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SIX NEW GENERA IN THE CHAETOGNATH FAMILY SAGITTIDAE

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ABSTRACT The following six new genera of Sagittidae, with type species listed in parentheses, are proposed: *Adhesisagitta* (*Sagitta hispida* Conant, 1985), *Demisagitta* (*Sagitta demipenna* Tokioka and Pathansali, 1963), *Decipisagitta* (*Sagitta decipiens* Fowler, 1905), *Tenuisagitta* (*Sagitta tenuis* Conant, 1986), *Abacisagitta* (*Sagitta pulchra* Doncaster, 1903), *Oculosagitta* (*Sagitta megalophthalma* Dallot and Ducret, 1969).

INTRODUCTION

While reviewing recently (Bieri, In Press) the genera of the chaetognath family Sagittidae, I noticed that some genera are heterogeneous and therefore neither parallel nor symmetrical with the other genera of the family. Among the asymmetries are differences in fin ray distribution, body proportions, body texture, and the shape and structure of the seminal vesicles. To correct these heterogeneous assemblages I propose the following new genera:

Sagittidae Tokioka, 1965

Adhesisagitta, new genus

Figure 1

Type species — *Sagitta hispida* Conant, 1895, by monotypy and present designation.

Name — From the Latin "adhaesus", clinging to, referring to the habit of this "quasi-planktonic" species of clinging to the substrate.

Definition — Corona ciliata long, extending from just anterior to eyes to well posterior on trunk but not reaching ventral ganglion; intestinal diverticula present; lateral fins completely rayed; body rigid; seminal vesicles slightly swollen at anterior end when mature, but not forming distinct knob; ovaries moderately long and narrow with ova irregularly spaced rather than in a single row; mouth appearing sutured or buckled by 4 rod-like structures or bars about 1/3 as long as distance between them; species can cling to vertical substrate.

Species included — One, *Sagitta hispida*.

Discussion — Published drawings and descriptions of this species are not consistent with one another in several critical features. Figure 1 is a composite of the drawings of Pierce (1951), Tokioka (1955), Michel

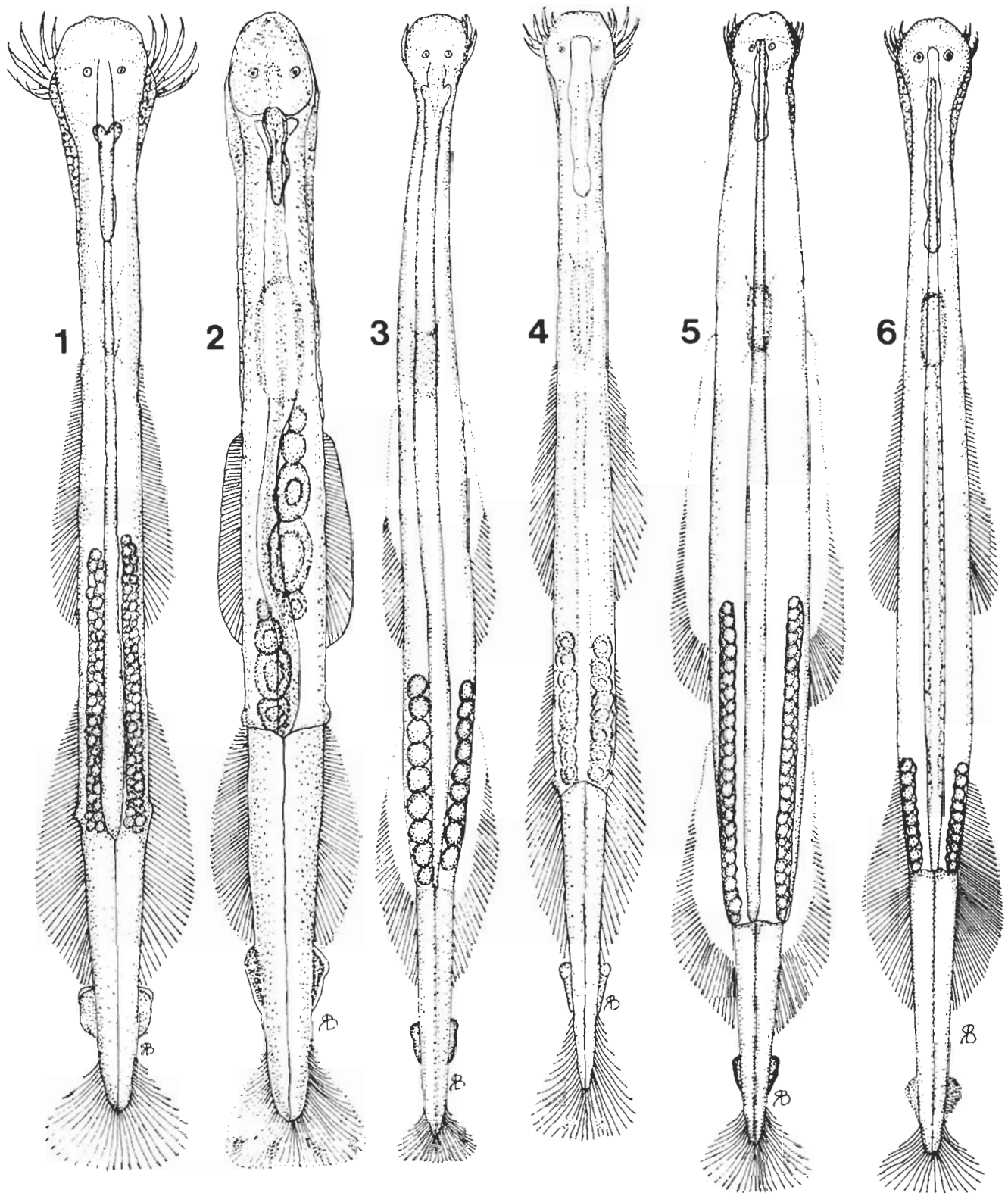
(1984), McLelland (1989), and my own observations. In distinguishing *Adhesisagitta* from *Sagitta* and *Ferrosagitta* the structure of the seminal vesicle and variations in its appearance at different stages of maturity are important and are best illustrated by Tokioka (1955). Although perhaps not of generic significance, the space between the seminal vesicle and the tail fin is about 1/2 the length of the vesicle. Pierce shows the vesicle in contact with the tail fin, and Michel, although stating in her text that it is widely separated from the tail fin, illustrates it as rather close, as does McLelland. The irregular arrangement of the ova is distinctive. Although the number of chaetognath species examined with SEM now exceeds 17 (Thuesen et al 1988), *A. hispida* is the only species found to have well developed bars or buckles across the mouth. They are shown exceptionally clearly in the SEM photograph of Cospser and Reeve (1970). It is also the only sagittid known to cling habitually to the walls of glass aquaria (H. Michel, pers. comm.) and to eel grass (McLelland, pers. comm.), a behavior that may be related to its hyper-neritic distribution (Pierce, 1951). The conjectured buckles may function as adhesive organs. *Adhesisagitta* is distinguished from the possibly closely related genera *Sagitta* (sensu Tokioka) and *Ferrosagitta* not only by the mouth buckles but also by its clinging ability, shape of the seminal vesicles, and the irregular arrangement of the ova.

Demisagitta, new genus

Figure 2

Type species — *Sagitta demipenna* Tokioka and Pathansali, 1963, by monotypy and present designation. Tokioka (1965) placed *S. demipenna* in *Aidanosagitta* Tokioka and Pathansali, 1963

Name — From the trivial name of the type species, referring to the short or "half" posterior fin, which is limited to the tail.



Figures 1—6. Composite and schematic habitus drawings of Chaetognatha, in dorsal view. (1) *Adhesisagitta hispida*, based on Pierce 1951, Tokioka 1955, Michel 1984, McLelland 1989, and the author's observations. (2) *Demisagitta demipenna*, based on Tokioka and Pathansali 1963, Pathansali 1974, and Alvaríño 1967. (3) *Decipisagitta decipiens*, based on Pierrot-Bults 1979, McLelland 1989, and the author's observations. (4) *Tenuisagitta tenuis* based on Pierce 1951, McLelland 1980, and the author's observations. (5) *Abaciasagitta pulchra*, based on Tokioka 1966, Alvaríño 1967, and the author's observations. (6) *Oculosagitta megalophthalma*, based on Dallot and Ducret 1969, and Michel 1984.

Definition — Very similar to *Aidosagitta* as defined by Tokioka (1965). Corona ciliata beginning posterior to eyes; intestinal diverticula present; lateral fins completely rayed, rays at anterior ends of fins perpendicular to body wall; body very stiff and rigid, wider than in *Aidosagitta*, more like *Spadella* and *Pterosagitta*; tail relatively long; seminal vesicle situated just behind posterior fin and separated from tail fin, no external differentiation of anterior glandular part; mature ovaries reaching ventral ganglion, ova in single row, so large that they crowd and distort gut, maturing asynchronously; posterior fin extending anteriorly only to level of transverse septum.

Species included — One, *Demisagitta demipenna*.

Discussion — No other species of Sagittidae has the posterior fin limited to the tail. This remarkable feature clearly separates *D. demipenna* from all other known sagittids and requires modification of the usual textbook definition of Sagittidae. If *D. demipenna* were to lose the anterior fin and develop a pair of large hair fans, it would fit into the genus *Pterosagitta*, which demonstrates the close affinity of the Pterosagittidae to the Sagittidae. The occurrence of a "demi-fin" in the relatively short, wide-bodied, and heavily muscled genera *Pterosagitta* and *Spadella* as in *Demisagitta* argues for a specialized form of locomotion associated with the short, powerful muscles and the short, stiff "demi-fin."

Decipisagitta, new genus

Figure 3

Type species — *Sagitta decipiens* Fowler, 1905.

Name — From the trivial name of the type species.

Definition — Agreeing mostly with Tokioka's (1965) definition of *Mesosagitta*. Corona ciliata beginning on neck and extending posteriorly onto anterior part of trunk; intestinal diverticula present; fin rays diagonal to body wall rather than perpendicular as in *Mesosagitta*, rays completely appressed, not irregularly spaced, missing in some areas of both lateral fins; more of posterior fin on trunk than on tail; seminal vesicles separated from posterior fin; maximum body width rather spread out; between 1/3 and 1/2 of trunk length anterior to transverse septum, in contrast to *Mesosagitta* in which less than 1/4 of trunk is anterior to transverse septum; no marked constriction of tail at transverse septum as in *Mesosagitta*; body muscles weakly developed, stronger than in *Flaccisagitta* but weaker than in *Serratosagitta*, stronger and more opaque than in *Mesosagitta*; mature ovaries approaching but usually not reaching ventral ganglion, relatively long and narrow with ova in single row.

Included species — Four: *Decipisagitta decipiens*, *D. sibogae*, *D. neodecipiens*, and possibly the doubtful species, *D. batava*.

Discussion — Erection of this genus leaves *Mesosagitta* with a single species, *M. minima* (Grassi, 1881). Of the four species listed above, only two were recognized as valid by Pierrot-Bults in her 1979 review of the group. *Decipisagitta batava* may have been described from deformed specimens of *Sagitta setosa*. It has not been reported since the original description by Bierstecker and van der Spoel (1966), who said that small intestinal diverticula, show in their figure 2, are "usually present." No other chaetognath has been reported with diverticula "usually present"; they are either present or absent. Although possibly due to poor preservation, this type of preservational artifact has not been reported previously (Bieri, 1989). The other three species of *Decipisagitta* are mesoplanktonic, whereas *D. batava* is epiplanktonic, which is also anomalous. However, the original description is so well done that the species should be retained pending further study.

Although Pierrot-Bults synonymized *Sagitta neodecipiens* Tokioka (1959) with *S. decipiens* Fowler (1905), there are very significant differences in the arrangement of the fin rays as shown by Tokioka (1959) in his original description of *S. neodecipiens* and in *S. decipiens* as drawn by Pierrot-Bults from the lectotype and paralectotype. In view of these striking differences and the differences in the eye pigments, *S. neodecipiens* should be retained as a valid species.

Tenuisagitta, new genus

Figure 4

Type species — *Sagitta tenuis* Conant, 1896.

Name — From the trivial name of the type species.

Definition — Corona ciliata very elongate, extending from just anterior to eyes to well onto trunk; intestinal diverticula absent; lateral fins completely rayed, rays completely appressed; body rather transparent with longitudinal muscles of moderate strength, weaker than in *Sagitta* but stronger than in *Mesosagitta*; seminal vesicles simple but with circular process at anterior end that becomes ovoid when fully mature; ovary variable, in small species with ova arranged in single row and maturing synchronously, in large species with ova arranged in double row and sometimes maturing asynchronously.

Species included — As presently understood, six species: *Tenuisagitta tenuis*, *T. setosa*, *T. friderici*, *T. euneritica*, *T. peruviana*, *T. popvicci*.

Discussion — Although *Tenuisagitta* bears a strong superficial resemblance to *Parasagitta*, the two genera differ in several significant features, including the presence in *Parasagitta* of intestinal diverticula, and large vacuolated gut cells containing NH₄⁺ rather than Na⁺ resulting in a lower body density in *Parasagitta* than in *Tenuisagitta* (Bone et al., 1987). All included species of

Tenuisagitta are epiplanktonic and more or less neritic.

Abaciasagitta, new genus
Figure 5

Type species — *Sagitta pulchra* Doncaster, 1903, by monotypy and present designation.

Name — From the Latin "ab", off, away from, plus "acia", thread, referring to the partial lack of rays in the lateral fins.

Definition — Corona ciliata very long, extending from just anterior to eyes to well onto trunk; intestinal diverticula absent; lateral fins with conspicuous rayless zones, especially large in posterior fins, much larger than in *Zonosagitta*; head not as wide as maximum body width which is at about midlength; body muscles weaker and more translucent than in *Zonosagitta*; anterior fins flat-sided and broadest near posterior end; seminal vesicle in two parts rather than forming bulb as in *Zonosagitta*; ovary very long, reaching from midbody to ventral ganglion when mature, ova viewed dorsally usually in a single row; tail about 1/5 as long as head and trunk combined.

Species included — One, *Sagitta pulchra*.

Discussion — Tokioka (1965) included *S. pulchra* in his new genus *Zonosagitta*. Alvarino (1967), on the other hand, excluded it from her "bedoti group" (= *Zonosagitta*), stating that "This species is not included in any group." In view of the fin differences as well as differences in the body muscles and the seminal vesicles, this species merits its own genus.

Oculosagitta, new genus
Figure 6

Type-species — *Sagitta megalophthalma* Dallot and Ducret, 1969, by monotypy and present designation.

Name — From the Latin "oculus", eye, referring to the importance the authors of *S. megalophthalma* placed on the size of the eye pigment.

Definition — Corona ciliata very long, extending from just anterior to eyes to well back onto trunk but not reaching ventral ganglion; intestinal diverticula absent;

lateral fins completely rayed, all rays appressed one to another; body moderately firm; head barely wider than maximum body width which is at about 1/3 of trunk length anterior to transverse septum; body width tapering gradually towards head and tail, without marked constriction at transverse septum; seminal vesicle simple, ovoid, touching tail fin but widely separated from posterior fin; ova reaching only to anterior end of posterior fin (mature specimens may not yet be known), ova in double row or irregularly spaced when viewed dorsally; gut with large vacuolated cells in middle two-thirds easily visible in dorsal view, these cells may line the entire gut in juveniles.

Species included — One: *Sagitta megalophthalma*.

Discussion — In their original description Dallot and Ducret discussed Tokioka's genera and Alvarino's groups and decided that *S. megalophthalma* did not fit into any of the extant genera or groups. Although somewhat similar to *Sagitta bipunctata* and vaguely reminiscent of *Mesosagitta minim*, the species does not fit in any sagittid genus and therefore merits its own genus. The large, heavily pigmented eyes, large head, slender body, small collarete, and long series of vacuolated gut cells set it off from all other known species of Sagittidae.

A NOTE ON THE FIGURES

The figures are composites of figures published by several different authors as noted with modifications based on the author's experience. The separation of the fin rays, which are actually closely appressed, is much exaggerated. Particular attention has been given to body proportions, relative head width, location of seminal vesicles, extent of ovary and arrangement of ova, and disposition of the fins in relation to the ventral ganglion and transverse septum. A less than successful attempt has been made to indicate the stiffness of the body musculature by the degree of shading. The author is personally well acquainted with all the type species from well preserved formalin specimens with the exception of *Demisagitta demipenna* and *Oculosagitta megalophthalma*.

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Robert Bieri died on July 31, 1990 after a lengthy bout with cancer. He was Professor Emeritus of Environmental Studies at Antioch College in Yellow Springs, Ohio, where he taught for 30 years. He previously held posts at the Scripps Institution of Oceanography and the Lamont-Doherty Geological Observatory of Columbia University. His numerous expeditions included excursions to the Arctic Ocean, the Pacific Coast of Mexico, the Caribbean Sea, the Mediterranean Sea, and the Boreal North Atlantic. He spent two sabbatical years in Japan and three months in Ecuador as a visiting scientist at the Instituto Oceanografico de la Armada. He made numerous contributions to the knowledge of chaetognath biology and systematics, and will be greatly missed as a reviewer and contributor to Gulf Research Reports.