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NOTES ON SYMBIOTIC DECAPOD CRUSTACEANS FROM GORGONA ISLAND, COLOMBIA, WITH A REVISION OF THE EASTERN PACIFIC SPECIES OF *TRAPEZIA* (BRACHYURA, XANTHIDAE), SYMBIONTS OF SCLERACTINIAN CORALS

By

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SUMMARY

Collections of decapod crustaceans associated with scleractinian corals at Gorgona Island, Colombia, have provided material for a revision of the eastern Pacific species of *Trapezia* (Brachyura, Xanthidae), obligate symbionts of the coral *Pocillopora*. Four sympatric specie are recognized: *T. corallina* GERSTAECKER, *T. formosa* SMITH, *T. ferruginea* LATREILLE, and *T. digitalis* LATREILLE. Two species of symbiotic natantian shrimps [*Harpiliopsis spinigera* (ORTMANN) from *Pocillopora* and *Periclimenes soror* NOBILI from asteroids] are recorded from Gorgona for the first time.

RESUMEN

Colecciones de crustáceos decápodos asociados con corales escleractínidos en la Isla de Gorgona, Colombia, han suministrado material para una revisión de las especies del Pacífico americano de *Trapezia* (Brachyura, Xanthidae), simbiontes obligatorios del coral *Pocillopora*. Cuatro especies simpátricas son reconocidas: *T. corallina* GERSTAECKER, *T. formosa* SMITH, *T. ferruginea* LATREILLE, y *T. digitalis* LATREILLE. Dos especies de camarones simbióticos [*Harpiliopsis spinigera* (ORTMANN) encontrada en *Pocillopora* y *Periclimenes soror* NOBILI en asteróideos] representan nuevos registros para Gorgona.

INTRODUCTION

Collections made during the 1979 Sula III expedition to the Island of Gorgona, on the Pacific coast of Colombia, provided valuable material and several species of eastern Pacific decapod crustaceans. This material has been of special significance in elucidating the systematic position of the eastern Pacific species of *Trapezia*, xanthid crabs that are obligate symbionts of live *Pocillopora* corals (CASTRO, 1976). The brilliantly colored species of *Trapezia* are found living sympatrically on their coral

hosts throughout the tropical Indian and Pacific Oceans. They form heterosexual pairs and actively defend territories established in the colony (PRESTON, 1971; CASTRO, 1978).

The systematic position of the many described species of *Trapezia* has unfortunately remained very confusing and in great need of revision. These species have traditionally been defined strictly by the use of anatomical characters. Consequently, many distintive color forms have been treated as varieties of single species, or the existence of distinct color forms ignored. Few reliable color notes are available and almost all identifications have been made from preserved material where the natural color is lost. Furthermore, coloration appears to be of great importance in species recognition and pair formation and hence crucial as a mechanism of reproductive isolation of sympatric species.

Trapezia and other decapod crustaceans were collected from Gorgona during the 1924-25 *St. George* Expedition (FINNEGAN, 1931), the 1941 *Askoy Expedition* (GARTH, 1948), and the 1968 *Te Vega* Stanford Oceanographic Expedition (M. YOUNGBLUTH, unpublished data). Additional collections have been made by von PRAHL *et al.* (1978; 1979).

This preliminary revision of the eastern Pacific species of *Trapezia* reflects investigations on the ecology and behavior of *Trapezia* in Panamá (CASTRO, unpublished data) in addition to material collected in Panamá and the Galápagos Islands.

MATERIAL AND METHODS

The distribution of *Trapezia* among colonies of *Pocillopora* was investigated by sampling 20 whole colonies [12 *P. damicornis* (L.), 6 *P. elegans* DANA, and 2 *P. eydouxi* MILNE EDWARDS & HAYME] from the fringing reef along La Azufrada beach. The reef is described by GLYNN *et al.* (in press). All coral colonies were selected at irregular intervals while swimming along an imaginary transect line across the reef flat and extending into the outer reef slope to a depth of aproximately 6 m at low tide. Very small or large colonies were not sampled. The colonies were placed in plastic bags and brought ashore where they were measured (maximum height, length, and width), and broken up in order to remove all associated crustaceans. All *Trapezia* individuals were sexed and measured (length and maximum width of carapace, interorbital width).

The description of colors in live *Trapezia* follows the classification and nomenclature of KORNERUP & WANSCHER (1967).

RESULTS AND DISCUSSION

Table I summarizes the distribution of *Trapezia* in the 20 colonies of *Pocillopora* quantitatively sampled. The number of individuals of *Trapezia* present showed a significant correlation with the area of the colonies ($P<0.05$, Kendall rank correlation coefficient $= 0.35$).

All nine species of decapods listed by von PRAHL *et al.* (1978) as associates of *Pocillopora* at Gorgona were found during this investigation. *Domecia hispida* EYDOUX & SOULEYET, the only brachyuran crab other than *Trapezia,* was infrequently found (a total of 4 individuals in 3 colonies). One heterosexual pair of *Alpheus lottini* GUÉRIN was found in every sampled colony. Two species of natantian shrimps new to Gorgona (including one from *Pocillopora*) were also collected.

ACCOUNT OF SPECIES

Natantia, Palaemonidae, Pontoniinae

Harpiliopsis spinigera (ORTMANN)

Anchistia spinigera ORTMANN, 1890, *Zool. Jahr. Syst., 5: 511,* pl. 36, fig. 23a.

Harpiliopsis spinigera; BRUCE, 1978b, *Bull. Mar. Sci., 28: 129* (synonymy).

Remarks. This species and *Harpiliopsis depressa* (STIMPSON) were collected together from most colonies of *Pocillopora* sampled at Gorgona. Individuals of this species are characterized by having numerous dark brown and white irregular spots distributed throughout the otherwise transparent body and appendages. Color photographs of both species of *Harpiliopsis* are given in BRUCE (1977).

H. spinigera is an Indo west Pacific species but it has been collected from *Pocillopora* in Panamá (ABELE & PATTON, 1976).

Periclimenes soror NOBILI

Periclimenes soror NOBILI, 1904, *Bull. Mus. Hist. Nat. Paris, 10:* 232, pl. 2, fig. 6; BRUCE, 1978a, *Tethys, 8:* 299, figs. 1-4 (synonymy).

Remarks. Periclimenes soror is a common associate of numerous species of asteroids. It has been recorded from locations throughout the Indo west Pacific. BRUCE (1978a) reviews its distribution and reports it from the eastern Pacific for the first time.

Three adult individuals associated with the asteroids *Nidorellia armata* (GRAY) and *Pharia pyramidata* (GRAY) were collected from Gorgona Islands. The hosts were collected at depths of 7-9 meters from the sand and coral rubble bottom east of Gorgonilla Island. The two individuals associated with *Nidorellia* were dark purple but the dorsal surface of one was white; the single individual from *Pharia* was off-white in color.

In Panamá the shrimp has also been collected in association with these two asteroids and from *Acanthaster planci* (L.) (CASTRO, unpublished data).

Trapezia corallina GERSTAECKER

Trapezia corallina GERSTAECKER, 1856, *Arch. Naturg., 22:* 126 (Panamá); SERÈNE, 1959, *Treubia, 25*: 129 (in key), 131; SERÈNE, 1969, *J. Mar. Biol. Ass. India,* 11: 48 (in key).

Trapezia digitalis; ORTMANN, 1897, *Zool. Jahr. Syst., 10:* 203, 208; RATHBUN, 1930, *Bull. U.S. Nat. Mus., 152:* 559.

Morphological diagnosis. The anterolateral margins of the carapace are slightly convex but a little inflated in the middle so that the margins are parallel along the lower half portion. In postlarval and juvenile individuals, however, the complete anterolateral margins are almost parallel. A small tooth is present at the junction of the anterolateral and posterolateral margins. It is especially well developed in postlarvae and juveniles, becoming blunt and inconspicuous in very large adults.

Color in life. The carapace and walking legs are brownish orange; eyes dark gray. The chelipeds show dark brownish orange reticulations that extend throughout the lower inner surface of the propodus (see fig. 11 labelled as *T. ferruginea* by GLYNN, 1976). The fingers and dactyli of the chelipeds are dark brownish orange.

Remarks. ORTMANN (1897) included *T. corallina* as one of the uniformly colored varieties of *T. digitalis* LATREILLE. RATHBUN (1930) similarly treated it as a synonym of *T. digitalis.* SERÈNE (1959; 1969), however, preferred to keep *T. corallina* as a distinct species on the basis of its color characteristics. It is evident that the more recent authors were not able to differentiate between *T. corallina* and two other sympatric species, *T. ferruginea* LATREILLE and *T. formosa* SMITH due to the similarity of their color. Preserved specimens are especially difficult to identify since they show the same orange color in all three species.

T. corallina was found to be the most common species of *Trapezia* at Gorgona, where it was collected from every colony of *Pocillopora* examined (Table I). It is also the most common species in Panamá (locations in the Gulfs of Panamá and Chiriquí) but the least common in the Galápagos Islands (CASTRO, unpublished data). The species has only been recorded from the eastern Pacific.

The type specimens, originally at the now Zoologisches Museum, Museum für Naturkunde, Berlin, G.D.R., have been destroyed (E. GRUNNER, pers. com.).

Trapezia formosa SMITH

Trapezia formosa SMITH, 1869, *Proc. Boston Soc. Nat. Hist., 12:* 286 (Panamá); MILNE EWARDS, 1873, *Rech. Zool. Faune Amerique Centr. Mexique,* pt. 5, *1:* 343, pl. 58, figs. 1-1b (Panamá); SERÈNE, 1959, *Treubia, 25:* 129 (in key), 131. SERÈNE, 1969, *J. Mar. Biol. Ass. India, 11:* 148 (in key).

Trapezia digitalis; ORTMANN, 1897, *Zool. Jahr., Syst., 10:* 203, 208; RATHBUN, 1930, *Bull. U.S. Nat. Mus., 152:* 559.

Morphological diagnosis. The carapace of adult individuals lacks a spine or tooth at the junction of the anterolateral and posterolateral margins; postlarvae and juveniles, however, show a small lateral tooth. The carapace is much wider in the middle than at the anterior border, giving the carapace a conspicuously round appearance. The chelipeds particularly the slightly larger one, are somewhat swollen in appearance, with a relatively short dactylus and finger.

Color in life. The carapace and walking legs are reddish orange. The eyes are greenish grey. The lower portion of the inner surface of the chelipeds is orange-yellow to deep orange. It contrasts strongly with the upper portion of the cheliped, which is darker reddish orange. The fingers and dactyli of the chelipeds vary from brown to dark brown.

Remarks. T. formosa was placed, together with *T. corallina,* as a synonym of *T. digitalis* by ORTMANN (1897) and RATHBUN (1930). SERÈNE (1959; 1969), however, considers the species different from both *T. digitalis* and *T. corallina* as far as color is concerned and treats it as a separate species. *T. formosa,* as in the case of *T. corallina,* most probably have been referred to as *T. ferruginea* by recent authors because of close similarities in color, especially when contrasted with the dark brown *T. digitalis.*

This species also appears to be restricted to the eastern Pacific. It is the third most common species at Gorgona (see Table I) as well as in Panamá and the Galápagos Islands (CASTRO, unpublished data). It is smaller in size and seemingly less aggressive than the other three sympatric species of *Trapezia.* Adult and juvenile individuals are typically found among the deeper branches of the coral colony. It is also especially abundant in coral fragments.

The type specimens (deposited at the Muséum National d'Histoire Naturelle, Paris) and the cotypes (Museum of Comparative Zoology, Harvard University) have been examined.

Trapezia ferruginea LATREILLE

Trapezia ferruginea LATREILLE, 1825, *Encycl. Méth., Hist. Nat., 10:* 695; ORTMANN, 1897, *Zool. Jahr., Syst., 10:* 203, 205; SERÈNE, 1969, *J. Mar. Biol. Ass. India, 11:* 146 (in key), figs. 27, 29, 31, 33; von PRAHL *et al.,* 1978, *An. Inst. Inv. Mar. Punta Betín, 10:* 89, fig. 4 (Gorgona).

Trapezia cymodoce ferruginea RATHBUN, 1907, *Mem. Mus. Comp. Zool. Harvard, 35*(2): 58; RATHBUN, 1930, *Bull. U.S. Nat. Mus., 152:* 557, pl. 228 figs. 1, 2; (México, Panamá); FINNEGAN, 1931, *J. Linn. Soc. London, Zool., 37:* 645 (Gorgona); GARTH, 1948, *Bull. Am. Mus. Nat. Hist., 92*(1): 51 (Gorgona).

Morphological diagnosis. The anterolateral margins of the carapace are convex throughout their length. The junction of the anterolateral

and posterolateral margins is provided with a small tooth. As in the other eastern Pacific species of *Trapezia,* postlarvae and juveniles have parallel to almost parallel anterolateral margins and a more pronounced lateral tooth. The propodus, dactylus, and finger of the chelipeds are noticeably thicker and higher in the larger individuals (especially males) than in the other eastern Pacific species.

Color in life. The carapace and walking legs are orange. The eyes are dark brown, almost black. The lower portion of the inner surface of the chelipeds is orange yellow to light orange with no reticulations. The fingers and dactyli of the chelipeds are dark brown, almost black. Postlarvae and juveniles have a blue spot on the inner junction of the carpus and merus of the chelipeds.

Remarks. This species has been referred to by numerous authors as a color variety of *T. cymodoce* (HERBST) but SERÈNE (1969) has established their status as distinct species.

T. ferruginea has been recorded throughout the tropical Indian and Pacific Oceans (see GARTH, 1974). Individuals from eastern Pacific and Indo west Pacific populations of *T. ferruginea* appear to be morphologically similar. No differences were observed when specimens from Gorgona and Panamá were compared with specimens collected from the Island of Oahu, Hawaii.

Adult individuals attain a larger size than that observed in the other eastern Pacific species of *Trapezia.* Heterosexual pairs of the large individuals appear to occupy a dominant position in the upper portion of coral colonies that were examined *in situ.*

T. ferruginea was found to be the second most abundant species at Gorgona and Panamá (CASTRO, unpublished data).

Trapezia digitalis LATREILLE

Trapezia digitalis LATREILLE, 1825, *Encycl. Méth. Hist. Nat., 10:* 696; ORTMANN, 1897, *Zool. Jahr., Syst., 10:* 203, 208; RATHBUN, 1930, *Bull. U. S. Nat. Mus. Nat. Hist., 152:* 559, pl. 228, figs. 5, 6 (México); GARTH, 1948, *Bull. Amer. Mus. Nat. Hist., 92*(1): 51 (Gorgona); SERÈNE, 1959, *Treubia, 25:* 128, figs. 1, 2A, pl. I; SERÈNE, 1969, *J. Mar. Biol. Ass. India, 11:* 148 (in key); von PRAHL *et al.,* 1978, *An. Inst. Inv. Mar. Punta Betín, 10:* 89.

Trapezia nigrofusca STIMPSON, 1860, *Ann. Lyc. Nat. Hist. N. Y., 7:* 219 (México).

Morphological diagnosis. The anterolateral borders of the carapace are conspicuously parallel to each other. The anterior margin between the eyes is finely denticulated, not with well defined lobes as in the other eastern Pacific species. A lateral tooth is observed only in the postlarvae; it decreases in size with age until hardly any trace remains in most adults. The external orbital angle is provided with a sharp tooth in the postlarvae but the angle remains pointed throughout life.

Color in life. The carapace, upper portion of the chelipeds, and eyes are dark brown. The walking legs vary from light to reddish brown. The lower portion of the chelipeds, including the dactylus and finger, is orange white (cream). Light brown reticulations, often following square or rectangular patterns, are observed on the upper portion of the chelipeds of most adults. A blunt, flat tooth of the same orange white color is present on both surfaces of the distal end of the propodus at the base of the dactylus. Postlarvae and juveniles may show a broad, orange white band across the carapace.

TABLE I. Distribution of *Trapezia* species among 20 colonies of *Pocillopora* from La Azufrada reef, Gorgona Island. Area of coral colonies = maximum height x maximum length x maximum width; *P. d.* = *Pocillopora damicornis; P. el.* = *P. elegans; P. ey.* = *P. eydouxi;* f = reef flat; s = reef slope.

Coral Species and Habitat	Area	*T. corallina*	*T. ferruginea*	*T. formosa*	*T. digitalis*
P. d. (f)	413	0	0	2	0
P. d. (f)	612	2	1	2	0
P el. (s)	614	2	5	2	0
P. d. (f)	643	4	3	6	0
P. d. (f)	1.242	3	0	2	0
P. d. (s)	1.500	8	5	2	0
P. d. (f)	1.620	4	0	3	0
P. el. (s)	1.725	4	5	0	0
P. d. (s)	2.448	6	3	0	0
P. d. (f)	3.150	10	6	7	0
P. d. (f)	3.300	3	3	0	2
P. el. (s)	3.675	3	2	2	0
P. ey. (s)	4.158	4	2	0	0
P. d. (f)	4.416	3	4	2	0
P. d. (s)	4.896	5	3	0	0
P. el. (s)	5.040	16	4	5	2
P. d. (f)	5.148	5	3	2	0
P. ey. (s)	6.732	3	2	1	0
P. el. (s)	7.176	5	4	4	0
P. el. (f)	7.605	9	6	2	0
TOTAL		99	61	44	4

Remarks. SERÈNE (1959) reviewed the species and removed from it four species (including *T. corallina* and *T. formosa*) previously grouped by ORTMANN (1897) as color varieties of *T. digitalis*. ORTMANN used the lack of a lateral tooth in these species as a basis for his classification.

T. digitalis, together with *T. ferruginea* and a few other decapods associated with scleractinian corals, is an Indo west Pacific species also present in the tropical eastern Pacific (see GARTH, 1974). No morphological differences were found between specimens from Gorgona, Panamá, and Hawaii.

T. digitalis was rare in all Panamá locations sampled but relatively common in the Galápagos Islands (CASTRO, unpublished data). It was the least common species of *Trapezia* at Gorgona (Table I).

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