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NOTES ON BERMUDA HERMIT CRABS
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NOTES ON BERMUDA HERMIT CRABS¹

(CRUSTACEA; ANOMURA)

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ABSTRACT

Seven spp. of pagurids from Bermuda shallow waters are listed and discussed. The status of *Calcinus verrilli* (*Clibanarius verrilli* Rathbun) as endemic to Bermuda is confirmed. *Clibanarius hebes* Verrill (in part) and *C. brachyops* Bouvier are probably referable to *C. tricolor* (Gibbes). *Clibanarius antillensis* Stimpson and *Pagurus miamensis* Provenzano are new to Bermuda. Availability of gastropod shells is probably a limiting factor in abundance of hermit crabs in this locality. The three most abundant species occupy different ecological niches.

INTRODUCTION

A recent treatment of many of the West Indian littoral pagurids (Provenzano, 1959) left a number of problems in this group untouched. Since Verrill's general discussion of the decapods of Bermuda half a century ago nothing has been written concerning the pagurid fauna of those islands and the two species listed as endemic at that time have been unreported. Examination of co-types of *Clibanarius verrilli* Rathbun revealed that the generic status of that species was questionable. Search through collections failed to turn up the illustrated type of *Clibanarius hebes* Verrill, but examination of the paratypes indicated that more than one species was before Verrill at the time of his description of *C. hebes*. The age and small number of specimens did not facilitate solution of these problems, and with the aim of obtaining additional material the writer visited 27 localities at Bermuda in November 1958.

I am most grateful to Dr. William H. Sutcliffe, Jr., Director of the Bermuda Biological Station, for his kindness before, during, and after my stay there, and to other members of the staff for their assistance. Dr. Willard D. Hartman of the Yale Peabody Museum and Dr. Fenner A. Chace, Jr. of the Smithsonian Institution were helpful in providing material from their collections for study. I am sincerely grateful to Dr. Jacques Forest of the Paris National Museum of Natural History for examining specimens sent him, and for permission to quote portions of his correspondence.

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All material from shore localities was collected by wading or shallow diving, but the off-shore collections were made with the aid of a boat and aqua-lung to depths not exceeding 25 feet. The material collected was divided among the following institutions: Yale Peabody Museum of Natural History; Smithsonian Institution; Paris National Museum; and the University of Miami Marine Laboratory.

TABLE 1
LIST OF LOCALITIES VISITED AT BERMUDA AND SPECIES COLLECTED
AT EACH, 5-14 NOVEMBER 1958.

<i>Locality</i>	<i>Species Found</i>	<i>Number</i>
Coney Is. Bay	<i>C. tricolor</i>	many
	<i>P. miamensis</i>	8
Coney Is., east side	None	
Bailey's Bay	<i>C. tricolor</i>	1
Pt. at Shelly Bay	<i>C. verrilli</i>	2
Rocky tide pools west of Shelly Bay	<i>C. tricolor</i>	2
	<i>P. miamensis</i>	1
Gibbet Is.	None	
Harrington Sound at Flatts Bridge	<i>P. miamensis</i>	1
Ducking Stool	<i>C. verrilli</i>	1
Mangrove Bay	<i>C. tricolor</i>	many
	<i>C. antillensis</i>	1
Ely's Harbor	<i>C. tricolor</i>	many
Somerset Bridge	<i>C. tricolor</i>	a few
Coral heads off Wreck Hill	<i>C. verrilli</i>	many
	<i>P. miamensis</i>	a few
Hungry Bay	<i>C. tricolor</i>	many
	<i>C. tibicen</i>	1
Devonshire Bay	<i>C. tricolor</i>	a few
Smith Beach	<i>C. verrilli</i>	a few
	<i>P. miamensis</i>	a few
Pink Beach	<i>C. verrilli</i>	a few
	<i>P. miamensis</i>	a few
	<i>C. tricolor</i>	many
Boilers, S.E. shore	<i>P. miamensis</i>	3
Charles Is., outside slope	<i>C. verrilli</i>	15
	<i>P. miamensis</i>	17
	<i>C. tibicen</i>	7
Tuckerstown Pt.	None	
Dolly's Bay	<i>C. tricolor</i>	a few
St. Georges Harbor	<i>C. tricolor</i>	many
Tobacco Bay	None	
Ferry Reach (Biol. Station)	None	
Western Ledge reef	<i>C. verrilli</i>	2
Coral heads in western lagoon	None	
Three Hill Shoal	<i>C. verrilli</i>	6
North Rocks Reef	<i>C. verrilli</i>	23
	<i>P. miamensis</i>	6

Coenobita clypeatus (Herbst, 1791)

Cancer clypeatus Herbst, 1791: 22, figs. 2a, 2b.

Cenobita diogenes, Verrill, 1908: 438, fig. 55.

Coenobita clypeatus, Provenzano, 1959: 359, figs. 3a, 3b, 3c.

Verrill remarked on the use of fossil shells by this species and on its occurrence far from shore. Although no specimens of this land hermit were taken during the brief collecting period available for this study, it is still present, for members of the Biological Station reported having seen specimens recently.

Pagurus miamensis Provenzano, 1959

4/ *Pagurus miamensis* Provenzano, 1959: 414, fig. 21.

This was one of the three most abundant pagurids taken. That it hasn't been noticed before may be due to its avoidance of the inter-tidal zone, for it is usually found at depths of one fathom or more. Its range is now extended from Florida and the Bahamas. A number of the females taken were ovigerous.

Dardanus venosus (H. Milne-Ed., 1848)

Pagurus venosus H. Milne-Edwards, 1848: 61.

Dardanus venosus, Verrill, 1908: 441, figs. 58, 59.

Dardanus venosus, Provenzano, 1959: 374, fig. 6.

This is probably the largest hermit occurring at Bermuda and the general scarcity of suitable shells may be one factor responsible for the absence of greater numbers of individuals. Only one specimen was seen, and that at the government aquarium, in one of the fish tanks. It had been collected "on the reefs."

Clibanarius antillensis Stimpson, 1862

Clibanarius antillensis Stimpson, 1862: 85.

Clibanarius antillensis, Provenzano, 1959: 368, fig. 5b.

A single specimen, establishing the first record of this species at Bermuda, was taken on rocky sand at the beach on Mangrove Bay, near the intersection of Mangrove and Somerset Roads, only a few yards away from large colonies of *C. tricolor*.

Clibanarius tricolor (Gibbes, 1850)

Pagurus tricolor Gibbes, 1850: 189.

Clibanarius tricolor, Verrill, 1908: 447, figs. 61, 62, 63.

Clibanarius tricolor, Provenzano, 1959: 366, fig. 5a.

Without question this is the most abundant hermit crab along the Bermuda shores, for intertidally it is found wherever small shells are available, congregating at low tide in colonies by the hundreds. It seems to be especially fond of protected rocky or shelly shores, but may

also be found at depths of a fathom or more, as at Pink Beach where a large series was taken from depressions beneath rocks, on hard but somewhat sandy bottom. Some of the females were ovigerous.

Verrill stated that it is easily distinguished from all others by its remarkable blue coloration, but he was unaware of the color in life of *C. verrilli* (q. v.)

Calcinus tibicen (Herbst, 1791)

Cancer tibicen Herbst, 1791: 25, pl. 23, fig. 7.

Calcinus sulcatus, Verrill, 1908: 439, figs. 56, 57, & pl. 28, fig. 7.

Calcinus tibicen, Provenzano, 1959: 363, fig. 4.

Occasionally taken intertidally with *C. tricolor*, this species is also found in exposed localities, but it was far from common. Females of this species too, were ovigerous.

Calcinus verrilli (Rathbun, 1901)

Fig. 1

Clibanarius verrilli Rathbun, 1901: 328.

Clibanarius verrilli, Verrill, 1908: 449, pl. 27, fig. 5 & pl. 28, fig. 6.

From examination of the co-type material, it was apparent that this species had been misplaced in the genus *Clibanarius*, for it has all the characters of the genus *Calcinus*. Thus it is now the second species of *Calcinus* known from the western North Atlantic.

The detailed physical description given by Rathbun and repeated in quotation by Verrill mentioned red spots on alcoholic specimens, but the color in life was not recorded. Like other members of its genus, *C. verrilli* is strikingly pigmented in life. Overall color of the hard parts is blue-purple spotted with red. The antennules are vivid blue. The segments of the antennae, although transparent, are edged with faint blue color. The eyestalks are purple near the base but with increasing amounts of red distally. The area immediately proximal to the cornea is white, while the cornea itself is black or black spotted with white. The chelipeds are purple with red patches on the upper, forward margins of the carpus and merus. An irregular row of red pigment along the upper margin of the hand extends onto the movable dactyl. Similar rows of red pigment are present on the upper surface of each ambulatory leg, but do not show in the present side-view illustration.

The species is very abundant on rocks and reefs, but not intertidally. Verrill said his specimens attained 40 mm and that the species becomes much larger. The largest specimens collected during the present study were about 8 mm in carapace length, and the greatest total length.

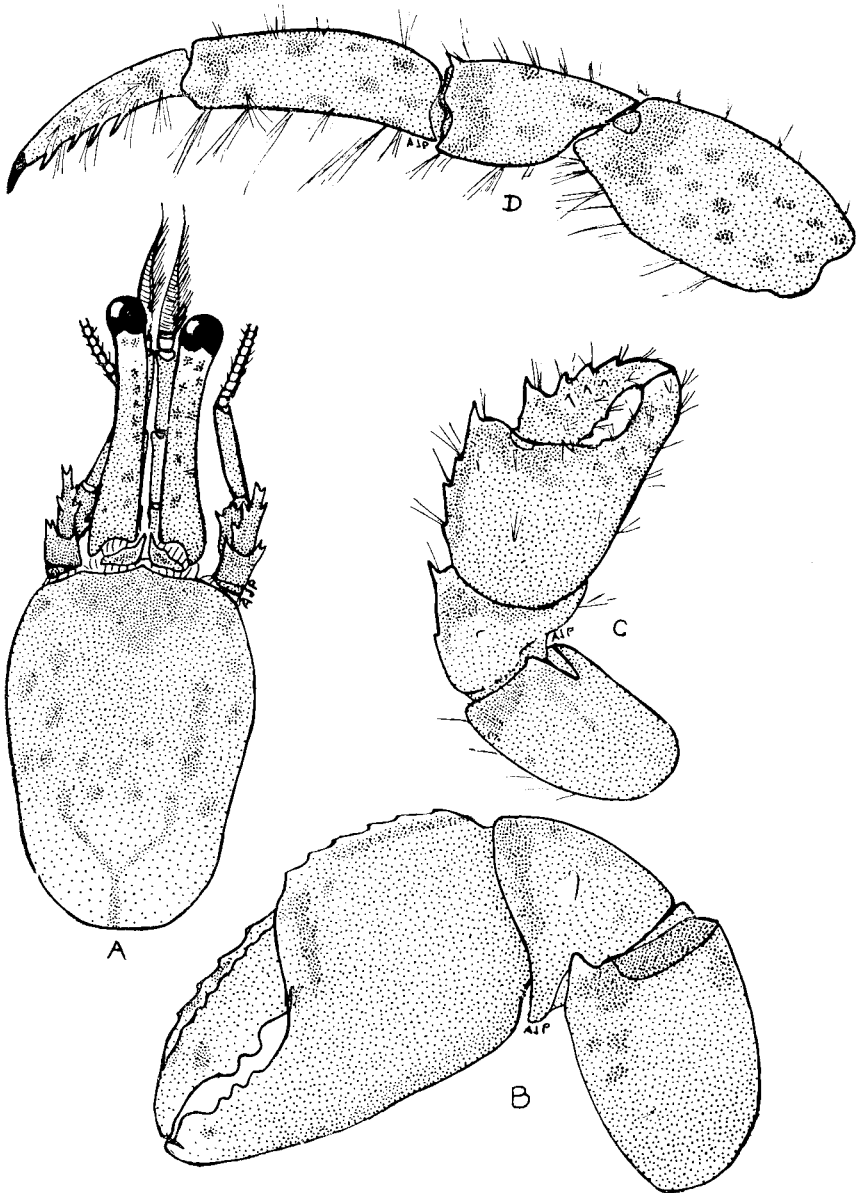


FIGURE 1. *Calcinus verrilli* (Rathbun), a male with total carapace length of 7 mm. A. Anterior carapace and cephalic appendages; B. Major cheliped, lateral view; C. Minor cheliped, lateral view; D. Second left ambulatory leg (p3), lateral view.

even when measured from the tips of the chelipeds (instead of from the rostrum) to the telson, did not exceed 25 mm. None of the females were ovigerous.

Although *C. verrilli* is very distinct from *C. tibicen* of the West Indies, I did not know its affinities to *C. ornatus* of the eastern Atlantic and therefore sent specimens to Dr. J. Forest at Paris who very kindly examined them and who has allowed me to quote him as follows:

J'ai procédé à une comparaison sommaire de *C. verrilli* à *C. ornatus* (Roux) et je puis vous dire qu'il s'agit sans aucun doute de deux espèces distinctes: la main du chélipède gauche est plus allongée chez le ♂ de *C. ornatus*, et dans cette espèce, les pattes ambulatoires p2 et p3* sont plus grêles, avec un dactyle plus long par rapport au propode. La disposition des marques colorées est tout à fait différente: en particulier les p2 et p3 présentent des lignes longitudinales rouges jusqu' au bord antérieur du propode que est marqué par un anneau d'un brun violacé intense. Le dactyle porte des taches rouges plus nombreuses que chez *C. verrilli*.

Cependant il s'agit de deux espèces apparentées et *C. verrilli* me paraît plus proche de *C. ornatus* que des autres espèces américaines.

Verrill was correct apparently, in his belief that *C. verrilli* is endemic to Bermuda.

The Status of *Clibanarius hebes* Verrill and *C. brachyops* Bouvier

Verrill based *C. hebes* on three specimens, the largest being illustrated with photographs and serving as the principal object of his description. Since his material was alcoholic and several years old, there were no distinguishing color patterns to aid him. The largest specimen, of the *cubensis-vittatus* group with acuminate eye-scales, is apparently lost, for a search through the Yale collections failed to turn it up and it seems not to have been deposited in the U. S. National Museum. However, the other two specimens upon which the species was based were found and examined. These do not belong to the same species as the illustrated type, but possess the denticulate eye-scales of the *tricolor-antillensis* group.

The ophthalmic proportions of pagurid crabs have long been used as an important descriptive feature. However, the character is reliable only in fully adult specimens because the ratio of eyestalk length to width changes radically with growth. A large series of *C. tricolor* from glaucothoe to fully adult animals was taken at Pink Beach and from this series some tentative conclusions may be drawn. The identity of

*The symbols "p2" and "p3" as used by Forest and others (referring to pairs of pereopods) are equivalent to "first" and "second" ambulatory legs respectively, as used in this and my preceding paper.

Verrill's lost type of *C. hebes* remains obscure, for despite re-collection at the type locality (Coney Is.), no specimens which might agree with the missing type were found. The smaller specimens of "*C. hebes*" however, except for the absence, due to preservation, of the very diagnostic color patterns, resemble most closely the younger stages of *C. tricolor* taken in the Pink Beach series.

A related problem involves a species described from Cuba. *Clibanarius brachyops* Bouvier, 1918 was erected primarily because the type (presumed by the presence of eggs on the pleopods to be fully mature) had eye-stalks much shorter and stouter than previously described species. It is now known however that female individuals may become ovigerous before attaining the size and the ophthalmic proportions of full-sized adults. As in the case of *C. hebes*, color patterns, so useful in separating some members of this genus, were absent in the type material. It would seem then that *C. brachyops* and *C. hebes* (in part) are referable to *C. tricolor*. Because of the overwhelming abundance of *C. tricolor* at Bermuda, the evidence is especially strong in favor of this conclusion with respect to *C. hebes* (in part). Nevertheless, because of the very close morphological similarity of *C. antillensis* and *C. tricolor*, the possibility that young specimens of the former species are involved in at least the *brachyops* problem cannot be ignored.

DISCUSSION

As shown in Table 1, the number of species at any given Bermuda locality was always small and the number of individuals often so. The only species exceeding a couple of dozen at any locality was *C. tricolor*, and this always at places where *Batillaria* or similar small shells were abundant intertidally. The isolation of the Bermudas is undoubtedly one factor in the small number of species of pagurids found there. Another feature of these islands which may have even more significance, at least in limiting numbers of individuals if not species, is the general scarcity of gastropod shells so necessary for these crabs. Only at some intertidal localities could shells be called abundant, and very rarely could an empty gastropod shell be found.

The three most abundant hermits exhibit differences in requirements in which must certainly relieve competition amongst themselves. *C. tricolor* has the intertidal zone almost exclusively to itself; *Calcinus verrilli* and *Pagurus miamensis* share habitat, but are fairly well restricted to different types of shells. *C. verrilli* was taken most often in

Cerithium which has a rather large, round opening, while *P. miamensis* was found usually in the dove shell, *Pyrene* which has only a narrow, slit-like opening. Morphology seems to be the key here, for *C. verrilli* can seal off to some extent the round opening of *Cerithium*, but would be unable to withdraw its large left cheliped through the narrow opening of *Pyrene*. On the other hand, *P. miamensis* is well able to utilize the smaller dove shell, since its hands are much more slender than those of the *Calcinus*, but might have difficulty in utilizing the relatively large *Cerithium*.

Boden (1952) described the probable method by which planktonic larvae produced by Bermuda bottom fauna would tend to remain in the area. It is very likely that at least the three most common pagurids are able to maintain resident populations. Whether the remaining species are present in sufficient numbers to contribute significant numbers of larvae for repopulation, or whether they are represented at Bermuda only by a few successful migrants from the West Indies which are replaced periodically is unknown at present.

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