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Character and Distribution of the genus *Perigonimus*.

By

Prof. Chas. W. Hargitt, Ph. D.,
Syracuse, N. Y.

The discovery and description of a member of the genus *Perigonimus*, taken in the waters of Long Island Sound in July 1892, by Dr. H. L. OSBORN and the present writer, and the unique character exhibited by it, so impressed me that occasion has been taken during a sojourn at the Naples Zoological Station to examine members of the genus found in the waters of the Gulf of Naples, by way of comparison with the one taken in the waters of the New York coast, and with the purpose, moreover, of establishing more certainly its relations with European species.

In so doing I have had occasion to review with some care the available literature relative to the genus and am disposed to submit the following synopsis as touching points in its character, habit and distribution. I am the more impressed with the desirableness of such a review, since it may serve to bring together a conspectus of our present knowledge of the literature of the subject, if nothing more. It has seemed, moreover, that attention has not heretofore been adequately directed to points of structure which, it seems to me, make the genus one of peculiar interest to the biologist. To bring together these records, emphasize features of morphological significance, and contribute additional information as to distribution, are a few of the inducements prompting the paper.

Perigonimus, one of the principal genera of the Gymnoblastic Hydroids, was established by MICHAEL SARS¹ in 1840, based upon

¹ Fauna Littoralis Norvegiae. 1. Heft 1846 pag. 8—9.

Mittheilungen a. d. Zoolog. Station zu Neapel. Bd. 11.

characters found in a Hydroid taken by him in August of that year at Manger, Norway, at a depth of from 20—30 fathoms. The name was based upon the occurrence of the gonads surrounding the hydrocaulis, a character now well known to have no generic value whatsoever, as it is shared by many other genera.

I cannot ascertain whether the species described by Sars has ever been noted by subsequent students of the Hydroidea. ALLMAN¹ expressly states that his description of it is based upon characters published by Sars. WEISMANN² also refers to this species with a degree of conservatism which might clearly indicate a doubt as to Sars' species. Indeed neither from his descriptions nor his figures would one recognize typical members of the genus as at present known. However, ALLMAN considers the Hydroid as entitled to generic rank, and whatever may be the doubts as to its affording a typical representation of the genus, the genus itself is one of the best defined of the entire family of which it forms a member.

The generic characters given by HINCKS³ seem to me to be, upon the whole, the most distinctive, and I reproduce them here, adding what seems necessary to adapt them to our present knowledge of the genus:

Coenosarc sheathed in a chitinous, sub-chitinous, or gelatinous perisarc; hydrocaulis branching or simple, from a filiform hydrorhiza; hydranths fusiform, with a single verticil of filiform tentacles surrounding the base of a conical hypostome; gonophores developed from the coenosarc. Gonozooids free and medusiform. Umbrella deep bell-shaped; manubrium short; radiating canals four; marginal tentacles two or four, often increasing with age, springing from non-ocellated bases.

The modifications included in the characters are made necessary by reason of structures peculiar to at least two of the more recently described species, namely, *P. cidaritis*, Weismann⁴, and *P. Jonesii*, Hargitt & Osborn⁵. In both these species the perisarc is in what may be regarded as a primitive, non-differentiated, gelatinous condition; a sort of slimy ectodermal secretion, not yet solidified, but

¹ Gymnoblæstie Hydroids 1871 pag. 323.

² Die Entstehung der Sexualzellen bei Hydromedusen 1883 pag. 115.

³ British Hydroid Zoophytes Vol. 1 1868 pag. 89.

⁴ Op. cit.

⁵ American Naturalist Vol. 28 1894 pag. 27.

nevertheless of a nature analogous to the more highly specialized skeletons of the higher forms, as well as homologous in many points.

I have not been able to obtain more than a single species from the Naples bay, though two have been reported, viz. *P. linearis*, Alder, by DU PLESSIS¹ in 1880, and the species described as new by WEISMANN in 1883, namely, *P. cidaritis*.

The species *P. linearis* has also obtained record in the Station faunal list, but I am rather disposed to doubt its occurrence here, as protracted search with the dredge under the most varied circumstances failed to procure it. It should be said, however, that *P. cidaritis* was found in limited numbers and in poor condition. In his studies of the Hydroids of the bay in 1883, WEISMANN did not find the species, but found the one he described, in the same habitat as had been given for *linearis*. It would seem probable therefore that only one exists in these waters.

This, moreover, seems to be in general accord with the distribution of the genus, in only a few cases a given locality affording a habitat for more than one species.

A careful comparative study of *P. cidaritis* with *P. Jonesii* has led to the following results:

1. A more intimate morphological relationship than seems to exist between any other members of the genus, at least in so far as pertains to the hydrozoid persons. I have not been able to obtain gonozooids of the former species, and have only the descriptions of WEISMANN as a basis of comparison. Both species have similarly a simple perisarc, though in *P. cidaritis* it is somewhat more dense, and slightly chitinized in the older portions of the stem. The bathymetrical range of the species is very nearly the same, varying from 10 to 30 fathoms.

They differ in their host habitat, *P. cidaritis* being chiefly, possibly wholly, found upon the sea-urchin *Dorocidaris papillata*; *P. Jonesii* being found thus far only upon the spider crab, *Libinia emarginata*.

2. An exceedingly simple, or generalized character. This is seen in both the hydrozoid and gonozooid persons, specially the former. The morphological characters are very similar to those of the lower Tubularians, and the skeletal features would seem to rank with those of the simplest of the Gymnoblasic Hydroids.

¹ Mitth. Z. Stat. Neapel 2. Band 1880 pag. 143.

I cannot do better than to quote in this connection from our original description¹ of *P. Jonesii*, as follows: »To the morphologist a form like the one just described has peculiar interest because of the many primitive characters which are united in it. It is not improbable that the higher calyculate Campanularian Hydroids may have descended from athecate ancestors that were more or less closely like the genus *Perigonimus*. This is a very lowly form of Tubularians, having only a single row of tentacles, the mode of reproduction is very simple, and the medusa is of the most simple character.

»Still while *Perigonimus* is treated among the naked Hydroids, it has a covering. This covering is such a one as such an animal as the naked Hydroids might have in their earlier stages of acquiring a strong skeleton. It is not a highly differentiated product, but a delicate, hardly compacted slime not very unlike the mucous secretions that all animals are so commonly throwing off from their bodies. If the semi-fluid coat of this sort were stiffened only a little, we should arrive at the more compact, chitinous cuticle of the calyculate forms. The case of *Perigonimus* thus furnishes a suggestion of the probable history of the chitinous cuticle of the Hydroids: at first a thin envelope, later a stiffened cover forming a greater protection to the body and providing for freedom of motion by the formation of joints at stated intervals. The facts of ontogeny are in favor of such a view of the history of the cuticle, for we know that it arises as an excretion thrown off from the ectoderm and hardened on exposure to the water. The differences between the gelatinous and chitinous cuticle are such differences in the chemical or metabolic functions of cells as might easily be conceived to come within the range of the operation of natural selection.«

These deductions and suggestions, while primarily the results of the study of *P. Jonesii*, are almost equally applicable to *P. cidaritis*, and more or less so to the whole genus; though certain members exhibit departures from the typical generic characters, but not of such extent as to vitiate them.

Concerning the origin of the sexual cells of *P. Jonesii* as compared with *P. cidaritis* I have not yet been able to satisfy myself wholly, not having as yet obtained medusae sufficiently mature to show any signs of germinal cells. It will not therefore be possible

¹ Op. cit. pag. 33.

to enter upon any comparison, further than in a very general way. This much, however, may be said, that in *P. Jonesii* the germ-cells evidently mature at a much later date in the life of the medusa than in *P. cidaritis*. In the latter they may be found, according to WEISMANN at, or shortly prior to, the setting free of the medusa. »So viel steht jedenfalls fest, dass die Geschlechtszellen bei *Perigonimus* erst in der Medusenknospe entstehen kurz vor ihrer Lösung, und zwar aus dem inneren Blatt des Glockenkerns, aus dem Ektoderm des Manubrium.« I have not been able to demonstrate their presence in *P. Jonesii* at any stage previous to the maturation and liberation of the medusa, even in the most primitive forms; though careful search has been made through many sections of the medusa-buds in various stages of development. In a previous account of the development of this species¹, attention was called to the circumstance that the medusae were kept in aquaria — apparently in healthy condition for at least a fortnight — without any appearance of sexual organs; but it must be said that no sections were made of specimens so kept, though careful observations upon stained and mounted specimens failed to show any traces of sexual cells.

It would seem therefore that in this respect at least, there is a rather remarkable difference as to the origin and maturation of the sexual cells in these two species. But attention should be called to the fact that WEISMANN's conclusions were in part based upon sexual organs found upon medusae taken from the »Auftrieb«, and whose age, and indeed relations, must therefore be a matter of some doubt. I shall hope to be able to secure such additional material as will afford means for certainly establishing this point for the American species, and at the same time for completing an account of its minute structure and development, of which only preliminary notice has so far been given.

In numbers the genus is also an important one, perhaps only the Corynidae and Tubularidae including more species. HINCKS² records 5 distinct species, and adds several which he considers as of doubtful affinities, though they are now generally recognized as distinct species. ALLMAN in his classical monograph recognizes 8 distinct species, and adds two of doubtful character. He adds also an additional species³, *P. multicornis*, reported in 1874.

¹ Op. cit. pag. 28.

² Op. cit. pag. 89.

³ Journ. Linn. Soc. London Vol. 12 pag. 252.

In 1873 G. O. Sars reported a new species¹ which he took from a depth of 400 fathoms off the coast of Norway and named *P. abyssi*.

In 1883 WEISMANN² described a new species from the Gulf of Naples which he named *P. cidaritis*.

So far as I have been able to ascertain no further addition was made to the list till 1892, when the new species *P. Jonesii* was described by us from Long Island Sound³.

This makes a list of at least 12 species, not including several of doubtful affinities, which are as follows:

1. *P. muscoides* Sars; 2. *repens* S. Wright; 3. *minutus* Allman; 4. *sessilis* S. Wright; 5. *palliatum* S. Wright; 6. *vestitum* Allman; 7. *serpens* Allman; 8. *linearis* Alder; 9. *multicornis* Allman; 10. *abyssi* Sars; 11. *cidaritis* Weismann; 12. *Jonesii* Hargitt & Osborn.

Habitat. In reference to the habit of the genus it may be said to be distinctively commensal. I have found no record of any species of which a different character might be predicated. So far as I have been able to ascertain, the following seems to be the general range of habit so far as any has been reported:

P. muscoides, attached to other Hydroids and tests of Ascidians. *P. repens*, attached to Sertularians and upon the back and legs of the spider crab; *P. minutus*, attached to the operculum of *Turritella communis*; *P. sessilis*, on shells and occasionally on rocks; *P. palliatum*, attached to shells of hermit crab; *P. vestitum*, attached to old shells of *Buccinum*; *P. serpens*, chiefly on stems of other Hydroids; *P. linearis*, on shells of *Turritella* and other Gasteropods; *P. cidaritis*, on spines of *Dorocidaris*; *P. Jonesii*, attached to abdomen and pereopods of spider crab. Concerning other species no records were found.

That some advantage accrues from this mode of life hardly admits of doubt, though it may be difficult in each case to clearly perceive in just what it may consist. In certain cases the commensalism may approximate parasitism to a degree which is difficult to distinguish from it. FEWKES⁴ has described an extremely interesting case of what seems to be genuine parasitism among Hydroids in a species which he named *Hydrichthys mirus*, from its habitat as a parasite upon a fish of the genus *Seriola* (*zonata*, Cuv.).

¹ Forh. Vid. Selsk. Christiania 1874 pag. 91.

² Op. cit.

³ Op. cit.

⁴ Bull. Mus. Harvard Coll. Vol. 13 1888 pag. 224.

The case is the more interesting in this connection in that it resembles very closely in its medusoid persons those of *Perigonimus*; and as FEWKES has indicated, if only the medusa stage had to be considered, its affinities with the Tubularians would certainly be very close. In the original description of *P. Jonesii* the possibilities of a parasitic character were intimated, though no evidence was directly perceived which would establish such a relationship. The close commensal relations of *Hydractinia*, *Podocoryne* and other related forms are very well known. I have often verified the observations of Miss MARTHA BUNTING in her recent paper upon this point¹. That a similar form of commensalism exists between *P. Jonesii* and the spider crab seems quite probable, but of its exact nature I cannot speak with certainty.

Distribution. It is not yet time to propose an exhaustive account of either the geographical, or bathymetrical range of the genus, since we know too little of the hydroid fauna of the globe to afford sufficient basis for even a tentative discussion of the laws of its distribution. A record of the facts known is however always in order; and through such a process we may hope to contribute to the general sum of knowledge, which in its aggregation may at some time justify the larger undertaking. Indeed it may be said that in a general way this is exactly the method by which most of our knowledge of such laws have been worked out and verified. The following summary of facts in reference to the special group under consideration will not therefore be without value.

The following notes on its distribution will afford a summary of our present knowledge on the subject:

In a paper entitled »Ergänzungen zu HELLER's Zoophyten etc. des Adriatischen Meeres»² F. W. PIEPER reports one species, *P. repens*, as found on shells at Pirano, Lesina, Rovigno, and Lissa.

J. PETERSEN, in a report of the scientific work of the gun-boat »Hauchs»³ within the waters of the Danish seas during the years 1883—86, records the following species: — *P. repens*, Kattegat, etc., from depths of 5—26 fathoms, and reports it as found also in Scotland, England, and the Adriatic sea. *P. vestitus* (?), Öresund (Hellebäck), also in Scotland. *P. serpens* (?), Hellebäck, also England. *P. multicornis*, Kattegat.

¹ Journ. Morph. Boston Vol. 9 1894 pag. 203 seq.

² Z. Anzeiger 7. Jahrg. 1884 pag. 148.

³ Det videnskabelige Udbytte af Kanonbaaden Hauchs Togter etc. 1893 pag. 377.

J. V. CARUS¹ records the following species: — *P. repens*, seas of Great Britain, giving PIEPER's records as to its occurrence in the Adriatic. *P. linearis*, Distribution similar to *repens*. Habitat, Bay of Naples, DU PLESSIS. *P. serpens*, shores of Great Britain. Habitat, »Sea of Tuscany«, RICHIARDI.

An examination of the extensive and painstaking reports on the »Hydromedusae of Australia« by R. VON LENDENFELD², while showing a comparatively rich Hydroid fauna, affords no record of the occurrence of *Perigonimus*.

In a report on a North-polar Expedition, by E. VON MARENZELLER³ there occur but few records of Hydroid life. Only 4 genera with 5 species were collected, and *Perigonimus* does not appear among them.

F. E. SCHULZE⁴ reported *P. repens* as found in Firth of Forth at a depth of 25 fathoms, and in Terschelling at 20 fathoms. Distribution »Vor der Ostküste von Schottland und England«.

It will be seen from these records that the larger proportion of species have been reported from the environs of the British Isles and North sea. This may be due in part to the greater attention which has been given to this aspect of zoology by English naturalists, but it can not be wholly due to this. It would seem that these regions afford a more congenial habitat than some others.

In some cases it would seem that the range of a given species is considerable. For example, *P. linearis* has been reported from the coast of Northumberland and from the Gulf of Naples. I have intimated above, however, that there seems to be some doubt as to the distinctness of the Naples species. With this exception it would seem that the range of a given species is usually limited. But at the same time it appears that the range of the genus is rather wide, being found on both shores of the Atlantic and in the Mediterranean, yet less so than many others of the family.

Another fact is worthy of attention and that is that no reports of the genus occur from distinctively pelagic regions. I find no account of it in the Challenger Reports upon the Hydroidea, nor in the Reports of the Hydroidea of the Gulf Stream, nor in AGASSIZ'

¹ Prodrömus Faunae Medit. 1885 Vol. 1 pag. 4.

² Proc. Linn. Soc. New Wales Vol. 9 pag. 206, 345, 401, 467, 581.

³ Denkschr. Akad. Wien Math. Nat. Cl. 35. Bd. 1877.

⁴ Ber. Comm. Wiss. Unters. D. Meere Kiel 2./3. Jahrg. 1875 pag. 127.

Illustrated Catalogue of North American Aclephae. It would seem to be limited therefore to what have been designated as the Littoral, Laminarian, and Coralline regions. In only one case has this limit been probably exceeded, namely in that of *P. abyssii*, from a depth off the west coast of Norway, of 400 fathoms. Again, in only one case has it been reported from other than the coasts of Europe. The description of *P. Jonesii* from the American coast is the only occurrence, so far as I am aware, of any member of the genus in these waters.

Concerning the causes of distribution relative to *Perigonimus* little can be said. Propagated by free-swimming medusae, it is probable that this fact has contributed to its more local distribution. Its commensal habit may also have similarly aided in extending its range, though this has more probably operated against any general extension of range, since the host is generally of a somewhat sedentary habit. So far as the facts at hand are of significance, they would seem to point to the origin of the genus in the region of the British Isles, and its very slow transplanting to adjacent and remoter regions. Its occurrence in such remote points as Naples Bay and Long Island Sound must probably be accounted for by causes of a somewhat extraordinary character, such as conveyance by ships.

Such in brief is a synoptic glimpse of the more striking characteristics of the genus. That it is tentative and incomplete in some of its aspects will be recognized in the nature of the case. It is hoped, however, that enough has been gathered into the review to afford a fair introduction to the extremely interesting character of the genus, and to indicate some of the more important morphological problems in its structure and ontogeny. To the latter points I hope to contribute further as soon as suitable material can be secured for investigation.

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