Notes on Grapsoid Crabs from the Raffles Museum

By M. W. F. Tweedie, M.A., C.M.Z.S.

1. A new genus and description of a new species of the subfamily Sesarminae.

Genus Nanosesarma gen. nov.

Genotype, by present designation, *Sesarma andersoni* De Man, 1887.

This genus is proposed to comprise those species hitherto included in *Sesarma*, Say, and one new species, which have the distal part of the hind border of the ambulatory meri spinate or denticulate. All the members of the genus are small and in all but one (the rather imperfectly known *vestita* Stimpson) there are, at least in the female, one or more raised finely granular lines on the outer surface of the chela.

The posteriorly spinate ambulatory merus is a very usual character of the Grapsinae and in such genera as *Pachygrapsus* it is found combined with the raised lines on the chelae. It is my opinion that the species of *Nanosesarma* represent a link between the Grapsinae and Sesarminae and are the most primitive members of the latter subfamily.

The generic name denotes the small size of all the known species.

I can find seven Indo-Pacific species referable to the new genus; five of these are in the Raffles Museum collection of which one is described herein as new. *Sesarma barbimana* Cano, from Peru, should probably also be transferred to *Nanosesarma*.

Key to the Indo-Pacific species.

1.	A definite epibranchial tooth present ..	2.
–.	Epibranchial tooth absent, rudimentary or defined only in exceptional atypical specimens	3.
2.	Outer surface of palm with a single granulated line	*N. minuta.*
–.	Outer surface of palm with three granulated lines	*N. gordoni.*
3.	Carapace scarcely broader than long, breadth: length as 1·03: 1	*N. vestita.*
–.	Carapace much broader than long, breadth: length as 1·25: 1 or more	4.
4.	Surface of carapace beset with tufts of hair ..	5.
–.	Surface of carapace smooth and hairless ..	6.

5. A thick growth of hair on and around the base of the fingers; male dactylar tubercles not small and close proximally, numbering 12–13	*N. batavica.*
–. Little or no hair round the base of the fingers; male dactylar tubercles very small and closely set proximally, numbering (in adults) 15 or more	*N. edamensis.*
6. A number of short pectinated ridges distal to the longest one on the male chela; a short transverse ridge on the carapace close behind the middle of the orbit	*N. andersoni.*
–. The distal pectinated ridge of the male chela is the longest; no transverse ridge behind the orbit	*N. nunongi.*

Nanosesarma minuta (De Man).

De Man 1887, p. 650; 1888, p. 379 (*Sesarma minuta*).
Rathbun 1910, p. 327.
Tesch 1917, p. 174.
Tweedie 1936, p. 52.

Distribution: Java, Gulf of Siam, South China Sea, Singapore.

Nanosesarma gordoni (Shen).

Shen 1935, p. 27 (*Sesarma gordoni*).
Sakai 1939, p. 687.

This species appears to be very close to *minuta*. It is distinguished by the presence above the raised granular line separating the hairy from the smooth part of the palm of two more granular lines, only visible by denudation of the palm and said (by Sakai) to be indistinct. In *minuta* the hairy part of the palm is granular but there are no alignments of granules. I have not seen specimens of *gordoni*.

Distribution: Hongkong, China, Japan.

Nanosesarma vestita (Stimpson).

Stimpson 1858, p. 106; 1907, p. 136 (*Sesarma vestita*).
Tesch 1917, p. 208.
Sakai 1939, p. 684.

This crab has not been rediscovered since it was described. The nearly equal breadth and length of the carapace distinguishes it from the other species.

Distribution: Japan.

Nanosesarma batavica (Moreira).

De Man 1890, p. 104 (*Sesarma barbimana* praeocc.).
Moreira 1903, p. 117 (*Sesarma batavica*).
Kemp 1915, p. 238.
Tesch 1917, p. 132.
Tweedie 1936, p. 62; 1940, p. 90.

It is in this species that an epibranchial tooth is usually absent or at most rudimentary but occasionally fairly well defined (Tweedie 1940 fig. 1).

Distribution: Java, Orissa, Singapore, east and west coasts of the Malay Peninsula.

Nanosesarma edamensis (De Man).

DE MAN 1887, p. 657; 1888, p. 379 (*Sesarma edamensis*).
TESCH 1917, p. 147.
TWEEDIE 1950, p. 346.

If I was correct in identifying a male and a female from Labuan with this species, it differs from *N. batavica* in having only a sparse growth of hair on the outside of the palm and bases of the fingers and in the dactylar tubercles being very small and closely crowded proximally and numbering (in the adult) sixteen or seventeen as against twelve or thirteen in *batavica*. De Man counted only eleven to thirteen tubercles in his small males but noted that they were very crowded proximally. This is not the case in *batavica* (*see* Kemp 1915, fig. 15). Females are hardly to be distinguished from those of *batavica*, but the latter have a certain amount of hair representing the palmar growth of the male and my female *edamensis* has practically no hair on the palm.

Distribution: Java, Borneo.

Nanosesarma andersoni (De Man). Fig. 1, d, e.

DE MAN 1887, p. 657; 1887–88, p. 172 (*Sesarma andersoni*).
TESCH 1917, p. 129.
KEMP 1918, p. 234.
TWEEDIE 1950, p. 346.
(*nec* TWEEDIE 1940, p. 89 = *N. nunongi* sp. n. *infra*).

Having reported this species from Kuantan and Prai in Malaya in 1940 I collected specimens at Kuching in Sarawak in 1949 which were clearly different from the Malayan ones and which seemed to agree better with the published descriptions of *andersoni*. I sent examples of both to the Director of the Zoological Survey of India and received a reply from Mr. K. K. Tiwari confirming my suspicion that I had misidentified the Malayan crab and that the species from Sarawak was indeed *andersoni*.

The species is known from the west coast of the Malay Peninsula between Lat. 8° and 13° N. (Trang and Mergui) and from Kuching in Sarawak. No zoogeographical conception that I know of accounts for this discontinuous distribution and it is probably rather apparent than real; nevertheless it is rather puzzling. *Andersoni* might be expected to occur at Penang, but was not in the collection made at Prai (mainland opposite Penang) in December, 1938, which included the allied new species. I have collections of Grapsoid crabs made in mangrove at a number of Malayan localities including Port Swettenham on the west coast, Kuantan on the east and Singapore Island and have encountered it in none of them. Nor was it represented in the large East Indian collections made by Storm, Brock, Kükenthal and others and reported on by its author, Dr. J. G. De Man.

Nanosesarma nunongi sp. n. Fig. 1, a-c.

TWEEDIE 1940, p. 89 (*Sesarma andersoni*).

Cotypes.—A male and a female from Kuantan, Pahang, east coast of Malay Peninsula, September, 1935.

Material.—Seventy-three additional specimens from the type locality and sixteen from Prai in Province Wellesley on the west coast. Both collections were made by Mr. G. Nunong, a collector on the Raffles Museum staff, after whom the species is named.

Description.—The carapace is broader than long, broadest at or just behind the antero-lateral angles, smooth, finely punctate, hairless and almost devoid of inter-regional grooves, even the central part of the cervical groove and those dividing the post-frontal lobes and defining the anterior tip of the mesogastric area being very shallow and faint. A short oblique granular ridge runs inwards from a point just behind each antero-lateral angle and a longer, curved one a little behind it; posteriorly to this ridge are a number of others, less well defined and irregularly arranged, not parallel with it or with each other. The lateral borders are entire and the frontal border, seen from above, is quite straight without any median embayment.

The chelipeds are unequal or subequal in the male, equal in the female. The inner border of the arm is expanded to form a rounded lacinate process, its border is slightly notched sub-distally but not toothed. The carpus has a blunt tooth internally and its upper surface bears fine squamiform granular lines. The male chelae are inflated, smooth externally with a trace of granulation towards the upper surface and a raised line on the lower part of the outer surface running onto the base of the finger. On the upper surface a single long ridge, pectinated for most of its length, granular at its outer end, crosses the palm meeting its border near the base of the dactylus and at a point a little above the carpal articulation; internal and parallel to it is another ridge, rather obscurely pectinated for part of its length, and internal to this a number of irregularly disposed lines of granules. Outside, or in front of the long pectinated ridge there are no more ridges or alignments of granules. The inner surface of the palm is smooth with a few scattered granules, its lower border curved with a distinct convexity opposite the base of the finger. The upper border of the dactylus bears fourteen or fifteen smooth transverse tubercles, close together proximally, more distant, low and obscure towards the tip. The dentition of the fingers is rather inconstant but towards their base they are usually devoid of teeth and gape widely.

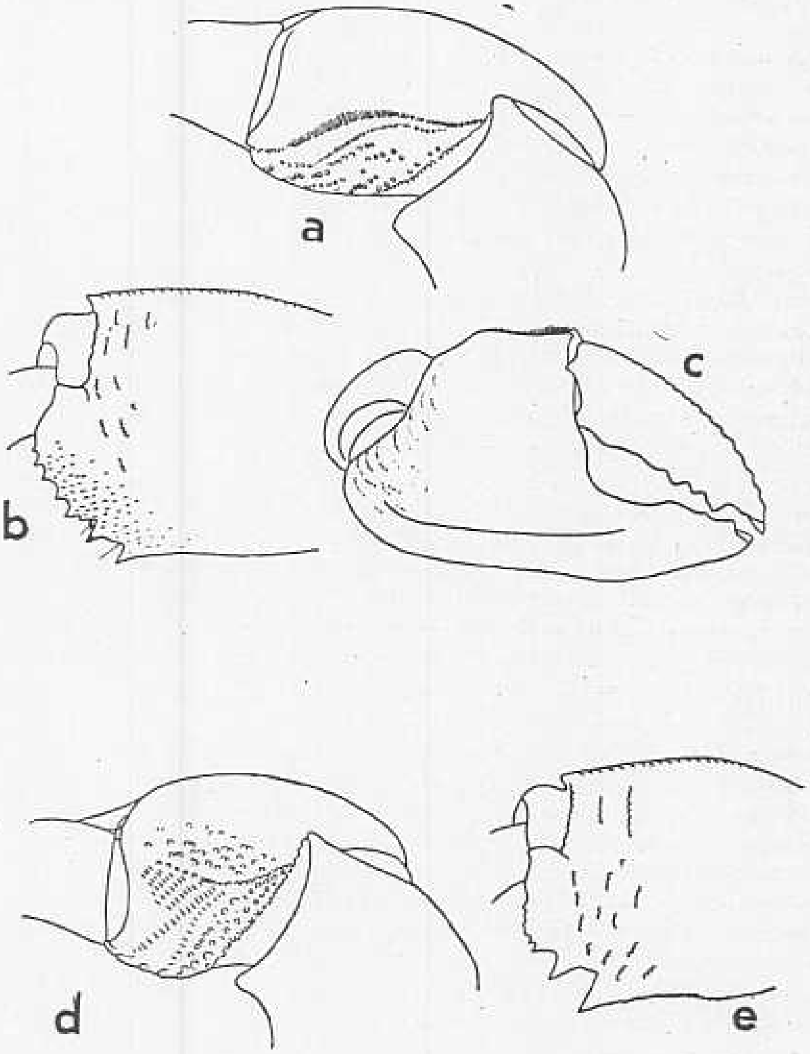

Fig. 1. a, b, c, *Nanosesarma nunongi* sp. n.; d, e, *N. andersoni*. a, d, upper surface of male chela showing pectinated and granular ridges; b, e, distal part of merus of penultimate leg; c, right male chela.

The female chelae are small and slender; the fingers do not gape at their base and the dactylar tubercles are absent. The pectinated ridges of the male are represented by simple granular ridges similarly disposed. The raised line on the lower outer surface of the palm is higher and stronger than in the male.

The meri of the walking legs have a distinct anterior subdistal tooth. The postero-distal denticles are five to seven in number, decreasing in size gradually from behind forwards, the hinder two or three not greatly larger than the anterior (distal) ones. The carpi and propodi of the three anterior pairs are covered with matted hair in front and below.

N. nunongi is close to *andersoni*, the two differ as follows: in *andersoni* the grooves of the carapace are deeper, the orbits more oblique and the front slightly embayed in the middle line; the presence of an isolated transverse ridge behind the middle of the orbit seems to be a constant character of this species as it is present in the types (*see* Kemp 1915, p. 239) and in the Sarawak specimens. The pectinated ridges on the male palm are in *andersoni* just as described by De Man; the longest and most strongly pectinated ridge does not completely cross the palm as in *nunongi*, and in front of or distal to it is a series of six or more very short pectinated ridges. The dactylar tubercles are similarly developed in the two; I count thirteen in the Sarawak *andersoni* (13–14, De Man). The inner surface of the palm is more granular in *andersoni*. The postero-distal spines on the ambulatory meri of *andersoni* comprise two or three large dentiform spines, the posterior the larger, anterior to which are only some extremely minute spinules. The measurements of the larger male of *andersoni* from Sarawak are given together with those of the cotypes of *nunongi*, and reveal some other slight differences in proportions. This specimen of *andersoni* is not, however, fully adult; De Man's largest specimen had acb. 12.6 mm.

As remarked previously the known distribution of *nunongi* is suggestive of a geologically recent marine connection across the northern part of the Malay Peninsula.

Measurements of the cotypes of *N. nunongi* and a male of *N. andersoni* from Sarawak, in mm.

	♂ *Cotype*	♀ *Cotype*	♂ *andersoni*
CARAPACE—			
Anterior breadth	10·4	9·4	8·3
Median length	8	7	6·6
Breadth of front	6·3	5·6	4·7
ABDOMEN—			
Length of 6th segment ..	0·75		0·8
Basal breadth of 6th segment ..	2·5		2·5
Length of last segment ..	1·65		1·4

	♂ *Cotype*	♀ *Cotype*	♂ *andersoni*
THE LARGER CHELA—			
Total length of chela ..	7·2	4·5	6
Height of palm	4·5	2·2	3·5
Length of dactylus	4·4	2·6	3·7
PENULTIMATE WALKING LEG—			
Length of merus	5·6	5	4·5
Breadth of merus	3	2·75	2·2
Combined length of carpus and propodus	6·3	5·5	4·8
Length of dactylus	2·3	2·1	1·9

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2. On the habits of three Ocypodid crabs. (Plate 7).

Dotilla mictyroides (Milne Edwards). In January, 1950, while on holiday at Port Dickson on the west coast of the Malay Peninsula, I spent some time observing the habits of this crab. The shore there is sandy and gently sloping so that a wide area of it is alternately flooded and uncovered by the tide. Most of the sand is yellowish and appears clean on the surface, but must be rich in organic content as below about 5 cm. depth it is dark grey in colour.

When the tide is up the *Dotilla* pass the time below the surface of the sand, emerging near the edge of the falling tide to spend the period when the flats are uncovered in feeding and the pursuit of their various other occasions. They are present in very large numbers, certain areas of sand being, for no apparent reason, much more thickly populated than others. The pattern of their behaviour is rather complicated and can conveniently be discussed under the three headings, feeding, burrowing and intercourse between individuals.

Feeding. They feed entirely bv scraping up sand with the chelae and pushing it into the mouth at the lower end of the opening between the outer maxillipeds. Inside the mouth it appears to undergo some kind of trituration to extract the finely divided organic matter, and is ejected at the upper end of the opening, whence it is removed with one of the chelae as soon as a pellet of sufficient size has accumulated, a matter of two or three seconds. Where the crabs are feeding in abundance the whole surface of the sand becomes thickly covered with these pellets. Favourite feeding grounds are the edges of shallow pools and puddles, but not beyond a depth of three or four mm. (Plate 7, top), and along the edge of the tide, especially about its lowest ebb. In such places the crabs are closely crowded but they also feed all over the firm sand where their open burrows are situated. Stranded plankton from the surface of the sand is probably the main source of food, but, as noted above, the sand has a considerable organic content in depth.

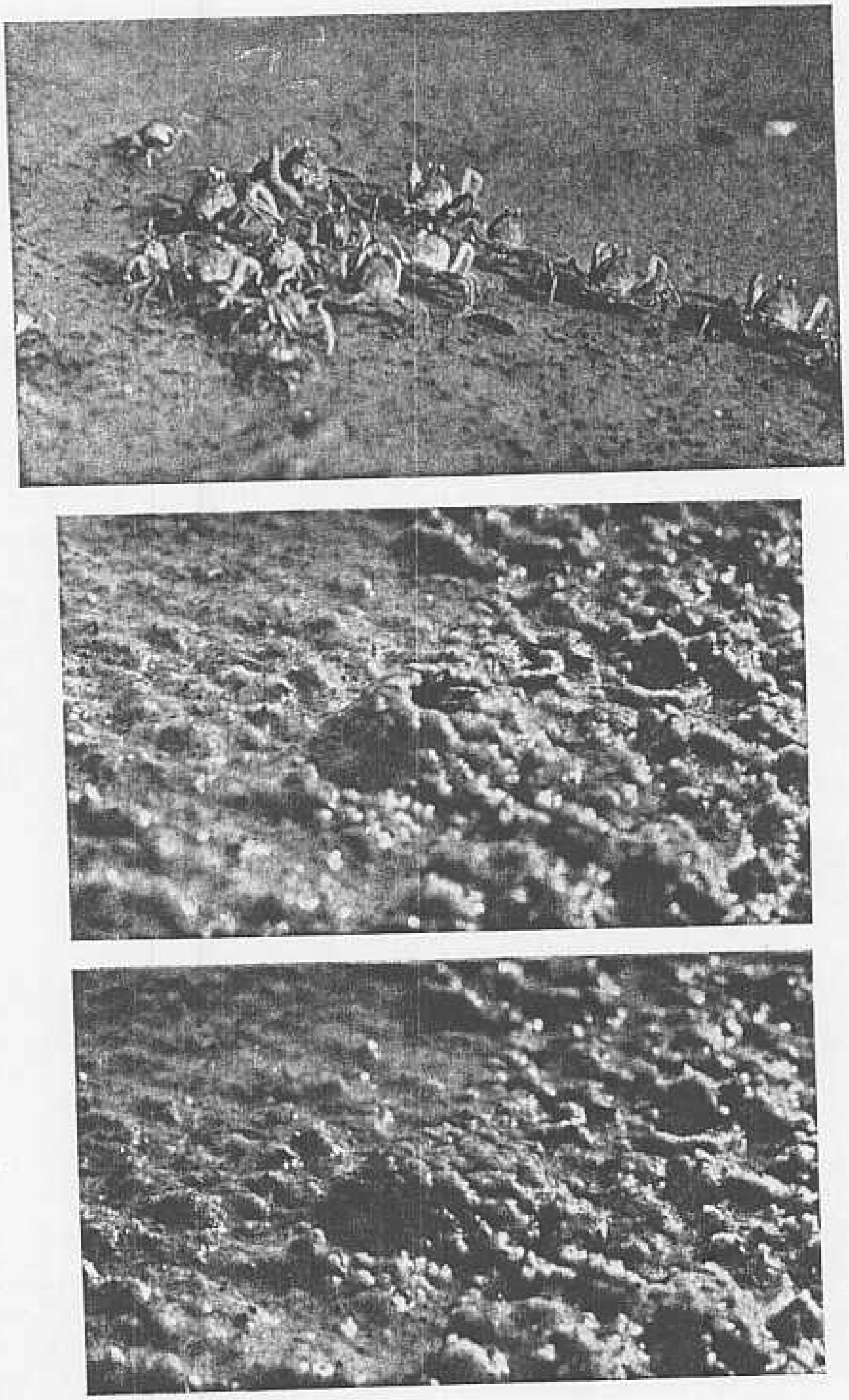
The greatly expanded second maxilliped which Kemp (1919, fig. 1, p. 308) first described as a feature of *Dotilla* and *Scopimera* certainly forms part of the mechanism whereby nourishment is extracted from sand, the residue of which is discarded as a pellet from the mouth. The other Scopimerine crabs (*Ilyoplax, Dotillopsis* etc.), which have the second maxilliped normally developed, are all mud feeders.

Burrowing. On areas of firm sand vertical burrows are dug, usually between ten and twenty cm. deep, the sand being thrown out as a spoil around their entrances in the form of pellets. These are considerably larger than the food pellets and, except around very shallow burrows, are partly composed of the dark grey sub-surface sand. Crabs feeding near their burrows use them as refuges, running into them as one approaches but emerging again within half a minute if one stands still. A crab does not dig a single burrow and remain in its vicinity for the whole of the inter-tidal period, but wanders about digging fresh burrows at intervals. A male watched for about forty minutes dug and abandoned two burrows in succession and then appropriated that of a smaller crab. The digging of these open burrows is a leisurely business, often interrupted by periods of feeding and encounters with other crabs. When an unalarmed crab enters its burrow it often blocks the entrance by pulling in a pellet of spoil. When they are feeding in soft sand or shallow water the crabs are not associated with open burrows.

In wet, semi-liquid sand, insufficiently firm to support an open shaft, a highly peculiar mode of burrowing is practised. A shallow depression is made in which the crab turns on its side and quickly runs round backwards, pushing pellets of sand upwards and outwards. The semi-liquid pellets coalesce at first to form a circular wall, then the top of this, as it increases in height, arches inwards so that a dome-shaped structure results. At the point of completion only a small hole remains at the top of the dome and it is finished off by this hole being plugged by a final pellet, resulting in a bubble or blister of sand in which the crab is enclosed together with a quantity of air. The surface tension cohesion of the sand grains gives these structures strength and durability far beyond that of a bubble of liquid, and both in construction and appearance they reminded me forcibly of the well-known Eskimo Igloo. When the dome is completed the crab continues to push sand upwards and so achieves a downward progress, together with its trapped bubble of air. This is apparent from the fact that a finished dome is often found to be solid, the crab being found in an open chamber a few centimetres below it. Two stages in the construction of a dome are shown on plate 7.

This method of burrowing is often seen in progress in wet sand when the crabs are not alarmed and is invariably resorted to when they finally bury themselves at the edge of the advancing tide. Here a modification is sometimes seen when a roof is added to an existing open burrow just as it is being swamped. When they are coming out of the sand along the edge of the falling tide the air which each crab carried down with it bubbles up, visibly and audibly, as it emerges. I associate this habit with the need of the crab to lodge itself in an open chamber containing air during its period of inter-tidal inactivity.

Crabs feeding in wet sand away from their open burrows will, if alarmed, merely force their way down into the sand with



Grapsoid crabs (M. W. F. Tweedie).
Dotilla mictyroides.

a spiral motion, carrying no pocket of air with them. They never stay submerged in this way for long, however, and I regard this mode of burrowing as only a reaction to the threat of danger.

Intercourse between individuals. The crabs' relations with each other are far less easy to observe and describe than is the way they feed and house themselves. Most of their visible reactions towards each other seem to be associated with sexual behaviour. Adult males can be distinguished by their larger size and their colour, the body slate blue, the legs and claws pinkish brown; the females and young males are uniform greyish brown and cannot be separated without capture and close examination.

For an hour or so after they have emerged at the edge of the falling tide they are hungry and employ themselves mainly in feeding. As their hunger abates and as the sand hardens with the draining away of the water, open burrows are made and the crabs begin to take notice of each other. On several occasions individual adult males were watched for periods of half an hour or more. Such a male, feeding in the vicinity of his burrow, would retreat to it at my approach, but would soon come out if I stood or squatted motionless. As already stated the males wander about, digging new burrows at intervals; if such a wandering male approaches the burrow under observation, its owner immediately engages in a wrestling or grappling contest with the intruder, the chelipeds of both being extended forwards at full length. These contests are quite harmless and I do not think the crabs are capable of inflicting injury on each other with their weak, spoon-like claws. Soon, however, one, usually the intruder, gives ground and disengages, whereupon the victor executes a rather absurd looking dance of triumph, bouncing up and down on his long legs and drumming on the sand with his chelae. Such engagements are usually the result of trespass by one male near the burrow of another, but any two wandering males will grapple if they meet. The very loose association of the *Dotilla* with his burrow and the fact that a triumphal dance follows the encounter persuades me that sexual at least as much as territorial rivalry stimulates these combats.

If a male encounters one of the small brown coloured individuals he nearly always tries to capture it; the smaller crab always tries to evade capture, and the sanctuary of its burrow is respected. If the male is successful he half carries, half rolls his victim to his own burrow, halts at its entrance and palpates it; in the majority of cases he then releases it and it runs away and resumes feeding quite unperturbed. Occasionally a captured crab, presumably a nubile female, is not released but pushed down the burrow and followed immediately by the male. As any movement of the observer stops the continuity of the crabs' behaviour, I was always reluctant to catch and examine the captured ones. The few I did examine were females, but as any small crab encountered by a prowling male is pursued I think it likely that young males are captured too.

Scopimera intermedia Balss. This species was observed casually on various occasions and at Loyang on the Singapore shore of the Johore Strait for one day on which high tide was rather before mid-day. I cannot say, therefore, that my observations were as complete as those on *D. mictyroides*, but they are recorded chiefly on account of the contrast they present with the habits of that species, in spite of the fact that the inter-tidal cycle of activity and method of feeding is essentially the same in both. The *Scopimera* are less numerous than the *Dotilla*, and their burrows are generally grouped in small colonies, which tend to remain constant in situation because these crabs normally make only one burrow in any one inter-tidal period and feed only in its immediate vicinity.

When first observed on the rising tide they were feeding on clean sand, varying in texture from fine to quite coarse and gritty, on the sloping part of the shore near the high tide limit, a habitat never frequented by *Dotilla*. They are extremely timid, retreating to their burrows at the slightest movement by the observer and staying down from one to two minutes, the larger ones being always the more cautious in this respect. Their movements are far more quick and active than those of *Dotilla*. Unlike the latter, each *Scopimera* appears to be centred on its burrow throughout the inter-tidal period. In feeding the crab advances slowly away from its burrow, walking sideways and scraping a shallow furrow as it goes. It faces constantly in one direction, pushing the ejected pellets out behind it, so that they are disposed on one side of the furrow and never allowed to lie inside it. The furrow is thus kept clear to form an uninterrupted path for the lightning retreat to the burrow in the event of an alarm. After such an alarm the crab always recommences feeding at the mouth of the burrow, sometimes advancing along an existing furrow, sometimes starting a new one, but never going to the point where it stopped feeding at the end of an existing one. The longest feeding furrows were 20 to 30 cm., indicating that this is the maximum distance which a *Scopimera* cares to place between itself and its burrow. At the end of the feeding period there are always several furrows radiating from each burrow, and even in the unlikely total absence of alarms it seems probable that a crab would abandon a furrow before it much exceeded the observed maximum length.

The tidal advance up the sloping sand is much slower than that which invades the *Dotilla*-haunted flats, but the *Scopimera* cease feeding when the sea is between one and two metres from their burrows and twenty minutes or more before it floods them. The crab's last visible act is to go deliberately to the mouth of its burrow, scrape up a small mass of sand (not coherent enough to be called a pellet), and then enter the burrow pulling the mass after it. If any deliberate provision is made of an open chamber of air to contain the crab between periods of activity, this must be done beneath the surface. If a crab is scared down at the time when the colony as a whole is retreating in anticipation of the tidal advance, it merely stays down and does not come up to block the mouth of its burrow.

When the tide fell I waited, expecting the crabs to re-appear at the water's edge; they did not appear until the tide was far below the region of sand they occupy, having uncovered it one and a half hours previously. This was the case all along the beach and was not due to my presence being perceived in some way by the buried crabs. As the sand was quite firm when they emerged the presence of a chamber of air could not be betrayed by bubbles accompanying the crabs' exit.

During the feeding period I never saw the construction of any equivalent of the *Dotillas'* open burrows, but in most colonies there were a few burrows covered (not surrounded) by a spoil of sand and clay. I excavated two of these and in both cases found that the sand gave place at a depth of about ten cm. to stiff clay and that the burrow ended in a chamber hollowed out in this and was blocked with clay above the sand-clay junction. In each case the chamber contained a single male crab. Possibly all the crabs occupy chambers of this kind when the tide rises, but I do not think it likely that all the localities in which I have seen *S. intermedia* had a clay substratum beneath the sand.

The most emphatic contrast in the behaviour of the two species is in their intercourse with each other. During the whole of this day, and on other occasions of casually observing the species, I have never seen one *Scopimera* encounter or take the slightest notice of another, and I have no information regarding the type of behaviour that leads to mating.

Ocypode ceratophthalma (Pallas). In August, 1950, I visited the State of Trengganu on the east coast of the Malay Peninsula. On the sandy beaches south of Kuala Trengganu *O. ceratophthalma* is very abundant and its habits were observed during a period when the tide was falling in the late afternoon, leaving bare stretches of fairly steeply shelving, very clean sand.

Feeding. Two distinct types of feeding were observed to be practised by the adults. The most conspicuous feeding activity consists of the sifting of stranded plankton from the sand accompanied by ejection of pellets, just as in *Dotilla* and *Scopimera*. These, with the scrape-marks made by the chelae, leave a characteristic pattern on the shore, very like that figured by Crane (1941, pl. 2, fig. 3) for *O. gaudichaudii*. Crabs watched with field-glasses could be observed to be raking up the sand with rapid alternate sweeps of the chelae (but in one large male only the smaller, unmodified chela was used), the pellets being dropped from the mouth in rapid succession. The maxillipeds could be seen to be vibrating with a semi-liquid mass of sand apparently in a state of suspension between them.

In a few instances feeding of this kind was carried out, *Scopimera*-like, with the burrow as a focus of operations. Most of the burrows, however, are above high tide level, and the crabs from these descend to the wet sand and feed in definitely localised flocks of from twenty to fifty individuals, running into the sea if alarmed and burying themselves in the wave-washed zone of sand until only the vertically held eyes protrude. These flocks of crabs only assembled towards evening, when the sun had sunk below the level of the palms fringing the eastward facing shore. The crabs with burrows situated between tide marks fed earlier in the afternoon and used the burrow as a retreat. In general I have observed adult *O. ceratophthalma* to be crepuscular and nocturnal in habits, though the young are abroad during the day.

The other type of feeding observed was of a wholly different character. During the afternoon, before the flocks had congregated, numbers of adult crabs were seen running along the shore just within the zone alternately washed and stranded by the waves. Such a crab, watched at close range through the glasses, could be seen to stop and anchor itself by digging into the sand when a wave washed over it. Between the onsets of the waves it would alternately run and halt, probing the sand with the chelae and with the dactyli of the legs. At intervals the probing would discover something in the sand which was seized and either put straight into the mouth or torn piecemeal and then eaten. Numbers of crabs were doing this and their actions made it quite clear that they were hunting small animals in the sand, but I could not identify the prey.

The feeding of the young crabs, which were everywhere running about on the sand, remained rather mysterious. I found one small *Ocypode* burrow surrounded with feeding pellets but a wait resulted only in the crab emerging and wandering away. Another small one was seen scavenging a pellet of human faeces, but although numbers of similar sized crabs were around there was no sign of a general scramble for this morsel. These were the only two evidences of the feeding of the young that I encountered.

Other activities. One adult crab was watched at close range with glasses while excavating its burrow. It remained below for twenty to forty seconds at a time, emerging with quite a ball of sand which was thrown well clear of the hole. It then waited at the mouth of the burrow for some time before going down for another load. When outside their burrows the crabs always hold the eyes vertically and can be observed (especially the ones that are being washed by the waves) to lower them momentarily from time to time, either one or both together. The crab under consideration usually performed this action, with one eye, when it emerged from the burrow, and I was able to see that it is accompanied by a wiping of the eye with the palp of the third maxilliped.

When walking about and deposit feeding the adult crabs always carry the body well clear of the sand, standing, as it were, on tiptoe. Occasionally the legs are deliberately flexed and the body lowered onto the sand for one or two seconds; sometimes the crab squats squarely down, sometimes only one side is lowered. My interpretation of this is that the tufts of hair at the inhalent branchial openings are being applied to the damp sand to soak up water from it. From what I could see of the feeding mechanism the sand that is being triturated in the mouth is in a far wetter condition than that which is actually scraped up, the extra water being supplied presumably from the gill-chambers. Although the pellets are fairly firm when dropped, some wastage of water probably occurs which is made good by the process observed.

When compared with the account given by Crane (1941) of the habits of *O. gaudichaudii* these observations conflict with the suggestion that this species is the only one of which the adult feeds by raking and sifting sand. Dr. Crane had not observed *O. ceratophthalma* but based this statement on Takahasi's observation that only young *ceratophthalma* feed in this way (Crane l.c. pp. 297, 306). Judging from her account the method of deposit feeding in the two species is very similar.

Gibson-Hill (1947, p. 43, footnote) observed on Christmas Island an *Ocypoda* intercepting young turtles on their way to the sea and preying on them, and mentions the same thing in his account of the reptiles of the Cocos-Keeling Islands (1950, p. 207); in both cases the predator is identified as *O. ceratophthalma.* I have discussed the matter with him and he agrees that *O. cordimana* was probably the species concerned, as he collected only this species and *O. kuhli* at Christmas Island and at Cocos-Keeling he found only *cordimana* and *ceratophthalma.* His collections from both localities are in the Raffles Museum.

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