

Made in United States of America
Reprinted from
PROC. BIOL. SOC. WASH.
90(1), pp. 108-115

CAVE SIIRIMPS IN THE CAICOS ISLANDS

Donald W. Buden and Darryl L. Felder

CAVE SHRIMPS IN THE CAICOS ISLANDS

Donald W. Buden and Darryl L. Felder

Distributions of West Indian natantian decapod crustaceans have been given by Holthuis (1956), Vandell (1965), Chace and Hobbs (1969), and Chace (1972). Although these reports include records of many hypogean species, none mentions records of troglobitic shrimps from the Bahamas. Holthuis (1974) stated that *Barbouria cubensis* had been taken on Abaco Island in the Bahamas sometime after Botosaneanu and Holthuis (1970) reported on subterranean shrimps of Cuba. To the best of our knowledge this report is the only record of a cave shrimp from the Bahamas. *B. cubensis* was known previously only from saline pools in Cuba and from Cayman Brac in the Cayman Islands (Botosaneanu and Holthuis, 1970).

In 1975 Buden collected shrimps from brackish pools in sinkholes on Providenciales (Fig. 1) on the Caicos Bank. The Turks and Caicos Islands are an independent British Crown Colony but geographically and geologically they are a southeastward extension of the Bahama Islands. Felder identified two species in this lot of specimens, *Typhlatya garciai* Chace, previously known only from subterranean freshwater habitats in Cuba, and the aforementioned *Barbouria cubensis* (Von Martens).

Atyidae

Typhlatya garciai Chace

Fig. 2

On 9 April 1975 a series of 42 *Typhlatya garciai* was collected at a brackish pool on Providenciales, about 1.0-1.5 km N of the new airstrip, near the settlement of Blue Hills. The pool is well exposed to sunlight and contains much loose sedimentary material apparently derived largely from decomposition of terrestrial plant debris. The pool occupies part of a crescent shaped fissure and its surface is about 3-5 m below ground level. The bottom undercuts the outside wall as part of what seems to be a water filled cave. *T. garciai* was most abundant in those parts of the pool less than 1 m deep. These small white shrimp were not particularly elusive and were readily captured with a small dip net.

The postorbital carapace length of 37 specimens from our series of *T. garciai* ranges from 2.7 to 4.8 mm ($\bar{x} = 3.9$ mm). Total length (tip of rostrum to tip of telson) of these specimens, in alcohol, ranges from 9.8 mm in a juvenile of undetermined sex to 14.7 mm in a nonovigerous female. One ovigerous female (carapace length = 3.8 mm) carried 74 eggs ranging 0.3-0.4 mm in diameter.



Fig. 1. Northern Caribbean region showing pertinent localities discussed in the text; PR = Puerto Rico; VI = Virgin Islands; stippling denotes banks delineated by the 45.7 m contour line (only those associated with the Bahamas and the north coasts of the Greater Antilles have been included).

Five specimens (carapace length = 3.3–3.8 mm) were identified as males by the presence of an appendix masculina on the endopod of the second pleopods. In some individuals the appendix masculina is little more than an obscure “bud,” and in all five specimens it is much shorter than the appendix interna (Fig. 2a). The endopod on the first pleopod of distinguishable males has a cluster of small coupling hooks at the distal end (Fig. 2b).

Hippolytidae

Barbouria cubensis (Von Martens)

Fig. 3

In the period 25 March–14 April 1975 a total of 34 specimens of *Barbouria cubensis* (all apparently males) were taken from a saline pool about 0.4–0.8 km N of the new airstrip on Providenciales. This pool is located in a crescent-shaped fissure about 12–15 m below the surface of the ground. The surface of the pool describes an arc about 9–12 m long along the outer perimeter and about 1–2 m wide. The water was extremely clear at the time shrimp were collected; “bottom” could be seen about 3–5 m below the surface, but it undercut the far wall and sloped precipitously to unknown depths. Although dim light penetrated parts of the fissure the pool was largely unexposed to daylight.

Fluctuations in water level observed during several visits to the pool may be attributed to the influence of tidal flow through subterranean channels in the eroded karst. The pool has no direct surface connection

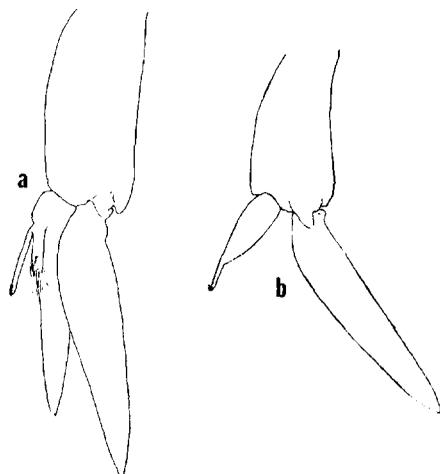


Fig. 2. Pleopods of male *Typhlatya garciai* from Providenciales, carapace length 3.6 mm: a, Anterior view of left second pleopod; b, Posterior view of right first pleopod.

to the sea, which is about 1.6 km to the north. A water sample taken from just below the surface had a salinity of 19.0‰ as determined by refractometry.

Individuals of *B. cubensis* were observed in all parts of the pool but they retreated quickly beneath protective ledges when disturbed. Their presence was first noted while bats (*Erophylla sezekorni*) were being collected from walls of the cave; groups of 10–15 shrimp often gathered together and appeared to feed upon the open wounds of injured bats that had fallen into the pool.

Field notes on coloration of *B. cubensis* from this pool are as follows: body red, scarlet, or deep salmon, occasionally white with only traces of pink; flagella white but with basal segments sometimes pink; terminal segments of pereopods white or red, sometimes white with a distal band of pink; eyes black. Many individuals blanched shortly after removal from the cave.

The postorbital carapace length of 32 specimens of *B. cubensis* from Providenciales ranges from 8.2–15.6 ($\bar{x} = 11.3$ mm). Twelve individuals exceed the 12 mm maximum carapace length reported by Chace and Hobbs (1969) for Cuban specimens and one exceeds the 15 mm maximum carapace length reported by Botosaneanu and Holthuis (1970). Total length (tip of rostrum to tip of telson) of the Providenciales specimens, in alcohol, ranges from 25.8–49.5 mm.

The series of *B. cubensis* includes males with (Fig. 3a, b) and males without (Fig. 3c, d) terminal coupling hooks on the endopod of the first

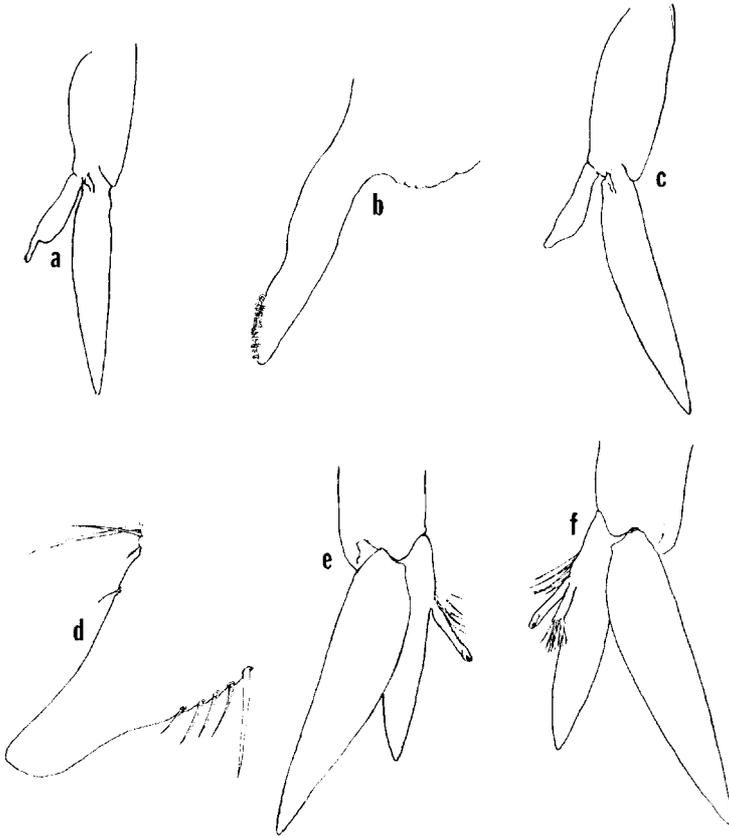


Fig. 3. Pleopods of *Barbouria cubensis* from Providenciales: a, Posterior outline of right first pleopod of male, carapace length 13.1 mm; b, Endopod of same; c, Posterior outline of right first pleopod of male, carapace length 14.7 mm; d, Endopod of same; e, Anteromesial view of right second pleopod of sex indeterminate specimen (male?), carapace length 15.6 mm; f, Anteromesial view of left pleopod of same.

pleopod. Such coupling hooks, previously thought absent in *B. cubensis*, were described in *B. antiguensis* by Chace (1972) and were mentioned as one of several characters which might phylogenetically relate *B. antiguensis* more closely to members of the genus *Ligur* than to *B. cubensis*. The presence of these coupling hooks in both species of *Barbouria* is further evidence that this genus and *Ligur* are closely allied and increases the likelihood that *Barbouria* will eventually be placed in synonymy of *Ligur*.

No females have been reported from previous collections of *Barbouria cubensis*, and none were found in our series from Providenciales. However, one of our specimens has a well developed appendix masculina on the endopod of the left second pleopod but no evidence of this structure on the

right second pleopod (Fig. 3e, f). Aside from the absence of an appendix masculina, the left second pleopod of this individual is similar to those of other apparently normal males and closely resembles that of a male specimen illustrated by Chace and Hobbs (1969). This individual is therefore assumed to represent an aberrant male.

On 27 February 1976 Buden observed a red shrimp in a brackish pool within a small cave near Cape Comete Hill at the northwest end of East Caicos (Fig. 1). No specimen was collected, but the individual resembled *B. cubensis* in size and coloration.

Unidentified Species

In February 1972 the low-lying mesic woods between the settlements of Kew and Sandy Point on North Caicos were flooded by heavy, persistent rains. Here Buden observed a scattering of "small, yellowish gray, translucent shrimps." A number of natural freshwater wells had overflowed and may have been the source for these "woodland shrimp." No specimens were collected.

Discussion

The discovery of a population of *Typhlatya garciai* in a saline pool on Providenciales is further evidence that present day species in this genus probably arose from a more widespread marine ancestor (see Chace and Manning, 1972, and Monod and Cals, 1970). Of the four other species of *Typhlatya* only *T. rogersi* of Ascension Island in the South Atlantic and *T. galapagensis* in the Galapagos are known to inhabit saline pools. *T. pearsei* from Yucatan, *T. consobrinus* from Cuba, and *T. monae* from Barbuda, Isla Mona, and Hispaniola characteristically are found in subterranean bodies of freshwater (Chace and Manning, 1972; Chace, 1975). If we accept certain proposals of continental drift theory then the hypothesized common ancestor of contemporary species of *Typhlatya* may have had a more continuous distribution when these land areas or their precursors were in much greater proximity than at present. Rosen (1976) has discussed correlations of present day animal distributions with recent evidence and theory for geographical shifting of land masses, particularly as these correlations pertain to the Caribbean area.

The presence of *Barbouria cubensis* at opposite ends of the Bahama chain may be an indication that this species is present, in suitable habitats, throughout the archipelago. Individual islands in the Bahamas are widespread and well separated from adjacent land masses, but the banks upon which these islands lie should also be considered in any biogeographical appraisal of this region. Figure 1 shows the Bahama banks as delineated by the 45.7 m depth contour. All of the shaded region likely represents

land that was exposed at various times during Pleistocene sea level changes. In view of this aspect of geographic proximity of Cuba (the only large Antillean Island known to be inhabited by *B. cubensis*) to the Bahamas the presence of a Cuban faunal element, even in the far northern Bahamas, is not completely unexpected. Furthermore, ocean currents, at least those at the surface, flow in a general northward direction from Cuba, Hispaniola and Puerto Rico to the Bahamas. There are also currents that set from eastern Cuba toward the Cayman Islands where *B. cubensis* has been taken.

Islands and banks of the Bahamas south of the Great Bahama Bank (the largest shaded area in Fig. 1) are separated from the northern islands, from the Greater Antilles, and from each other by depths that range from about 1,500 to 3,700 m (Schuchert, 1968), and they probably formed no large continuous land masses comparable to those of the more northern islands. Also, the southernmost Bahamas are outside the range of any present day surface currents from Cuba. A hypothesis that suggests some form of hydrochore dispersal from Cuba to the southern Bahamas must rely upon highly fortuitous events, at least in view of present geographical alignments; dispersal in this direction may have been facilitated by past geological configurations different from those of the present (see discussion and references on *Typhlatya garciai*).

If *B. cubensis* were known to inhabit any of the more eastern islands in the Greater Antilles (i.e., Hispaniola, Puerto Rico or the Virgin Islands) then dispersal westward and northward via ocean currents would appear a much more likely event. Drift bottles released in the vicinity of Hispaniola, Puerto Rico and the Virgin Islands have been recovered in the Turks Islands (about 27 km E of the Caicos Bank), in the Caicos Islands, and in the Bahamas proper (Bane, 1965; Metcalf and Stalcup, 1974).

Although *B. cubensis* is known only from spelean habitats individuals of this species appear much less specialized for cave life than do most cavernicoles, as evidenced, at least in part, by the presence of well developed eyes and pigmentation in this species. Also, *B. cubensis* is apparently absent from strictly freshwater habitats. Botosaneanu and Holthuis (1970) state that "*Barbouria cubensis* may not be treated as cave-dwelling . . ." but as a species "engaged in the conquest of the subterranean realm . . . the giant network of cracks, completely or partly filled with brackish water (or even with almost salty water), which pierces in all directions the limestones along the sea shores." Recent records from the Bahamas support these statements. However, at present too little is known of the distribution, habitats, and life history of *B. cubensis* to postulate more confidently on its origin or dispersal. The larval stages and females of this species are as yet unknown.

Prior to the study by Botosaneanu and Holthuis (1970) *Barbouria cubensis* was known only from subterranean saline pools in Cuba, and Chace and

Hobbs (1969) suggested that this species evolved there, in situ, from a marine ancestor. Recent records of *B. cubensis* from the Bahamas and the Cayman Islands show that this species is much more widely distributed and invite further speculation as to the origin of these disjunct populations.

Representative specimens from our series of *Typhlatya garciai* and *Barbouria cubensis* have been deposited in collections of the Division of Crustacea, National Museum of Natural History, Washington, D.C., and have been made available for a detailed review of American troglobitic decapods that is now in preparation by Horton H. Hobbs, Jr.

Acknowledgments

For reviewing drafts of the manuscript we thank Horton H. Hobbs, Jr., and George H. Lowery, Jr. We also thank Fenner A. Chace, Jr., and Horton H. Hobbs, Jr., of the U.S. National Museum of Natural History for confirming identifications of the shrimp, and Pauline Baran of Providenciales and Beverlea Aldridge of Canandaigua, New York, for their assistance in the field. Field expenses were partly defrayed by a grant from the Louisiana State University Chapter of the Society of Sigma Xi and by funds from the Student Government Association and the LSU Foundation through the Graduate School of Louisiana State University.

Addendum

The descriptions of two new species of *Typhlatya* (*T. mitchelli* and *T. campecheae*) from freshwater habitats in Mexico, by H. H. Hobbs III and Horton H. Hobbs, Jr. (Smithsonian Contributions to Zoology, Number 240, 1976), came to our attention after this paper was in press.

Literature Cited

- Bane, G. W., Jr. 1965. Results of drift bottle studies near Puerto Rico. *Carib. Jour. Sci.* 5:173-174.
- Botosaneanu, L., and L. B. Holthuis. 1970. Subterranean shrimps from Cuba (Crustacea: Decapoda: Natantia). *Trav. Inst. Spéol. "Émile Racovitza"* 9:121-133.
- Chace, F. A., Jr. 1972. The shrimps of the Smithsonian-Bredin Caribbean expeditions with a summary of the West Indian shallow-water species (Crustacea: Decapoda: Natantia). *Smithsonian Contrib. Zool.* 98:x + 179 pp.
- . 1975. Cave shrimps (Decapoda: Caridea) from the Dominican Republic. *Proc. Biol. Soc. Wash.* 88:29-44.
- , and H. H. Hobbs, Jr. 1969. The freshwater and terrestrial decapod crustaceans of the West Indies with special reference to Dominica. *U.S. Nat. Mus. Bull.* 292:vi + 258 pp.
- , and R. B. Manning. 1972. Two new caridean shrimps, one representing a new family, from marine pools on Ascension Island (Crustacea: Decapoda: Natantia). *Smithsonian Contrib. Zool.* 131:18 pp.

- Holthuis, L. B. 1956. An enumeration of the Crustacea Decapoda Natantia inhabiting subterranean waters. *Vie et Milieu* VII:43-76.
- . 1974. Subterranean Crustacea Decapoda Macrura collected by Mr. L. Botosaneanu during the 1973 Cuban-Rumanian Biospeological Expedition to Cuba. *Int. Jour. Speleol.* 6:231-242.
- Metcalf, W. G., and M. C. Stalcup. 1974. Drift bottle returns from the eastern Caribbean. *Bull. Mar. Sci.* 24:392-395.
- Monod, T., and P. Cals. 1970. Sur une espèce nouvelle de crevette cavernicole: *Typhlatya galapagensis* (Decapoda Natantia; Atyidae). *Mission Zoologique belge aux îles Galapagos et en Ecuador* (N. et J. Leleup, 1964-1965) 2(VI): 55-103.
- Rosen, D. E. 1976. A vicariance model of Caribbean biogeography. *Syst. Zool.* 24:431-464.
- Schuchert, C. 1968. Historical geology of the Antillean-Caribbean region. (fascimile of the 1935 edition). Hafner Publ. Co., New York. 811 pp.
- Vandel, A. 1965. *Biospeleology*. Pergamon Press. 524 pp.

Museum of Zoology, Louisiana State University, Baton Rouge, Louisiana 70893, and Department of Biology, University of Southwestern Louisiana, Lafayette, Louisiana 70504.

