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SYNOPSIS OF THE AMERICAN SPECIES OF *PALICUS*
PHILIPPI* (= *CYMOPOLIA* † ROUX), WITH
DESCRIPTIONS OF SIX NEW SPECIES. ‡

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The following summary is based on a study of the specimens collected by the steamers 'Bache,' 'Blake,' § and 'Albatross,' and is preliminary to a complete report on the genus.

The genus *Palicus* is remarkable not only as the sole representative of a family, but as exhibiting two forms in the male of at least one species (*P. alternatus*).

SYNOPSIS OF AMERICAN SPECIES.

- A. Length of second ambulatory leg less than twice the width of the carapace.
- B. Crests on the second and third abdominal segments, and on the fifth sternal segment not forming conspicuous laminiform expansions visible in a dorsal view.
- C. Meri of ambulatory legs with strongly dentate anterior crest.
Lateral margin of carapace with 4 teeth besides the orbital.
crisatipes A. Milne Edwards.

* I have not seen the following paper by Philippi, "*Palicus granulatus*, ein neues Genus der rückenfüssigen Krabben." <Zweiter Jahresber. d. Vereins f. Naturk. in Cassel, 11, 1838. Specimens of *Cymopolia caronii* Roux, bearing the inscription '*Palicus granulatus*,' are preserved in the Museum at Berlin, and are perhaps Philippi's types.

† *Cymopolia* used by Lamouroux, Hist. Pol. Coral. Flex., 292, 1816, for a genus of polyps.

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§ Examined through the courtesy of Professor Agassiz.

- C'. Meri without strongly dentate anterior crest. Lateral margin of carapace with less than four teeth besides the orbital.
- D. Anterior margin of meri of second and third ambulatory legs terminating in a nearly rectangular non-projecting tooth.
- E. Lateral teeth of carapace dentiform, acute, scarcely projecting beyond the margin of the carapace. *zonatus* Rathbun.
- E'. Lateral teeth tuberculiform or lobiform, projecting from the margin of the carapace.
- F. Two frontal lobes, each bilobed.
alternatus Rathbun, new species.
- F'. Two frontal lobes, each obscurely emarginate.
isthmicus Rathbun, new species.
- D'. Anterior margin of meri of second and third ambulatory legs terminating in a spiniform, projecting tooth.
- E. Lateral margin of carapace with three teeth besides the orbital.
tuberculatus Faxon.
- E'. Lateral margin with two teeth besides the orbital.
- F. Branchial regions much swollen.
obesus A. Milne Edwards.
- F'. Branchial regions not swollen.
- G. Granules of carapace very fine, not visible to the naked eye.
dentatus A. Milne Edwards.
- G'. Granules of carapace coarse.
faxoni Rathbun, new species.
- B'. Crests on the second and third abdominal segments and on the fifth sternal segment forming conspicuous laminiform expansions visible in a dorsal view.
- C. Posterior margins of laminiform crests of first and second abdominal segments subparallel in a dorsal view.
bahamensis Rathbun, new species.
- C'. Posterior margins of laminiform crests of first and second abdominal segments not subparallel, that of the second having a greater median expansion.
- D. Ridge above the posterior margin of the carapace one unbroken curve; distal end of meri of ambulatory legs without a tooth.
depressus Rathbun, new species.
- D'. Ridge above the posterior margin sinuous; distal end of meri with a tooth.
- E. Length of carapace more than $\frac{4}{5}$ its width.
angustus Rathbun, new species.
- E'. Length of carapace $\frac{4}{5}$ its width or less.
sica A. Milne Edwards (restricted).
- A'. Length of second ambulatory leg more than twice the width of the carapace.
- B. Front with two teeth.
- C. Chelipeds smooth.
gracilipes A. Milne Edwards.
- C'. Chelipeds tuberculate.
acutifrons A. Milne Edwards.
- B'. Front with four teeth.

- C. Lateral teeth 4 besides the orbital. *fragilis* Rathbun.
 C'. Lateral teeth less than 4 besides the orbital.
 D. Median suborbital lobe midway between the outer and inner lobes.
 cursor A. Milne Edwards = *dilatata* A. Milne Edwards.
 D'. Median suborbital lobe much nearer the outer than the inner lobe.
 gracilis Smith.

Palicus alternatus Rathbun, new species.

Carapace subquadrate, coarsely granulate. Front with four distinct lobes, the median pair smaller and more deeply separated from each other than from the outer pair. Superior orbital lobes subquadrate. Outer margin of outer orbital tooth nearly straight. Median lobe of inferior margin most advanced at its inner angle. Lateral teeth two, broad, lobate, obtuse. In large specimens a third very small tooth or tubercle behind the second.

There are two forms of the male in this species. In one the appendages of the first segment of the abdomen are strong and twisted, the tip is bilobed, the inner lobe thinner and longer than the outer. In the second form the appendages are weaker and not twisted, the tip less spreading.

In the first form the chelipeds are very unequal, the left is always slender and weak, the right large and heavy. Both chelipeds are tuberculate and pubescent. The carpus is covered with irregular laminiform lobes; the manus is surmounted by a double crest of the same. The width of the right manus at its distal end equals one-half the length of the carapace. Pollex very short. Dactylus strongly bent down, overlapping the pollex at the tip. Left manus a little more than one-third the width of the right, enlarging but little towards the long and rather narrow fingers.

In the second form of the male the right manus is about twice the width of the left and its fingers are also long and slender. In the females the chelipeds are more nearly equal.

The second ambulatory leg is about twice the length of the carapace; the first reaches about the middle of the propodus of the second; the third reaches about the middle of the dactylus of the second. The meri are rough with squamose tubercles, and have two longitudinal grooves on the upper surface and one on the anterior surface. The anterior margin terminates in a blunt rectangular tooth in the second and third pairs; in the first pair this tooth is produced outward toward the carpus. Posterior margin of the dactyli concave as a whole, but nearly straight for the proximal two-thirds.

The two forms of the male agree in every respect excepting in the chelipeds and abdominal appendages. These forms perhaps represent alternating conditions in the life of an individual similar to those existing in the genus *Cambarus*; the first form that which occurs during the breeding season, the second that which occurs between breeding seasons. No other species of the genus exhibit this phenomenon, a fact which may

be due to the scarcity of material collected and does not prove its non-existence.*

Dimensions.—♂, form I: Length, 6.6 mm.; width, 7.6; length of second ambulatory leg, 14; length of merus, 4.4; carpus, 2.2; propodus, 3.6; dactylus, 3.2.

♂, form II: Length, 11 mm.; width, 13.2.

Distribution.—*P. alternatus* occurs in from 24 to 60 fathoms off Cape Hatteras, N. C., and in the Gulf of Mexico between the delta of the Mississippi and Cedar Keys, and from Cedar Keys to Florida Straits. It has been taken by the steamers 'Albatross' and 'Blake' and the schooner 'Grampus.'

Type locality.—Station 2374, str. 'Albatross,' lat. 29° 11' 30'' N., long. 85° 29' W., 26 fathoms (U. S. Nat. Mus., No. 19840).

Palicus faxoni Rathbun, new species.

Allied to *P. alternatus*, but longer and narrower; granules of the carapace similar in size; granulated tubercles of the branchial region more elevated and more squamose; median lobes of front more advanced; superior orbital lobes triangular and separated by wider sinuses than in *P. alternatus*; median lobe of the inferior margin subtruncate, inclining slightly forward toward the median line; lateral teeth of the carapace dentiform, acute, projecting outward and forward; ridge above the posterior margin with six linear and a few smaller tubercles.

Abdominal appendages of the single male examined slender, with long, slender tips; just posterior to the terminal portion there is a tridentate lobe on the inner side.

Chelipeds unequal, similar in the two sexes; the right propodus about twice the width of the left. They resemble strongly those of *P. alternatus*, ♂, form II.

Meri of second and third ambulatory legs characterized by a sharp spine at the end of the anterior margin; anterior margin spinulous; upper surface flatter and less coarsely granulate than in *P. alternatus*; last three joints wider than in that species; the dactyli differ in having the proximal half of the posterior margin convex.

Dimensions.—♀, station 2596: length, 9.5 mm.; width, 10.7; length of second ambulatory, 18; merus, 5.2; carpus, 3.1; propodus, 4.7; dactylus, 3.7. ♀, Yucatan Bank: length, 15.4; width, 17.3. ♂, station XXX, length, 9.5; width, 10.

Distribution.—Taken off Cape Hatteras by the 'Albatross,' station 2596 (type, U. S. Nat. Mus., No. 19841), and off Yucatan by the 'Blake,' station XXX; range in depth, 49 to 51 fathoms.

* Professor Smith, in Proc. U. S. Nat. Mus., VI, 22, 1883, describes two forms of the male of *Ethusa microphthalma*, and suggests the possibility of their specific distinctness. They may, however, represent a case similar to that of *P. alternatus*.

***Palicus isthmius* Rathbun, new species.**

Allied to *P. alternatus*, but broader. Carapace depressed. Front with median sinus broader than in *P. alternatus*; lateral lobes faintly marked. Preorbital lobe very sinuous, a small but well-marked tooth at its outer angle. Both superior orbital lobes triangular, obtuse. Median lobe of inferior margin subtruncate or slightly arcuate. Lateral teeth of carapace two, directed obliquely outward, the anterior lobiform, the posterior a little longer and subacute.

Chelipeds in the immature ♀ small and feeble, as in *P. alternatus*. Merus of the first pair of ambulatory legs with an acute spiniform tooth instead of the blunt tooth in *P. alternatus*. Meri of the second and third pairs with the distal angle thin and almost a right angle, tipped with a small sharp point. Carpi without lobes on their anterior margins. Third ambulatory leg very little shorter than the second.

Dimensions.—Immature ♀: length, 5.8 mm.; width, 7; length of second ambulatory, 13.7; merus, 4; carpus, 2.5; propodus, 3.2; dactylus, 3.3.

Type locality.—One specimen only was dredged by the 'Albatross,' station 2145, near Aspinwall, latitude 9° 27' N., longitude 79° 54' W., 25 fathoms (U. S. Nat. Mus., No. 7753).

***Palicus sica* (A. Milne Edwards).**

***Palicus angustus* Rathbun, new species.**

***Palicus depressus* Rathbun, new species.**

Cymopolia sica A. Milne Edwards, Bull. Mus. Comp. Zoöl., VIII, 29, 1880.

Among the specimens referred to *Cymopolia sica* by its author, there appear three distinct forms, which agree in the following characters: The carapace is granulate, many of the granules forming clusters on the more elevated regions. Front with four small, tuberculiform teeth, the median the most prominent, separated from each other by a deep triangular notch, and from the lateral teeth by very broad, shallow sinuses. The tooth of the superior orbital border nearest the preorbital is arcuate; the next narrower, also obtuse. The median suborbital lobe is subtriangular and much less advanced than the inner lobe. The lateral margin of the carapace bears three small, thickened teeth.

First segment of the abdomen with a narrow carina on either side behind the postero-lateral angle of the carapace. Second carinated throughout its width, the carina much longer in the center. Third segment carinated, but much less sharply. There is also a carina on the sternum in a line with the suture between the second and third abdominal segments; it extends well outwardly, but not so far posteriorly as the second abdominal. These carinae form horizontal plates, visible in a dorsal view, excepting that of the third abdominal segment in the male.

Chelipeds slender and feeble. Ambulatory legs of moderate length, the third very little shorter than the second, the first very slender and reaching about midway of the carpus of the second. Meri of second and

third with longitudinal rows of spinules and a deep groove on the anterior half; anterior distal angles subrectangular.

The three forms of so-called *sica*, which may be designated as Nos. 1, 2, and 3, differ mainly as follows: No. 2 is much narrower than Nos. 1 and 3; No. 3 is most depressed. Just above the posterior margin there is in No. 3 a continuous ridge following the curve of the margin; in Nos. 1 and 2 there is instead a sinuous line of tubercles, more uneven in No. 1 than in No. 2. Inner suborbital fissure a broader sinus in No. 1 than in Nos. 2 and 3. The median portion of the second abdominal plate is most prominent in No. 1 and least so in No. 3. Ischium of maxilliped much wider in Nos. 2 and 3 than in No. 1; in No. 3 widening considerably toward the merus. Merus of second ambulatory long and comparatively narrow in No. 1; short and very broad in the middle in No. 2, with very convex posterior outline; in No. 3 the merus is of moderate width proximally, but at the distal end is very narrow, with scarcely a trace of a tooth.

The description given by Professor Milne Edwards is applicable to all of the forms above described. Of the ambulatory legs he says, "Les deux derniers articles sont très aplatis et élargis." These articles are widest in No. 2. The dimensions given do not, however, apply to No. 2. I have therefore restricted the name "*sica*" to No. 1, the form taken in greatest abundance by the U. S. Coast Survey steamers 'Bache' and 'Blake.' Form No. 2 may be known as *Palicus angustus*, form No. 3 as *Palicus depressus*.

Dimensions.—In *P. sica* the width of the carapace varies from 1.25 times its length in smaller specimens to 1.39 times its length in larger specimens. Length of largest specimen, adult ♀, 9.8 mm.; width, 13.5.

A specimen of *P. angustus* measures 9 mm. long, 10.3 wide; ratio, 1:1.14.

A female of *P. depressus* is 7 x 9.4 mm.; ratio, 1:1.34. Another specimen measures 6.5 x 8.2 mm.; ratio, 1:1.26.

Distribution.—*P. sica* is found from the Gulf of Mexico and Florida Keys to Barbados and Grenada, in depths of from 60 to 117 fathoms. It was dredged by the 'Bache' on the west coast of Florida and at Sand Key; by the 'Blake' at stations 32, 36, 132, 149, 253, 293; by the 'Albatross' at stations 2403 and 2641.

P. angustus is known only from off Santa Cruz, 117 fathoms, station 32, 'Blake.'

P. depressus was taken by the 'Blake' off Santa Cruz, Dominica, and Barbados, in from 56 to 138 fathoms, at stations 132, 192 (type locality), 272, 292, and 293.

***Palicus bahamensis* Rathbun, new species.**

This species, although possessing abdominal and sternal laminae, as in *sica*, *depressus*, and *angustus*, resembles in the characters of the carapace *dentatus* and its allies. Carapace very rough, with coarse granulation. Front divided by a wide and deep V-shaped notch; each lobe thus formed is faintly emarginate. Two superior orbital lobes triangular and obtuse.

Lateral teeth two, subequal in length, acute, and directed outward and only slightly forward. Median suborbital lobe truncate. Lobe at angle of buccal cavity very large and produced far beyond the inner lobe of the inferior orbital margin. Crest above posterior margin sinuous, broken into seven irregular scallops.

Crests on the first two abdominal segments of the ♂ trilobate and subparallel in a dorsal view, that of the first the wider. Third segment with a lobe on each side of the middle, partially visible in a dorsal view. Crest on the fifth sternal segment or that between the bases of the third ambulatory legs about half as wide as the second abdominal segment; its posterior margin is sinuous.

Chelipeds unequal in the male; the right one rather small; manus bicristate above, outer surface granulate, lower margin convex. Pollex slightly deflexed; its length not equal to the width of the manus. Merus of first ambulatory terminating in a large blunt tooth; meri of the second and third armed on the anterior margin with 4 or 5 curving, spiniform teeth; terminal tooth large, subacute; posterior margin spinulose; upper surface with squamose granules. Lobes on the anterior margin of the carpal joints small but distinct. Dactyli slender, posterior margin concave.

Dimensions.—♂: Length, 4.8 mm.; width, 5.5; length of second ambulatory (approximate), 11.6; merus of same, 3.2; carpus, 2; propodus, 2.6; dactylus, 2.8.

Type.—A single male was taken by the 'Albatross' at station 2651, lat. 24° 2' N., long. 77° 12' 45'' W., 97 fathoms, east of Andros Island, Bahamas, in Tongue of Ocean. U. S. Nat. Mus., No. 11394.