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“*Facelinella quadrilineata* (Baba, 1930)”, a Pair of Cryptic Species of *Facelina* from Japan

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ABSTRACT—One of the two colour variations in *Facelinella quadrilineata* (Baba, 1930) is found to be an undescribed species, which has been commonly collected from the Pacific coast of Boso Peninsula, central Japan. Although both species are similar enough morphologically to be considered cryptic species, there is a marked difference in the penial structure. The new species possesses an ejaculatory penis, while *Facelinella quadrilineata* does not. Considering close affinity between the two species and the reasons for separating the two genera of *Facelinella* and *Facelina*, invalidity of *Facelinella* becomes obvious and it is proposed to merge *Facelinella* into *Facelina*. The new species is herein described and illustrated as *Facelina bilineata* and compared with *Facelina quadrilineata* comb. nov.

INTRODUCTION

Facelinella quadrilineata (Baba, 1930) is one of the commonest facelinid nudibranchs in Japan and is known to occur from central Honshu to southern Hokkaido. Baba (1935) found a colour variety of the species which was slightly different from the type in body ground colour, and in colour and a pattern of peculiar streaks on the body surface. The anatomy of the species was given by Baba (1965), but he did not define which colour morph he had investigated. Without being examined closely the two morphs have been considered to be mere colour variations of a single species.

Ito and Hirano (1996), however, reported that the two colour morphs showed different developmental features such as shape of the egg mass and egg size, and suggested that the two morphs might represent two distinct species. In order to determine whether the two morphs are variations of a single species or representatives of different species the internal morphology was carefully examined and compared between the two. As a result a significant difference was found in penial structure, and it was revealed that the two morphs should be distinct species. While the type corresponded well in the penial structure with the description of Baba (1965) and is referred to *Facelinella quadrilineata*, the variety was found to be an undescribed species.

The main anatomical difference between the two is that in *Facelinella quadrilineata* the vas deferens opens at the base of the penial papilla while in the new species it passes through it. In this regard the new species should be allocated not to *Facelinella* but to the related genus *Facelina*. However, the

two species are too similar to separate into different genera in any aspects other than penial structure and colouration. The validity of *Facelinella* itself becomes problematic. It seems better to combine two genera rather than to place the two species into different genera. Herein we propose to merge *Facelinella* into *Facelina* presenting a description of the new species as *Facelina bilineata* and detailed comparison with *Facelina quadrilineata* comb. nov.

SYSTEMATIC DESCRIPTION

Facelinidae Bergh, 1899

Genus *Facelina* Alder & Hancock, 1855

Facelina Alder & Hancock, 1855

Facelinella Baba, 1949

Diagnosis: Facelinids with cerata standing in many rows, a number of small chitinous spines on the penial head.

Type species: *Eolis coronata* Forbes & Goodsir, 1839; validated in I.C.Z.N. Opinion number 775 (see Thompson and Brown, 1984).

Facelina bilineata Hirano, sp. nov.

(Japanese name, Futasuji-minoumiushi, new)

Cuthona (Hervia) quadrilineata variety Baba, 1935: 356-357, text-fig. 17, pl. 6, fig. 3.

Facelinella quadrilineata Baba, 1960: 109, pl. 54, fig. 10.

Facelinella quadrilineata Baba, 1965: 410-414 in part, pl. 26, figs. 3, 4.

Material examined

Specimens of *Facelina bilineata* examined were collected at Kominato (35°07'N, 140°11'E) and Choshi (35°41'N,

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140°51'E), Boso Peninsula, central Honshu. One hundred-one specimens were obtained in total during 1989-1990 and 1993-1997. Fine dissection was made under a stereomicroscope.

Specimens of *Facelina quadrilineata* for detailed comparison with the present new taxon were also collected at Kominato.

External morphology (Figs. 1-2)

The living specimens extend to approximately 20 mm in length, although some have reached 28 mm. The body is elongate and slender, with the rather long and sharply pointed tail being up to one third of the whole body length when the body fully extended. The width of the foot is approximately equal to that of the notum. The foot corners are tentacular and the frontal margin of the foot is transversely grooved. The smooth oral tentacles are much larger than the rhinophores which are either verrucose or weakly annulated. The cerata are arranged in oblique rows, up to 16-19 rows in total number per side; 7-9 rows form one large cluster in precardial region and 9-10 rows are subdivided into 3-4 clusters in postcardial area. Ceratal arrangement, or formula, of right side of the body in a 22 mm specimen was 1, 2, 3, 3, 4, 5, 6; 2, 5, 6, 6, 6, 6, 4, 2, 2, 2. The gonopore is situated below and slightly anterior to the last row of the right precardial ceratal rows. The anus is

cleioproctic, located below and immediately anterior to the second or third postcardial ceratal row. The nephroproct is located near the posterior end of interhepatic space.

Colour (Fig. 1)

The general ground colour is translucent white. The rhinophores are translucent orange. A thick orange streak runs along the dorsal surface of each oral tentacle to the base of the rhinophores. The anterior margins of the head, of the oral tentacles and of foot are thickly edged with the same orange pigment. Opaque white pigment forms a small Y-shaped mark on the head. A pair of short and thin orange streaks may be present around the eyes, just posterior to the rhinophores. The distal one third of the oral tentacles and rhinophores is opaque white. Two orange lines, which are often broken or faded, run along each flank, with the upper line making a downward detour around the gonopore and the lower one being straight along the edge of the foot. On each flank, there is also a longitudinal thick opaque white band running between the ceratal area and the upper longitudinal orange line. The white bands from both flanks unite mid-dorsally to form a single line on the tail. Most of the cerata are tipped with orange. On the cerata, there are many scattered opaque white dots which may form into longitudinal streaks. There are minute opaque white dots scattered over the pericardium region.

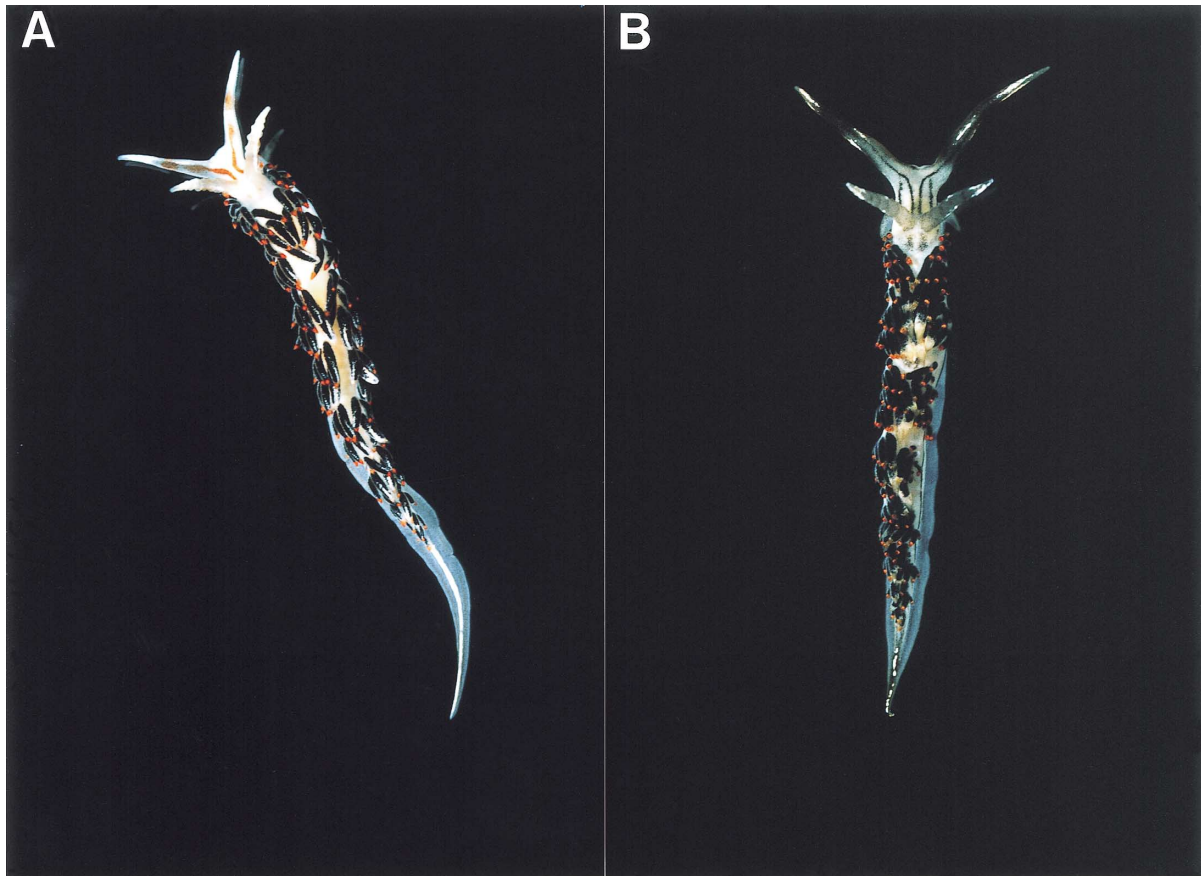


Fig. 1. (A) *Facelina bilineata* sp. nov. (B) *Facelina quadrilineata* comb. nov. Living animals.

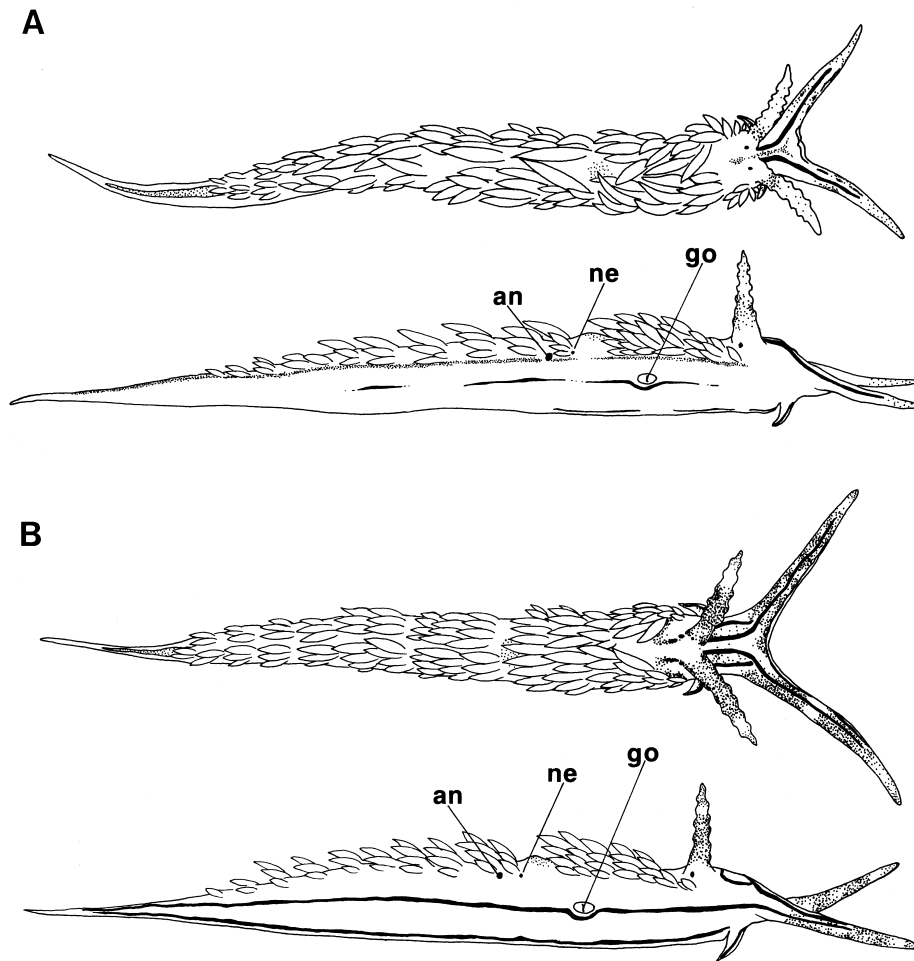


Fig. 2. (A) *Facelina bilineata* sp. nov. (B) *Facelina quadrilineata* comb. nov. Diagrammatic illustrations of dorsal and lateral views of ca. 20 mm specimens. an, anus; go, gonopore; ne, nephroproct.

Internal morphology (Figs. 3-6)

The jaws are elongate and their masticatory process has a single row of small denticulations (Fig. 3A). The radular teeth are uniseriate with a long and wide central cusp, and 4 - 8 small denticulations on the both sides (Fig. 4A). The number of radular teeth varies between 14 and 20 in specimens ranging in length between 10 and 20 mm.

The reproductive system is androdiaulic (Fig. 5A). The weakly coiled ampulla bifurcates to form a short oviduct and a longer prostatic vas deferens. The long duct of the small proximal receptaculum seminis opens near the origin of the oviduct and vas deferens. The receptaculum seminis is light red and slightly oblong. The vas deferens runs through the penial papilla to open in the centre of a ring-shaped thickening on which minute conical chitinous spines occur in orderly rows (Fig. 6A1). In preserved specimens in which the penis is half everted, a small slit-like opening of the vas deferens can be clearly observed (Fig. 6A2, A3). When fully everted the penis can be quite long resembling an elephant's trunk (Fig. 6A4). Female and male apertures are contained in common external gonopore.

Type material: Holotype, National Science Museum of Tokyo, NSMT-Mo 71130 collected on July 1, 1996, at Kominato. Paratypes, 3 specimens, dissected, NSMT-Mo 71131 collected on March 28, 1997 at Choshi.

Etymology: The species is named for possessing two orange streaks on the head.

Geographic distribution: Mustu Bay, northern top of Honshu (Baba, 1935); Sugashima, Shima Peninsula (Baba, 1965); Kominato and Choshi, Boso Peninsula (present study).

Natural history

Facelina bilineata sp. nov. has been found during most of the year at Kominato. It can be found on the surface of boulders and algae from the low-intertidal to the shallow subtidal zone. In the field, close association with an athecate hydroid *Eudendrium* sp. growing on the rock surface was observed. In laboratory observations to test feeding preferences, at least six species of hydroids such as *Hydrocoryne miurensis*, *Coryne* sp., *Sarsia* sp., *Obelia* sp., and *Campanularia* sp. as well as *Eudendrium* sp. were ingested. The eggs, about 180 μ m in diameter, developed to lecithotrophic veliger larvae (see

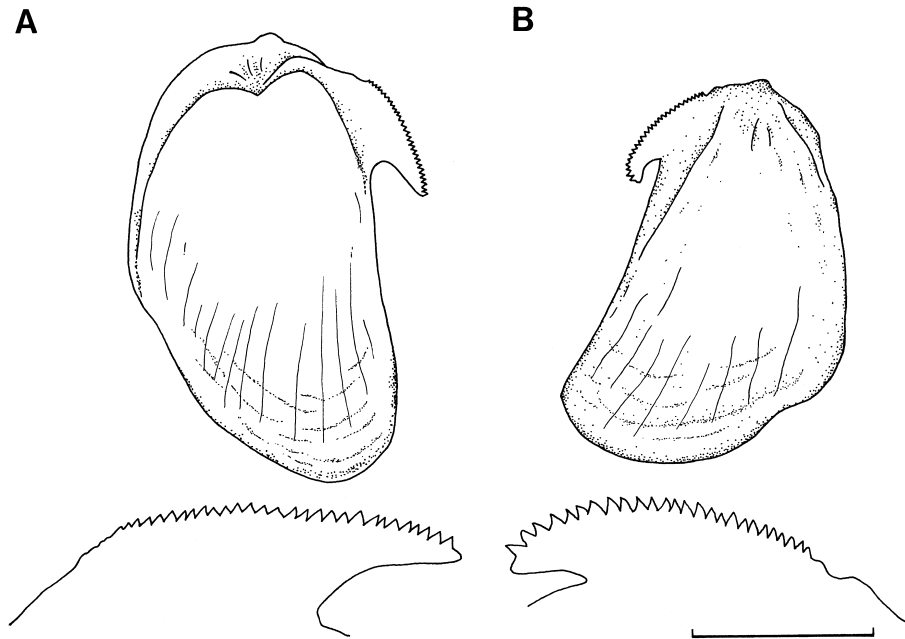


Fig. 3. (A) *Facelina bilineata* sp. nov. (B) *Facelina quadrilineata* comb. nov. Left jaws: views of inner surface for A and of outer surface for B (scale = 500 μ m for overall shapes and 200 μ m for masticatory processes).

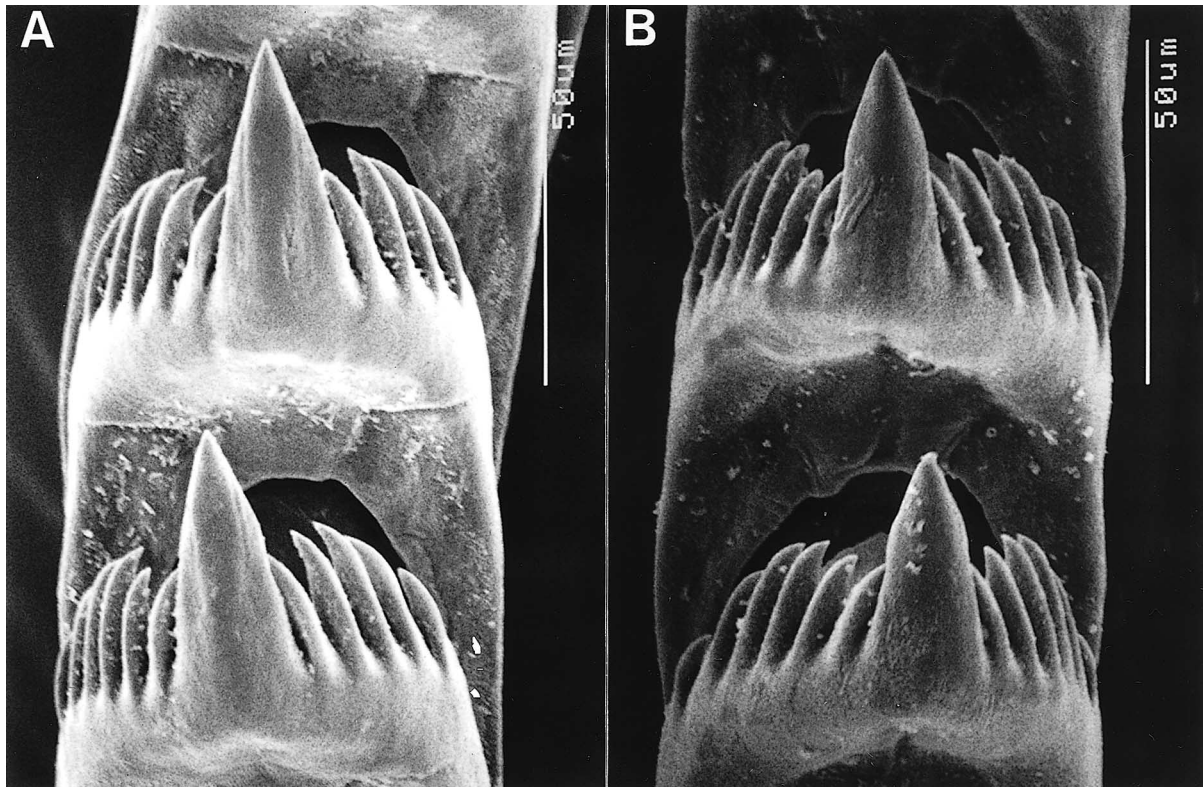


Fig. 4. (A) *Facelina bilineata* sp. nov. (B) *Facelina quadrilineata* comb. nov. Scanning electron microscopic image of radular teeth. (scale = 50 μ m).

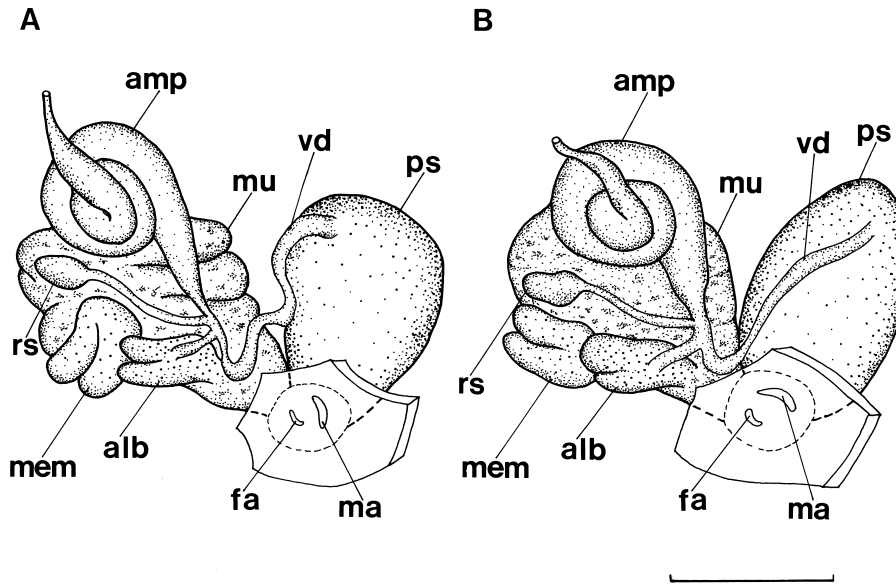


Fig. 5. (A) *Facelina bilineata* sp. nov. (B) *Facelina quadrilineata* comb. nov. Diagram of reproductive system depicting configuration and placement of major components. alb, albmen gland; amp, ampulla; fa, female aperture; ma, male aperture; mem, membrane gland; mu, mucous gland; ps, penial sac; rs, receptaculum seminis; vd, vas deferens. (scale = 1 mm).

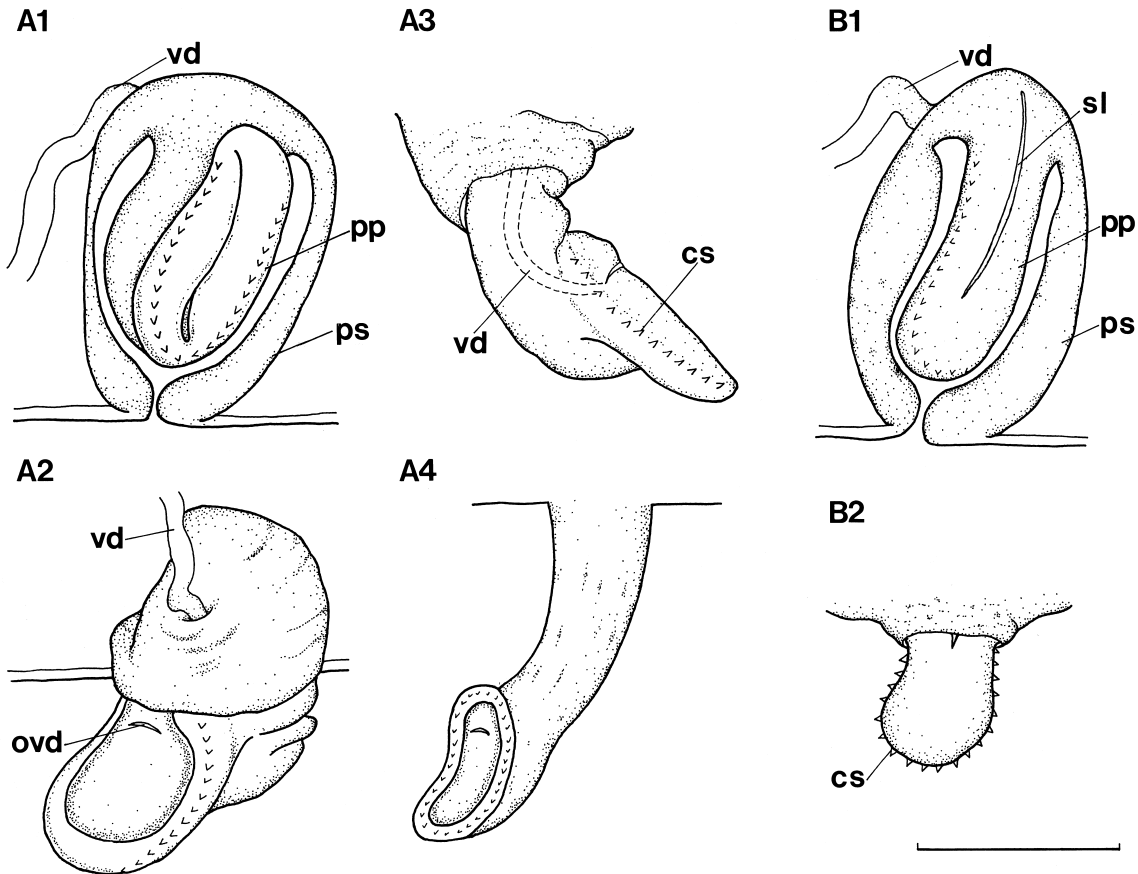


Fig. 6. (A1-A4) *Facelina bilineata* sp. nov. (B1-B2) *Facelina quadrilineata* comb. nov. A1 and B1 show inner view of penis when wall of penial sac is partially removed. The others are various states of penis protrusion. cs, chitinous spines; ovd, opening of vas deferens; pp, penial papilla; ps, penial sac; sl, slit; vd, vas deferens (scale = 1.5 mm for A4 and 1 mm for the rest).

Ito and Hirano, 1996 for more details on development).

Instantaneous and peculiar copulatory behaviour has been observed. As soon as the mates extended their long penes (Fig. 6A4) they became entangled and were immediately withdrawn. A small amount of white seminal fluid was seen to be left at the closed gonopore soon after this mutual entanglement of penes. The tip of long penis was not observed being inserted into the female aperture of the mating partner. It is therefore considered that sperm exchange probably takes place by attaching their autosperms on the penial surface of their mate. The seminal fluid of the partner can then be transported to the nearby female aperture when the penis withdraws into the body.

DISCUSSION

Before starting discussion on the merger of *Facelinella* into *Facelina*, the morphology of the two species in question should be carefully compared. Figs. 1 and 2 give a comparison of the external features of *Facelina bilineata* sp. nov. and *Facelinella quadrilineata*. The body ground colour is almost white in *Facelina bilineata* while slightly more yellow in *Facelinella quadrilineata*. The streaks on the body surface are orange in the former and chocolate brown in the latter. The two species also differ in the numbers of the streaks on the head and the side, which are two and one, respectively, in *Facelina bilineata* and four and two in *Facelinella quadrilineata*. Minute opaque white dots forming a Y-shaped mark on the head and those forming a longitudinal line immediately below the cerata region on each side of body are present in *Facelina bilineata* but not in *Facelinella quadrilineata*. Although the two species are easily distinguished by these differences in colouration, the affinity between the two is obvious since no significant differences are found in the mode of ceratal ar-

rangement, locations of gonopore and anus, characteristics of four head tentacles, or podial structure.

Comparison of internal morphology further suggests affinity between the two species. Both aeolids possess similar jaws with a single row of minute denticulations along the masticatory border (Fig. 3). Radula morphology is almost identical between the two species, and their uniseriate teeth are equally provided with a long, wide central cusp and several small denticles on each side (Fig. 4). Both species have similar numbers of rows of teeth (14-20 in *Facelina bilineata* vs 14-24 in *Facelinella quadrilineata* corresponding to the same range of body length, 10-20 mm). Furthermore the two species have a very similar reproductive morphology (Fig. 5), e.g., a weakly coiled ampulla and an oblong-shaped reddish receptaculum seminis with a long duct.

In spite of the above similarities, there is a significant difference in their penial structure. As shown by Baba (1965), the penial papilla of *Facelinella quadrilineata* is non-ejaculatory; the vas deferens opening into the lumen of the penial sac below the base of the penial papilla (Figs. 6B1, B2 and 7B). In contrast, *Facelina bilineata* undoubtedly possesses ejaculatory penis (Fig. 6A1-A4 and Fig. 7A) with the vas deferens running through the penial papilla.

In external shape and colour *Facelina bilineata* and *Facelinella quadrilineata* are so similar that they have been considered to be a single species. In internal anatomy they differ only in the detail of the penis. In a recent review of some species of the genus *Flabellina*, penial structure was shown to vary greatly within the genus (Hirano and Kuzirian, 1991). Because of this we would suggest that these two species are best considered to be congeneric. Although most species of *Facelina* possess a penial sac gland, its absence in *Facelina bilineata* is not unique, *Facelina dubia* also lacking this structure. *Facelinella quadrilineata* was considered to differ suffi-

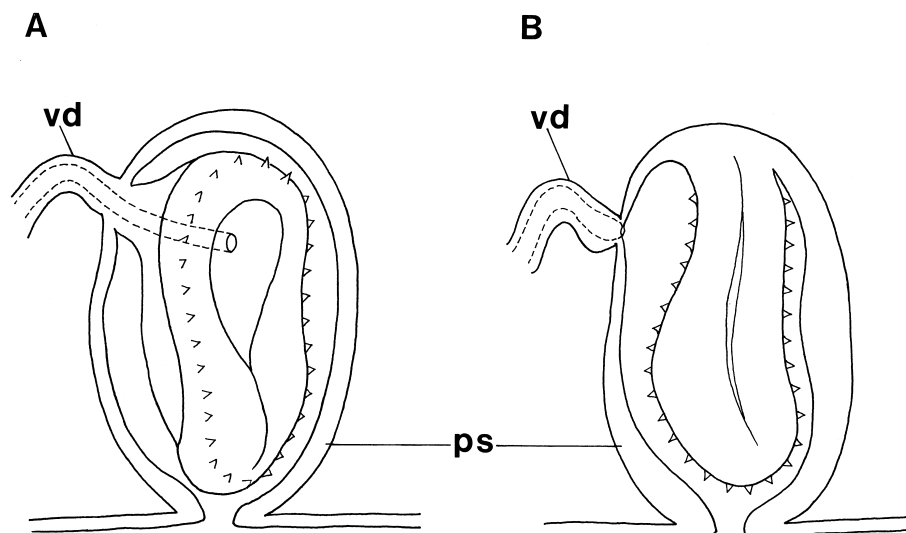


Fig. 7. (A) *Facelina bilineata* sp. nov. (B) *Facelina quadrilineata* comb. nov. Schematic representation of penial structure, showing positional difference of opening of vas deferens. ps, penial sac; vd, vas deferens.

ciently from other species of *Facelina* on ceratal arrangement (Baba, 1949) and penial structure (Baba, 1965) to be separated into a new distinct genus *Facelinella*. We do not consider the penial structure of *Facelinella quadrilineata*, in which the vas deferens opens at the base of the armed penial papilla (or pseudopenis), is a difference of sufficient magnitude to justify a distinct genus. As for ceratal arrangement we find no difference between *Facelina* and *Facelinella*; Baba (1965) himself withdrew this diagnosis from that of *Facelinella*. We therefore place both species in the genus *Facelina*. To place the two species in a common taxon, adoption of a far bigger genus *Phidiana s. l.* as proposed by Miller (1974) might also be possible. However we are of the same opinion as Gosliner (1979) in that the genera in Facelinidae should be retained as distinct until more accurate relationships can be assessed in future.

Now that the genus *Facelinella* is invalidated, *Facelinella semidecora* (Pease, 1860) (= *Facelinella anulifera*, Baba, 1949; synonymised by Gosliner, 1979), which is distributed in Hawaii and Sagami Bay, Japan, should also be included in *Facelina*; *Facelina semidecora* comb. nov.

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