

Eutherian condition of the postcaval vein. Furthermore the two veins may be compared with the *Didelphys* embryo figured by McClure*, where the right cardinal collateral is immensely larger than the left-hand vein. This is one among many variations which occur in the venous system of the embryos, as well as the adults, of that marsupial. Both this variation in *Didelphys* and the adult condition in *Orycteropus* appear to me to be an intermediate step in the reduction of the two veins found in Monotremes and Edentates to the single right-hand postrenal postcaval of other Eutheria.

I now turn to the branches of the postcaval vein. The renals are as is usual asymmetrical, the right-hand veins flowing into the postcaval a little anteriorly to those of the left side. There are two renal veins on each side, and those of the left are connected by an obliquely running joining vessel. Of these two latter vessels the anterior arises from the postcaval vein, where it is single, and the posterior from the slender left postcaval. It is very important to notice, from the point of view of a comparison with other Edentates, that the renals are quite unconnected with the spermatic veins. No recognisable branch appeared accompanying the ureter. The spermatic veins themselves, as is shown in text-figure 225, are quite symmetrical with each other and arise each from its own postcaval vein about half-way down between the renal and the posterior bifurcation of the postcaval.

There is no caudal plexus and the veins are not so massive as in various Armadillos; nor is there any tendency to form plexuses, such as are often met with in the Armadillos. In fact the venous system of *Orycteropus* is in its entirety more approaching that of other Eutherian Mammals.

3. On Decapod Crustacea from Christmas Island, collected by Dr. C. W. Andrews, F.R.S., F.Z.S. By W. T. CALMAN, D.Sc., F.Z.S.†

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(Plate LXXII.‡)

I. *Introductory.*

This paper deals with the Decapoda collected by Dr. Andrews on his second visit to Christmas Island in 1908. The names of a few specimens obtained during his stay on the island in 1897-98 but not hitherto determined are also included in the list given below.

Dr. Andrews has pointed out (P. Z. S. 1900, p. 116) that "the shores of Christmas Island are singularly unfavourable for the collection of marine animals," and practically all the marine

* Am. Journ. Anat. vol. v. no. 2, 1906, p. 193, fig. 15.

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‡ For explanation of the Plate see p. 713.

species here recorded were obtained in one place, at Flying-fish Cove. In addition to collections made on the reef a rich fauna was found sheltering in crevices of the wooden piles of the pier, and many of the smaller Decapoda, as well as Isopoda, Amphipoda, and Pycnogonida, were got in this way.

It would be of much interest to determine whether the littoral fauna of Christmas Island shows any peculiarities correlated with its very isolated geographical position. The present collection, at all events, gives no clear evidence of any such peculiarities; the larger Decapods, without exception, belong to well-known and widely-ranging Indo-Pacific species, while the few new species which I have to describe belong to the groups of the smaller and less conspicuous forms among which novelties may be expected anywhere. On the other hand, the restricted opportunities for collecting forbid us to attach any importance to the absence of many widely-distributed species from the collection. It must be borne in mind also that our knowledge of the Indo-Pacific littoral Decapods is still far from adequate for discussion of zoogeographical problems.

The terrestrial and fresh-water species in the following list are distinguished by an asterisk. All of these have been already recorded from the island (although sometimes under different names) except the two species of *Geograpsus* which, Dr. Andrews tells me, are abundant on the shore terrace at Flying-fish Cove. *Ptychognathus pusillus* was found only in the pool above the waterfall on the east coast, where it was collected by Dr. Hanitsch*, but *Palaemon lar* (apparently identical with the variety described by Dr. de Man, *l. c.*) was found not only in that locality but also in Hugh's Dale and Sidney's Dale on the west coast.

A few minute crabs and a larger number of small Caridea remain over which I cannot identify with any described species but which, from the imperfection of the specimens or for other reasons, I do not attempt to describe as new. The Alpheidæ, of which a number were collected on the reef, are omitted altogether for the present.

II. List of the Species.

XANTHIDÆ.

- Carpilodes rugatus* (Latr.).
 „ *vaillantianus* A. M.-E.
 „ *cariosus* Alc.
Liocanthodes alcocki, g. et sp. n.
Zozymus ieneus (Linn.).
Lophozozymus dodone (Herbst).
Xantho bidentatus A. M.-E.
Leptodius sanguineus M.-E.
 „ *cavipes* (Dana).

* See de Man, P. Z. S. 1905, p. 537.

XANTHIDÆ (continued).

- Actea tomentosa* M.-E.
 „ *rufopunctata* M.-E.
 „ *speciosa* (Dana).
Daira perlata (Herbst).
Xanthodes lamarckii (M.-E.).
 „ *notatus* Dana.
Chlorodius niger (Forsk.).
 „ *lavissimus* Dana.
Phymodius sculptus (A. M.-E.).
Chlorodopsis areolata (M.-E.).
 „ *venusta* Rathbun (?).
Cyclodius gracilis Dana.
Cymo melanodactylus de Haan.
Eriphia levimana Latr.
 „ *scabricula* Dana.
Trapezia cymodoce (Herbst).
 „ *ferruginea* Latr.
 „ *ferruginea*, var. *areolata* Dana.
 „ *digitalis* Latr.
 „ *rufopunctata* (Herbst).
Tetralia glaberrima (Herbst).
Domecia hispida Eydoux & Souleyet.
Melia tessellata Latr.

PORTUNIDÆ.

- Thalamita* sp. (juv.).

OCYPODIDÆ.

- Ocyroda ceratophthalma* (Pallas).

GRAPSIDÆ.

- Grapsus grapsus* (Linn.).
 „ *strigosus* (Herbst).
 * *Geograpsus grayi* (M.-E.).
 * „ *crinipes* (Dana).
 * *Ptychognathus pusillus* Heller.
Sesarma murrayi, sp. n.
Liolophus planissimus (Herbst).

GECARCINIDÆ.

- * *Cardisoma hirtipes* Dana.
 * *Gecarcoidea lalandii* M.-E.

MAIIDÆ.

- Acheus spinosus* Miers (?).
Oncinopus aranea de Haan.
Camposcia retusa Latr.
Hyastenus andrewsi, sp. n.
 „ *uncifer*, sp. n.
Tylocarcinus gracilis Miers.
Perinea tumida Dana.
Schizophrys aspera (M.-E.).

DYNOMENIDÆ.

Dynomene sp.

PORCELLANIDÆ.

Petrolisthes dentatus (M.-E.)." *coccineus* (Owen) (?).*Pachycheles sculptus* (A. M.-E.).

GALATHEIDÆ.

Galathea affinis Ortmann (?).

PAGURIDÆ.

Calcinus herbstii de Man.

CÆNOBITIDÆ.

* *Cænobita rugosus* M.-E.* " *clypeatus* Latr.* *Birgus latro* (Linn.).

PALINURIDÆ.

Panulirus penicillatus (Olivier)." *versicolor* (Latr.).†" *longipes* (M.-E.) (? juv.).

STENOPIDÆ.

Stenopus hispidus (Olivier).

HIPPOLYTIIDÆ.

Lysmata seticaudata (Risso).

PANDALIDÆ.

Thalassocaris lucida (Dana).

PALEMONIDÆ.

* *Palemon lar* Fabr., var.*Corallicaris graminea* (Dana)." *superba* (Dana) (?).III. *Systematic Notes and Descriptions of New Species.*

Family XANTHIDÆ.

LIOXANTHODES, gen. nov.

Carapace extremely broad, strongly convex antero-posteriorly, smooth; antero-lateral borders thick, with only traces of division into three lobes; postero-lateral borders very strongly convergent, straight.

Front one-third of width of carapace, strongly deflexed, slightly notched. Orbits large, without suture-lines. Fronto-orbital border about two-thirds of width of carapace.

Antennules folded transversely. Basal antennal segment short

† I have described elsewhere some young stages of this species obtained by Dr. Andrews (Ann. Mag. Nat. Hist. (8) iii. p. 441, 1909).

and broad, not reaching front; the short flagellum standing in orbital hiatus.

Endostomial ridges very slightly developed, not reaching to anterior margin of buccal frame.

Chelipeds massive, unequal in both sexes; fingers not hollowed at tip.

Abdomen of male with third to fifth somites coalesced.

Type species, *L. alcocki*, sp. n.

The little crab described below presents a combination of characters which seems to exclude it from any of the existing genera of Xanthidæ. The great width of the carapace gives it the facies of a *Liomera*, but it differs widely from that genus and its immediate allies in the proportionate width of the fronto-orbital border, a character which would refer the species to the neighbourhood of *Xanthodes* in the sub-family Chlorodinæ of Alcock's classification. The massive chelipeds recall those of the Trapezioida, but in this character *Liomera longimana* A. M.-E. (Crust. Miss. Sci. Mexique, p. 240, pl. xlvi. fig. 1) makes some approach to the new species.

Lt.-Col. Alcock, F.R.S., to whom I have fortunately been able to submit the specimens of this crab, tells me that he considers *Liomera sodalis* Alc. (Jour. Asiatic Soc. Bengal, lxvii. (2) p. 88, 1898) to be probably congeneric with it.

LIOXANTHODES ALCOCKI, sp. n. (Plate LXXII. figs. 1-3.)

Carapace a little less than twice as broad as long, strongly convex antero-posteriorly, slightly so from side to side; surface smooth and polished, without inter-regional markings except for a shallow meso-gastric groove and a pair of crescentic depressions parallel to the inner edges of the orbits. The greatest width is well in front of the middle of the carapace and the straight postero-lateral margins are strongly convergent. The strongly arched antero-lateral margins show the faintest possible traces of three teeth or lobes, and in front of the second and third of these on the dorsal surface is a shallow pit in which are set a few hairs. The front is very much deflexed and its margin is one-third of the width of the carapace or a little less; there is a shallow median notch, and the lateral lobes are nearly straight and not separated from the inner supra-orbital angles. The orbits are very large, and the eyes, when retracted, are incompletely hidden; the fronto-orbital width is about two-thirds of the width of the carapace.

The basal antennal segment is short and broad, reaching to the inner sub-orbital angle but not to the front. It appears to touch a small downward process from the front.

The endostome has a pair of very slight ridges which do not nearly reach its front margin.

The exopod of the third maxillipeds is about half as wide as the ischium; the merus is broader than long; the ischium has a longitudinal groove.

The chelipeds are very massive and very unequal in both sexes;

a considerable part of the length of the merus projects beyond the carapace and its margins are smooth; the carpus has a blunt inner angle; in the larger cheliped the palm is slightly compressed, about three-fourths as high as long, its outer surface with longitudinal rows of low, smooth tubercles; the fingers are short, the immovable one only about one-fourth as long as the lower edge of the palm; both fingers are furrowed and toothed, with a good deal of hair on the inner edges, not excavated at the tips. The smaller cheliped is more slender, its outer surface nearly smooth.

The walking legs have the segments rather broad and flattened and beset with longish hairs, especially distally.

In the male the third, fourth, and fifth abdominal somites are coalesced.

Colour (in spirit) dark brown, marbled on the posterior part of the carapace and on the limbs with yellowish; under parts yellowish. The chelipeds have a longitudinal whitish band on the outer surface of the hand.

In the larger of two ovigerous females the carapace measures only 2.2 mm. in length by 4.2 mm. in breadth, so that the species is one of the smallest of the Brachyura. The eggs are about .35 mm. in diameter.

Family GRAPSIDÆ.

SESARMA MURRAYI, sp. n. (Plate LXXII. figs. 4, 5.)

Carapace moderately convex, much broader than long, the four post-frontal lobes not prominent, sub-equal; except for a deep transverse groove between the gastric and cardiac regions the inter-regional grooves are not defined; the whole surface is covered with sharply-marked transverse striæ, becoming oblique on the branchial regions and breaking up into rows of minute granules anteriorly. Front more than half the width of the carapace, nearly straight as seen from above. Lateral margins strongly convergent posteriorly, without teeth behind the orbital angle.

Chelipeds a little larger in the male than in the female. The anterior margin of the merus is expanded, finely serrated for the greater part of its length and cut into two or three large teeth distally. The outer surface of the merus and carpus is transversely striate, the striæ microscopically beaded. The outer surface of the hand is nearly smooth except for a fine longitudinal line near the lower border; the upper surface has a longitudinal line running along its whole length with a number of oblique lines on the inner side. In some specimens a few fainter oblique lines are also present on the outer side. All these lines, although sharply cut, are very fine and are microscopically beaded. The upper surface of the dactylus is rounded and quite smooth except for a few very fine oblique beaded lines near the base in both sexes.

The merus of the walking legs has two or three strong teeth at the distal end of its hinder edge and, in addition, the merus of the last pair has two smaller teeth side by side near the proximal end. The legs carry rather long hairs and the dactylus is strongly spined.

Measurements :—

	Male.	Female (ovigerous).
Length of carapace.....	4·5 mm.	3·75 mm.
Breadth of "	6·6 "	5·75 "
(between orbital angles)		
Breadth of front	3·75 "	3·0 "

Remarks :—Assuming that the fine beaded lines on the upper surface of the hand represent the "pectinated ridges" found in the males of some other species of *Sesarma*, this little species will fall into the third section or sub-genus (*Parasesarma*) in de Man's classification of the genus. Within this section it comes into relation with a group of species, all of small size, which are distinguished by the toothed meropodites of the walking legs. So far as I am aware only four species of this group have been described—*S. vestita* Stimpson*, *S. andersoni* de Man, *S. edamensis* de Man, and *S. batavica* Moreira (= *S. barbimana* de Man, nec Cano). In all of these the pectinated ridges on the upper surface of the hand are more strongly developed than in the new species and are differently arranged; the upper edge of the dactylus of the chelipeds is strongly "milled" in all except *S. vestita*, where it is stated to be acute; and none of the species possesses teeth at the proximal end of the merus of the last pair of legs. Further, *S. batavica* is distinguished by the tufts of hair on the fingers, *S. edamensis* by the much broader legs, *S. andersoni* by having the carapace smooth and the sides much less strongly convergent posteriorly, and *S. vestita* by having the carapace only a little longer than broad (breadth-ratio 1·03 as against 1·46 to 1·53 in the new species). Outside of de Man's third section, the only species of *Sesarma* which are described as having the meropodites of the legs toothed are *S. minuta* de Man and *S. barbimana* Cano, both of which are separated from the species here described by the presence on the lateral margin of a tooth behind the orbital angle.

The specimens of this crab were collected on the shore at Flying-fish Cove.

The specific name is chosen in compliment to Sir John Murray, K.C.B., F.R.S., by whom the specimens described in this paper have been presented to the British Museum.

* This is referred by de Man to his first section (Zool. Jahrb. ii. p. 644, 1887), but the recently published description and figure (Stimpson's Rep. Crust. N. Pacific Expl. Exp., Smithsonian Miscell. Coll. xlix. p. 136, pl. xiii. fig. 6, 1907) show that the species possesses pectinated ridges on the upper surface of the hand and must be referred to de Man's third section.

Family GECARCINIDÆ.

GECARCOIDEA LALANDII Milne-Edwards.

G. lalandii Ortmann, Zool. Jahrb., Abth. Syst. vii. p. 738 (1893).

To the synonymy given by Ortmann the following are to be added:—

Hylæocarcinus natalis Pocock, P. Z. S., 1888, p. 561.

Pelocarcinus humei (Wood-Mason) Alcock, Jour. Asiatic Soc. Bengal, lxi. pt. 2, p. 449 (1900).

Gecarcinus lagostomus (in error) Andrews, Monogr. Christmas Island, p. 163 (1900).

An examination of the Museum collection of Gecarcinidæ gives no reasons for dissenting from the synonymy which Ortmann has established for this species. The specimen recorded under this name from "S. America" by Adam White in the "List of Crustacea in the British Museum," p. 32 (1847), cannot now be traced, but a Museum copy of the List contains a note in the handwriting of Mr. Miers, "Certainly not this species," so that no confirmation is afforded of Milne-Edwards's statement that the type of the species came from Brazil.

With reference to the erroneous determination of the specimens recorded in the 'Monograph of Christmas Island' (a determination for which Dr. Andrews was not responsible) it is desirable to point out that there is no trustworthy evidence for the occurrence of *Gecarcinus lagostoma* outside the Atlantic area. Milne-Edwards indeed originally described that species as "rapporté de l'Australasie par MM. Quoy et Gaimard" (Hist. Nat. Crust. ii. p. 27, 1837), and Miers refers to a series in the British Museum obtained in the same region during the voyage of the 'Erebus' and 'Terror' (Challenger Rep. Brachyura, p. 219 footnote, 1886). With regard to the latter I can obtain no confirmation of the locality from the Museum registers. The specimens date from a time when the records of locality were less strictly kept than they are now, and it seems possible that specimens arriving at the Museum without indication of locality may have been assumed to come from the same region as the type-specimens. Miers also mentions a specimen from the Cape of Good Hope, and I may add that there is another in the collection labelled "Madagascar" but in neither case can the history of the specimens be traced.

Dr. Andrews has described (*l. c.*) the annual migration of *G. lalandii* to the sea during the rainy season for the purpose of hatching off the eggs. On his visit to the island in 1908, he obtained specimens of a large *Megalopa*-larva which occurred in enormous quantities in the sea shortly after the migration, and also of a small crab which appeared in similar numbers at a slightly later date. It seems practically certain that these larvæ and young can belong to no other species than *G. lalandii*, and it

is hoped that it may be possible to obtain the earlier stages and to give a complete account of the life-history.

CARDISOMA HIRTIPES Dana.

Cardiosoma hirtipes Alcock, Jour. Asiatic Soc. Bengal, lxi. pt. 2, p. 447 (1900).

Cardisoma carnifex (Herbst) Andrews, Monogr. Christmas Island, p. 164 (1900).

Miss Rathbun has recently employed for this species the name *C. rotundum* Quoy & Gaimard (Bull. U. S. Fish Comm. for 1903, pt. iii. p. 838, 1906), but, so far as I know, she has not explained in detail her reasons for doing so. The figure to which she refers (Freycinet's Voyage autour du Monde, Atlas Zool. pl. 77. fig. 1, 1825) is very poor, and there seems no obvious reason for taking it to represent this species rather than *C. carnifex*.

The account which Dr. Andrews has given (*l. c.*) of the habitat of this species—in deep burrows by the side of freshwater streams—agrees with what Ortmann has recorded (Zool. Jahrb., Abth. Syst. x. p. 339, 1897) of the closely allied *C. carnifex* in East Africa. Dr. Andrews tells me that he never saw this species at or near the sea (in marked contrast to *Gecarcoidea*), which also coincides with Ortmann's experience. Since nothing appears to be recorded of the breeding habits of the species of this genus, it may be worth while to mention that in the West African *C. armatum* (the only species of which the Museum possesses an ovigerous female) I find the young within the minute eggs to be in the zoea stage. There can be little doubt therefore that in this genus also the young stages are passed in the sea.

Family MAIIDÆ.

HYASTENUS ANDREWSI, sp. n. (Plate LXXII. figs. 6, 7.)

Carapace and limbs closely covered with long, thick, soft hairs which, on the walking legs and especially on the merus and carpus of the first two pairs, fringe the anterior and posterior margins and make the limb appear broad and flat. The carapace is triangular, with a convex posterior margin and, when denuded of hair, is smooth and polished, with a single low tubercle on each side of the gastric region. The gastric, cardiac, and intestinal regions are strongly convex, defined by well-marked grooves. The rostral spines are less than a quarter of the total length, coalesced for some distance in front of the orbits, deflexed at the base and curving upwards at the tip. The supra-orbital margin is not very prominent and its anterior corner is rounded off. The basal segment of the antenna is little expanded so that the floor of the orbit is very incomplete, and is without tubercle or spine at its anterior end; the free segments of the antenna are visible at the side of the rostrum and are beset with long hairs. The first

pair of walking legs are a little longer than the carapace and rostrum. The dactyli are slender, curved, and very sharp-pointed, with two or three teeth near the base on the lower edge.

An ovigerous female specimen measures 12 mm. in length to base of rostral spines, by 9 mm. across the widest part of the carapace.

Remarks:—This little crab, which I have failed to identify with any described species, differs from the usual type of *Hyastenus* by the comparatively slight development of the supra-orbital margin. In this character and in the narrowness of the basal antennal segment it seems to approach the American genus *Pelia*, from which, however, it differs in the absence of a tooth at the distal end of the same segment. As there are considerable differences in the relative development of these parts in the various species of *Hyastenus*, the new species may provisionally be placed in that genus.

HYASTENUS UNCIFER, sp. n. (Plate LXXII. figs. 8, 9.)

Carapace sub-pyriform, pointed behind, tomentose, tuberculate. There is a transverse row of five tubercles (the outer pair the largest) on the gastric region and, behind this, a single median tubercle; the cardiac region is convex and the intestinal region bears two tubercles, the posterior one acute and recurved; there is a very prominent hepatic spine, and the branchial regions bear each several tubercles and a procurved epibranchial spine. The rostral horns are equal to, or a very little shorter than the carapace (in the male), slender, divergent, and gently decurved. The supra-ocular eave is acutely produced anteriorly; there is no intermediate tooth between it and the post-ocular process, which is not expanded distally. The basal antennal segment has a sharp spine at the antero-external angle.

The chelipeds (in the female) are slender, with two or three spines on the carpus; the fingers are less than half the length of the palm and meet for the greater part of their length.

The walking legs are slender, with a few granules on the carpus, and with the dactylus armed with a row of stout recurved spines.

A female specimen measures 11 mm. in length to the base of the rostral spines.

Remarks:—In the length of the rostral horns this species approaches *H. brockii* de Man, but has the carapace more tuberculate and more pointed behind. The very prominent hepatic spine and the strong hooked teeth on the dactyli of the walking legs are unlike those of any species with which I have been able to compare it.

TYLOCARCINUS GRACILIS Miers.

T. gracilis Miers, Ann. Mag. Nat. Hist. (5) iv. p. 15 (1879).

In describing this species, Miers suggested that it might "perhaps prove to be only a variety" of *T. styx* (Herbst). The numerous specimens collected by Dr. Andrews, however, show no

perceptible approximation to *T. styx* as compared with Miers's type specimens. The long, straight, rostral spines, divergent from the base, and the more numerous and longer spines on the legs, are characters which seem to justify the separation of the species. I do not find, however, that the carapace is "much narrower" than in *T. styx*, and the rostral spines are not always more than half the length of the carapace. Dr. Andrews's collection includes some males in the breeding phase, with enlarged chelæ and widely gaping fingers.

PERINEA TUMIDA Dana.

Perinea tumida Dana, Crust. U.S. Expl. Exp. i. p. 114, pl. iv. figs. 1 *a-f* (1855); Rathbun, Bull. U.S. Fish Comm. for 1903, pt. iii. p. 881 (1906).

Parathoë rotundata Miers, Ann. Mag. Nat. Hist. (5) iv. p. 16, pl. v. figs. 2, 2 *a* (1879); Haswell, Cat. Austral. Crust. p. 30 (1882); Klunzinger, Spitz- und Spitzmundkrabben des Roten Meeres, p. 45, pl. i. figs. 7 *a-d*, text-fig. 10 (1906).

About 18 specimens of a little crab collected by Dr. Andrews are identical with the types of Miers's *Parathoë rotundata* from Port Curtis and Fiji. The rostral teeth, although short, are much more prominent than in Miers's figures and are separated by a rounded notch, and there is a small tooth at the distal end of the basal segment of the antenna unnoticed by Miers.

There can be little doubt, however, that Miers's genus and species are synonymous with those of Dana, quoted above. By the courtesy of Miss Rathbun I have been able to examine a specimen from Laysan recorded by her (*l. c.*) as *Perinea tumida* Dana. It is a large male in which, as in the large female from the Gulf of Suez mentioned by Miers, the tubercles on the carapace are rather less prominent than in smaller specimens, but it undoubtedly belongs to the same species. In addition to the differences from Dana's account mentioned by Miss Rathbun, it is to be noted that the rostral teeth are much less prominent than in the original figures and the notch between them is rounded instead of angular. The tooth at the end of the basal segment of the antennules is also less prominent. I see no reason, however, to dispute Miss Rathbun's identification of the Laysan specimen with Dana's species and if this be accepted the name given by Miers must be placed as a synonym.

EXPLANATION OF PLATE LXXII.

- Fig. 1. *Lioxanthodes alcocki*, g. et sp. n. Female, dorsal view. $\times 9$.
 2. " " " Anterior part of body, ventral view. $\times 18$.
 3. " " " Larger chela of male, from outer side.
 4. *Sesarma murrayi*, sp. n. Male, dorsal view. $\times 6$.
 5. " " " Upper surface of chela.
 6. *Hyastenus andrewsi*, sp. n. Male, dorsal view. $\times 3$.
 7. " " " Orbital region from below.
 8. *Hyastenus uncifer*, sp. n. Female, dorsal view. $\times 3$.
 9. " " " Dactylus of leg of last pair.