

ON THE CASTLE BUILDING HABIT OF THE CRAB *CARDISOMA*  
*CARNIFEX* (HERBST) (FAMILY GEOCARCINIDAE), OF THE  
ANDAMAN ISLANDS<sup>1</sup>

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OUR knowledge of the ecology and habits of land crabs of the family Geocarcinidae, especially of the genus *Cardisoma* is wanting in several respects. In the tropical Indo-Pacific, where two species of this genus are recognised, the available information is restricted to stray observations, mostly pertaining to locality records.

During a recent visit to the Andamans and Nicobar Islands in February-March 1960, we were interested to see in several places close to the shore in Andamans, characteristic earthen mounds, some of exceptionally large size and each resembling a termitarium. A close scrutiny showed that the mounds were crab castles, and in some fields several of these castles of varying sizes were seen generally ranging in height between 30 and 50 cms. and spread out almost to the shoreline. The largest of such aggregations both in numbers and size we found in places adjacent to Phoenix Bay, Port Blair, and at Mayabundur, where each mound was about 75 cms. high with an almost equal basal diameter. Although we were told that several hundreds of these crabs teem over the colony areas and adjacent fields at night, this was not to be the case, atleast during the period of our visit and only on the last night of our stay at Port Blair were we able to catch one of the crabs from a colony near Marine Drive, Aberdeen Bay which we visited or passed by at different hours of the night as well as during day time when observations were made. The crab is a large female *Cardisoma carnifex* (Herbst) (Plate I, fig. 2), a species having a fairly wide distribution in the tropical Indo-Pacific.

It is somewhat surprising that in spite of there being several accounts on the natural history of the Andamans and Nicobar islands (Alcock, 1902 ; Kloss, 1902 ; Temple, 1903 ; Sewell, 1922 ; etc.), this phenomenon of castle building by *C. carnifex*, so conspicuous a feature of the topography of some of the shore areas has not found mention in them. This species is nocturnal and contrary to expectation even at night they were not found to stray away from their respective castles or open burrows (in places where castles were not yet constructed or only partly finished). Commenting on the habits of *C. carnifex* from the Tuticorin coast (Gulf of Mannar), Henderson (1893) remarked that '... its underground dwellings, unlike those of most land crabs, do not pass vertically downwards for the first part of their course ; they also lack the neat and finished appearance of the external opening, seen in the burrows of most *Telphusae*'. This we found to be the case where the crabs had not yet constructed their castles, but in the latter case, the main burrow from its opening near the summit drops vertically to the ground level from whence the burrow slants. Borradaile (1901) remarks that *C. carnifex* 'Generally makes its burrows under coconut trees at the edges of *Kuli* or swamps, the openings being

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often covered at high tide.' In the case of open burrows as well as the castles, invariably the entrance was seen to be plugged during day time. Each period of activity appeared to be marked by fresh layers of excavated earth at the burrow openings or at the summit of the castles. These additions are in the form of large irregular pellets copiously mixed with water making them firmly adhere to the previous layer, thus forming a compact mass, but when too watery the wet mud drips along the sides of the castle (Plate I, fig. 1, *a*). Many of the castles, in addition to the main burrow opening at the top had one or two openings at the base which remained similarly plugged (Plate I, fig. 1, *b*). It was not possible to verify whether these tunnels were always kept open during the periods of activity. As in the case of the double exit openings of the U-shaped burrows of some ocypodids, these probably represent means of easy access or exit for the crab when disturbed during its period of activity.

Unlike the scattered accumulation of sand outside the burrow entrances of ocypodids, the castle building habits of *C. camifex* appears to be executed for some purpose for many reasons. Besides the initial excavation of earth in constructing the burrow, their close proximity to the shore naturally subject the tunnels to tidal influence. During the high tide period seepage water is likely to enter the burrows and the wet earth excavated during ebb tide to clear the tunnels will account for much accumulation of the earth at the burrow entrance, but their orderly placement eventually to form the castle is amazing. Compared to *C. camifex*, the castles of the land crab *Paratelphusa guerini* (M. Eds.) are but miniature replicas and McCann (1937) remarks that the latter are constructed to keep off intruders for 'At the time that the crab is about to aestivate there are numerous other animals which are looking for a suitable retreat. Some are unable to excavate their own burrows ; others prefer to find a convenient ready made burrow rather than dig one, and find a crab hole convenient. If the entrance of the crab's burrow were flush with the ground, the entrance with its fresh plug of mud would be readily accessible. But as the entrance is raised and the wall of the castle solid they act as a bluff which is mistaken for a clod of earth!' Protection from intruders may also be a plausible reason for *C. camifex* to resort to this castle building habit. However, unlike *Paratelphusa* which perforce aestivates during the dry months when the water level in the soil goes down, the daily tidal fluctuations affecting the shore areas inhabited by *C. camifex* may not allow for any quiescence unless aestivation is carried out above the ground level in the castle itself.

The movements of the crabs around the burrow openings and the castles appeared extremely sluggish, but at the slightest disturbance they darted into the burrows, entering sidewise, and in the open burrows were invariably found lingering partly hidden at the point where the burrow disappears from view. Only once at night did we notice a crab about ten metres away from some open burrows into one of which it fled when disturbed.

As to whether these castles are permanent structures or not we are unable to say. Our visit was about two months after the monsoon was over and most of the castles appeared to have been built since then. Although many of the fields in which the castles were present were found to be overgrown with weeds and grass, the castle walls were bereft of any encrusting vegetation, thus pointing to their recent construction. In contrast, one of the fields off Marine Drive and just to one side of the Andamans Club, Port Blair, is studded with numerous small dome-shaped mounds not exceeding 25 cm. in height, but covered with grass, which no doubt represents a disused colony, the castles themselves having been obviously planed down by rain action.

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In the Chilka lake, *C. carnifex* occurs in the islands in the outer channel near Manikapatnam, and Kemp (1915) observes that 'In March 1914, when the water was low and as salt as that of the sea outside the lake, large burrows of *C. carnifex* were found, their mouths often four or five inches in diameter. Similar burrows were noticed below the surface of water in the vicinity and, on the shore, fragments of specimens that had been eaten by birds were abundant. In September, when the water in the outer channel was fresh, the species was also in evidence, but on this occasion, owing to the rise in the water-level, most of the burrows were below the surface. The crabs seem to live at a considerable depth in the mud and as a rule, do not wander by day; it was in consequence difficult to obtain specimens.' We found no remains of the crab or its moulted shell in any of the colony areas. However, it is likely that in low-lying places subject to inundation during the rains the open burrows may be covered with water.

Alcock (1900) records both *C. carnifex*, and *C. hirtipes* Dana from Andamans and remarks that these species are '——very common in the jungles of Andamans where they may be found in the day time crouching under roots, fallen logs, etc., sometimes in burrows near the shore.' The ecological niches occupied by these two species are also of interest. In the Great Cocos Island of the Andaman-group, Alcock (1902) has found *C. hirtipes* occurring along with large *Coenobites* in the thick jungles. This species he records along with *Pleocarcinus humei* (Wood-Mason) which especially on the smaller islands grow to a large size. Further evidence that *C. hirtipes* lives away from the shore comes from the observations of Dr. C. Andrews on this species from the Christmas Island in the Indian Ocean, cited by Caiman (1911) wherein it is stated that 'In this island at any rate this species must be regarded as a freshwater form, and, in fact, when a specimen was seen it might be taken as an indication that freshwater was not far off. It lives in deep holes in the mud at the sides and bottom of brooks.' In addition Caiman mentions that 'Dr. Andrews tells me that he never saw this species at or near the sea (in marked contrast to *Gecarcoidea*) and this agrees with the observations of other travellers on species of the genus *Cardisoma*, so that the breeding habits remain unknown. There is every possibility, however, that in this case also, the young stages are passed in the sea.' In the Aldabra, Fryer (1911) found *Cardisoma* (species not mentioned) which are preyed upon by the common rat *Mus rattus*, acting as a general scavenger, but resorting to digging burrows in the vicinity of wells and filling them with dirt so as to make the water undrinkable. During our visit to Neill Island and Long Island in the Andaman-group we found further away from the shore at the bases of several very large trees and fallen trunks deep crab burrows with excavated earth accumulated on one side of the burrows. In Neill Island these were also present in the areas bordering a freshwater swamp. Unfortunately specimens of crabs from such situations could not be collected. However, after witnessing the castle building habits of *C. carnifex* and from the accounts of Alcock (1900, 1902), Borradaile (1901), and Caiman (1911) we are inclined to believe that the burrows in the interior of these islands were those of *C. hirtipes* or *P. humei* and not those of *C. carnifex*. Fryer's account of the species of *Cardisoma* polluting well water may also refer to *C. hirtipes*. Here is an interesting case of zonation where one species, (*C. carnifex*) is a shore dweller, atleast seasonally constructing castles above their underground dwellings and being more tolerant to salinity while its congener (*C. hirtipes*) lives far removed from the shore, preferably near freshwater resources, does not resort to castle building, and is probably also less tolerant to salinity.

Considering these, one question that needs solving is whether the castle building habit of *C. carnifex* is the result of a response to any special ecological feature such

as, the daily tidal fluctuations which is of considerable magnitude in the Andamans. If this be the case, the species may be expected to evince such a behavioural pattern wherever it occurs along coasts subjected to such tidal fluctuations. On the other hand, if the habit is localised, it will be worth investigating whether such a specialised behavioural pattern has any taxonomic significance as well.

No doubt, the gaps in our knowledge of the habits and natural history of these two species of *Cardisoma* are immense and more detailed observations are called for. Lack of time and other pressing duties kept us from extending our observations, but what little we saw of these crabs was so interesting that we have felt it desirable to report on the same. Any reader who has unique opportunities to observe *C. carnifex* in nature could unravel the mysteries surrounding its natural history, especially on questions whether there is any social hierarchy in the colonies, whether they aestivate at all, their breeding habits, etc., and thus needless to say, will be doing a great service to the science of Carcinology.

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