

## New *Calcinus* Species (Decapoda : Anomura : Diogenidae) from Hawaii, with a Key to the Local Species<sup>1</sup>

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**Abstract**—Two new species of hermit crabs of the diogenid genus *Calcinus* are described, bringing to nine the number of species of this genus recorded from the Hawaiian Islands. A key to the local species, based both on morphological characters and on color patterns, is presented.

The most common shallow-water Hawaiian hermit crabs (Edmondson, 1946) belong to the diogenid genus *Calcinus*. Species of this genus are all morphologically quite similar; therefore, species recognition or identification has, for the most part, been based on the colors of living animals or the residual patterns found in preserved specimens. Colors change markedly when hermit crabs are preserved and patterns frequently fade quite rapidly. Consequently, misinterpretations and misidentifications are not uncommon. The fact that nearly one-half of all the *Calcinus* species in the Hawaiian Islands are just being described for the first time by Wooster (1984) or in the present paper has made accurate identifications of the local species very difficult.

Edmondson (1946) described the general color patterns for three species, i.e., *Calcinus laevimanus* (Randall) (as *C. herbstii* DeMan), *C. elegans* (H. Milne Edwards) and *C. latens* (Randall). His reference to legs banded with blue for *C. latens* agrees with the brief description of that species given by Randall (1839) for his type material from the Hawaiian Islands. However, the statements of both authors are somewhat misleading. The proximal "band" of color on the dactyl of each ambulatory leg is actually formed by short longitudinal stripes of blue and dark violet, as may be seen on the dactyl of the right third pereopod in Fielding's (1979:79) photograph. In preservation most color is quickly lost; however, the longitudinal stripes remain as red stripes on a white background for several years, and make *C. latens* readily recognizable. In contrast, the recently described *C. guamensis* Wooster possesses a distinctly solid band of color proximally on each dactyl of the ambulatory legs that in life is brown. This band fades relatively uniformly in preservative. As the two species

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share the darkly colored, white spotted carpal and meral segments of the chelipeds, field identification manuals such as those of Anonymous (1978) and Demanche (1980) must be used with caution.

Color patterns generally are believed to remain species specific, although shifts in color are known for some *Calcinus* species. For example, Reese (pers. comm.) has found that the orange-colored bands seen on the ambulatory legs of *C. elegans* in Hawaii are bright blue on specimens of this species collected at Enewetak. Solid bands of color on the proximal portions of the dactyls of *C. latens* have been reported by Dana (1852), Fize and Serène (1955), Miyake (1956, as *C. terrae-reginae* Haswell), Lee (1969) and Ball and Haig (1972). Whether these authors have observed a change in pattern for this species over its range or have confounded *C. latens* with a second species is uncertain. Quite clearly, Miyake's figure (1956:20a) of *C. latens* with multispinose ocular acicles, is incorrectly assigned. His specimens from Takara-jima more probably are referable to *C. guamensis*.

Reese (1969) reported *C. elegans*, *C. laevimanus*, *C. latens* and *C. seurati* Forest as occurring in the reef-flat and littoral zones of Oahu and *C. gaimardi* (H. Milne Edwards) as an uncommon subtidal species. Forest's (1951) description of the color in *C. seurati* was based on preserved material and his emphasis was on the patterns which distinguished this species from *C. laevimanus*. Although living Hawaiian specimens of *C. seurati* do have black and white bands on the dactyls and propodi of the ambulatory legs as figured and/or described by Anonymous (1978) and Demanche (1980), it is the longitudinal black stripe on the outer surface of the carpus and the oblique black stripe on the outer surface of the merus that distinguish this species from *C. laevimanus*. In the latter species the stripes are brown in color and longitudinal on both the carpi and meri. These patterns appear as red bands or stripes in preserved specimens of both species. Neither the patterns nor the colors described by Miyake (1978) for presumed Japanese representatives of *C. seurati* agree with Forest's (1951) description or with Hawaiian representatives of this species.

During studies of shell fighting and sexual behavior among hermit crabs, Hazlett (1973) discussed this behavior for two undescribed additional species of *Calcinus*. Subsequently, colored illustrations of these species were kindly provided to us by Jacques Forest and Michèle de Saint Laurent, Muséum National d'Histoire Naturelle, Paris. More recently, collections of shallow-water hermit crabs made during ecological studies for the Hawaiian Electric Company on Oahu and by the Hawaii Cooperative Fishery Research Unit on Midway have been made available to us. These collections have included individuals recognizable as Hazlett's *Calcinus* species "A" and "B" in sufficient numbers to permit us to describe these new taxa. *C. guamensis* and a second new species, *C. haigae* Wooster, also described by Wooster (1984), bring the total number of Hawaiian *Calcinus* species to nine.

The holotypes and some paratypes of *Calcinus hazletti* n. sp. and *C. laurentae* n. sp. have been deposited in the Bernice P. Bishop Museum, Honolulu (BPBM). Other paratypes have been deposited in the collections of the Allan Hancock Foundation, University of Southern California (AHF), Florida International University (FIU),

the National Museum of Natural History, Smithsonian Institution (USNM), and the Rijksmuseum van Natuurlijke Historie, Leiden (RMNH). Comparative materials have been obtained from the Muséum National d'Histoire Naturelle, Paris (MNHN) and the Australasian Marine Photographic Index (AMPI).

#### KEY TO THE HAWAIIAN SPECIES OF *CALCINUS*

1. Right chela with smooth or granular upper margin ..... 2
- 1'. Right chela with spinous or tuberculate upper margin ..... 3
  2. Anterior lobe of sternite of 3rd pereopods subsemiovate, anterior margin usually produced centrally. Dactyls of 2nd pereopods approximately 3 times longer than deep. [Dactyls of ambulatory legs white with subdistal colored ring and proximal spot; carpi and meri each with longitudinal colored stripe on outer face.] ..... *C. laevimanus*
  - 2'. Anterior lobe of sternite of 3rd pereopods subrectangular, anterior margin not produced. Dactyls of 2nd pereopods approximately 4 times longer than deep. [Dactyls of ambulatory legs with colored band proximally; propodi with colored band distally and proximally; carpi each with longitudinal colored stripe and meri each with oblique colored stripe on outer face.] . . . . . *C. seurati*
3. Dactyls and propodi (distally) of 3rd pereopods with dense tufts of closely-spaced setae forming obvious brush ..... 4
- 3'. Dactyls and propodi of 3rd pereopods without dense tufts of closely-spaced setae forming obvious brush; sometimes with 3 to 5 sparse tufts of moderately close or widely-spaced setae ..... 5
  4. Lower outer margin of merus of right cheliped with 1 spine distally [Chelipeds colored, chelae white-tipped; ambulatory legs colored but usually with white on dactyls distally.] ..... *C. gaimardi*
  - 4'. Lower outer margin of merus of right cheliped with 2 or more spines distally [Chelipeds with white-tipped spines and tubercles; ambulatory legs with alternating bands on propodi, carpi and meri; dactyls with spots; black/brown and orange/red in life, red and white in preservative.] . . . . . *C. elegans*
5. Telson with terminal margin of right posterior lobe armed with row of spines; ocular acicles typically multispinous ..... 6
- 5'. Telson with terminal margin of right posterior lobe unarmed or with 1 submarginal spine; ocular acicles simple. [Chelipeds white distally; dactyls of ambulatory legs with short longitudinal colored stripes, often forming "band" proximally.] . . . . . *C. latens*
6. Telson with lateral margin of left posterior lobe unarmed ..... 7
- 6'. Telson with lateral margin of left posterior lobe with row of spines .... 8
7. Dactyls of 2nd pereopods short, less than 3.5 times as long as deep; carpus of right cheliped typically with distal spine of upper margin appreciably stronger.

- [Chelipeds white-tipped; ambulatory legs with spots of color on propodi and dactyls.] ..... *C. haigae*
- 7'. Dactyls of 2nd pereopods moderately long, at least 4 times as long as deep; carpus of right cheliped typically with 3 subequal spines on upper margin. [Chelipeds colored, with dactyls and fixed fingers white, spines white-tipped; ambulatory legs colored with dactyls white except for patch of color proximally] ..... *C. hazletii* n. sp.
8. Dactyls of 2nd pereopods short, less than 3 times as long as deep. [Chelipeds with carpi and meri (distally) colored with white tubercles; dactyls of ambulatory legs with band of color and white tubercles proximally, white distally.] ..... *C. guamensis*
- 8'. Dactyls of 2nd pereopods moderately long, more than 3 times as long as deep. [Chelipeds colored with palms (distally), dactyls and fixed fingers white; ambulatory legs with dactyls lighter] ..... *C. laurentae* n. sp.

*Calcinus hazletti* new species

Fig. 1a-f

*Calcinus* species "A": Hazlett, 1973:810.

**DIAGNOSIS:** Ocular peduncles long and slender, approximately equalling length of shield; acicles narrow, ovate, with 2 to 4 spines distally. Dactyls of 2nd and 3rd pereopods shorter than propodi, each with widely separated sparse tufts of simple setae on ventral margins. Sternite of 3rd pereopods with anterior lobe subrectangular and developed as pair of low, rounded projections. Telson with terminal margins of posterior lobes each with row of short spines, lateral margins unarmed. Color (from illustration): ocular peduncles dark red-orange, with broad white band adjacent to cornea; chelipeds dark orange-red, fingers and tips of spines white; 2nd and 3rd pereopods dark orange-red, dactyls white except for small orange-red area proximally.

**DESCRIPTION:** Shield (Fig. 1a) one and one-fifth to one and one-third times as long as broad; anterior margin between rostrum and lateral projections shallowly concave; dorsal surface lightly pitted; sparsely setose along lateral margins. Rostrum produced, slightly exceeding lateral projections; obtusely triangular. Lateral projections angular, with minute terminal spinule.

Ocular peduncles long and slender, approximately as long as shield (in large individuals) or slightly shorter, nearly devoid of setation. Ocular acicles short, narrow, ovate, distal margin with 2 to 4 spines; separated basally by approximately one-half basal width of 1 acicle.

Antennular peduncles long, reaching to distal fourth of ocular peduncles. Ultimate and penultimate segments unarmed; basal segment with 1 to 4 spinules at ventrolateral distal angle.

Antennal peduncles reaching to distal half (sometimes to distal third) of ocular

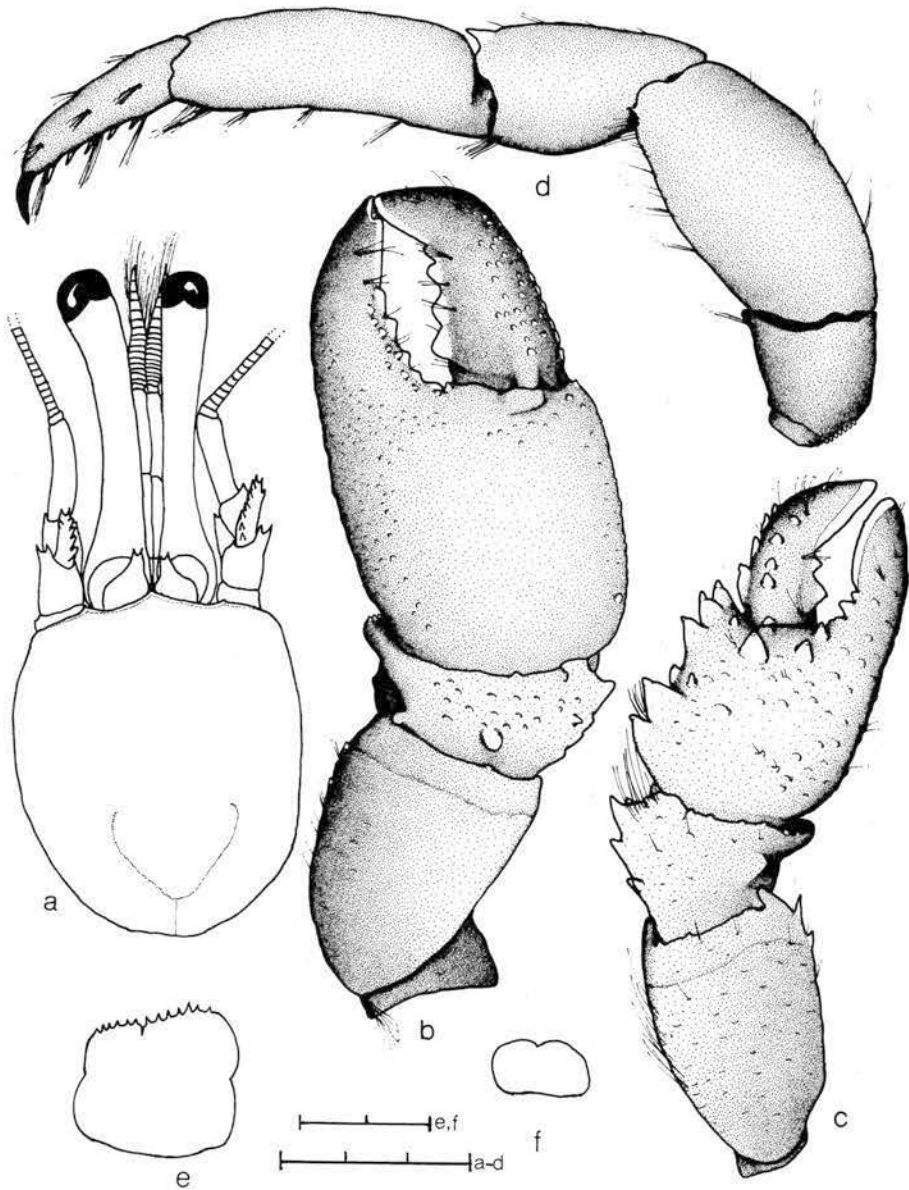


Fig. 1. *Calcinus hazletti* n. sp. a shield and cephalic appendages; b left cheliped; c right cheliped; d left 3rd pereopod; e telson; f anterior lobe of 3rd sternite. (Scales equal 3 mm a-d and 1 mm e, f)

peduncles; with supernumerary segmentation. Fifth segment long, unarmed, with short scattered setae. Fourth segment with 1 or 2 spines at dorsolateral distal angle, and with scattered long setae. Third segment with spine at ventromesial distal angle;

lateral surface and ventral margin with long setae. Second segment with dorsolateral distal angle produced, terminating in short bifid spine, lateral margin unarmed; mesial margin inflated, dorsal surface near mesial margin with large tubercles, dorsomesial distal angle with spine; mesial and lateral faces with scattered setae. First segment with dorsolateral distal angle and lateral face unarmed; ventromesial angle produced, minutely crenulate. Antennal acicle short, slightly surpassing distal end of penultimate segment of peduncle; terminating in strong simple or bifid spine; mesial margin with 3 to 5 strong spines, lateral margin with 1 or 2; both margins with long setae. Antennal flagellum long, overreaching left chela, minutely setose.

Left cheliped (Fig. 1b) with chela one and two-thirds to twice as long as width of palm. Dactyl approximately as long as palm, or slightly longer; cutting edge with 2 or 3 calcareous teeth and with tufts of setae; outer and upper faces tuberculate or granulate; inner face smooth. Fixed finger with cutting edge with 3 or 4 (rarely 2) calcareous teeth, forming weak or strong hiatus with dactyl; outer face tuberculate or granulate. Palm long, approximately one and one-half times length of carpus, compressed; outer surface convex, nearly smooth to finely granulate; upper face in large males nearly smooth, in females and small males with row of small, low tubercles or small spines; outer lower margin nearly straight or slightly convex; lower face usually with flattened tubercles, continuing onto lower face of fixed finger; inner lower margin with scattered tufts of setae; inner face flattened, smooth. Carpus broad, subtriangular, shorter than merus, compressed; outer surface smooth, granulate or weakly tuberculate, with prominent tubercle placed submedianly or toward upper margin; outer distal and lower distal margins often with row of indistinct granules or small spines; outer upper margin and upper face with few low granules and small tubercles, most distal one sometimes developed into spine; inner and lower faces smooth. Merus compressed; outer surface flat, nearly smooth; outer lower margin with 1 or 2 small spines distally, distal angle frequently produced into small or large spine; upper margin unarmed; outer distal margin unarmed or with 1 or 2 small spines; lower and inner faces smooth; inner lower margin unarmed or with few small spines.

Right cheliped (Fig. 1c) reaching proximal end of dactyl of left chela. Dactyl approximately as long as palm; cutting edge with 1 or 2 teeth proximally and with tufts of setae; outer upper margin and upper face each with row of spiniform, corneous-tipped tubercles; inner and outer surfaces smooth and with tufts of setae. Fixed finger with scattered granules or small tubercles and tufts of setae on outer and lower faces and along inner lower margin; cutting edge with 1 or 2 teeth proximally, forming weak or strong hiatus with dactyl. Palm approximately one and one-fifth or one and two-fifths times length of carpus, compressed; outer surface convex or flattened, granulate or nearly smooth, with 3 prominent spines or spine-tipped tubercles near base of fingers, and with tufts of long setae; upper margin produced into crest with 5 corneous-tipped spines, occasionally 1 or 2 smaller spines, and tufts of long setae; lower face with few tufts of long setae, smooth proximally and with low tubercles distally, tubercles continuing onto lower face of fixed finger; inner face flat

and smooth. Carpus broad, shorter than merus, compressed; outer face smooth or with small spinulose granules; lower face smooth; outer distal and lower distal margin each with row of small tubercles or spinules and with scattered short setae; upper margin with 3 corneous-tipped spines; inner face flattened, smooth, with tufts of long setae on distal margin. Merus compressed; outer surface flat, nearly smooth but with long setae; outer lower margin with 1 or 2 spines near distal end; lower and inner faces smooth; inner lower margin with 1 to 4 small spines.

Second pereopods long, exceeding length of left cheliped. Dactyls shorter than propodi, moderately stout, terminating in strong corneous claw; ventral margins each with row of short corneous spines and widely spaced sparse tufts of long simple setae; lateral and mesial faces with tufts of short setae. Propodi approximately one and two-thirds times length of carpi; dorsal faces with short setae, mesial faces with scattered long setae; ventral margins with widely separated tufts of long, simple setae. Carpi approximately two-thirds length of meri; dorsodistal margins each with 2 small to moderately strong spines; ventral margins with scattered long setae. Meri compressed; ventral margins each with row of minute spinules; dorsal and ventral margins with tufts of long setae.

Third pereopods (Fig. 1d) slightly shorter than second; similar to second in armature and proportions, except for shorter propodi (approximately one and one-half times length of carpi), and carpi sometimes with only 1 spine at dorsodistal margin; ventral margins of dactyls and propodi with widely spaced sparse tufts of long setae as in second pereopods.

Sternite of third pereopods (Fig. 1f) with anterior lobe broad, subrectangular, developed as pair of low, rounded projections, each with dense tuft of long setae.

Telson (Fig. 1e) with posterior lobes asymmetrical, left usually considerably larger than right; separated by narrow, short median cleft; terminal margins of both posterior lobes with few short spines, lateral margins unarmed or rarely with 1 spine on left, margins with fringe of long setae.

**COLORATION** (from illustration): Shield pink or pale orange, tip of rostrum and anterolateral corners dark orange-red; ocular peduncles dark orange-red, with broad white band next to cornea; ocular acicles dark orange-red; antennular peduncles dark orange-red, terminal segment pink distally, flagellum pink; antennal peduncles dark orange-red, terminal segment with broad, longitudinal pink stripe, flagellum pink. Chelipeds generally dark orange-red with fingers and tips of spines white. Ambulatory legs dark orange-red, dactyls white with small orange-red area proximally. In preservative color fades rapidly to cream or white in small specimens, but persists in large individuals as orange on appendages and on anterolateral corners of shield.

**MATERIAL EXAMINED:** Holotype: ♂ (SL=4.2 mm), BPBM S10538 Kahe Point, Oahu, 22°22'N, 158°08'W; 5 m, from base of *Pocillopora meandrina*; October 18, 1976; coll. S. L. Coles, Hawaiian Electric Co. Survey, Sta. 6B. Paratypes: 11 ♂ (SL=2.4–5.4 mm), 5 non-ovigerous ♀ (SL=2.3–4.1 mm), 6 ovigerous ♀ (SL=

2.9–3.9 mm), BPBM, FIU, AHF, USNM, RMNH, Kahe Point, Oahu; 2.5 to 8 m, from bases of *Pocillopora meandrina*; 1975–1977; coll. S. L. Coles. 1 ♂ (SL=4.7 mm), 1 ovigerous ♀ (SL=3.6 mm), AHF 6142, N. end Kaneohe Bay, Oahu; shore, February or March 1961; coll. E. S. Reese. 2 ♂ (SL=4.2, 5.2 mm), 2 non-ovigerous ♀ (SL=1.9, 3.8 mm), 2 ovigerous ♀ (SL=2.5, 4.0 mm), BPBM, Midway Island lagoon, 5 to 8 m, from dead *Pocillopora meandrina* and *P. damicornis*, coll. J. Parrish and M. Callahan.

REMARKS: *Calcinus hazletti* is closely related to three Indo-West Pacific species—*C. nitidus* Heller, *C. minutus* Buitendijk and *C. haigae* Wooster, the last now also reported from Hawaii. In all four species the ocular peduncles are long and slender, the ocular acicles are multispinous, the left chelae are comparatively elongate, the dactyls of the ambulatory legs are shorter than the propodi, and in both pairs the ventral margins of both dactyls and propodi are sparsely setose. Although these species are distinguished from each other by differences in the proportional measurements of the antennular, antennal, and ocular peduncles and certain pereopodal segments, and by details of granulation and spinulation, juvenile and faded specimens are frequently difficult to identify. As with other *Calcinus* species, colors and color patterns provide the best diagnostic characters. The important color characters for the three allies of *C. hazletti* are summarized below.

*C. nitidus*: A characteristic, large red patch on the anterior part of the shield. The ocular peduncles are white. The chelipeds are white, with large red patches on the palm, carpus and merus. The ambulatory legs are red, the color most intense on the dactyls and distal part of the propodi. The red areas eventually fade to orange after preservation (Forest, 1956: 220, figs. 1–4).

*C. minutus*: Ocular peduncles are white or pink. The chelipeds are white or pale purple, with small orange dots. The dactyls and distal parts of the propodi of the ambulatory legs are orange, the remainder of the legs white with small orange dots (Forest, 1958a: 188, 1958b: 7; Ball and Haig, 1972: 102; Nakasone, 1975: 3, fig. 2; Wooster, 1984: 153).

*C. haigae*: The ocular peduncles are purple with a narrow white band next to the cornea. The chelipeds have white finger tips, the proximal parts of the fingers and distal parts of the palm are pale purple with dark orange spots, and the remainder of the chelipeds are purple. The ambulatory legs are purple except for the distal ends of the dactyls which are white. Both the dactyls and the distal parts of the propodi have orange spots. Following preservation, the color fades to pink or light orange; however, the spots on the pereopods remain darker than the base color (Wooster, 1984: 147).

DERIVATION OF NAME: For Brian A. Hazlett, who discussed the shell fighting and mating behavior of this species.

DISTRIBUTION: Known only from the Hawaiian Islands; to a depth of 8 meters.



*Calcinus laurentae* new species

Fig. 2a-f

*Calcinus* species "B": Hazlett, 1973:811.

**DIAGNOSIS:** Ocular peduncles moderately long and slender, inflated at base; left longer than right and slightly shorter than shield; acicles narrow, ovate, usually with 3 or 4 small spines distally. Dactyls of 2nd and 3rd pereopods about as long as propodi; P<sub>3</sub> with moderately closely spaced, sparse tufts of long plumose setae on ventral and lateral faces of dactyls and distal part of propodi, setation of P<sub>2</sub> much more sparse. Sternite of 3rd pereopods with anterior lobe developed as pair of somewhat rounded projections. Telson with terminal margins of posterior lobes and lateral margin of left posterior lobe armed with spines. Ocular peduncles orange, with broad white band next to cornea; chelipeds with fingers and distal part of palm white, greater part of palm orange-brown with large, median dark brown area; 2nd and 3rd pereopods orange with dactyls pinkish.

**DESCRIPTION:** Shield (Fig. 2a) slightly to about one-fourth longer than broad; anterior margin between rostrum and lateral projections shallowly concave; dorsal surface lightly pitted and with scattered short setae, lateral margins also with tufts of setae. Rostrum produced, exceeding lateral projections, usually obtusely triangular. Lateral projections angular, with minute terminal spinule.

Left ocular peduncle almost invariably longer than right except in early crab stages; peduncles moderately long and slender in larger individuals, with left slightly shorter than shield; basally inflated and with scattered setae. Ocular acicles short, narrow, ovate, distal margin with 3 or 4 (rarely 1 or 2) small spines, these occasionally reduced to tubercles; separated basally by about one-half basal width of 1 acicle.

Antennular peduncles long, extending to distal fourth of left ocular peduncle and sometimes to base of left cornea. Ultimate and penultimate segments unarmed; basal segment frequently with 3 spinules at ventrolateral distal angle.

Antennal peduncles reaching to distal third of left ocular peduncle; with supernumerary segmentation. Fifth segment long, unarmed, with few short setae distally. Fourth segment with spine at dorsolateral distal angle. Third segment with spine at ventromesial distal angle; lateral face and ventral margin with long setae. Second segment with dorsolateral distal angle produced, terminating in short, distinctly or obscurely bifid spine, lateral margin unarmed; mesial margin inflated, dorsal face near mesial margin with large tubercle, dorsomesial distal angle spined; dorsal, mesial and lateral faces with scattered setae. First segment with dorsolateral distal angle and lateral face unarmed; ventromesial angle produced. Antennal acicle short, slightly surpassing distal end of penultimate peduncular segment; terminating in strong spine; mesial margin with 2 to 5 strong spines, lateral margin with 2, these spines frequently obscured by long plumose setae on margins and dorsal face. Antennal flagellum long, reaching at least to distal end of left chela; minutely setose.

Left cheliped (Fig. 2b) with chela nearly twice as long as width of palm in large

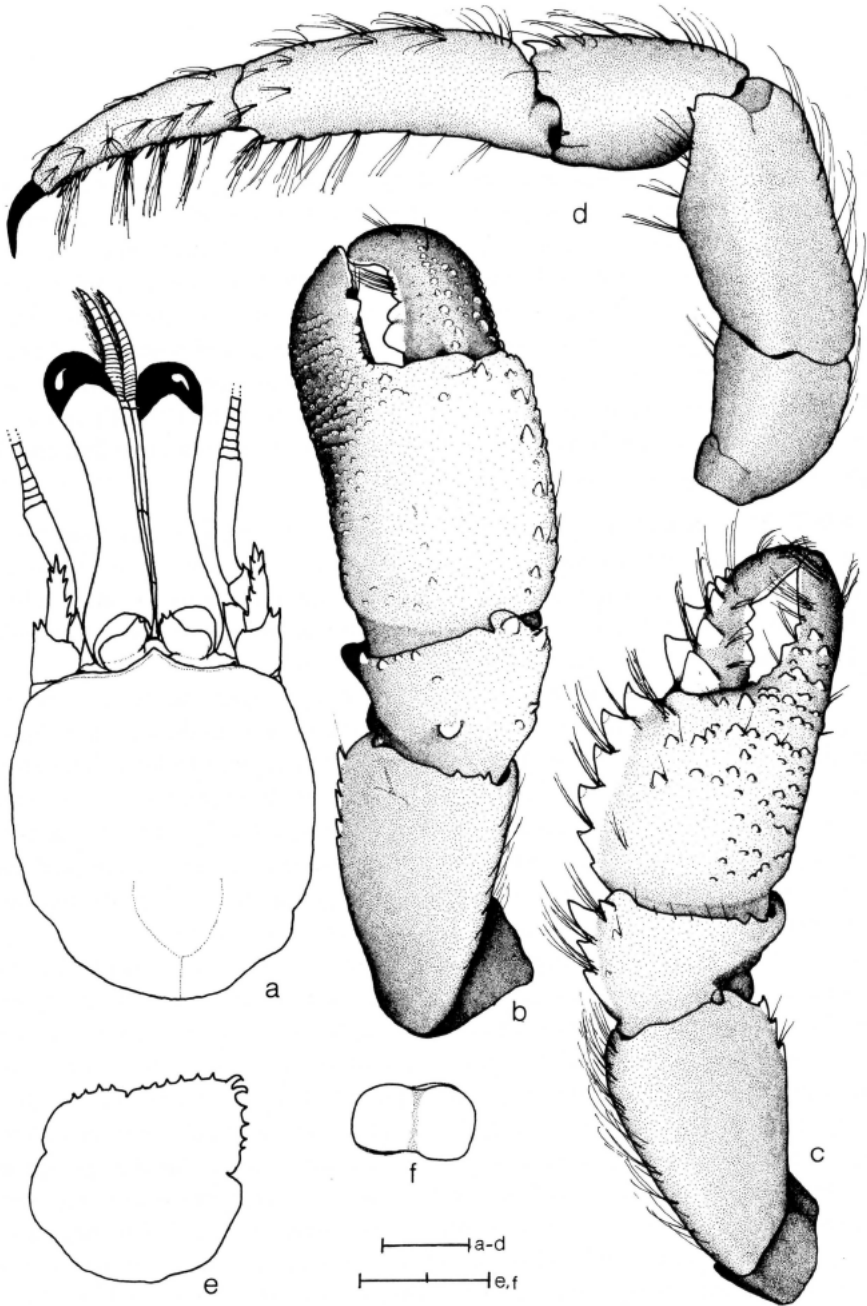


Fig. 2. *Calcinus laurentae* n. sp. a shield and cephalic appendages; b left cheliped; c right cheliped; d left 3rd pereopod; e telson; f anterior lobe of 3rd sternite. (Scales equal 1 mm)

males, scarcely more than one and one-half times as long in large females. Dactyl slightly shorter than palm; distal half with tufts of long setae, sometimes strongly deflexed; cutting edge with 2 (occasionally 3) large calcareous teeth and with tufts of setae; outer and upper faces with large, often closely set granules, these spiniform in small individuals. Fixed finger with cutting edge with 1 to 4 calcareous teeth, forming strong or weak hiatus with dactyl; outer and lower faces rather coarsely granulate, with tufts of setae distally; inner face with row of small granules and tufts of setae. Palm approximately one and one-third to one and one-half times length of carpus, compressed; outer surface convex; nearly smooth to finely granulate, with prominent pointed granules or small spines near upper margin and near articulation with dactyl; upper margin with row of spiniform granules or tubercles; outer lower margin nearly straight or slightly convex, sometimes slightly concave proximally; lower face often rather coarsely granulate; inner face flattened, smooth, with tufts of setae near lower margin. Carpus broad, triangular, shorter than merus, compressed; outer surface with prominent submedian tubercle, and often with few large, closely set tubercles near upper margin; distal margin with few or row of small, frequently spine-tipped granules or tubercles; upper face with row of 2 to 4 spines; inner and lower faces smooth. Merus compressed; outer surface flat, nearly smooth; outer lower margin sometimes tuberculate or spinulose distally and with distal angle produced into spine; upper margin crenulate; distal margin often with 1 or 2 spines; lower face smooth, usually with long setae distally; lower inner margin with few small spines.

Right cheliped (Fig. 2c) reaching to proximal end of dactyl of left chela. Dactyl about as long as palm, or slightly shorter; distal half strongly deflexed; cutting edge with 2 or 3 calcareous teeth and with tufts of setae; outer upper margin and upper face each with row of spiniform, corneous-tipped tubercles or spines and with tufts of long setae; outer and inner faces nearly smooth and with tufts of setae. Fixed finger granulate or tuberculate and with tufts of setae on outer and lower faces; cutting edge with 1 or 2 calcareous teeth proximally, forming strong or weak hiatus with dactyl. Palm approximately one and one-fifth to one and two-fifths times length of carpus, compressed; outer surface flattened or slightly convex, granulate or tuberculate, granules or tubercles larger and corneous-tipped near articulation with dactyl, and with tufts of long setae; upper margin produced into low crest with 5 large corneous-tipped spines (sometimes sixth small spine present proximally) and tufts of long setae; lower face smooth proximally and with few tubercles distally, latter with tufts of long setae; inner face flat and smooth. Carpus broad, shorter than merus, compressed; outer face frequently granulate or with few small spines; lower face smooth; outer distal and lower distal margins sometimes with widely set spinules or sharp granules and with tufts of setae; upper margin with 3 large corneous-tipped spines and with tufts of long setae; inner face flattened, smooth. Merus compressed; outer face flat, often finely granulate; upper margin with long setae; outer lower margin with 2 or 3 spines distally; lower and inner faces smooth; inner lower margin with 1 or 2 spines.

Second pereopods long, exceeding length of left cheliped. Dactyls approximately

as long as propodi in large individuals, slender or moderately so, terminating in strong corneous claws; ventral margins each with row of short corneous spines and with widely separated sparse tufts of long, simple setae; dorsal, lateral and mesial faces with tufts of short to moderately long setae. Propodi approximately one and three-fifths times length of carpi; dorsal and mesial faces with scattered long, simple setae, lateral faces with scattered short setae; ventral margins with widely separated tufts of long, simple setae. Carpi about two-thirds length of meri; dorsal margins each with 2 or more spines dorsally and/or distally, and row of short setae; ventral margins with long setae. Meri compressed; ventrolateral margins each with row of small pointed granules and frequently with small spine distally; dorsal and ventral margins with long setae.

Third pereopods (Fig. 2d) slightly shorter than second; dactyls, propodi and carpi stouter in proportion to their length than in  $P_2$ . Dactyls approximately as long as propodi, or slightly shorter; each terminating in strong corneous claw and with row of corneous spines on ventral margin; dorsal and mesial faces with short to long tufts of scattered setae; lateral faces and ventral margins each with 4 or 5 moderately closely spaced, sparse tufts of long plumose setae. Propodi about one and one-third times length of carpi; dorsal and mesial faces with tufts of long to short setae; lateral faces with scattered short, simple setae and with dense tuft of long plumose setae distally; ventral margins with tufts of moderately closely spaced, sparse tufts of long plumose setae in distal one-third to one-half of segments, more widely spaced tufts proximally as in  $P_2$ . Carpi about seven-tenths length of meri; dorsal margins each usually with 2 spines distally and with fringe of moderately long setae; ventral margins with long setae. Meri compressed; dorsal margins with long, simple setae; ventrolateral margins each with tuft of plumose setae.

Sternite of third pereopods (Fig. 2f) with anterior lobe subrectangular, in large individuals developed as pair of rounded projections, each with dense tuft of long setae.

Telson (Fig. 2e) with posterior lobes asymmetrical, left considerably larger than right; separated by narrow, short median cleft; terminal margins of both posterior lobes with few short spines, lateral margin of left posterior lobe with 4 to 6 spines; margins also with fringe of long setae.

**COLORATION** (from illustration and slide): Shield orange with irregular dark brown area anteriorly; ocular peduncles red-orange, with broad white band next to corneae, corneae black with white spots; ocular acicles orange, spines white. Antennular peduncles red-orange to dark brown, distal portion of ultimate segments light orange or white. Antennal acicles and proximal segments of peduncles brown dorsally, lighter colored or white ventrally, terminal segment orange or white, spines white; flagella pale orange. Chelipeds with base color orange-brown, fingers and distal part of palms white, large dark brown areas on median parts of palm, on carpi and on distal-halves of meri, spines and tubercles white. Ambulatory legs with dactyls pinkish, but lighter proximally and distally; other segments red-orange medially, white or pinkish proximally and distally and with white spots, most numerous on

dorsal margins of carpi and meri; carpal spines white. In preservative color disappears rapidly to buff, darker areas of chelipeds and carapace sometimes remaining as pale brown or orange patches.

**MATERIAL EXAMINED:** Holotype: ♂ (SL=4.6 mm), BPBM S10526 Kahe Point, Oahu, 22°22'N, 158°08'W; 6 m, from base of *Pocillopora meandrina*; August 5, 1977; coll. S. L. Coles, Hawaiian Electric Co. Survey, Sta. 7C. Paratypes: 24 ♂ (SL=1.0–4.4 m), 16 non-ovigerous ♀ (SL=1.4–2.8 mm), 14 ovigerous ♀ (SL=1.9–3.7 mm), 23 juv. (SL ca 0.8–1.2 mm), BPBM, FIU, AHF, USNM, RMNH. Kahe Point, Oahu; 2.5 to 8 m, from bases of *Pocillopora meandrina*; 1976–1977; coll. S. L. Coles.

**REMARKS:** *Calcinus laurentae* is closely related to *C. spicatus* Forest. This latter species was described from a female with a carapace length of 11 mm, from the Tuamotu Archipelago (Forest, 1951:90, figs. 10–13). [A specimen from Vietnam, reported by Forest (1958a, b) as *Calcinus* aff. *spicatus*, seems to be specifically distinct.] Recently we examined a specimen of *C. spicatus* (♂ SL=5.6 mm) from the New Hebrides Islands (MNHN 2694) and four specimens from Lord Howe Island off the east coast of Australia (AMPI 1002, 1003, 1028, 1037). The male from the New Hebrides and a male and female from Lord Howe Island, each with a shield length of 6.1 mm, all are close to the carapace length of the holotype. A second male and female from Lord Howe Island (SL=3.7 mm and 3.3 mm, respectively) have been compared with *C. laurentae* of approximately the same size.

Allowing for intraspecific variation, and except for a few characters, the two species are almost identical in the form and proportions of the shield, ocular, antennular and antennal peduncles and pereopods, as well as in the structure and position of granules, tubercles, spines and setae. In *C. laurentae* the ocular acicle is typically multidentate, whereas in the known specimens of *C. spicatus* it bears a single spine. In the left cheliped of male *C. laurentae* the upper margin of the carpus bears a few spines, and the outer carpal face is somewhat tuberculate; in the males of *C. spicatus* examined these areas of the left carpus are smooth except for the usual submedian tubercle on the outer face. In both sexes the left chela is longer in proportion to the width of the palm in *C. spicatus* than it is in *C. laurentae*.

The coloration described by Forest (1951) for *C. spicatus* was based on the preserved holotype. We have recently been able to observe a photographic color slide of a living specimen, and its colors are distinctly different from those observed in *C. laurentae*. In *C. spicatus* the shield is purplish brown; the ocular peduncles orange-brown with a broad white band next to the cornea. The antennular peduncles are orange except for the distal portion of the ultimate segment which is bright blue; the flagellum is orange. The antennal peduncles appear brownish and the flagella orange. The fingers and distal portions of the palms of the chelipeds are purplish-brown, the remainder of the palms are black; the carpi and meri also are black with narrow purplish-brown areas distally. The dactyls of the ambulatory legs are purple, the proximal two-thirds of the propodi are dull orange and the distal thirds purple; the carpi and meri are orange-brown proximally, dark purplish-brown distally, and each

has a black streak or elongate spot on the outer surface near the upper margin. The setae on the propodi and dactyls of the ambulatory legs are pale in color, but noticeably much coarser than in *C. laurentae*.

Hazlett (1973), who found *C. laurentae* on coral heads at depths of 60–70 feet at the entrance to Kaneohe Bay, Oahu, discussed the shell fighting repertoire and copulatory behavior of this species.

**DERIVATION OF NAME:** For Michèle de Saint Laurent, in appreciation of her generous assistance, particularly in providing the colored illustrations of the two new Hawaiian *Calcinus* species.

**DISTRIBUTION:** Known only from the Hawaiian Islands; to a depth of 21 meters.

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