

## Additional records of *Calcinus* species (Decapoda: Anomura: Diogenidae) from French Polynesia with description of three new species and a key to Indo-West Pacific species of the genus

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**Abstract.** — Three additional hermit crabs belonging to the genus *Calcinus* are described from French Polynesia: *Calcinus anani* n. sp., from Tuamotu and Marquesas sublittoral waters (18/55–140 m); *C. hakahau* n. sp., from the Marquesas (18–55 m); and *C. revii*, a dwarf species from the Tuamotu. Coloration, one of the most important diagnostic characters for species of this genus, is illustrated for each species. The diagnosis of *Calcinus gouti* Poupin, 1997, previously known from a single specimen, has been amplified by observations made from a second specimen found in the collections of the Muséum national d'Histoire naturelle, Paris. A key to the thirty Indo-West Pacific *Calcinus* species is presented.

### Introduction

The material upon which the present study is based has, for the most part, been collected since Poupin's (1997) revision of the French Polynesian species of *Calcinus*. It includes, *Calcinus anani* n. sp., from unstudied material dredged in October 1990 and January 1991 from the fishing research vessel *Marara* (see Poupin, 1996). This species was collected again during the *Alis* Marquesas MUSORSTOM 9 Expedition, 18 August to 11 September 1997. During this Marquesas Expedition, a second new species, *Calcinus hakahau* n. sp., was also obtained. Additionally, a third new species, *Calcinus revii* n. sp., was found on the outer reef of Fangataufa atoll,

Tuamotu, during an ecological survey aboard the French Navy towing-vessel *Revi*, 3–10 May 1997. This material has been supplemented with *Calcinus* specimens collected in French Polynesia by Monteforte (1984), and deposited in the Muséum national d'Histoire naturelle, Paris. This latter collection includes five species. Of these, four are from Moorea, Society Islands, and include *Calcinus gouti* Poupin, 1997, previously known from a single specimen, *C. guamensis* Wooster, 1984, *C. isabellae* Poupin, 1997, and *C. ? minutus* Buitendijk, 1937; and one is from Maitava atoll, Western Tuamotu Islands, and is assignable to *C. revii* n. sp.

### Materials and Methods

Shield length is used as the standard measurement for all specimens. It is measured from tip of rostrum to posterior edge of the carapace. All specimens are catalogued and deposited at the Muséum national d'Histoire naturelle, Paris, MNHN. Other abbreviations used hereafter are as follows: CRIOBE, Centre de Recherche Interinsulaire et Observatoire de l'Environnement, Moorea, Society Islands; LACM, Natural History Museum of Los Angeles County; ORSTOM, Institut Français de Recherche Scientifique pour le Développement en Coopération; stn for station, and ov. for ovigerous female. Vessels and gear are abbreviated as: Frv, Fisheries research vessel; CP, beam trawl; D, 'Charcot' dredge; DR, rock dredge; DW, Waren dredge.

## Systematic account

*Calcinus anani* new species

(Figs. 1a–e and 2)

*Calcinus pulcher*.— Miyake, 1982: 114, pl. 38, fig. 5, color photograph (Female n°1171, Shirahama, Japan; depth 40–50 m). Not *C. pulcher* Forest, 1958.

Material examined.— French Polynesia - Tuamotu: Moruroa atoll - 1 ♂ 5.9 mm, coll. Frv *Marara* stn D51, 15 October 1990, 21°53.1'S, 139°02.6'W, depth 140 m (MNHN Pg5559, holotype). - Marquesas: Nuku Hiva Island - 1 ♂ 2.1 mm, coll. Frv *Marara*, stn D79, 22 January 1991, 8°57.6'S, 140°05.8'W, depth 59 m (MNHN Pg5560); 8 ♂ 1.6–3.6 mm, 1 ov. ♀ 2.1 mm, 1 ♀ 1.8 mm, coll. Frv *Alis* MUSORSTOM 9, stn DW1170, 25 August 1997, 8°45.1'S, 140°13.1'W, depth 104–109 m (MNHN Pg5561, paratypes); 1 ov. ♀ 2.0 mm, stn DR1181, 26 August 1997, 8°45.5'S, 140°03.2'W, depth 102–130 m (MNHN Pg5562); Hiva Oa Island - 1 ♂ 2.8 mm, coll. Frv *Alis*, MUSORSTOM 9, stn CP1228, 30 August 1997, 9°44.6'S, 138°51.5'W, depth 107–108 m (MNHN Pg5563); Ua Pou Island - 1 ♂ 1.7 mm, 1 ov. ♀ 1.7 mm, coll. Frv *Alis*, MUSORSTOM 9, stn CP1265, 3 September 1997, 9°20.4'S, 140°07.3'W, depth 90–92 m (MNHN Pg5564); 1 ov. ♀ 1.7 mm, stn DW1143, 22 August 1997, 9°20.9'S, 140°02.7'W, depth 18–55 m (MNHN Pg5565).

Type material.— Holotype, 1 ♂ 5.9 mm, Tuamotu, Moruroa atoll, depth 140 m (MNHN Pg5559); Paratypes, 8 ♂ 1.6–3.6 mm, 1 ov. ♀ 2.1 mm, 1 ♀ 1.8 mm, Marquesas, Nuku Hiva Island, depth 104–109 m (MNHN Pg5561).

Etymology.— The specific name is from the Polynesian *anani*, meaning the native orange fruit, and reflects the general orange coloration of this species.

Diagnosis.— Ocular acicles simple. Ocular peduncles 0.8–1.1 length of shield. Outer face of palm of left cheliped regularly convex, finely granular; upper margin with 7 or 8 spines, sometimes with 1–4 smaller

spines interspersed. Upper margin of right chela with 4 or 5 strong corneous-tipped spines. Dactyl of third left pereopod 0.8–1.1 length of propodus; lower margin of dactyl and distal part of propodus with brush of long plumose setae. Telson usually with 1 spine on terminal margins of both right and left posterior lobes, sometimes only on left.

Live coloration.— Shield bright orange-white on distal and outer margins. Posterior shield bright orange or white. Ocular acicles white. Ocular peduncles uniformly white to pale orange. Antennular peduncles with proximal segment orange; basal 0.5 of penultimate segment orange, distal 0.5 white; ultimate segment white. Antennal peduncles orange on 2 proximal segments, paler on 3 distal segments; antennal acicle and spines of second peduncular segment white. Chelipeds orange, grading to pale orange on fingers and distal part of palm; chelae with scattered small orange flecks. Ambulatory legs pale orange, with darker orange stripes (Fig. 1c, d); stripes merging into more intricate network of reticulations on propodi and dactyls, and in some specimens, reticulations appearing also even on meri and carpi. Abdomen and eggs white.

Description.— Distal margin of shield between rostrum and lateral projections slightly concave. Rostrum acute, overreaching level of lateral projections. Ocular peduncles slender, 0.8–1.1 length of shield. Ocular acicles triangular, terminating in simple spine. Antennular peduncles reaching to distal 0.25 of ocular peduncles.

Antennal peduncles reaching distal 0.5–0.65 of ocular peduncles. Basal segment with ventrolateral angle minutely crenulate. Second segment with short dorsomesial distal spine; dorsolateral distal angle produced, terminating in strong bifid spine. Third segment with acute spine at ventromesial distal angle. Fourth segment with small distodorsal spine. Fifth segment unarmed. Antennal acicle terminating in strong spine; dorsolateral margin with 2 subdistal spines, dorsomesial margin with 3 or 4 spines.

Left chela (including fixed finger) approximately twice as long as width of palm. Dactyl slightly shorter than palm; cutting edge with 2 or 3 triangular teeth; proximal portion of upper face with 2 subparallel rows of granules. Fixed finger with 2 (rarely 3) triangular teeth on cutting edge. Outer face of palm regularly convex, finely granular; lower face with some squamous tubercles; inner face smooth, with sharp ventral tubercle; upper margin with 7 or 8 spines, sometimes with 1–4 smaller spines interspersed. Carpus with row of rounded, sometimes spinulose, tubercles on outer distal margin; upper margin with strong distal spine and 1–3 denticles proximally; outer face with prominent tubercle in upper 0.5. Merus compressed; ventrolateral and ventromesial margins each with 1 or 2 distal denticles.

Right chela 0.6–0.7 length of left. Dactyl 0.8–0.9 times as long as palm; cutting edge with 2 or 3 proximal teeth; upper face with 2 subparallel rows of small corneous spines. Fixed finger with 1–3 triangular teeth on cutting edge proximally. Outer face of palm weakly convex, granular or nearly smooth, with spine-tipped tubercles near bases of fixed finger and dactyl; lower face with disparate squamous protuberances; inner face smooth; upper margin armed with 4 or 5 strong corneous-tipped spines. Carpus with 2 or 3 spines on upper margin, distalmost spine much stronger; outer distal margin with row of tubercles, generally spinous near upper margin; outer face almost smooth, with 1–3 small squamous tubercles. Merus with 1–3 distal denticles on ventrolateral margin; ventromesial margin with 1–5 usually spinulose denticles.

Second pereopods long, exceeding left cheliped by length of dactyls. Dactyl of left 0.8–0.9 length of propodus; lower margins with widely-spaced sparse tufts of setae and 7 or 8 acute spines. Propodus unarmed; upper and lower margins with short setae. Carpus approximately 0.6 length of propodus; dorsodistal margin

with 2 or 3 spines. Merus slightly shorter than propodus, with 1 spine at outer distoventral angle. Left third pereopod shorter than left second, overreaching tip of left cheliped by distal 0.35 length of dactyl; distal brush of plumose setae present. Dactyl of left third pereopod 0.8–1.1 length of propodus; lower margin with 5 tufts of long setae, and 7 acute spines. Lower margin of propodus denticulate on distal 0.35, and with several tufts of long setae. Carpus 0.8 length of propodus; dorsodistal margin with strong spine, sometimes with 2 additional smaller spines. Merus about 1.1 length of propodus, with 1 obtuse spine at outer distoventral angle.

Telson with posterior lobes asymmetrical, left slightly larger than right. Terminal margins each with fringe of long setae; left with 1 long, inwardly curved spine, outer margin unarmed; right usually with 1 smaller spine, sometimes unarmed.

Distribution and habitat.— French Polynesia: Marquesas (Hiva Oa, Nuku Hiva, Ua Pou); Tuamotu (Moruroa). Southern Japan, Shirahama. Depth 18/55–140 m. Paratypes from Nuku Hiva occupied gastropods shells of the genera *Bursa*, *Cancilla* and *Chicoreus*; Miyake (1982) mentions shells of the genera *Lophiotoma* and *Trochus*.

Remarks.— *Calcinus anani* is closely related to *Calcinus sirius* Morgan, 1991. Primary characters shared by *C. anani* and *C. sirius* include simple ocular acicles, regularly convex outer faces of the left chelae, spinose upper margins of the right chelae, greater distal setation on the third pereopods than on second, and telsons with a single spine on both terminal margins. However, in *C. anani*, distal setation of third pereopod forms a distinct brush of setae, whereas in *C. sirius* it is only slightly greater than on second pereopod, not forming a brush. Moreover, the color patterns of the ambulatory legs are very different, those of *C. sirius* lacking stripes. Morgan (1991: 903) described the coloration of the

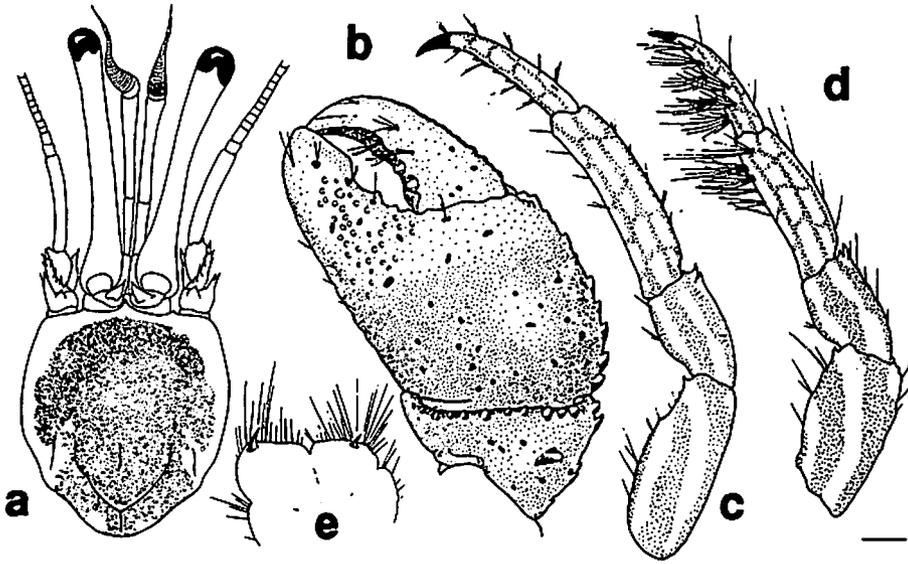


Fig. 1. *Calcinus anani* new species – Holotype ♂ 5.9 mm, Moruroa (MNHN Pg5559) – a, shield and cephalic appendages; b, left chela and carpus, outer face; c, left second pereopod, outer face; d, left third pereopod, outer face – Paratype ♂ 2.9 mm, Nuku Hiva (MNHN Pg5561); e, telson, ventral view. Scale bar is 1.0 mm for a–d, and 0.5 mm for e; stippling indicate color patterns.

second and third pereopods of *C. sirius* from preserved specimens as “rather uniform medium brown with tip of the dactylus cream, distal part of propodus somewhat paler brown; spines and tubercles paler, often cream; scattered darker orange or brown spots at setal pores”. Although colors are effected by preservation, usually patterns remain for extended periods of time, thus, it is not likely that living specimens of *C. sirius* would show the stripes and reticulations seen in *C. anani*.

*Calcinus anani* is also allied to the eastern Pacific *C. pascuensis* Haig, 1974, described from Easter Island, and known by a single, incomplete, male holotype. The holotype of *C. pascuensis* was deposited in the collections of the Allan Hancock Foundation, University of Southern California (AHF 653). The Foundation’s crustacean collections were recently transferred to the Natural History Museum of Los Angeles, but unfortunately, the holotype of *C. pascuensis* has not been located in the

LACM collections (J. Martin, personal communication). *Calcinus anani* and *C. pascuensis* have a similar pattern of longitudinal stripes on the ambulatory legs, particularly on the meri and carpi. However, in *C. pascuensis* (Haig, 1974: figs. 4–6) the stripes of the propodi and dactyls in preserved specimens do not merge in a more intricate network, as may be seen in *C. anani* (Fig. 1c, d). Coloration of ocular peduncles and right chela (the left chela is missing in *C. pascuensis*) is also different. Haig reported that the ocular peduncles of *C. pascuensis* were orange with a pink basal portion and a “sharply defined” narrow white ring just proximal to the cornea. No ring has been observed in *C. anani*. The right cheliped of *C. pascuensis* was noted to have a white ground color with dark orange-red patches. In *C. anani* the ground color is orange, with small darker orange flecks. Additionally, Haig mentioned that the “Degree of setation is about the same on all legs” in *C. pascuensis*. This character

alone is sufficient to distinguish between the two species.

Occurrence of *Calcinus anani* in Japanese waters is attested by the color photographs published by Miyake (1982: 114, pl. 38, fig. 5, as *C. pulcher*). On this illustration, stripes patterns on ambulatory legs are clearly similar to *C. anani*. Distal setation of third pereopods is also greater than on distal second pereopods, which excludes assignation of this Japanese specimen to *C. pascuensis* Haig, as suggested by Shi & Yu (1995).

### *Calcinus gouti* Poupin, 1997

*Calcinus gouti* Poupin, 1997: 690, figs. 3b, 5f, 7a, color photograph (Moruroa atoll, Tuamotu).

Material examined.— French Polynesia - Society: Moorea Island - 1 ♂ 2.7 mm, coll. M. Monteforte, 26 June 1982, outer reef, Tiahura, depth 10–15 m (MNHN Pg5550) - Tuamotu: Moruroa atoll - 1 ov. ♀ 2.6 mm, coll. B. Gout, 7 October 1996 (Holotype, MNHN Pg5412).

Diagnosis.— Ocular peduncles 0.8–0.9 length of shield. Ocular acicles bi or tripinose. Upper margin of left chela with 6 or 7 spines with few smaller spines interspersed. Upper margin of right chela with 5 or 6 strong corneous-tipped spines. Distoventral setation of left pereopod either dense, almost forming a true brush of setae, in larger male, or obviously greater than on second pereopod but not forming a brush of setae, on female holotype (see Remarks). Telson with posterior lobes asymmetrical; left posterior lobe with 4–6 spines on outer margin (very long in female holotype, but much shorter in additional male specimen) and 5 spines on terminal margin; right posterior lobe with 5–8 spines on terminal margin.

Live coloration.— Shield cream with few darker yellow spots on anterior half. Ocular peduncles pink on basal half, grading to white distally (see Remarks). Antennular peduncles yellow except for

white distal 0.5 of terminal segment; flagella yellow. Antennal peduncles white with scattered yellow patches; flagella yellow. Palm of each cheliped white with dark brown spot proximal to mid-length on outer and inner faces; each spot central to larger light brown area. Dactyls, propodi, carpi and meri of second and third pereopods with median pink bands and longitudinal pale yellow flecks (these flecks disappearing quickly in alcohol); on propodi median band largest, occupying 0.5 length segment; on meri of third pereopods median band defined only on upper 0.5 of segment. Eggs red.

Distribution and habitat.— French Polynesia: Society (Moorea); Tuamotu (Moruroa). Depth 10–15 m. Holotype was associated with coral *Pocillopora* sp.

Remarks.— In the holotype of *Calcinus gouti* the distal setation of the left third pereopod was described as “slightly greater than on second pereopod, not forming an obvious brush” (Poupin, 1997: 692). However, in the new material from Moorea, the setation is much more abundant, almost forming a brush of setae. This definition of the setal character of the left third pereopod leaves an element of ambiguity; however, on the basis of only two specimens it is not possible to provide a precise definition. Therefore, until additional material can be examined, we can only describe the setation as being greater than on the second pereopods and tending, in some specimens, toward the formation of a setal brush. A comparable situation occasionally has been observed in *Calcinus gaimardii* sensu lato which usually has a distal brush of setae on distal third pereopod. However, in some small specimens of this species, distal setation on third pereopod does not form a typical brush although it is obviously greater than on distal second pereopod. Such variations must be taken into consideration when using a key as they can lead to serious misidentification (see also Discussion).

Coloration of the ocular peduncles

appears to be variable in *Calcinus gouti*, as has also been observed in *C. guamensis* Wooster, 1984 and *C. vachoni* Forest, 1958 (Poupin, 1997: 695, 713, fig. 8; Shi & Lee, 1997, fig. 1). In life, the ocular peduncles of the female holotype are uniformly white, with only few pale yellow flecks on proximal halves. In contrast, the additional specimen from Moorea, had a basal pink band, despite 15 years of preservation in alcohol.

### *Calcinus guamensis* Wooster, 1984

*Calcinus guamensis*.— Wooster, 1984: 141, fig. 4. (Guam, Mariana Islands).— Poupin, 1997: 694, figs. 2c–c', 3d, 4c, color photograph and further references (Fatu Hiva and Hiva Oa Islands, Marquesas).— Hoover, 1997b: 9, 12 (Hawaii; illustration of two color patterns, adult and juvenile).

Material examined.— French Polynesia - Society: Moorea Island - 1 ♂ 2.2 mm, coll. M. Monteforte stn 3, 26 June 1982, Tiahura reef (MNHN Pg5553).

Diagnosis of material examined.— Ocular acicles trifold. Outer face of left chela regularly convex. Upper margin of right chela with 5 spines. Dactyls of second pereopods short, 2.6 times as long as deep. Distal setation of left third pereopod weak, similar to left second pereopod. Left lobe of telson with 3 spines on outer margin and 4 on terminal margin; right lobe with 4 spines on terminal margin. No color remaining.

Remarks.— The dark rings typical of *Calcinus guamensis* on the ocular peduncles, carpi of chelipeds, and dactyls of the ambulatory legs, are totally missing on this specimen. They must have persisted at least some months after preservation in alcohol since a label noted "*Calcinus cf. vachoni*, probably. sp. nov. voir Forest, 1958". This '*Calcinus cf. vachoni*' most probably refers to the abnormally pigmented specimen, reluctantly attributed by Forest (1958: 286–287, ♀ 6 mm, Rte 1774) to *C. vachoni*. From Wooster's (1984) description, and Morgan's (1991:

879) observations, we now know that this atypical '*vachoni*' is actually *C. guamensis*. The occurrence of *C. guamensis* in the Society Islands is additionally confirmed by field observations of the senior author (Tahiti, September 1997, Tahara beach, in coral *Pocillopora*).

In absence of coloration, *C. guamensis* might be confused with *C. laurentae* Haig & McLaughlin, 1984, which shares most of the diagnostic characters cited above. The two species can be separated by the length/depth ratio of the dactyls of the second pereopods, which is approximately 2.6 times as long as deep in *C. guamensis* as opposed to more than 3.0 times as long as deep in *C. laurentae*; and by the distal setation of third pereopod, which is similar to second pereopod in *C. guamensis*, in contrast to greater than the distal setation of the second pereopod in *C. laurentae*.

Distribution.— Christmas and Cocos Islands; North Western Australia; Indonesia; Viet-Nam; Taiwan; Japan; Mariana; Hawaii; French Polynesia (Fatu Hiva and Hiva Oa Islands, Marquesas; Moorea and Tahiti Islands, Society).

### *Calcinus hakahau* new species

(Figs. 2 and 3a–e)

Material examined.— French Polynesia - Marquesas: Ua Pou Island, 1 ov. ♀ 1.8 mm (Holotype MNHN Pg5557), 2 ♂ 1.8 and 3.2 mm, 1 ♀ 1.1 mm (Paratypes MNHN Pg5558), coll. Frv *Alis* MUSORSTOM 9, stn DW1143, 22 August 1997, 9°20.9'S, 140°02.7'W, depth 18–55 m.

Type material.— Marquesas, Ua Pou Island. Holotype, 1 ov. ♀ 1.8 mm (MNHN Pg5557); Paratypes, 3 sp. 1.1–3.2 mm (MNHN Pg5558).

Etymology.— Named for Hakahau, the Marquesas bay where the main village of Ua Pou Island is located. The sampling station where this new *Calcinus* was collected is north of that bay.

Diagnosis.— Ocular acicles multispinose (2–4 spines). Ocular peduncles 0.8–

1.0 length of shield. Outer face of left palm regularly convex; upper margin with 5 or 6 stout spines, sometimes with smaller interspersed denticles. Right chela with 4 or 5 strong corneous-tipped spines on upper margin. Distal setation of third pereopods sparse, similar to that of second pereopods. Dactyl of left third pereopod 0.8–0.9 length of propodus. Telson with posterior lobes asymmetrical; left posterior lobe with 2–7 spines on terminal margin and 2–5 spines on outer margin; right lobe with 1–6 spines on terminal margin.

**Live coloration.**— Shield orange brown, paler on proximal 0.5, and with scattered dark brown or white spots. Ocular acicles white to light brown. Basal 0.65 of ocular peduncles pink, color somewhat lacking near base; distal 0.35 white to pale violet. Antennular peduncles with basal segment white-violet; median segment yellow; terminal segment yellow on proximal 0.5, grading distally to white-violet; flagella yellow. Basal four segments of antennal peduncles orange-brown, with tips of spines white (occasionally third and fourth segments totally white); ultimate segment and flagella yellow. Antennal acicles white with small orange brown patches near base. Chelipeds light brown to pink-violet, grading to white on distal parts of palms and fingers, and on tips of spines. Ambulatory legs banded with pink-violet median rings, very broad on propodi and carpi, narrower on dactyls. Abdomen and eggs pale yellow. In smaller specimens, median ring of ambulatory dactyls narrow and incomplete. On a single specimen ( $\delta$  1.8 mm, MNHN Pg5558), pink basal ring on ocular peduncles and pink-violet median rings of ambulatory legs turn to orange-brown coloration.

**Description.**— Distal margin of shield weakly concave between rostrum and lateral projections. Rostrum obtusely subtriangular, slightly exceeding level of lateral projections. Lateral projections

blunt or with minute terminal spine. Ocular peduncles equal to shield length, in larger specimens, distinctly shorter in smaller specimens. Ocular acicles typically multispinous, with 2–4 spines on left, and 2 or 3 spines on right.

Ultimate segment of antennular peduncles reaching distal 0.3 of ocular peduncles; upper flagella overreaching ocular peduncle by distal 0.5. Antennal peduncles reaching 0.5–0.65 length of ocular peduncles. Proximal segment with 2–4 small spines at outer distoventral angle. Second segment with sharp dorsomesial spine; distolateral angle produced in strong bifid spine. Third segment with distoventral spine. Fourth segment with small distodorsal spine, sometimes indistinct. Terminal segment unarmed. Antennal acicle overreaching distal margin of penultimate segment, terminating in strong acute spine; dorsomesial margin with 2 or 3 strong spines; dorsolateral margin with 2 subdistal spines. Flagella considerably overreaching tip of left chela.

Left chela 1.3–1.4 length of right. Dactyl 0.6–0.8 length of palm; upper face with 2 subparallel sets of granules; proximal cutting edge with 2 triangular teeth. Cutting edge of fixed finger with 1 or 2 triangular teeth and 1 or 2 smaller denticles; outer face coarsely granular. Outer face of palm regularly convex, with some spinulose tubercles near bases of fingers, upper margin, and proximoventral corner. Inner face almost smooth, with some sparse, spinulose tubercles along upper margin, and strong tubercle in middle of lower margin (missing on smaller specimens). Upper margin with 5 or 6 stout spines, sometimes with 1–3 smaller denticles interspersed. Lower margin smooth to slightly tuberculate. Carpus with row of rounded granules on outer distal margin; upper margin with strong terminal spine and 1 or 2 smaller spines on proximal portion; outer face with prominent submedian tubercle and



Fig. 2. Live coloration – Left top – *Calcinus anani* new species, holotype ♂ 5.9 mm, (MNHN Pg5559) – Left bottom – *Calcinus hakahau* new species, holotype ♀ ov. 1.8 mm, (MNHN Pg5557) – Right – *Calcinus revii* new species, holotype ♂ 2.2 mm (MNHN Pg5554).

few ventral tubercles; inner face almost smooth with only some low granules. Merus compressed; outer face almost flat, with scattered scale-like tubercles; outer lower margin with 1–3 distal spines; inner lower margin with 2 or 3 somewhat spinous denticles.

Right chela with 4 or 5 strong corneous-tipped spines on upper margin. Dactyl with 2 subparallel rows of spines on upper face, inner spines acute, almost twice as long as outer spines; cutting edge with 2 large triangular teeth in proximal 0.5. Fixed finger almost smooth; cutting edge with 1 or 2 proximal triangular

teeth. Outer face of palm weakly convex with few scattered tubercles, these tubercles being spinulose on female holotype; inner face weakly convex, smooth; lower margin with 2 tubercles in distal 0.5. Carpus broad; outer face granular or with small spines; inner face flattened and smooth; upper margin with 3 spines, distalmost largest. Merus compressed, outer face slightly convex, almost smooth; upper margin unarmed; outer lower margin with 1–3 distal spines; inner lower margin with 2 or 3 denticles.

Left second pereopod overreaching left cheliped by length of dactyl. Dactyl

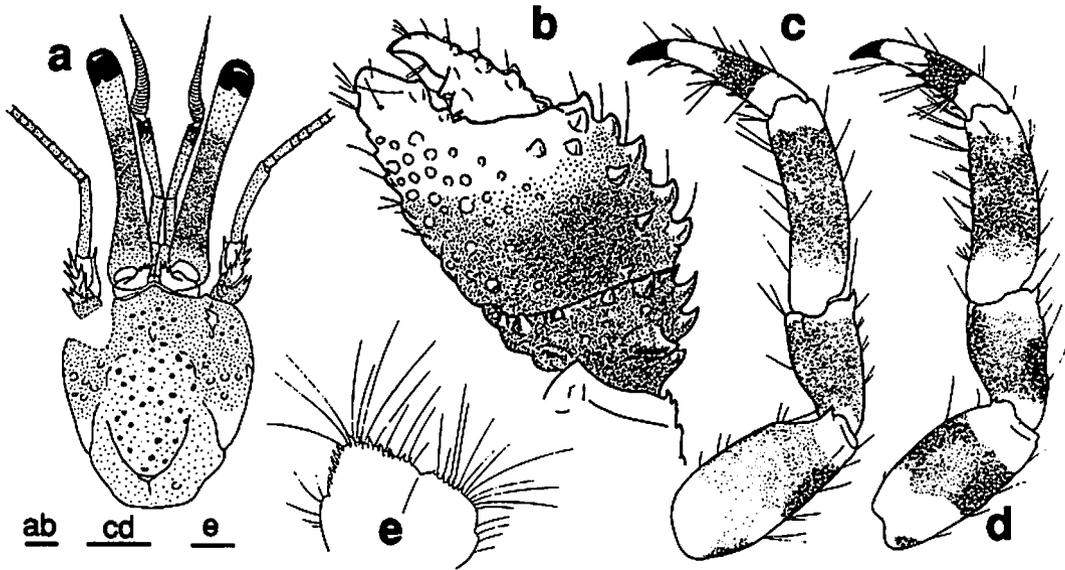


Fig. 3. *Calcinus hakahau* new species – a, shield and cephalic appendages (left corner of shield broken); b, left chela and carpus, outer face; c, Left second pereopod, outer face; d, left third pereopod, outer face; e, telson, ventral view – a, e, paratype ♂ 3.2 mm (MNHN Pg5558); b–d, holotype ov. ♀ 1.8 mm (MNHN Pg5557). Scale bars are 0.5 mm; stippling indicate color patterns.

slightly shorter than propodus; lower margin with row of 5 or 6 acute spines and widely-separated sparse tufts of setae. Propodus unarmed; upper and lower margins each with scattered long simple setae. Carpus about 0.65 length of propodus; distodorsal angle with 1 strong spine, sometimes with 1 or 2 additional smaller spines. Merus laterally compressed; outer and inner faces flat; outer distoventral angle with prominent spine. Left third pereopod slightly shorter than second, overreaching tip of left cheliped by distal 0.3 of dactyl. Lower margin of dactyl and distoventral margin of propodus with widely separated tufts of setae. This distal setation of left third pereopod is similar to the distal setation of left second pereopod. Dactyl 0.8–0.9 as long as propodus, with row of 5–7 acute spines on lower margin. Propodus slightly shorter and stouter than that of second pereopod; lower margin weakly denticulate in distal 0.65, with scattered sparse

tufts of setae. Carpus approximately 0.65 length of propodus; distodorsal angle with strong spine and sometime smaller inner spine; upper margin with 1 or 2 spinous scales proximal to strong distodorsal spine. Merus about same length of propodus; inner face flattened; outer distoventral angle with small spine.

Telson with fringe of long simple setae on each lobe. Left posterior lobe only slightly larger than right; terminal margin with 2–7 spines; outer margin with 2–5 spines. Right posterior lobe with 1–6 spines on terminal margin.

Distribution and habitat.— Known only from the type locality. French Polynesia (Ua Pou Island, Marquesas). Depth 18–55 m. Specimens were intermingled with broken corals.

Remarks.— The coloration of the ambulatory legs of this species suggests a relationship to the Polynesian *Calcinus gouti*. However, 1) in *C. hakahau* distal setation of third pereopods is similar to

that of second, rather than greater in *C. gouti*; 2) palms of *C. hakahau* do not have the submedian dark brown spots observed in *C. gouti*; 3) colored rings on ambulatory legs are much larger in *C. hakahau* than in *C. gouti*.

Among the other Indo-West Pacific species, the most closely related species appears to be *C. laurentae*. *Calcinus laurentae* is different by the distal setation of third pereopods that is greater than on the second pereopods, and by the coloration of the ambulatory legs. In *C. laurentae*, the second and third pereopods are orange on the meri, carpi, and propodi, and pink on the dactyls; colored rings are absent. A photograph of *C. laurentae*, published by Hoover (1997a: 182, 186), shows this difference very clearly.

Unfortunately, the type material of *C. hakahau* is in rather poor condition, and most of the specimens are small. Further collections of this new species would be helpful in improving the present description.

#### ***Calcinus isabellae* Poupin, 1997**

*Calcinus isabellae* Poupin, 1997: 698, figs. 2e, 3f, 5a–b, 7c, color photographs and further references (Tahiti Island, Society; Morane and Moruroa atolls, Tuamotu).

**Material examined.**— French Polynesia - Society: Moorea Island, 1 ♀ 2.7 mm, coll. M. Monteforte stn 4, 28 June 1982, Tiahura reef (MNHN Pg5551).

**Diagnosis of material examined.**— The following diagnosis is limited to this single specimen, missing right ocular peduncle, both chelipeds, and most of the ambulatory legs except for right third pereopod (full diagnosis of *C. isabellae* is given in Poupin, 1997). Ocular acicle simple. Third pereopod with distal brush of setae; propodus 2.8 times as long as deep; merus 2.1 times as long as deep. Telson with single spine on each lobe. Coloration almost totally faded, with only obscure colored rings on right third pereopod.

**Remarks.**— The present specimen agrees with *Calcinus isabellae* Poupin, 1997 or *C. imperialis* Whitelegge, 1901. The propodus and merus of the third pereopod are relatively long, as in *C. isabellae*, and the ratio length/depth of these articles, 2.8 for the propodus and 2.1 for the merus, exceed the ranges observed in *C. imperialis*, which are 2.1–2.5 for the propodus and 1.4–1.7 for the merus (cf. Poupin, 1997: 702). The occurrence of *C. isabellae* in the Society Islands is moreover confirmed by recent field observations of the senior author (1 sp., Tiahura reef, September 1997, Moorea, Society Islands; leg to CRIOBE collections, Moorea).

**Distribution.**— French Polynesia: Society (Moorea and Tahiti Islands); Tuamotu (Morane and Moruroa atolls). Mariana: Asuncion, Pagan, and Guam Islands.

#### ***Calcinus ? minutus* Buitendijk, 1937**

*Calcinus minutus* - Poupin, 1997: 704, fig. 6a, color photograph of an Australian specimen, and further references.

**Material examined.**— French Polynesia - Society: Moorea Island, 2 ♂ 2.8 et 4.0 mm, in bad condition, coll. M. Monteforte stn 4, 28 June 1982, Tiahura reef (MNHN Pg5 552).

**Diagnosis of material examined.**— Ocular acicles trifold. Upper margins of left and right chelae each with 5 spines (chelae are missing on largest specimen). Distal setation of third left pereopod weak, similar to second pereopod. Left lobe of telson with 5 spines on terminal margin; outer margin unarmed. Right lobe with 4 spines on terminal margin. Specimens totally white, without any coloration remaining.

**Distribution.**— Christmas and Cocos Islands; Australia; Viet-Nam; Taiwan; Japan; New-Guinea; Salomon; Palau; Carolines; Mariana; Samoa; ? French Polynesia (Moorea Island, Society; to be confirmed by observation of fresh and colored specimens).

Remarks.— The material examined here was labelled "*Calcinus minutus* à vérifier" and most probably represent the first report of *Calcinus minutus* in French Polynesia (see Monteforte, 1984). It was not included in the previous study of the senior author (Poupin, 1997), where it was concluded that more collections were necessary to confirm the occurrence of *C. minutus* in the area. Unfortunately, in absence of coloration, we cannot confidently attribute the above material to *C. minutus*, which is closely allied to *C. nitidus* Heller, 1865. The two species are very similar and coloration (see Poupin, 1997, figs. 6a and 6b) is the only confident mean for separating them. In the present two specimens, the ocular acicles are trifid, whereas they are most often bifid in *C. nitidus*. Furthermore, the large orange patches, always present on the chelipeds of *C. nitidus*, are here totally absent whereas some remains of coloration have persisted in the *C. isabellae* collected at the same time (see above Pg5551, coll. 28 June 1982). Thus, it is probable that coloration of the chelipeds really was white on fresh material, as in *C. minutus*.

*Calcinus revii* new species

(Figs. 2 and 4a–e)

Material examined.— French Polynesia - Tuamotu: Fangataufa atoll, 1 ♂ 2.2 mm (Holotype MNHN Pg5554), 11 ♂ 1.1–1.8 mm (Paratypes MNHN Pg5555), 1 ov. ♀ (material lost), coll. B. Salvat, outer reef, May 1997; Maitava atoll, 1 ♂ 1.8 mm, coll. M. Monteforte, probably 1982, 'Papiro Hoa' (MNHN Pg5556).

Type material.— Tuamotu, Fangataufa atoll.— Holotype, 1 ♂ 2.2 mm (MNHN Pg5554); Paratypes, 11 sp. (MNHN Pg5555).

Etymology.— This species is named for the French Navy towing-vessel *Revi*, used for the 1997 Tuamotu, Fangataufa Expedition, during which this dwarf

species was first recognized.

Diagnosis.— Very small species; shield length 1.1–2.2 mm. Ocular acicles simple. Outer face of left chela almost smooth, regularly convex. Upper margin of right chela with row of 4 or 5 strong corneous spines. Distoventral setation of left third pereopod obviously more profuse than second, forming weak brush of setae. Telson with 1 or 2 terminal spines on left lobe (no spines on outer margin), and 0–2, usually 1, terminal spine on right lobe.

Live coloration.— General coloration almost totally white. Ocular peduncles white to very pale violet distally; 2 narrow dark lines often present on median outer and inner faces. Shield and ocular acicles white. Antennular peduncles and flagella yellow. Antennal peduncles and flagella yellow. Chelipeds uniformly white. Ambulatory legs white with black claws. Brush of left third pereopod pale pink, coloration vanishing quickly in alcohol. Posterior shield and abdomen pale yellow to white. Eggs red.

Description.— Shield approximately 1.1–1.2 longer than broad. Rostrum triangular, tip acute, exceeding level of lateral projections. Lateral projections broadly triangular with minute terminal spinules. Ocular peduncles 0.7–1.1 length of shield. Ocular acicles simple or with additional minute spinule on right acicle.

Antennular peduncles reaching to distal 0.25 of ocular peduncles, overreaching corneae by distal 0.5 of upper flagella. Antennal peduncles reaching 0.50–0.65 of ocular peduncles. First segment with 1–3 minute spines at outer distoventral angle; second segment with acute dorsomesial spine and strong bifid distolateral spine; third segment with acute distoventral spine; fourth segment with small distodorsal spine; fifth segment unarmed. Flagella considerably exceeding tip of left cheliped. Antennal acicle slightly overreaching distal margin of fourth peduncular segment, terminating in strong spine; dorsolateral margin with 2

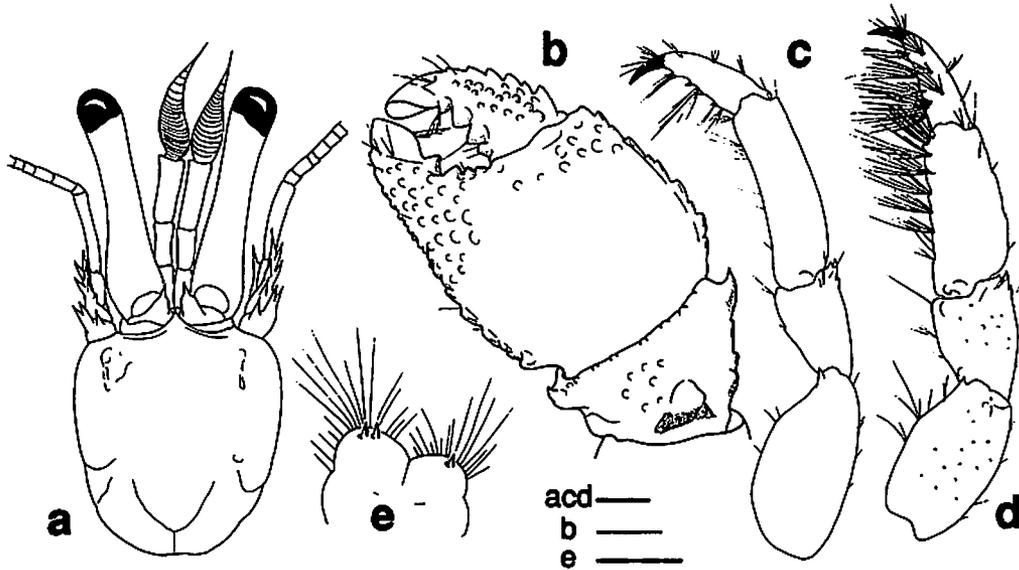


Fig. 4. *Calcinus revi* new species – Holotype ♂ 2.2 mm, Fangataufa (MNHN Pg5554) – a, shield and cephalic appendages; b, left chela and carpus, outer face; c, left second pereopod, outer face; d, left third pereopod, outer face; e, telson, ventral view. Scales bars are 0.5 mm.

strong subdistal spines; dorsomesial margin with 2 or 3 spines.

Left chela slightly more than 1.5 width of palm. Dactyl 0.7–0.8 length of palm; cutting edge with 3 or 4 large triangular teeth; outer face strongly tuberculate; upper margin with 2 subparallel rows of granules; inner face almost smooth. Cutting edge of fixed finger with 2–4 triangular teeth and prominent hiatus with dactyl; outer face tuberculate; inner face almost smooth; lower margin crenulate. Outer face of palm regularly convex, granular on distal 0.3, nearly smooth proximally; upper margin with row of 4–7 irregularly-sized spines; inner face slightly convex, with 1 or 2 disto-ventral tubercles; lower face rounded, with row of circular tubercles. Carpus broad, subtriangular; outer face with prominent submedian tubercle; distal outer margin with row of small rounded granules; upper margin crenulated, with strong spine at distal angle; inner and

lower faces smooth. Merus compressed, almost as long as palm; outer face weakly convex with scattered short transversal ridges; inner face flat and smooth; ventrolateral margin denticulate in distal 0.5, with sharp terminal spine; ventromesial margin with single distal spine.

Right cheliped reaching about to distal 0.8 of left. Chela 1.7–1.9 longer than width of palm; dactyl 0.8–1.0 length of palm; cutting edge with 2 broad proximal triangular teeth; upper margin with double row of small, corneous-tipped teeth, diminishing in size distally. Fixed finger with few low tubercles on outer surface and along lower margin; cutting edge with 1–4 triangular teeth. Palm about as long as wide; upper margin with row of 4 or 5 strong corneous spines; outer face weakly convex, with 1–5 spinous tubercles behind articulation of dactyl; inner face feebly convex, smooth or with few scale-like protuberances. Carpus broad, outer face smooth or with few low

granules; upper margin with 1 or 2 denticles and strong terminal spine; lower and inner faces flat and smooth. Merus about as long as chela; upper margin unarmed; outer and inner faces flat; outer and inner distoventral angles each with 2 or 3 spines.

Left second pereopod exceeding left cheliped by length of dactyl. Dactyl 0.7–0.8 as long as propodus, terminating in strong corneous claw; lower margin with 4 or 5 small acute spines, and widely-separated tufts of short to moderately long setae; upper margin with few short setae. Propodus long and slender, 0.8–0.9 times as long as shield; lower margin with few scattered long setae; upper margin rounded. Carpus 0.6–0.7 times as long as propodus; dorsodistal angle with strong terminal spine and additional smaller spine, slightly before; upper margin with few shallow depressions; lower margin unarmed but with moderately long setae at distoventral angle. Merus compressed, about as long as propodus; inner and outer faces flat; outer distoventral angle with spine; upper and lower margins with few setae. Third left pereopod slightly shorter than second; overreaching left chela by length of terminal claw. Dactyl 0.8–0.9 times as long as propodus, terminating in strong corneous claw; lower margin with 5 small acute spines and row of dense tufts of setae. Propodus stout, slightly shorter than propodus of left second pereopod; distal 0.65 of lower margin indented and furnished with several tufts of long setae. Carpus 0.6–0.7 as long as propodus; distodorsal angle with prominent spine and additional smaller spine; upper and lower margins each with sparse setae. Merus compressed, outer face slightly convex, inner face flat; upper and lower margins with few scattered long setae; outer distoventral margin with small spine.

Telson asymmetrical with marginal fringes of long simple setae. Left posterior lobe semicircular, much larger than right;

terminal margin armed with 1 or 2 spines, outer margin unarmed. Right posterior lobe usually with 1 spine on terminal margin, sometimes unarmed or armed with 2 spines.

Distribution and habitat.— French Polynesia: Tuamotu (Fangataufa and Mataiva atolls). Found on the outer reef at low tide. The species occupies small gastropods shells identified as *Mitra litterata* and *Morula uva* (B. Salvat det.).

Remarks.— *Calcinus revi* is a dwarf species, rather difficult to find because of its small size. Despite intensive collecting efforts in past years, this species was never obtained because no attention was paid to the tiny shells in which it lives. In fact, during the *Revi* Expedition it was discovered by a team of malacologists, systematically collecting all the shells found in a given area.

In French Polynesia, it is easily differentiated from the other *Calcinus* species by its small size and almost totally white coloration. The most similar species would be *Calcinus spicatus* Forest, 1951 and *C. latens* Randall, 1840. However, in these two species the telsons are always armed with several spines (4–13) on the left posterior lobes, and coloration is clearly different. Among the other Indo-West Pacific species, the closest allies are *C. sirius* and *C. tropidomanus* Lewinsohn, 1981. *Calcinus sirius* is differentiated by its greater size, different coloration, and distal setation of the left third pereopod, which is slightly denser than on second pereopods but does not form a brush. *Calcinus tropidomanus* also differs by its greater size, the left third pereopod lacking the brush of setae, absence of spines on both posterior lobes of telson, and red colored rings and patches on the ambulatory legs.

#### Discussion

With the discovery of the three new species described herein, 30 species of

*Calcinus* are now known from the Indo-West Pacific. This total includes *Calcinus pascuensis* Haig, 1974, described from Easter Island on the eastern side of the East Pacific ridge. The affinities of that species with most of the Indo-West Pacific forms has been recognised by Haig (1974: 30), and it is not morphologically close to any of the Eastern Pacific species. The four known Eastern Pacific species, *Calcinus californiensis* Bouvier, 1898, *C. chilensis* (H. Milne Edwards, 1836), *C. explorator* Boone, 1930, and *C. obscurus* Stimpson, 1859, form a distinct group characterized by a massive, rather smooth left chela, and a right chela with a smooth, or slightly granular upper margin. Only two Indo-West Pacific species, *C. laevimanus* and *C. seurati* Forest, 1951 show similar features of the chelipeds.

Coloration is very important to recognize the species of the genus and is certainly the easiest and most reliable way to identify living specimens. For some species, such as *C. minutus* and *C. nitidus*, it is actually the only decisive character, and the two can be separated only with difficulty when coloration has faded. Other important diagnostic characters include: 1) armature of ocular acicles and telson; 2) aspects of outer face of the left chela, regularly convex or with depression(s); 3) armament of the upper margin of right chela, with or without a row of spines; 4) distal setation of the left third pereopod; 5) relative proportions of some segments of the appendages primarily those of the meri, propodi and dactyls of the ambulatory legs.

Although most often constant, some of the above characters do show variations. Size-related variations can lead to misidentification when using a key. Additionally, abnormal lack of pigmentation of the ocular peduncles such as has been observed in *Calcinus gouti*, *C. guamensis*, and *C. vachoni* can also be misleading. The distal setation of the left third pereopod is also subject of variation. While this

setation is usually categorized as: 1) similar to that of the second pereopod; 2) slightly greater than that of the second pereopod, but with setal tufts not forming a distinct brush; and 3) dense tufts, forming a distinct brush of setae, the difference between the second and third categories is sometimes difficult to distinguish, especially in small specimens in which the setal brush is not fully developed (see above under *C. gouti*). Armature of the ocular acicles is also subject to variations. Often a distinction between the 'simple ocular acicle' form and the 'multispinose ocular acicle' form is not always precise. Some species, such as *C. latens*, and *C. argus* Wooster, 1984, usually have the 'simple' form, but can occasionally have additional spines. Similar variation has been observed in *Calcinus vanninii* Gherardi & McLaughlin, 1994. Although diagnosed as having ocular acicles "simple, bi- or trifold", we have observed (3 ♂ 4.7–5.5 mm, 2 ♀ 4.3 et 4.8 mm, La Réunion, lagon et récif de Saint Gilles, J. Forest & M. de Saint Laurent coll., September 1983, MNHN Pg5566) that *C. vanninii* from this locale commonly has simple ocular acicles, and only occasionally bifid (2 specimens out of 5, and unilaterally). In contrast, others species, like *C. minutus* (see Morgan, 1991: 871) that usually have the 'multispinose ocular acicle' form, occasionally can be represented by the 'simple' form. In the case of *C. latens* at least, we know that similar variations can be reflected in the spination of the telson (see Morgan, 1991: 892).

The taxonomic status of some species is still not clear. For example, *Calcinus rosaceus* Heller, 1861, at present can still only be distinguished by its reported coloration. Its morphological characters are so similar to *C. haigae* Wooster, 1984, that only an examination of fresh *C. rosaceus* from the Red Sea and/or Indian Ocean, can convincingly establish whether or not the two taxa represent distinct species (see Poupin, 1997: 696). The

status of *Calcinus gaimardii* (H. Milne Edwards, 1848) *sensu lato* is another taxonomic enigma. Two different color morphs have been observed (Fize & Serène, 1955; Morgan, 1991; Asakura, 1995; Tudge, 1995). Although Rahayu (1992) proposed that these color morphs represent distinct taxa, her *Calcinus* n. sp. is still awaiting formal publication. This formalization is currently in preparation by Rahayu & Forest, and should be published, together with a second new species of the '*gaimardii* complex,'—recently recognized in Indonesia. The status of *Calcinus pascuensis*, described from Easter Island from a single specimen is another problem. Its diagnosis is incomplete and further collections are necessary from the topotypic area to determine: 1) aspect of the outer face of left chela (regularly convex or with depressions); 2) armature of telson; 3) coloration of living material.

Despite all the difficulties encountered in the genus, we believe useful to present a key to the Indo-West Pacific species of *Calcinus*. It is based on the earlier keys of Haig & McLaughlin (1984), Morgan (1991), Poupin (1997), and Wooster (1984). We have attempted to combine morphological attributes with characters afforded by the distinctive color patterns of the species; however, in some cases, our information on morphology is limited. In such cases, species can only be separated confidently only by their coloration.

Key to the Indo-West Pacific species of  
*Calcinus*

- 1 Ocular acicles simple (unusually multispinose in *C. argus*, *C. latens*, and *C. vanninii*) ..... 2
- Ocular acicles bi or multispinose (occasionally simple in *C. minutus*) ..... 19
- 2 Right chela with smooth or slightly granular upper margin ..... 3
- Right chela with spinous or strongly tuberculate upper margin ..... 4
- 3 Dactyls of pereopods 2 and 3 subequal to propodi; dorsolateral ridge on propodus of pereopod 3. Left chela white; meri of pereopods 2 and 3 with a transverse band ..... *C. seurati* Forest
- Dactyls of pereopods 2 and 3 distinctly shorter than propodi; dorsolateral ridge lacking on propodus of pereopod 3. Left chela black, white only at tip of fingers; meri of pereopods 2 and 3 each with longitudinal band ..... *C. laevimanus* (Randall)
- 4 Dactyl and distal part of propodus of pereopod 3 with dense tufts of long setae, forming a distinct brush ..... 5
- Dactyl and distal part of propodus of pereopod 3 without obvious brush of setae; setation similar or slightly greater than on pereopod 2 ..... 12
- 5 Outer face of left palm with 1–3 depressions, not regularly convex ... 6
- Outer face of left palm regularly convex ..... 7
- 6 Outer face of left palm with single longitudinal depression; upper margin tuberculate. Proximal two-thirds of ocular peduncle green olive, distal third white; pereopods 2 and 3 banded in red, black, and white ..... *C. isabellae* Poupin
- Outer face of left palm with 2–3 circular or subcircular depressions, upper margin spinose. Ocular peduncle uniformly green-olive; pereopods 2 and 3 banded in green-olive, black, and pale yellow ..... *C. imperialis* Whitelegge
- 7 Pereopods 2 and 3 banded or striped .. ..... 8
- Pereopods 2 and 3 not banded or striped ..... 10
- 8 Telson with 1 terminal spine on each posterior lobe (right sometime miss-

- ing). Pereopods 2 and 3 with longitudinal stripes on meri and carpi, merging in a more intricate network on propodi and dactyli ..... *C. anani* n. sp.
- Telson with several terminal spines on each posterior lobe. Propodi, carpi, and meri of pereopods 2 and 3 with transverse bands ..... 9
- 9 Dactyls of pereopods 2 and 3 with subcircular black patches; propodi, carpi and meri banded in black, and dark blue .....  
..... *C. elegans* (H. Milne Edwards)
- Dactyls of pereopods 2 and 3 with a median black ring; propodi, carpi, and meri banded in black, white, and blue ..... *C. orchidae* Poupin
- 10 Left posterior lobe of telson with more than 2 terminal spines (usually 5) .....  
..... *C. gaimardii* (H. Milne Edwards) s.l.
- Left posterior lobe of telson with 1–2 terminal spines ..... 11
- 11 Large species (known range of shield length 3.6–10.3 mm). Pereopods 2 and 3 burgundy with numerous white dots ..... *C. argus* Wooster
- Small species (known range of shield length 1.1–2.2 mm). Pereopods 2 and 3 white ..... *C. revii* n. sp.
- 12 Dactyl and distal part of propodus of pereopod 3 with greater development of setae than on pereopod 2 ..... 13
- Dactyl and distal part of propodus of pereopod 3 with no greater development of setae than on pereopod 2 ..... 15
- 13 Telson with 1 terminal spine on each posterior lobe. Pereopods 2 and 3 uniformly brown, with dactyls cream at tip..... *C. sirius* Morgan
- Telson with more than 1 terminal spine on left or both posterior lobe(s). Pereopods 2 and 3 not uniformly coloured ..... 14
- 14 Telson with several terminal spines on left posterior lobe only, and 1 (rarely 2) on right posterior lobe. Proximal 0.5 of dactyls of pereopods 2 and 3 with a red-purple ring (composed of short longitudinal stripes on a paler background) ..... *C. latens* (Randall)
- Telson with numerous terminal spines on both posterior lobes. Dactyls and distal propodi of pereopods 2 and 3 purple ..... *C. spicatus* Forest
- 15 Pereopods 2 and 3 with longitudinal stripes on meri, carpi, and propodi ....  
..... *C. pascuensis* Haig
- Pereopods 2 and 3 without longitudinal stripes ..... 16
- 16 Outer face of left palm marked by one or two shallow depressions. Lower margins of dactyls of pereopods 2 and 3 with row of 9–13, usually 12, small corneous spines .....  
..... *C. vanninii* Gherardi & McLaughlin
- Outer face of left palm regularly convex. Lower margins of dactyls of pereopods 2 and 3 with row of 6–8 spines ..... 17
- 17 Both posterior lobes of telson without spine .... *C. tropidomanus* Lewinsohn
- Both posterior lobes of telson with spines ..... 18
- 18 Telson with 1 terminal spine on both posterior lobes. Pereopods 2 and 3 banded in white, red, and brown .....  
..... *C. dapsiles* Morgan
- Telson with several terminal spines on both posterior lobes. Pereopods not banded ..... *C. inconspicuus* Morgan
- 19 Dactyl and propodus of pereopod 3 with greater development of setae than on pereopod 2 ..... 20
- Dactyl and propodus of pereopod 3 with no greater development of setae than on pereopod 2 ..... 22
- 20 Inner and outer faces of palms of chelipeds with dark spot. Pereopods 2 and 3 with transverse pink bands .....

- ..... *C. gouti* Poupin
- No dark spot on palms of chelipeds. Pereopods 2 and 3 not banded ..... 21
- 21 Ocular peduncle cream, grey or brown, usually with black proximal patch (sometimes this patch is missing, or of variable extension). Pereopods 2 and 3 cream, grey, or green, meri darker, without marked stripes or bands ..... *C. vachoni* Forest
- Ocular peduncle red-orange, with broad white band proximal to base of cornea. Dactyls of pereopods 2 and 3 pinkish, other segments red-orange ....  
..... *C. laurentae* Haig & McLaughlin
- 22 Telson with outer margin of left posterior lobe with a row of spines ..... 23
- Telson with outer margin of left posterior lobe unarmed ..... 26
- 23 Outer and inner faces of palms with dark brown spots; pereopods 2 and 3 with longitudinal flecks or stripes ..... 24
- No dark brown spot on outer and inner faces of palms; pereopods 2 and 3 not flecked or striped ..... 25
- 24 Pereopods 2 and 3 with short longitudinal flecks on all segments, each segment with dark median patch except carpi of pereopod 2 (these being rose) .....  
..... *C. pulcher* Forest
- Pereopods 2 and 3 lacking flecks, propodi with dark brown or maroon longitudinal stripes on proximal 0.6 .....  
..... *C. lineapropodus* Morgan & Forest
- 25 Ocular peduncle cream with dark band proximally (somewhat variable in extension and occasionally missing); pereopods 2 and 3 cream, with dark proximal band on dactyls .....  
..... *C. guamensis* Wooster
- Ocular peduncle pink on proximal 0.6, white to pale violet distally; pereopods 2 and 3 with transversal pink-violet bands ..... *C. hakahau* n. sp.
- 26 Pereopods 2 and 3 predominantly purple ..... 27
- Pereopods 2 and 3 predominantly orange or white and orange ..... 28
- 27 Ocular acicle usually tri-spinose. Pereopods 2 and 3 with dark purple dots on dactyls and distal portion of propodi ..... *C. haigae* Wooster
- Ocular acicle usually bi-spinose. Pereopods 2 and 3 without dark purple dots (this point must be checked on fresh material) ..... *C. rosaceus* Heller
- 28 Ocular peduncle pale orange, without distal white ring proximal to base of cornea. Large orange patches present on meri, carpi and palms of chelipeds .....  
..... *C. nitidus* Heller
- Ocular peduncle dark red-orange or pale orange, with distal white ring proximal to base of cornea. Chelipeds without large orange patches ..... 29
- 29 Meri, carpi, and propodi of pereopods 2 and 3 dark orange; dactyls white except for small orange-red area proximally ....  
..... *C. hazletti* Haig & McLaughlin
- Meri, and carpi of pereopods 2 and 3 white, with scattered orange specks; propodi and dactyls orange, dactyls much brighter ..... *C. minutus* Buitendijk

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The French Navy has given its sup-

port, with its towing-vessel *Revi*, during the Fangataufa 1997 Expedition, where *Calcinus revii* was discovered. It was collected on the reef by Bernard Salvat, director of the CRIOBE, Moorea. Alain Crosnier and Bertrand Richer de Forges (French ORSTOM) have permitted the participation of one of us (J. Poupin) to the 1997 *Alis* Marquesas MUSORSTOM 9 Expedition, where we discovered *Calcinus hakahau*. To all we want to express our warmest thanks.

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