Mimulus Stimpson, 1860, a junior synonym of Pugettia Dana, 1851
(Decapoda: Brachyura: Majoidea: Epialtidae)

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Abstract

William Stimpson (1860) established Mimulus (Brachyura: Majoidea: Epialtidae), with a single species, M. foliatus. Rathbun (1894) placed the genus in synonymy with Pugettia Dana, 18951, but subsequent authors have considered Mimulus to be a valid genus. Genetic evidence and re-examination of the morphology indicate that M. foliatus belongs to a clade of majoid crabs consisting of species of Pugettia. We therefore consider Mimulus to be a junior synonym of Pugettia. We provide a list of all species of Pugettia.

Key words: Mimulus, Pugettia, kelp crab

Introduction

William Stimpson (1860, 200, pl. 5, fig. 1) described and figured a new genus and species of brachyuran crab, Mimulus foliatus. A second species, M. acutifrons A. Milne-Edwards, 1867, was described without illustrations or a type locality. With the exception of Newcombe (1893) and Rathbun (1894), subsequent authors have used the name M. foliatus in reference to the species of Mimulus found in the northeastern Pacific. A recent genetic analysis co-authored by the second author (Hultgren & Stachowicz 2008b) indicates that M. foliatus is closely related to Pugettia gracilis Dana, 1851 and does not warrant designation as a species of a different genus. We examined specimens and studied descriptions and illustrations of M. foliatus and compared its morphology to that of species of Pugettia and other epialtid crabs. We herein synonymize Mimulus Stimpson, 1860 with Pugettia Dana, 1851, and provide a list of species.

Material and methods

Hultgren & Stachowicz (2008b: table 1) analyzed four specimens of M. foliatus from Bodega Bay, California (38°20′N 123°2.9′W) and compared them to 12 specimens of five other species of Pugettia. The first author examined specimens of a male (carapace width 38 mm) and a female (carapace width 22 mm) taken by scuba diving at 8 m on 7 August 1971 from Monastery Beach, Carmel, California (36°31.5′N 121°55.5′W) (Texas A&M University Teaching Collection). These specimens were compared with descriptions given by Stimpson (1860) and Garth (1958), and with a diagnosis given by Wicksten (2012). The gonopods of the male M. foliatus were compared with those of one specimen each of Pugettia richii Dana, 1851, and P. producta (Randall, 1840), from the Texas A&M Collection, and a male Talipeus nuttallii (Randall, 1840) from the Natural History Museum of Los Angeles County (LACM 41120), as well as with those illustrated by Garth (1958) for M. foliatus, six species of Pugettia and T. nuttallii. We follow the classification of Ng et al. (2008) for majoid crabs. The list of species of Pugettia is from Ng et al. (2008) with the addition of P. ogasawarensis Komatsu, 2011.
Taxonomy

Superfamily Majoidea Samouelle, 1819

Family Epialtidae Macleay, 1838

Subfamily Epialtininae Macleay, 1838

Genus Pugettia Dana, 1851


Type locality Puget Sound, Washington.

Species included

Pugettia dalli Rathbun, 1894
Pugettia elongata Yokoya, 1933
Pugettia foliata (Stimpson, 1860)
Pugettia gracilis Dana, 1851 (type species)
Pugettia hubbsi Garth, 1958
Pugettia incisa (De Haan, 1839)
Pugettia intermedia Sakai, 1938
Pugettia kagoshimensis Rathbun, 1932
Pugettia leyensis Rathbun, 1916
Pugettia marissinica Takeda & Miyake, 1972
Pugettia mindanaoensis Rathbun, 1916
Pugettia minor Ortmann, 1893
Pugettia nipponensis Rathbun, 1932
Pugettia ogasawaraensis Komatsu, 2011
Pugettia producta (Randall, 1840)
Pugettia quadridentis (De Haan, 1839)
Pugettia pellucens Rathbun, 1932
Pugettia richii Dana, 1851
Pugettia similis Rathbun, 1932
Pugettia tasmanensis Richer de Forges, 1993
Pugettia venetiae Rathbun, 1924

Remarks. In his Latin description (translated by Holmes 1900), Stimpson (1860) defined the genus as:

“Carapace flattened, more or less pentagonal; antero-lateral margin laminate and cut by a narrow fissure into two closely approximate lobes. Rostrum short, bifid, and horizontal. Orbits incomplete below, but furnished above with a preorbital and postorbital spine. Eyes not concealed when retracted. Merus of the external maxillipeds short, the external angle obtuse, the internal angle incised; outer margin of the exognath dilated. Hand of the chelifeds much compressed and sublaminate. The propodi of the ambulatory legs have a setose tooth near the middle of the inferior margin. First pair of ambulatory legs exceeding the others.”

Stimpson stated "this genus is near Epialtus, with lamellar expansions of the sides of the carapax as in some Hueniae". The narrow chelifeds shown in the original illustration demonstrate that this individual was a female (Stimpson 1860: pl.1A). The type locality was “taken from the stomachs of percoid fishes, (“Cabesones”) caught off Monterey, California, by A.S. Taylor”. Cabezon is the common name of Scorpaenichthys marmoratus (Ayres, 1854), family Cottidae, a crab-eating fish. Stimpson made no mention of or made comparison to species of Pugettia. Stimpson’s specimens were housed in the Chicago Academy of Sciences, which was destroyed in a fire in
1871. The type specimen almost surely was destroyed. Garth (1958) reported that a “male cotype without chelipeds or legs” existed in the Museum of Comparative Zoology, Harvard University, but no syntypes of *M. foliatus* have been found in the British Museum (Natural History) (Evans 1967).

**FIGURE 1.** *Pugettia foliata* (Stimpson, 1860). A, Original illustration of *Mimulus foliatus* (Stimpson 1860: plate 5, fig. 1). B, Adult male from Monterey Bay, California. Scale = 10 mm. Photograph by T.J. Boyle, Texas A&M University. C, Adult male from Sonoma County, California. Photograph by Kristin Hultgren, Seattle University.

A. Milne-Edwards (1867) described a second species, *Mimulus acutifrons*, which supposedly could be distinguished from *M. foliatus* by the “frontal teeth” (rostral horns), which are “short and hardly separated from the median line, and by the supra-orbital angles not reaching as far” (translated from the French). There were no illustrations and there was only a single specimen (sex not stated), and no information on the type locality was given except that the specimen had been part of the collections of “Baron de Lafresnaye”. The type material, which
seems to have been deposited in the Muséum National d’Histoire Naturelle, Paris, is apparently lost (D. Guinot, pers. comm.) Garth (1958) questionably placed M. acutifrons in synonymy with M. foliatus. The length of the rostral horns is variable in specimens of M. foliatus, and the supra-orbital angles can vary with age and sex. It is impossible without the examination of the holotype to know for certain if Milne-Edwards’ specimen could be assigned to Mimulus or a related genus, or in which localities one might look for a similar specimen.

Newcombe (1893) contacted M.J. Rathbun regarding a specimen collected in Clayoquot Sound, British Columbia. She stated that she was “unable to separate the genus from Pugettia”. Newcombe (1893) recorded the species as Pugettia (Mimulus) foliata Stimpson. Rathbun (1894:72) wrote "there seems to be no good reason for placing this (Mimulus foliatus) in a genus distinct from Pugettia," and referred to the species as Pugettia foliata. The "antennae have the basal joint as in that genus" (Pugettia) and the flagellum is flattened and exposed at the side of the rostrum, the "carapace is wider than in other species of Pugettia" and the chelipeds present showed "nothing distinctive". The maxillipeds, abdomen, sternum, and ambulatory legs were considered as "almost exactly" as in Pugettia gracilis Dana, 1851.

Holmes (1900: 23) translated Stimpson's original Latin description of Mimulus but made no comparisons to species of Pugettia. Without explanation, he cited Pugettia foliata, as given by Rathbun (1894), as a junior synonym of M. foliatus. Rathbun (1904: 173) referred it as M. foliatus. Schmitt (1921), Rathbun (1925), and Garth (1958) considered Mimulus a valid genus, containing only one species, M. foliatus. Garth’s work provided a brief re-description of the species along with illustrations, and Garth (1958) and Wicksten (2012) provided extensive synonymies.

Schmitt (1921), Rathbun (1925), and Garth (1958) distinguished species of Pugettia from Mimulus on the basis of the lateral margins of the carapace being markedly flattened or produced. Schmitt (1921) stated that the upper surface of the carapace of Pugettia bore spines or tubercles instead of being smooth, and assigned P. producta Randall, 1839, to Epialtus H. Milne-Edwards, 1834. The dorsal surface of the carapace of P. producta is smooth. Schmitt's description of M. foliatus noted that it possessed two median "obsolescent" tubercles as well as a tubercle on the posterior branchial region, and thus contradicted the generic distinction from Pugettia given in his key.

Garth (1958: pls. L, O, P, Q) figured the right first pleopods of male epialtid crabs (subfamilies Acanthephychinae and Pisinae of the Majidae), including M. foliatus, P. producta, P. richii, four other Pugettia species, and Talipeus nuttallii. In both M. foliatus and the species of Pugettia, this pleopod bears a flared apex with a pointed tip and one or two opposing grooved projections of equal or slightly shorter length. Both M. foliatus and the species of Pugettia bear some form of median protuberance: a spinous lobe, "tongue," rounded lobule, or two smaller lobes. In contrast, the first pleopods of T. nuttallii do not have the median protuberance, and the lateral projections are not curved, as in Pugettia. The male pleopods of other species of Epialtidae vary, ending in a curved, spiny, or flattened apex, two concave points, small and blunt lobes or a complicated structure of depressed areas and protrusions. The shapes of the distal areas of the male first pleopods of M. foliatus, P. producta P. richii, and T. nuttallii are in close agreement with those figured by Garth. Griffin & Tranter (1986: fig. 28) figured the male first pleopods of the western Pacific P. incisa, P. intermedia, P. marissinica, and P. quadridens. Komatsu (2011), in the original description of P. ogasawarensis, and Richer de Forges (1993), in the original description of P. tasmanensis, also figured the first pleopods. The pleopods of all of the western Pacific and Tasman Sea species have similar apices, only varying in fine details of the angle, length, and curvature of the lobes and tubercles. The structure of the first pleopod of male M. foliatus falls within the range of species variation of the genus Pugettia.

Hultgren & Stachowicz (2008a) studied the habitat distinctions between P. producta, P. richii, and M. foliatus. These three species can be found in intertidal areas along the coast of California, but have distinct habitats: P. producta is usually found among large kelps, (Macrocytis or Egregia spp.), P. richii among red algae (Rhodophyta), and M. foliatus typically in the lowest intertidal zone into shallow subtidal regions, on rocks, among algae, or in kelp holdfasts (Fig. 1C). The relatively smooth carapaces of P. producta and M. foliatus may be related to climbing on algae or hiding among kelp holdfasts. Of the three species, only P. richii decorates by attaching algae or hydroids to its rostrum and the sides of the carapace. The other two species may attach a small piece of alga to the rostrum but do not cover the body from dorsal view. The three species share similar ranges: P. producta from the Queen Charlotte Is., Canada to Point Asunción, Baja California, Mexico; P. richii from Prince of Wales I., Alaska to Asunción Bay, Baja California; and M. foliatus from Unalaska, Alaska to San Diego, California, although it is uncommon south of Point Conception, California. A report of M. foliatus from Mazatlán, western Mexico is "questionable" (Garth 1958).
Hultgren & Stachowicz (2008b) used a genetic analysis to study the relationships among majoid crabs. The study included members of the Epialtidae, including six species of Pugettia, M. foliatus, and Talipeus nuttallii. It was found that M. foliatus was as closely related to other species of Pugettia as species of Pugettia were to each other. As pointed out by Rathbun (1894: 72), the closest relative to M. foliatus seems to be P. gracilis. Hultgren & Stachowicz (2008b) suggested, but did not confirm, that Mimulus should be considered to be a junior synonym of Pugettia.

Stimpson (1860) and subsequent authors gave great importance to the lateral flattened expansions of M. foliatus, as seen in the "Hueniae", as a difference with other majoid crabs. The first author examined specimens of Huenia heraldica (De Haan, 1837) (Epialtidae) in the collections of the Bishop Museum, Honolulu, Hawaii. In H. heraldica, the shape of the lateral expansions of the carapace is sexually dimorphic, with those of the female being less sharply defined than those of them male. These lateral expansions occur in other epialtoid crabs, such as Epialtoides hiltoni (Rathbun, 1894).

Large, well-separated teeth along the lateral margin of the carapace in most species of Pugettia, but in P. gracilis, the anterolateral projections of the carapace have been described as "wing-like" (Garth 1958). Hultgren & Stachowiz (2008a) related the surface of the carapace to habitat, suggesting that crabs that climb among algae or hide under rocks might be more likely to have a smooth carapace than those living among dense algae. The function of the "wing-like expansions" of the carapace remains uncertain, but combined with a color similar to the algae on or among which they live, may help to conceal the crab in the natural habitat.

As in M. foliatus, adult male Pugettia frequently have larger chelae than do mature females, often with a gape between the fingers, and a pronounced ridge along the carpus and the upper margin of the propodus (Fig. 1B). These features are prominent in P. richii, P. dalli, and P. gracilis from the eastern Pacific; somewhat less so in P. producta and P. hubbsi; and in the Japanese species P. minor, P. incissa, P. quadridens, P. nipponensis, and P. sagamiensis (Sakai 1965: pls. 31–33).

Species of Pugettia, with the exception of P. tasmanensis, are confined to the western and northern Pacific Ocean, ranging from the Philippines northward along the Asian coast, across the Aleutian Islands south to Baja California, Mexico. Thirteen of the 21 species inhabit the area from the Philippines to Russia, and seven are found in the eastern Pacific. P. tasmanensis is the only species reported from the southern hemisphere. In California, these are called "kelp crabs", an appropriate name because many of them live among algae.

Based on external morphology, structure of the male first pleopods, sexual dimorphism, habitat, range and new genetic data, we find no reason to separate Mimulus foliatus from the known species of Pugettia. We therefore place Mimulus Stimpson, 1860 in synonymy with Pugettia Dana, 1851. The revised name of the foliose kelp crab is hereby changed to Pugettia foliata (Stimpson, 1860).

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