth.
Xiphonectes tuerkayi sp.n. from the Indian Ocean

Gulf has a poorly distinguishable proximal spine so that illustration of this specimen in Apel and Spirdonov [1998: fig. 114] may leave impression of the presence of 3 spines only. The largest male from Philippines has the 5th proximal spine (smallest in size) on the anterior margin of cheliped merus.

SIZE. Female lectotype measures 6.3 × 12.9. Male paralecotype measured by Dana [1852b: 278] had CL 3 lines (7.6 mm), and CWmax 6.75 lines (17.1 mm). Gulf of Martaban: female 6.5 × 16.5. Philippines: males 9.0 × 22.8 – 9.2 (CL), females ov 7.9 × 18.8 – 9.4 × 19.5. Persian Gulf and the Gulf of Oman: male 7.2 × 15.8, female 6.5 × 14.3. Red Sea: males 6.3 × 17.8 – 6.9 × 16.5; females 3.6 × 9.6 – 4.0 × 9.4; female ov 6.5 × 15.0. Ovigerous female, holotype of Xiphonectes vigi-
lans var. obtusidentatus 10.5 × 24.0.

ECOLOGY. The type material originates from a coral reef [Dana, 1952b]. The specimens collected in

Fig. 4. Xiphonectes tuerkayi sp.n., male, holotype (ZMMU Ma 4109), Arabian Sea, off Socotra I. A — dorsal view; B — details of dorsal carapace and proximal parts of pereiopods; C — ventral view; D — details of thoracal sternal region and pleon; E — chelae and cheliped carpi, outer view; F — maxillipeds, buccal cavity and orbit, ventral view. Scale bar: 2 mm (A, C, F), 5 mm (B, D), 4 mm (E).
the Persian Gulf, the Gulf of Oman [Apel, Spiridonov, 1998], Madagascar [Crosnier, Thomassin, 1975] and the Red Sea (present study) inhabited sandy (in one case muddy) bottom in the vicinity of coral reefs in the upper subtidal zone (3–13 m) and demonstrated nocturnal activity (author’s observation). In the Red Sea, *X. longispinosus* was also recorded as a characteristic species of the lower intertidal – upper subtidal communities of sandy bays [Fishelson, 1971].

**DISTRIBUTION.** Ovalau, Fidji (type locality), Philippines (present study). Australia [Stephenson, Campbell, 1959]. Andaman Islands (present study). Persian Gulf, Gulf of Oman [Apel, Spiridonov, 1998], Maldive Islands [Rathbun, 1902]; Madagascar, Toulear [Crosnier, Thomassin, 1975]. Red Sea [Paulson, 1875; Klunzinger, 1913; Balss, 1924; Fishelson, 1971; present study]. Other records in the literature need confirmation of the species identity (see Remarks).

**REMARKS.** When recognizing heterogeneity in *X. longispinosus* Stephenson and Rees [1967] pointed out variation in the ratio of cheliped to carapace length. This is a variable character also subject to sexual dimorphism, i.e. relatively shorter chelipeds in females. The male of *X. longispinosus* sensu Sakai [1939, 1976] is characterized by relatively long chelipeds (about 2.5 times as long as CL) and thus it could be referred either to the present species or *X. tuerkayi* sp. n. but for the final decision details of the carapace granulation, frontal margin and male pleon morphology should be examined. *X. cf. longispinosus* sensu Crosnier [2002], another form with long cheliped is closer but probably not conspecific to *X. tuerkayi* sp. n (see below). On the other hand *X. longispinosus* sensu Rathbun [1906: pl. 12, fig. 6] from the Hawaiian Islands appears to be different from *X. longispinosus* in the present concept. It has 8–9 anterolateral teeth, relatively short chelipeds (about 2.5 times longer than CL) but 4–5 teeth on the anterior margin of cheliped merus while the ratio of cheliped merus length to width in males measured using a photograph [Rathbun, 1906: pl. 12, fig. 6] is less than 2.5.

Dana [1852a] described *Amphitrite vigilans* based on the specimens from Ovalau, Fidji and Sandwich Islands (Hawaii). The difference between this species and *X. longispinosus* may be derived from Dana’s description and illustrations [1852b: 278, pl.17, figs 3a–3d]: among 8 anterolateral teeth, the 2nd and 3rd are less distinct granular patches than in *X. longispinosus* in the present concept. *X. longispinosus* is characterized by relatively long chelipeds (about 2.5 times longer than CL) and thus it could be referred either to the present species or *X. tuerkayi* sp. n. but for the final decision details of the carapace granulation, frontal margin and male pleon morphology should be examined. *X. cf. longispinosus* sensu Crosnier [2002], another form with long cheliped is closer but probably not conspecific to *X. tuerkayi* sp. n (see below). On the other hand *X. longispinosus* sensu Rathbun [1906: pl. 12, fig. 6] from the Hawaiian Islands appears to be different from *X. longispinosus* in the present concept. It has 8–9 anterolateral teeth, relatively short chelipeds (about 2.5 times longer than CL) but 4–5 teeth on the anterior margin of cheliped merus while the ratio of cheliped merus length to width in males measured using a photograph [Rathbun, 1906: pl. 12, fig. 6] is less than 2.5.


**Portunus longispinosus forma longimera** — Spiridonov, 1994: 136–138, fig. 5 (non-available name in the sense of ICZN: Article 15.2).

**Portunus longispinosus longimerus** — Ng et al., 2008: 150 (non-available name in the sense of ICZN: Article 15.2).

**Portunus longispinosus vigilans** — Nagai, 1981: 27, pls. 1 A–D.

**Portunus tuerkayi** sp. n.

Figs 3E–H, 4A–F, 5A–D, 6A–B, 7A–D.


**Portunus longispinosus forma longimera** — Spiridonov, 1994: 136–138, fig. 5 (non-available name in the sense of ICZN: Article 15.2).

**Portunus longispinosus longimerus** — Ng et al., 2008: 150 (non-available name in the sense of ICZN: Article 15.2).

**Portunus longispinosus vigilans** — Nagai, 1981: 27, pls. 1 A–D.

**Portunus tuerkayi** sp. n. — Crosnier, 2002: 405, figs 2–3.

**Not Amphitrite longispinosus** Dana, 1852a: 84.

**MATERIAL EXAMINED.** Holotype. Male (ZMMU Ma 4109), Arabian Sea, Yemen Exclusive Economic zone, off Socotra I., R.V. “Odyssey”, cruise 33, Sigsbee trawl haul # 2, 11°55.9′N 53°47.9′E, 86 m, coll. B.I. Sirenko.

**OTHER MATERIAL.** Straits of Bab al Mandab.1 male, 1 female ov (ZMMU Ma 2609, identified as *Portunus longispinosus*), R.V. “Akademik Alexander Kowalevsky”, Stat. 607/57A, Sigsbee trawl, 35 m, sand with remains of byrozoans and shell, 8.09.1963, V.V. Murina coll. 1 male (ZMMU Ma 3497), Bab al Mandab, R.V. “Akademik Alexander Kowalevsky”, Stat. 401, 11.01.1962.

**Infer Gulf of Aden.** 20 males, 8 females, 20 juv. (SMF 22968, identified as *Portunus longispinosus*), Jibouti, R.V. “Meteor”,
Fig. 5. External genital characters of *Xiphonectes tuerkayi* sp.n. A — holotype, gonopod 1, pleonal view; B — same specimen as A, sternal view; C — holotype, gonopod 2, pleonal view; D — ovigerous female (ZMMU Ma 2409), Bab al Mandab, thoracal sternal region and genital openings. Scale bar: 1 mm (A, B), 0.5 mm (C), 2 mm (D).

Cruise 5, Stat. 236 Ku, 12º21.2′N 43º27.1′E – 12º219.0′N 43º27.8′E, 35–45 m, 6.03.1987. 7 males, 5 females (SMF 22974, identified as *Portunus longispinosus*), Jibouti, R.V. “Meteor”, Cruise 5, Stat. 236 Ku, 12º21.2′N 43º27.1′E – 12º219.0′N 43º27.8′E, 35–45 m. 16 juv. (SMF 33390), same data as SMF 22974, Baumkurre. 5 males, 7 females, 3 juv. (SMF 22973, identified as *Portunus longispinosus*), Jibouti, R.V. “Meteor”, Cruise 5, Stat. 236 KD, 12º21.4′N 43º26.9′E – 12º20.6′N 43º27.3′E, 35–45 m, 6.03.1987. 1 female (ex NHM 87.16, identified as *Xiphonectes longispinosus* var.), Gulf of Oman, Muscat, 9–36 m (5–20 fm), Al. J.B. Miles coll. 1 female (ex NHM 88.34), Andaman Sea, Burma, Gulf of Martaban, J.W. Oates coll.

**COMPARATIVE MATERIAL of *Xiphonectes cf. longispinosus* sensu Crosnier, 2002.** 1 male (NHM 83.31) Tongatabu (Tonga Is.), HMS “Challenger”, Station 172, 18 fathoms (about 32.5 m), 22.07.1874.

**TYPE LOCALITY.** Arabian Sea, off Socotra I. (Yemen).

**DIAGNOSIS.** Carapace with patches of coarse granules, posterolateral granular ridge relatively high, consolidated. Nine anterolateral teeth both in adult and juvenile specimens. Lateral frontal lobes relatively long, usually reaching to level of inner infraorbital lobe, about as broad as long, triangular, sharpened terminally in both sexes, median frontal lobes about half as long as submedians, triangular, sharpened terminally,
patches proximal to 2nd–4th and 5th–6th anterolateral teeth; granules are present in the anterior part of carapace: a The following ridges and patches consisting of larger Carapace maximum height to length ratio about 0.5. level of 5th anterolateral teeth. Two pairs of broad anterolateral tooth to about fourth of carapace width at arched epibranchial ridges extend from tips of last posterolateral margin markedly concave, posterolateral re-entrant well developed. Posterior margin comprises about 33% of carapace width, slightly convex, its corners are spiniform and turned upward. Subhepatic and pterygostomial regions moderately granulated (Fig. 4F). Sutures of thoracic sternum relatively distinct, 2nd, 3rd and anterior part of 4th sternite covered with coarse granules; median hollow running along sternite 4. Sternites 5, 6 and lateral part of sternite 7 with finely granulated anterior margins, otherwise nearly smooth. Sternite 5 with mesial posteriorly directed projection bearing a button of the pleon-locking mechanism. Median portion of posterior margin of sternite 4, secondary sternal sulci and mesial projections of sternite 5 form horseshoe-shaped cavity. Suture 5/6 nearly complete, suture 6/7 complete in lateral two thirds, suture 7/8 complete in lateral half. Sutures between sternites and episternites complete. Episternites sickle-shaped (Fig. 4D). Penial furrow shallow, with short feebly produced quasitriangular lobes in lateral portion of sternite 8; penis reaching to about 80% of sternite width.

Mouthparts characteristic for Portunoida. Endopod of maxilliped 1 with a somewhat enlarging distally and terminating in a tuft of setae lobe which extends beyong mesial margin of broadened distal part of endopod (Fig. 4F). Endopod of maxilliped 2 with terminal three articles perpendicular to mesus; propodus with anteriorly directed lobe; strong bristles along mesial margins of this lobe and dactilus. Maxilliped 3 smooth in inner face, pilose in outer face and setose on margins. Exopod, and the coxa, basis and ischium of endopod have characteristic for Brachyura Heterotremata morphology. Ischium of endopod with a clear longitudinal groove on outer face, mesial margin beset with relatively sparse rigid setae. Anterior margin of merus produced forward and convex, with few long setae. Mesial margin narrowing from articulation with carpus to articulation with ischium, in posterior half densely beset with strong setae. Carpus, propodus and dactylus are of characteristic for Heterotremata morphology (Fig. 4F).

Chelipeds 2.5 times longer than carapace, finely and irregularly granular, covered with irregularly placed tomentum. Coxa and basis nearly smooth; ischium smooth to finely granulated in dorsal face, irregularly granular in ventral face and with a proximal eminence and a row of dentiform increasing in size granules along anterior margin. Merus 2.9 times as long as broad; a costa-like suture extends in posterior half of dorsal face ending in a distal spine on posterior margin; ante-rior to costa there are irregular oblique rows of granules; less regular granulation posterior to costa; on ventral face there is dense fine granulation in anterior half and a reticulate granular pattern in posterior half; curved distal spine in dorsal face at articulation with carpus. Four sharp curved spines at anterior margin of merus: distal most one located close to the articulation with carpus, about ten of large granules between it and three spines in the proximal half, most proximal one
Xiphonectes tuerkayi sp. n. from the Indian Ocean

being smallest (Fig. 4A, B). On dorsal face of carpus there are 3 diverging carinae, most lateral one ending in a sharp and relatively broad in dorsal view outer spine, one in middle going towards a proximal spine on cheliped propodus but not reaching margin of carpus, mesial one ending in a usual for Portunidae inner spine; scattered granules between carinae; distal margin beset with sharp granules (Fig. 4A, E). Chelae differ in size, heterodontic. On dorsal face of chela manus a usual spine at articulation with carpus present, being curved and sharp; two diverging granular carinae end in conspicuous spines in distal third of manus (Fig. 4A, E). Two less distinct carinae are present on outer (lateral) face of manus. Faces of manus between carinae and inner face evenly granulated, lower face with moderate squamiform marking. Chela fingers carinated. A moderate prismatic molariform tooth on cutting edge of dactylus of larger chela opposes to a mucronate tooth on the pollex. Anterior to the dactylus there is a series of closely set conical teeth resembling a saw, proximal of them are larger, then few large teeth are intermittent with numerous smaller ones. On cutting edge of pollex next to mucronate tooth there are 3 multi-lobed teeth with large central lobes (Fig. 4E).

Pereiopods 2–4 shorter than chelipeds, decreasing in size posteriorly; they are slender, smooth or finely granulated on anterior faces and morphologically similar to each other. Basis and ischium short, merus longest, about 5 times as long as broad, comprising about one third of pereopod length, carpus and propodus little narrower than merus, propodus and dactylus of about same length, dactylus narrow, styliform, indistinctly grooved. Sparse short hairs on anterior face of propodus and distal half of dactylus.

Pereiopod 5 shortest; merus and carpus are about as broad as long, antero-lateral corner of the latter serrated; propodus and dactylus comprise more than half of pereiopod length, with usual for Portunidae costae and emargination of dense tuft of hairs, propodus paddle-shaped, nearly 1.7 times as long as broad, dactylus foliaceous about 2.3 times as long as broad (Fig. 4A–C).

Male pleon broad at level of pleomeres 1–5 and then tapering. Pleonal terga 1–2 with transverse keels over nearly entire width. Terga 3–5 fused, their lateral margin sinuous. Distinct transverse keel extending over more than 70% width of tergite 3. Sixth pleomere about as broad as long, with sinuous lateral margins. Anterior margin slightly concave with wrapping postero-lateral corners of last pleomere. Telson nearly as broad as long, with convex lateral margins and rounded tip (Fig. 4D).

Gonopod 1 with quasi-trapezoidal basal lobe having rounded corners; proximal part robust, the sternal face is flattened and the pleonal one is convex. Sparse hairs along canal opening on sternal face, otherwise proximal part is bare. Neck is curving laterally smoothly but sharply to tapering tip and small laterally exposed opening. A row of about 15 microscopical spinules in the distal part run along sternal face nearly to the tip; there few additional spinules are irregularly placed; similar row of spinules and scattered spinules near tip on pleonal face. About 20 minute spinules on mesial face and about 12 ones on lateral face just near the tip (Figs 5A, B, 6A, B). Gonopod 2 more than half length of gonopod 1, thin, sinuous, tapering to tip but slightly enlarging to juncture with minute leaf-like terminal article (Fig. 5C).

FEMALE CHARACTERISTICS (specimen from the Bab al Mandab, Red Sea). CW/CL ratio is somewhat less than in male amounting to 2.0. Pleon broad, covering sterno-pleonal cavity. Pleomere terga 2–3 with transverse keels extending over entire width, in tergum 4 transverse keel extending for more than half of width. Terga 5–6 smooth. Genital opening occupies more than half length of mesial part of the sternite, tapering medially and broadening laterally, broader than long, with long axis nearly parallel to posterior margin of sternite (Fig. 5D).

COLOURATION. Colour in live unknown.

VARIATION. Specimens from the Gulf of Aden (including numerous juveniles) and the female from the Gulf of Martaban show relatively longer and narrower median frontal lobes (Figs 3F, G, 7C) than specimens from Bab al Mandab (Figs 3H, 7A). The penultimate pleomere in the males from the Gulf of Aden is usually longer than broad (Fig. 7B, D) vs. about as long as broad in the holotype and the specimens from Bab al Mandab (Figs 3H, 7A).

Fig. 6. Gonopod 1 of Xiphonectes tuerkayi sp. n., holotype. A — distal part, pleonal face; B — tip, sternal face. Scale bar 0.5 mm.
In contrast to *X. longispinosus* which demonstrates a tendency to reduction of the anterolateral teeth number, even juveniles of the present species have a complete set of nine teeth. The only example of the reduced number of anterolateral teeth is a juvenile male from the Gulf of Aden, which has 9 teeth on the right side and only 5 on the left one. However, an abnormally large 2nd tooth indicates malformation, possibly fusion of at least three teeth and reduction of others (Fig. 7C).

**SIZE.** Holotype measures CL 13.5, CWmax 30.0, CW0 21.0; P1 (right) 34.2, P1 (left) 33.3, P2 27.4; P4 22.0; P5 15.0. The male and ovigerous female CW0 21.0; P1 (right) 34.2, P1 (left) 33.3, P2 30.0, P3 18.0, P4 17.0 and 11.0. Smallest externally recognized sex-specific shape of pleon measure 7.8 (CL) to 11.4 × 25.0 × 18.5, smallest externally recognized female measures 7.5 × 19. 4 × 16.5. Juveniles with CL 4.0–5.5 can be hardly sexed using external characters.

Female from the Gulf of Martaban measures 8.0 × 18.0 × 12.4. AFINITIES. The present species belongs to the group of *Xiphonectes* species with four-lobed front, very long last anterolateral tooth (spine), a single distal spine on the posterior face of cheliped merus, and two distal spines on the upper face of cheliped manus. These species differ from such species as *Xiphonectes bidentis* (Laurie, 1906) which have only one distal spine on the upper face of cheliped manus. This group includes *Xiphonectes emarginatus* (Stephenson et Campbell, 1959) (= *Portunus stephensi* Moosa, 1981), *X. longispinosus* (Dana, 1852), *X. iranjae* (Crosnier, 1962), *X. leptoteles* A. Milne-Edwards, 1873, *X. macrophthalimus* (Rathbun, 1906), *X. tenuicaudatus* (Stephenson, 1961). They also have similar first gonopods, (i.e. Stephenson, 1961: figs 2C, 3H; Crosnier, 1962: figs 115–116; Crosnier, Thomassin, 1974: fig. 4g; Apel, Spiridonov, 1998: fig. 114b; Crosnier, 2002: fig. 3B); in *X. leptoteles* and *X. macrophthalimus* the gonopod is not illustrated). Macroscopic morphology of these gonopods can be hardly used for distinguishing between species while microscopic details have not been described for most of species.

From *X. emarginatus* [Stephenson, Campbell, 1959: 107, figs 2H, 3H, pl. 2, fig. 4] the new species differ by distinct and well-developed median and lateral frontal lobes vs. the frontal margin being markedly flattened, median lobes being very low and the lateral ones faint to practically absent [Crosnier, 1962: fig. 108].

*X. tuerkayi* differs from *X. iranjae*, *X. leptoteles*, and *X. tenuicaudatus* by 4–5 vs. 3 spines on the anerolateral margin of cheliped merus. *X. tuerkayi* also differs from *X. iranjae* by thinner anterolateral teeth of carapace (usually 9 in the new species vs. 6–7 in *X. iranjae*), by the absence of fused granular patches in the mesogastric and cardiac regions [Crosnier, 2002: fig. 4], by more elongated and rounded anterior part of the 3rd maxilliped merus which in *X. iranjae* is truncated [Crosnier, 1962: fig. 110].

From *X. leptoteles* [Milne-Edwards, 1873: 159–158, pl. 4, 1, 1a] *X. tuerkayi* differs by markedly developed granular patches and fine granulation of carapace surface between them and chelipeds vs. transformation of granular patches to solid tubercles and nearly smooth surface of the carapace and chelipeds in the former species.

From *X. tenuicaudatus* the new species also differs by the absence of elevated tubercles on the carapace in the gastric, mesobranchial and cardiac regions, relatively high and sharp median frontal lobes (vs. low and rounded) and sharper anterolateral teeth.

The new species differs from *X. macrophthalimus* by the presence of 9 anterolateral teeth vs. 7–8 ones and by morphology of penultimate pleomere which in the latter species is distinctly longer than broad and much constricted anteriorly [Rathbun, 1906: fig. 31]. *X. tuerkayi* is most similar to *X. longispinosus* sensu str. Even though the material is not yet sufficient for correct statistical comparison the first species appears to be a larger species than the second attaining greater maximum size in both males (CL 13.5 vs. 9.2) and females (CL 11.0 vs. 9.5). In the Red Sea and the Gulf of Aden area these contrasts are stronger than in other areas. While in *X. longispinosus* females as small as those with CL 6.5 may be ovigerous, in *X. tuerkayi* this is still a size of juveniles. Morphological differences between these two species are summarized in the Table.

The present species is also very similar to *Xiphonectes cf. longispinosus* sensu Crosnier, 2002 which is most likely not conspecific to the lectotype of *X. longispinosus* (see above). In our material we found a specimen apparently conspecific to *X. cf. longispinosus* sensu Crosnier, 2002. This male specimen (NHM 83.31) measuring (CL × CWmax × CW0) 8.5 × 20.0 × 13.0 (Fig. 7E, D) and Crosnier’s specimens from Marquesas Is. (maximum size of female, CL × CWmax 12.3 × 25.6, maximum size of ovigerous female 8.8 × 20.7) are distinguished by the following characters. They have moderately granular carapace, long and broad sharp triangular lateral frontal lobes and relatively narrow triangular median lobes, half as along (in the specimens from Marquesas) or less (in the specimen from Tonga) than lateral lobes. In contrast to *X. tuerkayi* the number of anterolateral teeth is reduced to 8 [Crosnier, 2002: figs 2, 3A] or 7 (Fig. 7E). Chelipeds possess 4 to 5 spines (Fig. 7E) on the anterior margin of merus; the latter condition we have not yet observed in *X. tuerkayi* but in *X. longispinosus*. Similarly to *X. tuerkayi* the penultimate pleomere of male is clearly not broader than long but there is a distinct keel on the 4th pleomere. Finally the gonopod 1 has more numerous bristles and spines in the terminal part [Crosnier, 2002: fig. 3D].
Xiphonectes tuerkayi sp.n. from the Indian Ocean

Fig. 7. Xiphonectes tuerkayi sp.n. and X. longispinosus sensu Crosnier, 2002. A — X. tuerkayi sp.n., ovigerous female (ZMMU Ma 2409), Bab al Mandab, dorsal view; B — X. tuerkayi sp.n., male (SMF 22973), 11.5 × 27.5 mm, Gulf of Aden, sternal region and pleon; C — X. tuerkayi sp.n., juvenile male (SMF 33390), 5.3 × 12.4 mm, Gulf of Aden; D — same specimen as C, sternal region and pleon; E — X. longispinosus sensu Crosnier, male (NHM 83.31), 8.5 × 20.0 mm, Tonga Is., dorsal view; F — same specimen as E, sternal region and pleon. 2 mm (A, C, E, F), 2.3 mm (D), 3 mm (B).

Ри. 7. Xiphonectes tuerkayi sp.n. и X. longispinosus sensu Crosnier, 2002. A — X. tuerkayi sp.n., яйценосная самка (ZMMU Ma 2409), проливы Баб эль Мандеб, дорсальный вид; B — X. tuerkayi sp.n., самец (SMF 22973), 11.5 × 27.5 мм, Аденский залив, торакально-стернальный отдел и плеон; C — X. tuerkayi sp.n., ювенильный самец (SMF 33390), 5.3 × 12.4 мм, Аденский залив; D — тот же экземпляр, что C, торакально-стернальный отдел и плеон; E — X. longispinosus sensu Crosnier, самец (NHM 83.31), 8.5 × 20.0 мм, о-ва Тонга, дорсальный вид; F — тот же экземпляр, что E, торакально-стернальный отдел и плеон. Масштабная линейка 2 мм (A, C, E, F), 2.3 мм (D), 3 мм (B).
I regard X. cf. longispinosus sensu Crosnier [2002] as a possibly separate but not yet described species of the X. longispinosus complex. However since transitional forms have been reported [Nagai, 1981], I refrain from description a new species until more material from the intermediate area between its range in Polynesia and the distribution area of X. tuerkayi sp.n. in the Indian Ocean, and phylogeographic data are available.


ECOLOGY. The species is generally known from sandy substrates at the low subtidal zone (35–86 m), the record from the Gulf of Oman originates from dredging in the depth range 9–36 m. Similarly to X. tuerkayi sp.n. X. cf. longispinosus from Polynesia is generally a lower subtidal species, occurring on the insular shelves at depth from about 32 m (Tonga) to 54–150 m in the Marquises area (one record from 95–350 m [Crosnier, 2002]).

DISTRIBUTION. Straits of Bab al Mandab in the Red Sea, Gulf of Aden, Arabian Sea (type locality), Gulf of Oman, Andaman Sea (present study), Seychelles [Crosnier, 1984], possibly Japan [Nagai, 1981].

REMARKS. The specimens recorded by Crosnier from the Seychelles are regarded X. tuerkayi sp.n. on the basis of the drawing of frontal region of carapace and male pleon [Crosnier, 1984: figs 2D, E].

Discussion

Xiphonectes longispinosus was considered as a species complex since Stephenson’s and Rees’ [1967] study. The present study changes the concept of this complex by excluding such taxa as Xiphonectes bidens (Laurie, 1906), X. iranjae (Crosnier, 2002), X. leptochaetes A. Milne-Edwards, 1873, X. macrophthlamus (Rathbun, 1906), and X. tenuicaudatus (Stephenson, 1961). They are morphologically well separated from X. longispinosus sensu lato and can be easily diagnosed. However, their diagnostic characters mainly refer to external morphology (carapace sculpture, cheliped morphology and male pleon) while the first gonopods are not clearly distinguishable between the species at least at the macroscopic level. The species of X. longispinosus complex in the present concept also show similar first gonopods to the discussed group. This is not a common situation in the Portunidae and even within those Xiphonectes spp. which are morphologically similar to the above mentioned species, there are species with very distinct gonopods, i.e. Xiphonectes guinotae Stephenson et Rees, 1961 [Stephenson, Rees, 1961: fig. 2D–F; see also Apel, Spiridonov, 1998: figs 102–103]. However, it may happen that microscopic investigation and, in particular scanning electronic microscopy will show differences in the pattern and morphology of spines in the distal part of the gonopod which likely function as sensillae.

The Xiphonectes longispinosus complex in the present concept includes the following morphological species: X. longispinosus s.str., X. emarginatus, X.

<table>
<thead>
<tr>
<th>Character</th>
<th>Xiphonectes longispinosus</th>
<th>X. tuerkayi sp.n. (Socotra Island, Gulf of Aden, Bab al Mandab)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ridges and patches on carapace</td>
<td>Moderately granulated, usually low</td>
<td>Coarsely granulated, elevated</td>
</tr>
<tr>
<td>Anterolateral patches</td>
<td>Few granules</td>
<td>As a distinct patch</td>
</tr>
<tr>
<td>Posterolateral carapace ridge</td>
<td>Low, diffused (Fig. 1A, 2A, C, E)</td>
<td>Elevated, distinct (Fig. 4A, B; 7A, C)</td>
</tr>
<tr>
<td>Lateral frontal lobes</td>
<td>Distinctly broader than long, relatively low, usually not reaching to inner infraorbital lobes, usually rounded at top (at least in females) (Fig. 1A; 2E; 3A–D)</td>
<td>Not distinctly broader than long or as broad as long, triangular, relatively high, usually reaching to inner infraorbital lobes, sharpened at top (Fig. 2B, 7A, C; 3E–H)</td>
</tr>
<tr>
<td>Median frontal lobes</td>
<td>Small, usually distinctly broader than long, separated from lateral lobes by shallow U-shaped gap, usually rounded at top (Fig. 3A–D)</td>
<td>Usually half or more than half as long as lateral lobes, separated from them by deep V-shaped incision, at least not distinctly broader than long, triangular, sharpened at top Fig. 3E–H</td>
</tr>
<tr>
<td>Mesial corner of inner supraorbital lobe</td>
<td>Usually rounded (Fig. 3A–D)</td>
<td>Usually angled (Fig. 3E–H)</td>
</tr>
<tr>
<td>Anterolateral teeth</td>
<td>With tendency to reduction, 7–9; inequal number on both sides possible</td>
<td>No tendency to reduction, always 9, even in juveniles</td>
</tr>
<tr>
<td>Keel on 4th pleonal tergum of male</td>
<td>Absent (Fig. 2B, F)</td>
<td>Present (Fig. 4C, D; 7B, D)</td>
</tr>
<tr>
<td>Pleomere 6</td>
<td>Distinctly broader than long (width to length ratio 1.1–1.5) (Fig. 2B, F)</td>
<td>As broad as long or longer than broad (width to length ratio 1.0–0.8) (Fig. 4C, D; 7B, D)</td>
</tr>
</tbody>
</table>
tuerkayi. It may also include X. vigilans if it turns that there is a separate species in the Hawaiian waters which should bear this name (see Remarks to X. longispinosus). These taxa differ from each other by a combination of characters and show a significant level of sympathy. In particular, both X. longispinosus and X. emarginatus were recorded from Australia and Madagascar, while X. longispinosus and X. tuerkayi were found by the same collectors in the Gulf of Oman and the Gulf of Martaban (in the collection of NHM). In the Red Sea – Gulf of Aden region X. longispinosus and X. tuerkayi appear to be separated: the first species is recorded so far only in the Red Sea proper while the second was found only in the Straits of Bab al Mandab connecting the Red Sea to the Gulf of Aden and in the Gulf of Aden proper. It is difficult to conclude at present if this reflects a real distribution pattern or it is a result of insufficient sampling.

None of the species of X. longispinosus complex was examined for the molecular barcode, the gene of mitochondrial cytochrome oxidase I and genomic identity. The future studies based on more extensive morphological material and involving molecular genetics and phylogeographic analysis will need to test the following hypotheses.

The zero-hypothesis is that these morphological species, in particular X. longispinosus and X. tuerkayi sp.n. are extreme phenotypic forms of a single polymorphic species. The alternative hypothesis is that these are separate biological species possibly originating as a result of ecological speciation [Nosil, 2012] that appears to be a relatively common process in tropical seas [Bowen et al., 2013; Li et al., 2016]. X. longispinosus might have been thus diverged as a species associated with lower intertidal – upper subtidal conditions and shallow reef areas, and X. tuerkayi sp.n. might have formed as a shelf species associated with the lower subtidal zone.

ACKNOWLEDGEMENTS. My gratitude are extended to Dmitry G. Zhadan for joint collecting of X. longispinosus, Adam Baldinger for kind sending of the photo and information on the type of Amphitrite longispinosa, Paul F. Clark for the help in studying collections in the NHM and Peter Dworschak for the guidance in the collection of NHMW. The research stays in the SMF was funded by the guest for the help in studying collections in the NHM and Peter Adam Baldinger for kind sending of the photo and information of Xiphonectes tuerkayi sp.n. from the Indian Ocean.


References


