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RAFINESQUE'S CRUSTACEAN GENERA *HETERELOS* AND *YALOMUS*

by

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The rediscovery of a forgotten manuscript written by C. S. Rafinesque makes it possible to identify the nomina nuda *Heterelos* and *Yalomus* as synonyms of *Phronima* and *Scyllarus*, respectively.

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I. THE NAMES *HETERELOS* AND *YALOMUS*, AND THEIR STATUS

The Linnean Society of London has in its archives the manuscript of one of C. S. Rafinesque's very early scientific papers, probably the first ever that he wrote on a carcinological subject. This paper, the original title of which is "Descriptions of Two New Genusses of Crustaceous *Heterelos* & *Yalomus* with their Figures", had been sent by its author to Sir James Edward Smith, president of the Linnean Society, under cover of a letter dated "Palermo, 30th March 1811", requesting publication "since the Linnean Society accepts com[m]unications from such as are not members"; Rafinesque went on to ex-

press the hope that such contributions would bring him membership in the Society. They did not.

More than three years passed before the manuscript was read at a Society meeting on Tuesday 1 November 1814, along with two other papers (one on *Echeneis*, the other on a Sicilian truffle) which he had submitted in 1812. A report of this meeting was published in *Annals of Philosophy*, vol. 4 no. 6 of December 1814. (Anon., 1814). In this report Rafinesque's paper was referred to as follows (pp. 448, 449): "At the same meeting, three papers by Mr. Rafinesque Smaltz were read . . . [p. 449:] The third paper contained a description of two new genera of crustaceous animals found in the Sicilian seas. Of the first genus, *heterilos*, he described only one species, the *punctatus*, which lives about seven miles from the Sicilian coast, and is never seen on the shore. The species of the second genus, *hyamonus*, described, was found attached to a shark, and appears to live by suction of that fish". Although many emendations appear in the manuscript in a hand other than Rafinesque's — placed there perhaps only to facilitate the reading — the essay was never published by the Linnean Society, and the generic and specific names printed in the report of its meeting are *nomina nuda*.

Rafinesque himself listed the title on three separate occasions as part of his published works, but in each instance he was careful to use the word "sent" because he had not seen the essay in print:

(1) On the inner back cover of Rafinesque's (1814) "Précis des découvertes et travaux somiologiques" is a list of the "Ouvrages et Essais déjà publiés par le même Auteur". In this list, as no. 9 (erroneously printed as 0), appears "Description of 2 N.G. of Crustaceous *Yalomus* et *Heterelus* . . . Envoyé en 1811 à la Société Linnéenne de Londres".

(2) In his "Circular address on Botany and Zoology" Rafinesque (1816) listed his previously published titles, among which (on p. 13) "Description of Two New Genera of Crustaceous . . . sent in 1811 to the Linnean Society".

(3) In an extremely rare printed letter titled "To the Trustees of the University of Pennsylvania", dated Philadelphia, January 25, 1816, Rafinesque (1816a) in a list of his published works gave under no. 15: "Description of 2 new Genera of Crustaceous . . . Sent in 1811 to the Linnean Society of London". This letter, though printed, hardly qualifies as a publication; it was written to state Rafinesque's qualifications for the academic position vacated by the death of Benjamin Smith Barton. It was unknown to Fitzpatrick (1911).

In addition to the above-cited mention of the names *Heterelos* and *Yalomus* on the cover of his 1814 "Précis des découvertes et travaux somiologiques", Rafinesque listed these names also in his 1815 "Analyse de la Nature", where *Heterelos* is found on p. 100 as one of the genera of the subfamily Elaphalia,

and *Yalomus* on p. 99 in the subfamily Branchiopia. The paper itself and the generic name *Yalomus* are alluded to in Rafinesque's autobiography, where, when writing of Smith he said "when I sent him on trial the figure of my N. G. *Yalomus*, with some new fishes and botanical monographs, he could not insert them in the memoirs of the society, which again discouraged me" (Rafinesque, 1836: 41). No other mention of these names by Rafinesque is known to me. In "Analyse de la Nature" (p. 100) Rafinesque treated *Heterelos* as a synonym of *Callirhoe* Rafinesque, also a nomen nudum (see Holthuis, 1954: 7, 18).

The names *Heterelos* and *Yalomus* have been listed in Sherborn's "Index Animalium" (2 (12): 2972 (1927) and 2 (28): 7030 (1932), respectively), in Schulze, Kükenthal, Heider & Hesse's "Nomenclator animalium generum et subgenerum" (3: 1532 (1932) and 5: 3685 (1940), respectively), and in Neave's "Nomenclator Zoologicus" (2: 632 (1939) and 4 : 684 (1940), respectively). Only Neave (1939, vol. 2) listed also the spelling variants *Heterelus* (2: 632), *Heterilos* (2: 633) and *Hyamonus* (2: 706). In his account of Rafinesque's carcinological work, Holthuis (1954) made mention of *Heterelus* (pp. 3, 18), *Heterelos* (pp. 7, 18), and *Yalomus* (pp. 3, 6, 7), but not of the other spellings.

All these generic names are nomina nuda or spelling variants of nomina nuda and are correctly listed as such in the various nomenclators. The names were so well publicized by Rafinesque himself, and since have been mentioned so often in the literature, that it is a matter of historical interest to know the true identity of these genera. The possibility to find this identity is now offered by the discovery of Rafinesque's original manuscript.

II. THE MANUSCRIPT

Rafinesque's manuscript, the pages being approximately 26 cm × 19.5 cm, consists of an ornate title page with an epigraph on its verso, eleven pages of handwritten text, and one page with figures. On the title page, in a different hand, are several inscriptions made after receipt of the manuscript: "N° 473", "Rafinesque", "Read Nov. 1.1814", and "Not printed in Linn. Trans.". Some general remarks may be made about it.

First, the English of the essay is so much better than that of the accompanying letter to Smith that it is highly likely that Rafinesque's original text was corrected or completely translated by someone more fluent in English than he was in 1811. However, his assistant evidently was not a biologist, or at least was not well enough acquainted with zoology to handle several of the technical terms. The corrections made at the Linnean Society involve precision of

technical terms (e.g., the substitution of “claw” for “nail”, “serrate” for “sawed”), improvement of the Latin (genera for genusses, etc.), and — what may suggest that the assistant was not a native speaker of English — the blunting of gender distinctions literally translated in Rafinesque’s manuscript from the practice of the Romance languages (where he wrote “her structure” the Linnean Society would have it “its structure”). In a letter of 3 May 1812 from Palermo, Rafinesque thanked J. E. Smith “for your kind revision of my Paper on *Bertolonia* & your corrections of my *italianisms*”.

Second, Rafinesque’s generic and specific descriptions are much longer and more elaborate than in his later carcinological papers. Moreover, the latter were published without illustrations (in some instances Rafinesque did prepare sketches, which, however, remained unpublished; see Holthuis, 1954: 11, 12, 17, 27). Both circumstances may be explained by the fact that when he had to pay his own printer’s bills, he economized on costs.

And third, it is interesting to see that already by 1811 Rafinesque had the habit of making generic names shorter and more euphonious by contracting the words from which they were formed. Thus *Hetero-skelos* becomes *Heterelos*; *Yalomus* is constructed out of *Hyalos-soma*. Later, for example, he would form *Nectylus* from *Nectos* and *dactylos*.

As printed here, the manuscript is reproduced verbatim, with the beginning of each page indicated by an appropriate number in square brackets. Also in square brackets are my own remarks, and (in quotes) the emendations made by the Linnean Society, placed in each case immediately after the word or passage that they are intended to correct, or placed at the appropriate place in the text when they are additions to the text. The signs < > bracket Rafinesque’s own cancellations, with the interlined replacement immediately following. When not otherwise clear, cancellations are labeled as such. At two places the Linnean Society provided qualifying annotations, suggesting that there was at least some thought of publishing the essay in 1814. These annotations are given in footnotes and identified here as such.

The verbatim text of the manuscript is as follows:

Title page: “Descriptions / of / Two New Genusses [“Genera”] / of / Crustaceous [“Crustacea”] / *Heterelos* [“*Heterochelus*”] & *Yalomus* [“*Hyalomus*”] / with their Figures. / by C. S. Rafinesque-Schmaltz. / Palermo March 1811. / Sent by the author to Dr. J. E. Smith to be / presented to the London Linnean Society”.

The verso of the title page carries in the centre the following epigraph: “Nous sommes loin de connaître toutes les productions de la nature & bien du tems s’écoulera encore avant que l’on parvienne à la connaissance des termes de leurs immenses domaines.”

The text (pp. 1-11) is as follows:

“Descriptions & c.

Two Linnean genusses [“genera”] *Cancer* & *Monoculus* were composed of such numerous & different varieties of species, that modern zoologists have proved them to be no more two simple genusses [“genera”] nor even one or two Orders in the class of Insects but to form each a division of a whole class sufficiently different from the Insects & which contains more than 50 genusses [“genera”] according to Latreille (*Histoire naturelle des Crustacés*) while they amount nearly to 80 in my Manuscript delineation of [“the”] said class: of these almost one half are found in the Sicilian Seas; these productive seas [preceding three words cancelled and replaced by: “which”] have offered me also many new species unnoticed by the [cancelled] authors, a general account of them would however <be at present> prove too voluminous & must be delayed for another time & place; confining [“I shall confine”] myself in [“at”] this moment in [“with”] noticing two of them (chosen [“from”] among the most remarkable) which constitute each a New Genus. And I hope thereby to prove <these> two assertions, namely, that many new genusses [“genera”] of Crustaceous [“Crustacea”] are yet unknown & that Sicily an Island so anciently known [two words cancelled and replaced by “ancient”]; but [“now”] so little and so badly known now [cancelled], (at least to naturalists,) affords many of them, [p. 2:] as she [“it”] has afforded me so many similar [cancelled] new ones of [preceding two words cancelled] Fishes & other Sea-animals.

I. *Heterelos* [“*Heterochelus*”]

Generic definition or character. — Head bent downwards, without antennas [“antennae”]; mouth with 4 palps [“palpi”]; 2 eyes even, irregular & spot-like . . . Body lengthened with 10 articulations of which the 7th is the longest; branchia [“branchiae”] lamellous between the legs; tail short terminated by 6 unequal 2 toothed bristles . . . 14 Unequal Legs & 6 equal false legs; a pair under each articulation of the body; the two first pair of legs 3 articulated & 2 nailed [“terminated by two claws;”] the 3^d & 4th 3 articulated & one nailed [“and furnished with one claw;”], the 5th pair the longest & biggest 4 articulated & 2 nailed [“with two claws”]; the two last pairs the smallest 2 articulated, & 1 nailed [“and terminated by 1 claw”]. The false legs short 2 articulated, second articulation ciliate deprived of nails [“claws”].

History of the Genus or Generic history. — This genus belongs to the subclass of the *Malacostraceous*, section of the *Branchiogasterous* [“*Branchiogastera*”], Order of the *gammarines* & my sub-order of the *Gymnocephalous*

["*Gymnocephala*;"], it has little affinity with the other genusses ["genera"] of the same order except with *Phronima* of Latreille which however has only 10 legs.* The Name I have given it is an abbreviation of *Heteroskelos* which means in greek *unequal legs* & express [sic] their singular anomaly. A single species belongs to it as yet ["only has been discovered"]. [p. 3:]

1. Heterelos ["Heterochelos"] punctatus. Fig. 1. A.

Specific definition. — Hyaline with small red dots, head granulated with a smooth longitudinal furrow, eyes brown, body & members smooth.

Specific Description. — This animal is an inch long at utmost: it has a large roundish head, regularly bent underneath & which cannot recede from that position; she ["it"] is entirely deprived of antennae ["antennae"]** & her ["its"] colour is transparent without dots; but ["it"] is slightly granulated all over, having however a smooth longitudinal furrow in the middle; the eyes are smooth not ["in"] the least ["degree"] prominent [sic] & have the appearance of an irregular-shaped brown spot. The mouth is at the extremity of the bend looking towards the throat & is furnished (fig. 1. B) of ["with"] 2 pairs of small unequal palps ["palpi"] the exterior pair is longer & terminated by 2 teeth; the interior pair is smaller & appears without teeth . . . The Body is about five times as long as the head of a transparent hyaline colour dotted with very small red dots spread regularly all over it & even over the legs & tail: its form is linear a little compressed & it is composed of 10 articulations, each of which bear a pair of legs, but the three last bear only false legs without nails ["claws"]: the two first of the fore articulations are very narrow, the four next or middle ones are a little larger, the 7th is very long & the three posteriors a little narrower but broader than the six first. The Branchiae ["Branchiae"] consist of many laminae situated [p. 4:] under the belly, between the legs in a longitudinal row — they are imbricated, scaly ["scale"]-like, vertical, obtuse & the lateral ones [cancelled] are shorter than the middle ones . . . All ["Nearly all"] the pairs of [preceding two words cancelled] legs are different in form & size; the two first anterior pairs are short & slender, they have 3 articulations of which the first & last are linear, nearly equal & the middle one is small & short, besides two toes compressed acute & a little bow-shaped, as are

* *Phronima* has fourteen legs like the other Edriophthalmous Malacostraca, see Trans. Linn. Soc. vol. XI. p. [Footnote by the editor of the Linnean Society].

** This statement does not seem correct [last two words cancelled and replaced by "appear to be probable"], as *Phronima* Latr. and its kindred genus *Iphis* Risso, have two short antennae [Footnote by the editor of the Linnean Society].

all the toes of the other legs, the anterior of which is smaller. The two next pairs of legs are nearly similar, but they are longer & they have only one toe. The <the> fifth pair is the longest of all & is shaped very differently, having 4 articulations of which the first is the longest, & is thickened at the extremity where it has an acute tooth posteriorly, the second articulation is very small & short, the third is nearly round & a little larger, & the fourth is large oblong & gibbous posteriorly; two toes terminate each of these legs, the anterior being the longest. The sixth and seventh pairs or the two posterior ones are the smallest of all, they are subulated with only two articulation & one small toe, the last of these pairs is situated in the anterior part of the articulation of the body, while all the other legs are in the middle of the articulations . . . The six false legs stand on the posterior part of the three last articulations of the body, they are shorter than any of the legs, & composed of [p. 5:] two articulations bent towards the tail, the first or upper one is globular, bladdery, empty & split posteriorly, the second & lower is ovate acute, convex anteriorly, concave posteriorly & ciliate on the edges . . . The Tail (Fig. 1. C.) is short conical furnished of six unequal bristles all two-toothed at the extremity, & of which 2 lateral ones are the shortest & two superior ones the longest.

Specific History. This sort of Shrimp lives in the Sea of Sicily, those that I have particularly studied, were taken in the month of January in a net of Sardines (*Clupea sprattus* L.) seven miles off Palermo, they do not frequent the shores but mostly live at a distance from them & at the bottom of the sea among the *Fuci* & *Zosteræ*: they appear to be scarce & little known of the Fishermen who confound them under the name of *Suffiziu de Mari* (*Sea Scorpion*) with some other shrimps which are not eaten, although this name & dislike is more owing to their scarcity, singular aspect & apparent form than to any bad quality of which said name might convey an idea, as they also confound under the name of *Gammaru* all the common shrimps that are eaten. All these are also indifferently [sic] used by them for fishes-bait, which shows that they are all a food for fishes, while they must themselves feed on small Mollusques ["Mollusca"] & Zoophytes. The peculiar structure of the head in this specie, might [p. 6:] lead to a belief that it must be difficult for him ["it"] to find his ["its"] food & carry it to its mouth, but on closer investigation it may be observed that nature <has> even there proved wiser than our thoughts, having on purpose provided him with a Stout pair of long legs on which the body rises, this action brings the mouth more to a level & enable him to carry to his mouth with his fore feet the food that his foreset eyes have detected. The false legs serve him of ["it for"] fins when he ["it"] swims & even in a State of repose are almost constantly in motion beating or hammering one over another. His ["Its"] walk is very awkward & in fact he ["it"] seldom walks

but often springs or jumps to which his pair of long legs also help him. I have not been able to study his mode of generation but suppose it very similar to that of the other genusses ["genera"] of the same order or tribe & lastly can only add that I have experienced he is ["found it to be"] eatable, tasting like shrimps & that once several individuals have lived eight hours out of the Seawater, hammering continually their False-legs.

II. Yalomus

Generic character. — Head flat round larger than the body, membranaceous and clypeaceous; two eyes pedunculated, four palps ["palpi"], two exterior without articulation one-toothed exteriorly; two interior ones articulated & bifid . . . Body similar to the head but oblong & smaller, without any articulation, obtuse anteriorly with a round naked Mouth situated at its [p. 7:] insertion with the head, posteriorly two-toothed . . . Fourteen legs, the first pair very small 2 articulated & 1 nailed [preceding three words cancelled and replaced by: "adorned with claws"] (all the nails ["claws"] crooked). Second pair 5 articulated & 1 nailed ["clawed"]. 3^d 4th 5th & 6th pairs 5 articulated, branching & 3 nailed [preceding two words cancelled and replaced by "terminated by claws"], last pair small 3 articulated & 1 nailed [preceding two words cancelled and replaced by "armed with claws"].

Generic History. — The natural place of this genus is rather doubtful as it has the appearance & bodily structure of the first sub-class of Crustaceous, the Entomostraceous ["Entomostraca"] while it has the eyes & feet of the Malacostraceous ["Malacostraca"] & it cannot with propriety be ranged with any of the Natural Orders or families of Latreille: it must therefore form an Order by itself, which I will call *Yalomidous* & shall characterize as follows: Body of two articulations, mouth at their union, eyes pedunculated, 4 palps, 14 legs terminated by nails & some of which branched . . . It will serve of natural tie between the two sub-classes; I am however of opinion that as the bodily structure is of greater consequence than the form of the members, it ought to belong to the first of these sub-classes. No one ought to be surprised at my forming a natural order with a single genus & even specie, this instance must occur frequently whenever all the productions of nature shall be ranged methodically, instead of being the consequence of a sistematical [sic] arrangement as some have thought, since the characters must form the orders & not the orders define the characters as erroneously believed by many. I have formed the name of this genus [p. 8:] from two greek words meaning *glassy body*, which express its colour & appearance.

1. *Yalomus depressus* Fig. 2.

Specific definition — Smooth, hyalin unspotted eyes brown, sides of the tail sawed [“serrate”] & gibbous on each side.

Specific Description — This singular animal is scarcely one inch long & as much broad, he is entirely flat, pellucid & very thin. The Head or first articulation is round, about $\frac{1}{2}$ an inch broad & with the edge quite entire: her [“its”] structure is glassy-[“glass-”] like but membranaceous instead of brittle, her shape is nearly similar to a target as it covers portion of the forepart of the body or second articulation; her [“the”] colour is like Water as it was a little undulated: On the anterior edge are situated 2 eyes bore on long cylindrical peduncles, which are inserted at the same point, but are afterwards diverging & forming a right angle, the eyes themselves are brown of an obovate shape & nearly truncated. Outside of them are 4 palps [“palpi”], the two nearest are as long as the eyes, subulated with 3 articulations & terminated by two acute teeth, the interior of which is the shortest; the exterior palps [“palpi”] are shorter without articulations subulated acute & have one tooth exteriorly towards their base: No sort of opening is discernible between those palps [“palpi”], the Mouth is therefore situated underneath [p. 9:] at the insertion of the two articulations, & is round small & naked. — The Body or second articulation, on which all the legs are inserted is as long as the first but three times narrower, his [“its”] shape being oblong, his Structure & shape is however similar excepting that underneath the water-colour like instead of being undulated [sic] is nearly scale-like. This body is inserted underneath of the head but much nearer her hindpart than her fore-part: at his fore part there is a prominent [sic] oblong spot, which I am inclined to believe to be the Stomach as the mouth is situated at his [“its”] fore part. — Seven pairs of legs are inserted on the edge of the body, the first pair is Simple very small & slender, in fact all the others are slender likewise & have slender crooked nails [“claws”], this first pair has besides only two articulations & one nail [“claw”], the second pair is much longer & has 5 articulations but is also simple & single nailed [“clawed”]. The 4 following pairs are the longest, they are nearly equal in length & structure being all branched & having each 5 articulations & 3 nails [“claws”], of which the first is at the end of a branch composed of an articulation springing from the posterior part (the anterior part in the 6th pair) of the end of the second articulation of the legs, the second nail [“claw”] is sessile at the end of the anterior part (the posterior in the 6th pair) of the 3^d articulation (the 3^d pair of legs has it on the 4th articulation,) And the third nail [“claw”] is [p. 10:] at the end of the legs. Lastly the 7th pair of Legs is again simple & very small having 3 articulations & one nail [“claw”]. The Tail or posterior part of the body is conical nearly truncate & terminated by 2 acute

lateral teeth, the edges are on each side first sawed ["serrated"] & afterwards swelled in an obtuse proeminence [sic].

Specific History. — I have not had the opportunity to see alive this interesting animal, which deprives me of giving a complete sketch of his history & will leave many desiderata in my short account of him ["it"]; those I have described were taken in June on a species of shark (my *Carcharias taurus* N Sp. vide *Caratteri di alcuni nuovi generi e N. Sp. di Animali e Piante della Sicilia*. Gen. I. Sp. 24. pag. 10. tab. 14. fig. 1) which entered a Tunny-fishery, they were parasitical on him & I suppose lived by sucking him, which is an additional <proof> affinity he has with many of the *Entomostraceous* particularly the species of the genus *Caligus*. The Sicilian fishermen called them *Granciu d'Imbertinu* which means Shark's Crab & pretend that they are found on some other species of sharks. His ["Its"] flat shape, his ["and"] prominent [sic] eyes, his ["its"] long horizontal legs with crooked nails ["claws"] & his mouth situated underneath & nearly in his center, seem to have been peculiarly adapted by providential Nature for his mode [p. 11:] of living, to secure him from enemies [sic] (who however must be few as he could only offer them a simple membrane for food) watch over them, make him cling fast to his support & enable him to feed at his pleasure in perfect safety. I apprehend he ["it"] seldom or never leaves willingly his ["its"] support, which also [cancelled] affords him [cancelled] the food he ["it"] is in need of & as he ["it"] seems ill-calculated for swimming. Of his organs of breathing & of generation I am unable to speak; but the little I have observed & said of him [two words cancelled] is sufficient to show how wonderful is his ["its"] simple structure & how well calculated for the fonctions [sic] he was ["is"] destined [sic] to execute.

Finis"

III. THE IDENTITY OF THE SPECIES

***Heterelos punctatus* Rafinesque**

The description and the figure (fig. 1, upper figure) make it clear that this is an amphipod, and that it can hardly be anything but *Phronima sedentaria* (Forskål, 1775). Rafinesque himself pointed to the affinity of *Heterelos* with *Phronima*, and the only difference between the two genera that he cited (*Heterelos* with 14, *Phronima* with 10 legs) was shown to be spurious in the Linnean Society's footnote.

I submitted the manuscript description and figure of *Heterelos punctatus* to

Dr. H.-E. Gruner, Zoological Museum, Berlin, one of the world's foremost specialists on Hyperiidæ (the family to which *Phronima* belongs). Dr. Gruner confirmed my tentative identification and remarked: "Die Abbildung von Rafinesque (*Heterelos punctatus*) ist zwar ein merkwürdiges Gebilde, es könnte sich aber tatsächlich um *Phronima sedentaria* handeln. Dafür sprechen die Grösse und die allgemeine Körpergestalt. Völlig verzeichnet sind der Kopf und die Schere am 5. Peraeopoden. Die Angabe "without antennae" deutet darauf hin, dass es sich um ein Weibchen handelt; diese haben nur sehr kurze 1. Antennen, die 2. fehlen. Was Rafinesque über die Färbung sagt (with small red dots), bedeutet nicht allzu viel. Die Tiere verlieren ihre Farbe offenbar sehr schnell. Ich habe aus Kopenhagen eine Reihe von Aquarellen, die Th. Mortensen während einiger Expeditionen angefertigt hat. Danach ist *Phronima* (verschiedene Arten) an den unterschiedlichsten Körperteilen gefärbt (meist rötlich oder bläulich). Darunter befindet sich auch ein Tier mit rotbraunen Punkten auf den Peraeopoden. Die Angaben zur Lebensweise stimmen insoweit, dass sich die Tiere nicht in Küstennähe aufhalten, nicht dagegen, dass sie am Boden zwischen Pflanzen leben sollen".

On the whole, Rafinesque's description is rather superficial and it does contain errors, obviously due to hasty or faulty observations. The pereopods are reasonably well described, the first two being subchelate, the third and fourth simple and the fifth, the largest, ending in a true chela, while the sixth and the seventh, the smallest, end in a simple dactylus. In details, however, such as the number of segments, and the actual shape of the chela of the fifth leg, Rafinesque's description is inaccurate. Other details have been observed accurately, such as the placement of the seventh pereopod in the anterior part of the last thoracic somite and the general shape of the uropods. Chevreux & Fage (1925: 394) indicated the colour of *Phronima sedentaria* as follows: "Corps et appendices transparents, maculés de rouge", which agrees well with Rafinesque's "hyaline with small red dots".

It is interesting to see that Rafinesque went to the trouble to observe the behaviour of the living animals as far as he was able to do so. As a true child of his time, he also tried to find out whether they were "eatable".

Phronima sedentaria is a rather common species in the Mediterranean and the subtropical Atlantic, occasionally going as far north as the British Isles. It is well known by its habit of eating the living portion of the colonial tunicate *Pyrosoma* and to use the barrel-shaped skin of its prey as a shelter. It is fully pelagic, and belongs to the Hyperiid Amphipods.

Yalomus depressus Rafinesque

Rafinesque's description and figure (fig. 1, lower figure) of this species immediately show it to be a *Phyllosoma* larva of a species of Scyllaridae (slipper lobster), and a comparison with the larvae of the species of scyllarids known from the Mediterranean proves Rafinesque's animal to be the larva of the most common species there, *Scyllarus arctus* (Linnaeus, 1758). The larva most likely is in Stage VII of its development. In that stage, according to Stephensen (1923: 68-75, figs. 21-24), the antennula (= Rafinesque's "inner palpi of the head") acquires the 3-segmented peduncle shown in Rafinesque's figure, while also the other characters are consistent with those of Stage VII.

Rafinesque's account gives contradictory information about the size of his specimen. His description of the whole animal states it to be "scarcely one inch long & as much broad". These measurements evidently include the legs, as the carapace (termed "head" by Rafinesque) is said to be "about 1/2 an inch broad". Judging by the drawing, which is said to represent the species "10-fold natural size", the total length of the body would be 10.3 mm and the width of the carapace 4.8 mm, being less than half the measurements given in the description. Stephensen (1923) gave the length of Stage VII of *Scyllarus arctus* as "(9) 12-20 mm", and a specimen of the same stage figured by Gurney (1936: 428, fig. 32) is 12.5 mm long with a carapace width of 8.1 mm.

Rafinesque's description of the eyes, antennules and antennae is quite correct. Also the maxillipeds and legs are rather accurately described, except for some rather serious mistakes. Rafinesque cannot be blamed for indicating the second maxilliped as first leg, etc., but, as in *Heterelos*, he got confused about the number of segments of the appendages, giving the second maxilliped one segment too few and the third one too many. He is correct in calling the maxillipeds (= his first and second legs) simple, i.e., without exopod. He is mistaken, however, in assigning "3 claws" to the first to fourth pereopods. One of these so-called claws is the dactylus of the leg, another is the exopod, but the third can be nothing but a figment of Rafinesque's imagination. In his figure this third claw resembles the exopod in shape, but it is inserted at the articulation between merus and carpus; no such appendage is found on the legs of *Phyllosoma* in any stage known. The fifth pereopod (= the seventh leg in Rafinesque's terminology) is described as 3-segmented; in Stage VII it usually is 2-segmented, sometimes with an indication of a third articulation, but has a general shape similar to that shown in Rafinesque's figure.

The abdomen, as figured by Rafinesque, is rather too long and too slender; this may have been due to the condition of the specimen (it could have curled by desiccation), or it could be an inaccurate representation of the animal. The

serrations described by Rafinesque as present on the edges of the abdomen can be nothing else but the buds of the pleopods, which are very small in this stage. The "obtuse prominence" at the end of the abdomen must be the uropods, which show as bilobed buds somewhat larger than the pleopods.

Apart from these inaccuracies, Rafinesque's description and figure are reasonably good and the species can confidently be identified with *Scyllarus arctus*.

Scyllarus arctus inhabits the eastern Atlantic between the British Isles and N.W. Africa and is quite common in the Mediterranean. The first published description of the larva is the one by Risso (1827: 88, pl. 3 fig. 9), who, like Rafinesque, treated it as a new genus and new species. Risso named it *Chryso-ma mediterranea*, basing his account on material that he had obtained in 1815.

All *Phyllosoma* larvae, both those of Scyllaridae (slipper lobsters) and Palinuridae (spiny lobsters), are pelagic animals and Rafinesque's statement that his *Yalomus depressus* lives parasitically on sharks (*Carcharias taurus* Rafinesque at present is named *Odontaspis taurus* (Rafinesque, 1810)) is a fable, evidently told him by fishermen as he himself stated that he had never seen the species alive. With this incorrect information and some imagination, Rafinesque showed quite convincingly how well-adapted the species was for this parasitic mode of life, even going so far as to speculate that the crustacean seldom leaves its shark host as "it seems ill-calculated for swimming", while in reality *Phyllosoma* is a pelagic species "swimming" all the time. The inclination of some zoologists for speculation on too few data and with unreliable information seems as great at the time of Rafinesque as it is today.

With hindsight, we can now conclude that the decision by the Linnean Society not to publish Rafinesque's contribution was the correct one. The two generic and two specific names proposed in this paper, even as early as 1811, would have been, all four of them, junior synonyms.

From a historical point of view, however, the manuscript is of great interest. More detailed than most of Rafinesque's published papers, it gives us an opportunity to study his descriptive techniques. Illustrated, as most of his published papers are not, it also enables us to judge his skill in drawing specimens. And most important of all, we now finally know what the published, but unavailable names *Heterelos* Rafinesque and *Yalomus* Rafinesque stand for.

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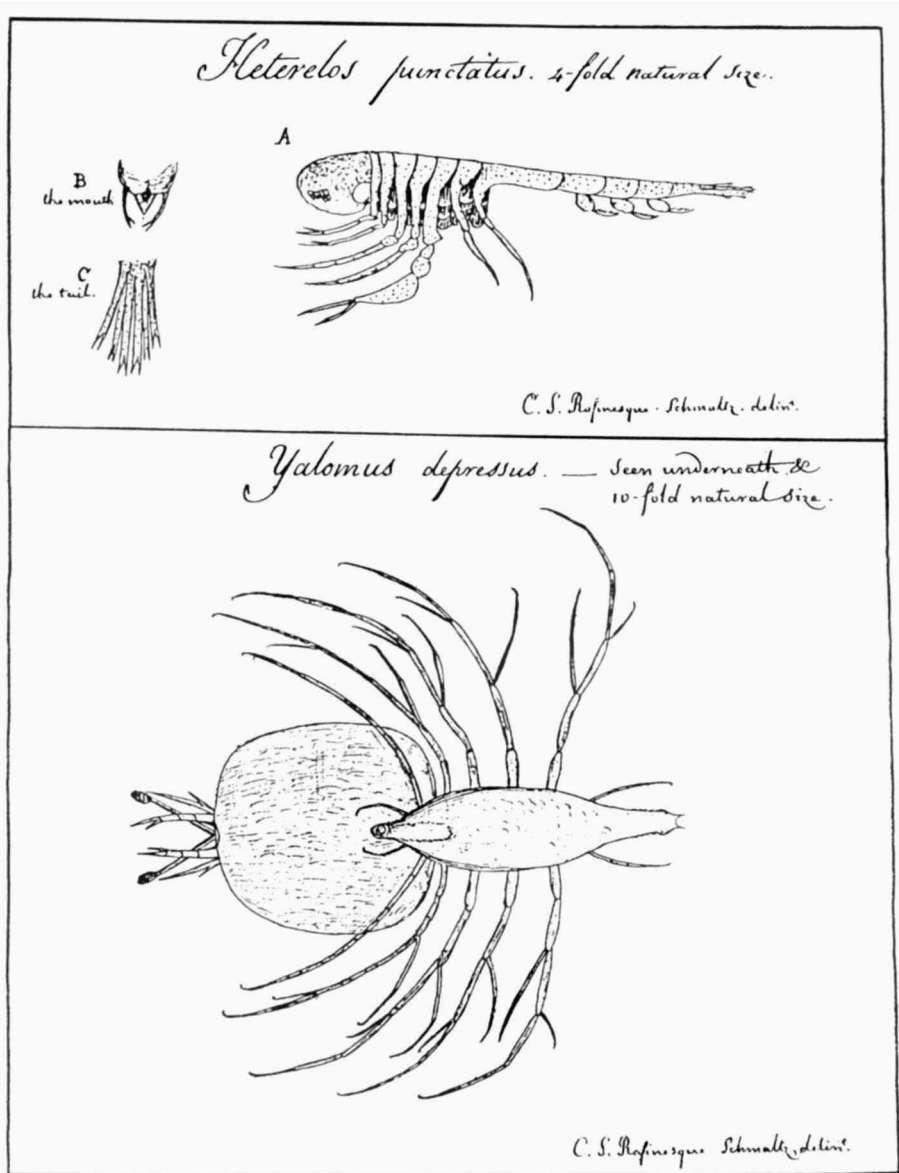


Fig. 1. Rafinesque's original figure of *Heterelos punctatus* Raf. (= *Phronima sedentaria* (Forskål), upper figure), and *Yalomus depressus* Raf. (= *Scyllarus arctus* (L.), phyllosoma stage, lower figure).