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NOTES ON SIPHONOPHORES
2. A REVISION OF THE ABYLINAE

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No. 1—*Notes on Siphonophores. 2. A Revision of the Abylinae*

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[1] Papers from the "Dana" Collection No. 31, and Contribution No. 602 of the Woods Hole Oceanographic Institution.

INTRODUCTION

Probably no plankton collection other than that of the "Discovery" has yielded such an abundance of siphonophores for studies of geographical distribution as that of the Carlsberg Foundation's Oceanographical Expedition Round the World, 1928–30, on the "Dana" (Carlsberg Foundation, 1934; 1944). In addition, the "Dana" material has provided an extensive series of abylids which were represented in earlier collections by only an occasional individual. Thus, it provides one of the first opportunities in recent years to re-examine this subfamily systematically. As a result, a number of misconceptions that have appeared in the literature during the last seventy-five years or more[1] can now be amended. From our observations of well-preserved colonies, the polygastric generation of most of the known members of this group can now be recognized with little difficulty. In addition, the characteristics of the eudoxids for the long established genera are now well defined. The new information at hand is sufficient to make it worthwhile to record our observations at this time with the hope of establishing a more natural grouping of the Abylinae, similar to that already developed by Totton (1932, pp. 345–346) for the Diphyinae, and to call attention to the points requiring further study when better material becomes available.

Several important contributions to our knowledge of the Abylinae are afforded by the "Dana" specimens listed in the appendix to this

[1] It should be remembered that earlier workers whose observations do not always appear correct, were handicapped in the days before formalin came into general use as a preservative (about 1900). Due to the shrinkage of specimens preserved in alcohol, they were forced to make most of their observations and sketches in the field and could not recheck them later. Dr. Bigelow informs me, for example, that all of Dr. Mayer's figures were made from life, in the field, for this reason and that he did not have the specimens available when writing his papers.

report. (1) Four new species of *Abyla* are reported: *A. schmidti* and *A. tottoni* (both previously confused with *A. trigona*), *A. ingeborgae*, (with an extra facet similar to *A. haeckeli*) and *A. brownia*. In addition, a new species, *A. peruana*, found in the "Albatross" material in the U. S. National Museum is described. (2) *Abyla carina*, long considered as a synonym for *A. trigona*, is reinstated as a good species. (3) The inferior nectophore of *Abyla bicarinata* Moser is now definitely known. (4) The truly prismatic superior nectophores of *A. haeckeli* were taken together with cormidia and small inferior nectophores attached within the hydroecium of several superior nectophores. (5) Two species, *leuckartii* and *dentata* formerly referred to the genus *Abyla*, are now transferred to the genus *Ceratocymba*. (6) The eudoxid of *Ceratocymba dentata* Bigelow previously identified by Totton (Moore, 1949) is figured and described for the first time. (7) The superior nectophore of a third new species, apparently a transitional one between *dentata* and *sagittata* is also described as *C. intermedia*. (8) It is possible to corroborate Bigelow's (1918) characters for distinguishing the bract of *Ceratocymba sagittata* Quoy & Gaimard from those of all other abylids. (9) Several additional, though minor, characters have been found for distinguishing more readily the superior nectophores and gonophores of *Abylopsis tetragona* Otto and *A. eschscholtzii* Huxley — even despite poor preservation — than was possible with Bigelow's (1931) criteria. (10) Well preserved gonophores can now be identified at least to genus in the absence of the bract, in all cases where the eudoxid is known. (11) Finally, four genera, *Pseudabyla*, *Pseudocymba*, *Pseudabylopsis* and *Abylopsoides*, are provisionally described. The structure of these suggests a tendency, not generally recognized among abylids, for the superior nectophores to develop asymmetrically as well as to increase or decrease the number of facets.

The revision is chiefly based on the "Dana" material, but I have also been able to compare this series with specimens taken on the "Albatross" and "Bache" in the collections of the Museum of Comparative Zoology at Harvard College and of the U. S. National Museum. These specimens were used in studies of the group made by Bigelow (1911; 1913; 1918; 1919) and I have therefore had the opportunity of checking my identifications with his. I have also had the privilege of receiving Dr. Bigelow's friendly advice and criticism, which encouraged me to attempt such a comprehensive review. In

addition, I wish to thank Captain A. K. Totton of the British Museum for his generosity in providing me with sketches, a discussion of his observations, and other material. Without his ready assistance I could not have clarified the status of *Abyla trigona* and *A. carina*. Similarly, Mr. A. Franc of the Museum National d'Histoire Naturelle, Paris, has kindly helped me in ascertaining the identity of Quoy and Gaimard's *Abyla trigona*. Dr. H. Engel of the Zoölogisch Museum, Amsterdam, loaned me not only the "Siboga" specimens of *A. trigona*, but also the type of *A. haeckeli*. I am also extremely indebted to Dr. Å. Vedel Tåning, Director of the Marinbiologisk Laboratorium, Charlottenlund, Denmark, for entrusting me with the examination of the "Dana" siphonophores and for his hospitality at the laboratory on two occasions. Finally, I am beholden to the Milton Fund for the grant to Dr. Bigelow which enabled me to make the first visit to Denmark in 1934 and to the Rask-Orsted Foundation for a most generous grant which permitted me to make a second trip in 1946.

ABYLINAE L. Agassiz, 1862

Within recent years, the group of species under discussion here have been generally accepted, with two exceptions (Totton, 1932, p. 328; Leloup, 1934, p. 4), as forming the Subfamilies, Abylinae L. Agassiz and Ceratocymbinae Moser, of the Family Diphyidae (Bigelow, 1911; 1931; Moser, 1925). Totton (1932), however, elevated the Abylinae to the status of a family because observations of living specimens led him to believe that the functions of the nectophores were so distinctive that separation from the Diphyidae was warranted. Whatever the merits for such action may be, function cannot be used as a means for distinguishing siphonophore families in most plankton collections. It therefore seems to me that structure, rather than function, is preferable for differentiating the families in this group, in a report such as this which is based entirely on preserved specimens. As a result, the closely related genera under consideration are placed in the Abylinae, a subfamily of the Diphyidae,[1] following other recent students of the group (Bigelow, 1911; Moser, 1925; Browne, 1926) rather than Totton (1932) and Leloup (1934).

[1] The Diphyidae, broadly speaking, include all siphonophores with two nectophores of dissimilar structure (Bigelow, 1911). For exceptions, see remarks in next paragraph on certain monophyid species.

I do subscribe, however, to certain innovations made by Totton as they appear to lead to a more natural grouping. In discussing his Abylidae, Totton (1932, p. 331) compares *Ceratocymba* (under the name *Diphyabyla*[1]) with *Abyla*, in such a way that it is to be presumed that he tacitly, at least, abandoned the Subfamily Ceratocymbinae of Moser (1925, p. 267), as had Browne (1926, p. 58) before him, in accordance with Bigelow's (1911, pp. 215–216) earlier views. This course has also been taken more recently by Leloup (1934, p. 4). Most recent authors have agreed that the peculiar prolongation of the apex of the superior nectophore of *Ceratocymba sagittata* hardly seems sufficient to warrant a special subfamily for this one species. At that time the genus was monotypic but, as already mentioned, two species previously referred to the genus *Abyla*, *leuckartii* and *dentata*, together with a new species, *intermedia*, are at present included in it. These form a well-defined transition from a species with no apical prolongation (*leuckartii*) to a marked one (*sagittata*) (Fig. 1)[2]. In short,

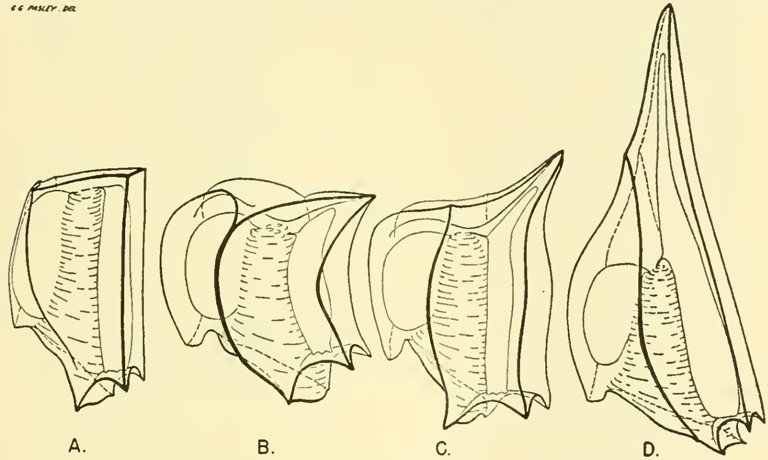

Fig. 1. Outline sketches of superior nectophores of *Ceratocymba*. A. *Ceratocymba leuckartii*. B. *C. dentata*. C. *C. intermedia*. D. *C. sagittata*.

[1] This name was superseded by *Ceratocymba sagittata* Quoy and Gaimard, when it was definitely proven that the eudoxid of that name belonged to the superior nectophore of Lens and Van Riemsdijk's *Diphyabyla hubrechti* (Moser, 1913; 1925; Bigelow, 1918, p. 412).

[2] The drawings throughout this paper have been prepared by Mr. Gale G. Pasley, to whom I am indebted for his painstaking efforts to devise a technique for illustrating transparent, geometric objects such as siphonophores, for his accurate observation of obscure details, and for his cooperation in making the drawings conform to the rather unusual requirements occasioned by the peculiarities of the group.

there now appears to be less justification than ever for maintaining a separate subfamily for *Ceratocymba sagittata*. Likewise, it is now agreed (Leloup, 1934; Bigelow and Sears, 1937, pp. 4–5) that Totton's (1932, p. 327) treatment of monophyid species results in a more natural classification of the heterogeneous genera previously referred to the Monophyidae. Within the limits of the present paper, *Enneagonum hyalinum* Quoy and Gaimard is the only such species definitely proven to be monophyid. In the Abylinae, as here defined, then, are included *E. hyalinum* and *Ceratocymba sagittata*, together with three other species now assigned to that genus.

The Abylinae differ from the other subfamilies of the Diphyidae in that the superior nectophores are rather generally prismatic and are distinctly smaller than the inferiors (with the exception of the modification found in *Ceratocymba sagittata*). The inferior nectophores are typically diphyid in character, with a basic plan of five ridges. There is a definite tendency, however, for one or another of the ridges to be suppressed (*Abyla*, *Ceratocymba* and *Bassia*) while others may be greatly expanded to form wing-like structures (*Abyla*). Supernumerary ridges may also be present (*Ceratocymba*). The bracts, like the superior nectophore, are prismatic and are larger and more conspicuous in the known species of *Ceratocymba* than those of other diphyids. Despite the diverse shapes of the bracts in this subfamily, they all have a basic plan which has been homologized and well illustrated by Totton (1932, p. 337, text fig. 17). A modified copy of his figure (Fig. 2) is included here to differentiate the bracts more clearly than can be done by words alone. It will be noted that in addition to differences in external shape, various portions of the somatocyst may be absent. Thus, in some the anterior median horn (or oleocyst) is missing, in one the median dorsal descending branch, and in another, the two ventro-lateral branches. Abylid gonophores are usually larger and more robust (*Abyla*, *Ceratocymba*, *Enneagonum*) than those of other diphyids and in many ways resemble the inferior nectophores of the group especially in the arrangement and size of the oral teeth. In one genus (*Abylopsis*), they appear both in size and in the arrangement of the ridges somewhat like those of the Diphyinae but the prominent apophysis, especially in the young stages, readily distinguishes them. The latter is markedly developed in all known genera of this group.

Before proceeding further, it appears desirable not only to present

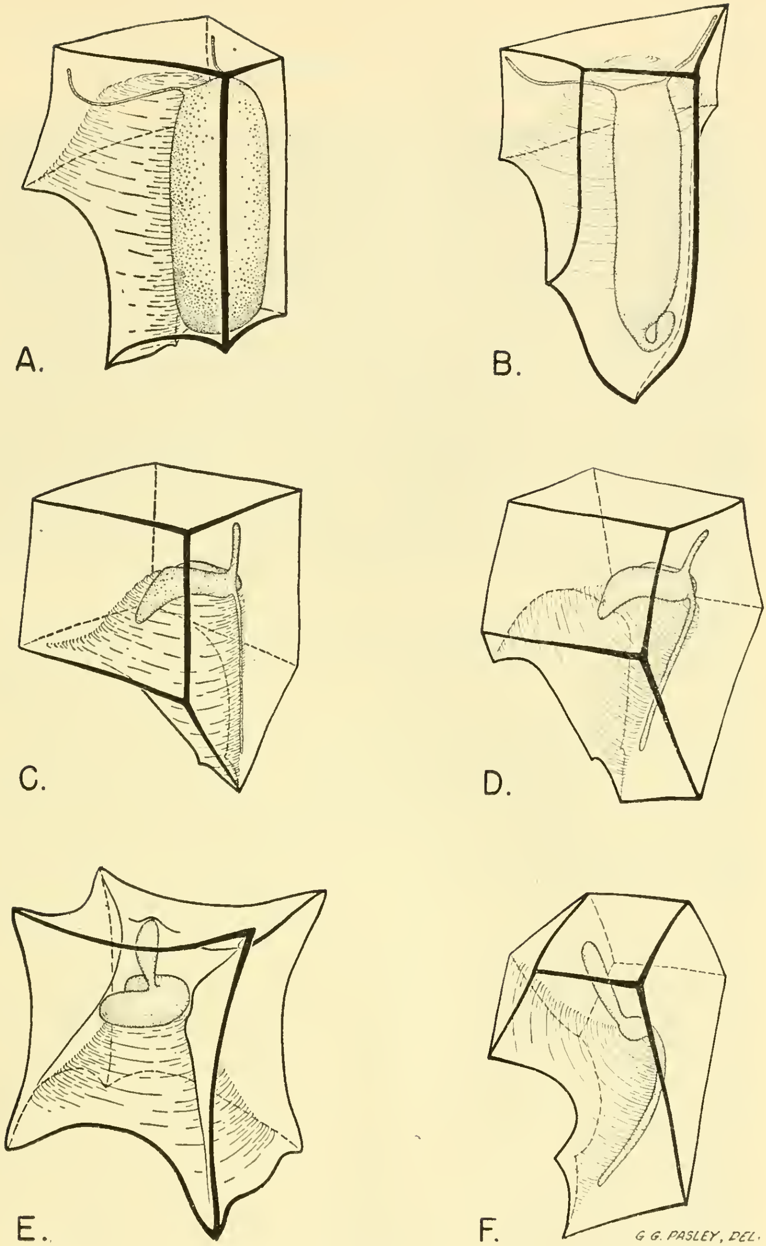

Fig. 2. Bracts of Abylinae. (After Totton, 1932, Text fig. 17). A. *Abyla* sp., with a dorsal facet of about 5 mm. in length. B. *Ceratocymba leuckartii*, with a dorsal ridge of 5–6 mm. C. *Abylopsis tetragona*, with a dorsal facet of 2.7–4.6 mm. in length. D. *Abylopsis eschscholtzii*, with a dorsal facet of 2 mm. in length. E. *Enneagonum hyalinum*, with a dorsal facet 10.3 mm. in greatest length. F. *Bassia bassensis*, with a dorsal facet of 5 mm. in length.

a problem which has arisen as a consequence of finding a half dozen superior nectophores of some new asymmetrical abylids in the "Dana" samples, but also to indicate my reasons for solving it by describing them as new species. These specimens are peculiar in that they have a curious asymmetry not found in other previously known members of the group. Therefore, since there are only one or two of a kind, it has been said that they are "monsters" (Totton, 1952). It seems to me difficult to draw a dividing line between "monsters" and valid species in this instance. One cannot say that because there is only one of a kind that it is a freak of some sort. In the literature, there are numerous examples of a genus or species described from one or two individuals. Over the years these have proven to be well-founded. On the other hand, there are examples of genera and species which were described when a good series were available for study and which have later been relegated to the synonomy of other well-known forms. A small number of specimens, then, is not a good reason for ignoring them.

Furthermore, on the basis of the present generic definitions for abylids, it would be difficult to draw the line between "monsters" and valid genera. In the Abylinae, the latter are differentiated by the number and arrangement of facets and ridges of the superior nectophore, in conjunction with the character of the hydroecium. It happens that in such well-established genera as *Abyla* and *Ceratocymba* the presence of two horizontal ridges subdividing the ventrolateral facets and an apical transverse ridge distinguishes the superior nectophores of *Abyla* from those of *Ceratocymba*. Both are symmetrical. It could equally well be, it seems to me, that the arrangement of the ridges or facets might be such as to make the superior nectophore asymmetrical. This is the situation found in *Pseudabyla*, *Pseudocymba* and *Abylopsoides* as described below. (In *Pseudabylopsis*, the asymmetry has chiefly developed in the region of the hydroecium.) Are we then to consider that all asymmetrical forms are "monsters" and symmetrical ones valid species? It hardly seems reasonable, especially as among the hundreds of thousands of specimens of *Abylopsis* examined within the past few years only a half dozen have been "monsters" and another half dozen mutilated, but recognizable as belonging to one of the known species. Were members of the genus *Abylopsis* highly variable, such variability should be described by a normal distribution curve. Obviously, from the above figures, this is not true, at least within the wide limits to be expected, if the "monsters" are extreme cases. Although not nearly as many specimens of *Abyla* and *Ceratocymba* have been examined, there is no indication that they are highly variable. In short, we have a series of specimens, although asymmetrical, which are as obviously related to the known abylids as are the previously described abylid genera.

One further point is of interest in arriving at our conclusion concerning these specimens. There appears to be a tendency among coelenterates for a seemingly good species to appear in a particular locality, often in considerable numbers, and after a time to disappear, never to be seen again. Examples that readily come to mind are the leptomedusan species, *Pseudoclytia pentata* (Mayer, 1910) and the siphonophore, *Dromalia alexandri* (Bigelow, 1911). These seem to have been accepted as legitimate species, because a number of specimens were found in tolerably good condition. In describing them there was no reason to suppose that they would vanish. There is, of course, always the chance that they will reappear sometime in the future. Consequently, they have not been discarded as freaks. It is conceivable that the same may be true of the new abylid genera described below.

Finally, if these specimens were described without placing them in an appropriate place in the taxonomic scheme, their true affinities would not be clear. As a result, they would probably be overlooked by future students. Hence, there might be a considerable delay in coming to an understanding as to their true position among siphonophores. On the other hand, if they are treated as they are here, their status may be clarified sooner. In short, it appears that there is sufficient justification for describing them as new.

In describing the genera of the Abylinae, in general, it appears wise to base the definitions primarily on the superior nectophores because without these the colony could not exist. Among the long established genera, the arrangement of the facets and ridges on the superior nectophores appears to provide the most reliable characters upon which to differentiate the genera one from another (Figs. 3–4). Other secondary characters are to be found in the depth of the hydroecium, in the shape of its opening, in its position with reference to the somatocyst and nectosac, and in the shape of the somatocyst, as well as in the character of the bract (Fig. 2) and the inferior nectophore (Fig. 5).

In only two genera, *Pseudabylopsis* and *Abylopsoides*, is it impossible

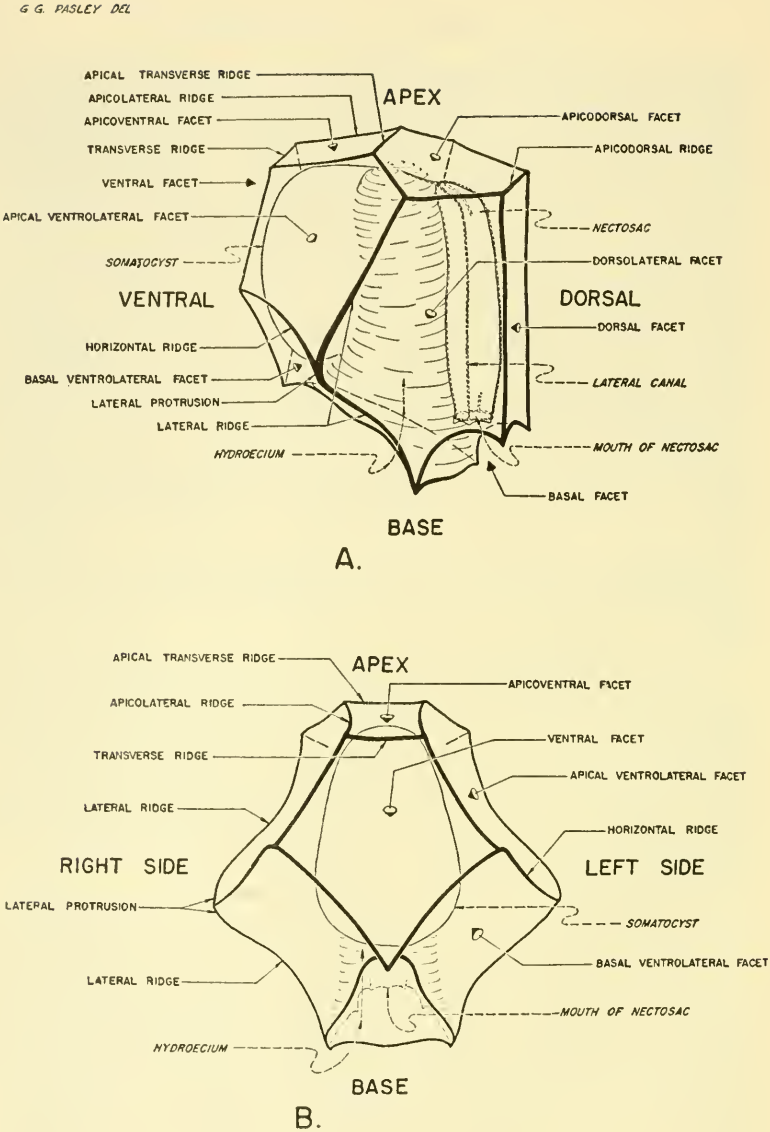

Fig. 3. Diagrammatic drawing of superior nectophore of *Abyla haeckeli*. A. Dorsolateral view. B. Ventral view.

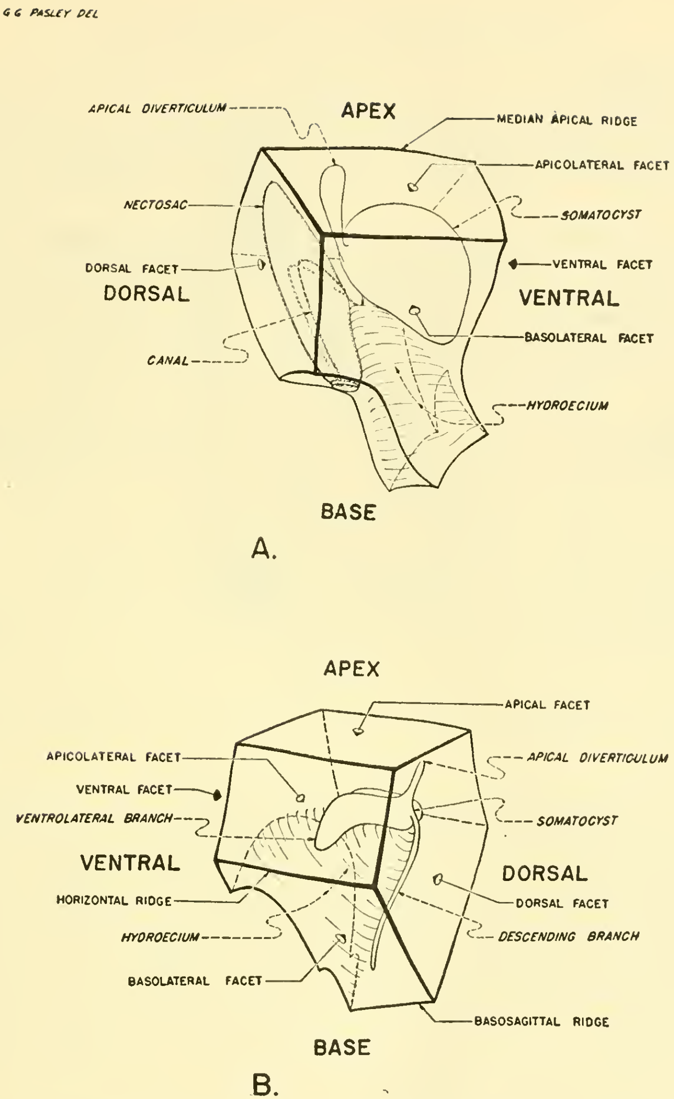

Fig. 4. A. Diagrammatic drawing of superior nectophore of *Abylopsis*. Dorsolateral view. B. Diagrammatic drawing of bract of *Abylopsis*. Dorsolateral view.

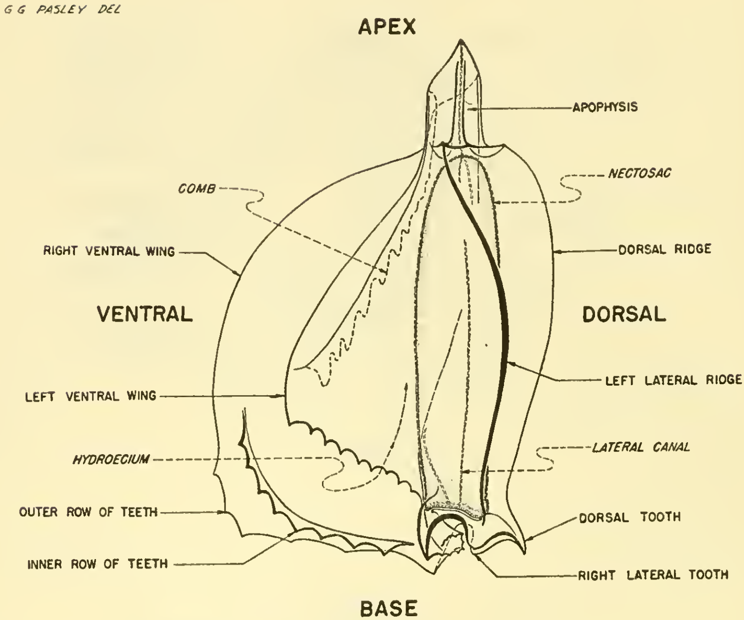

Fig. 5. Diagrammatic drawing of inferior nectophore of *Abyla tottoni*. Left lateral view.

to use the facets and ridges as a basis for separating them from all others. Thus, specimens have been found with an apical facet (as in *Ceratocymba*) or with a transverse apical ridge (as in *Abyla*). As a result were we to use merely the number and arrangement of the facets in each case in devising a key, the various species of *Pseudabylopsis* or *Abylopsoides* might be referred to *Abyla*, or *Ceratocymba* or the two closely allied genera, *Pseudabyla* or *Pseudocymba*. Yet, one recognizes a close affinity with *Abylopsis* because of the position of the hydroecium relative to the nectosac and somatocyst, as well as in the basal configuration. In most specimens of *Pseudabylopsis* and *Abylopsoides* the opening to the hydroecium is essentially a square with the corners marked by more or less well defined teeth. This is in contrast to the four genera (*Abyla, Ceratocymba, Pseudabyla, Pseudocymba*) in which this opening is more nearly triangular coming to a point beneath the somatocyst. The hydroecium itself in *Pseudabylopsis* and *Abylopsoides* is situated either below the somatocyst or is only partially intruded between the somatocyst and nectosac as in *Abylopsis*. On the other hand, in the other four genera, it completely separates these structures.

For convenience, we[1] have devised purely arbitrary keys, and we have included synonymies, figures, and sufficiently detailed descriptions of all the Abylinae in our discussion, to distinguish the genera and species which we have examined, without recourse to the widely scattered papers which have appeared in the last 125 years and which are not available in many libraries in this country.

The first key affords a means for separating the superior nectophores of the Abylinae into genera. As the parts are so often found separated from one another we have prepared keys not only for the superior nectophores, but also for the inferior nectophores, the bracts, and the gonophores, insofar as these are known. For a colony (i.e., both nectophores attached), the key to the superior nectophores will be the easier to use. The other keys are based on the obvious characters and structural peculiarities which we have found the most useful in our examination of the "Dana" material for distinguishing the various genera even when these are not too well preserved. The keys, as stated earlier, are thus entirely artificial and make no attempt to indicate possible relationships.

Care must be taken in using the keys to species because many specimens are so damaged or so shrunken by the preservative that they cannot always be recognized by any particular character. For this reason, it is almost impossible to discover relative proportions which might prove distinctive for any given species. We believe, however, that we have found characters to use in the keys which will be constant no matter what the conditions of the specimen. Nevertheless, in many cases, identification should not be made with certainty without consulting the descriptions and figures of the individual species given below.

To use the keys or read the subsequent descriptions, it is necessary to understand the terms used in describing bilaterally symmetrical

[1] My assistant, Miss Joan A. Brown, has been especially helpful in discussions as to the characters which prove most helpful in identifying the individual parts. Her careful attention to such details while sorting hundreds of thousands of specimens has made the burden of the work much lighter. In fact, it was she who first called my attention to the first colony of *Abyla bicarinata* and who found the specimens of *Abyla ingeborgae*, *A. brownia*, *Pseudabyla irregularis*, *P. dubia*, and the oddities referred to *Abylopsoides* and *Pseudabylopsis*.

animals as applied to accounts of radially symmetrical forms such as siphonophores, because this convention has resulted in so much confusion and so many inconsistencies in earlier papers (Bigelow and Sears, 1937, p. 4). The same arbitrary system, as was adopted earlier by Bigelow and Sears (1937, pp. 3–4) has been accepted here to conform with earlier work (Bigelow, 1911, 1918, 1919, 1931): "dorsal" is used for the abaxial side of eudoxids and of both nectophores, "ventral" for the axial, "anterior" or "apical" for the aboral end of the nectophores, and "posterior" or "basal" for the oral end, i.e., the end containing the opening to the nectosac. In the bracts, the upper end when the bract is attached to the stem becomes the apical or anterior end. "Left" and "right" sides of the bract then become automatically defined as they do in bilaterally symmetrical organisms.

It should also be noted that in describing an individual species, generic characters are not repeated unless needed for emphasis or clarity of some particular point. Furthermore, minute details of serrations on the ridges, the arrangement of the canals, etc. are not included unless they will prove helpful in distinguishing one species from another. In many instances, there appears to be considerable variation, in this respect, younger specimens being more strongly serrated than older ones. This suggests that serrations may wear off with age.

Finally, since so many specimens were damaged in one part or another, we have examined a series of individuals, whenever possible, to make sure that the specimens drawn were representative of the species. If only a single specimen is available, the details of that individual have been carefully reproduced. We believe the illustrations are thus more nearly like the living specimens. In most cases, the drawings seem quite characteristic of all sizes, except for the gonophores. The only specimens of these which were sufficiently well preserved to study in any detail were generally the smaller ones which were shielded within the bracteal hydroecium. For this reason, the apophyses are probably somewhat more prominent than in older specimens. The diagnostic characters, however, are present even in very young specimens, but the changes in the relative size and shape of the apophysis with the growth to the gonophore as a whole are not yet known.

Key to Known Genera of the Abylinae

A. Superior nectophores.

1. Nectophores with roughly square opening to the hydroecium; hydroecium lies below somatocyst or only partially separates the latter from the nectosac 2
   Nectophores with roughly triangular opening to the hydroecium; hydroecium separates somatocyst from nectosac 6
2. Nectophores with median apical ridge, dorsal and ventral facets, as well as lateral facets subdivided by a horizontal ridge 3
   Nectophores with one or more of these facets replaced by ridges or subdivided by the presence of additional ridges 4
3. Somatocyst with apical diverticulum . . . . *Abylopsis* Chun 1888
   Somatocyst without apical diverticulum . . . . *Bassia* L. Agassiz 1862
4. Nectophores with opening to nectosac next to dorsal wall of hydroecium at the base of a large triangular basal facet . . . .
   Enneagonum Quoy and Gaimard 1827
   Nectophores with opening to nectosac at base of rectangular or pentagonal basal facet next to dorsal wall of hydroecium 5
5. Nectophores with more than seven facets . . . . *Pseudabylopsis* n. gen.
   Nectophores with fewer than seven facets . . . . *Abylopsoides* n. gen.
6. Nectophores with apical transverse ridge 7
   Nectophores without apical transverse ridge 8
7. Ventral and dorsal facets present . . . . . . *Abyla* Quoy and Gaimard 1827
   Ventral or dorsal facet absent . . . . *Pseudabyla* n. gen.
8. Ventral and dorsal facets present . . . . *Ceratocymba* Chun 1888
   Ventral and/or dorsal facet absent . . . . *Pseudocymba* n. gen.

B. Inferior nectophores.

1. Nectophore with five ridges . . . . *Abylopsis* Chun 1888
   Nectophore with four ridges 2
2. Basal teeth slightly developed projections . . . . . . *Bassia* L. Agassiz 1862
   Basal teeth large and obvious 3
3. Right lateral ridge suppressed . . . . *Abyla* Quoy and Gaimard 1827
   Dorsal ridge suppressed; a supernumerary ridge is present on right ventral wing . . . . *Ceratocymba* Chun 1888

C. Bracts.

1. Bracts with median dorsal ridge 2
   Bracts with a dorsal facet rather than median dorsal ridge 3
2. Bract with two slender branches of somatocyst extending forward toward ventro-lateral margins and a stout median descending branch curved dorsad at posterior end . . . . *Ceratocymba* Chun 1888
   Bract without ventro-lateral branches to somatocyst; somatocyst has

a thin descending branch and a somewhat swollen apical horn......
Bassia L. Agassiz 1862
3. Bract imperfectly truncated pyramid; somatocyst with very much inflated descending branch and two very slender branches extending toward ventro-lateral margins.......*Abyla* Quoy and Gaimard 1827
Bract not of this type.......................................4
4. Bract cuboidal; somatocyst with apical horn and two short, stubby ventro-lateral branches.......*Enneagonum* Quoy and Gaimard 1827
Bract prismatic; somatocyst with a slender descending branch, a small apical horn and two short, inflated ventro-lateral branches.........
Abylopsis Chun 1888

D. Gonophores.
1. Gonophores with four relatively inconspicuous teeth...............2
Gonophores with five prominent teeth...........................3
2. Ventral ridges diagonal apically................*Abylopsis* Chun 1888
Ventral ridges vertical; all ridges opaque (Moser, 1925, pl. 22, figs. 6 and 8)..................................*Bassia* L. Agassiz 1862
3. Dorsal, one lateral, and one ventral ridge incomplete; deep pockets beneath apophysis...........*Enneagonum* Quoy and Gaimard 1862
Dorsal ridge, alone, incomplete.................................4
4. Lateral ridges meet in arch at their apical ends, forming a pocket; apicolateral ridge with indentation beneath it; these ridges lie well below apex of nectosac.............*Abyla* Quoy and Gaimard 1827
Lateral ridges joined by obvious apicodorsal ridge, it and apicolateral ridge lack pockets; both are situated above apex of nectosac.......
Ceratocymba Chun 1888

Abyla[1] Quoy and Gaimard 1827

Genotype: Abyla trigona Quoy and Gaimard 1827

Generic characters

Superior nectophore (Figs. 6, 8, 9, 10, 12, 13, 14). In *Abyla*, the superior nectophores have ten or eleven facets. Like all abylids with a triangular hydroecial opening, the superior nectophores have an apical facet rather than a median apical ridge. In addition, they are characterized by an apical transverse ridge subdividing this surface into an apicodorsal facet and an apicoventral portion. The latter merges with the shield-like ventral surface to form a single facet in all

[1] As defined here the genus *Abyla* includes *A. trigona* Quoy and Gaimard, *A. carina* Haeckel, *A. haeckeli* Lens and Van Riemsdijk, *A. bicarinata* Moser, *A. schmidti*, n. sp., *A. ingeborgae* n. sp., *A. brownia* n. sp., *A. tottoni* n. sp., and *A. peruana* n. sp.

but two of the known species. In these, a second transverse ridge further subdivides that facet into ventral and apicoventral facets. Lateral ridges extending from the lateral corner of the apicodorsal facet to the basal margin of the hydroecium divide the sides into dorsal and ventral facets. The latter are subdivided by a horizontal ridge into apical and basal portions. In addition, there is an almost square basal facet surrounding the opening to the nectosac and a rectangular dorsal one.

In most species there may be fine serrations on the ridges, especially on the basal half, but they seem to "wear off" as they are not always present. These fine serrations are omitted from the drawings, because they do not show with the magnification used. The more rugged serrations are, however, shown and it is these which appear distinctive.

The arrangement of the internal structures is quite unlike that of other diphyids. Thus, in *Abyla*, as well as in *Pseudabyla*, *Pseudocymba*, and most species of *Ceratocymba*, the hydroecium is relatively deep, extending nearly the full height of the nectophore. It is wedged in between a large oval somatocyst on its ventral side and a long narrow nectosac on the dorsal. In *Abyla*, however, the keel beneath the somatocyst is at about the same level as the opening to the nectosac. The four radial canals, a dorsal, a ventral and two laterals diverge from a point near its apex.

Inferior nectophore (Figs. 7, 11, 15). The inferior nectophores of *Abyla*, exclusive of the long tapering apophysis, are often only slightly longer than they are wide. The right lateral ridge is completely suppressed,[1] so that a dorsal and left lateral are the only ones present, other than the two ventral wings. These in reality are the expanded and modified ridges forming the hydroecium. On the inner apicoventral surface close to the margin of the left ventral wing is a comb with teeth. These vary in number with the species. The basal margin of this wing has a series of jagged serrations. The number of these serrations varies, but this appears to be an individual variation rather than a specific one, insofar as we have been able to determine. The right ventral wing, on the other hand, has two rows of teeth separated by a thickening along the basal margin. These may also continue for a slight dis-

[1] Haeckel (1888a, p. 158) states that the "right dorsolateral ridge [i. e., right lateral] is the smallest and more rudimentary," and Bigelow (1911, p. 214) says that "the right lateral ridge is nearly but not altogether, suppressed." As noted by Gegenbaur (1860, p. 341), the right lateral ridge is absent. This is true not only of all the specimens in the "Dana" collection, but also of those specimens of Quoy and Gaimard (1827), Haeckel (1888a), and Bigelow (1911) which have recently been re-examined.

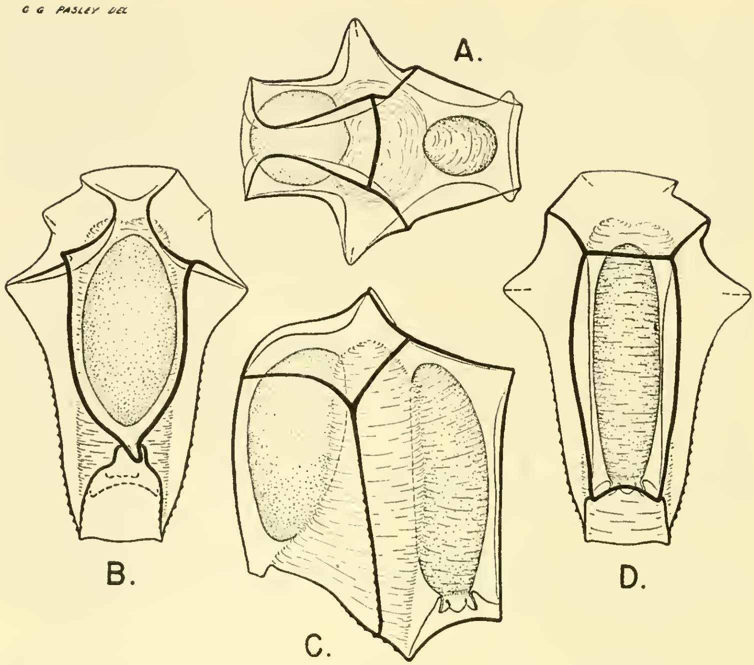

Fig. 6. Superior nectophore of Quoy and Gaimard's *Abyla trigona* of about 7 mm. in height. A. Apical view. B. Ventral view. C. Lateral view. D. Dorsal view.

tance along the ventral margin. The exact size, configuration and dentition of the basal margin is characteristic and affords a means for separating the species.

The absence of the right lateral ridge has seemingly effected a slight shift in the position of the right subumbral canal. Its insertion on the circular canal lies just above the right lateral tooth (mentioned below), but thence it bends rather sharply ventrad and comes to lie below the right ventral wing. It follows the sinuous course of the latter toward the apex where it joins the apical canal in a normal way. The other three canals are in their usual position.

There are five robust triangular oral teeth which are usually serrated. The two lateral ones curve inward toward the opening of the

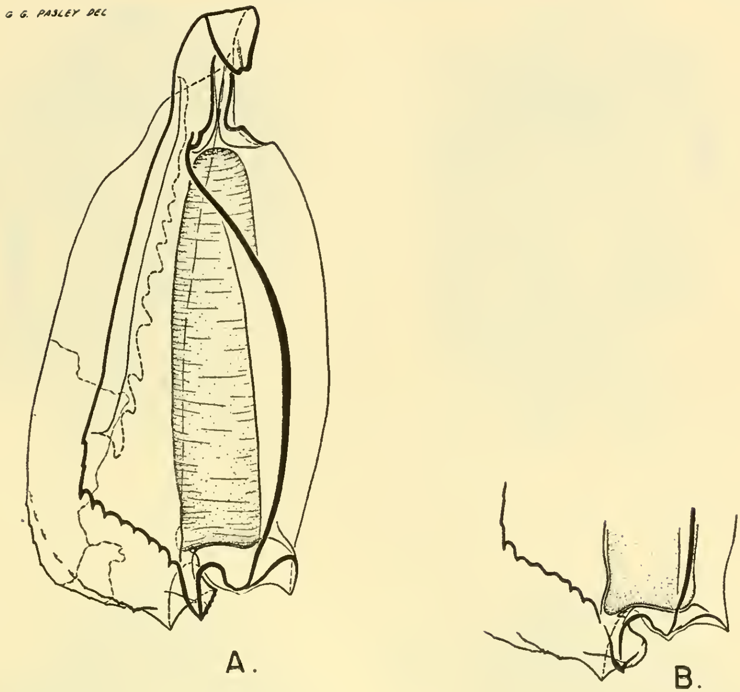

Fig. 7. Inferior nectophore of Quoy and Gaimard's *Abyla trigona* of about 24 mm. in height now referred to *A. carina*. A. Left lateral view. (Dashed line indicates fragments which have broken away from nectophore.) B. Detail of basal portion of second specimen of about 28 mm.

nectosac. The right lateral tooth may, however, be weaker and somewhat displaced. The dorsal tooth and the two ventral teeth are essentially straight. The lip between the two latter is thickened and on its free dorsal edge next to the opening of the nectosac, there is an ovoid serrated rim.

Bracts (Figs. 2, 26). Cormidia have been found on stems of the superior nectophores of most species of *Abyla* so that we now know that the "Amphiroa" type of eudoxid, usually referred to *A. trigona*, is characteristic for the genus as a whole. However, the identity of specimens described earlier by Gegenbaur (1859; 1860), Haeckel

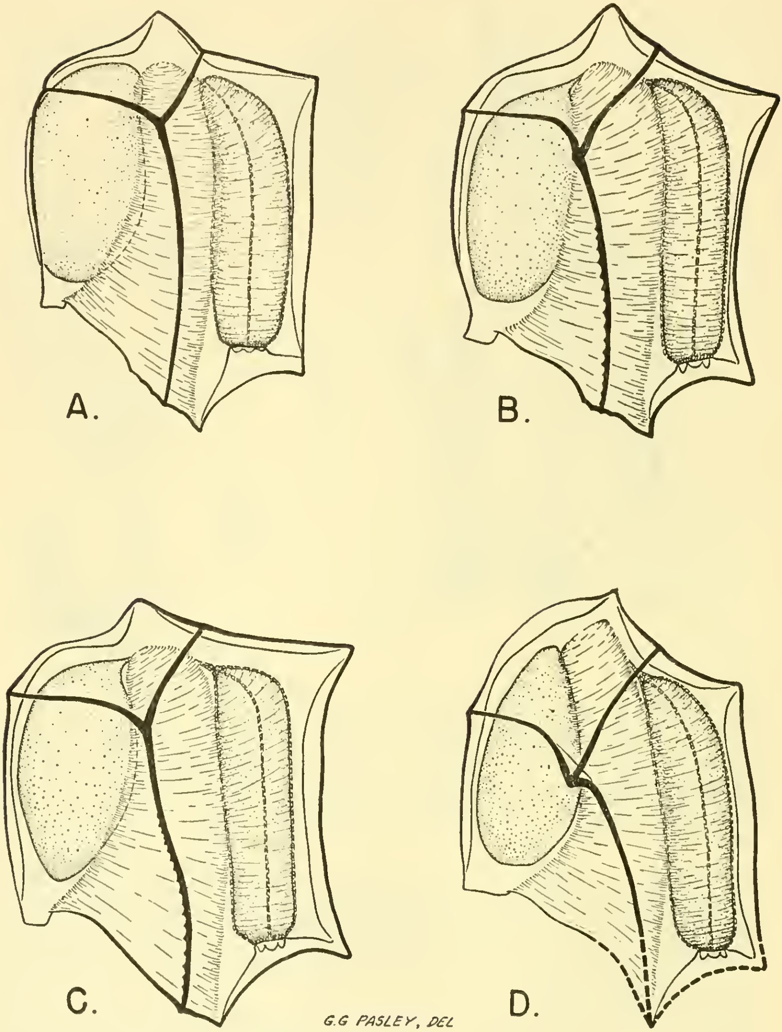

Fig. 8. Lateral view of superior nectophores. A. *Abyla carina* with a dorsal facet of 6.9 mm. in length. B. *A. trigona*, with a dorsal facet of 4.9 mm. in length. C. *A. schmidti*, with a dorsal facet of 7.4 mm. in length. D. *A. peruana*, with a dorsal facet of about 3.6 mm. in length.

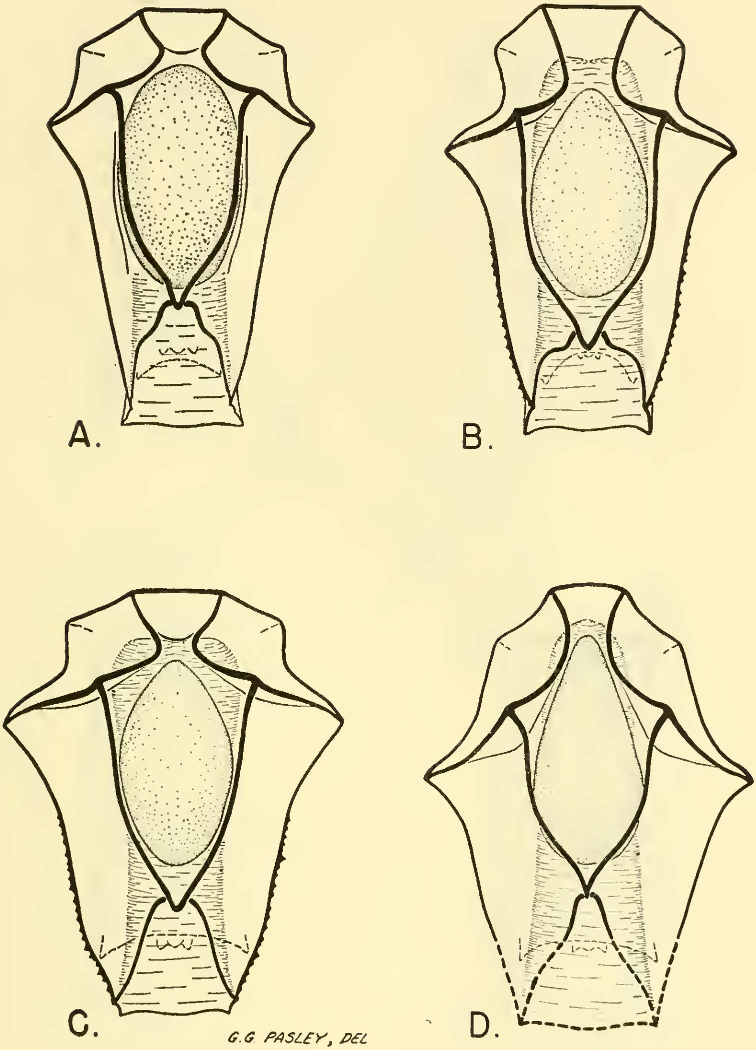

Fig. 9. Ventral view of same specimens as in Figure 8. A. *Abyla carina*. B. *A. trigona*. C. *A. schmidti*. D. *A. peruana*.

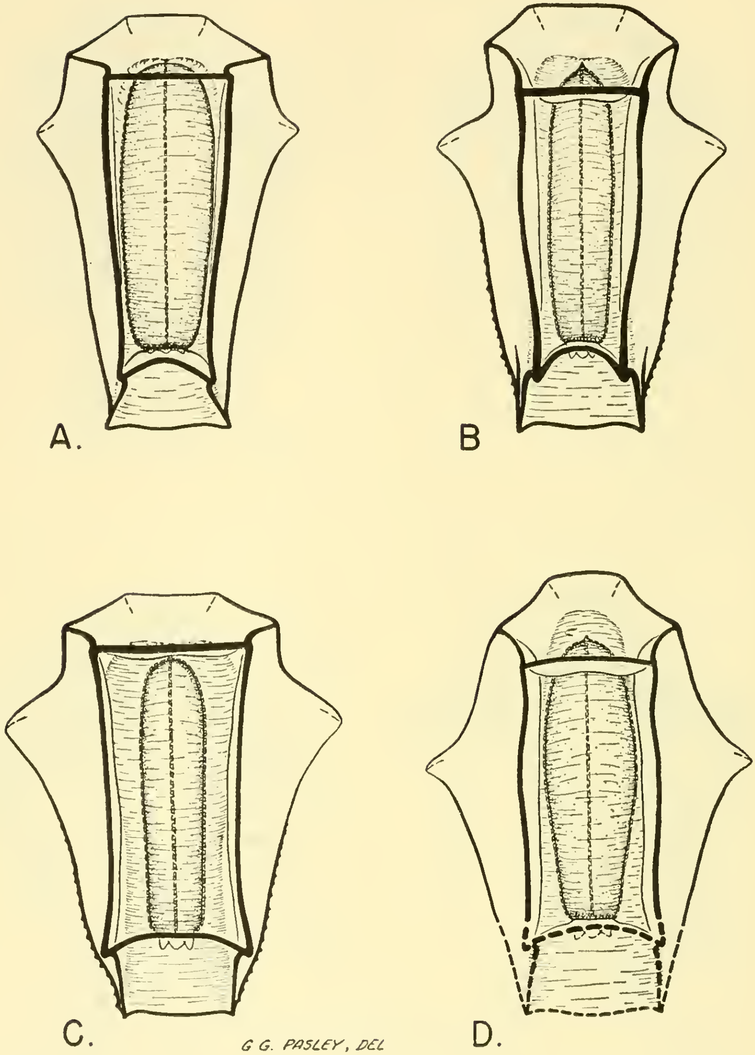

Fig. 10. Dorsal view of same specimens as in Figure 8. A. *Abyla carina.* B. *A. trigona.* C. *A. schmidti.* D. *A. peruana.*

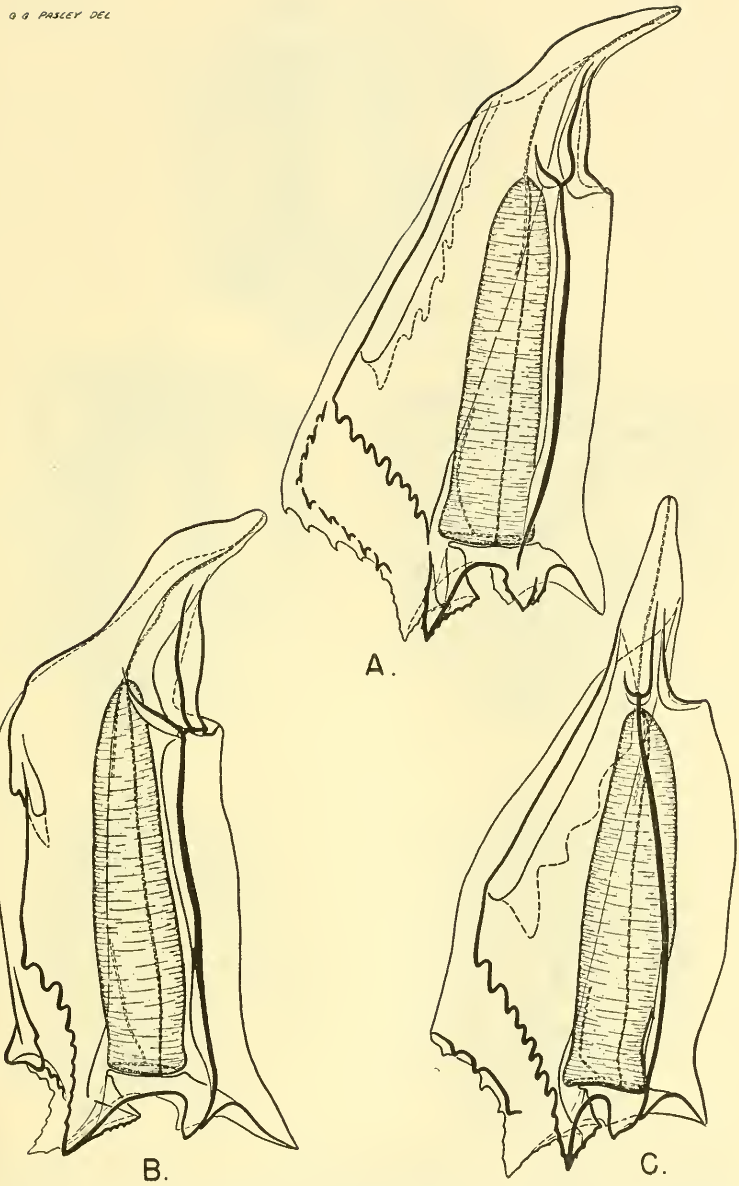

Fig. 11. Left lateral view of inferior nectophores. A. *Abyla trigona*, 10.8 mm. in length. B. *A. haeckeli*, 2.5 mm. in length. C. *A. ingeborgae*, 12 mm. in length.

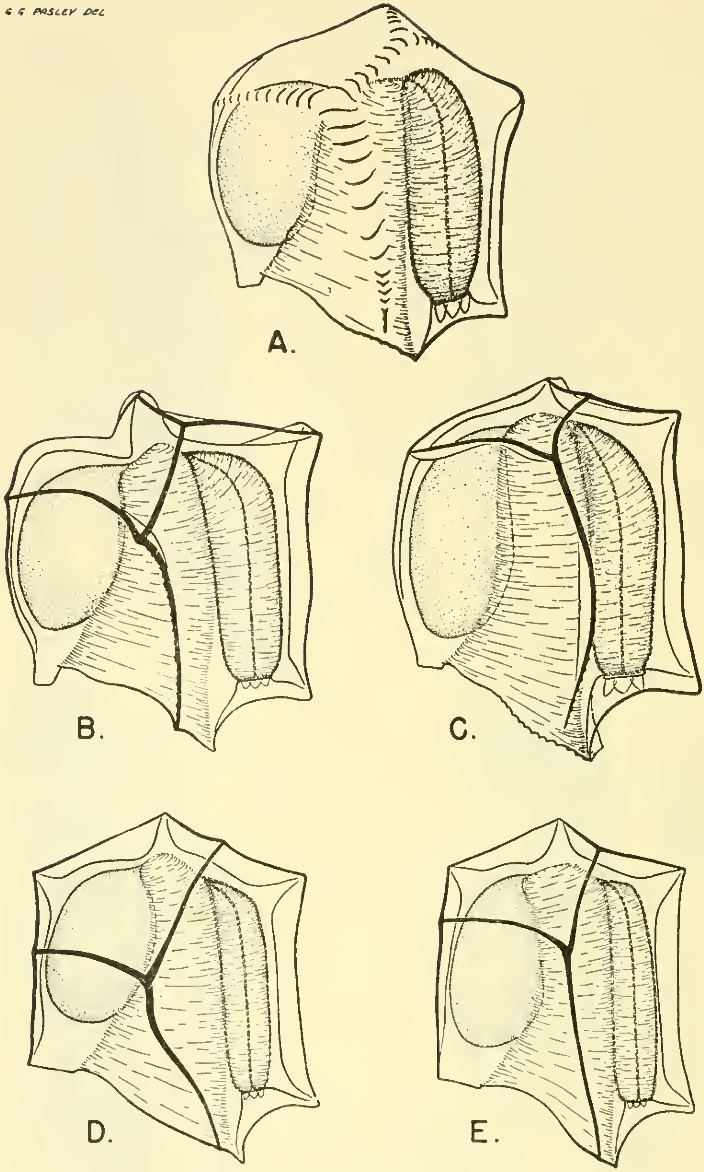

Fig. 12. Lateral view of superior nectophores. A. *Abyla bicarinata*, with dorsal facet about 9 mm. in length. B. *A. tottoni* with a dorsal facet of about 9 mm. in length. C. *A. brownia*, with a dorsal facet of about 3 mm. in length. D. *A. haeckeli*, with a dorsal facet of about 4 mm. in length. E. *A. ingeborgae*, with a dorsal facet of about 7 mm. in length.

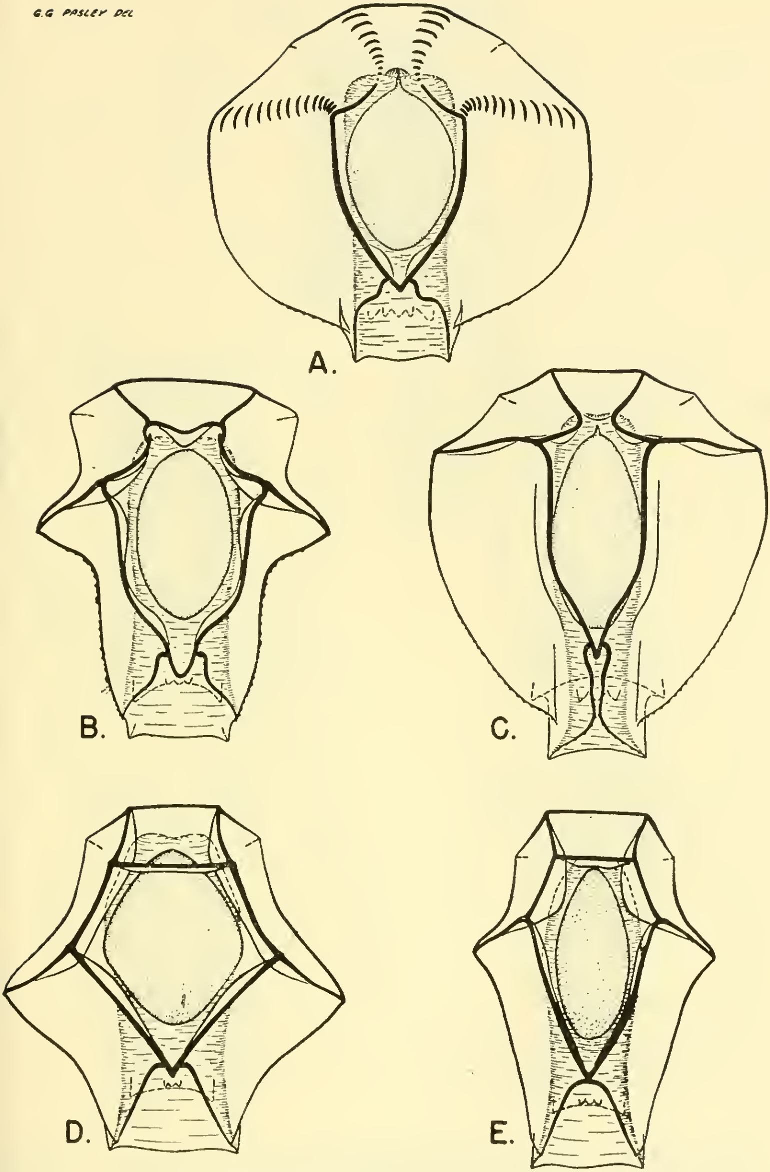

Fig. 13. Ventral view of same specimens as in Figure 12. A. *Abyla bicarinata.* B. *A. tottoni.* C. *A. brownia.* D. *A. haeckeli.* E. *A. ingeborgae.*

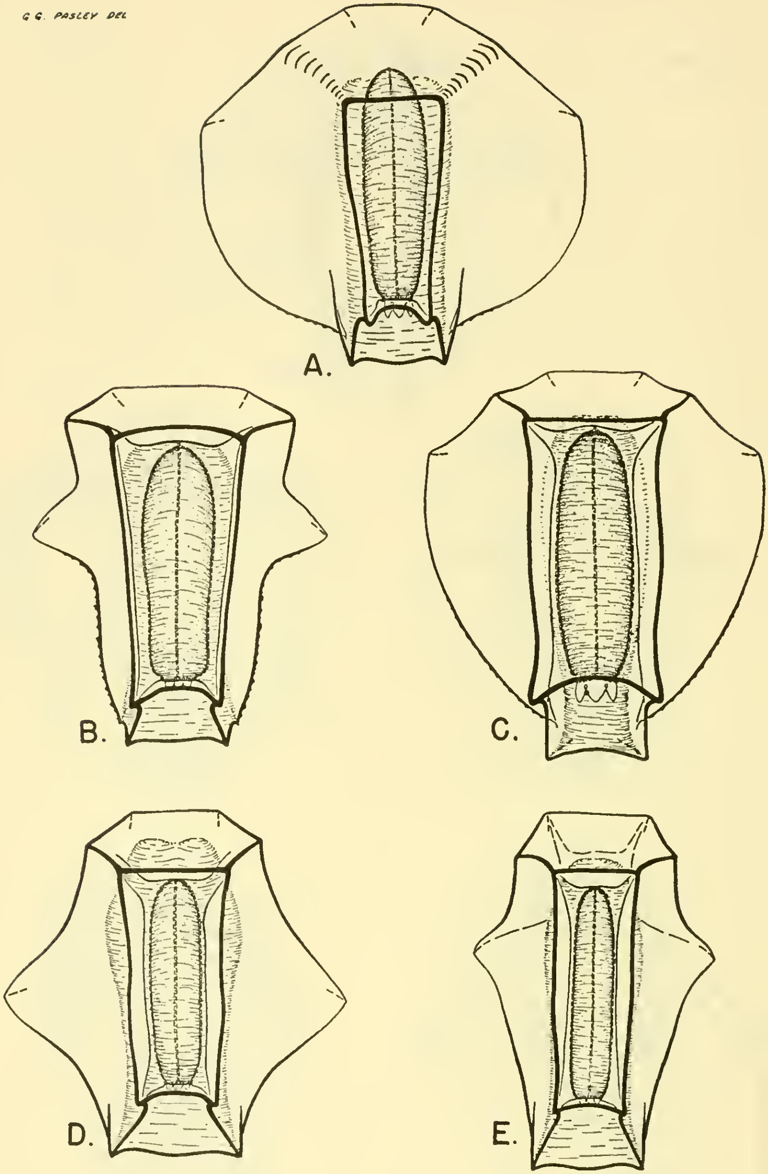

Fig. 14. Dorsal view of same specimens as in Figure 12. A. *Abyla bicarinata.* B. *A. tottoni.* C. *A. brownia.* D. *A. haeckeli.* E. *A. ingeborgae.*

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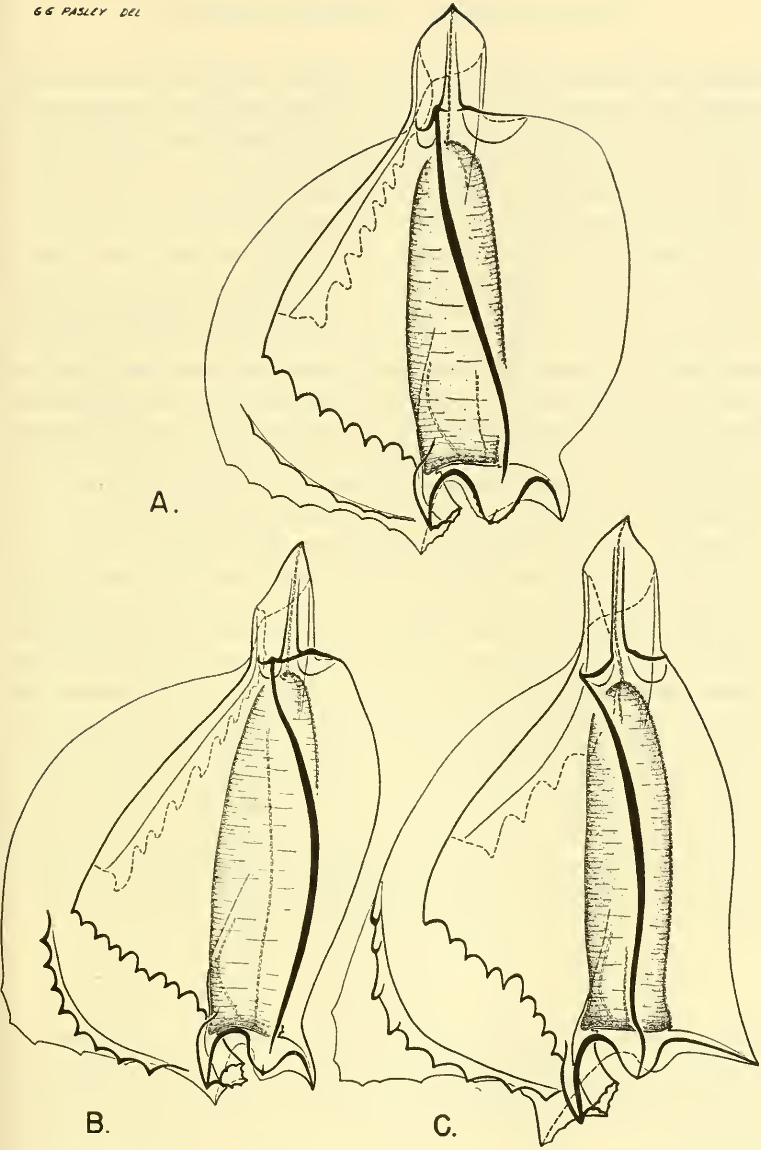

A.

B.

C.

Fig. 15. Left lateral view of inferior nectophores. A. *Abyla bicarinata* 19 mm. n length. B. *A. tottoni* of about 22 mm. in length. C. *A. schmidti*, of about .2.3 mm. in length.

(1888a), and others is still open to question now that we know the eudoxids are so similar that small cormidia cannot be distinguished. Until better material is available, than that found unattached in the samples of the "Dana", it is impossible to ascertain the characters of value in determining the individual species.

The bracts are prismatic with six facets. The dorsal surface is in general smaller than the ventral. As a result, the basal and lateral facets are not in one plane, but veer outwards toward the ventral border. The dorsal facet is rectangular; the others, the apical, ventral, basal, and two laterals, are all trapezoidal. However, the laterals are imperfectly so, since the ventrobasal corners are cut away for the opening of the hydroecium. The latter occupies the basal half of the ventral surface and extends up into the interior of the bract almost to the apical facet. Above it lies the much swollen descending branch of the somatocyst. From its anterior end two thin ventrolateral branches extend down toward the ventrolateral corners of the apical facet.

Gonophores (Fig. 26). The gonophores of *Abyla*, like those of *Ceratocymba* and *Enneagonum* have five stout oral teeth surrounding the opening to the nectosac as well as a stout hook folded in toward the hydroecium from one of the ventral ridges.[1] Similarly there are four ridges, two laterals and two ventrals, with a partial ridge extending upward from the dorsal tooth (as is also the case in *Ceratocymba* and *Enneagonum*). Hence, it is often difficult to determine the genus unless the specimens are well preserved. The outstanding differences among them occur on the apical half of the gonophore. In *Abyla*, the apicodorsal and apicolateral ridges are arched and lie well below the apex of the nectosac. Beneath each arch is an indentation which is most prominent on the dorsal surface. Because of the position of these ridges, the apophysis is relatively more conspicuous in this genus than in *Ceratocymba*, but less so than in *Enneagonum*.

Remarks

In the closely related genus *Abylopsis*, the superior nectophores of the two species are so similar that it is only in recent years that it has become possible to distinguish them with any certainty in the absence of the inferior nectophores. Much the same situation apparently

[1] Since the gonophores are mirror images of one another, the hook may occur on one or other of the ventral ridges, but not on both.

exists today especially among poorly preserved specimens of several species within the genus *Abyla*. It appears, however, that we are justified in distinguishing species of *Abyla* on the basis of seemingly minor differences in the superior nectophores but with greater differences in the inferior nectophores. We have found, for example, three superior nectophores (*carina, trigona, schmidti*) which unless well preserved, prove quite difficult to distinguish. We believe, however, that in each instance, we have found sufficiently distinctive characters to separate them.

In the older reports these three species and at least one other, were confused under one name, *trigona*,[1] partly because so few specimens had ever been examined, partly because complete colonies were taken so infrequently that slight differences in the superior nectophores appeared to be merely individual variations, and partly because so many of the earlier figures and descriptions were lacking in detail. Thus, most of the earlier reports were diagnostic of the genus as a whole as we define it here rather than of any particular species. As a result, most subsequent authors referred their specimens to *trigona* rather than establish a new species for individuals with seemingly minor modifications. Until recently, therefore, when a large series of specimens could be examined only four species in the genus were recognized as distinct. Two of these, *leuckartii* and *dentata*, are now referred to *Ceratocymba*: the other two, *haeckeli* and *bicarinata*, still remain in the genus *Abyla*. The two latter are quite distinctive and have probably seldom been confused with *trigona*.[2] Thus, the superior nectophore of

[1] Bigelow (1911; 1918; 1919), for example, lists as *Abyla trigona*, three other species, *carina*, *schmidti* and a new species, *peruana*, as listed below:

M. C. Z. No. 1602, "Albatross" Sta. 4715, *A. carina* — eastern tropical Pacific.
M. C. Z. No. 1603, "Albatross" Sta. 4684, *A trigona* — eastern tropical Pacific.
M. C. Z. No. 1658, "Albatross" Sta. 5601, *A. schmidti* — Celebes.
M. C. Z. No. 3074, "Albatross" Sta. 5672, *A. schmidti* — Philippines.
U. S. Nat. Mus. No. 28349, "Albatross" Sta. 4673, *Abyla peruana* n. sp. — off Peru.
U. S. Nat. Mus. No. 41556, "Bache" Sta. 10163, *A. trigona* — off North Carolina.
U. S. Nat. Mus. No. 41557, "Bache" Sta. 10166, *A. carina* — off South Carolina.
U. S. Nat. Mus. No. 41558, "Bache" Sta. 10171, *A. trigona* — off Bermuda.
U. S. Nat. Mus. No. 41562, "Bache" Sta. 10194, *A. trigona* — south of Bermuda.
U. S. Nat. Mus. No. 41563, "Bache" Sta. 10207, *A. carina* — Straits of Florida.
U. S. Nat. Mus. No. 41564, "Bache" Sta. 10211, *A. trigona*, *A. carina?* — north of Bahamas Bank.

In most instances, the original identification was based on detached superior nectophores. The three species concerned are, as stated above, difficult to distinguish unless well preserved and unless one has been fortunate to study a series of complete colonies.

[2] Huxley (1859, p. 48) states that, "It is with some little hesitation that I identify this species with the *Abyla trigona* of Quoy and Gaimard .... but there are so many points of similarity that I prefer to run the risk of making a species too few rather than one too many." Huxley's specimen has usually been referred to the synonymy of *A. haeckeli*, but is possibly *A. ingeborgae*. Totton (1925) reports that among Haeckel's specimens of *A. carina*, there was one of *A. haeckeli*.

Abyla haeckeli (Lens and Van Riemsdijk, 1908) is characterized by an extra transverse ridge subdividing the apicoventral facet and that of *A. bicarinata* (Moser, 1925) by a marked expansion of the lateral ridges. However, a new species, *A. ingeborgae,* also has a transverse ridge separating the ventral and apicoventral facets and a second new species, *A. brownia,* has expanded lateral ridges. It is possible, therefore, that these species have been confused with *haeckeli* and *bicarinata* respectively.

Fortunately, it has been possible to examine Quoy and Gaimard's (1827) specimens of *trigona* and to compare them with specimens described by Haeckel (1888a) as *carina.* Much of the confusion would appear to stem from the fact that both Haeckel (1888a) and Quoy and Gaimard (1827) apparently had two species in their samples. Today, Quoy and Gaimard's two superior nectophores are detached from the inferior nectophores. I believe that they never were attached, because the apophyses of the two inferior nectophores appear too big to fit into the hydroecium of either superior nectophore. Secondly, they are very similar to specimens in Haeckel's sample[1] and in the "Dana" collection, several of which also have small inferior nectophores attached within the hydroecium. These inferior nectophores are quite different from those in Quoy and Gaimard's sample. Finally, a colony in the Haeckel samples with a badly damaged superior nectophore has an inferior nectophore which appears to be the same as Quoy and Gaimard's. The superior nectophore is, however, distinct from theirs, but resembles three others in Haeckel's sample.

Since it thus seems certain that there are the same two species in both Quoy and Gaimard's (1827) and Haeckel's (1888a) samples, a decision must be made as to which should be *trigona* and which should be Haeckel's *carina.* It seems to me that Lens and Van Riemsdijk (1908, pp. 30–31) have already indicated the answer. They compared their specimens of *Abyla trigona* with those of Quoy and Gaimard and found them to be identical "in all respects". Re-examination of their specimens has shown their statement to be correct for the superior nectophores.[2] It would therefore seem that the superior nectophores

[1] One of these has a small inferior nectophore attached within the hydroecium. There is also a loose inferior nectophore quite unlike the inferior nectophores in Quoy and Gaimard's sample.

[2] Lens and Van Riemsdijk (1908, p. 28) show their hesitancy in identifying the inferior nectophore by recording it as ?*Abyla trigona* (Cat. 78D). This is in reality the new species *A. schmidti.* A second poorly preserved specimen (Cat. 126D) may possibly belong to this species. It certainly is not the same as those in Haeckel's (1888a) and Quoy and Gaimard's (1827) samples.

can be considered to have been designated by them as *Abyla trigona*. Since the inferior nectophores in Quoy and Gaimard's sample apparently belong to the same species as the colony and three superior nectophores in Haeckel's, it would seem appropriate to designate these as *carina*.

Keys to the Nine Known Species of Abyla
(Figs. 6–15)

A. Based on characters of the superior nectophores.

1. Apicoventral facet subdivided by a transverse ridge 2
   Apicoventral facet not subdivided 3
2. Ventral facet approaches a regular pentagon in shape; protrusion at juncture of horizontal and lateral ridges markedly overhangs basal half of ventrolateral surface; ridges elevated like rim of a pie plate . . *Abyla haeckeli* Lens and Van Riemsdijk
   Ventral facet elongate with basal sides of pentagon roughly three times as long as apical ones; protrusion at juncture of lateral and horizontal ridges not excessive; ridges well defined but not markedly elevated above facets . . . . *Abyla ingeborgae* n. sp.
3. Nectophores nearly circular in dorsal or ventral view due to pronounced expansion of lateral ridges 4
   Nectophores elongate in dorsal or ventral view, but with a more or less pronounced knob at the juncture of the lateral and horizontal ridges . 5
4. All ridges well defined; a definite angle at juncture of horizontal and lateral ridges, greatest width of ventral facet about one half length from insertion of horizontal ridges to basal tip . . *Abyla brownia* n. sp.
   Ridges delineating the apicodorsal facet as well as horizontal ridge rounded and often indistinct, lateral ridge circular throughout, not angular, greatest width of ventral facet greater than distance from insertion of horizontal ridges to basal tip . . . . *Abyla bicarinata* Moser
5. Greatest width of ventral facet is about the same (0.87 to 1) as its length from the insertion of the horizontal ridges to its basal tip 6
   Greatest width of ventral facet is only about one half to two thirds (0.45 to 0.6) the length from the insertion of the horizontal ridges to its basal tip 8
6. In side view, apex of hydroecium considerably higher, apex of nectosac lower than that of somatocyst; horizontal ridge crosses somatocyst only slightly above its middle; no obvious depression ventrad to transverse apical ridge . . . . *Abyla peruana* n. sp.
   Apices of nectosac and somatocyst at about same level, apex of hydroecium only slightly higher; horizontal ridge crosses somatocyst well

above middle; obvious depression ventral to transverse apical ridge.. *Abyla tottoni* n. sp.

7. Transverse ridge in true side view lies above somatocyst, resulting in elongate apicodorsal facet.................. *Abyla schmidti* n. sp.

   Transverse ridge in true side view lies above hydroecium...........8

8. In true side view apicodorsal facet almost vertical from insertion of lateral ridge to apical transverse ridge; lateral border of basal facet curved and tends to parallel horizontal plane; heavy and irregular serrations on lateral ridges........ *Abyla trigona* Quoy and Gaimard

   In true side view apicodorsal facet essentially flat; lateral border of basal facet diagonal and only slightly curved; serrations fine....... *Abyla carina* Haeckel

B. Based on characteristics of the inferior nectophores.[1]

1. About two to five teeth on comb of left ventral wing..............2

   About six to ten teeth on comb of left ventral wing................4

2. Two or three teeth on comb of left ventral wing; base of right ventral wing with thickening outlined by rather small teeth, the two ventral ones on both inner and outer row being the heaviest.............. *Abyla haeckeli* Lens and Van Riemsdijk

   Four or five teeth on comb of left ventral wing, right ventral wing triangular...3

3. Base of right ventral wing with inner row of stout teeth continuous with its ventral margin and the outer row of finer teeth projecting below on a more or less well defined triangular pad; left ventral wing not continuous with left ventral tooth............ *Abyla schmidti* n. sp.

   Base of right ventral wing with three or four stout teeth on inner margin, with a few weak teeth almost scallops on outer; left ventral wing continuous with left ventral tooth........... *Abyla ingeborgae* n. sp.

4. Outer row of teeth on basal margin of right ventral wing continuous with its ventral margin; with inner row ending on inner surface....5

   Inner and outer rows of teeth on basal margin of right ventral wing merge to become its ventral margin..............................6

5. Nectophore (exclusive of apophysis) about as wide as it is long, nearly circular in general appearance; usually about 7 teeth on comb of left ventral wing.............................. *Abyla bicarinata* Moser

   Nectophores (exclusive of apophysis); somewhat longer than wide; ovoid in general appearance; 8–9 teeth on comb of left ventral wing. *Abyla tottoni* n. sp.

6. Ventral teeth elongate, heavily serrated; about six teeth on comb of left ventral wing; teeth on basal margin of right ventral wing heavy and prominent.................. *Abyla trigona* Quoy and Gaimard

[1] Inferior nectophores have not yet been found for *Abyla brownia* n. sp., or *A. peruana* n. sp.

Ventral teeth stubby, 9–10 teeth on comb of left ventral wing; teeth on basal margin of right ventral wing scarcely more than strong serrations.
Abyla carina Haeckel

Abyla trigona Quoy and Gaimard 1827

Abyla trigona, Quoy and Gaimard, 1827, pp. 14–15, pl. 2B, figs. 1–8 (partim); Gegenbaur, 1859, pp. 1–10, pls. 1–2, figs. 1–12; 1860, pp. 337–349, pls. 26–27, figs. 1–12; Lens and Van Riemsdijk, 1908, pp. 29–34, text figs. 24–31, pl. 4, figs. 34–36; Bigelow, 1911, pp. 221–222 (partim); 1918, pp. 408–409 (partim); Moser, 1 925, pp. 301-310, pl. 18, fig. 7 (partim); Moore, 1949, p. 13 (partim).

?*Abyla trigona*, Eschscholtz, 1829, pp. 131–132; Blainville, 1830, p. 123; 1834, p. 135, pl. 4, fig. 4 (not seen); Chun, 1888, pp. 1160–1161; 1897, pp. 31–32; Haeckel, 1888, p. 35; Fewkes, 1889, p. 519; Schneider, 1898, pp. 90–91, 197; Bedot, 1904, p. 27; Moser, 1912a, fig. 20; Kawamura, 1915, pp. 578–580, pl. 15, figs. 27–28; Browne, 1926, p. 62; Leloup, 1932, pp. 20–22, fig. 3; 1933, p. 21; 1935a, p. 5; Totton, 1932, p. 332, fig. 17B.

?*Amphiroa alata*, Blainville, 1830, p. 121; 1834, p. 133, pl. 4, fig. 1 (not seen); Huxley, 1859, p. 64, pl. 5, fig. 1; Chun, 1888, p. 1160; 1897, pp. 31–32; Lens and Van Riemsdijk, 1908, p. 28, pl. 4, figs. 37–38.

Diphyes abyla, Quoy and Gaimard, 1834, pp. 87–88, pl. 4, figs. 12–17 (partim).

Non *Abyla trigona*, Vogt, 1854, pp. 121–127, pl. 15, fig. 4, pl. 20, figs. 4–7, pl. 21, figs. 3–6, 10–13; Huxley, 1859, pp. 47–48, pl. 3, fig. 1; Bigelow, 1911, pp. 221–222; pl. 13, figs. 3–4 (partim); 1918, pp. 408–409 (partim); 1919, p. 334.

Abyla carina, Haeckel, 1888a, pp. 156–157, pl. 35 (partim).

?*Amphiroa carina*, Haeckel, 1888a, pp. 114–115, pl. 36.

Superior nectophore (Figs. 8B, 9B, 10B). The superior nectophore of *Abyla trigona*, even when poorly preserved, is perhaps the most readily distinguished of the three species, *trigona*, *carina*, and *schmidti*. Most of the ridges are heavily and irregularly serrated, the laterals and at times the basal ridges of the ventral facet and the laterals of the dorsal facet are especially so. In side view, the profile of the dorsal half is characteristic: the lateral ridges of the basal facet almost describe a semicircle close to the dorsal wall of the hydroecium, but the curvature widens gradually dorsad, to end parallel to the horizontal[1] plane or to continue down onto the prominent dorsal teeth. Almost without exception, whether well preserved or not, the apico-

[1] At times the sharp curvature is absent and the curve described may approach the diagonal of *A. carina*.

dorsal facet is sharply bent upward from the insertion of the lateral ridges to the transverse apical ridge. The latter lies above the center of the hydroecium. Just ventral to it the apicoventral facet drops away gradually so that there is only a slight depression in the furrow. The lateral protrusions are somewhat sharper and more prominent than those of *A. carina.* In addition, the facets of the nectophore as a whole are depressed below the ridges surrounding them. Thus, the nectophore often appears thinner and more fragile than *carina.*

Inferior nectophore (Fig. 11A). The inferior nectophore of *A. trigona* is only about one-half as wide as it is long. None of the ridges are markedly expanded. It is most readily distinguished from *carina,* however, by the decrease in number of teeth on the comb (6–8). In addition, in mature specimens, there are two rows of large sharp teeth on the basal margin of the right ventral wing, much as Haeckel (1888a, pl. 35, figs. 8–9) has shown them. These seem to vary in appearance with growth. In small specimens found attached within the hydroecium of the superior nectophore, the teeth are little more than a series of punctae and those on the outer row diverge somewhat from the inner and produce a small angular flap rather like that of *A. schmidti.* In somewhat older nectophores, the latter tends to disappear or to become very small. On such nectophores the two rows of teeth which are essentially parallel and separated only by a thickening of the basal part of the wing, continue for a distance along the ventral margin. In the oldest specimens examined, however, the teeth were limited to the basal margin.

The ventral teeth, likewise, show some variation with age. In younger specimens, they are straight and elongate rather like those on the inferior nectophore of *Ceratocymba leuckartii.* They become relatively shorter with age but they always remain straight, rather sharper than in most species, and are always coarsely serrated. The other oral teeth are also more heavily serrated than in any other known species of this genus.

Eudoxid. Although the eudoxid of this species may have been described by Gegenbaur (1860) and Haeckel (1888a) we cannot be sure whether their specimens were *A. carina* or *A. trigona.* As no cormidia were found in the "Dana" collection sufficiently far advanced to determine the specific characters, it is not possible to describe the eudoxid of this species for certain.

Remarks

On examination of Lens and Van Riemsdijk's (1908) specimens, most were in every way similar to others of *trigona* we have seen. However, two of their superior nectophores (Cat. 77B) had much more pronounced lateral protrusions. Nevertheless, they too appear to belong to this species.

Abyla carina Haeckel 1888

Abyla trigona, Quoy and Gaimard, 1827, pp. 14–15, pl. 2B, figs. 1–8 (partim); Bigelow, 1911, pp. 221–222 (partim); 1918, pp. 408–409 (partim); Moore, 1949, p. 13 (partim).
Abyla carina, Haeckel, 1888, p. 35; 1888a, pp. 156–159, pl. 35 (partim).

Superior nectophore (Figs. 8A, 9A, 10A). The superior nectophore of *A. carina* has a number of distinguishing features, although they are not always apparent in poorly preserved specimens. In lateral view the sides of the basal facet are diagonal and only slightly curved because the dorsal teeth do not protrude below it as they do in *trigona*. The apicodorsal facet is usually a flat surface and in side view its lateral ridges likewise form a diagonal to the dorsal facet. There may, however, be a slight break at the insertion of the lateral ridge especially in somewhat shrunken and poorly preserved specimens. If so, the transverse apical ridge which lies above the center of the hydroecium is elevated slightly above the surface of the facet as a whole. This is never as exaggerated as is characteristic for *trigona*. Ventral to it, there is almost always a slight depression in the furrow of the apicoventral facet. The lateral protrusions as seen in ventral or dorsal view are not prominent and may be quite unobtrusive. The ridges of the nectophore as a whole are not raised above the facets, but most of these on the basal half of the nectophore are slightly serrated. Finally, the nectophore as a whole appears more massive than that of *trigona*.

Inferior nectophore (Fig. 7). Quoy and Gaimard's specimens of the inferior nectophore, now referred to *A. carina* (p. 32), which are preserved in alcohol, have apparently shrunken considerably because they are only about one-half as wide as they are long. A well preserved specimen in the "Dana" collection, on the other hand, is about two thirds as wide as it is long. This is due chiefly to the expansion of the right ventral wing, as the dorsal ridge is only moderately expanded.

The general shape is not sufficient to differentiate this nectophore from that of other species. One feature which appears reliable is the number of teeth (9–10) on the comb of the left ventral wing. These were all the same size in both Quoy and Gaimard's and Haeckel's specimens, but they formed a graduated series on some of the "Dana" specimens which seemingly belong to this species. An equally distinctive character is the dentition at the base of the right ventral wing. The teeth on the latter are not as robust and jagged as are those of *A. trigona*. The inner row of nine or ten small spines is parallel to the basal margin close to the two ventral teeth but ventrad it gradually swerves inward a short distance from the margin crossing the inner surface to merge with the outer row at the ventral margin much as is shown in one of Haeckel's drawings (1888a, pl. 35, fig. 1). The outer row has about the same number of teeth as the inner, which are likewise weak and relatively inconspicuous. The ventral teeth are often quite blunt except for a sharp point at the tip.

Eudoxids. The eudoxids belonging to this species have been described by earlier authors, but it has not been possible to check their observations with specimens of known parentage. It therefore seems better to omit a description as it would only be misleading.

ABYLA SCHMIDTI[1] n. sp.

Abyla trigona, Lens and Van Riemsdijk, 1908, pp. 29–34 (partim); Bigelow, 1919, p. 334.

Abyla bicarinata Moser, 1925, pp. 298–301 (inferior nectophore) pl. 19, figs. 7–9 (partim).

Abyla sp. Totton, 1950.

The type specimen of *Abyla schmidti* consists of a well preserved superior and inferior nectophore taken at "Dana" Station 3922, at 3°45′S, 56°33′E with 1000 meters of wire out, on 12 December 1929 at 1850 hours with an open ring trawl, 300 cm. in diameter. These will be deposited in Universitets Zoologiske Museum, København, Denmark.

Superior nectophore (Figs. 8C, 9C, 10C). The superior nectophore of *Abyla schmidti*, although quite similar to the two previous species, is best differentiated by its proportionately larger apicodorsal facet. In a true lateral view, this is seemingly effected by a protrusion dorsad

[1] Named in honor of the late Professor Johannes Schmidt, the leader of the Carlsberg Foundation's Oceanographical Expedition Round the World, 1928–30.

over the dorsal facet and by the more ventral position of the transverse apical ridge over the dorsal portion of the somatocyst. Ventral to this ridge the apical portion of the apicoventral facet gradually slopes ventrad without any marked depression, although it is slightly furrowed. A second feature which is helpful in identifying many specimens is a dorsal facet tapering toward the base rather than one which bulges in the middle as in *trigona* and *carina*.

Inferior nectophore (Fig. 15C). On well preserved specimens of the inferior nectophore of *A. schmidti*, the right ventral wing is expanded so that the width of the nectophore nearly equals its length. In most specimens, however, it is damaged so that the relative measurements are not helpful in identification. Its triangular shape, however, provides the best means for separating this species from others in the genus. The inner row of teeth along the basal margin of the right ventral wing is rather strongly developed and joins the outer row to continue apically as the ventral margin. The triangular protrusion hanging below the inner row is in reality the thickening between the two rows of teeth since the outer row of weak teeth delimits it before it merges with the inner. This species is also readily recognized by the teeth on the comb on the left ventral wing which are fewer in number (4–5), larger, and more robust than in any other known species of *Abyla*.

Eudoxid. Cormidia have been found on stems attached to superior nectophores of *A. schmidti* but they are not distinctive enough to assist in identifying loose bracts and eudoxids. About all one can determine is that the bract is a typical "*Amphiroa*".

Small gonophores known to be *schmidti* likewise appear very similar to those found on cormidia attached to the superior nectophores of other species. On these the large tooth on one of the ventral wings is thin, elongate, and almost fingerlike. Insofar as we have been able to ascertain, teeth of this sort are characteristic of small specimens belonging to a number of other species. Other characters which might be diagnostic in differentiating the species are not obvious. It is possible that as the gonophore matures, differences not obvious on small specimens may appear.

ABYLA HAECKELI Lens and Van Riemsdijk 1908

?*Abyla trigona* Huxley, 1859, p. 47, pl. 3, fig. 1.[1]

[1] Huxley's specimen actually may have been the species described below as *ingeborgae*.

?*Amphiroa angulata* Huxley, 1859, pp. 64–65, pl. 5, fig. 2.
?*Amphiroa carina* Haeckel, 1888a, pp. 114–116, pl. 36.
?*Abyla alata* Haeckel, 1888a, pp. 113 and 156.
Non *Amphiroa dispar* Bedot, 1896, p. 373, pl. 12, figs. 5–6.
Abyla haeckeli Lens and Van Riemsdijk, 1908, pp. 32–34, text figs. 32–40, pl. 5, figs. 39–41; Bigelow 1911, pp. 222–224, pl. 13, figs. 1–2; Moser, 1925, pp. 310–318, pl. 18, fig. 6.
?*Abyla haeckeli* Browne, 1926, p. 63[1]; Leloup, 1932, pp. 19–20; Totton, 1925, pp. 446–447; 1932, pp. 331–333, figs. 12–13, 17B[2].

Non *Abyla haeckeli* Totton, 1932, text fig. 12.

Superior nectophore (Figs. 12D, 13D, 14D). In outline, the superior nectophore of *haeckeli* is as wide as it is high. It is also more truly prismatic than that of any other abylid. Mentioned, but not stressed, by Lens and Van Riemsdijk (1908, p. 33) in their original description are the flat facets. These are accentuated by sharp raised ridges so that most facets have rims the shape of polygonal pie plates. Two other characters at once separate this species from those already described and contribute to its unique appearance. The apicoventral facet is separated by a second transverse ridge to form a quadrangular facet on the ventral half of the apical surface and a nearly regular pentagonal one on the ventral surface. The latter is nearly twice as wide (1.8) at the insertion of the horizontal ridges as thence to its basal tip. The apical ventrolateral facet is large and overhangs the basal one, due to the shelf-like protrusion formed by the horizontal ridge and the basal half of the lateral ridge. The surface of the basal ventrolateral facet, however, appears to be only slightly smaller than the apical one. Nevertheless, in side view the horizontal ridge appears to lie just above the basal tip of the somatocyst. In no other *Abyla* have we found the horizontal ridge lower than the midpoint of the somatocyst.

Inferior nectophore (Fig. 11B). Several inferior nectophores so small that they have been shielded within the hydroecial cavity, have enabled us to learn the peculiarities of this species. Study of these permits identification of larger poorly-preserved detached inferior

[1] The fact that Browne (1926, p. 63) states that "the species is likely to escape notice unless every anterior nectophore of *Abyla trigona* is carefully examined on the ventral side" suggests that he may have had *ingeborgae* rather than *haeckeli*.

[2] "One anterior nectophore, the identification of which rests upon the presence of a transverse ridge dividing the ventral facet into two parts" (Totton, 1932, p. 331) might equally well refer to *ingeborgae*.

nectophores. The dorsal tooth, the largest of the five surrounding the oral cavity, juts forward and slightly downward. The two lateral oral teeth are relatively small, the right being distinctly the smaller. Rather than being midway in position between the dorsal and ventral teeth as is customary, both the laterals are displaced so that they lie close to the dorsal. The left ventral wing is continuous with the ridge of its corresponding tooth, the coarse serrations extending part way down the ridge of the latter. There are two or three teeth on the comb. The thickened basal margin of the right ventral wing is concave and is delimited by about four teeth on the inner and outer rows. Those on the inner row are somewhat heavier than the outer. The teeth at the ventral end of each row are stubby and connected to each other. The ventral margin above these teeth is likewise thickened. The ventral wings may be sufficiently expanded so that the nectophore as a whole may be nearly as wide as it is long.

Bract (Fig. 26A). Cormidia attached to the stem of the superior nectophore appear to have a peculiar flat dorsal facet with raised rims of the sort found only on the superior nectophore of *haeckeli*. The basal facet is at right angles to the dorsal and lacks all indications of teeth. Loose specimens have been found with these characters, but their gonophores have been too badly preserved to check their identity further.

Gonophore. Insofar as we can judge, the only distinctive feature of the gonophore of *A. haeckeli* is the stubby engorged curved tooth on the midportion of one of the ventral wings. We have not found older specimens in sufficiently good condition to study further.

Remarks

The peculiar shape of the horizontal and lateral ridges of the superior nectophore of *haeckeli* is figured but not mentioned by Lens and Van Riemsdijk (1908, pl. 5, fig. 41). Re-examination of their specimens proves that our specimens are more exaggerated in this respect than theirs. In Bigelow's (1911, pl. 13, fig. 1) figure, the horizontal ridge appears to be rather higher and it together with the basal half of the lateral ridge apparently is not protruded to overshadow the basal portion of the ventrolateral ridge. We have reexamined his specimens which are relatively small and perhaps not fully developed and his drawing is correct. Moser (1925, pl. 18, fig. 6) follows Bigelow in general outline but she depicted the facets as flat and surrounded by raised rims of the sort observed on our specimens. We have seen one rather poorly preserved specimen which is very like the one Moser (1925) figured.

The question of the identity of all the *Abyla* eudoxids is perplexing because insofar as we can see, the differences in each species are so slight that they cannot be determined for either the bracts or gonophores when small specimens are attached to the stem within the hydroecium of the superior nectophore. We have found specimens of *A. haeckeli* with cormidia which are not too unlike the one described by Huxley (1859, pl. 5, fig. 2) and which we believe develop into the detached specimens of the sort shown in Figure 26. Other bracts previously have been referred to *haeckeli* (Bedot, 1896, p. 373, pl. 12, figs. 5–6 [*Amphiroa dispar*]; Totton, 1932, text fig. 12) because they seemingly differed from the one described earlier as that of *trigona*. These, however, are not *haeckeli*, I believe, because the basal facet in *haeckeli* is at right angles to the dorsal and they do not have the angularity of Bedot's (1896, pl. 12, figs. 5–6) or the cleft of Totton's (1932, text fig. 12) specimens.

Abyla ingeborgae[1] n. sp.

?*Abyla trigona*, Huxley, 1859, pp. 47–48, pl. 3, fig. 1.
Abyla haeckeli Kawamura, 1915, pp. 577–578, pl. 15, figs. 24–26.
?*Abyla haeckeli*, Totton, 1932, pp. 331–333.

The type specimens of *Abyla ingeborgae* are 23 superior nectophores from ϕ. K 1.—Sta. No. 4762 at 8°13′S, 2°54′E taken on 11 February 1933 at 1930 hours with a stramin net 200 cm. in diameter. There are also five loose inferior nectophores which, we believe, belong to this species. These will be deposited in Universitets Zoologiske Museum, København, Denmark.

Superior nectophore (Figs. 12E, 13E, 14E). The superior nectophore of *Abyla ingeborgae* is very similar to that of *schmidti* in general appearance, when well-preserved, but it is readily distinguished from it by a transverse ridge dividing the apicoventral facet into two. Because of this character it may have been referred to *haeckeli* in the past. Nevertheless, the two species are quite distinct. The ventral surface is only about one half as wide at the insertion of the horizontal ridge as it is high from this point to its basal tip. This is seemingly due to the two

[1] Named in honor of Mrs. Johannes Schmidt, the widow of the expedition's leader.

elongate basal ridges of this facet. In addition, the width of the nectophore is only about two-thirds the height (0.69). The lateral protrusions are relatively inconspicuous and, in addition, are distinctly higher than those of *haeckeli*. The horizontal ridge in side view appears to lie well above the middle of the somatocyst not well below it, as in *haeckeli*. Hence, the apical ventrolateral facet is definitely smaller than the basal ventrolateral one below it. The dorsal facet is almost a perfect rectangle. In other words, it does not taper from the top as is usual in *schmidti* or bow on the sides as in a number of other species. The only serrations visible even under quite high magnification are at the base of the dorsal wall of the hydroecium.

Inferior nectophore (Fig. 11C). The inferior nectophore which we believe to be that of *A. ingeborgae* has some characters rather like that of *A. haeckeli*, some like those of *A. schmidti*. Thus, the comb has five teeth like *schmidti*, the right ventral wing is more nearly triangular rather than concave on its basal border and the dorsal tooth is smaller and less prominent. On the other hand, the position of the lateral oral teeth is close to the dorsal one as in *haeckeli*, but the right lateral tooth is almost as large as the left and has a well defined ridge. Likewise, the left ventral wing is continuous with the ridge of the left ventral tooth. Also, the dentition of the right ventral wing is more like that of *haeckeli*. There may be three or four stout teeth on the inner basal margin, but the outer one has only a weak scallop or two. There are, however, no strong teeth delimiting the ventral extent of the basal margin and the ventral margin is not as thickened as it is in *haeckeli*.

The general appearance of the nectophore is very like that of *haeckeli* in the specimens we have seen. Thus, while it may be almost as wide as it is long due to the expansion of the ventral wings, these are fragile and easily damaged.

Eudoxid. A cormidium was found attached within the hydroecium of one specimen. The bract is characteristic of that for the genus and the gonophore is seemingly like that of *haeckeli* with perhaps a conspicuous dorsal tooth and ridge and variations in the serrations on the ventral ridges and teeth.

Remarks

One small inferior nectophore was found within the hydroecium of a superior nectophore of *A. ingeborgae*, but it was not possible to observe characters to distinguish it from *A. haeckeli*. The above description is therefore based on two fairly well preserved specimens found in the same sample as the type (superior nectophores) and at one other station, where the superior nectophores of *A. ingeborgae* were found. It seems probable, therefore, that these inferior nectophores are actually those of *A. ingeborgae*, because we have proof from the small attached inferior nectophores that they are very like those of *A. haeckeli* and because the larger detached specimens have always been found associated with the superior nectophores of *A. ingeborgae*.

Abyla peruana n. sp.

Abyla trigona, Bigelow, 1911, pp. 221–222 (partim); pl. 13, figs. 3–4.

The type specimen of *Abyla peruana* is a superior nectophore collected at "Albatross" Sta. 4673 off Peru by Dr. H. B. Bigelow on 21 November 1904 and was deposited in the U. S. National Museum (No. 28349). It has previously been referred to *A. trigona*.

Superior nectophore (Figs. 8D, 9D, 10D). The superior nectophore of *Abyla peruana* superficially looks more like *A. haeckeli* than *A. trigona*. This is chiefly due to the fact that the horizontal ridge when seen in side view lies just above the middle of the somatocyst. There is no danger that this is a young specimen of *haeckeli* because it lacks the extra ridge separating the ventral and apicoventral surfaces. Indeed, in the one specimen seen, the two surfaces are only at an angle of about 45° rather than at a right angle. This appears to be due to the fact that the apex of the hydroecium is distinctly higher than either the somatocyst or nectosac. The transverse apical ridge is thus correspondingly higher. The apex of the nectosac is also lower than that of the somatocyst. In other species of *Abyla* these have been at the same level, although the apex of the hydroecium is usually slightly above the other two cavities. The ridges outlining the facets are in general more pronounced and wider than they are in *haeckeli* and presumably stood well above the facet when living. As the lower part of the dorsal facet and the basal facet are damaged, the only other peculiarity that one can see is an unusually long and heavy keel beneath the hydroecium.

Inferior nectophore. Unknown.

Eudoxid. Unknown.

Remarks

Although the specimens from two stations of the "Albatross" Expedition to the Eastern Tropical Pacific have not been found, it seems very likely that it was this specimen which Bigelow (1911, pl. 13, figs. 3–4) drew. The specimen is now damaged as described above, but it is hard to reconcile Bigelow's (1911, pl. 13, fig. 4) ventral view either with his (1911, pl. 13, fig. 3) lateral view or its present condition. While it is possible that the ventral ridge of the basal facet is as wide as he shows it, it seems unlikely that the nectophore ever narrowed along the lateral ridge (1911, pl. 13, fig. 4). One other feature not shown in Bigelow's drawings is the very marked ridges.

ABYLA BICARINATA Moser 1925

Abyla bicarinata Moser, 1925, pp. 298–299, pl. 19, figs. 3–6 (superior nectophores).
Non *Abyla bicarinata* Moser, 1925, pp. 299–301, pl. 19, figs. 7–9 (inferior nectophores).

Superior nectophore (Figs. 12A, 13A, 14A). The superior nectophore of *Abyla bicarinata* is unique in that it is wider than it is high. This is due to the extraordinary wing-like expansion of the lateral ridges. In some specimens these appear to end above the basal margin of the hydroecium but it is usually possible to trace them to the base, at least as a series of punctae. In addition, the edges of the facets are all rounded and tumid, but the exact location of the ridges may be traced as fine hair-like lines. There is no depression or furrow ventral to the transverse apical ridge. The apical ventrolateral facets appear more as a slight depression between the apical surface and upper half of the lateral and horizontal ridges. Furthermore, they do not actually lie in the horizontal plane, but are part of the apical surface. The result is that in a true lateral view the somatocyst may be viewed in its entirety through the basal ventrolateral facet.

Several other characters make this species quite distinct from the next species (*brownia*) to be described. The width of the ventral facet at the insertion of the horizontal ridge is about three-quarters (0.76) the height, thence to its basal tip. In ventral view the vertical distance between the insertion of the horizontal ridges to the ventral facet and the transverse apical ridge is proportionately greater in this species than in *brownia*. In side view, the lateral ridges of the basal segment are diagonal almost as in *A. carina*.

Inferior nectophore (Fig. 15A). The inferior nectophore of *Abyla bicarinata* is the only one known so far which is as wide as it is long. In addition, the left lateral ridge is as pronounced and as conspicuous as the dorsal one. Both are more expanded than in any other species and the two together, in preserved specimens at least, bound a somewhat circular rather than rectangular surface covering most of the left lateral half of the nectophore. In addition, the right ventral wing[1] forms an almost perfect semicircle. In fact, the inferior nectophore does not have the conventional diphyid outline but rather gives the impression of being two, flat, superimposed discs. While the teeth surrounding the opening to the nectosac are very like those of the other species in the genus, they are stronger and more prominent. The dorsal tooth lacks serrations. One further character helpful in distinguishing the inferior nectophores is that there are 4–7 teeth on the comb. Finally, there are six teeth on the inner row of the basal portion of the right ventral wing. This row at first parallels the outer but diverges from it to end on the inner surface well in from the ventral margin, a characteristic also found in *A. tottoni*.

Eudoxid. Unknown.

Remarks

The most obvious differences which Moser (1925) apparently failed to stress between this and closely related species is that in most specimens the nectophores are opaque as in *haeckeli*. Also, all of them are rather more turgid than others in the genus. In this respect, they resemble *Ceratocymba sagittata* and *C. dentata*. In one colony from the "Dana" collection, however, only the outer part of the ridges is opaque and a few of the inferior nectophores are quite transparent.

ABYLA BROWNIA[2] n. sp.

?*Abyla* sp., Totton, 1950.

[1] In some specimens viewed from the right side, there appears to be a partial ridge. Careful examination indicates that this is in reality the line of attachment of the right ventral wing, which may be more or less pronounced depending on preservation.

[2] Named in honor of its discoverer, Miss Joan A. Brown.

The type specimen of *Abyla brownia* is a superior nectophore, which came from "Dana" Sta. 3964^{VIII} at 25°19′S, 36°13′E on 15 January 1930 at 2355 hours in a stramin net 150 cm. in diameter, with 2000 meters of wire out. It will be deposited in Universitets Zoologiske Museum, København, Denmark.

Superior nectophore (Figs. 12C, 13C, 14C). This nectophore will not be confused with any other species except possibly *bicarinata*, for it too has expanded lateral ridges which end just above the basal margin of the hydroecium. Relatively, these are not as wide as in *bicarinata*; the greatest width is somewhat less than the height (0.85). The ventral facet is likewise narrower, being somewhat less than half as wide (0.45) at the insertion of the horizontal ridges as it is thence to its basal tip. Furthermore, the ridges are well defined and most of them are finely serrated. The basal margins of the lateral walls of the hydroecium are heavily serrated, as is the basal portion of the laterals. Also, in contrast to *bicarinata* the arc formed by the lateral margins of the basal facet, as seen in a lateral view, has a marked curvature rather like that in *A. trigona*. The apicodorsal facet appears to be distinctly shorter than in *bicarinata*. This may possibly be due to the fact that in ventral view the vertical distance between the transverse apical ridge and the insertion of the horizontal ridges and the ventral facet is proportionately shorter than in *bicarinata*. Finally, the apical portion of the apicoventral facet is slightly furrowed, but lacks any indication of a depression just ventral to the transverse apical ridge.

Inferior nectophore. Unknown.

Eudoxid. Unknown.

ABYLA TOTTONI[1] n. sp.

Abyla trigona Moser, 1925, pp. 301–310, text figs. 42–47, pl. 16, figs. 6–7, pl. 18, fig. 7 (partim).

The type specimen is a colony from "Dana" Sta. 3994^{I} at 15°45′S, 5°45′W taken on 24 February 1930 at 1930 hours with a stramin net 200 cm. in diameter. It will be deposited in the Universitets Zoolgiske Museum, København, Denmark.

[1] Named in honor of Captain A. K. Totton of the British Museum (N. H.) in appreciation for his many kindnesses in furthering my understanding of this genus.

Superior nectophore (Figs. 12B, 13B, 14B). The superior nectophore of *Abyla tottoni* is tumid, especially the apical portion. The transverse apical ridge is not distinct, but looks rather like a rounded chamfer or rolled joint. In large specimens this may also be true of the apicolateral and the apicodorsal ridges. The exact location of the ridges is, however, delimited by fine hair-like lines which may be seen with proper lighting. The horizontal ridge may be indistinct but it can always be traced by a series of punctate elevations. Likewise, in some of the larger specimens the projection formed at the junction of the lateral and horizontal ridges is a definite knob rather than angular, as it usually is in this and other species. These knobs might be caused by poor preservation, although it is seldom possible to detect any damage on such specimens. In any event, the lateral protrusions are more marked than in any species other than those with expanded lateral ridges. Thus, the nectophore is nearly (0.86) as wide as it is high.[1] Two other characters together with those just mentioned serve to distinguish it from all other species even when detached from the inferior nectophore. At the insertion of the horizontal ridge, the ventral facet is as wide (1.09) as from that point to its basal tip. Finally, one of the most consistent features is the extremely deep depression just ventral to the transverse apical ridge.

Inferior nectophore (Fig. 15B). The inferior nectophore of *A. tottoni* is usually about three-quarters as wide as it is long (exclusive of the apophysis). The dorsal ridge is so expanded toward the apex that it curves sharply before merging with the dorsal tooth. Likewise, the right ventral wing is a somewhat lopsided semicircle. The outer row of teeth (8–12) on its basal margin is continuous with serrations of its ventral margin. The inner row parallels the outer close to the ventral teeth, but gradually diverges to end on the inner surface of the wing well in from the ventral margin very much as it does in *bicarinata*. These teeth are coarser and may be slightly more numerous than those on the outer row. The characters enumerated above, together with the row of eight or nine teeth on the comb of the left ventral ridge make it possible to distinguish the inferior nectophore of *tottoni* without any difficulty.

Eudoxid. Unknown.

[1] Poorly preserved specimens, however, have been seen in which these protrusions were so damaged that this character cannot always be relied upon in differentiating this species.

PSEUDABYLA n. gen.

Genotype: *Pseudabyla irregularis* n. sp.

Generic Characters

Superior nectophore (Figs. 16 and 17). The genus *Pseudabyla* is established for three damaged superior nectophores. These resemble specimens of *Abyla* and might be referred to that genus if not examined carefully. They have a number of characters in common, a transverse apical ridge and horizontal ridges as well as the same internal arrangement and configuration of the basal region. Closer examination, however, reveals that there are fewer facets and that the nectophore is asymmetrical due to the absence of a facet or ridge and perhaps to a shift in the position of one ridge or another.

Inferior nectophore. Unknown.

Eudoxid. Unknown.

Remarks

The description given for *Pseudabyla* is general to include specimens of what appear to be two species closely related to *Abyla*, but until more is known of these it appears premature to go into greater detail. At present, the known variants of *Abyla* are included here to emphasize their existence. In making this genus, as well as three to be described later (*Pseudocymba*, *Abylopsoides*, *Pseudabylopsis*), so inclusive, the usual practise of differentiating the genera of the Abylinae by the number and arrangement of the facets and ridges of the superior nectophore has admittedly been disregarded. Such a course seems warranted, in view of the fact that only two or three specimens are known in each genus, at least until such time as a sufficient number of specimens become available either to substantiate or to disprove such action. One more or less parallel case among the Diphyinae also makes it somewhat justifiable. In that group, most genera have five ridges on the superior nectophore, but in one genus, *Lensia*, the number varies (Totton, 1941). This variation is one of the characters which is helpful in distinguishing the individual species. Totton (1941) had a sufficient number of specimens to prove the existence of good species in *Lensia*. It is possible then that much the same situation

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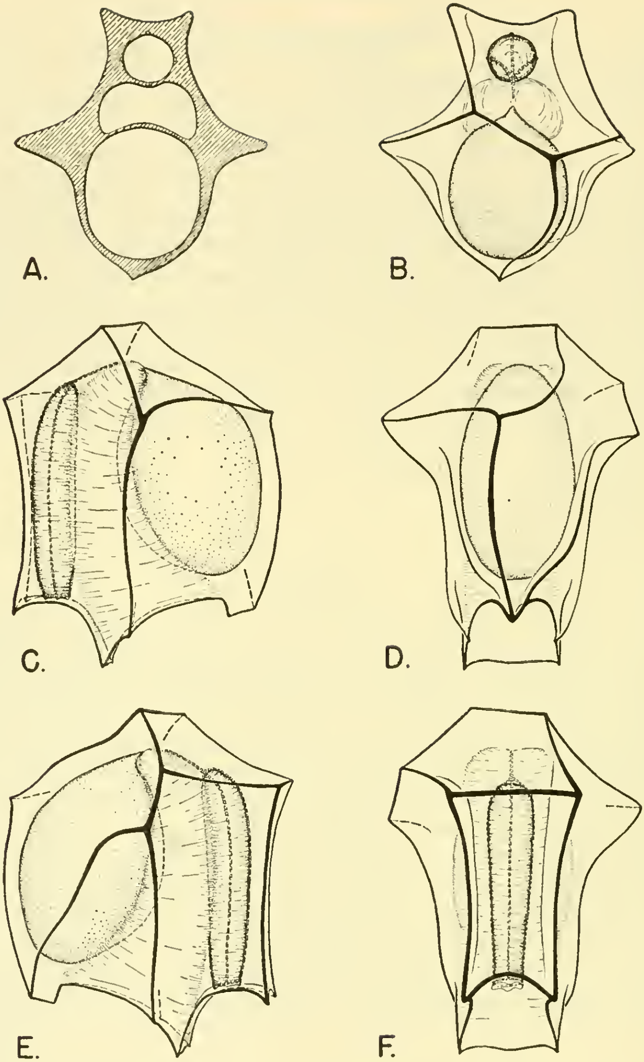

Fig. 16. Superior nectophore of *Pseudabyla irregularis* dorsal facet of about 3 mm. in length. A. Cross section. B. Apical view. C. Left lateral view. D. Ventral view. E. Right lateral view. F. Dorsal view.

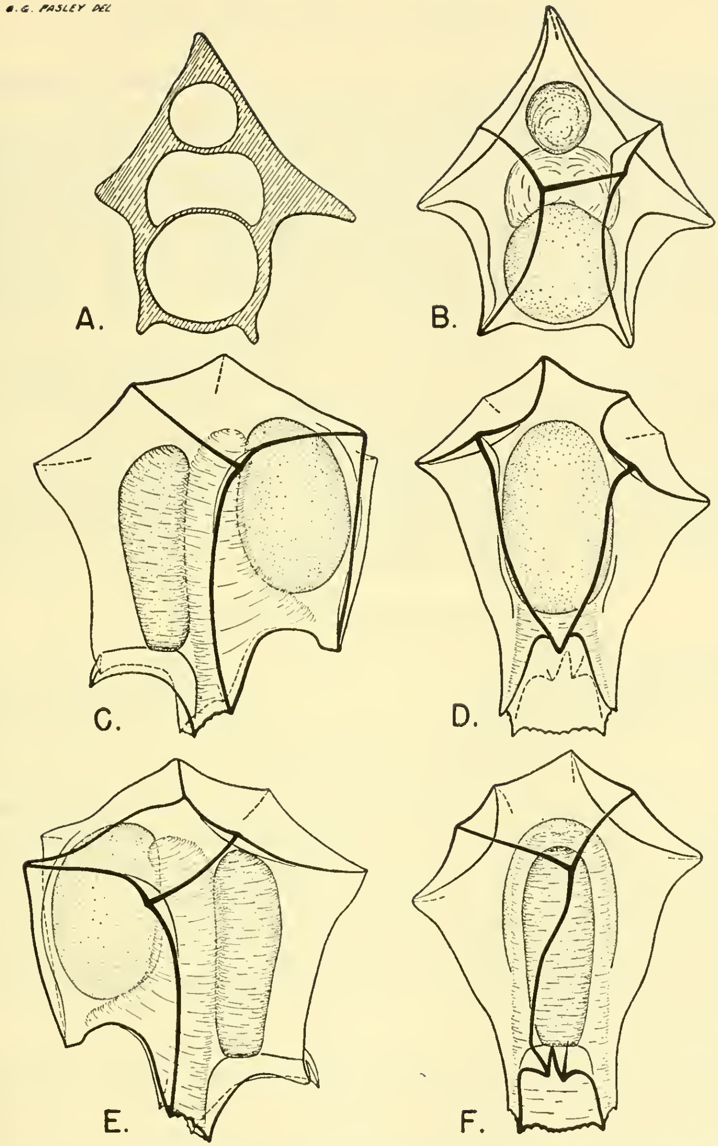

Fig. 17. Superior nectophore of *Pseudabyla dubia* with a dorsal facet of nearly 2 mm. A. Cross section. B. Apical view. C. Right lateral view. D. Ventral view. E. Left lateral view. F. Dorsal view.

exists among the Abylinae, but as yet we have an insufficient number of specimens to feel certain.

Another problem to be solved in the Abylinae, which does not arise in the Diphyinae, is the reason for the asymmetry in some of these variants. The chief difference between *Abyla* and *Ceratocymba* is the absence of the transverse apical ridge and the two horizontal ridges with a consequent reduction in the number of facets, but otherwise little change in their arrangement. The actual loss of a facet, however, seems to result in an asymmetrical arrangement. This has been found to be the case not only in this genus, but also in *Pseudocymba* and *Abylopsoides*. So far, we have only two bits of evidence to suggest that the asymmetry is a specific character. Two specimens of *Pseudabyla irregularis* have been found at widely separated localities and yet, despite the poorly preserved condition they were found in, it appears that the two are asymmetrical in exactly the same way. A second suggestion that this may, indeed, be true is that both species of *Pseudocymba* have triangular basal facets.

Key to the Species of Pseudabyla

A. Superior nectophore
  1. Ventral ridge present . . . . *Pseudabyla irregularis* n. sp.
     Ventral facet present . . . . *Pseudabyla dubia* n. sp.

PSEUDABYLA IRREGULARIS n. sp.

The type specimen of *Pseudabyla irregularis* is a superior nectophore taken at "Dana" Station 3919^{IV}, at 0°07′S, 63°56′E on 8 December 1929 at 1910 hours in a stramin net, 200 cm. in diameter, towing with 100 meters of wire out. A second superior nectophore was taken at "Dana" Station 3964^{V} at 25°19′S, 36°13′E on 15 January 1930 at 2030 hours in a stramin net 150 cm. in diameter, towing with 50 meters of wire out. The specimens will be deposited in Universitets Zoologiske Museum, København.

Superior nectophore (Fig. 16). The two specimens appear to be identical, insofar as can be determined in their damaged condition. The asymmetry which might be presumed to have resulted from poor preservation is actually caused by structural peculiarities as mentioned below. The most obvious characteristic of this species of *Pseudabyla* is the presence of a ventral ridge rather than a facet, but a more critical examination reveals that the left horizontal ridge crosses the ventrolateral surface diagonally and joins the ventral ridge at its basal end. The right horizontal ridge is in the position usual in *Abyla*. However, the apicolateral ridge on this side which in *Abyla* separates the apicoventral and apical ventrolateral facet is apparently missing. Consequently, the transverse apical ridge is diagonal and one of the right lateral ridges bordering the apicodorsal facet has seemingly disappeared. Thus, this facet is pentagonal rather than hexagonal as in *Abyla*.

Inferior nectophore. Unknown.

Eudoxid. Unknown.

Remarks

Since the two specimens taken at widely separated localities appear identical, even in their asymmetry, *irregularis* would seem to be a valid species which may previously have been overlooked because it appears so similar to *Abyla* unless carefully examined.

Pseudabyla dubia n. sp.

The type specimen of *Pseudabyla dubia* is a superior nectophore taken at "Dana" Sta. 3921^{III} at 3°36′S, 58°19′E on 11 December 1929 at 1900 hours in a stramin net 200 cm. in diameter, towing with 300 meters of wire out. The specimen when found was damaged and, most regrettably, was dried up after the sketches (Fig. 17) were made. The specimen has, however, been saved and will be placed in Universitets Zoologiske Museum, København.

Superior nectophore (Fig. 17). This species differs from the previous one in that the dorsal facet is replaced by a ridge. Also, a ventral facet is present. On the other hand, this is not symmetrical as in *Abyla*: the apical part being twisted to the left and the point of junction with the horizontal ridges is slightly higher on the right than on the left. In addition, the upright vertical ridge separating the dorsal facet from the right dorsolateral is seemingly missing. Strangely enough, the tooth at the end of the left upright (or dorsal ridge) is smaller and more irregular than the right. The apicodorsal facet is pentagonal, apparently due to the disappearance of the ridge which is present in *Abyla* and which separates the dorsal and apicodorsal facets in that genus. Finally, as in *irregularis* the transverse apical ridge is skewed.

Remarks

Despite the poor condition the specimen is now in, because it was accidentally dried, these characters can still be observed and hence, it appears desirable to call attention to this peculiar variant of *Abyla*.

CERATOCYMBA Chun 1888

Genotype: *Ceratocymba sagittata* Quoy & Gaimard 1827

Generic Characters

Superior nectophore (Figs. 18A, 19, 22). In general appearance the superior nectophores of the several species of *Ceratocymba* form a graduated series (Fig. 1), varying from an almost rectangular (*leuckartii*)[1] to an elongate pyramidal shape (*sagittata*). However, all members of the genus have the same basic arrangement of facets as in *Abyla*, but the number is reduced to a total of seven. The smaller number is due to the absence of any subdivision on the apical and ventral surfaces, or of the ventrolateral facets, i.e., both transverse and horizontal ridges are absent. In three of the four species, the dorsal facet is triangular rather than rectangular. When triangular, its apex, together with the adjacent facets, is more or less produced. This is slight in *dentata*, greater in *intermedia*, and very pronounced in *sagittata*. As a result of this growth, the definite apical facet in *leuckartii* and *dentata* seemingly disappears in *sagittata*. However, the ventral surface apical to the somatocyst is homologous with the apical surface as determined by the insertion of the lateral ridges. Primarily, the arrangement of the somatocyst, hydroecium, and nectosac is the same in this genus as in *Abyla*, but with the prolongation of the dorsal facet, the nectosac becomes correspondingly elongate. While the arrangement of the somatocyst, hydroecium and nectosac on the other hand, are essentially as in *Abyla*, the keel beneath the somatocyst in side view appears to lie well above the opening of the nectosac, unlike that of *Abyla*.

Inferior nectophore (Figs. 18D, 20C, 21C). The inferior nectophores of *Ceratocymba* differ from those of *Abyla* in that none of the ridges is expanded into pronounced wing-like structures. Hence, the nec-

[1] As defined here the genus *Ceratocymba* includes two species, *leuckartii* Huxley and *dentata* Bigelow previously referred to *Abyla*, as well as *C. sagittata* and a new species, *C. intermedia*.

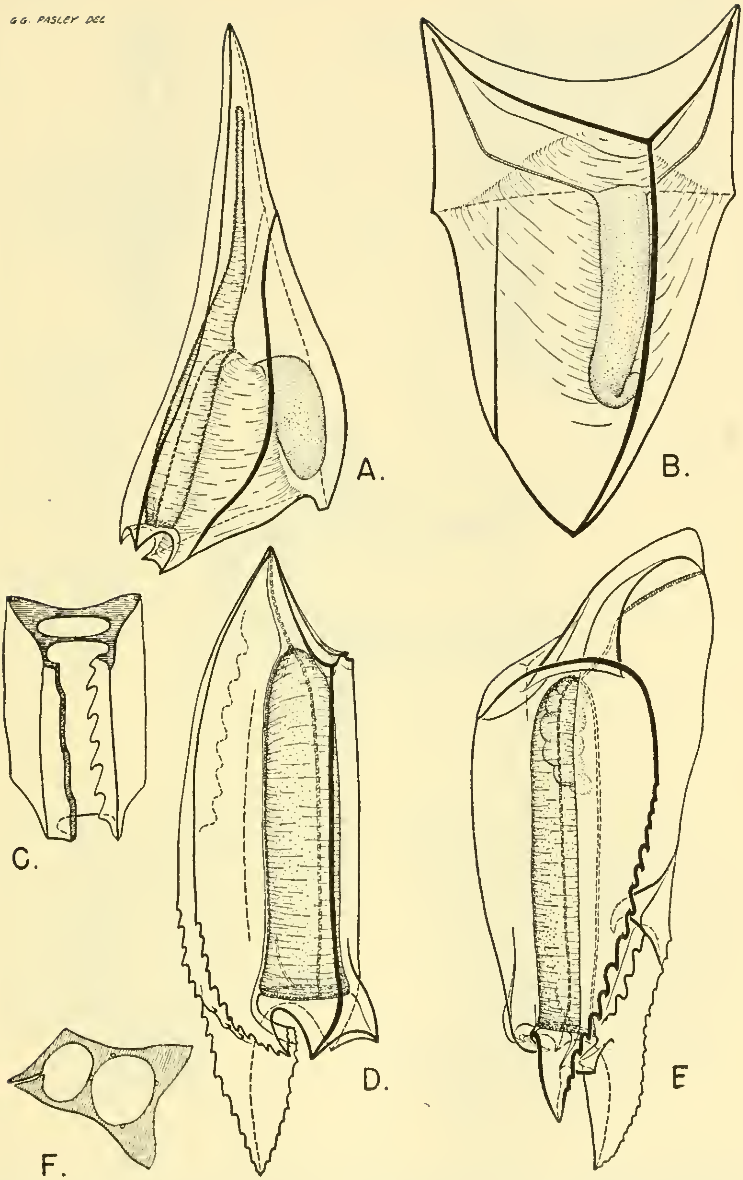

Fig. 18. *Ceratocymba sagittata.* A. Lateral view of superior nectophore with a dorsal facet of about 19 mm. in length. B. Dorsal view of bract with a dorsal ridge of 17 mm. in length. C. Section of hydroecial cavity of inferior nectophore. D. Lateral view of inferior nectophore with a total length of 40 mm. E. Lateral view of gonophore with a total length of 25 mm. F. Cross section of inferior nectophore.

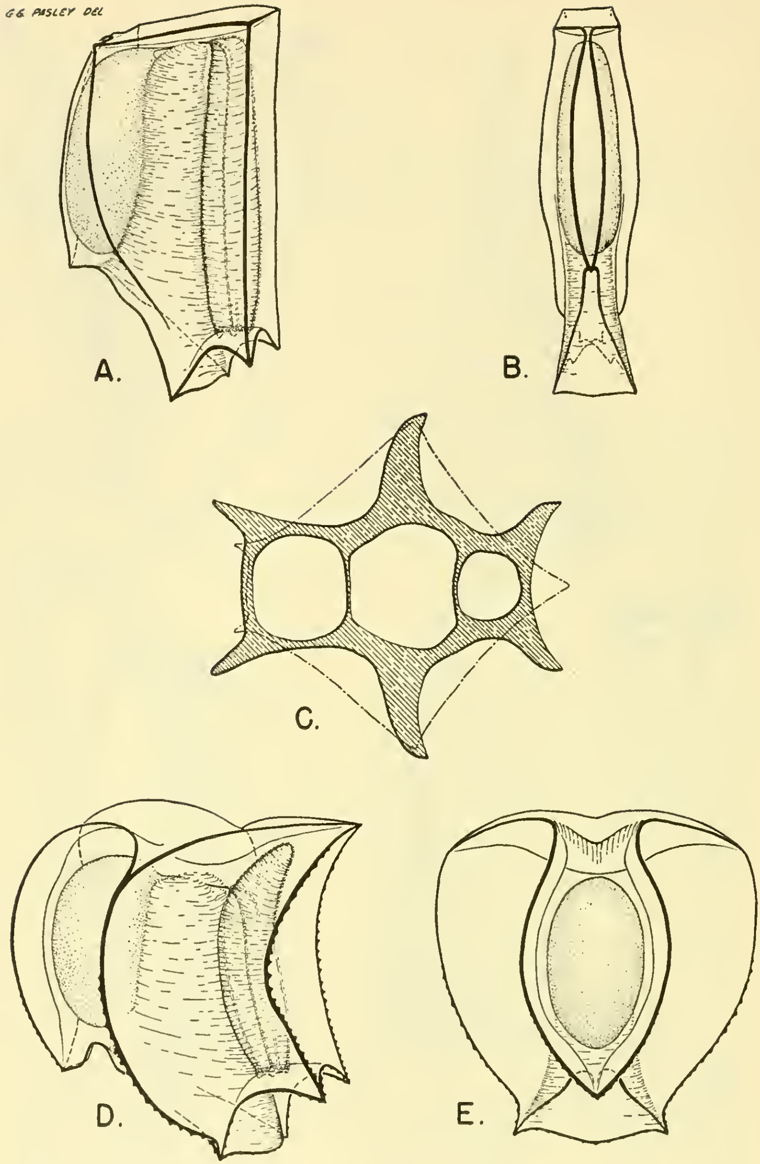

Fig. 19. Superior nectophores. *Ceratocymba leuckartii:* A. Lateral view of specimen with dorsal facet of about 5 mm. in length. B. Ventral view of same. *C. dentata:* C. Cross section with outline at apex superimposed as a dashed line. D. Lateral view of specimen with a dorsal facet of about 9 mm. E. Ventral view of same specimen.

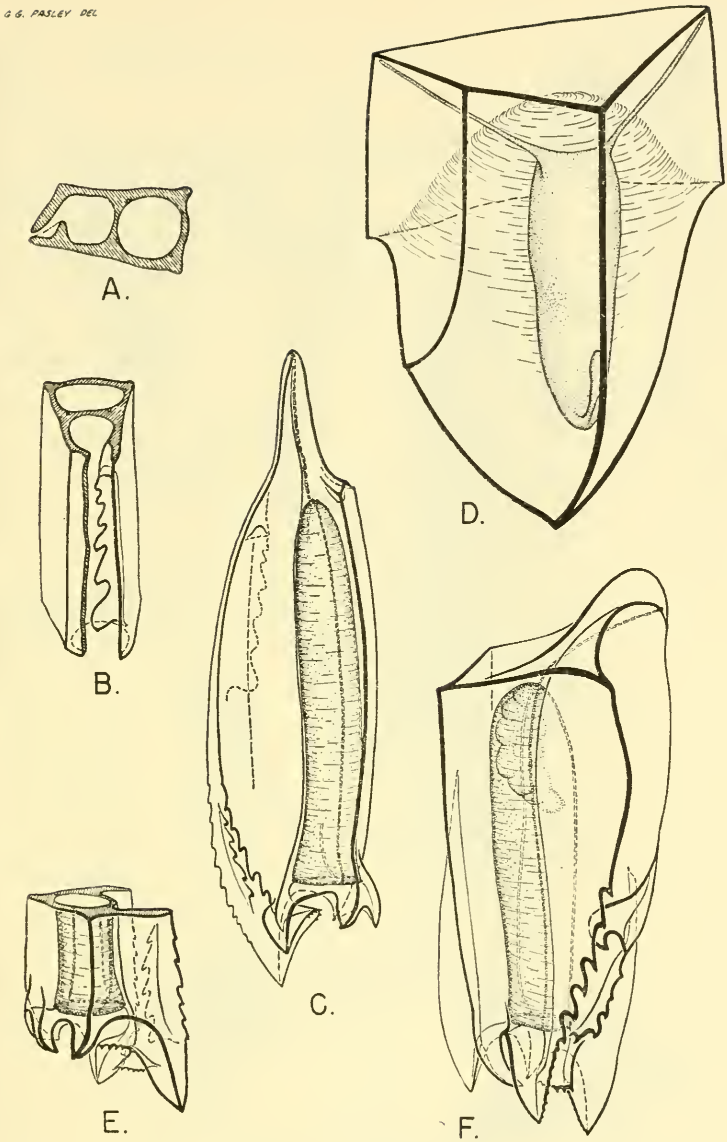

Fig. 20. *Ceratocymba leuckartii:* A. Cross section of inferior nectophore. B. Section of hydroecial cavity of same. C. Left lateral view of inferior nectophore 9.5 mm. in length (exclusive of apophysis). D. Bract drawn from specimens with a dorsal ridge of about 6 mm. E. Detail of mouth region from right side of same. F. Gonophore, about 4 mm.

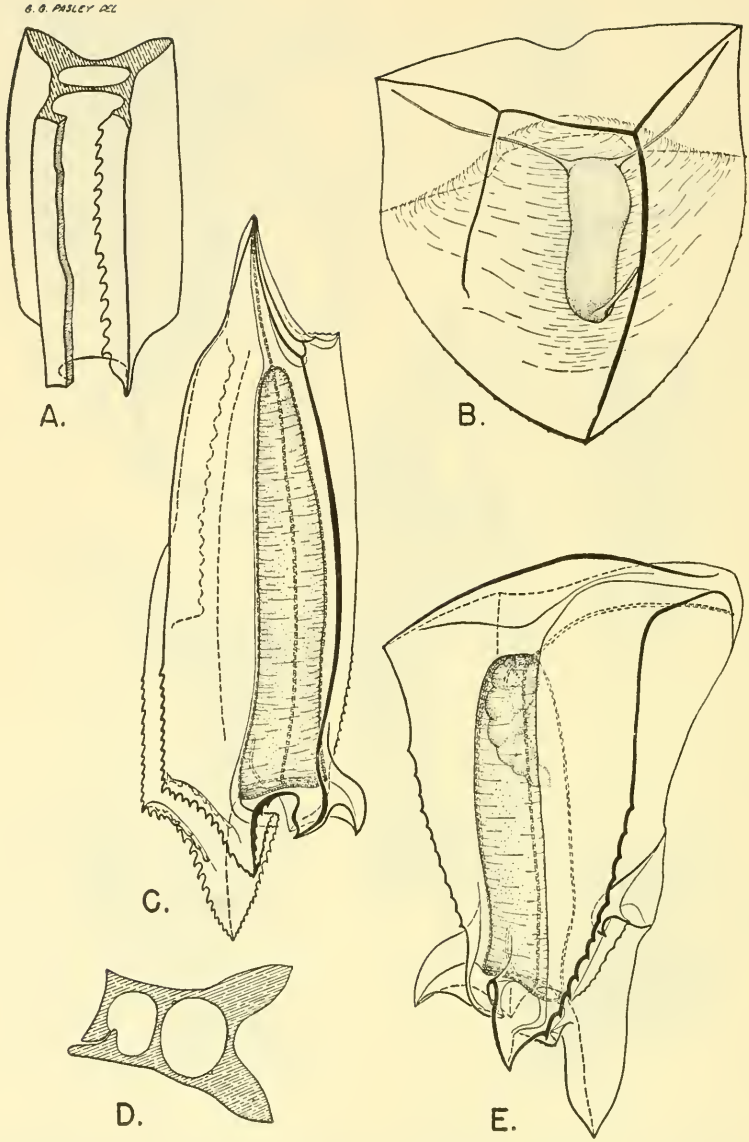

Fig. 21. *Ceratocymba dentata:* A. Section of hydroecial cavity of inferior nectophore. B. Dorsal view of a bract with a dorsal ridge of 13 mm. in length. C. Left lateral view of inferior nectophore of 45 mm. in total length (exclusive of apophysis). D. Cross section of inferior nectophore. E. Lateral view of gonophore 13.3 mm. in length.

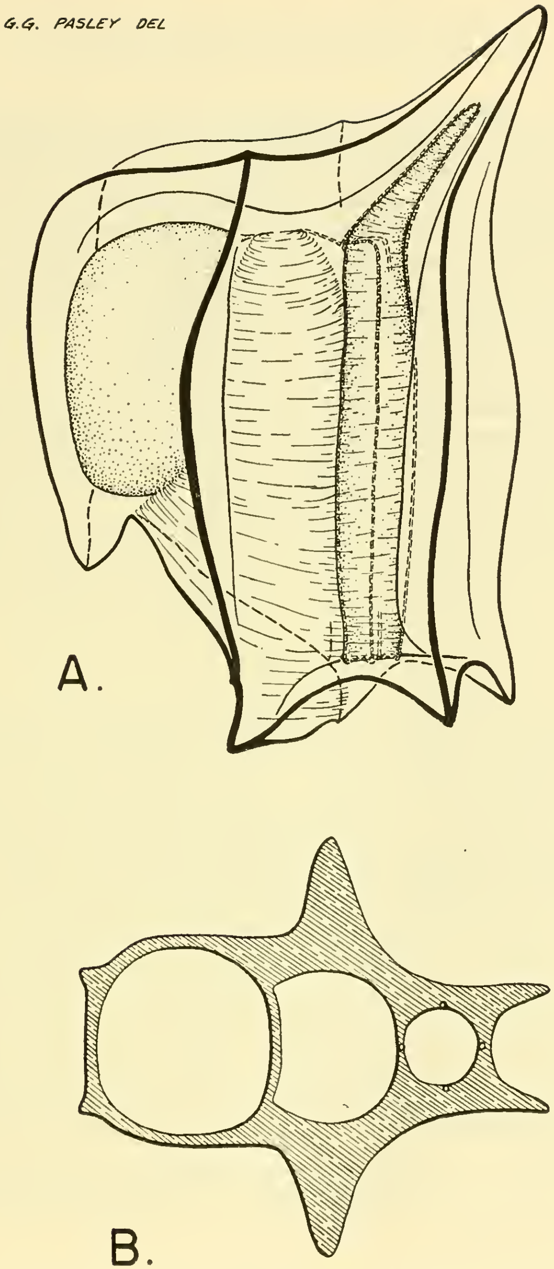

Fig. 22. Superior nectophore of *Ceratocymba intermedia:* A. Lateral view of a superior nectophore with a dorsal facet of 7 mm. in length. B. Cross section.

tophore as a whole tends to be long and narrow. Also, in contrast to *Abyla*, it is the dorsal ridge which is suppressed rather than the right lateral. This is shown by the fact that the ridge of the dorsal tooth ends abruptly a short distance above the tooth on the dorsal wall of the nectophore. The lateral ridge, especially the right, tends to replace the dorsal. As a result the basal teeth are usually somewhat asymmetrical in their arrangement. Still another character is a prominent supernumerary ridge on the outer surface of the right ventral wing. This appears to act as a hinge for the outer half of the wing bends along the ridge at a right angle to the lateral surface as a whole. Thus, its distal half forms a ventral wall to the hydroecium which is rather shallower in this genus than in *Abyla*. It would seem that this device affords a better protection for the stem than the comb of the left lateral wing. The latter structure is, however, quite as well developed in this genus as in *Abyla*. Likewise, the oral teeth are as prominent and stout as in *Abyla*, but the dorsal tooth, in the absence of the dorsal ridge, may appear to protrude forward rather more. The ventral teeth are joined by a thickened lip which on the side toward the opening to the nectosac has an ovoid serrated rim.

Within the nectophore, the only peculiarity of the genus is the arrangement of the radial canals. Two, the ventral and left lateral, are to be found in their usual positions, but the dorsal has shifted to a slightly lateral position and lies under the right lateral ridge. The right lateral canal has come to lie under the accessory ridge. As a result, the latter is not straight, but veers sharply dorsad just prior to its insertion on the ring canal. It enters the canal, then, close to the point where one might expect to find the right lateral canal.

Bracts. (Figs. 18B, 20D, 21B). The bracts of this genus are of the "*Cymba*" type which differ considerably in general appearance from the "*Amphiroa*" of *Abyla*, although of the same basic plan (Fig. 2). In contrast to the "*Amphiroa*" bract, however, these are dorsoventrally flattened, with a median ridge rather than a dorsal facet. The basal facet is also missing but nevertheless there are usually[1] a total of five facets, because the left lateral facet is further subdivided by a more or less complete lateral ridge. The somatocyst system is very similar to that of the "*Amphiroa*" type, with two thin ventrolateral branches and a swollen descending branch. The chief differ-

[1] In *Ceratocymba sagittata*, according to our observations, the lateral ridge may be missing as shown by Bedot (1904).

ence is that the posterior extremity of the latter curves sharply dorsad ending in a blind sac. The relative length of the descending branch of the somatocyst, the position and extent of the lateral ridge, and the degree of serration and the relative prominence of the ridges appear to be the best characters on which to base specific differences.

Gonophores (Figs. 18E, 20F, 21E). In many ways the gonophores of each species of *Ceratocymba* resemble the inferior nectophores of that species, i.e., in the number and arrangement of the ridges and the oral teeth. However, the apophysis is lopsided to fit into the hydroecial cavity of the bract. Depending on the sex, this together with the ventral ridges and teeth are mirror images of one another. The hydroecial cavity of the gonophore is characterized by the presence of a hook[1] curved inward from the margin of one of the ventral ridges. From beneath the tip of the hook a diagonal ridge extends down along the floor of the hydroecium toward the ventral tooth on the opposite side. This ridge may be scarcely detected, may be serrate, or even denticulate.[2] In any event, with the hook it forms a finger-like pocket in the lower portion of the hydroecium.

Remarks

The genus *Ceratocymba* has previously been considered monotypic, chiefly because the general outline of the superior nectophore of *sagittata* is unique among abylids. "This external modification obscures its close relationship to *A. leuckartii*, but when the ridges and facets are analyzed their fundamental unity is at once apparent" (Bigelow, 1911, p. 231; see also, p. 232). This statement remains true whether Bigelow's *Diphyabyla hubrechti* actually is *intermedia* or *sagittata*. As mentioned above, two species (*leuckartii* and *dentata*) which had earlier been considered as members of the genus *Abyla*, actually have the characteristic number and arrangement of the ridges and facets of the superior nectophore of *C. sagittata* (a comparison made by Lens & Van Riemsdijk (1908) in their original description), as well as similar inferior nectophores and eudoxids. That the apical prolongation in *sagittata* is merely an exaggerated development of the apicodorsal peak in *dentata*, seems quite obvious

[1] Since male and female gonophores are mirror images of one another, this character is found on the left ventral ridge in the female and the right in the male.

[2] There appears to be considerable individual variation in this character. It does not seem, however, to be entirely dependent on the state of preservation.

on comparing the two (Fig. 1). In short, the only pronounced differences between the two species are the apical extension of the dorsal facet and the consequent stretching of contiguous facets and nectosac. That this is indeed the case, now seems apparent on finding a superior nectophore of a new species intermediate between the two, which is described below as *intermedia*[1]. This transitional form affords a most convincing proof of the importance of the ridges and facets of the superior nectophore in determining generic differences in the Aby linae. Certainly, the close similarity, even in quite minute details, of the structure of the inferior nectophores, eudoxids, and gonophores in this genus as construed here, seems to justify the present definition of *Ceratocymba*. The broad outlines, on the other hand, appear to be a specific rather than a generic difference (Fig. 1). At the same time, it becomes obvious that the elongate apex of the superior nectophore, the elongate tooth below the right ventral wing of the inferior nectophore, and the apical horns of the bracts are merely specific differences of *sagittata*, as one might suspect, rather than generic characters as has previously been supposed.

Key to the Species of Ceratocymba

A. Based on the characters of the superior nectophore.

1. Dorsal facet rectangular . . . . *Ceratocymba leuckartii* Huxley
   Dorsal facet triangular 2
2. Lateral ridges expanded into wing-like structure; deep apical depression
   Ceratocymba dentata Bigelow
   Lateral ridges not markedly expanded 3
3. Nectosac at least twice as long as the hydroecium . . . .
   Ceratocymba sagittata Quoy and Gaimard
   Nectosac less than twice as long as the hydroecium . . . .
   Ceratocymba intermedia n. sp.

B. Based on the characters of the inferior nectophores (where known).

1. Nectophore with an elongate right ventral tooth; 6–7 teeth on flap folded in along apical portion of left ventral wing . . . .
   Ceratocymba sagittata Quoy and Gaimard
   Nectophore without an elongate right ventral tooth 2
2. Nectophore laterally flattened; accessory ridge short and inconspicuous;

[1] It is this species, I believe, which Bigelow (1911, pl. 12, fig. 7) has illustrated as *Diphyabyla hubrechti* and which Moser (1925, p. 274) considered to be a young specimen of *C. sagittata*. To be sure all known specimens are 5–7 mm., but the outline of *sagittata*, even when as small, is that of the adult (i.e., 19 mm. or more).

at most 5–6 teeth folded in along apical portion of left ventral wing. . *Ceratocymba leuckartii* Huxley

Nectophore not flattened; accessory ridge long, conspicuous and serrated; about 15 relatively small teeth folded in along apical margin of the left ventral wing. . . . . *Ceratocymba dentata* Bigelow

C. Based on the bracts (where known).

1. Bract with two prominent anterior horns; apical facet triangular; left lateral ridge does not usually join apicodorsal ridge. . . . . *Ceratocymba sagittata* Quoy and Gaimard

   Bract without horns; apical facet quadrangular; left lateral ridge joins apicodorsal ridge. 2

2. Left lateral ridge usually extends posteriorly to basal margin; margins and ridges generally smooth; somatocyst extends almost to posterior margin of bract. . . . . *Ceratocymba leuckartii* Huxley

   Left lateral ridge ends abruptly shortly before reaching posterior margin; ridges expanded; ridges and margins serrated; somatocyst confined to anterior half of bract. . . . . *Ceratocymba dentata* Bigelow

D. Based on gonophores (where known)

1. Gonophore with a dorsal ridge extending about half way up the nectophore above the dorsal tooth. . . . . . . *Ceratocymba leuckartii* Huxley

   Gonophore with ridge of dorsal tooth ending a short distance above it.2

2. Gonophore with prominent dorsal tooth projecting forward. . . . . *Ceratocymba dentata* Bigelow

   Gonophore with rather inconspicuous dorsal tooth. . . . . *Ceratocymba sagittata* Quoy and Gaimard

CERATOCYMBA SAGITTATA Quoy and Gaimard 1827

Cymba sagittata, Quoy and Gaimard, 1827, pp. 16–17, pl. 2c, figs. 1–9; 1829 p. 134; Eschscholtz, 1829, p. 134; Lesson, 1843, p. 454.

Nacella sagittata, Blainville, 1830, p. 120; 1834, p. 131, pl. 4, fig. 2 (not seen).

Diphyes cymba, Quoy and Gaimard, 1834, pp. 95–97.

Diphyes nacelle, Quoy and Gaimard, 1834, pl. 5, figs. 12–17.

Ceratocymba spectabilis, Chun, 1888, pp. 1160–1162.

Ceratocymba sagittata, Chun, 1888, p. 1162; 1897, p. 33; Bedot, 1904, p. 5, pl. 1, figs. 1–3; Bigelow, 1918, pp. 411–415, pl. 5, fig. 5, pl. 6, figs. 1–3, pl. 7, figs. 1–5; 1931, pp. 548–549; Bigelow and Sears, 1937, pp. 28–29; Browne, 1926, pp. 65–66; Leloup, 1932, pp. 18–19; 1933, p. 19; 1934, pp. 54–55; Moser, 1911, p. 431; 1912, figs. 22–23; 1912b, p. 408; 1913, p. 149; 1925, pp. 269–283, text fig. 40, pl. 15, pl. 16, figs. 1–5; Totton, 1925, p. 446; 1932, p. 332; 1936, p. 233.

Enneagonum sagittatum, Schneider, 1898, pp. 92–93.

Abyla leuckartii, Agassiz and Mayer, 1902, p. 165 (partim).

Diphyabyla hubrechti, Lens and Van Riemsdijk, 1908, pp. 36–39, text figs. 46–51, pl. 6, fig. 47; Bigelow, 1911, pp. 231–233, pl. 12, fig. 7; Moser, 1911, p. 431; Totton, 1932, p. 332.
Abyla sagittata, Moore, 1949, p. 13.

Superior nectophore (Fig. 18A). The general resemblance of *C. sagittata* to the diphyids was the reason for the choice of the original generic name, *Diphyabyla*, given to the superior nectophore by Lens and Van Riemsdijk (1908). This resemblance is effected by an extreme apical prolongation of the triangular dorsal facet and adjacent portions of other facets to produce a long, narrow, pyramidal extension above the characteristically abylid nectophore. This means that the apical facet is not obvious and that the portion of the ventral facet above the somatocyst is homologous with this structure in the other species of the genus as indicated by the insertion of the lateral ridges. With the apical prolongation of the dorsal facet the nectosac becomes tubular and about twice as long as the hydroecium. The somatocyst and hydroecium, however, are not proportionately increased in length.

One further character which contrasts with the new species, *intermedia*, is that the width of the basal facet in side view is much less than one third the width of the basal margin of the nectophore.

Inferior nectophore (Fig. 18D). The inferior nectophore of *C. sagittata* may be distinguished by the elongate right ventral tooth, by the 6–7 teeth on the comb of the left ventral wing and by the accessory ridge intermediate in length between *dentata* and *leuckartii*. The latter arises slightly below the level of the apex of the nectosac and extends basally almost to the level of the nectosac opening. Details in the mouth region, although minor, are diagnostic for the species. The ventral edge of the right ventral wing is continuous with the teeth on the inner surface of the giant tooth. The ventral ridge of this tooth continues upward and disappears on the outer surface of the right ventral wing. On the left ventral wing where there is but a single row of teeth, the free edge merges directly with the ventral ridge of the corresponding tooth.

Bract (Fig. 18B). The bract of *C. sagittata* is unique in that it has prominent lateral horns and a triangular, deeply concave apical facet. In addition, the left lateral ridge does not usually join the apicodorsal ridge in most specimens, although on a number of individuals it does. In every case we have examined, however, the lateral ridge when present starts at the posterior margin. The somatocyst in *sagittata* as in *dentata* does not extend into the posterior half of the bract.

Such variability in the location of the lateral ridge might indicate that more than one species is involved. However, without more evidence than is now available, I am inclined to believe that this is due to individual variation. Thus, there may be a partial ridge, starting at the posterior margin and ending short of the apicodorsal ridge, as is most usual, or the two may join. The latter type tends to be more serrate along the ridges than the others and this appears also to be true of the gonophores attached to it.

Gonophore (Fig. 18E). The gonophore of *C. sagittata* is often recognized by the relative length of the ventral teeth, but unfortunately this is not an infallible character. It appears usual for one to be elongate as in the inferior nectophore, but quite often the two are more nearly the same length. Bigelow (1918, p. 415) considered the variations to be dependent on the stage of development. Thus, he believed that ventral teeth of nearly equal length were found more often in younger stages than those with a greater disparity in length. Our observations contradict his account, for at times we have found the greatest disparity on the smallest gonophores (1–2 mm.) and *vice versa*. Insofar as we have been able to ascertain, this variability cannot be correlated with variations of the bract (i.e., with those of the lateral ridge). Constant characters on the gonophores of this species are: (1) the relatively small inconspicuous hook arising from one of the ventral ridges and curved in toward the floor of the hydroecium, (2) the presence of serrations extending well above this hook on the ventral margin of the opposite wing, and (3) a very weak inconspicuous dorsal tooth. Finally, the apex is distinctive in that its lateral ridge attached next the hydroecial wall of the bract is higher than the opposite exposed one.[1]

Remarks

Although the eudoxid of this species was described by Quoy and Gaimard (1827) as *Cymba sagittata* from the Straits of Gibraltar, the polygastric generation remained unknown until Lens and Van Riemsdijk (1908) recorded a superior nectophore as *Diphyabyla hubrechti* from the East Indies. Soon thereafter, both Moser (1925, pp. 271–272)

[1] Often when preservation is poor, it is impossible to determine the gonophore of this species with certainty because the apex and the hydroecial region are so damaged.

and Bigelow (1918, p. 414) found stems still attached to the nectophores of *D. hubrechti* with cormidia sufficiently well developed to ascertain that they actually were the nectophores of *Ceratocymba sagittata.*[1]

The similarity between the eudoxid of *sagittata* and that of *leuckartii* has been known for some time (Bigelow, 1911; Moser, 1925; Browne, 1926). Indeed, although at one time Moser (1913) considered the two bracts as quite distinct, later she (1925) was not able to distinguish them. Bigelow (1918), on the other hand, listed a number of differences most of which have proven constant in the "Dana" material. Earlier difficulties in distinguishing the bracts of *leuckartii* and *sagittata*[2] exist merely because of Moser's (1925, pp. 272–273) confusion. Perhaps she had too few specimens, or she placed too much confidence in finding the bracts associated with the polygastric generation or the gonophores of one or the other species in her samples, as was the reason for her erroneous identification of the inferior nectophore of *A. bicarinata.* She includes in her synonymy of *sagittata* the eudoxid described by Lens and Van Riemsdijk (1908, p. 9) as *C. asymmetrica* and figured a specimen of it which she called *sagittata* (1925, p. 278, text fig. 40a). Bigelow (1911, p. 218) was able, however, to prove the connection of this bract with *leuckartii* by finding attached cormidia of that species sufficiently far advanced to make their identity with the detached eudoxids of *asymmetrica* quite certain. All the bracts of *leuckartii* we have seen, definitely have a truncated apex as do the superior nectophores. In short, Moser's (1925, text fig. 40a) figure of the bract which she presumed to be *sagittata* is very like bracts which had earlier been referred to *leuckartii* (Bigelow, 1911, pl. 15, figs. 3–4; Lens and Van Riemsdijk, 1908, pl. 1, figs. 2–4, as *C. asymmetrica*). On the other hand, there seems to be little doubt that the bracts figured by Quoy and Gaimard (1827, pl. 16, pl. 2c), Bedot (1904, pl. 1, fig. 1), and Bigelow (1918, pl. 5, fig. 5) were all specimens of *sagittata.*

[1] Chun (1888, p. 1162) substituted *Ceratocymba* for *Cymba* since the latter name was preoccupied by a genus of the Mollusca.

[2] Lens and Van Riemsdijk (1908, pp. 9–10) make several contradictory statements concerning this species: "It differs from the *Ceratocymba's* hitherto described (. . . BEDOT, 1904 . .) by the absolute asymmetrical structure of the bract." "BEDOT 1904 has published a figure of a *Ceratocymba* caught in the Atlantic which is to our opinion absolutely identical with our *Ceratocymba.*" "We are sure that as soon as CHUN publishes figures of his *Ceratocymba sagittata*, every one will be struck by the differences which exist in his *Ceratocymba* and in BEDOT's and ours." Examination of Bedot's figure (1904, Pl. 1, fig. 1) and those of Lens and Van Riemsdijk (1908) make it very obvious that the bracts were not identical. Lens and Van Riemsdijk in reality figured *leuckartii*, Bedot, *sagittata*.

Ceratocymba leuckartii Huxley 1859

Abyla leuckartii Huxley, 1859, p. 49, pl. 3, fig. 2; Agassiz and Mayer, 1902, p. 165 (partim); Lens and Van Riemsdijk, 1908, p. 34, pl. 5, text figs. 42–45; Bigelow, 1911, pp. 216–221, pl. 13, figs. 5–8, pl. 15, figs. 3–4; 1918, p. 409; 1919, pp. 333–334; 1931, pp. 543–544; Moser, 1913, p. 149; 1925, pp. 288–293, pl. 17, figs. 4–6; Kawamura, 1915, p. 580, pl. 15, figs. 29–31; Browne, 1926, p. 62; Leloup, 1932, p. 22; Totton, 1932, text fig. 17A.
Enneagonum leuckartii, Schneider, 1898, p. 93.
?*Abyla leuckartii*, Totton, 1925, p. 448.

Superior nectophore (Fig. 19A, B). The superior nectophore of *Ceratocymba leuckartii* is laterally flattened as is *sagittata*. Thus, the dorsal, apical, and ventral facets are narrow and elongate,[1] while the two lateral facets together are pentagonal. The lateral ridge in this species is, however, peculiar in that it lies nearer the ventral surface than in the other three species of the genus, and near the base it curves sharply dorsad almost parallel to the basal margin. Furthermore, it ends well above the lateral tooth on the dorsal wall of the hydroecium. Thus, the dorsolateral and ventrolateral facets are incompletely and unequally divided. The ventrolateral facet is elongate like all the other facets except the dorsolateral. Not usually mentioned in earlier descriptions is the fact that apically, at least, the lateral ridge delimits the ventral surface, rather than the extraordinarily narrow ventral facet itself. Also, all the ridges are finely serrated when viewed with a moderately high power of a binocular microscope. Other characters which separate this species from others in the genus, are that the apices of the somatocyst, hydroecium, and nectosac are all at the same level as in *Abyla* and that the dorsal facet is rectangular.

Inferior nectophore (Fig. 20C). The fragile inferior nectophore of *leuckartii* is flattened laterally, but even in side view, it is about three times as long as it is wide. Contrary to Bigelow's (1911, p. 218) statements that there is a "well-marked dorsal ridge", there is none. The ridge which often appears to be the dorsal because it has shifted dorsad, is actually the right lateral, as is characteristic of the genus. In *C. leuckartii* the supernumerary ridge is relatively short, arising just below the apex of the nectosac and extends basad only about two thirds its length. Another distinctive feature is that there appear to be only five or at most six teeth on the comb of the left ventral wing. The

[1] For example, the dorsal facet is nearly five times as long as it is wide.

elongate tooth at the base of the right ventral wing is definitely larger than the left but not as long as is usual for the corresponding tooth in *C. sagittata* or *C. dentata*. Certain minor features of the mouth region are also characteristic of *leuckartii*. The free edge of the right ventral wing merges with the ventral ridge of the corresponding tooth. The inner row of teeth on this wing does not merge with the ventrobasal margin, but rather parallels it. The free edge of the left ventral wing, on the other hand, ends on the dorsal wall of the hydroecium ventrad to the ventral ridge of the left ventral tooth, which ends slightly above it and laterad. Finally, the lip between the two basal teeth separating the hydroecial cavity from the opening of the nectosac is thickened and overdeveloped, but at the same time it has a definite pocket, surrounded at its periphery by stout serrations.

Bract (Fig. 20D). Although the bract of *C. leuckartii* was confused with that of *C. sagittata* by Moser (1925), as mentioned above, the following combination of characters will differentiate the species under consideration from either of the other known species: the apical facet is flat and quadrilateral, the descending branch of the somatocyst extends almost to the basal margin, and the left lateral ridge extends from the basal margin to the apical ridge subdividing the left lateral facet into two unequal parts, the outer one covering but about half the area of the inner one.

Gonophores (Fig. 20F). In the "Dana" material, the gonophore of *leuckartii* like the inferior nectophore is usually in an extremely poor state of preservation. From study of a considerable series, however, it has been possible to ascertain that the gonophore is basically like those of *sagittata* and *dentata*. The lower part of one ventral wing is heavily and irregularly denticulate up to the level of the hook on the other. The membrane on the dorsal wall of the hydroecium below the hook is smooth except for one or two jagged teeth at its base. The oral teeth are strongly serrated and appear to be rather uniform in length but on occasion one of the ventral ones may be exaggerated. Furthermore, not only is the dorsal tooth heavier than either lateral, but also the ridge continues nearly half way up the nectosac before disappearing completely. Finally, the apicolateral ridges are at the same level just above the tip of the nectosac.

CERATOCYMBA DENTATA Bigelow 1918

Abyla dentata Bigelow, 1918, pp. 409–410, pl. 5, figs. 1–4; Totton, 1932, p. 334, text figs. 14A, 15A; 1936, p. 233; Moore, 1949, p. 12.
Abyla quadrata Moser, 1925, pp. 293–298, text fig. 41, pl. 17, figs. 1–3, pl. 18, figs. 1–5, pl. 19, figs. 1–2.

Superior nectophore (Fig. 19C, D, E). The superior nectophore of *C. dentata* is at first sight likely to be confused with *A. bicarinata* because it is cuboidal and has pronounced lateral ridges. However, it is obviously a *Ceratocymba*, not an *Abyla*, because of the absence of the horizontal ridges and of the transverse apical ridge. The most distinctive feature as originally described by Bigelow (1918), is, however, the triangular dorsal facet with strongly bowed and heavily serrated lateral margins and a deeply emarginated base. Its apex, together with portions of the adjacent facets, is produced to form a definite peak. As a result, the nectosac is relatively longer and its apex higher than those of the somatocyst and hydroecium.

The apical surface is essentially square, one corner at the apex of the dorsal facet, one at each of the junctions of the lateral and apicolateral ridges, and one at the sharp curvature in the narrow portion of the apicoventral facet separating the apical and ventral surfaces. This surface, furthermore, has an extraordinarily deep depression not found on any other abylid.

Inferior nectophore (Fig. 21C, D). The robust, elongate[1] opaque nectophore of *dentata*, originally described and well figured by Moser (1925) as *quadrata*, makes this species the most conspicuous of all abylids, not excepting *sagittata*. In keeping with its sturdy appearance, the supernumerary ridge on the right ventral wing runs the full length of the nectosac and is almost as pronounced as the other ridges. In addition, it is markedly serrate. Likewise, the lack of a dorsal ridge is more apparent because the dorsal tooth is larger and stronger than in the other members of the genus. As a result, it appears to be thrust forward in a characteristic manner. There are sixteen teeth on the comb, which are thus not only more numerous but also smaller in size than in closely related species.

The lower portions of the ventral wings and their corresponding teeth also are characteristic and at the same time show similarities

[1] The nectophore is at least three times as long as it is wide, i.e., 42 x 13 mm. in one specimen actually measured.

with *Abyla* which are not obvious in *leuckartii* or in *sagittata*. Thus, although the wings are only slightly expanded, they do have thickened basal margins. On the right ventral wing, seven spiny teeth delimit the inner border while the outer border is strongly serrate. The basal margin of the left ventral wing is almost a mirror image of the right, except that there are only six teeth along the inner border. The serrations marking the outer border on both basal margins continue down to merge without demarcation with the ventral ridge of the ventral teeth.

Bract (Fig. 21B). The bract which appears to belong to *dentata* is very similar to that of *leuckartii* except that it is as wide as it is long and the dorsal ridge is usually raised and often quite arched. At times it is even serrated. Thus, it is much more prominent than in *leuckartii*. The left lateral ridge, likewise serrated, is more elevated than in the preceding species and ends abruptly some distance short of the basal margin. The descending branch of the somatocyst occupies only the anterior half of the bract. Finally, in some specimens, at least, the basal and lateral margins of the bract are thinned.

Gonophore (Fig. 21E). The gonophore found attached to the bract referred to *dentata*, has a number of distinctive features: the lateral ridges are rather strongly serrate except near the apex. The serrations on the ventral ridge opposite the enlarged hook extend above it, but not as much so as in *sagittata*. The hook arising from one of the ventral wings and curved inward toward the floor of the hydroecium is large and conspicuous. The teeth surrounding the opening of the nectosac are unusually heavy. In fact, the dorsal and lateral teeth are almost exact replicas of those of the inferior nectophore of this species. Finally, the apex is peculiar in that the lateral ridge away from the bracteal hydroecium (when the gonophore and bract are attached) is higher than the opposite one.

Remarks

An abylid bract and eudoxid not hitherto figured or described has been found repeatedly in the "Dana" material. Presumably it belongs to *dentata*, not only because it is the only species of *Ceratocymba* (other than the new *intermedia*) for which the bract is not known but also because it has repeatedly been taken in the same haul with the polygastric generation of this species. Although Moser (1925) described and figured both the superior and inferior nectophores (apparently taken attached), neither she nor any subsequent author has published a detailed description of the eudoxid. Totton (1932, p. 332) probably had specimens similar to ours, because he mentions that the eudoxids of his *Abyla dentata* and *Diphyabyla hubrechti* [*Ceratocymba sagittata*] are of the "*Ceratocymba*" type. He does not, however, give a description.[1] Later, he identified two specimens from the Bermuda region as belonging to this species (Moore, 1949). I have had access to these and they prove to be identical with those I have found in the same samples as the polygastric generation. Hence, Totton and I appear to be in agreement as to the identity. As yet, however, attached cormidia with bracts sufficiently far advanced to prove their identity with the polygastric generation of *C. dentata* have not been found.

CERATOCYMBA INTERMEDIA n. sp.

?*Diphyabyla hubrechti* Bigelow, 1911, pp. 231–233, pl. 12, fig. 7.
?*Ceratocymba sagittata* Moser, 1925, pp. 269–283 (partim) pl. 15, fig. 3.

The type is a superior nectophore from "Dana" Sta. No. 3678 taken with a stramin net 150 centimeters in diameter in a tow to 300 meters. This specimen will be deposited in Universitets Zoologiske Museum, København.

Superior nectophore (Fig. 22). A superior nectophore, not too well preserved, but nevertheless quite distinct from *sagittata* was found in the same sample with a number of small specimens of the latter species. The striking characteristic of this specimen[2] is that its apical prolongation is intermediate between that of *dentata* and *sagittata*, i.e., in the latter the hydroecium extends only one third the total height of the nectophore, whereas in *intermedia* it is about one half the total height. The large basal facet occupies nearly one half the width of the nectophore at the base, as compared with less than one third the width in *sagittata*. The prominent apical surface is slightly dented just above the hydroecium and at the point where the lateral ridges join the apicoventral ridges. This depression is not as marked as in *dentata*. In other words, this species may be likened to *dentata* with

[1] In a letter dated 1 September 1950, he states that he has "never published on the eudoxids of *A. dentata*" and that he "arrived at their identity by deduction from association in the usual way."

[2] In the description and figures, we have made allowances for the mutilations, chiefly twisting of the lateral ridges and compression of the hydroecium.

the dorsal facet and contiguous surfaces produced into more of an apical prolongation. The dorsal teeth of the basal facet protrude forward and the ventral ones downward and ventral. The dorsal facet is elongate and narrow rather as in *sagittata,* the two upright ridges bordering it are elevated as much if not more than those in *dentata.* However, these appear to extend forward rather than to the sides as in the latter. As a result the dorsal surface is almost hidden between them. Due to poor preservation, it is not possible to ascertain the extent of the lateral ridges. These appear, however, to be relatively thinner and narrower than in *dentata,* but wider than in *sagittata.*

Inferior nectophore. Unknown.

Eudoxid. Unknown.

Remarks

Judging from their drawings of superior nectophores, both Bigelow (1911) and Moser (1925) appear to have had specimens of the species here called *intermedia,* but which they quite naturally supposed were representatives of the species now called *sagittata.* This was due to the fact that Bigelow's (1911) specimen was only the second to be recorded and was only about a quarter the size of Lens and Van Riemsdijk's (1908) *Diphyabyla hubrechti.* It could therefore be presumed that any differences were merely differences in the stage of development. Likewise, Moser (1925, pl. 15, fig. 3) illustrates a specimen of 5 mm. which she believed to be a young nectophore. It so happens that we have seen considerable numbers of young superior nectophores of *sagittata* and in every case the definitive shape has been established before they are 5 mm. in height. In short, specimens with a proportionately large basal facet and a definite apical depression above the lateral and apicoventral ridges are all probably the new species described above as *intermedia.* Unfortunately, the specimen from "Albatross" Station 4683 is no longer available so that it is not possible to re-examine it.

PSEUDOCYMBA n. gen.

Genotype: *Pseudocymba asymmetrica* n. sp.

Generic characters

Superior nectophore (Figs. 23 and 24). The genus *Pseudocymba* is proposed[1] for two superior nectophores which have many of the

[1] See remarks on p. 49 for *Pseudabyla,* many of which are also applicable to this genus.

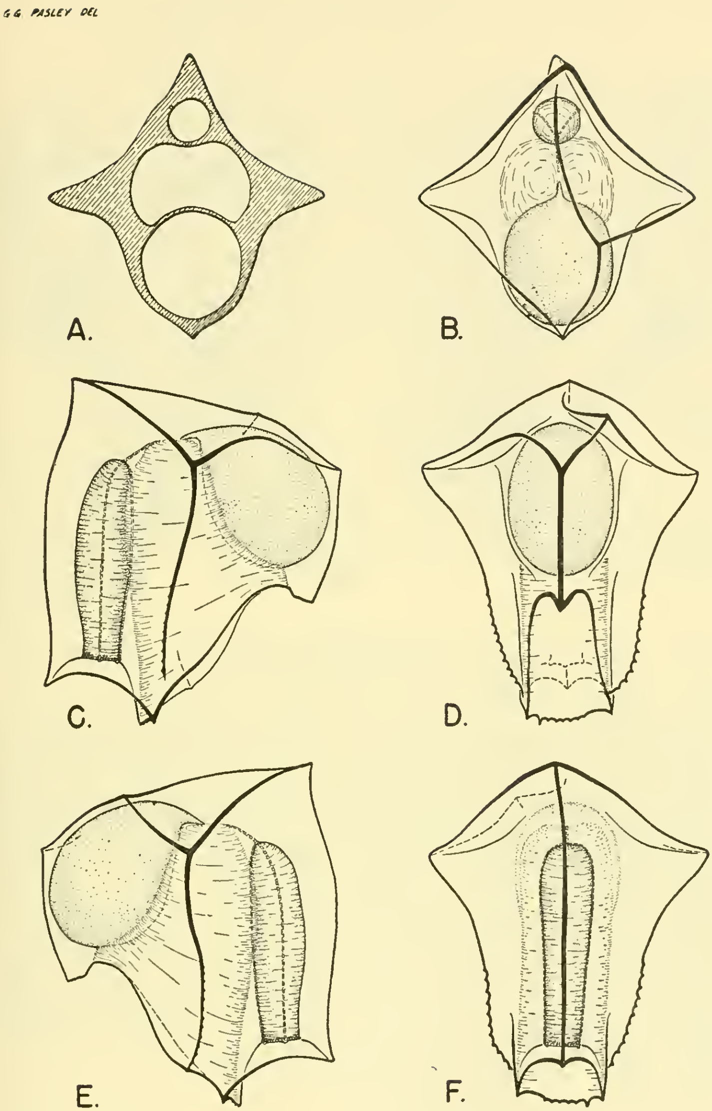

Fig. 23. Superior nectophore of *Pseudocymba asymmetrica* with a dorsal ridge 9.6 mm. in length. A. Cross section. B. Apical view. C. Left lateral view. D. Ventral view. E. Right lateral view. F. Dorsal view.

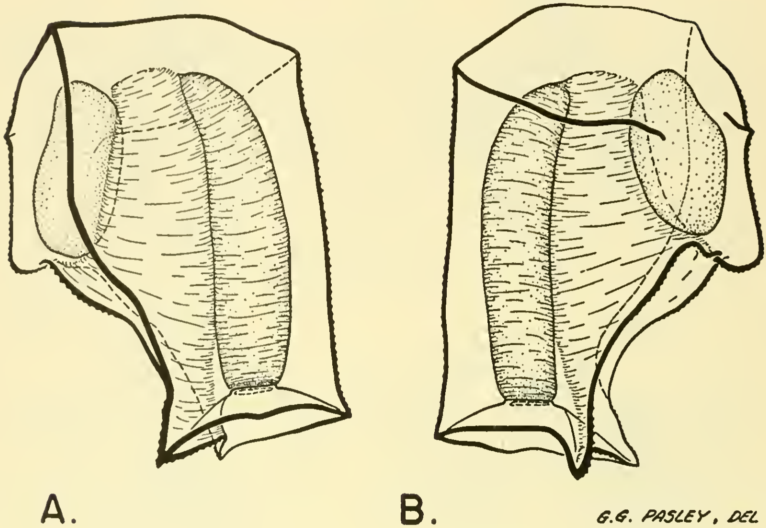

Fig. 24. Superior nectophore of *Pseudocymba anomala* with a dorsal ridge of about 3 mm. A. Left lateral view. B. Right lateral view.

characteristics of *Ceratocymba* in the arrangement of the facets and ridges, but which, like *Pseudabyla*, are variants with fewer facets and ridges than in that genus. The affinities with *Ceratocymba* are indicated by the absence of a transverse apical ridge subdividing the apical facet, and of the horizontal ridges. The general arrangement of the somatocyst, hydroecium, and nectosac is essentially as in *Ceratocymba*. One further peculiarity like *Ceratocymba* is that in lateral view, the keel beneath the somatocyst is obviously higher than the opening of the nectosac. In contrast to *Ceratocymba*, however, there is a dorsal ridge, not a facet. Furthermore, the basal facet is triangular, a characteristic previously found only in *Enneagonum hyalinum*. Other differences appear to be specific rather than generic.

Inferior nectophore. Unknown.

Eudoxid. Unknown.

Pseudocymba asymmetrica n. sp.

The type is an exceptionally well preserved superior nectophore from "Dana" Sta. 3920 taken at 1°12′N., 62°19′E. in a tow at 50 meters with a stramin net 200 cm. in diameter. It is to be deposited in Universitets Zoologiske Museum, København.

Superior nectophore (Fig. 23). The superior nectophore of *P. asymmetrica* has not only a dorsal ridge but also a ventral one. Thus, the ventrolateral and dorsolateral facets on one side are separated from the corresponding facets on the other by the ventral and dorsal ridges respectively. Hence, the number of facets have been reduced from seven in *Ceratocymba* to six in this species. Unlike any species in the previous genus an incomplete ridge starts at the left ventrolateral ridge of the apical facet and runs diagonally across it. The nectophore is therefore slightly asymmetrical.

The arrangement of the somatocyst, nectosac and nectophore are essentially as in *Ceratocymba* except that the number of radial canals on the nectosac have been reduced from four to three, a ventral and two laterals.

Pseudocymba anomala n. sp.

The type specimen is a badly multilated superior nectophore from the "Siboga" collection in the Zoölogisch Museum, Amsterdam. It bears the Catalogue No. 144C with a label *Abyla trigona*. In Lens and Van Riemsdijk's (1908) paper they record Cat. No. 144C as a sample containing four superior nectophores of *Abylopsis tetragona* from "Siboga" Sta. 220 at the "anchorage off Pasis-Pandjang, west coast of Binongka." Since the specimen is badly squashed, they seemingly had difficulty in its identification, but they apparently recognized its affinities with *Abyla*, as then defined, after the publication of their paper and segregated it from the other specimens of *tetragona*.

Superior nectophore (Fig. 24). Insofar as one can ascertain in its present mutilated condition, the left side is quite like that of *C. leuckartii*. There is a wide dorsolateral facet and a narrow ventrolateral. The right side seems to have no lateral ridge and there is no demarkation between it and the ventral surface. There is, however, a ridge separating the lateral surface from what appears to be the apical surface. The latter in its present condition is actually on the right side rather than apical and the left apicolateral ridge is seemingly apical. It would seem that the right lateral ridge and the ridge separating the ventral and right lateral facets are missing. The dorsal ridge and triangular basal facet appear to be characteristic for the genus but the latter is markedly curved on its outer margins. The ridges are all regularly and somewhat coarsely serrated.

ABYLOPSIS Chun 1888

Genotype: *Abylopsis tetragona* Otto 1823

Generic Characters

Superior nectophore (Fig. 25). As in *Ceratocymba* the superior nectophores of *Abylopsis* have seven facets.[1] In contrast to the preceding genera, however, it does not have an apical facet, but rather the lateral facets join to form a median apical ridge. Furthermore, the two lateral facets are divided horizontally into apicolateral and basolateral facets, not vertically as in the four genera just described. The apicolateral ones are quadrilateral, as are the basolaterals except for a break at the lower ventral corner for the opening to the hydroecium and its attendant basal teeth. The dorsal and ventral facets are both pentagonal. The basal facet is more elongate and quadrangular than square or triangular as in the genera just described. The opening to the nectosac is not in the center of this facet but at the angle between it and the dorsal wall of the hydroecium, a characteristic of this and succeeding genera. The somatocyst is swollen and ovoid. It is unique in that it has a small apical diverticulum not found in any previously known abylid genus.[2] In addition, the hydroecium is only partly interposed between the nectosac and somatocyst unlike most species in the preceding genera. It is not, however, relatively shorter than in the others, as it protrudes well below the base of the nectophore. The opening to the hydroecium is essentially square with a more or less marked tooth in each corner. In this way, it differs from the preceding genera.

[1] Certain aberrant specimens have been found very rarely (fewer than a half dozen out of more than 100,000 specimens) on which a ridge of one of the facets is missing. I believe these to be damaged in some way because other details of the species are intact, so that I have little hesitancy in referring them to either *tetragona* or *eschscholtzii*.

[2] The somatocyst of *Enneagonum* is constricted apically so that this might be construed as being a true diverticulum. The somatocyst is, however, quite different in shape from that of other abylids, being elongate rather than swollen and ovoid.

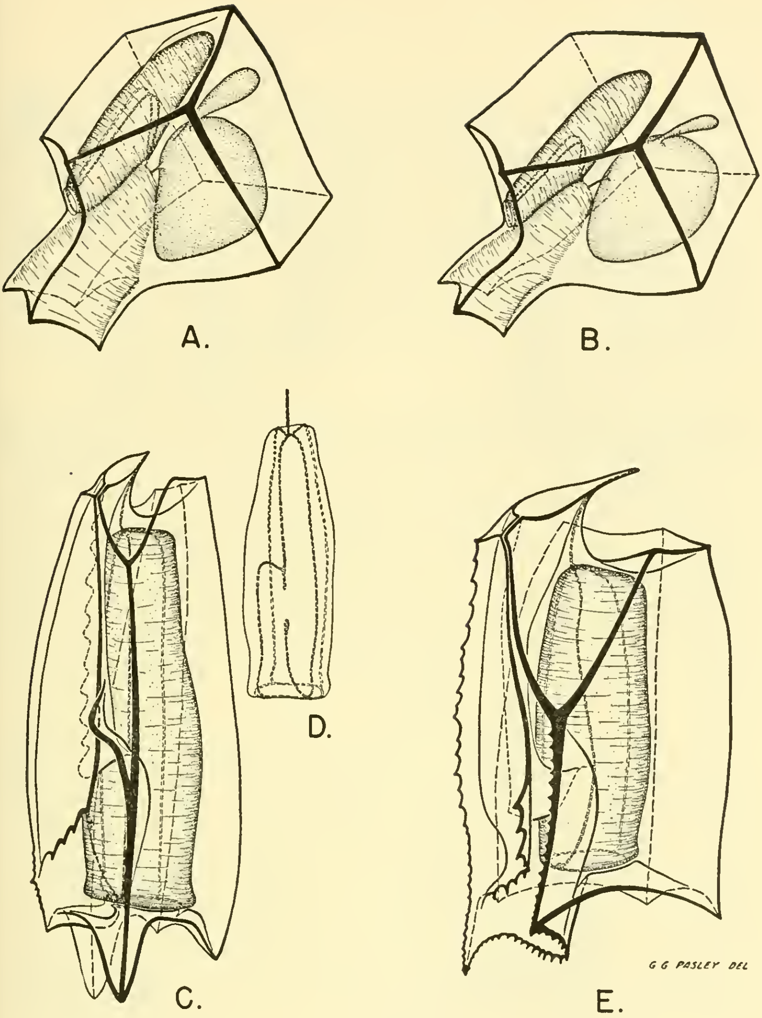

Fig. 25. A. Lateral view of superior nectophore of *Abylopsis tetragona* with a dorsal facet about 3.3 mm. in length. B. Lateral view of superior nectophore of *A. eschscholtzii* with a dorsal facet about 2.4 mm. in length. C. Ventrolateral view of inferior nectophore of *A. tetragona* about 22.5 mm. in overall length. D. Nectosac of *A. tetragona* to show canals. E. Ventrolateral view of inferior nectophore of *A. eschscholtzii* about 4.5 mm. in overall length.

Inferior nectophore. (Fig. 25). The inferior nectophores of *Abylopsis* have a combination of characters which readily separate them from those of any other abylid genus. Thus, the apophysis is much shorter than in the preceding genera and very characteristically hooked. There are five ridges each ending in a more or less prominent straight tooth. The left ventral wing is peculiar in that it forks at its apical end. The hydroecium is open, but deep and effectively covered by interlocking flaps from the inner surfaces of both ventral wings. Among the abylids so far known, flaps on both wings are found only in this genus and in *Bassia*.

Bract (Fig. 2C, D). The bracts are relatively smaller than in the preceding genera and have seven facets rather than five. In fact, their arrangement somewhat resembles that of the superior nectophores. In contrast, however, the bracts have an apical facet. The hydroecium is deep, almost thimble-like in shape, but flared at its base. The somatocyst is distinctive in that the descending branch is thin and the ventrolaterals swollen. In addition, there is an apical diverticulum somewhat more elongate than that in the superior nectophore. This structure is also found on the bracteal somatocyst of *Bassia* and *Enneagonum,* but not in the other genera of the subfamily insofar as is known.

Gonophores (Fig. 26B, D). Among the abylids, the gonophores of *Abylopsis* are the simplest and least adorned. Thus, there are four definite ridges, each ending in a straight tooth. Beneath each ridge lies one of the radial canals. One of the ventral ridges especially is peculiar in that it crosses the lateral surface to join the dorsal and apicolateral ridges where they meet. The other also diverges from the vertical but is not so erratic in its course and joins the apicolateral ridge at its ventral extremity. The apophysis, however, is in younger specimens (of about 1.5–2.5 mm.) extraordinarily large, perhaps being as much as a third of the entire structure. In older individuals (of 5 mm. or more) it is very much reduced, but nevertheless, together with the apical surface, it is prominent. The apophysis is flat, the edge on one side continuing down part way into the hydroecium as a wide band, which tapers to a thin ridge below a more or less conspicuous tooth (often so damaged that it is unrecognizable) located about midway down the nectosac. On the other side, the edge extends, sometimes as a rounded surface, to the junction of the ventral and apico-

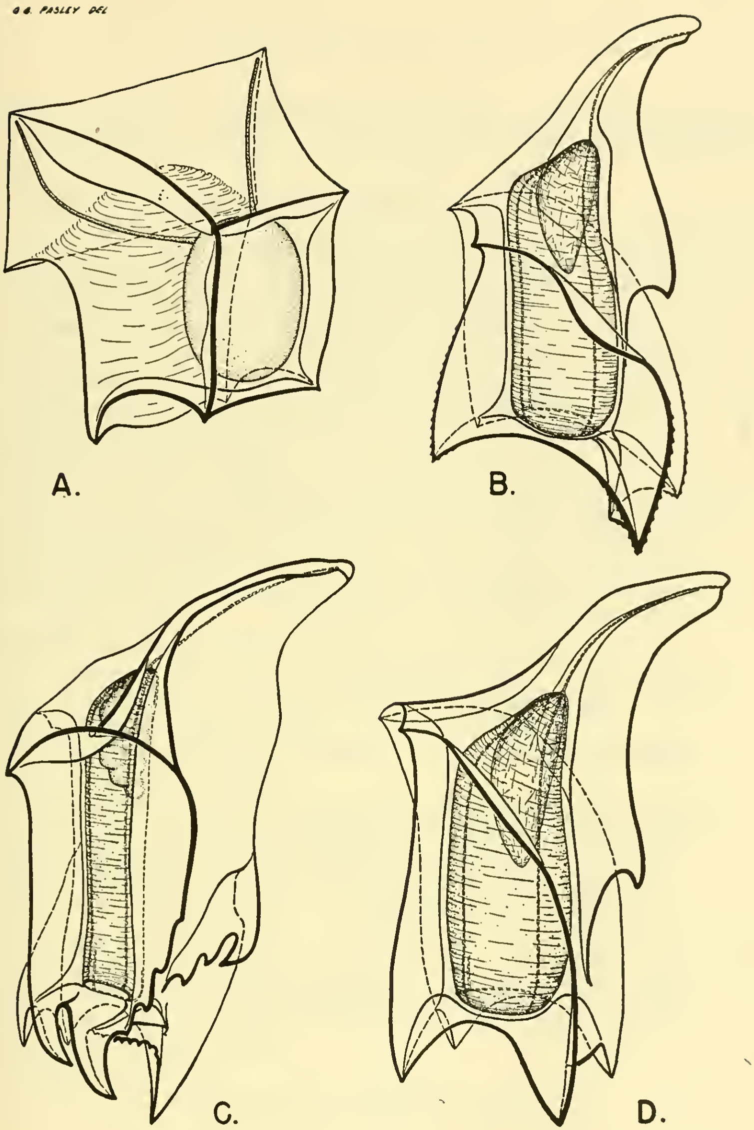

Fig. 26. A. Bract of ?*Abyla haeckeli*. Dorsal surface 4.7 mm. in length. B. Lateral view of gonophore of *Abylopsis eschscholtzii* of about 2.5 mm. in length. C. Lateral view of gonophore of *Abyla* sp.? of about 3 mm. in total length. D. Lateral view of gonophore of *A. tetragona* of about 2.5 mm. in length.

lateral ridge. The gonophores are mirror images of one another irrespective of the sex.

Key to the Species of Abylopsis

A. Based on the characters of the superior nectophores.

1. Ridges not obviously serrate; dorsal surface irregular pentagon, narrower, more elongate than in *eschscholtzii*; dorsal surface smaller than ventral; apex of nectosac extends apically above main body of somatocyst; lateral subumbral canals arched ...... *Abylopsis tetragona* Otto

   Ridges heavy, serrate; dorsal surface nearly regular pentagon of same size and shape as ventral; apex of nectosac does not extend apically beyond main body of somatocyst; lateral subumbral canals not arched .... *Abylopsis eschscholtzii* Huxley

B. Based on the characters of the inferior nectophores.

1. Nectophore at least twice as long as it is wide; margin of flap on inner surface of left ventral ridge denticulate; right lateral subumbral canal broken .... *Abylopsis tetragona* Otto

   Nectophore only slightly longer than wide; margin of flap on inner face of left ventral ridge entire; canals normal .... *Abylopsis eschscholtzii* Huxley

C. Based on the characters of the bracts.

1. Dorsal facet of bract subrectangular; general appearance cuboidal .... *Abylopsis tetragona* Otto

   Dorsal facet of bract almost a regular pentagon .... *Abylopsis eschscholtzii* Huxley

D. Based on the characters of the gonophores.

1. One ventral ridge diagonally crosses lateral surface of gonophore to join dorsal and apicolateral ridges roughly dividing lateral surface into one quarter toward the apex and three quarters toward the base; lower half of ventral ridges only very weakly serrated .... *Abylopsis tetragona* Otto

   One ventral ridge diagonally crosses lateral surface of gonophore to join dorsal and apicolateral ridges, roughly dividing lateral surface into two equal portions; lower half of ventral ridges markedly serrate *Abylopsis eschscholtzii* Huxley

ABYLOPSIS TETRAGONA Otto 1823

Pyramis tetragona, Otto, 1823, p. 306, pl. 42, figs. 2a–2e (not seen).

Aglaja baerii, Eschscholtz, 1825, p. 743, pl. 5, fig. 14.

Plethosoma crystalloides, Lesson, 1826, pl. 4, fig. 2 (partim); 1830, p. 64 (not seen).

Calpe pentagona, Quoy and Gaimard, 1827, pp. 11–13, pl. 2A, figs. 1–7; Blainville, 1830, p. 132; 1834, p. 134, pl. 4, fig. 3 (not seen); Lesson, 1843, p. 449 (not seen).

Aglaisma baerii, Eschscholtz, 1829, p. 129, pl. 12, fig. 5.

Abyla pentagona, Eschscholtz, 1829, p. 132; Leuckart, 1853, p. 56, pl. 3, figs. 1–6; 1854, pp. 259–273, pl. 11, figs. 1–10; Kölliker, 1853, pp. 41–46, pl. 10; Gegenbaur, 1853, pp. 292–295, pl. 16, figs. 1–2; 1860, pp. 349–356, pl. 28, figs. 17–19; Sars, 1857, p. 13; Huxley, 1859, pp. 40–44, pl. 2, fig. 2; Keferstein and Ehlers, 1861, pp. 14–15, pl. 3, figs. 5–6; Spagnolini, 1870, p. 21; Fewkes, 1879, pp. 318–324, pl. 3, fig. 1; 1880, p. 132; 1883, pp. 835–837, figs. 1–4; Chun, 1885, p. 525, pl. 2, fig. 11; 1897, p. 30; Lens and Van Riemsdijk, 1908, pp. 17–19, pl. 2, figs. 17–20; Moser, 1911, p. 431; 1912, p. 531, fig. 13; 1912a, fig. 14; 1912b, p. 408; 1917, p. 732.

Diphyes calpe, Quoy and Gaimard, 1834, p. 89, pl. 4, figs. 7–11.

Aglaisma pentagonum, Leuckart, 1853, p. 150, pl. 3, figs. 2–3.

Eudoxia cuboides, Leuckart, 1853, p. 54, pl. 8, figs. 7–10; Müller, 1871, pp. 264–266, pl. 11, figs. 6–7, pl. 13, fig. 9; Chun, 1885, pl. 2, fig. 11; 1888, p. 1160; Bedot, 1896, pp. 375–376.

Abyla trigona, Vogt, 1854, p. 121, pl. 15, fig. 4, pl. 20, figs. 4–7, pl. 21, figs. 3–6, 10–13.

Aglaismoides elongata, Huxley, 1859, p. 61, pl. 4, fig. 3.

Calpe huxleyi, Haeckel, 1888, p. 36; 1888a, p. 164.

Aglaisma gegenbauri, Haeckel, 1888a, pp. 119–121, pl. 40.

Calpe gegenbauri, Haeckel, 1888a, pp. 164–167, pls. 39–40.

Aglaisma cuboides, Chun, 1897, p. 30; Lens and Van Riemsdijk, 1908, p. 19, pl. 2, fig. 21.

Abyla tetragona, Schneider, 1898, pp. 89–90, 197.

non *Abyla pentagona*, Mayer, 1900, p. 77, pl. 30, figs. 101–103.

non *Aglaisma cuboides*, Mayer, 1900, p. 77, pl. 30, fig. 104.

Abyla huxleyi, Agassiz and Mayer, 1902, p. 166, pl. 11, fig. 48.

Abylopsis tetragona, Bigelow, 1911, pp. 224–226, pl. 14, figs. 6–8, pl. 15, fig. 2; 1913, pp. 68–69; 1918, p. 411; 1919, pp. 334–335; 1931, pp. 544–546, figs. 191–192; Kawamura, 1915, pp. 581–584, pl. 15, figs. 32–36; Browne, 1926, pp. 63–64; Totton, 1932, pp. 333–335, figs. 14B, 15B, 17C; 1936, p. 233; Boone, 1933, p. 36; Leloup, 1934, pp. 55–57, fig. 14; 1935, pp. 10–11; 1936, pp. 6–7; Bigelow and Sears, 1937, pp. 23–26; Gamulin, 1948, p. 9; Moore, 1949, p. 13.

Abylopsis pentagona, Moser, 1925, pp. 320–334, text figs. 52–53, pl. 20, figs. 1–4, pl. 21, figs. 3–4; Leloup, 1932, pp. 23–24.

Superior nectophore (Fig. 25A). The superior nectophore of *A. tetragona* is very similar to that of *A. eschscholtzii*. However, there are a number of characters which differentiate the two species even in the absence of an inferior nectophore. In *tetragona*, the ridges are not strongly serrate. In fact, few serrations are obvious in most specimens except in the basal region. The dorsal and ventral surfaces are proportionately more elongate along the apicobasal axis. The dorsal pentagonal facet is smaller than the ventral. Hence, the lateral surfaces flare outward toward the ventral forming a rather irregular truncated pyramid. In dorsal view, the apex of the nectosac extends above the main body of the somatocyst. Finally, the lateral subumbral canals of the nectosac are usually highly arched.[1]

Inferior nectophore (Fig. 25C, D). In this species, the inferior nectophore is at least twice as long as it is wide. Its apical hook is relatively smaller and less prominent than in *eschscholtzii*. Four ridges are distinct, but the fifth, the dorsal, is somewhat reduced and rather difficult to locate, were it not for a small basal tooth at its lower extremity. The fork of the left ventral wing starts near the apex of the nectosac. There are two conspicuous basal teeth, the left ventral and right lateral.[2] On the basal surface beneath each of the lateral teeth there is a small spine, a character which was overlooked by Bigelow (1911, pl. 14, fig. 7), although described and figured by both Haeckel (1888a, p. 167, pl. 39, figs. 2–4, 12) and Moser (1925, p. 330, pl. 20, fig. 4).

The two large straight teeth together with the characteristic shape of the apophysis afford the best means for distinguishing the inferior nectophore of this species from those of other abylids with rather similar outlines (*Ceratocymba*). Another character which is unique is the peculiar modification of the subumbral canals (Gegenbaur, 1860; Fewkes, 1879, 1880; Lens and Van Riemsdijk, 1908; Bigelow, 1911). Thus, the right lateral is incomplete with a segment of the lower half lacking. Parallel to it an extra canal runs from the ring canal and turns at right angles to enter the upper part of the right lateral slightly above the middle of the nectophore. Finally, the structure of the hydroecium is distinctive. Along the margin of the right ventral wing, there is an elongate flap without sculpturing except for four prominent teeth along its transverse basal margin. This flap is tucked over a denticulate flap projecting from the inner surface of the left ventral wing close to its junction with the wall of the nectophore.

[1] The canal illustrated by Vogt (1854, pl. 20, fig. 4) leading from these arches to the apex has not been seen in any of the thousands of specimens examined.

[2] Agassiz and Mayer (1902, pl. 11, fig. 48) incorrectly figured the right ventral tooth as being enlarged in their *Abyla huxleyi*, now referred to the synonomy of *tetragona*.

Bract (Fig. 2C). The cuboidal bract of *tetragona* is quite similar in shape to that of *Enneagonum hyalinum.* At first glance, this may be misleading, but in *tetragona* only the ventral and apical facets are square or nearly so. The dorsal and apicolaterals are squared only toward the apex. Thus, although quadrilateral, the latter are not rectangular but trapezoidal. Hence, the ridge separating the lateral facets, horizontal in *eschscholtzii*, is diagonal in *tetragona.* This is due to the unequal length of the lateral ridges of the ventral and dorsal facets, which they join; those of the dorsal facet being somewhat more elongate. These together with the comparatively short basal ridges make this surface quite different in shape from that of *eschscholtzii*, although it is pentagonal in both species.

The effect of a cube is further simulated by a reduction of the basolateral facets. These are proportionately very much smaller than in *eschscholtzii* and are roughly triangular. They extend from the apicolateral facet, where they are attached along the horizontal ridge, down the basal margin of the dorsal facet to its tip, thence diagonally to the lateral rim of the hydroecium. The free margin usually has a tooth and may, for a short distance from the dorsobasal tip, be contiguous with the margin of the opposite basal facet to form a short basosagittal ridge.

A large proportion of our specimens, however, lack any trace of a basosagittal ridge, a prominent feature in *eschscholtzii* (as well as in *Bassia*). There seems, however, to be considerable individual variation, because others — and these appear to be in the minority — have a short but definite ridge perpendicular to the dorsal facet at its basal tip. It does not appear that the presence or absence of the ridge is dependent on the state of preservation or the size (i.e., age) of the specimen, because both types have been seen on both well preserved and poorly preserved specimens of all sizes. Nor are there many gradations between the two extremes. In the specimens we have examined, however, the ridge has never been seen to protrude below the basal tip of the dorsal facet in the manner shown by both Bigelow (1911, pl. 15, fig. 2) and Totton (1932, fig. 17C).

Gonophore (Fig. 26D). The gonophore of *A. tetragona* is comparatively narrow and elongate like the inferior nectophore. This is largely due to the facts that the ridges are not expanded and that the relatively long teeth project straight downward. Both vertical ridges deviate from the vertical rather near the apex. The lateral surfaces (in true side view) are roughly divided into an apical quarter and a basal three-quarters. Finally, the ventral halves of all the ridges are only weakly serrated.

ABYLOPSIS ESCHSCHOLTZII Huxley 1859

Aglaismoides eschscholtzii Huxley, 1859, p. 60, pl. 4, fig. 2; Chun, 1888, p. 1160; Bedot, 1896, p. 375; Lens and Van Riemsdijk, 1908, pp. 25–26, pl. 3, figs. 28–31.

Eudoxia prismatica, Gegenbaur, 1860, pp. 363–364, pl. 27, figs. 13–16.

Abylopsis quincunx, Chun, 1888, p. 1160; Bedot, 1896, p. 375; Lens and Van Riemsdijk, 1908, pp. 21–25, pl. 3, figs. 22–27; Moser, 1911, p. 431.

Abyla (*Abylopsis*) *quincunx*, Chun, 1897, p. 29.

Aglaismodes quincunx, Chun, 1897, pp. 29–30.

Abyla tetragona, Schneider, 1898, p. 89 (partim).

?*Abyla quincunx*, Agassiz and Mayer, 1899, p. 180.[1]

Aglaisma cuboides, Mayer, 1900, pp. 77–78, pl. 30, fig. 104.

Abyla quincunx, Mayer, 1900, p. 78, pl. 34, figs. 115–117; Agassiz and Mayer, 1902, p. 163, pl. 11, figs. 46–47.

non *Abyla pentagona*, Mayer, 1900, p. 77, pl. 30, figs. 101–103.

Chunia capillaria, Mayer, 1900, pp. 78–79, pl. 27, fig. 90.

Aglaisma quincunx, Agassiz and Mayer, 1902, p. 164, pl. 10, fig. 45; Mayer, 1900, p. 78.

Abylopsis eschscholtzii, Bigelow, 1911, pp. 226–229, pl. 14, figs. 1–5, pl. 15, fig. 1; 1913, p. 69; 1918, p. 411; 1919, p. 335; 1931, pp. 546–548, figs. 193–194; Kawamura, 1915, pp. 584–585, pl. 15, figs. 37–38; Moser, 1925, pp. 334–347, pl. 20, figs. 5–6, pl. 21, figs. 1, 2, 5; Browne, 1926, p. 65; Totton, 1932, p. 338, fig. 17E, 1936, p. 233; Leloup, 1932, pp. 24–25; 1934, pp. 57–58; 1935a, p. 5; Boone, 1933, pp. 35–36; Moore, 1949, p. 13.

Superior nectophore (Fig. 25B). As already mentioned, the superior nectophore of *eschscholtzii* is very like that of *tetragona*. Yet it may be separated quite readily by a combination of characters which seem trivial, but which nevertheless are fairly consistent. The most reliable features for identifying *eschscholtzii* are that the lateral canals of the nectosac are not arched, the main body of the somatocyst does not extend above the nectosac in either dorsal or ventral view, and the nectophores are generally more rigid. Also, the dorsal and ventral

[1] I cannot refer this record with certainty to *eschscholtzii* because of the statement made by the authors that Huxley described their *quincunx* under the name *Abyla pentagona*. Huxley's (1859) species of *pentagona* has always been considered as a synonym of *tetragona*, and I believe rightly so. Hence,in the absence of any figures or description, we lack definite proof as to which species they actually had. (An incorrect page reference is also given in citing Huxley.)

facets are more regularly pentagonal than in *tetragona* and are nearly the same size. The lateral facets are thus more nearly perpendicular to both dorsal and ventral surfaces. Finally, the ridges separating all facets are not only more markedly serrate but they are more distinctly outlined than in *tetragona*, as has often been previously illustrated (Bigelow, 1931, fig. 194; Mayer, 1900, pl. 34, fig. 115). This is seemingly due to a difference in the consistency of the "jelly" of ridges and that within the nectophore.

Inferior nectophore (Fig. 25E). The inferior nectophore of *eschscholtzii* is proportionately much shorter than that of *tetragona*. Thus, it is about two thirds as wide as it is long, but the apophysis is relatively bigger and more robust. The teeth are all more or less uniform in size, none of them being extended conspicuously. Also, they tend to flare outward rather than to extend straight downward. The subumbral canals have no irregularities. The flap on the inner surface of the right ventral wing has distinct teeth along its basal margin, whereas the left-hand one is entirely smooth. The lower portion of the latter, however, forms a much thickened projection into the lower part of the hydroecial cavity.[1]

Bract (Fig. 2D). The bract of *eschscholtzii* in dorsal view forms a fairly regular pentagon. This character at once distinguishes it from *tetragona*. The ventral facet is essentially like the apical half of the dorsal but its basal ridges are very much foreshortened with a deep arch between them bordering on the opening to the hydroecium. The apicolateral facets are rectangular. Also, there is a prominent basosagittal ridge separating the basolateral facets. The latter are almost square, were it not for the arched ventral margin (interrupted near the base by a tooth) at the opening to the hydroecium.

Gonophore (Fig. 26B). In *eschscholtzii*, as in *tetragona*, it is the younger gonophores which have been sufficiently well preserved to study. The stance of the gonophore in *eschscholtzii* is remarkably like that of the inferior nectophore. The ridges are all more elevated than in *tetragona* and the lower halves, particularly, are strongly serrated. In addition, they, like the teeth at their basal extremities, tend to

[1] In this connection, it should be noted that Agassiz and Mayer (1902, p. 164) in the discussion of *Aglaisma quincunx* (i.e., the eudoxid of this species) and referring to their figure of this eudoxid (pl. 10, fig. 45) state that "a saw-toothed projection extends down the open groove of the inferior nectophore." They figure this structure on the inferior nectophore shown on plate 11, figure 46. I have never observed such a structure in *eschscholtzii*.

flare. The vertical ridges, like the left ventral of the inferior nectophore swerves from the vertical rather lower than in *tetragona*. Also, it differs in that the curve is sigmoid.

Remarks

In most cases, I agree with Bigelow (1911, p. 226) as to the earlier synonymies of this species. There are, however, several exceptions: for Mayer's (1900, p. 77, pl. 30, figs. 101–103) *Abyla pentagona*, the references he (Mayer, 1900, p. 77) lists have long been accepted as synonyms for *Abylopsis tetragona* (Bigelow, 1911, p. 224). On the other hand, he (Mayer, 1900, pl. 30, fig. 101) figures a colony which bears little resemblance to *tetragona*, as we know it, or to *eschscholtzii*. It does not even resemble his *Abyla quincunx* (Mayer, 1900, pl. 34, fig. 115). The latter was apparently *eschscholtzii*, as is generally agreed (Bigelow, 1911, p. 226). The superior nectophore (Mayer, 1900, pl. 30, fig. 101), judging from the configuration of the somatocyst and nectosac, as well as from their relative positions, is undoubtedly *Bassia bassensis*. The presence of a fifth ridge on the inferior nectophore appears, however, to have been an error. As it more nearly resembles *Bassia* than *A. eschscholtzii* I am inclined to believe that the drawing is not only somewhat inaccurate but also a composite. Thus, the bracts on the cormidia (Mayer, 1900, pl. 30, figs. 101–102) appear to be those of *eschscholtzii* (his *Aglaisma cuboides*, Mayer, 1900, pl. 30, fig. 104). The type of tentacles shown both for *A. pentagona* and *Aglaisma cuboides* (Mayer, 1900, pl. 30) are rather different from those for *Abyla quincunx* (Mayer, 1900, pl. 34, figs. 115–116). Which of the two he has illustrated actually belongs to *eschscholtzii* cannot be determined without examining the stems of both species. Unfortunately, none have been found thus far in the "Dana" material. Nevertheless, it seems to me that Mayer's figure (1900, pl. 30, fig. 101) must now be referred to the synonymy of *Bassia bassensis*, at least in part. The synonymies he lists (Mayer, 1900, p. 77), on the other hand, should be listed under *Abylopsis tetragona*, not *eschscholtzii* as hitherto.

I also agree with Moser (1925) in questioning whether Agassiz and Mayer's (1899, p. 180) specimens of *Abyla quincunx* should be referred to *eschscholtzii* because they consider it identical with Huxley's (1859)[1] *Abyla pentagona*. This appears to have been *Abylopsis tetra-*

[1] Agassiz and Mayer (1899) gave an erroneous page reference to Huxley's *pentagona*.

gona as we know it today. Furthermore, in Mayer's (1900, p. 77) record of *Abyla pentagona*, he listed known synonyms of *tetragona* but figured (Mayer, 1900, pl. 30, fig. 101) *Bassia bassensis* as described above. However, I am inclined to believe that their record (Agassiz and Mayer, 1899, p. 180) of the eudoxids of *eschscholtzii* (as *Aglaisma quincunx*) from the Fiji Islands is correct, because they figured it under this name elsewhere (Agassiz and Mayer, 1902, pl. 10, fig. 45). On the other hand, Bigelow (1911, p. 226) does not consider the latter record (Agassiz and Mayer, 1902, p. 164) to have been this species. In view of the figure (Agassiz and Mayer, 1902, pl. 10, fig. 45), which obviously belongs to *eschscholtzii*, there seems to be no reason for not including it as a synonym of this species.

ABYLOPSOIDES n. gen.

Genotype: *Abylopsoides dorsalis* n. sp.

Generic Characters

Superior nectophores (Fig. 27). The superior nectophores referred to this genus have definite affinities with *Abylopsis*. Thus, the opening to the hydroecium is essentially square and usually with a more or less prominent tooth at each corner. The basal facet together with the dorsal wall of the hydroecium is elongate, with the opening to the nectosac at the angle between the two. Within the nectophore the position of the nectosac and hydroecium relative to the somatocyst is more or less similar to that of *Abylopsis*. The arrangement of the canals radiating from a point on the ventral wall of the nectosac is also characteristic of that genus. The shape of the somatocyst may or may not be the same and may have a diverticulum. Likewise, the nectosac may be like that of *Abylopsis* or it may be short and stubby, more as in *Bassia*. Whether variations in these are characteristic of the species or whether in this genus each individual may vary cannot be determined until we have a longer series available for study.

The differences between this genus and *Abylopsis* are chiefly that there are fewer facets. As a result, there may be an apical surface, a transverse ridge, or perhaps a median apical ridge. Thus, the general arrangement of the facets and ridges bear no obvious relationship to *Abylopsis* in most instances. Even the character of the ridges differs by being elevated and ribbon-like.

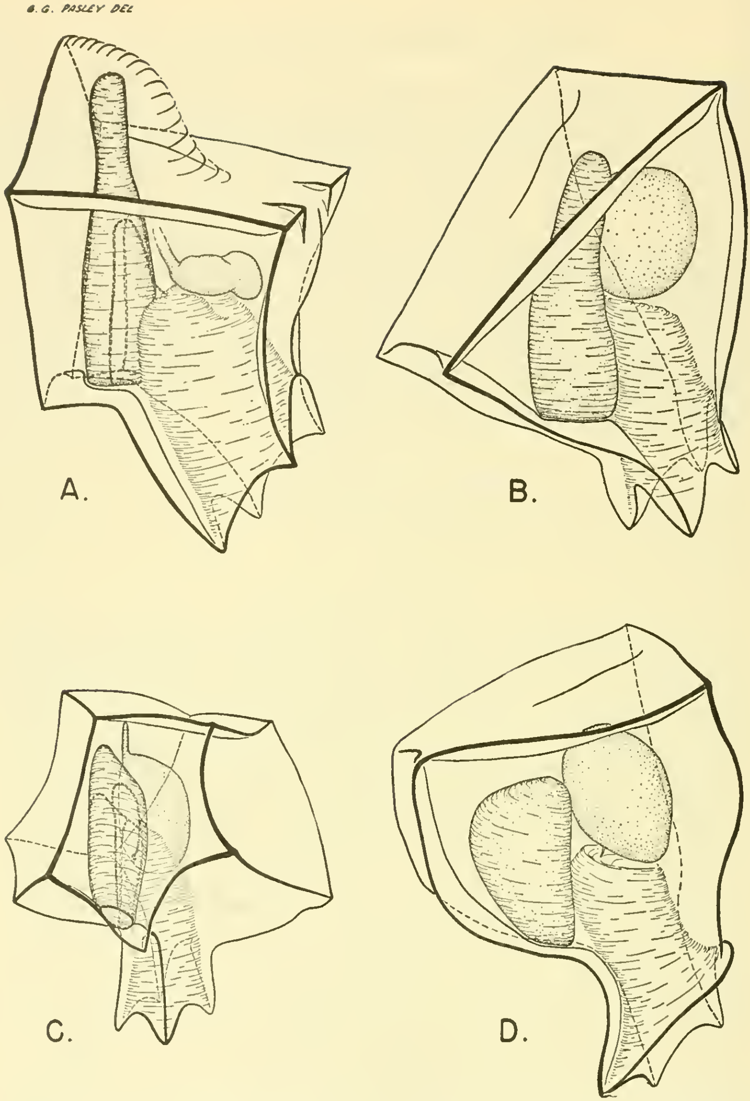

Fig. 27. A. Ventrolateral view of superior nectophore of *Abylopsoides dorsalis* with a dorsal facet of about 3.7 mm. in length. B. Dorsolateral view of superior nectophore of *A. ventralis* with a diagonal dorsal facet of about 2.6 mm. in length. C. Dorsolateral view of superior nectophore of *Pseudabylopsis anomala* with a dorsal ridge 1.5 mm. in length. D. Lateral view of superior nectophore of *Abylopsoides basalis* with an apical surface of about 3 mm. in length.

Remarks

Hundreds of thousands of superior nectophores belonging to *Abylopsis tetragona* and *eschscholtzii* have been examined. These have all been remarkably constant in general appearance. Of this number, there have been perhaps a dozen specimens which can be considered as mutilated in some way. A corner is missing or a ridge is incomplete, but in each instance, it has been possible to refer these to one or the other species of *Abylopsis*. At first, it appeared that the variants under consideration here should be placed in this same category. However, in these specimens, restoration of the missing parts would not produce an individual which could be identified as either *tetragona* or *eschscholtzii*. In the specimens examined, some of the ridges form pronounced knife-like edges not characteristic of *Abylopsis*. On one, the basal segment is elongate, on another it is shortened. Because these differences are more marked than any variations or mutilations yet observed in *Abylopsis*, it seems justifiable to establish the genus *Abylopsoides* for specimens of abylopsids with a reduced number of facets.[1]

Key to Species[2] of Abylopsoides

A. Superior nectophores
 1. Transverse apical ridge present . . . . *Abylopsoides ventralis* n. sp.
  Transverse apical ridge absent 2
 2. Pentagonal dorsal facet present . . . . *Abylopsoides dorsalis* n. sp.
  Dorsal facet absent . . . . *Abylopsoides basalis* n. sp.

ABYLOPSOIDES DORSALIS n. sp.

The type specimen of *Abylopsoides dorsalis* is a superior nectophore taken at "Dana" Sta. 3921$^{\mathrm{III}}$(3°36′S, 58°19′E) on 11 December 1929, at 1900 hours in a stramin net 200 cm. in diameter, towing with 300 meters of wire out. The specimen when found was in tolerably good condition, but most regrettably it was dried up after the sketches for Figure 27 were made. The specimen has, however, been salvaged and will be placed in Universitets Zoologiske Museum, København, Denmark.

[1] See remarks on p. 49 for *Pseudabyla* many of which are also applicable here.

[2] One or two other specimens have been found which might belong to this genus, but their condition is not sufficiently good to determine the relationships.

Superior nectophore (Fig. 27A). The superior nectophore of *dorsalis* is essentially of the abylopsid type but it seemingly lacks most of the apical portion (i.e., the apicolateral facets and upper part of the ventral are absent). As a result, there is an apical surface which extends from the peak of the intact pentagonal dorsal facet but becomes flattened perpendicular to the ventral surface. This surface is, however, only partially separated from the ventral, so that there is actually but a single facet covering both surfaces. The horizontal ridges, the partial apicoventral and the ventrolaterals are distinctive in that they are like thin knife edges. The hydroecium is not unlike that of *Abylopsis* except the two teeth at the outer corners of the dorsal wall are longer and somewhat more obvious, because of a rather deeper cleft between them. It is also somewhat wider and occupies a greater part of the nectophore as a whole. The somatocyst is seemingly damaged but there is some evidence that it, like *Abylopsis*, has a diverticulum. In any event, the somatocyst must have been reduced in size because the nectosac and hydroecium nearly fill the nectophore. The nectosac is very like that of *Abylopsis* and the lateral canals were arched much as in *A. tetragona*. The basal facet is, however, somewhat shortened.

Inferior nectophore. Unknown.

Eudoxid. Unknown.

Abylopsoides ventralis n. sp.

The type specimen of *Abylopsoides ventralis* is a superior nectophore taken at "Dana" Sta. 3921^{III} at 3°36′S, 58°19′E on 11 December 1929 at 1900 hours in a stramin net 200 cm. in diameter, towing with 300 meters of wire out. The specimen was only slightly damaged when found but, most regrettably, was dried up after the sketches (Fig. 27) were made. The specimen has, however, been salvaged and will be placed in Universitets Zoologiske Museum, København, Denmark.

Superior nectophore (Fig. 27B). The resemblance of *A. ventralis* to *Abylopsis* is not as obvious, perhaps, as the previous species, but the configuration of the opening to the hydroecium and the relation of the mouth of the nectosac to the basal facet and dorsal wall of the hydroecium are characteristic of that genus. Although *ventralis*, like *dorsalis*, has five facets, its outer surface is further reduced. Thus, it appears as if the apical half of an *Abylopsis* had been sliced off diagonally from the level of the horizontal ridges on the ventral facet to the dorsal ridge of the basal facet. In other words, there is apparently a rectangular dorsal facet separated from the ventral by a transverse ridge. The basal facet is more elongated dorsally than in other abylopsids which increases the space within the nectophore to provide room for a good-sized nectosac[1] and hydroecium. The somatocyst lacks a diverticulum. The four teeth surrounding the opening to the hydroecium are more pronounced than in the other three species, with deeper indentations between them. That on the ventral surface is a narrow and deep cleft.

Inferior nectophore. Unknown.

Eudoxid. Unknown.

ABYLOPSOIDES BASALIS n. sp.

The type specimen of *Abylopsoides basalis* is a superior nectophore taken at "Dana" Sta. 3921^{VIII} at 3°36′S, 58°19′E, on 11 December 1929 at 2240 hours in a stramin net 200 cm. in diameter, towing with 100 meters of wire out. The specimen is in a somewhat damaged condition. It will be placed in Universitets Zoologiske Museum, København, Denmark.

Superior nectophore (Fig. 27D). The specimen of *basalis* differs from *ventralis* in shape and in the arrangement of its facets. Thus, as far as one can ascertain in its present state of preservation, the basal appears to continue without demarcation to form the dorsal and apical surfaces. In any event, in contrast to *ventralis* which has a transverse apical ridge, this species has an apical surface. As a result, it resembles the basal half of an *Abylopsis*. In keeping with this, the nectosac[2] is very much shortened and ovoid in shape. Likewise, the somatocyst is relatively small and ovoid. The configuration of the opening of the hydroecium is asymmetrical because the right ventral tooth is missing. Consequently, the right ventral ridge, which in most cases continues down as the ridge of this tooth, veers inward toward the apex of the cleft between the teeth. The right lateral base of the hydroecial opening then curves from this point down to the right dorsal tooth. This species is thus somewhat asymmetrical in the ventral region.

Inferior nectophore. Unknown.

Eudoxid. Unknown.

[1] The canals were not apparent on the specimen even before it had been dried.

[2] The canals cannot be seen as the nectosac is badly damaged.

?Abylopsoides sp.

Finally, a superior nectophore taken at "Dana" Sta. 3921$^{\mathrm{VIII}}$ at 3°36′S, 58°19′E, on 11 December 1929 at 2240 hours in a stramin net 200 cm. in diameter, towing with 100 meters of wire out, has proven so aberrant that one cannot be certain of its status. It certainly has the appearance of a freak, although it has a number of abylopsid characters. There is, however, only one complete facet, the basal, and it is of the type characteristic of *Abylopsis*. The ridges delimiting the other facets are incomplete — so incomplete, in fact, that the various surfaces cannot be compared with the facets in other species with certainty. The ventral surface, determined because of its relationship to the somatocyst, is outlined apically by two prominent partial ridges meeting at the apex, which become tabs at their basal ends. This surface does not extend down, as one might expect in an abylopsid, to the ventral wall of the hydroecium, because of the peculiar twisted hydroecial opening. Its ventral margin does not protrude below the main body of the nectophore. Thus, the lateral margins end a short distance apart, the left on the ventral surface, the right on the lateral wall.

There is a short median apical ridge separating the dorsal from the ventral surface. It is not, however, as prominent as in most specimens we have seen of *Abylopsis*. The dorsal surface itself is large and, judging from the presence of two short, but pronounced tabs on the lower part of this surface, it extends down onto the right side. The latter, therefore, is very narrow and irregular. On the left side, an inconspicuous ridge extends from the base to the apex in a more normal position. As a result, the left lateral surface is wider and more regular than the right. The somatocyst seemingly has an apical and a basal diverticulum. The nectosac, although the apical half is somewhat collapsed, was reinflated enough to show its shape and canals to be more or less of the *Abylopsis* type. The left lateral did, however, bifurcate before joining the ventral.

Pseudabylopsis n. gen.

Genotype: *Pseudabylopsis anomala* n. sp.

Generic characters

Superior nectophore (Fig. 27C). In contrast to *Abylopsoides*, *Pseuda-*

bylopsis is proposed for a species with more facets than are characteristic for *Abylopsis*. The basal region and arrangement of the internal parts show the same affinities with *Abylopsis* as do specimens of *Abylopsoides*.

PSEUDABYLOPSIS ANOMALA n. sp.

The type specimen is a superior nectophore from "Dana" Sta. No. 2922V taken at 3°45′S, 56°33′E on 12 December 1949 at 1850 hours with a stramin net 200 cm. in diameter towed with 50 meters of wire out. It will be deposited at Universitets Zoologiske Museum, København, Denmark.

Superior nectophore (Fig. 27C). The superior nectophore of *P. anomala* in its present state of preservation appears to be misshapen and slightly asymmetrical. It seems possible, however, that a better preserved specimen might be almost symmetrical. It has much the same arrangement of facets as occurs in *Abylopsis* with but two exceptions. An apical facet is interposed between the two apicolateral facets. This is not rectangular as one might expect, because its dorsal border comes to a point to conform with the apical portion of a subdivided dorsal facet. The two facets formed by this subdivision are pentagonal. However, because of preservation, it is not possible to ascertain whether they are exact mirror images of one another. The basal facet likewise is irregular, but it too appears damaged. Reconstructed, I believe it would be nearly square with a long extension from one corner down the dorsal wall of the hydroecium. Its base is forked but not as sharply as on the ventral wall. The ventral facet, on the other hand, is nearly pentagonal with an extension down the ventral wall of the hydroecium. It is sharply forked at its base. The apicodorsal facets are nearly square, the basolaterals are quadrangular with processes extending down as the lateral walls of the hydroecium.

The arrangement and shape of the internal parts is essentially as in *Abylopsis* even to an apical diverticulum of the somatocyst. It appears that there are only two highly arched lateral canals on the walls of the nectosac. No trace can be found of a dorsal or ventral canal. The nectosac is quite damaged so that these may therefore have been destroyed.

Inferior nectophore. Unknown.

Eudoxid. Unknown.

BASSIA L. Agassiz 1862[1]

Genotype: *Bassia bassensis* Quoy and Gaimard 1834

BASSIA BASSENSIS Quoy and Gaimard

Abyla quadrilatera, Blainville, 1830, p. 123 (not seen); Haeckel, 1888a, p. 160.
Diphyes bassensis, Quoy and Gaimard, 1834, pp. 91–92, pl. 4, figs. 18–20.
Calpe bassensis, Lesson, 1843, p. 451 (not seen).
Abyla bassensis, Huxley, 1859, pp. 45–46, pl. 2, fig. 1; Haeckel, 1888a, pp. 116, 160; Schneider, 1898, pp. 91, 197; Lens and Van Riemsdijk, 1908, pp. 26–28, pl. 4, fig. 32.
Sphenoides australis, Huxley, 1859, p. 62, pl. 4, fig. 4; Chun, 1888, p. 1160; Haeckel, 1888a, p. 360; Bedot, 1896, p. 375; Lens and Van Riemsdijk, 1908, pp. 27–28, pl. 4, fig. 33.
Abyla perforata, Gegenbaur, 1860, pp. 356–359, pl. 29, figs. 20–21; Haeckel, 1888a, p. 160.
Bassia perforata, L. Agassiz, 1862, p. 372; Chun, 1888, p. 1160; Haeckel, 1888, p. 36; 1888a, p. 116; Bedot, 1896, p. 374; Moser, 1913, p. 148.
Bassia obeliscus, Haeckel, 1888, p. 36; 1888a, pp. 160–163, pls. 37–38.
Sphenoides obeliscus, Haeckel, 1888, p. 33; 1888a, pp. 116–118, pl. 38.
Sphenoides perforata, Haeckel, 1888, p. 33; Chun, 1897, p. 32.
Bassia tetragona, Haeckel, 1888a, p. 160.
Bassia quadrilatera, Haeckel, 1888a, p. 160.
?*Parasphenoides amboinensis*, Bedot, 1896, p. 376, pl. 12, figs. 2–3.
Abyla (Bassia) perforata, Chun, 1897, p. 32.
Abyla pentagona, Mayer, 1900, pl. 30, fig. 101.
non *Abyla pentagona*, Mayer, 1900, pl. 30, figs. 102–103.
Bassia bassensis, Bigelow, 1911, pp. 229–231, pl. 12, fig. 8, pl. 14, fig. 9; 1913, p. 69; 1918, p. 411; 1919, p. 336; 1931, p. 548; Kawamura, 1915, pp. 585–587, pl. 15, figs. 39–40; Moser, 1917, p. 733; 1925, pp. 347–356, pl. 21, figs. 7–8, pl. 22, Browne, 1926, p. 65; Leloup, 1932, pp. 25–26; 1934, pp. 60–62; 1935, p. 11; 1936, p. 7; Totton, 1932, pp. 339–340, text figs. 17F, 18; Bigelow and Sears, 1937, pp. 26–28; Delsman, 1939, figs. 32–36; Gamulin, 1948, p. 9; Moore, 1949, p. 13.

Although the genus *Bassia*, represented by only a single species, *bassensis*,[2] is found in great numbers in all oceans, it is so fragile and is usually so flaccid that not a single truly well-preserved specimen occurs among the thousands examined so far in the "Dana" material.

[1] See Bigelow, 1911, p. 229 for reasons for attributing this genus to L. Agassiz.

[2] One poorly preserved specimen of a superior nectophore was seemingly aberrant but no consideration has been given to its proper place, i.e., as to whether it should be treated as a new species or a new genus, because it was not possible to determine its exact structure.

Nevertheless, fragments are readily identified when preserved in formalin, by their general appearance: on a black background, the ridges are milky-white and opaque, but with transmitted light, these become an opaque gray or brown.[1]

Generic and specific characters

Superior nectophore (Fig. 28B). The external appearance of the superior nectophore, except for the peculiarity of the ridges just described, is very like that of *Abylopsis* and more especially *tetragona*. Thus, the dorsal and ventral facets are pentagonal, the basolateral borders being the more elongate. The apicolateral facets are quadrangular, but are definitely smaller than the basolateral ones. The latter are comparatively larger than in *Abylopsis* and pentagonal. The basal surface, as in *Abylopsis*, is elongate and rectangular rather than square as in most abylids, because the dorsal wall of the hydroecium protrudes below the base of the nectophore as a whole.

In contrast to all other abylids, which are distinguished almost entirely by external characters of the facets and ridges, the superior nectophore of *Bassia* can only be distinguished from those of the preceding genus by the peculiar ridges mentioned above and by the shape and relative position of its internal structures: namely, by the relatively short, at times almost ovoid nectosac, with four subumbral canals of approximately the same length, and by theg lobular somatocyst, which lacks the diverticulum characteristic of *Abylopsis*. The somatocyst lies above the nectosac in this species close to the dorsal wall. Finally, the hydroecium is rather shallower and has a comparatively larger opening.

Inferior nectophore (Fig. 28C). Superficially, the inferior nectophore resembles that of *A. eschscholtzii* in shape and general proportions. However, it has only four ridges (see discussion below) and the teeth at the base of the ridges are not as pronounced. The two flaps of the ventral ridges are closely held in place by the turgidity of the jelly, but they are definitely not fused. Furthermore, the two flaps are so interlocked, even at the free ends toward the base, that the hydroecium appears tubular. The free basal end of the flap from the inner surface of the left-hand ridge lies under that from the right-hand

[1] Huxley (1859, p. 46) wrote, "the edges of the larger specimens were all coloured a deep blue." These were presumably living.

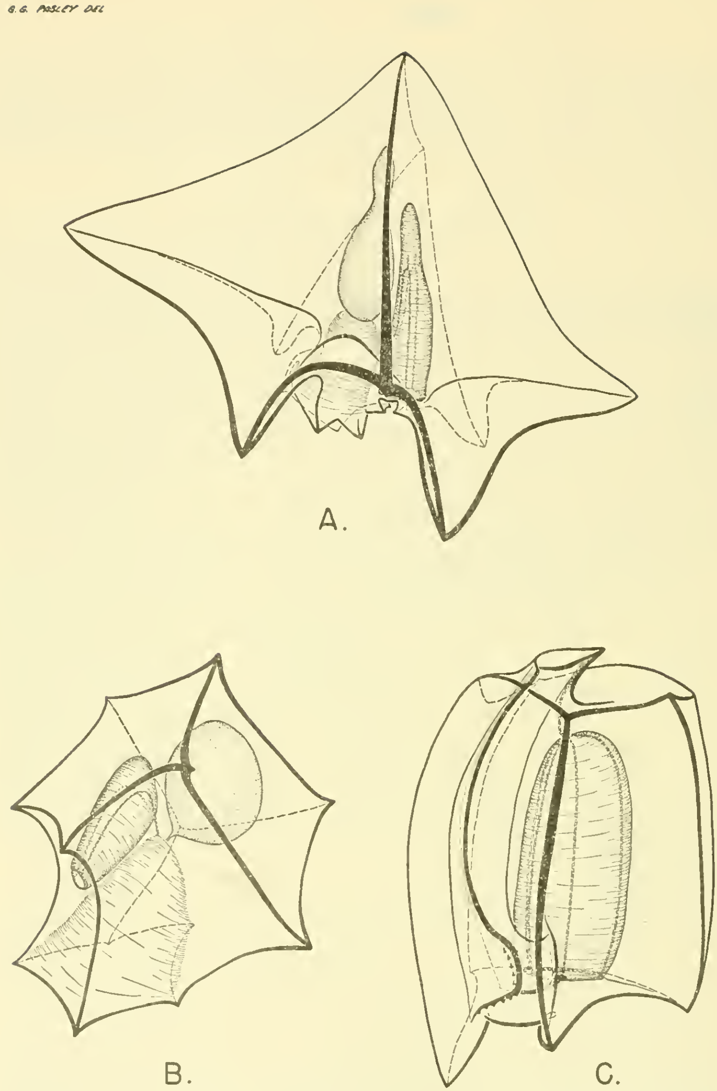

Fig. 28. A. Nectophore of *Enneagonum hyalinum* with a dorsal ridge 13.3 mm. in length. B. Lateral view of superior nectophore of *Bassia bassensis* with a dorsal facet of about 4 mm. in length. C. Ventrolateral view of inferior nectophore of *B. bassensis*.

one and protrudes into the enlarged basal portion of the hydroecium. The flap extends from this protrusion to the apex. It can, however, only be delimited from the ridge of the opposite side as a fine line. On prying the two ridges apart to view the hydroecial cavity, it can be seen to taper to a knife edge to fit under the right hand flap, at least on some of the better preserved specimens. The right hand flap, on the other hand, is rather flat with a wide toothed basal margin. From this it tapers toward the apex to fit into the flap from the opposite wing.

Bract (Fig. 2). A well-preserved bract appears to resemble *A. eschscholtzii* in general shape chiefly due to the length of the basolateral facets for the opening to the hydroecium. However, closer examination reveals that there is a median horizontal ridge rather than an apical facet. The dorsal facet is quadrilateral, the two apicolateral ridges being much shorter than the basolateral. The ventral facet is subdivided by a median longitudinal ridge. The horizontal lateral ridges divide the sides into a small quadrangular facet and a larger one which is essentially trapezoidal, but for the opening to the hydroecium. The hydroecium is, however, shallower and has a comparatively larger opening than in the previous genus. The unique character is the structure of the somatocyst: it has a thin descending branch, and an enlarged apical diverticulum but entirely lacks the ventrolateral branches.

Gonophore: The gonophores of *Bassia* have all been so poorly preserved that it has not been possible to corroborate earlier descriptions.

Remarks

A number of points have been raised by conflicting items in earlier descriptions of the inferior nectophore. Unfortunately our material affords insufficient evidence to clarify all of them. It is generally agreed that the inferior nectophore is a truncated obelisk with four ridges, two of which correspond to the ventrals of the species previously described and one to the left lateral. Bigelow (1911, p. 230) states that, "the right lateral ridge [is] entirely suppressed except at its basal extremity." Totton (1932, p. 339), on the other hand, reports: "I can see no trace of the almost-obsolete ridge marked by a very small pointed prolongation of the distal wall of the hydroecium of the posterior nectophore figured and mentioned by Huxley. . . . In my judgement it is not one of the laterals which has been suppressed, but the median dorsal ridge. The after end of the posterior nectophore is twisted round slightly . . ., so that the posterior end of the right lateral is brought near the middle line." However, the ridge in question seems to run diagonally from near the mid-dorsal region of the basal margin to what would appear to be the correct location for the insertion of a right lateral ridge at the apical margin. In *Abyla* and *Ceratocymba*, the arrangement of the oral teeth gave the clue as to which ridge was suppressed. In the present case, there is no such evidence, as the teeth are only found at the base of each ridge, so that it is not possible with the evidence at hand to decide which ridge was actually suppressed.

The other controversial question concerns the hydroecium of the inferior nectophore. Bigelow (1911, p. 230) considers "the coalescence of the two ventral wings, by which the hydroecium is closed for the upper two thirds of its length" as one of the most diagnostic characters for the genus. Haeckel (1888a, p. 162) likewise mentions the "funnel canal." Moser (1925, pl. 22, fig. 7, pp. 351–352), however, definitely shows and describes the two flaps from the ventral ridges.

ENNEAGONUM Quoy and Gaimard 1827

Genotype: *Enneagonum hyalinum* Quoy and Gaimard 1827

ENNEAGONUM HYALINUM Quoy and Gaimard

Enneagonum hyalinum Quoy and Gaimard, 1827, p. 18, pl. 2D, figs. 1–6; Schneider, 1898, pp. 91–92; Totton, 1932, pp. 335–338, text figs. 16, 17D; Leloup, 1933, p. 23; 1934, pp. 58–60, fig. 15; Bigelow and Sears, 1937, pp. 20–23, figs. 21–25.

Cuboides vitreus Quoy and Gaimard, 1827, p. 19, pl. 2E, figs. 1–3; Eschscholtz, 1829, p. 135; Huxley, 1859, p. 63, pl. 4, fig. 5; Gegenbaur, 1860, pp. 364–366; Haeckel, 1888a, p. 111; Bigelow, 1911, pp. 190–191, 1918, p. 403; 1919, pp. 331–332.

Abyla vogtii, Huxley, 1859, p. 46, pl. 2, fig. 3; Haeckel, 1888a, p. 111.

Halopyramis adamantina, Chun, 1888, pp. 1155–1156; 1892, pp. 111–121, pl. 11, figs. 1–4, pl. 12, figs. 1–3; Bedot, 1896, p. 369; Lens and Van Riemsdijk, 1908, pp. 7–8.

Cuboides adamantina, Chun, 1888, pp. 1155–1156; 1892, pp. 121–137, pl. 10, figs. 10–11, pl. 11, figs. 5–7, pl. 12, figs. 4–29; Bedot, 1896, p. 369; Lens and Van Riemsdijk, 1908, p. 8.

Cuboides crystallus, Haeckel, 1888, p. 37; 1888a, pp. 111–113, pl. 42.

Cymba vogtii, Haeckel, 1888, p. 34; 1888a, p. 138.

Cymba crystallus, Haeckel, 1888, p. 34; 1888a, pp. 111, 138, pls. 41–42.

Generic and Specific Characters

Superior nectophore (Fig. 28A). The nectophore of *Enneagonum* is "easily recognizable by the pyramidal form and nine prominent angles" (Bigelow and Sears, 1937, p. 21). However, this description does not reveal its relationship to other abylids and is not based on the number and arrangement of the facets. In all the other descriptions thus far, except in *Bassia*, the latter have provided the basis for separating the genera. Most published figures such as that shown by Bigelow and Sears (1937, fig. 21) with the somatocyst and nectosac in a nearly vertical position show four facets on the upper surface and four underneath, but little attempt has been made to homologize these with other abylids, except by Totton (1932, p. 335) and Huxley (1859). In comparing these with the facets of other abylids, the apical point[1] appears to be the junction of dorsal, apical,[2] and lateral ridges (Figs. 3 and 4) if we use the terminology applied to *Abyla*. On the other hand, if we compare *Enneagonum* with *Abylopsis* (Figs. 25 and 4A), it appears that aside from differences in size and shape of the facets, the major alteration has been the addition of a median dorsal ridge bisecting the dorsal facet found in *Abylopsis*. Beneath and between the two dorsal facets is a nearly triangular basal facet. Ventral to these are the apicolateral facets. Basal to and between the apicolaterals and the dorsals are the basolaterals. Basal to and between the apicolaterals is the ventral. The peculiarity, then, of this genus which delimits it from others of the type with a median apical ridge is the addition of the median dorsal ridge subdividing the dorsal facet, as in *Pseudabylopsis*.

In contrast to the ovoid somatocyst of the other genera, in *Enneagonum*, this is elongate with a more or less pronounced constriction below its apex. As in *Bassia*, it lies above the hydroecium. The opening to the nectosac is peculiar in that it is surrounded by three lappets, two of which separate it from the basal facet (see Bigelow and Sears, 1937, figs. 24 and 25). The radial canals on the nectosac are essentially as in *A. tetragona*, except that at the apex of the arched radial canals there is a blind diverticulum.

[1] In some specimens, this point becomes a short transverse ridge (Totton, 1932, text fig. 16; Bigelow and Sears, 1937, p. 22, fig. 23).

[2] This ridge has previously (Bigelow and Sears, 1937, p. 22) been called the ventral one, but this was apparently merely a matter of convenience as no attempt was made to compare this species with other abylids.

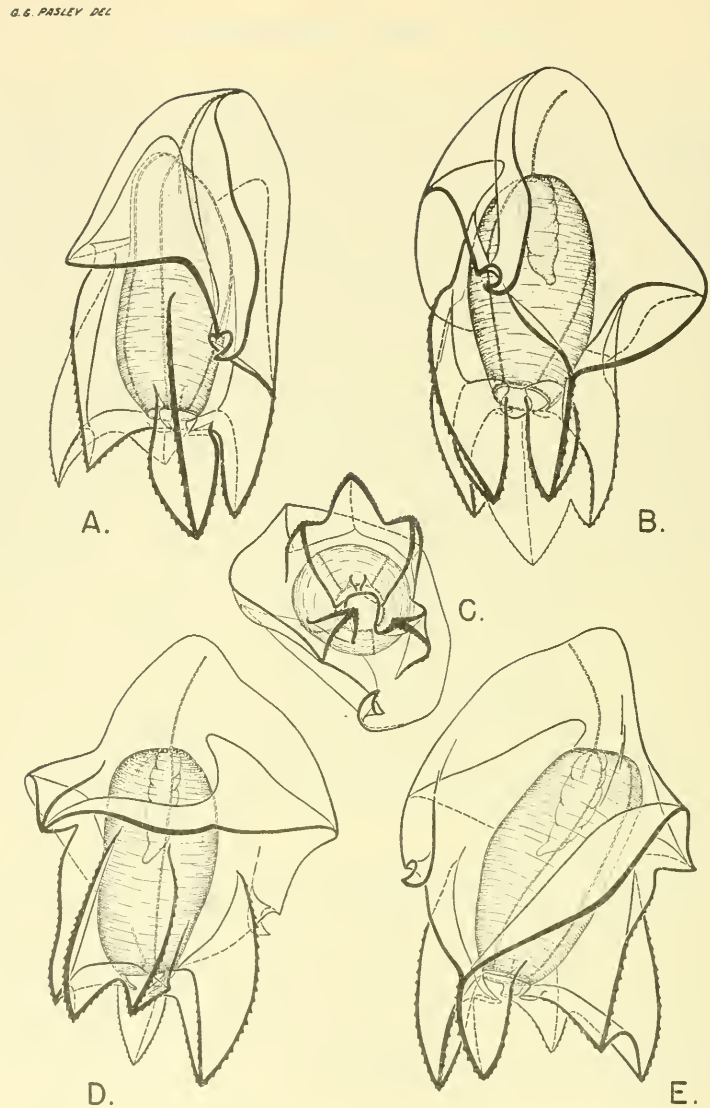

Fig. 29. Gonophore of *Enneagonum hyalinum* of 5.4 mm. in total length. A. Left ventrolateral view. B. Ventral view. C. Oral view. D. Lateral view. E. Right ventrolateral view.

Inferior nectophore. There is no inferior nectophore in this species.

Bract (Fig. 2). The bract is more nearly a perfect cube than that of *A. tetragona* the only other one with which it superficially might be confused. It has five facets, an apical, dorsal, ventral and two laterals. The basolateral facets are absent; the entire basal portion being the opening to the hydroecium. The somatocyst is unique in that it completely lacks the descending dorsal branch found in all other known genera of abylids. The lateral branches are swollen and the apical diverticulum is conspicuous.

Gonophore (Fig. 29). The best existing description and figures for the gonophore of *Enneagonum* appear to be those of Chun (1892). Unfortunately, certain of the more complex details were omitted. At first glance, it is difficult to visualize the relationship of the various surfaces with those of other gonophores among the abylids. However, comparison with those of *Abyla* or *Abylopsis* in which the apophysis is so developed as to form almost a third of the gonophore, at least in young specimens, suggests that the peculiar conical apex of *Enneagonum* is perhaps an overdeveloped apophysis which had become considerably modified. Thus, the lower margin of the almost conical upper portion might be considered homologous with the apical ridges separating it from the facets in *Abyla* or *Abylopsis*. In *Enneagonum*, however, the dorsal and right lateral[1] ridges do not extend apically as far as this margin and there are deep concave depressions beneath it. The latter are present, but less marked in young gonophores, at least, of *Abyla* and *Abylopsis*.

The lower half of the gonophore is essentially similar to others within the subfamily. There is a prominent dorsal tooth with almost equally prominent lateral teeth. The ridges associated with these are very pronounced, but extend only about half way up the nectophore. The laterals are not straight; apically, the right lateral swerves sharply dorsad, but the left lateral has a more sinuous dorsal course before connecting with the "apical ridge" girdling the mid-portion of the gonophore.

A peculiarity not found in other abylid gonophores, however, is the extensive concave surface beneath the dorsal and lateral teeth. At the base of each lateral tooth is a semicircular serrated lappet. Likewise, a third such protuberance extends forward from the ventral region.

[1] In order to avoid confusion, the gonophore is described as drawn. However, mirror images occur.

The ventral teeth are large and obvious. The ridge from the right ventral tooth ends like the dorsal and right lateral about half way up the nectophore. The left ventral ridge seemingly bifurcates, but joins again apically, surrounding a large concavity which apparently serves as the dorsal part of the hydroecium. One branch bears a definite hook resembling that found in *Abyla*, in *Ceratocymba*, and to a lesser extent in *Abylopsis*.

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Appendix

Listed alphabetically below are the specimens, other than uniques mentioned in the text and other than the ubiquitous species, *Abylopsis tetragona, Abylopsis eschscholtzii, Bassia bassensis, Ceratocymba sagittata,* and *Enneagonum hyalinum,* upon which the foregoing study was based. It should be noted in this connection, that the entire "Dana" collection has not yet been examined, so that the listing is by no means complete.

Abyla bicarinata Moser

St. 3620. 24°46.5′S. — 170°18.5′E. 7. XII. 1928.
S150. 100 m. w. 1 superior nectophore.
St. 3622. 25°54′S. — 172°36.9′E. 8. XII. 1928.
S200. 100 m. w. 5 superior nectophores.
S200. 200 m. w. 3 superior nectophores; 2 inferior nectophores.
St. 3623. 27°21′S. — 175°11′E. 9. XII. 1928.
S150. m. w. 1 superior nectophore; 1 inferior nectophore.
St. 3663. 33°33′S. — 154°94′E. 23. II. 1929.
S150. 50 m. w. 3 superior nectophores; 3 inferior nectophores.
S150. 100 m. w. 1 colony.
St. 3677. 5°28′S. — 130°39′E. 23. III. 1929.
E300. 5000 m. w. 1 superior nectophore; 1 inferior nectophore.
St. 3714. 15°22′N. — 115°20′E. 20. V. 1929.
S150. 100 m. w. 3 superior nectophores.

St. 3727. 25°27'N. — 121°30'E. 10. VI. 1929.
E300. 300 m. w. 6 superior nectophores; 5 inferior nectophores.
St. 3903. 5°50'N. — 93°28'E. 17. XI. 1929.
S200. 300 m. w. 1 superior nectophore; 1 inferior nectophore.
St. 3919. 0°07'S. — 63°56'E. 8. XII. 1929.
S200. 50 m. w. 4 superior nectophores; 2 inferior nectophores.
S200. 300 m. w. 1 inferior nectophore.
St. 3920. 1°12'N. — 62°19'E. 9. XII. 1929.
S200. 100 m. w. 1 superior nectophore.
St. 3921. 3°36'S. — 58°19'E. 11. XII. 1929.
S200. 200 m. w. 1 superior nectophore.
St. 3934. 11°24'S. — 50°05'E. 20. XII. 1929.
S200. 300 m. w. 6 superior nectophores; 4 inferior nectophores.
St. 3964. 25°19'S. — 36°13'E. 15. I. 1930.
S150. 50 m. w. 1 inferior nectophore.
S200. 100 m. w. 1 superior nectophore.
S200. 300 m. w. 7 superior nectophores; 6 inferior nectophores.
S150. 1500 m. w. 1 superior nectophore.
S150. 2000 m. w. 1 superior nectophore.
St. 4762. 8°13'S. — 2°54'E. 11. II. 1933.
S200. 293 m. w. 1 inferior nectophore.
St. 4775. 30°20'N. — 138°00'E. 11. IV. 1933.
S200. 220 m. w. 1 colony.

Abyla brownia n. sp.

St. 3622. 25°54'S. — 172°36.9'E. 8. XII. 1928.
S200. 200 m. w. 5 superior nectophores.
St. 3712. 12°44'N. — 110°45'E. 18. V. 1929.
S150. 50 m. w. 2 superior nectophores.
St. 3921. 3°36'S. — 58°19'E. 11. XII. 1929.
S200. 100 m. w. 1 superior nectophore.
St. 3964. 25°19'S. — 36°13'E. 15. I. 1930.
S150. 50 m. w. 8 superior nectophores.

Abyla carina Haeckel

St. 4003. 8°26'S. — 15°11'W. 9. III. 1930.
S150. 3000 m. w. 1 superior nectophore.
St. 4019. 33°08'N. — 10°22'W. 30. III. 1930.
S200. 300 m. w. 2 superior nectophores; 2 inferior nectophores.
St. 4195. 41°55'N. — 32°22'W. 22. VI. 1931.
S200. 100 m. w. 3 superior nectophores; 2 inferior nectophores
S200. 300 m. w. 1 superior nectophore; 1 inferior nectophore.

Abyla haeckeli Lens & Van Riemsdijk

St. 3620. 24°46.5′S. — 170°18.5′E. 7. XII. 1928.
S150. 100 m. w. 1 superior nectophore.
St. 3622. 25°54′S. — 172°36.9′E. 8. XII. 1928.
S200. 200 m. w. 4 superior nectophores.
St. 3663. 33°33′S. — 154°94′E. 23. II. 1929.
S150. 50 m. w. 2 superior nectophores.
St. 3676. 5°52′S. — 131°14′E. 22. III. 1929.
S150. 50 m. w. 2 superior nectophores.
S150. 100 m. w. 4 superior nectophores.
S150. 300 m. w. 5 superior nectophores.
St. 3677. 5°28′S. — 130°39′E. 23. III. 1929.
S150. 3000 m. w. 1 superior nectophore.
St. 3678. 4°05′S. — 128°16′E. 24. III. 1929.
S150. 100 m. w. 1 superior nectophore.
S150. 3000 m. w. 1 superior nectophore.
St. 3680. 2°22′S. — 126°58.5′E. 27. III. 1929.
S150. 50 m. w. 1 superior nectophore.
S150. 100 m. w. 1 superior nectophore.
S150. 1000 m. w. 1 superior nectophore.
St. 3751. 3°40.5′N. — 137°53′E. 12. VII. 1929.
S200. 600 m. w. 1 superior nectophore.
St. 3844. 12°05′S. — 96°45′E. 10. X. 1929.
S200. 200 m. w. 1 colony; 4 superior nectophores; 1 inferior nectophore.
St. 3919. 0°07′S. — 63°56′E. 8. XII. 1929.
S200. 50 m. w. 43 superior nectophores; 1 inferior nectophore.
S200. 100 m. w. 34 superior nectophores; 15 inferior nectophores.
S200. 300 m. w. 1 colony; 33 superior nectophores.
S200. 600 m. w. 5 superior nectophores.
St. 3920. 1°12′N. — 62°19′E. 9. XII. 1929.
S200. 100 m. w. 15 superior nectophores.
S200. 600 m. w. 5 superior nectophores.
S150. 1000 m. w. 3 superior nectophores.
S150. 2000 m. w. 1 superior nectophore; 1 inferior nectophore.
St. 3921. 3°36′S. — 58°19′E. 11. XII. 1929.
S200. 100 m. w. 5 colonies; 82 superior nectophores; 28 inferior nectophores.
S200. 200 m. w. 5 superior nectophores.
S200. 300 m. w. 2 superior nectophores.
S200. 600 m. w. 5 superior nectophores.
St. 3922. 3°45′S. — 56°33′E. 12. XII. 1929.
S200. 50 m. w. 8 superior nectophores; 4 inferior nectophores.

S200. 300 m. w. 5 superior nectophores.
St. 3934. 11°24′S. — 50°05′E. 20. XII. 1929.
S200. 300 m. w. 2 colonies; 127 superior nectophores.
S200. 500 m. w. 98 superior nectophores; 1 inferior nectophore.
St. 3955. 18°30′S. — 42°18′E. 9. I. 1930.
S200. 100 m. w. 1 superior nectophore.
St. 3964. 25°19′S. — 36°13′E. 15. I. 1930.
S150. 50 m. w. 11 superior nectophores.
S200. 100 m. w. 2 superior nectophores.
S200. 300 m. w. 1 colony; 56 superior nectophores.
S150. 1500 m. w. 1 superior nectophore.
S150. 2000 m. w. 1 superior nectophore.
St. 3998. 7°34′S. — 8°48′W. 1. III. 1930.
S200. 50 m. w. 1 superior nectophore.
St. 4808. 36°20′N. — 143°00′E. 2. V. 1934.
S200. 220 m. w. 3 superior nectophores.

Abyla ingeborgae n. sp.

St. 3920. 1°12′N. — 62°19′E. 9. XII. 1929.
S200. 600 m. w. 1 superior nectophore.
St. 3921. 3°36′S. — 58°19′E. 11. XII. 1929.
S200. 200 m. w. 35 superior nectophores.
S200. 400 m. w. 3 superior nectophores.
St. 3933. 11°18′S. — 50°03′E. 20. XII. 1929.
S150. 2000 m. w. 1 colony.
S150. 3500 m. w. 1 superior nectophore.
St. 3964. 25°19′S. — 36°13′E. 15. I. 1930.
S200. 600 m. w. 1 superior nectophore.
St. 3998. 7°34.5′S. — 8°84′W. 1. III. 1930.
S200. 100 m. w. 1 superior nectophore.
S150. 1000 m. w. 1 superior nectophore.
St. 4000. 0°31′S. — 11°02′W. 4. III. 1930.
S50. Surface. 6 superior nectophores.
S200. 50 m. w. 8 superior nectophores.
S200. 100 m. w. 15 superior nectophores.
S200. 300 m. w. 2 superior nectophores.
S150. 4000 m. w. 2 superior nectophores.
St. 4762. 8°13′S. — 2°54′E. 11. II. 1933.
S200. 293 m. w. 21 superior nectophores.

Abyla schmidti n. sp.

St. 3623. 27°21′S. — 175°11′E. 9. XII. 1928.
S150. 100 m. w. 1 superior nectophore.

St. 3657. 33°17′S. — 152°45′E. 31. I. 1929.
S150. 100 m. w. 1 superior nectophore.
St. 3665. 29°37.5′S. — 156°46′E. 25. II. 1929.
E300. 1000 m. w. 1 colony.
St. 3676. 5°52′S. — 131°14′E. 22. III. 1929.
S150. 50 m. w. 60 superior nectophores; 2 inferior nectophores.
S150. 100 m. w. 60 superior nectophores; 2 inferior nectophores.
S150. 300 m. w. 1 colony; 233 superior nectophores; 192 inferior nectophores.
S150. 600 m. w. 1 inferior nectophore.
S150. 3000 m. w. 2 superior nectophores; 2 inferior nectophores.
S150. 4000 m. w. 4 superior nectophores; 3 inferior nectophores.
S150. 5000 m. w. 1 colony; 1 superior nectophore; 1 inferior nectophore.
St. 3677. 5°28′S. — 130°39′E. 23. III. 1929.
S150. 1000 m. w. 6 superior nectophores; 2 inferior nectophores.
S150. 2000 m. w. 1 inferior nectophore.
S150. 4000 m. w. 5 superior nectophores; 3 inferior nectophores.
E300. 5000 m. w. 3 superior nectophores.
St. 3678. 4°05′S. — 128°16′E. 24. III. 1929.
S150. 300 m. w. 3 superior nectophores; 2 inferior nectophores.
E300. 1000 m. w. 1 superior nectophore.
S150. 2000 m. w. 1 superior nectophore.
S150. 4000 m. w. 1 superior nectophore; 1 inferior nectophore.
E300. 5000 m. w. 2 superior nectophores; 1 inferior netophore.
St. 3680. 2°22′S. — 126°58.5′E. 27. III. 1929.
S150. 100 m. w. 9 superior nectophores; 1 inferior nectophore.
S150. 300 m. w. 1 superior nectophore; 1 inferior nectophore.
S150. 2000 m. w. 1 colony; 1 superior nectophore.
St. 3681. 0°29′N. — 125°54′E. 28. III. 1929.
S150. 100 m. w. 8 superior nectophores.
S150. 300 m. w. 6 superior nectophores; 2 inferior nectophores.
St. 3682. 1°42′N. — 124°29′E. 29. III. 1929.
S150. 50 m. w. 15 superior nectophores; 5 inferior nectophores.
S150. 100 m. w. 18 superior nectophores; 6 inferior nectophores.
S150. 300 m. w. 7 superior nectophores; 5 inferior nectophores.
S150. 600 m. w. 3 superior nectophores; 1 inferior nectophore.
E300. 1000 m. w. 1 inferior nectophore.
St. 3689. 7°13.5′N. — 111°49′E. 9. IV. 1929.
S150. 50 m. w. 31 superior nectophores; 1 inferior nectophore
St. 3712. 12°44′N. — 110°45′E. 18. V. 1929.
S150. 100 m. w. 11 superior nectophores; 10 inferior nectophores.
S150. 300 m. w. 2 superior nectophores; 3 inferior nectophores.

St. 3713. 13°57′N. — 112°45′E. 19. V. 1929.
S150. 100 m. w. 3 superior nectophores; 1 inferior nectophore.
St. 3714. 15°22′N. — 115°20′E. 20. V. 1929.
S150. 4000 m. w. 2 superior nectophores; 1 inferior nectophore.
St. 3727. 25°27′N. — 121°30′E. 10. VI. 1929.
E300. 300 m. w. 5 superior nectophores.
St. 3729. 20°03.5′N. — 120°50′E. 14. VI. 1929.
S200. 300 m. w. 2 superior nectophores.
S200. 600 m. w. 2 superior nectophores; 2 inferior nectophores.
St. 3751. 3°40.5′N. — 137°53′E. 12. VII. 1929.
S200. 50 m. w. 66 superior nectophores; 16 inferior nectophores.
S200. 100 m. w. 1 colony; 66 superior nectophores; 42 inferior nectophores.
S200. 300 m. w. 1 colony; 10 superior nectophores; 3 inferior nectophores.
S200. 600 m. w. 2 superior nectophores; 2 inferior nectophores.
St. 3844. 12°05′S. — 96°45′E. 10. X. 1929.
S200. 200 m. w. 1 superior nectophore.
St. 3903. 5°50′N. — 93°28′E. 17. XI. 1929.
S200. 50 m. w. 8 superior nectophores; 1 inferior nectophore.
St. 3919. 0°07′S. — 63°56′E. 8. XII. 1929.
S200. 50 m. w. 71 superior nectophores; 53 inferior nectophores.
S200. 100 m. w. 60 superior nectophores; 40 inferior nectophores.
S200. 300 m. w. 10 superior nectophores; 3 inferior nectophores.
S200. 600 m. w. 7 superior nectophores.
St. 3920. 1°12′N. — 62°19′E. 9. XII. 1929.
S200. 100 m. w. 147 superior nectophores; 36 inferior nectophores.
S200. 300 m. w. 4 superior nectophores; 1 inferior netophore.
S200. 600 m. w. 4 superior nectophores; 1 inferior nectophore.
S150. 1000 m. w. 2 superior nectophores.
St. 3921. 3°36′S. — 58°19′E. 11. XII. 1929.
S200. 100 m. w. 2 colonies; 47 superior nectophores; 27 inferior nectophores.
S200. 200 m. w. 12 superior nectophores; 9 inferior nectophores.
S200. 300 m. w. 1 colony; 1 superior nectophore; 2 inferior nectophores.
S200. 400 m. w. 1 colony; 4 superior nectophores; 1 inferior nectophore.
S200. 600 m. w. 2 superior nectophores.
St. 3922. 3°45′S. — 56°33′E. 12. XII. 1929.
S200. 50 m. w. 45 superior nectophores; 8 inferior nectophores.
S200. 300 m. w. 1 superior nectophore.
E300. 1000 m. w. 1 superior nectophore; 1 inferior nectophore.
St. 3934. 11°24′S. — 50°05′E. 20. XII. 1929.
S200. 300 m. w. 1 colony; 49 superior nectophores; 16 inferior nectophores.
S200. 500 m. w. 7 superior nectophores; 3 inferior nectophores.

St. 3955. 18°30′S. — 42°18′E. 9. I. 1930.
S200. 100 m. w. 1 colony; 9 superior nectophores; 8 inferior nectophores.
St. 3964. 25°19′S. — 36°13′E. 15. I. 1930.
S150. 50 m. w. 1 colony; 61 superior nectophores; 19 inferior nectophores.
S200. 100 m. w. 10 superior nectophores.
S200. 300 m. w. 51 superior nectophores.
S200. 600 m. w. 4 superior nectophores.
E300. 1000 m. w. 2 superior nectophores.
S150. 2000 m. w. 2 superior nectophores.
S150. 2500 m. w. 1 colony.
St. 4762. 8°13′S. — 2°54′E. 11. II. 1933.
S200. 293 m. w. 1 superior nectophore.

Abyla tottoni n. sp.

St. 3677. 5°28′S. — 130°39′E. 23. III. 1929.
S150. 2000 m. w. 1 superior nectophore.
St. 3996. 15°41′S. — 5°50′W. 25. II. 1930.
S200. 50 m. w. 8 superior nectophores; 6 inferior nectophores.
S200. 100 m. w. 1 colony; 6 superior nectophores.
S150. 3000 m. w. 1 superior nectophore; 1 inferior nectophore.
St. 3997. 11°00′S. — 7°36′W. 27. II. 1930.
S200. 50 m. w. 13 colonies; 3 superior nectophores; 2 inferior nectophores.
S200. 100 m. w. 7 colonies; 2 superior nectophores; 2 inferior nectophores.
S200. 300 m. w. 1 colony.
E300. 1000 m. w. 1 colony; 1 superior nectophore.
St. 3998. 7°34′S. — 8°48′W. 1. III. 1930.
S200. 50 m. w. 4 colonies; 3 superior nectophores; 4 inferior nectophores.
S200. 100 m. w. 5 superior nectophores; 4 inferior nectophores.

Abyla trigona Quoy & Gaimard

St. 3728. 24°15′N. — 122°00′E. 12. VI. 1929.
S200. 300 m. w. 1 superior nectophore.
St. 3804. 9°09′S., 114°47′E. 30. VIII. 1929.
S200. 600 m. w. 2 superior nectophores.
St. 3920. 1°06′N. — 62°25′E. 9. XII. 1929.
S150. 2000 m. w. 1 colony; 2 superior nectophores.
St. 3921. 3°36′S. — 58°19′E. 11. XII. 1929.
S200. 100 m. w. 4 superior nectophores.
St. 3955. 18°30′S. — 42°18′E. 9. I. 1930.
S200. 100 m. w. 1 superior nectophore.
St. 3971. 35°49′S. — 23°09′E. 29. I. 1930.
S200. 100 m. w. 33 superior nectophores; 20 inferior nectophores.

St. 3978. 30°15'S. — 13°15'E. 13. II. 1930.
S200. 600 m. w. 1 superior nectophore.
St. 3996. 15°41'S. — 5°50'W. 25. II. 1930.
S200. 100 m. w. 1 superior nectophore.
St. 4000. 0°31'S. — 11°02'W. 4. III. 1930.
S200. 100 m. w. 4 superior nectophores.
St. 4003. 8°26'N. — 15°11'W. 9. III. 1930.
S200. 100 m. w. 6 superior nectophores; 8 inferior nectophores.
St. 4192. 39°57'N. — 24°59'W. 19. VI. 1931.
S200. 50 m. w. 1 colony; 17 superior nectophores; 2 inferior nectophores.
S200. 100 m. w. 11 superior nectophores; 1 inferior nectophore.
S200. 300 m. w. 5 superior nectophores; 2 inferior nectophores.
S200. 500 m. w. 2 superior nectophores; 3 inferior nectophores.
S200. 600 m. w. 2 superior nectophores.
St. 4195. 41°55'N. — 32°22'W. 22. VI. 1931.
S200. 50 m. w. 1 colony; 4 superior nectophores; 4 inferior nectophores.
S200. 100 m. w. 66 superior nectophores; 11 inferior nectophores.
S200. 300 m. w. 6 superior nectophores; 3 inferior nectophores.
St. 4768. 19°20'N. — 119°48'E. 22. IV. 1933.
S200. 293 m. w. 11 superior nectophores; 4 inferior nectophores.

Ceratocymba dentata Bigelow

St. 3556. 2°52'N. — 87°38'W. 14. IX. 1928.
S150. 200 m. w. 1 bract.
St. 3663. 33°33'S. — 154°04'E. 23. II. 1929.
S150. 300 m. w. 2 superior nectophores; 2 inferior nectophores; 3 bracts & eudoxids; 4 gonophores.
St. 3678. 4°05'S. — 128°16'E. 24. III. 1929.
S150. 300 m. w. 1 superior nectophore; 7 bracts & eudoxids; 13 gonophores.
St. 3681. 0°29'N. — 125°54'E. 28. III. 1929.
S150. 300 m. w. 1 superior nectophore.
St. 3712. 12°44'N. — 110°45'E. 18. V. 1929.
S150. 100 m. w. 5 superior nectophores; 3 inferior nectophores. 4 gonophores.
St. 3729. 20°03.5'N. — 120°50'E. 14. VI. 1929.
S200. 300 m. w. 2 superior nectophores; 2 inferior nectophores.
St. 3919. 0°07'S. — 63°56'E. 8. XII. 1929.
S200. 300 m. w. 3 superior nectophores; 1 inferior nectophore; 3 bracts & eudoxids; 5 gonophores.
St. 3920. 1°12'N. — 62°19'E. 9. XII. 1929.
S200. 300 m. w. 4 superior nectophores.
S150. 1000 m. w. 1 superior nectophore.

St. 3921. 3°36′S. — 58°19′E. 11. XII. 1929.
S200. 100 m. w. 1 superior nectophore.
S200. 200 m. w. 1 superior nectophore; 2 bracts; 2 gonophores.
S200. 400 m. w. 1 bract.
E300. 1000 m. w. 1 superior nectophore; 1 inferior nectophore.
St. 3922. 3°45′S. — 56°33′E. 12. XII. 1929.
E300. 1000 m. w. 1 colony.
St. 3934. 11°24′S. — 50°05′E. 20. XII. 1929.
S200. 300 m. w. 8 bracts & eudoxids; 16 gonophores.
S200. 500 m. w. 3 bracts; 3 gonophores.
St. 3964. 25°19′S. — 36°13′E. 15. I. 1930.
S200. 300 m. w. 4 bracts.
E300. 3000 m. w. 1 bract.
St. 3971. 35°49′S. — 23°09′E. 29. I. 1930.
S200. 100 m. w. 3 bracts.
St. 3996. 15°41′S. — 5°50′W. 25. II. 1930.
S200. 100 m. w. 1 superior nectophore.
St. 4003. 8°26′S. — 15°11′W. 9. III. 1930.
S150. 3000 m. w. 2 colonies; 1 superior nectophore; 1 inferior nectophore; 10 bracts & eudoxids; 2 gonophores.
St. 4762. 8°13′S. — 2°54′E. 11. II. 1933.
S200. 293 m. w. 1 colony.

Ceratocymba intermedia n. sp.

St. 3677. 5°28′S. — 130°39′E. 23. III. 1929.
S150. 1000 m. w. 1 superior nectophore.
S150. 3000 m. w. 1 superior nectophore.
St. 3678. 4°05′S. — 128°16′E. 24. III. 1929.
S150. 300 m. w. 1 superior nectophore.
S150. 600 m. w. 2 superior nectophores.
St. 3680. 2°22′S. — 126°58.5′E. 27. III. 1929.
S150. 4000 m. w. 1 superior nectophore.
St. 3712. 12°44′N. — 110°45′E. 18. V. 1929.
S150. 300 m. w. 1 superior nectophore.
St. 3751. 3°40.5′N. — 137°53′E. 12. VII. 1929.
S200. 600 m. w. 2 superior nectophores.

Ceratocymba leuckartii Huxley

St. 1361. 27°07′N. — 51°10′W. 4. VI. 1922.
S200. 100 m. w. 17 superior nectophores; 2 inferior nectophores; 2 bracts.
St. 3587. 11°00′S. — 172°37′W. 2. XI. 1928.
S150. 50 m. w. 40 superior nectophores; 15 inferior nectophores; 44 bracts & eudoxids.

St. 3676. 5°52′S. — 131°14′E. 22. III. 1929.

S150. 50 m. w. 14 superior nectophores.

S150. 100 m. w. 10 superior nectophores.

S150. 300 m. w. 20 superior nectophores.

S150. 600 m. w. 2 superior nectophores.

S150. 3000 m. w. 1 superior nectophore.

S150. 5000 m. w. 1 superior nectophore.

St. 3677. 5°28′S. — 130°39′E. 23. III. 1929.

S150. 2000 m. w. 2 superior nectophores; 3 eudoxids.

S150. 3000 m. w. 2 superior nectophores; 1 inferior nectophore; 3 eudoxids.

S150. 4000 m. w. 1 superior nectophore; 2 inferior nectophores; 1 bract.

St. 3678. 4°05′S. — 128°16′E. 24. III. 1929.

S150. 50 m. w. 12 superior nectophores.

S150. 100 m. w. 11 superior nectophores; 21 bracts & eudoxids; 15 gonophores.

S150. 300 m. w. 4 superior nectophores.

S150. 600 m. w. 2 superior nectophores; 1 bract.

S150. 1000 m. w. 1 superior nectophore.

St. 3680. 2°22′S. — 126°58.5′E. 27. III. 1929.

S150. 50 m. w. 22 superior nectophores; 2 inferior nectophores; 9 bracts & eudoxids; 14 gonophores.

S150. 100 m. w. 43 superior nectophores; 15 inferior nectophores.

S150. 300 m. w. 4 superior nectophores; 3 inferior nectophores.

S150. 1000 m. w. 1 superior nectophore; 2 inferior nectophores.

S150. 2000 m. w. 2 superior nectophores; 2 inferior nectophores; 3 bracts.

S150. 4000 m. w. 1 superior nectophore; 1 inferior nectophore; 1 bract.

St. 3681. 0°29 N. — 125°54′E. 28. III. 1929.

S150. 50 m. w. 1 superior nectophore.

S150. 100 m. w. 56 superior nectophores; 7 inferior nectophores; 546 bracts & eudoxids; 462 gonophores.

S150. 300 m. w. 21 superior nectophores; 2 inferior nectophores; 220 bracts & eudoxids.

S150. 600 m. w. 10 bracts & eudoxids; 20 gonophores.

St. 3682. 1°42′N. — 124°29′E. 29. III. 1929.

S150. 50 m. w. 32 superior nectophores; 5 inferior nectophores; 6 bracts & eudoxids.

S150. 100 m. w. 22 superior nectophores; 8 inferior nectophores; 1 eudoxid.

S150. 300 m. w. 5 superior nectophores; 3 inferior nectophores; 3 eudoxids; 1 gonophore.

S150. 600 m. w. 2 superior nectophores.

St. 3686. 8°34′N. — 119°55′E. 6. IV. 1929.

S150. 50 m. w. 1 superior nectophore.

St. 3689. 7°13.5′N. — 111°49′E. 9. IV. 1929.
S150. 50 m. w. 11 superior nectophores; 5 inferior nectophores; 2 bracts.
St. 3712. 12°44′N. — 110°45′E. 18. V. 1929.
S150. 50 m. w. 2 colonies; 17 superior nectophores; 6 inferior nectophores; 3 eudoxids.
S150. 100 m. w. 1 colony; 33 superior nectophores; 11 inferior nectophores; 16 bracts; 22 gonophores.
S150. 300 m. w. 3 superior nectophores; 1 eudoxid.
St. 3713. 13°57′N. — 112°45′E. 19. V. 1929.
S150. 100 m. w. 1 colony; 8 superior nectophores; 3 inferior nectophores; 8 gonophores.
S150. 600 m. w. 1 superior nectophore; 1 inferior nectophore; 1 eudoxid; 3 gonophores.
St. 3714. 15°22′N. — 115°20′E. 20. V. 1929.
S150. 100 m. w. 1 inferior nectophore.
S150. 5000 m. w. 2 superior nectophores; 1 inferior nectophore.
St. 3723. 23°30.5′N. — 125°28′E. 30. V. 1929.
S200. 600 m. w. 5 superior nectophores; 1 inferior nectophore.
St. 3728. 24°15′N. — 122°00′E. 12. VI. 1929.
S200. 300 m. w. 10 superior nectophores; 5 inferior nectophores; 1 gonophore.
St. 3729. 20°03.5′N. — 120°50′E. 14. VI. 1929.
S200. 600 m. w. 2 superior nectophores; 1 inferior nectophore; 2 eudoxids; 2 gonophores.
St. 3751. 3°40.5′N. — 137°53′E. 12. VII. 1929.
S200. 50 m. w. 57 superior nectophores; 23 inferior nectophores; 19 bracts & eudoxids.
S200. 100 m. w. 31 superior nectophores; 14 inferior nectophores.
S200. 300 m. w. 5 superior nectophores; 3 bracts.
S200. 600 m. w. 3 eudoxids.
St. 3804. 9°09′S. — 114°47′E. 30. VIII. 1929.
S200. 600 m. w. 2 superior nectophores.
St. 3844. 12°05′S. — 96°45′E. 10. X. 1929.
S200. 200 m. w. 78 superior nectophores; 23 inferior nectophores; 18 bracts & eudoxids; 2 gonophores.
St. 3903. 5°50′N. — 93°28′E. 17. XI. 1929.
S200. 50 m. w. 1 superior nectophore.
St. 3919. 0°07′S. — 63°56′E. 8. XII. 1929.
S200. 50 m. w. 1 colony; 9 superior nectophores; 1 inferior nectophore; 9 bracts.
S200. 100 m. w. 6 superior nectophores; 6 inferior nectophores; 3 bracts & eudoxids.
S200. 300 m. w. 1 superior nectophore.

S200. 600 m. w. 1 superior nectophore, 1 inferior nectophore; 1 bract.

St. 3920. 1°12′N. — 62°19′E. 9. XII. 1929.

S200. 100 m. w. 8 superior nectophores.

S200. 600 m. w. 1 eudoxid.

S150. 2500 m. w. 2 superior nectophores; 1 inferior nectophore.

St. 3921. 3°36′S. — 58°19′E. 11. XII. 1929.

S200. 100 m. w. 16 superior nectophores; 13 inferior nectophores; 26 bracts.

S200. 200 m. w. 1 inferior nectophore.

S200. 400 m. w. 2 superior nectophores; 1 bract; 2 gonophores.

St. 3922. 3°45′S. — 56°33′E. 12. XII. 1929.

S200. 50 m. w. 5 superior nectophores; 6 inferior nectophores; 4 bracts.

St. 3934. 11°24′S. — 50°05′E. 20. XII. 1929.

S200. 300 m. w. 1 colony; 146 superior nectophores; 45 inferior nectophores; 87 bracts & eudoxids.

S200. 500 m. w. 3 superior nectophores; 1 bract.

St. 3955. 18°30′S. — 42°18′E. 9. I. 1930.

S200. 100 m. w. 4 superior nectophores; 1 inferior nectophore.

St. 3964. 25°19′S. — 36°13′E. 15. I. 1930.

S150. 50 m. w. 23 superior nectophores; 7 inferior nectophores; 2 eudoxids.

S200. 100 m. w. 1 colony; 19 superior nectophores; 5 inferior nectophores; 1 bract.

S200. 300 m. w. 3 superior nectophores; 2 inferior nectophores; 5 bracts & eudoxids.

S150. 2000 m. w. 1 superior nectophore.

S150. 2500 m. w. 2 superior nectophores; 1 inferior nectophore

St. 3971. 35°49′S. — 23°09′E. 29. I. 1930.

S200. 100 m. w. 6 superior nectophores; 1 inferior nectophore.

St. 3998. 7°34′S. — 8°48′W. 1. III. 1930.

S200. 50 m. w. 2 superior nectophores.

S200. 100 m. w. 2 superior nectophores.

St. 4000. 0°31′S. — 11°02′W. 4. III. 1930.

S50. Surface. 3 superior nectophores.

S200. 50 m. w. 2 superior nectophores.

S200. 100 m. w. 1 superior nectophore.

St. 4003. 8°26′S. — 15°11′W. 9. III. 1930.

S150. 3000 m. w. 1 superior nectophore.

St. 4195. 41°55′N. — 32°22′W. 22. VI. 1931.

S200. 100 m. w. 1 inferior nectophore.

St. 4768. 19°20′N. — 119°48′E. 24. IV. 1933.

S200. 293 m. w. 67 superior nectophores; 21 inferior nectophores; 127 eudoxids.

St. 4775. 30°20′N. — 138°00′E. 11. IV. 1933.
S200. 220 m. w. 13 superior nectophores; 7 inferior nectophores; 8 bracts; 6 gonophores.

St. 4808. 36°20′N. — 143°00′E. 2. V. 1934.
S200. 220 m. w. 1 superior nectophore; 1 inferior nectophore.