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PROCEEDINGS

OF THE

CALIFORNIA ACADEMY OF SCIENCES

THIRD SERIES

ZOOLOGY VOL. III, NO. 11

Remarks on the Sexes of Sphæromids With a Description of a New Species of Dynamene

BY

SAMUEL J. HOLMES

WITH ONE PLATE

Issued October 11, 1904

SAN FRANCISCO

PUBLISHED BY THE ACADEMY

1904

REMARKS ON THE SEXES OF SPHÆROMIDS WITH A DESCRIPTION OF A NEW SPECIES OF DYNAMENE.

BY SAMUEL J. HOLMES.

PLATE XXXIV.

THE GENERA of the family Sphæromidæ are in a state of annoying confusion. Differences of age and sex have led, in some cases, to the establishment of more than one genus for members of the same species. In cases where a marked sexual dimorphism is supposed to exist, little has been accomplished towards connecting the forms with their proper mates. And aside from this there is more than the usual amount of difference of opinion regarding the validity and the limits of the genera into which this family has been divided.

M. Hesse[1] who has devoted a memoir to the sexual relations of the Sphæromidæ came to the conclusion that he had made a discovery which would greatly simplify matters; *Sphæroma* he believes to be only the female form of *Cymodoce*, and *Dynamene* the female of *Næsa*. The evidence upon which Hesse bases both his conclusions is, however, all indirect. Regarding the first conclusion he makes the interesting observation that "depuis que notre attention s'est fixée sur ses Crustacés, c'est-à-dire depuis plus de vingt ans, nous n'avons *jamais* vu un seul Cymodocéen adulte qui eût des œufs, tandis que nous avons *toujours trouvé des Sphéromiens adultes qui en avaient*, et nous avons même pu suivre leur éclosion et élever les jeunes." But he adds: "Malheureusement nous n'avons pas pu mener

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[1] Ann. Sci. Nat. ser. 5, t. 17, 1872.

jusqu'au bout notre épreuve; nous avons cependant conduit leur éducation jusqu'à la troisième mue: mais passé cette limite, soit que l'état de captivité dans lequel nous les tenions leur fût contraire, soit que le genre de nourriture que nous leur donnions ne leur convînt pas, ils finissaient par mourir successivement sans avoir atteint l'âge adulte." Since *Sphæroma* and *Cymodoce* closely resemble each other in form and habit and are often found in the same localities, and since Sphæromas carrying eggs are often met with, while *Cymodoce* has never been observed to bear ova, Hesse includes both forms under the latter genus. Dr. Stebbing[1], who takes exception to Hesse's conclusion, remarks that "as between British species assigned to the two genera, there is no resemblance in color worth speaking of, and no community of residence, except that *Cymodoce* is occasionally and very rarely found on some of the shores that also yield *Sphæroma*. In *Sphæroma quadridentatum* Say, Mr. Harger has ascertained that neither sex is a *Cymodoce*. . . . I can, however, myself testify that *Sphæroma rugicauda* Leach need not have recourse to a *Cymodoce* for a male form." Whatever validity there may be in Hesse's conclusion regarding the specific identity of the forms studied by him, his general conclusion that *Sphæroma* represents the female form of *Cymodoce* certainly cannot be maintained. On the west coast of the United States *Sphæroma* is represented by several species. I have observed thousands of specimens of this genus in various localities from Oregon to Lower California, and have never seen a single *Cymodoce* associated with them. In fact, up to this time, there has been no species of *Cymodoce* described from the Pacific coast of North America. Moreover, by an examination of the sexual organs of three west American species, *Sphæroma oregonensis* Dana, *Sphæroma rhomburum* Richardson, and *Sphæroma pentodon* Richardson, and of *Sphæroma serratum* (Fabr.) from the Bay of Naples, I have ascertained that both males

[1] A History of Crustacea, N. Y. 1883.

and females occur in each of these species, and that they exhibit no marked degree of sexual dimorphism.

That *Dynamene* represents the female form of *Næsa* is a conclusion that has more in its favor. At least it may be true that some species of *Dynamene* may have males that would come under the genus *Næsa*. *Næsa bidentata* and *Dynamene Montagui* were regarded by Bate and Westwood[1] as probably the male and female of the same species. Dr. Stebbing considers it "not improbable that the species named *Dynamene rubra* and *Dynamene viridis* by Leach and *Campecopia versicolor* by Rathke, may represent the female, and *Dynamene Montagui* the young male of *Næsa bidentata*. . . . No one appears to have ever found the *Næsa* form or *Dynamene Montagui* carrying eggs, and, as they are not at all uncommon, they may therefore be presumed to be of the male sex." The form described and figured by Hesse, however, is certainly not *Dynamene rubra* or *viridis*, and it may be added that the specimen figured as the male of this species differs wonderfully from the figure given by Bate and Westwood. Moreover, the form figured as the female differs so markedly from the male that it would require much stronger evidence than Hesse has adduced to convince a reasonably skeptical person that the two forms represent the two sexes of the same species. The differences are not confined to the posterior part of the body but extend to the anterior thoracic segments and head. Hesse does not state under what name the female of this species was previously described or whether it had been described at all. While sexual dimorphism may exist in the forms Hesse describes, it may not unreasonably be doubted whether this writer has connected the male and female of the same species.

The attempt was made by Hesse to raise the young of *Dynamene* in order to ascertain whether they would give rise to any specimens of *Næsa;* but, as in the experiment with *Sphæroma*, the young all died before reaching a stage

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As *Dynamene* is supposed to represent the female form of *Næsa*, Hesse assumes that it should rank as a synonym of the latter; all of the species he describes, some of which are known only from the female, or *Dynamene* form, are placed under the genus *Næsa*. According to the rules of the American Ornithologists' Union, which are largely followed in this country, if two names are given simultaneously to the same genus and are otherwise of equal pertinency, the name based on the adult male takes precedence over that based on the young male or female. *Nesæa* and *Dynamene* were both instituted by Leach in the article 'Crustaceology' in the 'Edinburgh Encyclopedia' in 1814. Other things equal, *Nesæa*, being based on the male form, would be retained; but other things were not equal, the names were not of equal pertinency, as *Nesæa* was preoccupied. *Næsa*, which was substituted for *Nesæa (nomen preocc.)* in 1818, becomes, if based as the male of *Dynamene*, a synonym of the latter genus. The same result would be arrived at by following most of the other codes of nomenclature now in vogue.

On the other hand, the retention of *Dynamene* may be objected to on the ground that, as no species were assigned to it, it was not properly defined, and should be considered indeterminate. According to canon 37 of the code above

referred to, "If an author describes a genus and does not refer to it any species, either then or previously described, the genus cannot be taken as established or properly defined, unless the characters given have an unmistakable significance." The definition of *Dynamene*, I believe, may be reasonably held to fulfill this requirement. The genus is characterized along with other genera from which it is accurately distinguished, so that there would be little difficulty in recognizing it even if species were not subsequently assigned to it by Leach himself. The original definition of the genus is as follows: "Eyes not reaching the anterior margin of the first segment; base of tail on each side with two equal foliaceous appendages, apex of the tail emarginate; nails bifid. There are several indigenous species of this genus, but the characters are not yet determined." Essentially the same definition is repeated without the assignment of any species in the 'Transactions of the Linnean Society' for 1818, but in the 'Dictionnaire des Sciences Naturelles' (t. 12, 1818) the genus is again defined and three species are assigned to it, *Montagui*, *rubra*, and *viridis* in the order named.

The name *Dynamene* may be further objected to on account of being nearly identical with *Dynamena*, which was described a few years before. How near one name must be to another to be rejected is a question which most codes of nomenclature leave to the discretion of individual writers. Are we to discard, as some writers do, such names as *Platymerus* because it is preoccupied by *Platymera?* or reject both because there is a still earlier name *Platymeris?* This is a subject concerning which it is unfortunate that different usages prevail, for this circumstance promises to give rise to much confusion when the validity of generic names is more critically looked into than is usually done at present. Names like the above, as well as numerous undoubted synonyms, have been suffered to stand simply because they have been neglected; but sooner or later judgment will be passed upon all such names, and the result will be that a large share of existing genera will

be discarded by some writers and retained by others. It is, I believe, a safe rule to follow, to allow a generic name to stand if it differs from the nearest preceding name both in spelling and pronunciation, be this difference ever so little. *Dynamene* would naturally be pronounced somewhat differently from *Dynamena*, and therefore ought not to be considered a synonym of the latter genus. Whether or not the two words are of the same derivation should not, I believe, be considered. For the purposes of zoological nomenclature a name is a name. If *Dynamene* is rejected on account of its similarity to *Dynamena*, new names should be substituted for *Dynomene* and *Dynamina* as well.

It is only after some hesitation that the following species have been referred to *Dynamene*. The females are congeneric with *Dynamene rubra* and *D. viridis*, and as these species are, I believe, members of a valid genus, the species here described should also be referred to *Dynamene*, although the males do not conform to the original definition of Leach.

Dynamene sculpta sp. nov.

PLATE XXXIV, FIGS. 1–7.

Male: — Body increasing slightly in width posteriorly. Head narrowed and scarcely longer than the first segment of the thorax. Eyes oblong, situated on prominent, rounded, lateral lobes. Thoracic segments minutely roughened behind, the lateral angles produced backwards into subacute, triangular processes; first segment longer than the succeeding ones, the lower side produced forward into a triangular process extending a little in advance of the eye, and backward into a triangular, acute lobe at the postero-inferior angle; last 3 segments with several small setose prominences on the posterior margin. Abdomen large, with 5 segments indicated, the anterior segment marked off by a line extending entirely across the upper surface, the 3 following segments are indicated by 2 pairs of lines which are visible only at the sides; second segment furnished with 3 setose tubercles in a transverse row. Caudal shield large and sculptured, the anterior portion with 3 tubercles, the middle one rather blunt and a little in advance of the others; a pointed tubercle with 2 lateral ridges in front of the posterior notch; notch deep, with a small spine at the end, behind which is a pair of larger spines. Inner branch of the uropods flattened and not nearly reaching the tip of the caudal shield, the tip subacute; outer branch very long, narrow, and incurved, extending considerably behind the tip of the caudal shield and directed obliquely upwards. First antennæ a little shorter than the second,

the first basal joint enlarged, oblong, and emarginate at the distal end at the insertion of the small, subquadrate second joint; flagellum longer than the peduncle and composed of 9-11 joints. Second antennæ scarcely reaching the middle of the thorax, the peduncle slender, the last 2 joints much longer than the preceding ones; flagellum a little longer than the peduncle, the joints furnished with short setæ. Thoracic legs increasing slightly in length posteriorly and furnished with short hairs; propodi armed below with spines; dactyls curved and ending in a spine with a strong spine behind the tip.

Female: —The females are smaller than the males; the head, antennæ, mouth parts, thoracic legs, and anterior segments are not distinguishable from those of the male, but the abdomen is markedly different. The caudal shield is relatively smaller and less sculptured, the notch at the extremity is simple and shallow; there are 3 oblong tubercles on the anterior portion; the 3 tubercles on the next segment in front are smaller than in the male. The branches of the uropods are flattened and of subequal size; neither extends beyond the tip of the caudal shield.

Both sexes possess the power of rolling themselves up, but they do not take on so nearly a spherical form as that assumed by the species of *Sphæroma*. This species was taken from pieces of sponge dredged in shallow water at San Clemente Island, August, 1893. In July, 1895, I collected several specimens at San Diego, California. The 2 sexes were found together and were associated with no other species of Sphæromid. It was inferred from the association of these forms and their similarity in all external features except in the posterior part of the body, that they represented the male and female of the same species, but this conclusion was confirmed by the dissection of several specimens. The males, however, may be distinguished in this species, as in other Sphæromids, by the possession of a stylet on the second pair of pleopods. None of the females were found bearing eggs, though the ovaries were well developed and the vasa deferentia of the males were distended with spermatozoa.

The male of this species is very closely allied to the form recently described by Miss Richardson[1] as *Cilicæa caudata gilliana*. It differs in having a single median spine, instead of a pair of spines, at the anterior end of the emargination of the caudal segment, and in having usually but a single pair of teeth, instead of three pairs, at the sides of this emargination. In some cases, however, the posterior angles of the emargination may be dentiform and partly included so as to give rise to two pairs of lateral teeth. The inner branch of the uropods presents a prominent angle which stands some distance away from the sides of the caudal segment, while the point of the ramus in *caudata*

[1] Proc. U. S. Nat. Mus. v. 21, p. 840, fig. 17, 1899.

gilliana is apparently concealed under the lateral margin. There are three tubercles instead of five at the base of the abdomen, although there are sometimes traces of another tubercle on either side of the lateral ones.

The females bear considerable resemblance to Miss Richardson's *Dynamene dilatata*, but the body is narrower, the epimera smaller and pointed at the sides, and the caudal shield more elongated.

Dynamene cordata *(Richardson)*.

PLATE XXXIV, FIGS. 8–10.

Cilicæa cordata RICHARDSON, Proc. U. S. Nat. Mus. v. 21, p. 839, fig. 16, 1899.
Dynamene tuberculosa RICHARDSON, *l. c.* p. 833, fig. 9.

Male:—Body tapering from behind forwards. Head somewhat produced in the middle, the anterior margin thickened and forming a broad lobe on either side of the prominent rounded frontal projection. Eyes situated on postero-lateral lobes of the head, which are produced backwards. First antennæ shorter than the second, the first joint oblong, having an acute process projecting below the small second joint; third joint slender and subcylindrical; flagellum 9–12 jointed, reaching beyond the posterior margin of the head. First thoracic segment longer than the succeeding ones, which are of subequal length. Epimera bent abruptly downwards and produced backwards into narrow but rounded points. On the posterior margins of the last few thoracic segments, especially in old specimens, is a transverse row of small double tubercles which increase in size posteriorly.

First abdominal segment with 5 double tubercles. On the convex base of the large caudal segment is a transverse row of 3 double tubercles, the cusps in the central tubercle situated in a transverse line, those in the lateral tubercles placed the one before the other. The deep median posterior emargination is armed with 3 pairs of teeth, the pair near the apex small; middle pair often double. A prominent tubercle near the apex of the emargination. Inner ramus of the uropods lamellate, concave above, distally acute, and much shorter than the caudal segment; outer ramus large, incurved, expanded on the inner side of the base into a lobe which fits under the inner ramus. The distal portion of the outer margin armed with 4 or 5 tubercles; the tip often turned slightly outwards, and extending somewhat beyond the extremity of the caudal segment.

Length of largest specimen 15 mm.

Female:—A detailed comparison of the mouth parts, antennæ, and other appendages revealed no differences between the forms considered to represent the 2 sexes of this species. The head of the males is a little more produced in front than in the females. The significance of this difference

is that the head of the male is especially adapted to fit into the under side of the large caudal segment, the 2 parts fitting together very neatly when the animal is rolled up.

There is a similar adaptation between the head and caudal segment of the female, the head being somewhat differently shaped in relation to the form of the parts against which it abuts. Aside from this, the sexual differences are confined to the posterior portion of the body. In the female the 3 tubercles on the convex basal portions of the caudal segment are less prominent than in the male, and the posterior emargination much less deep and devoid of lateral teeth. The rami of the uropods are of subequal length and flattened, and considerably shorter than the caudal shield. The tubercles on the first abdominal segment are less prominent, and those on the posterior margins of the last thoracic segments may be absent entirely. The whole posterior portion of the body is much less developed in the female than in the male. In immature females the caudal shield is relatively longer than in the adult, the basal portion less tumid, the posterior flattened portion relatively longer, and the tubercle near the apex of the posterior emargination frequently absent. Figure 9 is taken from an immature female collected at Monterey, November, 1895. Larger females taken at San Clemente in the summer of 1894 agree perfectly with Miss Richardson's figure of *D. tuberculosa*.

Specimens of both sexes were taken at San Diego, San Pedro, San Clemente Island, and Monterey. Both at San Pedro and at Monterey I have collected numerous specimens from the fronds of kelp. At the latter place they were found in great abundance, and the similarity of habitat and coloration shown by the two forms led to the surmise that they were the two sexes of the same species. This surmise led to the examination of a large number of each of the forms, and it was found that all of the one form were males and all of the other females.

Dynamene cordata is reported by Miss Richardson from Catalina Island, Monterey, and Popof Island (Aleutian Islands). The female form which Miss Richardson describes as *Dynamene tuberculosa* is reported from Catalina Island, Gualala, and Bodega Bay, California, and Popof Island, Alaska. I have retained the specific name *cordata*, rather than *tuberculosa*, because it was applied to the male form. The fact that the generic name *Cilicæa*, as it was founded after *Dynamene*, cannot be retained in this case, has nothing to do with the validity of the specific name.

Dynamene glabra *Richardson.*

Dynamene glabra RICHARDSON, Proc. U. S. Nat. Mus. v. 21, p. 834, fig. 11, 1899.

Specimens of this species were collected at Mendocino County, California, and at San Diego, California. The emargination of the caudal shield in this species is shallow and the caudal shield is very similar to that found in some species of *Sphæroma*. In *Sphæroma rhomburum* Richardson the sides of the caudal segment are folded down, forming a sort of groove on the lower side as in the present species. In *Sphæroma octoncum* Richardson there is a similar groove on the lower side of the shield and the apex is almost emarginate. In the females of *Dynamene sculpta* the posterior sinus is often very shallow, so that the genus *Dynamene* seems connected with *Sphæroma* by various transitional stages. *Dynamene glabra* shows a noteworthy point of agreement with *Sphæroma* in that the sexes do not show the marked dimorphism found in the two preceding species. An examination of several specimens of this species showed that the males present no appreciable external differences from the females except that, as a rule, they are of somewhat larger size.

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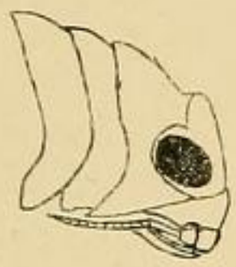
EXPLANATION OF PLATE XXXIV.

Fig. 1. *Dynamene sculpta*, male. Side view of head.
Fig. 2. *Dynamene sculpta*, male. Palp of the maxillipeds.
Fig. 3. *Dynamene sculpta*, male. First antenna.
Fig. 4. *Dynamene sculpta*, male. Second antenna.
Fig. 5. *Dynamene sculpta*, male. Last thoracic leg.
Fig. 6. *Dynamene sculpta*, male. Abdomen seen from above. As the long ramus of the uropods points obliquely upwards it appears foreshortened in the figure.
Fig. 7. *Dynamene sculpta*, female. Abdomen seen from above.
Fig. 8. *Dynamene cordata*, male. Abdomen seen from above.
Fig. 9. *Dynamene cordata*, female. Abdomen seen from above.
Fig. 10. *Dynamene cordata*. Last thoracic leg.

Figures 6, 7, 8, and 9 drawn to the same scale. All the figures were drawn with the aid of a camera.



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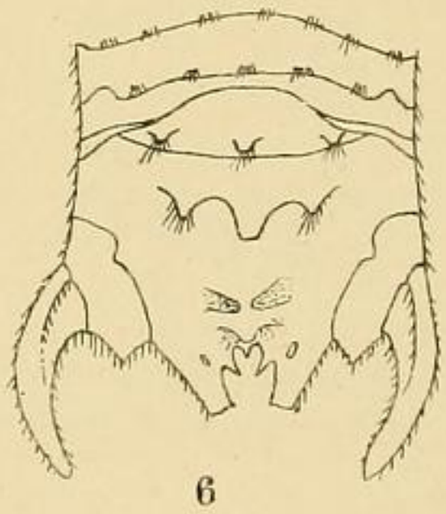

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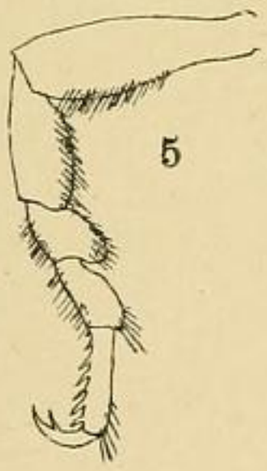

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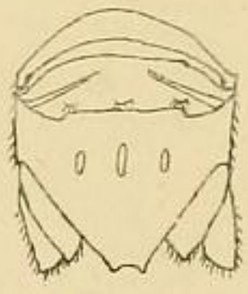

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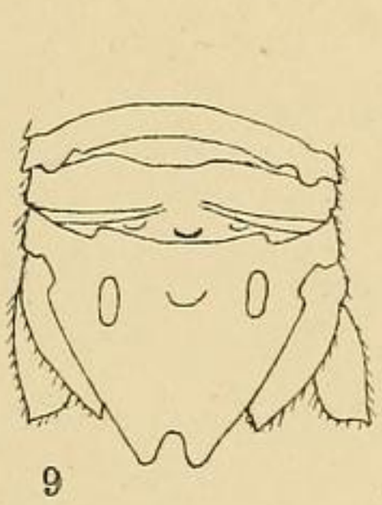

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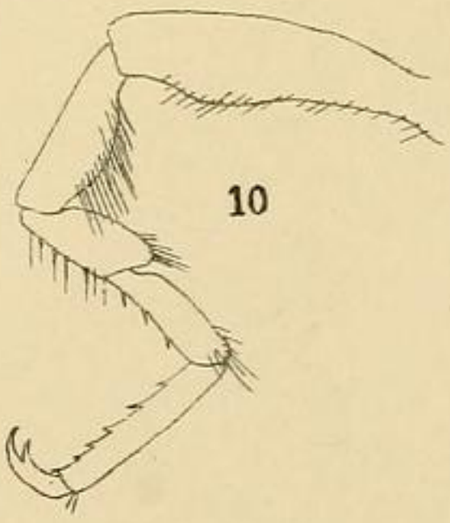

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1 Ann. Sci. Nat. ser. 5, t. 17, 1872.

[Begin Page: Page 296]

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[Begin Page: Page 298]

sufficiently advanced to enable the question to be definitely settled. It apparently did not occur to Hesse to attempt to ascertain the sex of these forms by dissection. Arguments are adduced at considerable length to prove by circumstantial evidence that certain forms are males and others females, while not a single attempt to determine the sex of any specimen by direct observation is recorded. We do not certainly know but that Hesse's specimens of Ncesa, Dynmnene, and Cymodoce all contain both male and female forms. The question may easily be determined without having recourse to internal dissection, as the males of the Sphaeromidae may be recognized by the presence of a stylet on the inner ramus of the second pair of abdominal appendages.

As Dynamene is supposed to represent the female form of NcBsa, Hesse assumes that it should rank as a synonym of the latter; all of the species he describes, some of which are known only from the female, or Dynamene form, are placed under the genus NcBsa. According to the rules of the American Ornithologists' Union, which are largely followed in this country, if two names are given simultaneously to the same genus and are otherwise of equal pertinency, the name based on the adult male takes precedence over that based on the young male or female. Nescea and Dynamene were both instituted by Leach in the article 'Crustaceology ' in the 'Edinburgh Encyclopedia' in 1814. Other things

equal, Nescea, being based on the male form, would be retained; but other things were not equal, the names were not of equal pertinency, as Nes(sa was preoccupied. Ncesa, which was substituted for Nescea (nomen freocc.) in 1818, becomes, if based as the male of Dynamene, a synonym of the latter genus. The same result would be arrived at by following most of the other codes of nomenclature now in vogue.

On the other hand, the retention of Dynamene may be objected to on the ground that, as no species were assigned to it, it was not properly defined, and should be considered indeterminate. According to canon 37 of the code above

[Begin Page: Page 299]

referred to, "If an author describes a genus and does not refer to it any species, either then or previously described, the genus cannot be taken as established or properly defined, unless the characters given have an unmistakable significance." The definition of Dynamene, I believe, may be reasonably held to fulfill this requirement. The genus is characterized along with other genera from which it is accurately distinguished, so that there would be little difficulty in recognizing it even if species were not subsequently assigned to it by Leach himself. The original definition of

the genus is as follows: "Eyes not reaching the anterior margin of the first segment; base of tail on each side with two equal foliaceous appendages, apex of the tail emarginate; nails bifid. There are several indigenous species of this genus, but the characters are not yet determined." Essentially the same definition is repeated without the assignment of any species in the ' Transactions of the Linnean Society ' for 1818, but in the ' Dictionnaire des Sciences Naturelles ' (t. 12, 1818) the genus is again defined and three species are assigned to it, Montagui, rubra, and viridis in the order named.

The name Dynaniene may be further objected to on account of being nearly identical with Dynamena, which was described a few years before. How near one name must be to another to be rejected is a question which most codes of nomenclature leave to the discretion of individual writers. Are we to discard, as some writers do, such names as Platynierus because it is preoccupied by Platymera ? or reject both because there is a still earlier name Platymeris ? This is a subject concerning which it is unfortunate that different usages prevail, for this circumstance promises to give rise to much confusion when the validity of generic names is more critically looked into than is usually done at present. Names like the above, as well as numerous undoubted synonyms, have been suffered to stand simply because they have been neglected; but sooner or later judgment will be passed upon all such names, and the result will be that a large share of existing genera will

[Begin Page: Page 300]

be discarded by some writers and retained by others. It is, I believe, a safe rule to follow, to allow a generic name to stand if it differs from the nearest preceding name both in spelling and pronunciation, be this difference ever so little. Dynamene would naturally be pronounced somewhat differently from Dynamena, and therefore ought not to be considered a synonym of the latter genus. Whether or not the two words are of the same derivation should not, I believe, be considered. For the purposes of zoological nomenclature a name is a name. If Dynamene is rejected on account of its similarity to Dynamena, new names should be substituted for Dynomene and Dynamina as well.

It is only after some hesitation that the following species have been referred to Dynamene. The females are congeneric with Dynamene rubra and D. viridis, and as these species are, I believe, members of a vaHd genus, the species here described should also be referred to Dynamene, although the males do not conform to the original definition of Leach.

Dynamene sculpta sp. no v.

Plate XXXIV, Figs. 1-7.

;i/a/^ .• — Body increasing slightly in width posteriorly. Head narrowed and scarcely longer than the first segment of the thorax. Eyes oblong, situated on prominent, rounded, lateral lobes. Thoracic segments minutely roughened behind, the lateral angles produced backwards into subacute, triangular processes; first segment longer than the succeeding ones, the lower side produced forward into a triangular process extending a little in advance of the eye, and backward into a triangular, acute lobe at the postero-inferior angle; last 3 segments with several small setose prominences on the posterior margin. Abdomen large, with 5 segments indicated, the anterior segment marked off by a line extending entirely across the upper surface, the 3 following segments are indicated by 2 pairs of lines which are visible only at the sides; second segment furnished with 3 setose tubercles in a transverse row. Caudal shield large and sculptured, the anterior portion with 3 tubercles, the middle one rather blunt and a little in advance of the others; a pointed tubercle with 2 lateral ridges in front of the posterior notch; notch deep, with a small spine at the end, behind which is a pair of larger spines. Inner branch of the uropods flattened and not nearly reaching the tip of the caudal shield, the tip subacute; outer branch very long, narrow, and incurved, extending considerably behind the tip of the caudal shield and directed obliquely upwards. First antennae a little shorter than the second,

[Begin Page: Page 301]

the first basal joint enlarged, oblong, and emarginate at the distal end at

the insertion of the small, subquadrate second joint; flagellum longer than the peduncle and composed of 9-1 1 joints. Second antennae scarcely reaching the middle of the thorax, the peduncle slender, the last 2 joints much longer than the preceding ones; flagellum a Httle longer than the peduncle, the joints furnished with short setae. Thoracic legs increasing slightly in length posteriorly and furnished with short hairs; propodi armed below with spines; dactyls curved and ending in a spine with a strong spine behind the tip.

i^^wa/^ .•— The females are smaller than the males; the head, antenna, mouth parts, thoracic legs, and anterior segments are not distinguishable from those of the male, but the abdomen is markedly different. The caudal shield is relatively smaller and less sculptured, the notch at the extremity is simple and shallow; there are 3 oblong tubercles on the anterior portion; the 3 tubercles on the next segment in front are smaller than in the male. The branches of the uropods are flattened and of subequal size; neither extends beyond the tip of the caudal shield.

Both sexes possess the power of rolling themselves up, but they do not take on so nearly a spherical form as that assumed by the species of Sphcsroma. This species was taken from pieces of sponge dredged in shallow water at San Clemente Island, August, 1893. In July, 1895, I collected several specimens at San Diego, California. The 2 sexes were found together and were associated with no other species of Sphasromid. It was inferred from the association of these forms and their similarity in all external features except in the posterior part of the body, that they represented the male and female of the same species, but this conclusion was confirmed by the dissection of several specimens. The males, however, may be distin-

guished in this species, as in other Sphaeromids, by the possession of a stylet on the second pair of pleopods. None of the females were found bearing eggs, though the ovaries were well developed and the vasa deferentia of the males were distended with spermatozoa.

The male of this species is very closely allied to the form recently described by Miss Richardson ^ as Cilic(Ba caudata gilliana. It differs in having a single median spine, instead of a pair of spines, at the anterior end of the emargination of the caudal segment, and in having usually but a single pair of teeth, instead of three pairs, at the sides of this emargination. In some cases, however, the posterior angles of the emargination may be dentiform and partly included so as to give rise to two pairs of lateral teeth. The inner branch of the uropods presents a prominent angle which stands some distance away from the sides of the caudal segment, while the point of the ramus in cmidata

1 Proc. IT. S. Nat. Mus. v. 21, p. 840, fig. 17, i8gg.

[Begin Page: Page 302]

gilliana is apparently concealed under the lateral margin. There are three tubercles instead of five at the base of the abdomen, although there are sometimes traces of another tubercle on either side of the lateral ones.

The females bear considerable resemblance to Miss Richardson's Dynamene dilatata, but the body is narrower, the epimera smaller and pointed at the sides, and the caudal shield more elongated.

Dynamene cordata (Richardson).

Plate XXXIV, Figs. 8-10.

Cilicisa cordata Richardson, Proc. U. S. Nat. Mus. v. 21, p. 839, fig. 16, 1899.

Dynamene tuberculosa Richardson, /. t. p. 833, fig. 9.

Male : — Body tapering from behind forwards. Head somewhat produced in the middle, the anterior margin thickened and forming a broad lobe on either side of the prominent rounded frontal projection. Eyes situated on postero-lateral lobes of the head, which are produced backwards. First antennae shorter than the second, the first joint oblong, having an acute process projecting below the small second joint; third joint slender and sub-cylindrical; flagellum 9-12 jointed, reaching beyond the posterior margin of the head. First thoracic segment longer than the succeeding ones, which are of subequal length. Epimera bent abruptly downwards and produced backwards into narrow but rounded points. On the posterior margins of the last few thoracic segments, especially in old specimens, is a transverse row of small double tubercles which increase in size posteriorly.

First abdominal segment with 5 double tubercles. On the convex base

of the large caudal segment is a transverse row of 3 double tubercles, the cusps in the central tubercle situated in a transverse line, those in the lateral tubercles placed the one before the other. The deep median posterior emargination is armed with 3 pairs of teeth, the pair near the apex small; middle pair often double. A prominent tubercle near the apex of the emargination. Inner ramus of the uropods lamellate, concave above, distally acute, and much shorter than the caudal segment; outer ramus large, incurved, expanded on the inner side of the base into a lobe which fits under the inner ramus. The distal portion of the outer margin armed with 4 or 5 tubercles; the tip often turned slightly outwards, and extending somewhat beyond the extremity of the caudal segment.

Length of largest specimen 15 mm.

Female: — A detailed comparison of the mouth parts, antennae, and other appendages revealed no differences between the forms considered to represent the 2 sexes of this species. The head of the males is a little more produced in front than in the females. The significance of this difference

is that the head of the male is especially adapted to fit into the under side of the large caudal segment, the 2 parts fitting together very neatly when the animal is rolled up.

There is a similar adaptation between the head and caudal segment of

the female, the head being somewhat differently shaped in relation to the form of the parts against which it abuts. Aside from this, the sexual differences are confined to the posterior portion of the body. In the female the 3 tubercles on the convex basal portions of the caudal segment are less prominent than in the male, and the posterior emargination much less deep and devoid of lateral teeth. The rami of the uropods are of subequal length and flattened, and considerably shorter than the caudal shield. The tubercles on the first abdominal segment are less prominent, and those on the posterior margins of the last thoracic segments may be absent entirely. The whole posterior portion of the body is much less developed in the female than in the male. In immature females the caudal shield is relatively longer than in the adult, the basal portion less tumid, the posterior flattened portion relatively longer, and the tubercle near the apex of the posterior emargination frequently absent. Figure 9 is taken from an immature female collected at Monterey, November, 1895. Larger females taken at San Clemente in the summer of 1894 agree perfectly with Miss Richardson's figure of D. tuberculosa.

Specimens of both sexes were taken at San Diego, San Pedro, San Clemente Island, and Monterey. Both at San Pedro and at Monterey I have collected numerous specimens from the fronds of kelp. At the latter place they were found in great abundance, and the similarity of habitat and coloration shown by the two forms led to the surmise that they were the two sexes of the same species. This surmise led to the examination of a large number of each of the forms, and it was found that all of the one form were males and all of the other females.

Dynamene cordata is reported by Miss Richardson from Catalina Island, Monterey, and Popof Island (Aleutian Islands). The female form which Miss Richardson describes as Dynamene tuherculosa is reported from Catalina Island, Gualala, and Bodega Bay, California, and Popof Island, Alaska. I have retained the specific name cordata, rather than tuberculosa, because it was applied to the male form. The fact that the generic name Cilicc^a, as it was founded after Dynamene, cannot be retained in this case, has nothing to do with the validity of the specific name.

[Begin Page: Page 304]

Dynamene glabra Richardson.

Dynamene glabra Richardson, Proc. U. S. Nat. Mus. v. 21, p. 834, fig. 11, 1899.

Specimens of this species were collected at Mendocino County, California, and at San Diego, California. The emargination of the caudal shield in this species is shallow and the caudal shield is very similar to that found in some species of SfhcBrotna. In Sphceroma rkomburum Richardson the sides of the caudal segment are folded down, forming a sort of groove on the lower side as in the present

species. In Sfhmroma octoncum Richardson there is a similar groove on the lower side of the shield and the apex is almost emarginate. In the females of Dynmnene scul^ta the posterior sinus is often very shallow, so that the genus Dynamene seems connected with SfhcBroma by various transitional stages. Dynamene glabra shows a noteworthy point of agreement with S-phceroma in that the sexes do not show the marked dimorphism found in the two preceding species. An examination of several specimens of this species showed that the males present no appreciable external differences from the females except that, as a rule, they are of somewhat larger size.

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[Begin Page: Page 305]

[Begin Page: Page 306]

EXPLANATION OF PLATE XXXIV.

Dynarnene sculpta, male.

Dynainene sculpta, male.

Dynarnene sculpta, male.

Dynarnene sculpta, male.

Dynarnene sculpta, male.

Dynarnene sculpta, male,

long ramus of the

Side view of head.

Palp of the maxillipeds.

First antenna.

Second antenna.

Last thoracic leg.

Abdomen seen from above. As the

uropods points obliquely upwards it

appears foreshortened in the figure.

Dynarnene sculpta, female. Abdomen seen from above.

Dynarnene cordata, male. Abdomen seen from above.

Dynaviene cordata, female. Abdomen seen from above.

Dynarnene cordata. Last thoracic leg.

Figures 6, 7, 8, and 9 drawn to the same scale. All the figures were

drawn with the aid of a camera.

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