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THE *PROVENZANOI* GROUP OF HERMIT CRABS (CRUSTACEA, DECAPODA, PAGURIDAE) IN THE WESTERN ATLANTIC

PART II. *PAGURUS GYMNODACTYLUS*, A NEW SPECIES FROM THE GULF OF MEXICO AND A COMPARISON WITH *PAGURUS ANNULIPES* (STIMPSON)

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ABSTRACT

A new species of hermit crab of the *Provenzanoi* group of *Pagurus* from the Gulf of Mexico is described and illustrated. A comparison with the closely related *Pagurus annulipes* (Stimpson) from the eastern coast of North America is included. Variations of diagnostic characters of the two species are discussed and illustrated. Similarities of *P. gymnodactylus* with other species of the group are discussed.

The systematics of the Gulf of Mexico shallow-water pagurid crabs have not been studied in great detail and consequently the taxonomy of the species from the region has remained obscure. Hermit crab species of the *Provenzanoi* group are among the most common and abundant pagurids in the Gulf of Mexico, Caribbean, and western Atlantic regions. A review of the species assigned to this group has revealed 3 new species previously confounded with others of the group.

Before the present review was undertaken (Lemaitre et al., 1982) a great deal of confusion existed with taxa reported several times from the Gulf of Mexico as *Pagurus annulipes*. McLaughlin (1975) clearly defined *P. annulipes*, but questioned the occurrence of that species in the Gulf. The examination of a large collection of specimens from various localities in the Gulf of Mexico revealed the existence of an undescribed species, *P. gymnodactylus*, closely related to *P. annulipes*, but clearly distinguishable in such characters as armature of the dactyls of the ambulatory legs and arrangement of setae of the antennal flagella. The fact that *P. annulipes* has not been found in these collections tends to confirm McLaughlin's (1975) proposition that its range does not include the Gulf of Mexico. From the present study the relationship between *P. gymnodactylus* and *P. annulipes* and their morphological variations can be evaluated.

Specimens used for the description have come from the collections of Florida International University (FIU); National Museum of Natural History, Smithsonian Institution (USNM); Texas A&M University (TAMU); and the personal collections of Drs. D. Felder and R. Heard. The holotype has been deposited at the National Museum of Natural History, Smithsonian Institution, paratypes at the Allan Hancock Foundation, University of Southern California (AHF); Florida International University; and Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands (RMNH). The remaining specimens have been returned. The material of *P. annulipes* has come from the collections of the Florida Department of Natural Resources (DNR); and University of Wisconsin (UW). Measurements indicated are in millimeters (mm) of shield length (SL) taken with an ocular micrometer and read to the nearest 0.1 mm. The photographs of Parts II–IV of this series were taken at 3× magnification using a Nikon F 2 camera equipped with a Medical Nikkor-C 1:5.6 f200 lens at a 15° angle with the upper portion of the ring light blanked; Panatomic-X or High Contrast Copy film was used.

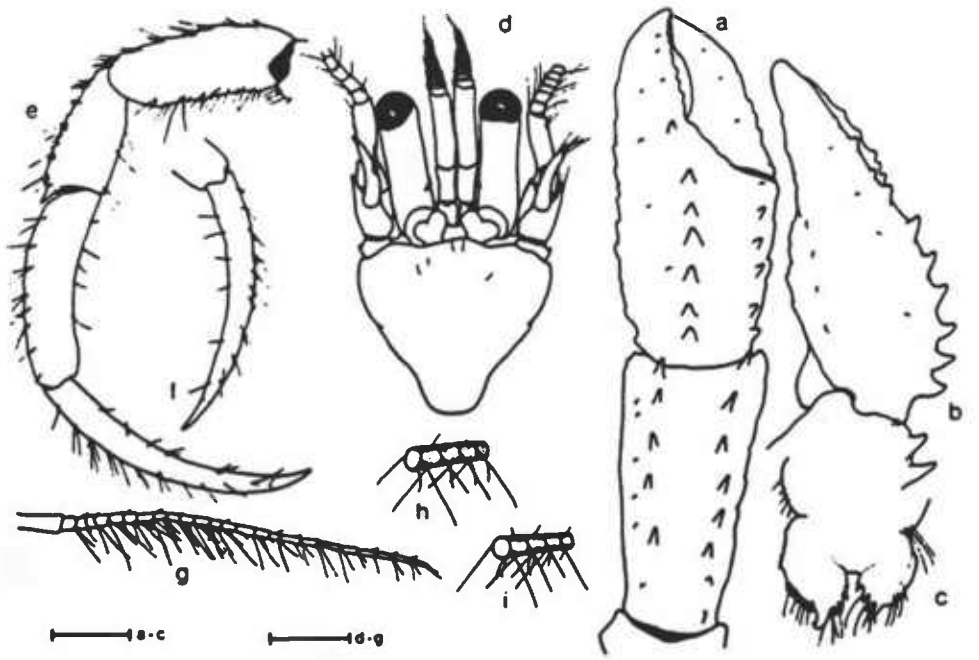

Figure 1. *Pagurus gymnodactylus* new species, male. a, Left cheliped (dorsal view); b, Left chela (lateral view); c, Telson; d, Shield and cephalic appendages; e, 2nd right pereopod (mesial view); f, Dactyl of 2nd right pereopod (lateral view); g, Antennal flagellum (lateral view); h, i, Diagrammatic section of antennal flagellum showing arrangement of setae. Scales equal 0.25 mm (a–c) and 0.5 mm (d–g).

Pagurus gymnodactylus new species
Figures 1, 2, 4c, d, 5a, b

Pagurus annulipes: Behre, 1950: 22.—Harper, 1970: 58.—Rouse, 1970: 142 (in part).—Felder, 1973: 26, pl. 3, fig. 4 [not *Pagurus annulipes* (Stimpson)].—Williams, 1974: 184 (in part).—Williams and Wigley, 1977: 9 (in part) [see remarks].

Pagurus annulipes (?): Felder and Chaney, 1979: 26. [not *Pagurus annulipes* (Stimpson, 1860)].

Pagurus stimpsoni: McLaughlin, 1975: 374. [not *Pagurus stimpsoni* (A. Milne Edwards and Bouvier, 1893)].

Holotype.—♂ (SL = 1.7 mm), 21.75 miles N.E. of Cedar Keys Light, Florida, USNM 107810.

Material Examined.—See Table 1.

Description.—Shield longer than broad; anterolateral margins sloping; anterior margin between rostrum and lateral projections concave; posterior margin truncate, dorsal surface with few scattered setae. Rostrum broadly rounded, little if any in advance of lateral projections. Lateral projections obtusely triangular, with small submarginal spinule.

Ocular peduncles short, moderately stout, corneae slightly dilated. Ocular acicles subcircular, with strong submarginal spine, separated basally by approximate basal width of 1 acicle.

Antennular peduncles moderately short, overreaching ocular peduncles by less than one half length of ultimate segment. Ultimate and penultimate segments unarmed; basal segment with small spine on lateral face dorsally.

Antennal peduncles short, equalling or slightly exceeding length of ocular peduncles; with supernumerary segmentation. Fifth and fourth segments with few

Table 1. *Pugurus gymnodactylus* new species (material examined)

Locality	Depth (m)	Station deposition	Date	Sex ♂	Sex ♀	SL (mm)	Collector
Gulf of Mexico							
Barra del Tordo, Tamaulipas, Mexico	14–19	— USWL	1976	2	9	0.8–2.0	Felder, Rabalais
Seven & One-Half Fathom Reef, TX	—	— USWL	7/13/71	1	juv	0.6	Felder
Off Galveston Island, TX	4–12	1–10 TAMU	9–12/68	106	65	0.5–1.0	Harper
Grande Isle, LA	—	34-9-d USNM 77458	—	2		1.5, 1.8	Behre
Horn Island, MI	—	— USNM, FIU	2/5/73	6	3	1.2, 2.5	Heard
Pensacola, FL	—	— USNM 107811	—	14	juv	~1.0	Benedict
21.75 mi NE Cedar Keys Lt, FL	10.3	— USNM 107810	1/11/73	1		1.7	—
Anclote Anchorage, FL	2	T23-5D RMNH, AHF	1/17/76	8	2	0.5–1.5	Beardsley, Lubin
Marco Beach, FL	—	— USNM, RSMAS	7/2/60	4	4	1.4–2.6	Manning

scattered setae. Third segment with small spine on ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in strong, acute spine, lateral margin with small spine distally and few setae, mesial margin unarmed; dorsomesial distal angle with strong spine, mesial margin with few long setae. First segment with small spine on laterodistal margin, ventral margin produced and with strong acute spine laterally. Antennal acicle moderately arcuate, terminating in acute spine encircled by moderately long setae; mesial margin with tuft of setae. Antennal flagella short, not reaching palm of right chela; proximal articles each with 2 long setae (3–5 articles in length) directed latero-ventrally, 1 or 2 shorter setae directed ventrally and 1 or 2 short setae (1 article in length) directed dorsally; setae diminishing in length distally.

Mandible without distinguishing characters. Maxillule with proximal endite tapered; endopod with internal and external lobes subequal, internal lobe with long terminal bristle. Maxilla with endopod inflated basally; scaphognathite somewhat wider proximally. First maxilliped with endopod moderately short; basal segment of exopod somewhat inflated proximally, narrowing distally. Second maxilliped with basis-ischium fusion complete. Third maxilliped with basis-ischium fusion incomplete; basis with 1 small spine; ischium with crista dentata moderately well developed, 1 accessory tooth; merus and carpus unarmed. Sternite of 3rd maxillipeds with broad obtuse median projection.

Right cheliped considerably longer and stronger than left. Dactyl approximately two-thirds length of palm, triangular in cross section, cutting edge with row of calcareous teeth, terminating in minute corneous claw, slightly overlapped by fixed finger and with prominent interdigital hiatus. Dorsomesial margin with row of small spinules and long setae, dorsal surface with scattered long setae and row of small spines in midline, ventral surface with row of small spinules laterally and

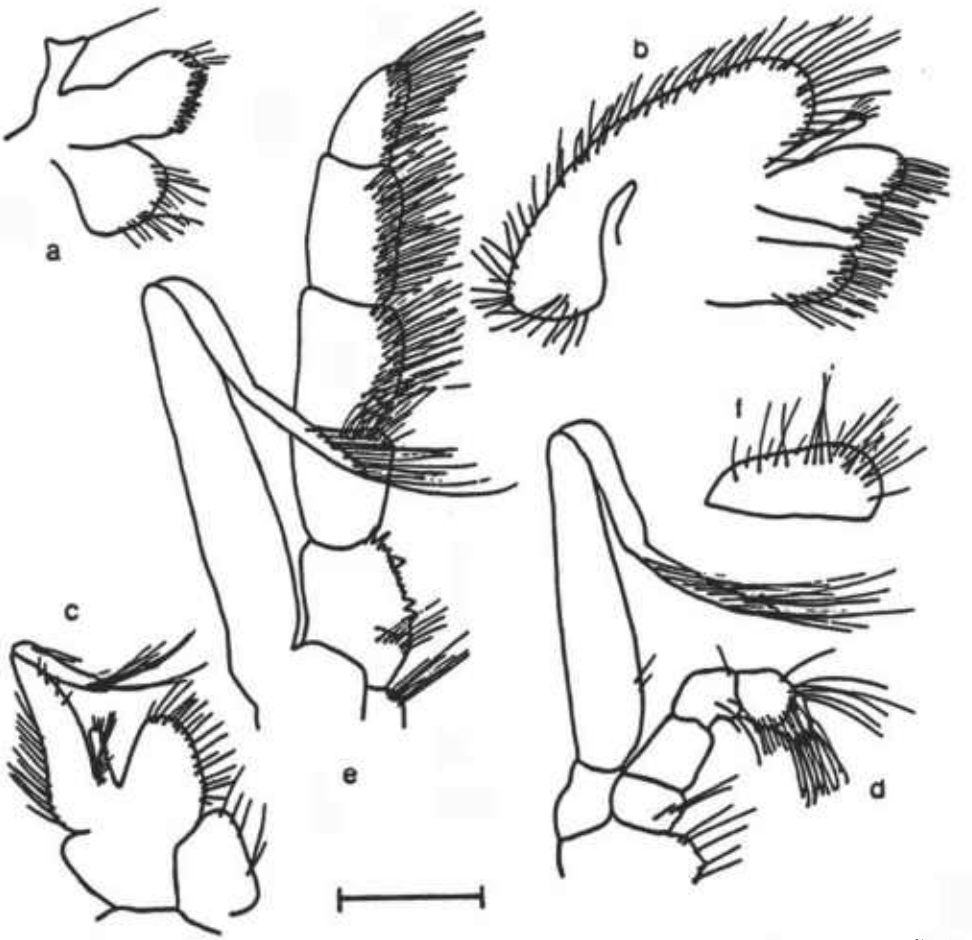

Figure 2. *Pagurus gymnodactylus* new species, a–e, mouthparts (left, internal view): a, Maxillule; b, Maxilla; c, 1st maxilliped; d, 2nd maxilliped; e, 3rd maxilliped; f, Anterior lobe of sternite of 3rd pereopods. Scale equals 0.25 mm.

scattered long setae. Palm and fixed finger dorsoventrally inflated. Palm long, approximately three-fourths length of carpus in larger specimens, shorter in smaller specimens; dorsomesial margin sloping and not clearly delimited, 1 or 2 irregular rows of small spines approximating margin, dorsal surface with 3 or 4 somewhat irregular rows of short spines or spinules and scattered long setae, 2 median rows generally better defined, dorsolateral margin with row of small spines somewhat obscured proximally. Spines usually sharper in females. Mesial, lateral, and to lesser extent, ventral surfaces with scattered, low, sometimes spinulose protuberances and scattered long setae. Cutting edge of fixed finger with row of calcareous teeth, terminating in strong calcareous tooth. Carpus long, slightly longer than merus. Dorsomesial margin with row of 8 strong acute spines, sometimes with several smaller spines intercalated, dorsal surface with 3 or 4 irregular rows of small spines or spinulose protuberances and scattered long setae; lateral and mesial faces with scattered, sometimes spinulose protuberances and setae;

ventral surface generally glabrose. Merus subtriangular; dorsal margin with transverse rows of stiff setae or bristles, distal margin with small spine laterally; ventrolateral margin with row of subacute small spines, surfaces with scattered long setae. Ischium with small spinules on ventrolateral distal angle.

Left cheliped reaching slightly beyond distal margin of carpus of right in larger specimens, reaching to base of dactyl of right in smaller specimens. Dactyl somewhat longer than palm, cutting edge with row of corneous teeth, terminating in corneous claw, overlapped by fixed finger and with prominent interdigital hiatus; dorsal midline and dorsomesial margin each with row of small spines and scattered long setae, ventral surface with scattered setae. Palm approximately half length of carpus, dorsal surface laterad of midline strongly sloping to ventral margin, with 1 proximal blunt spine, scattered low protuberances or tubercles and long setae. Dorsal midline with row of strong spines extending onto fixed finger and decreasing in size distally; dorsomesial margin with row of almost equally strong spines, dorsal surface with scattered long setae; mesial and ventral surfaces with few scattered setae, ventrolateral margin with row of small spines. Carpus approximately equalling merus in length; dorsomesial and dorsolateral margins each with row of strong spines and long setae. Lateral and mesial faces each with several transverse short rows of long setae, ventrolateral margin with row of spinulose protuberances and long setae. Merus subtriangular, dorsal margin with tufts of setae; ventromesial and ventrolateral margins each with sparse row of blunt or acute spines and long setae. Ischium unarmed. Coxae of both right and left chelipeds with few fine setae.

Second and 3rd pereopods generally similar from right to left. Dactyls considerably longer than propodi; in dorsal view slightly twisted, in lateral view curved ventrally; terminating in strong slender claw; surfaces completely unarmed (rarely with 1–3 minute spinules on ventral margin), but with scattered setae particularly dorsally and ventrally. Propodi moderately long, exceeding carpi by one-fourth to one-third own length, curved over entire length, dorsal surfaces with scattered long setae. Carpi moderately short, dorsodistal angles each with small spine, stronger on 2nd pereopods; right 2nd pereopod often with 1 to several additional small spines in distal half; dorsal and lateral faces with scattered long setae. Meri laterally compressed, dorsal and ventral margins with scattered long setae. Anterior lobe of 3rd sternite subsemicircular, skewed to left and with few long setae. Fourth pereopods with propodal rasp of 3 or 4 rows of corneous scales. Preungual process not apparent. Left uropodal endopod with ventral row of stiff setae. Telson with posterior lobes somewhat asymmetrical, subtriangular, separated by prominent median cleft, terminal margins oblique, each armed with several acute spines, lateral margins each with row of distinct corneous denticles.

Distribution.—Gulf of Mexico from Barra del Tordo, Tamaulipas, Mexico, and Seven and One-Half Fathom Reef, Texas to the west coast of Florida; subtidal to 19 m.

Etymology.—The specific name stems from the greek *gymnos*, meaning naked, indicating the lack of armature of the dactyls of the 2nd and 3rd pereopods.

Remarks.—Several authors (Behre, 1950; Harper, 1970; Felder, 1973; Felder and Chaney, 1979) have reported "*P. annulipes*" from the Gulf of Mexico. Examination of their material has shown that their specimens are referable to *P. gymnodactylus*.

Although general intraspecific variations among species of the group are dis-

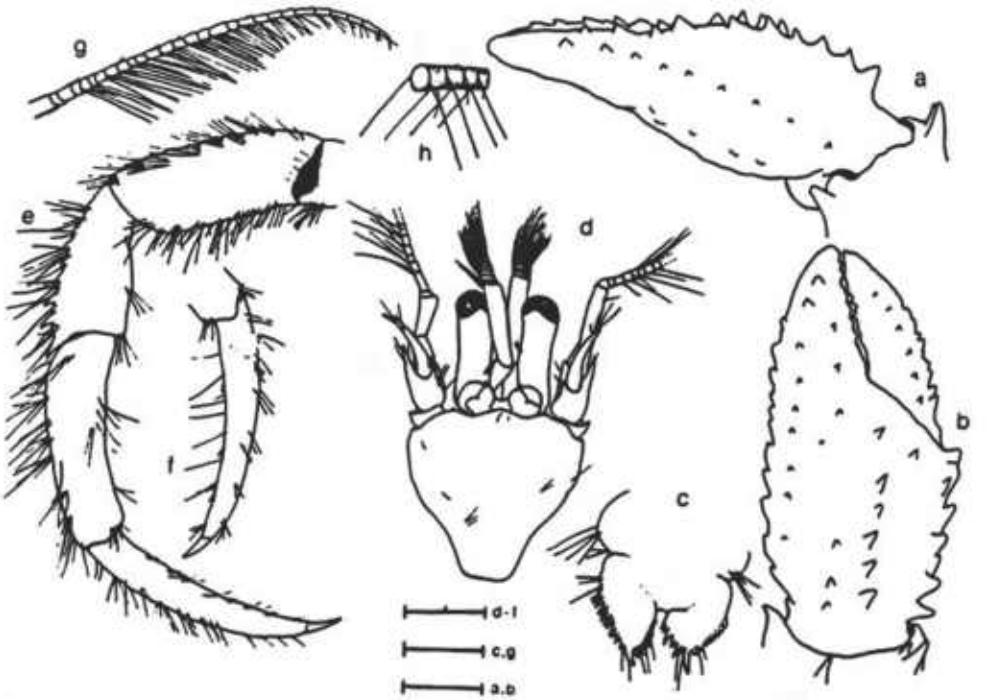

Figure 3. *Pagurus annulipes*. a, Left chela (lateral view); b, Left chela (dorsal view); c, Telson; d, Shield and cephalic appendages; e, 2nd right pereopod (mesial view); f, Dactyl of 2nd right pereopod (lateral view); g, Antennal flagellum (lateral view); h, Diagrammatic section of antennal flagellum showing arrangement of setae. Scales equal 1.0 mm (d–f), 0.5 mm (c, g) and 0.25 mm (a, b).

cussed by Lemaitre et al. (1982), variations influencing the recognition of these two closely allied species must be considered in some detail.

The characters pointed out by McLaughlin (1975) in defining *P. annulipes* were: (1) the long setae on the antennal flagella, and (2) the armature of the carpus of the 2nd right pereopod. However, the present study has shown that 5 species of the *Provenzanoi* group share the first character; these are: *P. gymnodactylus*, *P. annulipes*, *P. criniticornis*, *P. leptonyx* and *P. trichocerus*. The latter 2 species are distinctly set apart by the multifid spines of the ocular acicles. The longer antennal flagella and the absence of a dorsal row of spines on the carpus of the 2nd right pereopod in *P. criniticornis*, distinguish this species from *P. gymnodactylus* and *P. annulipes*. The close relationship between *P. gymnodactylus* and *P. annulipes* is suggested by their mutual possession of both characters.

In both species the antennal flagella are short but the setation of *P. gymnodactylus* differs from that of *P. annulipes* in the arrangement and length of the setae. The setae although long, are unequal in length over the entire flagellum of *P. gymnodactylus*. The setae of *P. annulipes* are more symmetrical and gradually diminish in length distally (Figs. 3g, h).

The dorsal margin of the carpus of the 2nd right pereopod usually bears a row of spines in both *P. gymnodactylus* and *P. annulipes*. These spines are strong and invariably present in larger specimens (SL > 1.0 mm) of *P. annulipes*; where-

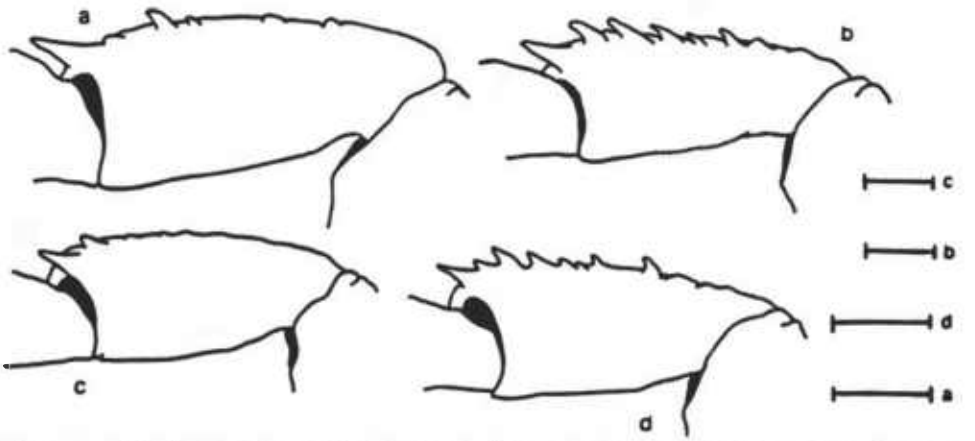

Figure 4. Carpi of 2nd right pereopods in mesial view. a, b, *Pagurus annulipes*: a, Male, SL = 1.3 mm; b, Male, SL = 2.5 mm. c, d, *Pagurus gymnodactylus* new species: c, Male, SL = 1.0 mm; d, Female, SL = 1.7 mm. Scales equal 0.25 mm (c), 0.5 mm (b, d) and 0.25 mm (a).

as, this row occasionally is represented by only a few weak spines in larger specimens (SL ~ 1.0 mm) of *P. gymnodactylus*. In very small specimens of both species (SL < 1.0 mm) this row may be lacking or consist of a few small spines (Figs. 4a–d). The right chelipeds of both species are similar in their proportions and spination patterns (Figs. 5b, d); however, Lemaitre et al. (1982) have shown that these characters are extremely variable. The spination pattern of the left chela of *P. gymnodactylus* differs from that of *P. annulipes* in that the dorsolateral margin of the left chela of the latter species has a row of small spines (Figs. 3a, b); whereas, this row is absent in *P. gymnodactylus*.

The character most useful in distinguishing between the 2 species is the armature of the dactyls of the 2nd and 3rd pereopods. The dactyls of *P. gymno-*

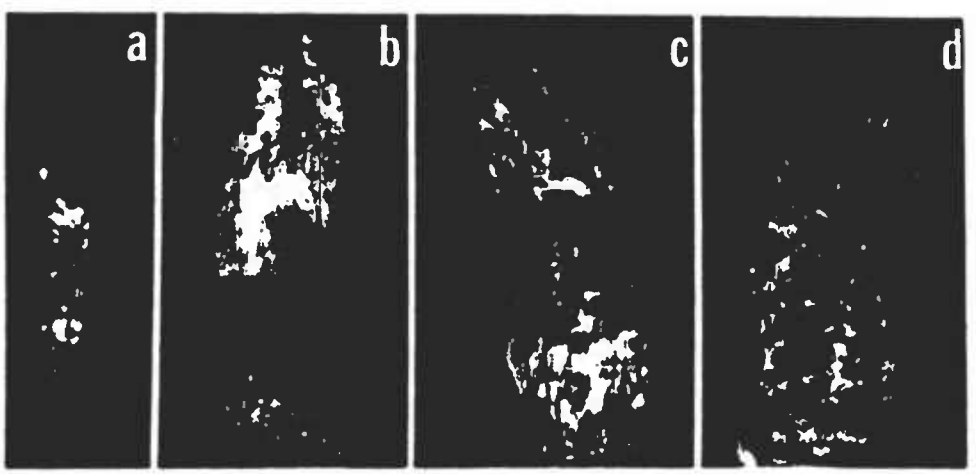

Figure 5. a, b, *Pagurus gymnodactylus* new species: a, Left cheliped, showing rows of spines (22×); b, Right chela (16.5×). c, d, *Pagurus annulipes*: c, Left cheliped (17.8×); d, Right chela (15.3×).

dactylus are unarmed or, rarely, 1–3 minute spinules may be present on some of the dactyls. The ventral margins of the dactyls of *P. annulipes* are armed with a row of small spinules directed nearly parallel to the ventral margin (Figs. 3e, f). In *P. gymnodactylus* the dactyls are longer in relation to the propodi, and more curved over their entire length (Figs. 1e, f) than in *P. annulipes*.

Summary

As previously indicated, an undescribed species in the Gulf of Mexico has been confounded with *P. annulipes* (Stimpson) from the eastern coast of North America. The 2 species are closely related, sharing such characters as a long type of setation on the antennal flagella and armature of the carpus of the 2nd right pereopod. On the basis of available data, it would appear that *P. gymnodactylus* is a species restricted in its distribution to the Gulf of Mexico; whereas, *P. annulipes* occurs along the east coast of North America but not in subtropical south Florida.

Acknowledgments

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