

A REVISED DESCRIPTION OF *ALDERIA NIGRA* BABA, 1937,
TYPE SPECIES OF *ALDERIOPSIS*, N. G.,
FROM JAPAN (OPISTHOBRANCHIA-SACOGLOSSA) ¹⁾

by

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The species *nigra* was originally reported by me (BABA, 1937) on a single specimen towed in the *Zostera* zone in Tomioka Bay, Amakusa, with a presumption that it belonged to *Alderia* Allman, 1846, in the general organization (depressed body-form and radula) of the animal. At the same time it was noticed that *nigra* differed from *modesta* (Lovén, 1844), type of the genus, in a series of such characters as the formation of the rhinophores, the arrangement of the branchial papillae, and especially in the non-terminal position of the anus. The real situation of *nigra* in the systematics has been obliged to remain unclarified until now.

Here I intend to refer to Dr. A. Inaba who kindly afforded me with chances to re-discover specimens of this rare species in fair numbers from among the bushes of *Zostera* in the vicinity of the Mukaishima Marine Biological Station. Immediately after the above finding the species was confirmed by me from above the leaves of this eel-grass in Osaka Bay. By examining the newly obtained material before me, I have been led to point out additional differences between *nigra* and *modesta* in the habitats, in the egg-masses, and in several points of the internal anatomy. Establishment of a new taxon of generic rank thus appeared to be necessary for the sake of the former species (cf. MARCUS & MARCUS, 1956, p. 16; HAND & STEINBERG, 1955, p. 26).

This paper was prepared to dedicate it to Prof. Dr. H. Engel of the Zoological Museum, University of Amsterdam, with the hope to recognize the interesting information given by his and his collaborators' work of 1940 on *Alderia modesta* from the coast line of The Netherlands.

Alderiopsis n. g.

Somewhat allied to *Alderia* in the depressed body-

form without formation of true rhinophores (produced head-corners may be horn-like, but they are flat, and not supplied with the extension of the rhinophorial nerves). Anus not terminal but situated at the right anterior corner of the pericardium. With a single branchial row on both sides. Radular teeth smooth as in *Alderia*. Stomach simple, not provided with secondary diverticula. A penial stylet is present as in *Alderia*. A distinct heart.

Egg-masses flat band-like, and tend to be coiled. Living on the leaves of *Zostera*.

Type: *Alderia nigra* Baba, 1937.

Alderiopsis nigra (Baba, 1937)

Alderia nigra Baba, 1937, pp. 249-251, text-figs. 1-3. — Tomioka, Amakusa.

The additional records of collecting are as follows: Tannowa, Osaka Bay (Mar. 28, 1960, 10 sps.; Apr. 24, 1960, many sps.); Mukaishima, Inland Sea of Seto (Mar. 4 and 16, 1960, 26 sps.; Apr. 2, 1961, 5 sps.; Mar. 22, 1962, 25 sps.; Mar. 28, 1963, 27 sps.; Mar. 28, 1967, 16 sps.).

The external features of the body were checked under a binocular microscope mostly on live specimens taken from the sea. For the examination of internal organs 9 specimens listed below were prepared in serial sections stained with Delafield's haematoxylin and eosin:

Sp. Nos. 1-2. Mukaishima, Mar. 16, 1960. (H.S.)

Sp. No. 3. Mukaishima, Apr. 2, 1961. (H.S.)

Sp. Nos. 4-6. Mukaishima, Mar. 28, 1963. (H.S.)

Sp. No. 7. Mukaishima, Apr. 2, 1961. (L.S.)

Sp. Nos. 8-9. Mukaishima, Mar. 16, 1960. (T.S.)

EXTERNALS: The general body-form and colours are approximately as noted previously (BABA, 1937) save the position of anus which is shown here as being in front of (not behind) the pericardium, and slightly to the right of the median line. The nephroproct lies

¹⁾ Contributions from the Mukaishima Marine Biological Station, No. 89.

closely behind the anus. To the right of the anus there is a small opening of the melanin black vesicle. The head is rather large, and extensible. The head-corners when greatly produced may assume the appearance of paired rhinophores but actually they are flat and not provided with the extension of the rhinophorial nerves. The genital openings consist of a male orifice, an oviducal orifice, and a vaginal cleft which does not pass directly into the inner vaginal lumen. Fusiform branchial papillae are set in a single longitudinal row on both sides. They contain each a short, unbranched liver-diverticulum. The body is typically depressed, and the foot has an expanded flat sole. The length of the matured animals is 2-3 mm. The general ground-colour of the integument is slightly ashy-yellow, but almost the whole surface of the head, back and sides are thickly covered with melanin black pigment. The produced head-horns including the eye-regions are whitish. Each of the branchial papillae is opaque white at the tip. The anal region forms a whitish circle. The sole is faintly darkcoloured.

INTERNALS: The general shape of the radular teeth is as figured before (BABA, 1937). The stomach forms a simple organ which passes laterally into a right and a left liver system. No other secondary diverticula are found on the periphery of the stomach in *A. nigra* (cf. EVANS, 1953, pp. 255-256. — median and pedal diverticula in *A. modesta*). Within each of the papillae the liver-diverticulum is short and unbranched. The intestine is short. It rises up to the anus which opens at the right anterior corner of the pericardium. No anal papilla is formed. Within the pericardium there is a distinct heart (a heart is absent in *A. modesta*; cf. ENGEL, GEERTS & ALTENA, 1940, p. 20; EVANS, 1953, p. 251; it is missing also in *A. uda*; cf. MARCUS & MARCUS, 1956, p. 10). The kidney is an elongated sac which takes a median dorsal position in the haemocoel. In the central nervous system the visceral ganglion is fused with the infra-intestinal one (cf. *A. uda*; MARCUS & MARCUS, 1956, p. 11). The rhinophorial nerves do not appear to pass forth into the head-horns. The gonad consists of a large number of hermaphroditic follicles. The ampulla is thick, and winding. The pallial gonoduct assumes a complete triaulic structure which relates most closely to that of *Limapontia* (cf. GHISELIN, 1966, pp. 338, 354, fig. 5E). It is accompanied by a spherical spermatheca (= bursa copulatrix) which is absent in the known type of *Alderia* (cf. GHISELIN, 1966, p. 354, fig. 5F). The vagina which functions partly as a spermatocyst (= receptaculum seminis)

forms a distal roomy vestibulum. Serial sections show that this vestibular part is closed, and not in open communication with the vaginal cleft of the overlying body integument. Similarly closed vagina was found also in the so-called *Hermaea dendritica* (Alder & Hancock) and *Stiliger boodleae* Baba, respectively (private observation). Branches of the albumen glands are not included within the branchial papillae. The penis has a curved stylet.

ECOLOGY: In its habitat *A. nigra* differs greatly from *A. modesta* (cf. ALDER & HANCOCK, 1854; ENGEL, GEERTS & ALTENA, 1940; HAND & STEINBERG, 1955; and others). That is, in the field the animals of *A. nigra* were found sitting on the leaves of *Zostera* by their flat sole. Presumably they feed on this grass though actual feeding action of radular teeth could not be secured under a binocular examination. They spawn on the *Zostera* leaves. The egg-mass of *A. nigra* consists of a flat band (not sausage-shaped as in *A. modesta*) which tends to coil. The ovum, about 75 μ in diameter, is opaque white. Copulation takes place very often between two individuals in usual reciprocal positions. During copulation the penis protrudes in great length, and passes into the partner's vaginal cleft. Pairing lasts for a while. After this sexual act the penis is withdrawn, and a stream of sperms can be seen flowing out from the tip of the stylet. As the vaginal vestibulum is closed, it appears reasonable to mention that a hypodermic injection into this vestibulum has occurred at the moment of copulation in the depth of the vaginal cleft. A hypodermic injection at random was reported precisely by HAND & STEINBERG (1955) for *A. modesta*, and REID (1964) for *Elysia maoria* (see also notes by ENGEL, GEERTS & ALTENA (1940) for *Limapontia* and *Alderia*). When irritated the animals emit as usual a milky white fluid from the surface of the body. The branchial papillae which are deciduous are capable of being regenerated. They appear to increase in number with the growth of the body.

SYSTEMATIC NOTES

It is suggested here to place *Alderiopsis* in the proximity of *Alderia*. A tentative arrangement of the species of these two genera will be shown below:

Family Alderiidae Pruvot-Fol, 1954.

Rhinophores obsolete; body broad, and depressed.

A. Alderiopsis n.g. Type: *Alderia nigra* Baba, 1937. — Amakusa. Anus at right anterior corner of pericardium. A single row of branchial papillae on both sides.

1. *A. nigra* (Baba, 1937). Dist.: Japan (Tannowa, Osaka Bay; Mukaishima, Inland Sea of Seto; Tomioka, Amakusa).

B. *Alderia* Allman, 1846¹⁾. Type: *Stiliger modestus* Lovén, 1844. — Norway. Specialized greatly in some points of the internal organization (missing of a

heart; possession of secondary diverticula to stomach; rearward elongation of the intestine; etc.). Anus mid-dorsal, and nearly terminal.

1. *A. modesta* (Lovén, 1844). Dist.: N. E. & N. W. Atlantic; Washington; California.

2. *A. uda* Marcus & Marcus, 1956. Dist.: Brazil.

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¹⁾ The species *A. comosa* of Costa, 1867 was omitted here as further elucidation of anatomical details is necessary.

EXPLANATION OF PLATES I-II

Alderiopsis nigra. All the specimens for this study were collected from the *Zostera* zones of Tannowa, Osaka Bay, and Mukaishima, Inland Sea of Seto, during the years 1960-67.

PLATE I

Fig. 1. Matured specimen in an actively crawling position (Mukaishima, Mar. 16, 1960). Total length 3 mm. a. produced head-horns (not true rhinophores), b. male genital orifice, c. anal circle. The branchial papillae in many specimens number 8-11 on both sides.

Fig. 2. Resting position of a specimen on the leaf of *Zostera* (Tannowa, Mar. 28, 1960).

Fig. 3. Another specimen of a resting phase (Mukaishima, Mar. 28, 1967). Showing more or less retracted head-horns (a).

Fig. 4. Head and foot from below (Mukaishima, Mar. 28, 1967).

Fig. 5. Composition of the anal circle, diagrammatic. Main material: Sp. No. 3. a. opening of the melanin black vesicle, b. nephroproct, c. anus.

Fig. 6. Digestive system in the body, diagrammatic. Main material: Sp. No. 3. a. pharyngeal bulb, b. oesophagus, c. intestine and anus, d. melanin black vesicle and its opening, e. kidney, f. right liver, g. left liver, h. nephroproct, i. stomach, j. salivary gland (this is exceedingly elongated, and a salivary ampulla is formed on the side of the pharynx).

Fig. 7. Longitudinal section of body on level of the anal circle ($\times 75$). Material: Sp. No. 7. a. opening of melanin black vesicle (b), c. kidney, d. nephroproct.

Fig. 8. A branchial papilla ($\times 60$). Material: Sp. No. 7. a. liver-diverticulum.

Fig. 9. Entire radular ribbon from right side ($\times 110$). Material: Mukaishima, Mar. 16, 1960. a. ascending series, b. descending series, c. a heap of teeth. Each tooth has a dorsal ridge and a ventral groove for jointing.

Fig. 10. Central nervous system from above ($\times 60$). Material: Sp. No. 3. a. cerebral ganglion, b. pedal ganglion, c. supra-intestinal ganglion, d. infra-intestinal ganglion (plus visceral ganglion).

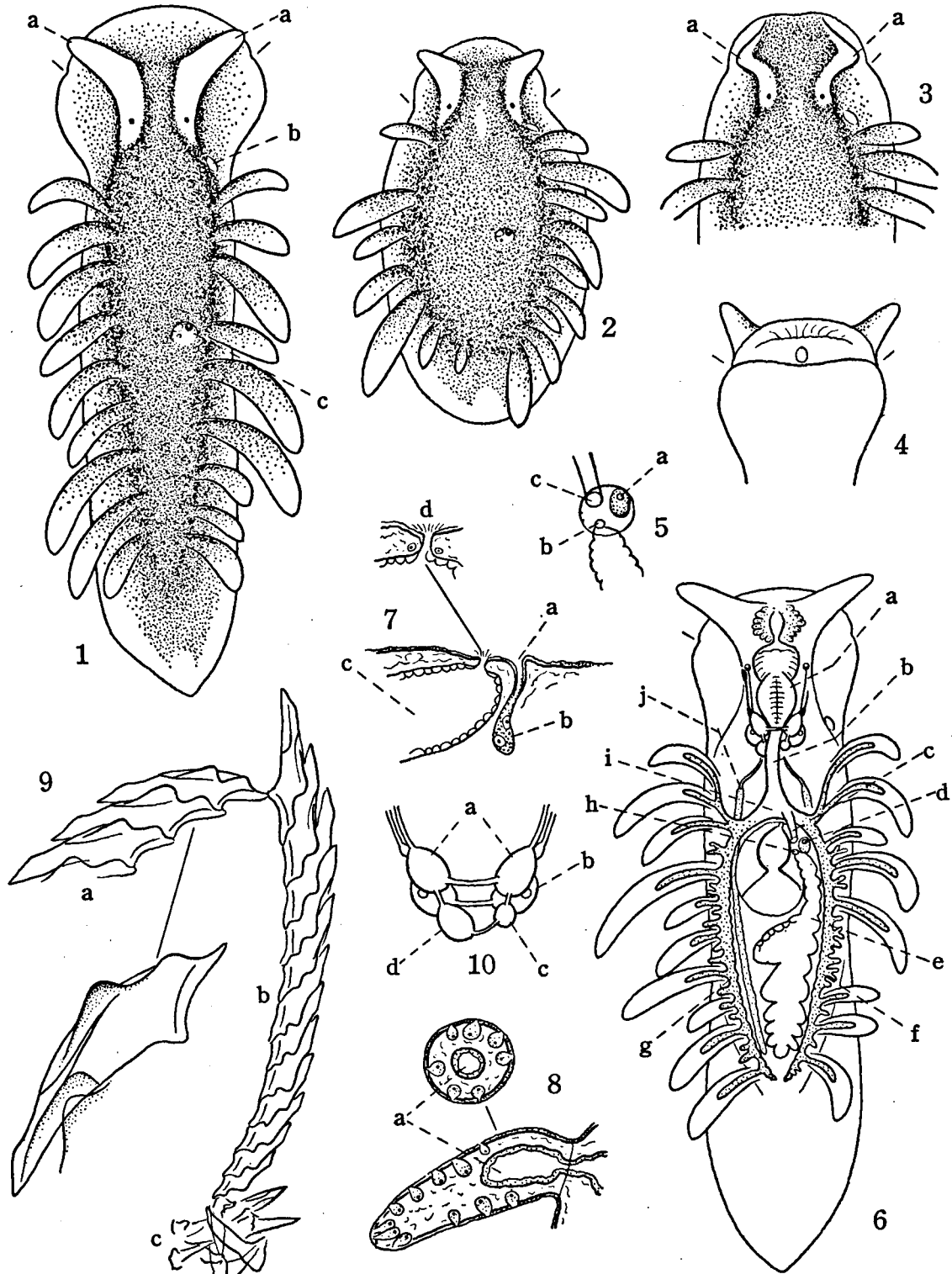


PLATE I

PLATE II

Fig. 1. A preserved specimen from right side (Mukai-shima, Mar. 28, 1963). a. angle of the retracted head-horn, b. male genital orifice, c. oviducal orifice, d. vaginal cleft, e. anal circle.

Fig. 2. Main part of digestive system from right side ($\times 35$). Material: Sp. No. 7. a. pharyngeal bulb, b. radular ribbon, c. mouth opening, d. stomach, e. anus, f. oesophagus.

Fig. 3. Showing transversely folded inner wall of oesophagus ($\times 150$). Material: As above.

Fig. 4. Protruded penis ready for copulation. Fresh material (Mukai-shima, Mar. 28, 1967). a. stylet, b. penis proper supported by an everted penial sac (c).

Fig. 5. Genital system in the body, diagrammatic. Main material: Sp. No. 3.

Fig. 6. Analysis of various parts of genital organs shown in Fig. 5. ($\times 75$). a. male genital orifice, b. oviducal orifice, c. vaginal vestibulum, d. vaginal cleft, e. mucous gland, f. vaginal canal, g. branches of albumen gland, h. common duct of right and left albumen glands, i. ampulla, j. prostate, k. membrane gland, l. spermatheca (= bursa copulatrix), containing sperms and prostate secretions, m. vas deferens, n. muscular penis, o. stylet.

Fig. 7. Cross-section of body on level of the vaginal cleft ($\times 35$). Material: Sp. No. 8. a. vaginal canal bridging over the mucous gland (b), c. prostate, d. main canal of right liver, e. right albumen gland, f. vaginal cleft, g. vaginal vestibulum, h. vas deferens passing from prostate, i. pharyngeal bulb, j. salivary glands, k. left albumen gland, l. main canal of left liver, m. cerebral ganglion, n. oesophagus.

Fig. 8. Cross-section of body on level of anus ($\times 35$). a. anus, b. opening of melanin black vesicle, c. main canal of right liver, d. ampulla, e. main canal of left liver, f. stomach.

Fig. 9. Egg-mass ($\times 30$). Fresh material (Tannowa, Mar. 28, 1960).

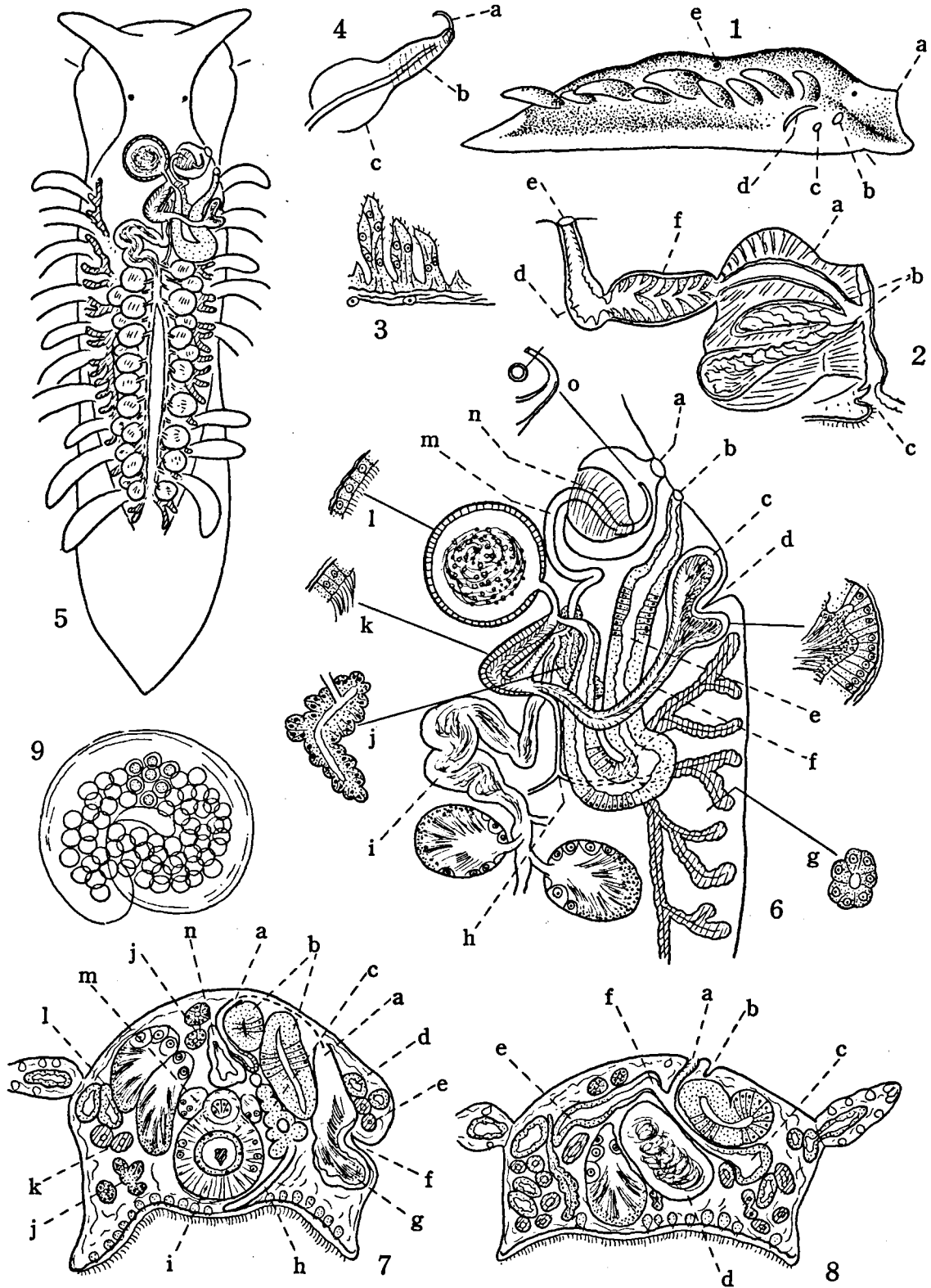


PLATE II