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XXXII.—*Notes on the Chætognaths.* By F. S. CONANT *.

THE following notes are based in part upon observations made at Beaufort, N. C., during the summer of 1895, and in part upon later work on preserved material. That which concerns the egg-laying rests wholly on one form, *Sagitta hispida*, a species very much like the *Sagitta bipunctata* of European writers, which was described by me in the 'University Circular' for June 1895 (no. 119)†. With the exception of *Sagitta hispida* and another form, *Spadella schizoptera*, described in the same article, the Chætognaths of American waters have not been subjected to the European standards of classification, and in the systematic part of this paper an attempt has been made to describe, as accurately as alcoholic material would allow, such of the American Chætognaths as have come into the writer's hands.

I. EGG-LAYING.

So far as is revealed by a search of the literature, the passage of the ova into the oviducts has not been actually

* From the 'Johns Hopkins University Circulars' for June 1896, pp. 82-85.

† Reprinted in the 'Annals' for 1895, vol. xvi. p. 288.

observed heretofore. The structure of the ovaries is such that no direct course is offered to the exterior, and it has been a matter of some speculation with the authors how the eggs do get into the ducts. The ovaries are two bilateral cylindrical bodies situated in the posterior part of the body-segment. Along the outer edge of each there extends a duct, which opens to the exterior laterally at the level of the posterior end of the ovary. This is called by Hertwig * the oviduct. By Grassi †, since it is very often found to contain spermatozoa, it is called the "ovisperm duct." A glance at fig. 1, which represents a cross section through the body of *Sagitta hispida*

Fig. 1.

* Cross section of *Sagitta hispida*, with eggs still in the ovary. *M*, muscle; *BC*, body-cavity; *I*, intestine; *GE*, germinal epithelium; *O*, ovarian eggs; *RS*, receptaculum seminis; *F*, lateral fin.

in the region of the ovaries, will show that the ova are separated from this duct by a layer of cells of the germinal epithelium. This extends between the ova and the duct throughout, and leaves no clearly marked communication, through which the eggs might pass, at either the anterior or the posterior end of the ovary. Hertwig supposes that the eggs pass into the duct near its opening posteriorly, being probably pressed through the intervening germinal epithelium. He concludes:—"Ist meine Deutung richtig, so würde nur das hintere Ende des Oviducts zur Ausführung der Eier dienen, und gleichzeitig den Ort abgeben, wo die Befruchtung erfolgt, dagegen würde der grössere blind geschlossene Theil des

* "Die Chætognathen," *Jenaische Zeitschr.* Bd. xiv. (1880).

† 'Fauna und Flora d. Golfes von Neapel,' no. 5 (1883).

Oviducts als eine Art Samentasche functioniren, wie der oft in ihr vorgefundene Inhalt lebender Spermatozoen beweist."

Grassi finds that the wall of the ovisperm duct is interrupted at irregular intervals, and that through these interspaces spermatozoa may pass into the ovary before the ova are mature, sometimes penetrating the unripe ova and causing degenerative changes. These interruptions in the wall exist along the whole length of the duct, and Grassi thinks that probably the ova make their way through them into the duct, thus passing into the duct anywhere throughout its length.

I may say, in brief, that while my preparations show nothing of these interruptions in the wall of the duct, the actual course of events points to the correctness of Grassi's supposition that the ova pass through some such interspaces. They do not, however, appear to pass into the "ovisperm duct," but into another entirely new channel. The "ovisperm duct" seems to function, at least throughout all but the posterior part of its course, as a receptaculum seminis, and Hertwig's supposition is found true in this regard.

Sagitta hispida, which is found in abundance at Beaufort, offers a favourable opportunity for the study of the passage of the ova into the oviduct in the living object. With this species the egg-laying occurs at about sunrise, as is stated also by Grassi for the Mediterranean form *Sagitta hexaptera*. Boveri quotes Fol as finding the eggs of *Sagitta bipunctata* laid at sunset; and he found the same himself in March, but the process was often much delayed, so that at times he waited till 11 or 12 o'clock in vain. The exact time with *S. hispida* is found to depend somewhat upon the temperature. While the eggs were generally laid about 5 o'clock in July and August, on a cooler morning than usual the process might be found to occur an hour later; and by artificial cooling in an ice-chest overnight the laying might be delayed as much as three hours. Such artificially retarded eggs developed regularly on the whole, but it was found safer to make the observations at the earlier normal hour.

To follow the process, then, the eggs are found in the ovary the first thing in the morning—at 5 o'clock in the case that we will select—with the large germinal vesicle still showing, but lying eccentrically toward the mid-line of the animal. By 5.16 the germinal vesicles have entirely disappeared. At 5.22 each egg has flattened somewhat from before backward, and a small cell is seen clearly at the outer end opposite the point where the germinal vesicle was. The ova of the *Chaetognaths* arise from the germinal epithelium on stalks (see Grassi, Taf. xi. figs. 9 and 10), and the small cell standing

out plainly in the living object at this stage is found in sections to be the stalk-cell, which thus precedes the ovum in its passage into the duct. The ovum itself now changes its spherical shape by sending out a projection, bearing the stalk-cell, into the duct. Then by a progressive series of changes in shape, such as is represented in fig. 2, each ovum makes

Fig. 2.

Diagrams illustrating the successive stages of constriction in the passage of an egg into the oviduct. *O*, ovum; *S*, stalk-cell; *IWD*, inner wall of the oviduct; *OWD*, outer wall

its way into the oviduct. It is evidently passing through some such interspace in the wall of the oviduct, as was supposed by Grassi. The process occupies about eight or ten minutes. All the ova of one side pass through the successive stages of constriction at essentially the same time, the anterior being slightly in advance of the posterior. There may be a difference of time, however, between the ova of the two sides.

The eggs remain in the oviduct from twenty minutes to half an hour before being laid, during which time the layer of gelatinous substance that surrounds each is thickened. The chief change, however, is a gradual compression of the eggs from before backward, so that they become ellipsoidal. The process is aided by contractions of the ovary, especially observed at the anterior end, and as a result the eggs are pushed backward toward the external opening. When the pressure has become great enough to overcome the resistance, which seems to be offered largely by a kind of mucous plug in the orifice, the eggs are extruded as two linear rows, one from each oviduct, the whole comprising anywhere from a few to sixty or seventy eggs.

The act of laying was seen by Boveri * in *S. bipunctata*. After describing the way in which the eggs were extruded, simultaneously from both sides and very quickly, with active movements of the animal, he adds:—"Wobei dieselben um die enge Austrittsöffnung zu passiren aus ihrer kugeligen Form in eine gestreckte Wurstform übergingen, die im Wasser allmählich zur Kugelgestalt zurückkehrte." This description applies perfectly to *S. hispida*, the "Wurstform," however, being first produced by the crowding of the eggs in the duct, and afterwards increased by the passage through the narrow orifice. The orifice is at right angles to the main axis of the duct, so that the crowding has the result of presenting the eggs with their longest diameter in the direction of the orifice.

It has already been mentioned that the so-called ovisperm duct, into which the eggs apparently pass, is found to contain spermatozoa, and the inference would be that the eggs pass into the mass of spermatozoa and are there fertilized. I found last summer that soon after the eggs begin the process of constriction the previously active movements of the spermatozoa cease; that after the complete passage into the oviduct the spermatozoa are held, as it were, congealed in a longitudinal streak external to the eggs; that when the eggs are laid there is no noticeable diminution in the number of spermatozoa, and that their active movements are later resumed. This suggested that the passage was not into the "ovisperm duct," and sections of material preserved at these stages confirmed the supposition. Fig. 3 shows that the spermatozoa are kept in the "ovisperm duct" (*RS*) apart from the ova, and that the latter have made their entrance into a new and apparently temporary channel between the germinal epithelium and the epithelium of the "ovisperm duct." The latter is therefore only a receptaculum seminis, as Hertwig supposed. It may be objected that the spermatozoa are, as it were, sealed up by a secretion of mucus about them, and that this, in the hardened material, gives the appearance of a membrane; but the occurrence of nuclei seems to show that the structure is a definite one. The walls of the oviduct did not show any such nuclei, and the existence of an epithelial lining in it is doubtful.

Of course the foregoing applies only to *S. hispida*, and cannot be at once assumed to be the case in all *Chætognaths*. It is probably the case, however, for *S. hispida* is a very typical form. *Spadella schizoptera* offers some collateral

* 'Zellen-Studien,' Heft iii. 1890, p. 18.

evidence ('Circular,' no. 119, June 1895). In this form it was found that the two "ovisperm ducts" were united by a transverse branch, a structure that would seem to have no significance in an oviduct, but would be extremely useful in uniting two receptacula seminis, inasmuch as a single copulation, affecting only one side, would thereby serve to fertilize the ova of both sides.

It would seem, then, that the female reproductive system of *S. hispida* (and, perhaps, all *Chaetognaths*) consists on each side of the ovary, the receptaculum seminis, and a temporary oviduct lying parallel and internal to the receptaculum and uniting with it posteriorly to open on a common genital

Fig. 3.

Fig. 4.

Fig. 3.—Cross section of *Sagitta hispida*, with eggs in the oviduct, before laying. *GE*, germinal epithelium; *OD*, oviduct; *OV*, ovum; *RS*, receptaculum seminis.

Fig. 4.—Diagrammatic optical section of the head and neck of *S. hispida* from above. *MO*, mouth; *OE*, oesophagus; *D*, diverticula; *I*, intestine.

papilla. A more detailed account of the histology of these structures could be given were it not that the *Chaetognaths* offer such very unfavourable material for the study of microscopic anatomy. Kleinenberg's picro-sulphuric, Perenyi's, and corrosive acetic give the best results; but even with them the objects are very unsatisfactory, and especially so during the processes of egg-laying, when the tissues are evidently being subjected to great stress.

The exact point at which the spermatozoa come in contact with the eggs I have not been able to determine. Grassi says that spermatozoa can pass into the ovary, where he has found them; but he does not state that fertilization occurs

here normally. In agreement with Hertwig, I have never found spermatozoa in the ovary. Neither do the eggs appear to be fertilized in the oviduct. Before they pass out of the ovary a number of very small chromosomes (the exact number was not determined) are found toward the inner end of the ovum, or the place where the germinal vesicle disappears. During the twenty to thirty minutes that the eggs are in the oviduct before being laid there are no changes in these bodies, and they continue to be the only chromatin that I am able to find in the egg until after the laying. The probability is, therefore, that the spermatozoa come in contact with the eggs, shortly before or during the process of laying, in the duct to the exterior common to the oviduct and receptaculum seminis.

Self-fertilization seems to be impossible, although the male and female elements develop at the same time. In the case of a *S. hispidus* isolated when the ovaries contained only immature ova, I found that by the second morning 30 or 40 eggs had matured and been laid, on the third 24 more, on the fifth 68, on the seventh 55-58. Of these the only ones that developed were fourteen out of the first lot, evidently fertilized by spermatozoa remaining in the receptaculum seminis. In all the others development proceeded only so far as the formation of the polar bodies. In this case the extrusion of the polar bodies is evidently not dependent upon the entrance of the spermatozoa, which Boveri states is necessary in the ova of *S. bipunctatus* observed by him.

The eggs when laid become attached to the sides of the dish by a gelatinous or mucilaginous substance, which facilitates handling somewhat, but also collects dirt. The development of the young *Sagittæ* up to hatching is completed in about thirty-six hours in warm weather. When hatched they have practically the adult structure, and in four or five days they are found to eat each other with as much zeal as is shown by their elders in the same performance. It is interesting to watch a *Sagitta*, with a relatively narrow digestive tract two thirds the length of its body, forcing down its oesophagus a fellow of equal size, and hence one third longer than the tract. The eating one another seems to be done purely out of natural depravity, for it occurs when plenty of the usual food, small tow-stuff, is present.

Upon the development of the eggs I have nothing to add. Like the previous observers, I have been unable to find a satisfactory method of preservation, in spite of many trials.

II. THE DIVERTICULA OF THE INTESTINE.

In two of the European species, *Sagitta minima* and *Spadella cephaloptera*, a pair of diverticula are described as occurring at the anterior part of the intestine. In the American forms this structure is more common, being found in three of the nine species about to be enumerated. In *S. hispida* they appear from the surface as outlined in fig. 4. A cross section through the animal in this region would show the digestive tract composed of three tubes lying side by side, as figured by Grassi for *Spadella cephaloptera* (Taf. vi. fig. 11), of which the middle one is in reality only the oesophagus, as it enters the stomach intestine. The epithelium of the diverticula is the same as that of the intestine, and they seem to be in fact only the prolongations of the intestine anteriorly beyond the point where the laterally compressed oesophagus makes connexions with it. In a variety of *S. hispida* from the Bahamas the diverticula are reduced to a very small size, and cannot have much function. In the Beaufort *hispida* and in *S. elegans* they may vary according to the individual—in some large, in some small.

Fig. 5.

Diagrammatic optical section of the head and neck of *S. elegans* from above. *MO*, mouth; *OE*, oesophagus; *D*, diverticula; *I*, intestine.

An interesting modification of apparently the same structure occurs in *S. elegans*. In many of the specimens from Woods Holl diverticula are found extending *within* the digestive tract. Fig. 5 gives a diagrammatic representation of these

structures. A cross section in this case would show a large tube—the œsophagus—enclosing two smaller yet relatively large tubes—the diverticula. The latter bear on the surface that is turned toward the digestive tract an epithelium like that of the rest of the tract, and they thus represent exactly the structure that might be produced by pushing external diverticula back upon themselves into the digestive tract. Much careful examination failed to reveal any specific differences between the animals having external and those having internal diverticula. It may be that observation of living specimens, however, would show that we have here two species. There is a possibility also that the two forms are different phases of the same structure in one and the same animal; but this seems to me improbable. Some specimens having internal diverticula show a formation at the base of these suggestive of external diverticula as well.

The function of such internal diverticula can hardly be surmised. The lumen, which is connected with the body-cavity, is often found to contain coagulated coelomic fluid. What strikes one most prominently, however, is that they would seem of necessity to be very much in the way in the act of swallowing.

III. CLASSIFICATION.

In May 1895 E. Béranek published in the 'Revue Suisse' (tome iii. fasc. 1) an article entitled "Les Chétognaths de la Baie d'Amboine," in which he devoted several pages to a critical review of the systems of classification. After comparing the defects in the classifications of Langerhans (followed by Strodttmann* in 1892), Hertwig, and Grassi, he came to the conclusion that the first offers the most advantages in our present state of knowledge.

At about the same time ('University Circular,' June 1895) I was having difficulty in finding a place for *Spadella schizoptera* in any of the systems. It seemed to me that Grassi's classification met the case the most satisfactorily, except that he unfortunately interchanged the names of his two genera, so that his *Spadella* very nearly represented the *Sagitta* of other authors.

Now, however, having seen Béranek's paper and having studied more forms, I am inclined to admit the full weight of the arguments against Grassi's system. Dividing a group of animals into two genera, one characterized by certain features

* Archiv für Naturgesch. lviii. (1892).

and the other by the absence of those features, is of itself enough to condemn the system. But at the same time it seems to me that Grassi's objections to the system of Langerhans, as based upon structures of such slight morphological importance as the fins and teeth, are equally sound. Yet the classification of Langerhans is very convenient, and on this account, and because it has been adopted by the last writers on the *Chætognaths*, I have followed it, except in one case—in the systematic portion that is appended. But that it, as well as the others, is unsatisfactory, can be readily shown by instances from the American species, in addition to the cases given by Béraneck.

For example, *Spadella schizoptera*, according to Langerhans and Hertwig, would be called a *Sagitta* on account of its five fins; only Grassi's system would retain it with the closely related *Spadella cephaloptera*.

Spadella maxima in the classification of Langerhans would belong to the genus *Krohnia* or to the genus *Spadella*, according as the fins or the teeth were accounted the more important; for its one pair of lateral fins lies partly on the trunk, partly on the caudal segment (*Krohnia*), while the teeth are in two series (*Spadella*). According to Grassi, it would probably be placed in his genus *Spadella* (*Sagitta* of the others), for none of his characteristics for the genus *Sagitta* (*Spadella* of the others) was found in the specimens studied. And yet in its coloration and in its habitat near the bottom it is evidently allied, notwithstanding its size, to the small *Spadellæ*.

By Langerhans *Krohnia hamata* is set apart with one other species to form a genus by themselves, characterized only by the fact that in connexion with one part of lateral fins there is but one series of teeth. According to Hertwig it is included with the *Spadellæ*, notwithstanding its free-swimming life at the surface. According to Grassi it would probably be included with the *Sagittæ* (his *Spadellæ*), although the form studied by me showed the transverse musculature that is a characteristic of the *Spadellæ* (his *Sagittæ*).

These cases are additional proof that none of the divisions of the *Chætognaths* into genera is satisfactory; while for convenience' sake and from deference to the later writers I have followed the classification of Langerhans, it would perhaps have been as well to give up the distinctions *Spadella* and *Krohnia* altogether, and retain only the one genus *Sagitta*.

IV. SYSTEMATIC.

*The known Chaetognaths of American Waters.*1. *Sagitta elegans* (Verrill).

Strodtmann mentions this species (*loc. cit.*), but was unable to find a description of it in the literature at his command. Professor Verrill's account is found on page 332 [626] of the 'Report upon the Invertebrate Animals of Vineyard Sound and Adjacent Waters' (Washington, Government Printing Office, 1874).

S. elegans resembles the widespread *S. bipunctata*. The length of the largest specimens in my possession is 25–30 millim. Maximum breadth 1 millim. Caudal segment one fifth total length. Fins 5, like those of *bipunctata* or *hispidata*. Seizing-hooks 9–12, shaped as in *bipunctata*. Anterior teeth 5–7. Posterior teeth 12–15. Corona ciliata elongated, sinuous, oval, as in *bipunctata* or *hispidata*. Diverticula of intestine both external and internal, as described in the preceding. Accessory longitudinal septa present in caudal segment. Tactile prominences generally few as compared with *S. hispidata* (see fig. 7 in 'Circular' for June 1895). Musculature of body not so stoutly developed as in *hispidata*. Head well marked off from trunk. Epidermis thickened around the neck.

S. elegans differs from *bipunctata* in size, in the relative proportions of caudal and body-segments, and in the presence of diverticula from the intestine. It is found at Wood's Holl, Mass., in winter, sometimes in great abundance. In summer it is rare there. None of the many specimens that I have seen, taken in the winter months by Mr. Vinal Edwards, of the Fish Commission, contained mature ova.

The name *elegans* was applied by Professor Verrill to specimens 16 millim. long; he also mentions a "much larger and stouter species than the preceding, taken in abundance in Vineyard Sound from January to May, 25–30 millim. long." I have not been able to find any specific difference between the large and small specimens from Wood's Holl, and do not doubt that they are the same.

Strodtmann mentions a "*S. gracilis*," figured by Verrill in the "Results of the Explorations made by the Steamer 'Albatross' off the Northern Coast of the United States in 1883." Professor Verrill has very kindly replied to my inquiry in reference to this, that the figure is of *S. elegans*, the name "*gracilis*" being the result of a clerical error. The

large salmon- or orange-coloured form mentioned in the same article is the species next described.

2. *Spadella maxima*, sp. n.

Specimens of this and the two following species were given me by Professor Verrill from the 'Albatross' material in his possession, and I am indebted also to Dr. G. Brown Goode, of the National Museum, for permission to include them in this list.

Spadella maxima is an unusually large and stout Chætognath, 52 millim. long and 5 millim. wide. Its one pair of lateral fins extends along the posterior two thirds of the body-segment and the anterior third of the caudal segment. According to the classification followed by Strodtmann, therefore, it would belong to the genus *Krohnia*. The reasons for including it among the *Spadellæ*, which otherwise are, without exception, small animals, are found in the note on classification. Seizing-hooks 6. Anterior teeth 3-5. Posterior teeth 5-7. The corona could not be made out satisfactorily in the preserved specimens; it seemed to resemble the pear-shaped form found in *S. hexaptera*. No diverticula from intestine. Muscles slender in proportion to the breadth of the body, a large lateral area on each side between the dorsal and ventral bands being free from muscle. Epidermis thickened to several layers of cell around the neck.

The specimens had been in alcohol for some years and were entirely devoid of the "deep salmon- or orange-colour" mentioned by Professor Verrill as characterizing them from the colourless surface-forms. They were brought up in the trawl-wings at Station 2428 of the 'Albatross,' in the North Atlantic, lat. N. 42° 48', long. W. 50° 55' 30".

3. *Krohnia hamata* (Möbius).

Chætognaths evidently belonging to this species were taken in the trawl-wings at Station 2045, off Martha's Vineyard. They have one pair of very delicate lateral fins, hooks bent sharply at the tips, anterior teeth wanting, and a very large number of posterior teeth—all of which are characteristic of *K. hamata*. But they offer one unusual variation in the possession of a well-marked ventral sheet of transverse muscle, such as in Grassi's classification is characteristic of his genus *Sagitta* (*Spadella* of the others). It extends from the beginning of the neck as far back as the posterior edge of the abdominal ganglion.

4. *Sagitta hexaptera* (d'Orbigny).

From the same station as the preceding there are some specimens, 24–34 millim. in length, which do not differ enough from the *S. hexaptera* of European writers to warrant establishing a separate species. The caudal segment is one fourth to one fifth the total length. Fins 5. Seizing-hooks 7–8. Anterior teeth 3–4. Posterior teeth 4–7. Ovaries immature. The body-muscles are stouter than is stated for *hexaptera*, however, and the specimen sectioned showed two large external diverticula from the intestine. It is very possible that study of fresh material would show them to be a distinct species instead of young *hexaptera*.

5. *Sagitta flaccida*, sp. n.

This species was collected by Dr. Andrews at Bimini, in the Bahamas. Length 13–18 millim. Breadth 1.25 millim. Caudal segment about one sixth total length. Fins 5, the middle and anterior comparatively short. Seizing-hooks 8 or 9. Anterior teeth 7 or 8, the inner very much longer than the outer. Posterior teeth 10–12. Corona ciliata almost wholly confined to the head, of an irregular oval outline. Ovaries, containing well-advanced ova, short. No diverticula from digestive tract. Caudal segment not divided longitudinally by incomplete accessory septa, but showing an arrangement of the testes and developing spermatozoa like that figured by Grassi for *S. hexaptera* (Taf. ix. fig. 7). Muscles of body slenderly developed, causing the preserved specimens to have a very limp appearance. Epidermis but slightly thickened around the neck, if any at all.

Of the European forms, *S. flaccida* resembles *hexaptera* and *magna* the most closely. It differs from them, however, in being much smaller, in having a larger number of teeth, in the smaller size of the caudal segment, and in the shape of the corona.

6. *Sagitta tenuis*, sp. n.

S. tenuis is a small species from Jamaica very closely resembling *S. hispida*. I am indebted to Mr. C. P. Sigerfoos for the specimens, which were collected by him in Kingston harbour, June 1893. Maximum length 5.25 millim. Breadth 0.2 millim. Caudal segment about one fourth total length. Seizing-hooks 7–8. Anterior teeth 4–5. Posterior teeth 7–10. Shape of fins, of seizing-hooks, corona ciliata, accessory longitudinal septa in caudal segment, number of tactile

prominences, and muscularity of body as in *hispid*a. No diverticula from digestive tract. In this form the nervous structures are especially large and prominent. The ovaries were short, though containing ova approaching maturity. Germinal epithelium composed of a single row of high columnar cells, not a double row of cubical, as in the forms like *bipunctata*.

S. tenuis differs from *hispid*a in size, in the prominence of the nervous structures, in the relatively shorter caudal segment, and the absence of diverticula from the digestive tract. It might seem that the specimens were young *hispid*a, were it not for the advanced ova and for the fact that diverticula were not present, while in *hispid*a they are very apparent as early as twenty-four hours after hatching.

7. *Spadella draco*.

Among the *S. flaccida* collected by Dr. Andrews at Bimini was a single specimen of this species. The cosmopolitan nature of certain of the Chætognaths is well illustrated by it. In his article on "Les Chætognathes de la Baie d'Amboine" (Malay Archipelago), E. Béraneck says:—"La *Spadella draco* est la plus commune des espèces de ce genre trouvées dans la pêche pélagique de la baie d'Amboine."

8. *Spadella schizoptera*.

This very unusual species was described in the 'Circular' for June 1895. It is another of the forms from the Bahamas.

9. *Sagitta hispid*a.

This form was described at the same time as the preceding. We have found it in Jamaica, at Beaufort, North Carolina, and at Bimini, in the Bahamas. Mr. A. Agassiz has found it elsewhere in the Bahamas, in the cruise of the 'Wild Duck' in 1893.

XXXIII.—*New Species of Pyralidæ &c. from the Khasia Hills.* By W. WARREN, M.A., F.E.S.

[Concluded from p. 177.]

ORTHOCONA, gen. nov.

Fore wings elongate; costa straight till shortly before apex; hind margin obliquely curved. Hind wings in female narrow,