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Three New Species of the Shrimp-associated Goby Genus *Vanderhorstia* (Perciformes: Gobiidae: Gobiinae) from Japan, with Re-descriptions of Two Related Congeners

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Abstract Three new species of the shrimp-associated goby genus *Vanderhorstia* are described based on the specimens collected from the southwest coast of Kochi Prefecture, Shikoku, Japan. Within the genus, these 3 species are assigned to the phenetically close-knit subgroup (named "large-scale group"), characterized by having the combination of 11 or 12 segmented rays on second dorsal fin and 26–45 longitudinal scale count, as well as relatively reduced sensory-papillae rows below eye. *Vanderhorstia hiramatsui* sp. nov. (2 specimens, 62.9–65.1 mm SL) differs from the other species of this subgroup in having 12 dorsal-fin soft rays (vs. almost always 11 in the latter). *Vanderhorstia kizakura* sp. nov. (single specimen, 34.9 mm SL) is readily distinguished from the other congeners in having separated pelvic fins (i.e., connecting membrane between innermost pelvic-fin soft rays greatly reduced). *Vanderhorstia rapa* sp. nov. (single specimen, 50.3 mm SL) closely resembles *V. auropunctata* in squamation (e.g., entirely or almost naked predorsal midline, and naked pectoral-fin base) and meristic counts (33–35 longitudinal scale count, 11–12 transverse scale count from origin of second dorsal fin backward and downward to anal-fin base), but differs from the latter in having a deep trough along posterior margin of eye (vs. undeveloped in the latter), larger jaws (jaw length 50.8% of head length vs. 43.9–44.1%), and first dorsal fin with minute yellow spots only (vs. narrow yellow lines on distal half). The large-scale group of *Vanderhorstia* is re-defined, 2 poorly-known congeners (i.e., *V. longimanus* and *V. puncticeps*) are re-described, and a key to all-known species of this subgroup is also provided.

Key words : *Vanderhorstia*, new species, Gobiidae, shrimp-associated goby.

Fishes of the Indo-Pacific gobiid genus *Vanderhorstia* Smith, 1959 are small- to moderate-sized marine gobies, symbiotically associated with alpheid shrimps (snapping shrimps or pistol shrimps). The genus currently recognized is characterized by having the following combination of characters (Shibukawa and Suzuki, 2004; present study): typical "Priolepis Group" type of axial skeletal features (Birdsong *et al.*, 1988), i.e., 10+16=26 vertebrae, P-V 3/II II I I 0/9, 2 anal-fin pterygiophores anterior to first haemal spine, and single epural; wide gill opening, extending anteriorly to well beyond a vertical line through posterior preopercular margin; branchiostegal membranes narrowly attached to isthmus (not forming free rear margin across isthmus); first gill slit moderately broad, i.e., ventral one-third or less of lower arch closed by membrane; no scales on cheek and operculum; relatively long caudal fin, longer than head; pelvic fins united

medially by well developed frenum (between spines) and interradial connecting membrane (between innermost rays) [*note.* —one of the new species herein described has almost separated pelvic fin]; vomer and palatine edentate; longitudinal pattern of sensory-papillae rows on cheek; sensory-papillae row *c* oblique and moderately long, its terminus close to rows *a* and *b* (row *a* apparently continuous with row *c* in some species); row *cp* comprising a single papilla; a pair of sensory papillae just behind chin (=row *f*); cephalic sensory canals well developed, with pores B′, C (unpaired), D (unpaired), E, F, G, H′, K′, L′, M′, N and O′. The other shrimp-goby genus *Ctenogobiops* Smith, 1959 resembles *Vanderhorstia* in sharing most of these features, but the former is chiefly distinguished from the latter in having relatively shorter caudal fin (subequal or shorter than head in many species) and characteristic bright white spot on pectoral fin [recently Randall *et al.* (2003) re-diagnosed *Ctenogobiops*, but we could not well separate *Ctenogobiops* from *Vanderhorstia* based only on the characters they provided]. Also, *Amblyeleotris* Bleeker, 1874, another Indo-Pacific shrimp-goby genus with a pair of sensory papillae just behind chin (Satapoomin and Winterbottom, 2002), differs from *Vanderhorstia* and *Ctenogobiops* in having several transverse rows of sensory papillae on cheek. The following 12 described species are currently assigned to *Vanderhorstia* (Shibukawa and Suzuki, 2004; Winterbottom *et al.*, 2005; Allen and Randall, 2006): *V. ambanoro* (Fourmanoir, 1957); *V. auropunctata* (Tomiyama, 1955); *V. bella* Greenfield and Longenecker, 2005; *V. delagoae* (Barnard, 1937) (=type species of *Vanderhorstia*); *V. flavilineata* Allen and Munday, 1995; *V. longimanus* (Weber, 1909); *V. macropteryx* (Franz, 1910); *V. mertensi* Klausewitz, 1974; *V. nannai* Winterbottom, Iwata and Kozawa, 2005; *V. nobilis* Allen and Randall, 2006; *V. ornatissima* Smith, 1959; *V. papilio* Shibukawa and Suzuki, 2004. Shibukawa and Suzuki (2004) suggested that *Vanderhorstia praealta* Lachner and McKinney, 1981 and *Vanderhorstia lanceolata* Yanagisawa, 1978 appeared to be not placed in the genus; these 2 species should be assigned to the other shrimp-associated goby genus *Flabelligobius* Smith, 1956 or *Tomiyamichthys* Smith, 1956 (Shibukawa and Iwata, 2005, in prep.).

Shibukawa and Suzuki (2004) described the new species *Vanderhorstia papilio* based on a single specimen collected from the Ryukyu Islands, Japan, and indicated that it was closed to two Japan-endemic congeners, *V. macropteryx* and *V. auropunctata*, as well as a single unidentified species from Japan. These 4 species form a phenetically close-knit assemblage, sharing relatively low number of longitudinal scale count (i.e., less than 40) and dorsal- and anal-fin segmented rays (i.e., usually 11 or 12) and reduced sensory-papillae rows below eye; this subgroup was called as "large-scale group." Shibukawa and Suzuki (2004) have overlooked another congener, *V. longimanus*, known from Indonesia and Australia, which also belongs to this subgroup.

More recently, Winterbottom *et al.* (2005) described *Vanderhorstia nannai* as a new species from Palau and the Philippines. This species could be assigned to the large-scale group by having 11 dorsal/anal segmented rays and characteristic configuration of sensory-papillae rows on cheek (e.g., row *a* comprising 3 or 4 widely-separated papillae), although it has slightly more longitudinal scale count (41–45) than the other congeners assigned to this subgroup.

Early in 2006, we had an opportunity to examine 2 specimens of a goby from Tosa Bay, off Pacific coast of Shikoku, Japan, as well as the color photographs of one of them. Judging from its characteristic coloration and the other general physiognomy, the species was identified as *Vanderhorstia puncticeps* (Deng and Xiong *in* Xu *et al.*, 1980) that had been hitherto recognized as a species of *Ctenogobius* (Xu *et al.*, 1980; Cheng and Zheng, 1987). These newly-obtained specimens also revealed that the unidentified species reported by Shibukawa and Suzuki (2004) was conspecific with *V. puncticeps*.

In this paper, we describe 3 new species of the large-scale group of *Vanderhorstia* from the

Japanese waters, re-describe 2 poorly-known congeners, i.e. *V. longimanus* and *V. puncticeps*, and provided a key to all known species of the large-scale group. All new species described in this paper were already reported by Senou *et al.* (2004) as 3 of 8 unidentified species of *Vanderhorstia* found in Japanese waters; the remaining 5 do not belong to the large-scale group, and, therefore, are not treated here.

Materials and Methods

Institutional abbreviations for materials examined follow Leviton *et al.* (1985), except for the Kanagawa Prefectural Museum, Japan (KPM). Comparative materials of the species of *Vanderhorstia* are listed in Shibukawa and Suzuki (2004), except as follows. *Vanderhorstia auropunctata*: KPM-NI 2791, 1 specimen, female, 58.7 mm SL, Suruga Bay, Ose-zaki, Shizuoka Prefecture, Japan, 53 m depth, 8 Sept. 1996, collected by H. Senou, M. Yanagita and A. Mishiku. *Vanderhorstia nannai*: ROM 76552, holotype of *Vanderhorstia nannai*, 29.5 mm SL, west coast of Babeldaob, Aimeliik, Palau (7°72.3′N, 134°26.0′ E), 9.1–15.2 m depth, 19 May 2004, collected by R. Winterbottom and party; NSMT-P 70085, paratypes of *V. nannai*, 10 specimens, 20.8–30.0 mm SL, purchased from Oasis Aquarium Store, Nagoya, Japan, between May 2001 and July 2002.

Measurements were made point-to-point with calipers under a dissecting microscope to the nearest 0.01 mm. The methods for measurements follow those of Hubbs and Lagler (1958), with exceptions given below (the snout tip refers to the mid-anteriormost point of the upper lip): interorbital width is the least width between innermost rims of right and left eyes; jaw length is the distance between the snout tip and the posteriormost point of lip; head width and depth were measured at preopercular margin; body depth was measured at the anal-fin origin; nape width is the distance between dorsalmost ends of gill openings; preanal and prepelvic lengths are the distances from the snout tip to the origin of each fin; pectoral-fin length is the length of the longest ray; pelvic-fin length is the distance between the base of pelvic-fin spine and the distal tip of the longest segmented ray; heights of pelvic-fin frenum and connecting membrane are least heights; lengths of fin spines and rays are the distances between the base to distal tip of each ray. Methods for counts follow Akihito (1984), except for the following: longitudinal scale count is the number of oblique (anterodorsal to posteroventral) scale rows and is taken from just dorsal to the upper attachment of the opercular membrane posteriorly to the mid-base of caudal fin; 3 methods of transverse scale count were taken (see descriptive accounts); circumpeduncular scale count is the number of scales along a zigzag vertical line through the narrowest point of the caudal peduncle; gill rakers were counted on the outer side of first arch, including all rudiments; count of pseudobranchial filaments includes all rudiments. Pectoral- and branched caudal-fin rays were counted and numbered from dorsal to ventral. Scales (except for predorsal and circumpeduncular scales), paired-fin rays, gill rakers and pseudobranchial filaments were counted bilaterally. Osteological features were studied from radiographs. The methods of Akihito (1984) were used in describing the pattern of the interdigitation of the dorsal-fin pterygiophores between the neural spines ("P-V"). Cephalic sensory canals and papillae were observed on specimens stained with cyanine blue, and notations on them follow Akihito (1984) and Miller (1986), respectively. All fish lengths given are standard lengths (SL).

Species are arranged in alphabetical order. Since the species assigned to the "large-scale group" of *Vanderhorstia* share many features with one another, we do not include the features other than meristic counts and coloration in the "Description" of each species; the other characteristics are found in the accounts of this subgroup, "Diagnosis" of each species account, and Table 1.

The Large-scale Group of *Vanderhorstia*

Diagnosis. Fishes of the large-scale group of *Vanderhorstia* are distinguished from the other congeners (hereafter referred as "small-scale group") by having: 11 or 12 segmented rays in second dorsal fin (vs. 11–16 in the small-scale group); 8–12, almost always 11, anal-fin soft rays (vs. 11–17); 26–45 longitudinal scale count (vs. 44 or more); reduced sensory-papillae row *a* comprising 3 (or rarely 4) widely-spaced papillae (vs. row *a* comprises 5 or more papillae); scales present on predorsal midline in all but 4 species (vs. always absent).

Description. Dorsal-fin rays VI-I, 11–12; anal-fin rays I, 8–12 (almost always 11); pectoral-fin rays 16–21; pelvic-fin rays I, 5; segmented caudal-fin rays 9+8, including 6–7+6–7 branched rays; dorsal unsegmented caudal-fin rays 6–10; ventral unsegmented caudal-fin rays 5–9; longitudinal scale count 26–45; transverse scale count from anal-fin origin dorsoanteriorly to first dorsal-fin base 9–20; transverse scales count from anal-fin origin dorsoposteriorly to second dorsal-fin base 8–16; transverse scale count from second dorsal-fin origin ventroposteriorly to anal-fin base 7–17; predorsal scales 0–16; circumpeduncular scales 10–12 (typically 12); gill rakers 3–5+9–19; pseudobranchial filaments 6–12; vertebrae 10+16=26; P-V 3/II II I I 0/9; epural 1; anal-fin pterygiophores anterior to first haemal spine 2; pleural ribs on third to tenth precaudal vertebrae.

Body moderately slender (body depth 13.0–17.8% of SL), compressed posteriorly. Head slightly compressed, its width 80.9–94.5% of its depth. Snout short, its length shorter than eye diameter; snout does not protrude beyond upper lip. Eye dorsolateral, large, its diameter 26.3–38.1% of head length; interorbital space narrow, its width narrower than pupil diameter and 3.1–5.9% of head length. No cutaneous ridge along dorsal midline of nape. Gape oblique, forming an angle of about 30–50 degrees with body axis. Lower jaw slightly projecting beyond upper jaw; posterior end of jaws extending to points between vertical lines through anterior margin of pupil and posterior margin of eye. Anterior naris opening at tip of short tube (its height shorter than diameter of its opening); no fleshy flap at tip of anterior naris; posterior naris opening a pore, located at approximately mid-point between anterior naris and anterior margin of eye. Tongue tip free from floor of mouth; anterior margin of tongue blunt and nearly truncate, without a distinct notch in the anterior margin. Posteroventral margin of lower lip interrupted at lower-jaw symphysis, except for *V. nannai* with uninterrupted, free ventral margin across symphysis. Mental flap on chin undeveloped. Gill opening wide, extending anteriorly well beyond a vertical line through posterior margin of preopercle; gill membranes narrowly attach to isthmus; attached gill membranes with no distinct free rear margin across isthmus. No fleshy projections on lateral wing of shoulder girdle. No bony projections along posterior margin of preopercle. Gill rakers on outer surface of ventral arm of first arch well developed, long and thin, finger-like; rakers on outer surface of dorsal arm of first arch short and rudimentary; first gill slit usually well open, ventral one-seventh to one-third of ventral arm closed by membrane. Caudal peduncle moderately slender, its depth 43.9–60.3% of caudal-peduncle length. First dorsal fin higher than second dorsal fin; first dorsal fin close to, but not connected to, second dorsal fin by membrane; all dorsal-fin spines slender and flexible; all segmented rays of second dorsal fin branched. Origin of anal fin on a vertical line between bases of first and second segmented rays of second dorsal fin; height of anal fin slightly lower than second dorsal fin; anal-fin spine slender and flexible; all segmented anal-fin rays branched. Caudal fin typically more or less symmetrical dorsoventrally, oblong or bifurcate; caudal fin long, its length 115.2–153.4% of head length. Pectoral fin nearly lanceolate, reaching posteriorly to points between vertical lines through bases of first and fifth segmented rays of second dorsal fin, and always extending beyond a vertical through anus; all pectoral-fin rays

branched, excluding 1–2 lowermost and/or uppermost simple ray(s). Origin of pelvic fin at, or slightly anterior to, a vertical line through origin of first dorsal fin; pelvic fins usually united medially by well developed frenum (between spines) and connecting membrane (between innermost rays), except for one species (i.e., *V. kizakura*) with deeply-concaved connecting membrane; pelvic frenum moderately thin, with smooth posterior margin; all segmented pelvic-fin rays branched.

Most of body and caudal-fin base covered by ctenoid scales with peripheral cteni; ctenoid-scale area extending anteriorly to a vertical line through middle or posterior part of base of first dorsal fin; cycloid scales on nape (when present), pectoral-fin base (when present), belly, prepelvic region, and small areas on anterodorsal part of body and behind and below pelvic-fin base; pectoral-fin base covered by cycloid scales in all but 3 species (i.e., *V. auropunctata*, *V. puncticeps* and *V. rapa*); head always naked.

Teeth in both jaws unicuspid, slender, more or less inwardly curved; upper jaw with 3–4 rows of teeth anteriorly, narrowing to 1–2 rows posteriorly; teeth on middle row(s) of upper jaw smaller than teeth in outermost and/or innermost rows; 1–3 strongly incurved, enlarged teeth (sometimes stout and canine-like) anteriorly in innermost row of upper jaw; lower jaw with 4 rows of teeth anteriorly, narrowing to single row posteriorly; 2–4 stout, enlarged canine-like teeth medially in innermost row of lower jaw; other teeth on lower jaw subequal in size; no teeth on vomer or palatine. Anterior tip of vomer enlarged in a blunt bilobed process, projecting downward behind symphysis of upper jaw.

Anterior oculoscapular-canal pores B′, C (unpaired), D (unpaired), E, F, G and H′ [*note.* — pore G of left side of holotype of *Vanderhorstia kizakura* absent]; posterior oculoscapular-canal pores K′ and L′; preopercular-canal pores M′, N and O′; right and left sides of anterior oculoscapular canals fused medially in interorbital space; ventralmost pore of preopercular canal (= pore O′) opening at point slightly below a horizontal line through posterior end of sensory-papillae row *d*. All cephalic sensory-papillae rows uniserial or comprising a single papilla, not forming multiple lines or aggregations; relatively reduced longitudinal pattern (could be expressed as reduced transverse pattern, following Winterbottom and Burridge, 1993a, b) of sensory papillae rows on cheek; row *a* short and reduced, comprising 3 (rarely 4) widely-spaced sensory papillae on both sides; row *b* broadly interrupted at midway, and extending from around ventralmost part of row *a* to posterior margin of preopercle; row *c* comprising 4 or 5 papillae and relatively short, its posterior end close to anterior ends of rows *a* and *b*; row *cp* comprising a single papilla; row *d* not reaching to, or extends slightly posterior to, a vertical line through row *cp*; each side of row *f* a single papilla (namely, a pair of papillae just behind chin); row *n* comprising a single papillae; row s^2 comprising a single papilla; row x^1 well separated from row x^2. Sensory papillae on midlateral body form uniserial vertical rows, each row short and restrictedly found on a single scale; 3 radiating rows of sensory papillae on caudal fin, each along the fourth, seventh and tenth branched caudal-fin rays; all 3 sensory papillae rows on caudal fin extend from posterior margin of scaled area to near distal end of each ray.

Remarks. According to Allen and Munday (1995), *Vanderhorstia flabilineata* has both 11 segmented rays on second dorsal and anal fins, likewise the species of the large-scale group; other species of the "small-scale group" has 14 or more segmented rays on these fins. However, *V. flabilineata* also has "approximately 50–55 (some scales missing)" longitudinal scales and the sensory-papillae row *a* appears to comprise 5 sensory papillae (Allen and Munday, 1995:104, fig. 8), and, thus, we do not assign it to the large-scale group tentatively. The large-scale group herein defined is only the artificially-compiled assemblage, not characterized by any obvious synapomorphies supporting its monophyly. In order to resolve the phylogenetic implication of this subgroup, comprehensive study on *Am-*

blyeleotris, *Ctenogobiops* and *Vanderhorstia* is needed (see also "Remarks" of *V. kizakura*).

Because of the difficulty in collecting correlated in their habits, there are very few museum specimens of this subgroup. We describe 3 new species (i.e., *V. hiramatsui*, *V. kizakura* and *V. rapa*) based only on 1–2 specimens of each species, therefore. Nevertheless, we are convinced that all of these are distinct species, because, as well as the morphological evidence based on the voucher specimens, we have had the opportunities to examine many excellent underwater photographs of more than one individual of each species; some of those images are appeared in the recently-published pictorial books (e.g., Hayashi and Shiratori, 2003; Senou *et al.*, 2004) and the "Image Database of Fishes" in the KPM (also available from the website "FishPix" of the National Museum of Nature and Science: http://fishpix.kahaku.go.jp/fishimage-e).

Included species. The following 9 species are assigned to the large-scale group of *Vanderhorstia*: *V. auropunctata*; *V. hiramatsui* (new species); *V. kizakura* (new species); *V. longimanus*; *V. macropteryx*; *V. nannai*; *V. papilio*; *V. puncticeps*; *V. rapa* (new species). Five species of this subgroup (i.e., *V. auropunctata*, *V. hiramatsui*, *V. kizakura*, *V. macropteryx* and *V. rapa*) are hitherto known only from Japanese waters, whereas the other 4 are found in the other areas of the West Pacific, as follows: *V. longimanus*, reported from Indonesia and Australia; *V. nannai*, known from Palau and the Philippines; *V. papilio*, described based on a single specimen from Japanese waters, and the underwater photographs of goby that appear to be identical with *V. papillio* were reported from Bali and Sulawesi, Indonesia by Kuiter and Tonozuka (2001: 633, misidentified as *Psilogobius prolatus*); *V. puncticeps*, originally described from Zhejiang Province of China, and newly recorded here from Japanese waters. Allen *et al.* (2003: 312) noted *V. macropteryx* is distributed in "Philippines to S. Japan," but the species in the underwater photograph given by them as *V. macropteryx* is apparently misidentification of *V. papilio*; we did not locate any certain evidence suggesting that *V. macropteryx* is also distributed outside of Japan.

Key to Species of the Large-scale Group of *Vanderhorstia*

1a. Pelvic fins separated, with very low connecting membrane between innermost rays (height of connecting membrane 23.3% of length of fifth pelvic fin soft ray); eye large, its diameter 38.1% of head length; 5 narrow dusky bars on head and body, anterior 4 of which diagonal rather than vertical (Shikoku and Ryukyu Islands, Japan) . . . . . ***V. kizakura*** sp. nov.

1b. Pelvic fins united medially via well-developed connecting membrane between innermost rays (length of connecting membrane 81.1–98.2% of length of fifth pelvic fin soft ray); eye diameter 24.3–37.2% of head length; dusky bars present or absent (if present, 2 bars between anal and second dorsal fins almost vertical rather than diagonal) 2

2a. Predorsal midline entirely or almost naked; pectoral-fin base naked 3

2b. Nape, including predorsal midline, broadly scaled (except for *V. longimanus* with only a single predorsal scale); pectoral-fin base scaled 6

3a. Fifth and ninth branched caudal-fin rays greatly elongate, forming a distinctly bifurcate caudal fin; lower lip with uninterrupted, free posteroventral margin across dentary symphysis; gape well oblique, forming an angle of about 50 degrees with body axis; jaw relatively small (length 10.4–13.2% of SL), extending posteriorly to a vertical line through anterior margin of pupil; more than 40 longitudnal scale count; 16–18 pectoral-fin rays; 3–4+16–19 gill rakers on outer

surface of first arch; 2 rows of orange spots on upper half of body, those on midlateral body surrounded by light blue (Palau and Philippines) . . . . . *V. nannai*

3b. Caudal fin rounded or lanceolate; posteroventral margin of lower lip interrupted at lower-jaw symphysis; gape moderately oblique, forming an angle of about 30 degrees with body axis; jaws moderate to relatively large (length 12.5–14.4% of SL), extending posteriorly to a vertical line through middle or posterior margin of eye; 26–35 longitudinal scale count; 20–21 pectoral-fin rays; 3–5+9–11 gill rakers on outer surface of first arch; color not as above 4

4a. Longitudinal scale count 26–27; 8 transverse scale count from origin of second dorsal fin downward and backward to anal-fin base; when freshly collected, distal margin of first dorsal fin red; a small red spot on operculum (Sagami Bay and Tosa Bay of Japan and Zheijiang Province of China) . . . . . *V. puncticeps*

4b. Longitudinal scale count 32–35; 10–12 transverse scale count from origin of second dorsal fin downward and backward to anal-fin base; no red markings on first dorsal fin and operculum 5

5a. Trough along posterior margin of eyes less developed, shallow; jaw moderate in size (43.9–44.1% of head length), extending posteriorly to a vertical through posterior margin of pupil (Fig. 1A); fourth spine of first dorsal fin longest, subequal or slightly longer than third spine (fourth spine 102.5–103.9% of third spine in length); sensory-papillae row *c* comprising 5 papillae; yellow markings on distal part of first dorsal fin vertically elongated, forming short lines; second dorsal, anal and caudal fins with a yellow submarginal line; a black blotch sometimes present on first dorsal fin between fourth and fifth or sixth spines (Sagami Bay and Izu Islands, off southern coast of middle of Honshu, Japan) . . . . . *V. auropunctata*

5b. Deep trough along posterior margin of eyes; jaw relatively large (50.8% of head length), extending posteriorly to a vertical through posterior margin of eye (Fig. 1E); third spine of first dorsal fin longest, longer than fourth spine (fourth spine 81.0% of third spine in length); row *c* comprising 4 sensory papillae; all yellow markings on first dorsal fin more or less circular, spot-like; second dorsal, anal and caudal fins without yellow submarginal lines; no distinct black spot on first dorsal fin (Kashiwa-jima Island, off southwest coast of Shikoku, Japan) . . . . . ***V. rapa*** sp. nov.

6a. Nape largely naked, with only a single predorsal scale; anterior 3 spines of first dorsal fin greatly elongate and filamentous; body slender, depth 13.0% of SL (Ceram of Indonesia and Western Australia) . . . . . *V. longimanus*

6b. Nape broadly scaled, with 7–18 predorsal scales rows; spines of first dorsal fin not so elongate and usually non-filamentous (distal tip of third spine forming a short filament in *V. papilio*); body less slender, depth 16.8% or more of SL 7

7a. Fifth and ninth branched caudal-fin rays longer than other rays, greatly elongate and filamentous, forming a distinctly bifurcate caudal fin; 27 longitudinal scale count (Western Pacific) . . . . . *V. papilio*

7b. Caudal fin more or less rounded without distinctly modified filamentous rays; 30–39 longitudinal scale count 8

8a. Second dorsal fin with I, 11 rays; no elongate and filamentous spines on first dorsal fin; trans-

verse scale count from origin of second dorsal fin downward and backward to anal-fin base 10–12; no distinct dusky saddle on nape; longitudinal yellow line across middle of cheek; orange line along dorsal margin of upper jaw (off Pacific coasts of southern part of Honshu, Shikoku and Kyushu, Japan) . . . . . *V. macropteryx*

8b. Second dorsal fin with I, 12 rays; third spine of first dorsal fin slightly elongate and filamentous; transverse scale count from origin of second dorsal fin downward and backward to anal-fin base 16–17; black saddle on nape extending ventrally to branchiostegal membrane, obviously broadened and vivid at operculum; yellow spots only on cheek (i.e., no longitudinal lines); no oran line along dorsal margin of upper jaw (Izu Islands and southwest coast of Shikoku, Japan) . . . . . ***V. hiramatsui*** sp. nov.

Vanderhorstia hiramatsui sp. nov.

(New Japanese name: Kuroerikanoko-haze)

(Figs. 1C, 3 and 4A–B; Table 1)

Vanderhorstia sp. 5: Senou *et al.*, 2004: 365 (underwater photograph and brief description; Izu-oshima Island and Kochi Prefecture of Shikoku, Japan).

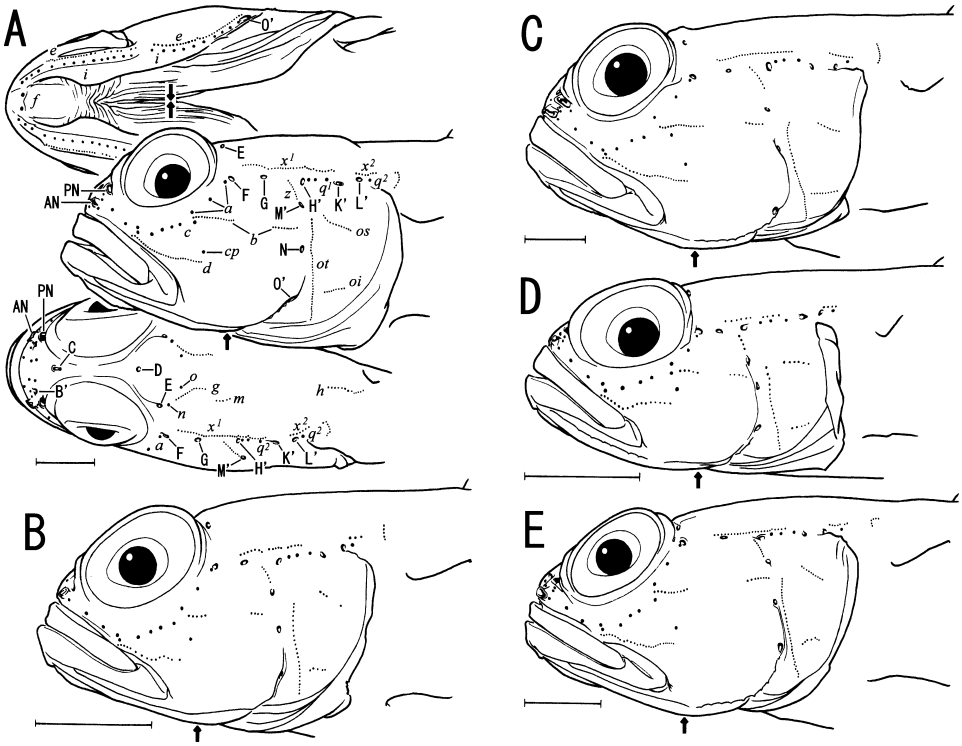

Fig. 1. Heads of six species of *Vanderhorstia*, showing cephalic sensory canal pores (indicated by roman uppercase letters, except for AN and PN) and papillae (indicated by roman lowercase letters). A: *Vanderhorstia auropunctata*, KPM-NI2791, female, 58.7 mm SL; B: *Vanderhorstia kizakura* sp. nov., NSMT-P 73010, holotype, female, 34.9 mm SL; C: *Vanderhorstia hiramatsui* sp. nov., NSMT-P 73121, paratype, female, 62.9 mm SL; D: *Vanderhorstia puncticeps*, BSKU 77244, male, 30.3 mm SL; E: *Vanderhorstia rapa* sp. nov., NSMT-P 73119, holotype, female, 50.3 mm SL. AN and PN, anterior and posterior nostrils, respectively. Arrows show position where gill membrane attached to isthmus. In the holotype of *V. kizakura*, sensory-canal pore G and sensory-papillae row *z* could not be examined, and, in this illustration (B), reproduced based on those of the right side. Bars indicate 3 mm. Drawn by K. Shibukawa.

Holotype. NSMT-P 73120, 65.1 mm SL, male, Tsutome-zaki Point, Issai, Ostuki, Kochi Pref., Shikoku, Japan, 41 m depth, 2 May 1998, collected by W. Hiramatsu.

Paratype. NSMT-P 73121, 62.9 mm SL, female, Tsutome-zaki Point, Issai, Otsuki, Kochi Prefecture, Shikoku, Japan, 42 m depth, 3 May 1998, collected by W. Hiramatsu.

Image database of fishes (see "Remarks" of "The large-scale group of *Vanderhorstia*"). KPM-NR 61047, Kashiwa-jima Island, Kochi Prefecture, Shikoku, Japan, 20 May 2001, photographed by Y. Miyamoto.

Diagnosis. *Vanderhorstia hiramatsui* is distinguished from the congeners in having the following combination of characters: 12 segmented rays on second dorsal fin; 38–39 longitudinal scale count; 15–16 predorsal scales; 16–17 transverse scale count from origin of second dorsal fin backward and downward to anal-fin base; pectoral-fin base broadly covered by cycloid scales; connecting membrane between innermost rays well developed; trough along posterior margin of eye well developed; operculum almost entirely blackened; cheek and occipital region scattered with minute yellow spots (and no yellow lines).

Description. In the following description, the counts of holotype are asterisked, and the frequency of each count is given in the parentheses following relevant count. Dorsal-fin rays VI-I, 12* (2); anal-fin rays I, 11* (2); pectoral-fin rays 18 (1) or 20* (3); pelvic-fin rays I, 5* (4); segmented caudal-fin rays 9+8* (2), including 7+7* (2) branched rays; dorsal unsegmented caudal-fin rays 9* (2); ventral unsegmented caudal-fin rays 8* (2); longitudinal scale count 38 (2) or 39* (2); transverse scale count from anal-fin origin dorsoanteriorly to first dorsal-fin base 18 (1), 19* (2) or 20* (1); transverse scale count from anal-fin origin dorsoposteriorly to second dorsal-fin base 15* (2) or 16* (1); transverse scale count from second dorsal-fin origin ventroposteriorly to anal-fin base 16* (3) or 17 (1); predorsal scales 15 (1) or 16* (1); circumpeduncular scales 12* (2); gill rakers 3+10* (1), 4+9 (1), 4+11* (1) or 5+10 (1); pseudobranchial filaments 11* (3) or 12 (1).

Color when alive [based on the underwater photograph found in Senou *et al.* (2004: 365)]. Ground color of head and body pale gray, a little tinged with blue, darkener dorsally; dorsal surface of head and body tinged with light green; 5 vertical dark-brown bars on head and body, first bar (darkest and more completely developed) from nape downward to ventral part of operculum, second bar from posterior part of first dorsal-fin base downward to belly, third bar from anterior part of second dorsal-fin base (between fourth and seventh rays) downward to just above anterior part of anal-fin base, fourth bar at anteriormost part of caudal peduncle, and the fifth and posteriormost one at caudal fin base; pupil edged narrowly by yellow; iris dark bronze to black dorsally, yellow to yellowish gray ventrally; cheek, anterodorsal part of operculum, occipital region and body scattered with minute yellow spots, those on midlateral part of tail of body continuous forming irregular longitudinal line; first dorsal fin translucent, a little tinged with yellowish gray or blue, scattered with minute yellow spots; second dorsal fin subtranslucent, a little tinged with blue, scattered with yellow spots (slightly larger than those on first dorsal fin), with a yellow submarginal line; caudal fin translucent, slightly tinged with blue, with elongate yellow spots and lines on its dorsal and ventral part, respectively; pectoral fin largely transparent; pelvic fin pale blue with yellow lines.

Color in alcohol. Similar to live coloration, except as follows: ground color of head and body pale yellow or pale brown, becoming slightly darkener dorsally; all yellow spots on head, body and fins pale; bluish areas of fins turn to dark brown; iris entirely blackish.

Distribution and habitat. *Vanderhorstia hiramatsui* is described based on 2 specimens collected from the southwest coast of Shikoku, Japan. Senou *et al.* (2004) reported that this species (as *Vanderhorstia* sp. 5) distributed in Izu-oshima Island (Izu Islands, off pacific coast of middle of Honshu) and Kashiwa-jima Island (off southwest coast of Shikoku).

Etymology. The new species is named *hiramatsui* in honor of W. Hiramatsu, who collected the type specimens of this species.

Remarks. *Vanderhorstia hiramatsui* is readily distinguished from the other members of the "large-scale group" in having 12 segmented rays on second dorsal fin (vs. almost always 11 in the latter, i.e., other than *V. hiramatsui*, 12 segmented-rays condition is examined only in a single specimen of *V. puncticeps*) and almost entirely blackened operculum (vs. not such color).

One or 2 caudal fin rays are slightly elongated in the type specimens of *Vanderhorstia hiramatsui*, but the length of these rays is shorter in this species from those in *V. papilio*: slightly prolonged, lengths of these rays 102.0–103.7% of middle caudal-fin ray (vs. greatly prolonged, lengths of these rays 143.0–146.9% of middle caudal-fin ray in *V. papilio*); 3 or more branches as for the neighboring branched rays (vs. dichotomous).

Vanderhorstia kizakura sp. nov.

(New Japanese name: Kizakura-haze)

(Figs. 1B, 2A and 4C–E; Table 1)

Gobiidae, indet. gen. & sp.: Anker, 2000: 5, fig. 5 (underwater photograph; Kochi Prefecture, Japan).

Vanderhorstia sp.: Hayashi and Shiratori, 2003: 160, image No. 313 (underwater photograph and brief description; Kume-jima Island, Japan).

Vanderhorstia sp. 8.: Senou *et al.*, 2004: 367 (underwater photograph and brief description; Kochi Prefecture of Shikoku, Amami-oshima Island, Okinawa-jima Island and Kume-jima Island, Japan).

Holotype. NSMT-P 73010, 34.9 mm SL, female,

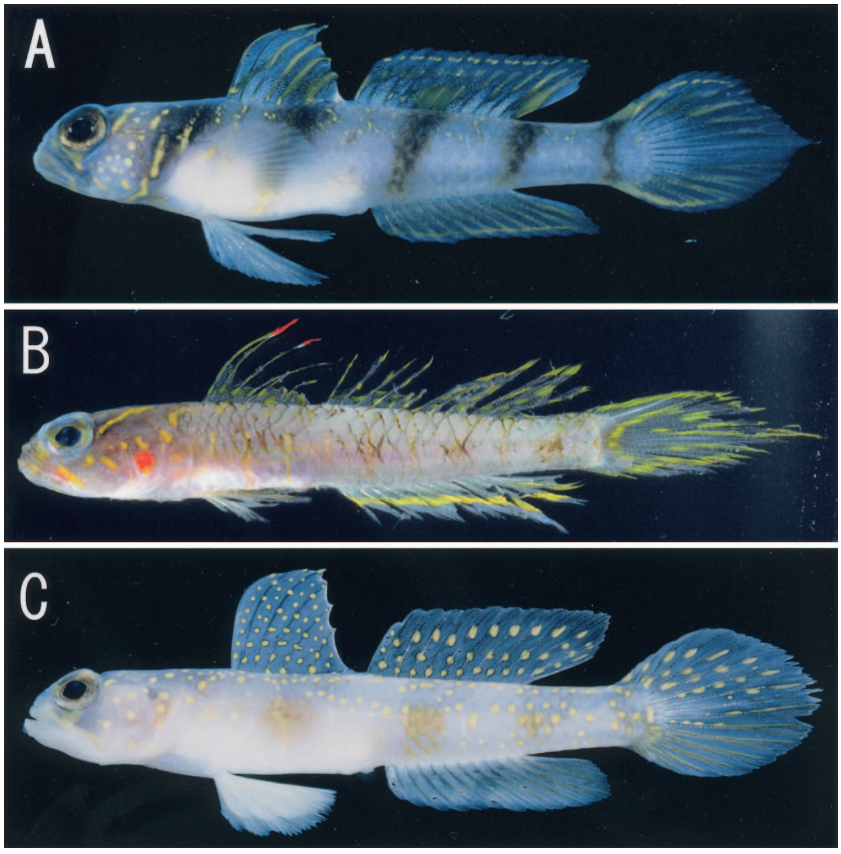

Fig. 2. Freshly collected specimens of four species of *Vanderhorstia*. A: *Vanderhorstia kizakura* sp. nov., NSMT-P 73010, holotype, female, 34.9 mm SL, Kashiwa-jima Island, Kochi Prefecture, Japan, photographed by A. Iwata; B: *Vanderhorstia puncticeps*, BSKU 77244, male, 30.3 mm SL, Tosa Bay, off Kochi Pref., Japan, photographed by E. Katayama; C: *Vanderhorstia rapa* sp. nov., NSMT-P 73119, holotype, female, 50.3 mm SL, Kashiwa-jima Island, Kochi Prefecture, Japan, photographed by A. Iwata.

Kashiwa-jima Island, off southwest coast of Shikoku, Japan, 30 m depth, 4 Aug. 1993 (kept in aquarium after collection, and fixed on 30 Nov. 1993), collected by A. Iwata and N. Ohnishi.

Image database of fishes (see "Remarks" of "The large-scale group of *Vanderhorstia*"). KPM-NR 16765, Kashiwa-jima Island, Kochi Prefecture, Shikoku, Japan, 37 m depth, 28 June 1998, photographed by K. Yamazaki; KPM-NR 27726, Kashiwa-jima Island, Kochi Prefecture, Shikoku, Japan, 38 m depth, 14 Nov. 1998, photographed by K. Yamazaki; KPM-NR 28876, Kume Island, Okinawa Group of Ryukyu Islands, Japan, 60 m depth, 6 June 1999, photographed by A. Mishiku; KPM-NR 28877, Kume Island, Okinawa Group of Ryukyu Islands, Japan, 60 m depth, 6 June 1999, photographed by A. Mishiku; KPM-NR 36004, Seragaki, Kunigami, Okinawa-jima I., Okinawa Group of Ryukyu Islands, Japan, 48 m depth, 8 Dec. 1999, photographed by M. Takata; KPM-NR 38868, Kashiwa-jima Island, Kochi Prefecture, Shikoku, Japan, 40 m depth, 1 Sep. 2000, photographed by A. Okumura; KPM-NR 63099, Kashiwa-jima Island, Kochi Prefecture, Shikoku, Japan, May 2001, photographed by A. Okumura; KPM-NR 63428, Kashiwa-jima Island, Kochi Prefecture, Shikoku, Japan, 20 Nov. 2001, photographed by K. Matsuno; KPM-NR 63429, Kashiwa-jima Island, Kochi Pref., Shikoku, Japan, 15 Oct. 2001, photographed by K. Matsuno.

Diagnosis. The new species *Vanderhorstia kizakura* is unique within the genus in having greatly reduced connecting membrane between innermost pelvic-fin rays, i.e., its height 23.3% of length of fifth pelvic-fin soft rays. The species is also distinguished from the congeners in having the following combination of characters: 11 segmented rays on second dorsal fin; 33–34 longitudinal scale count; 11 predorsal scales; 11–12 transverse scale count from origin of second dorsal fin backward and downward to anal-fin base; pectoral-fin base with cycloid scales; third spine of first dorsal fin longest, slightly elongate and filamentous; ninth segmented caudal-fin ray slightly elongate, forming a pin-tailed caudal fin; 5 narrow dusky bars on head and body, anterior 4 diagonal rather than vertical; some short diagonal yellow lines on operculum.

Description. In the following description, the values where we take bilaterally are separated by a slash, the first value representing the left count. Dorsal-fin rays VI-I, 11; anal-fin rays I, 11; pectoral-fin rays 19/20; pelvic-fin rays I, 5; segmented caudal-fin rays 9+8, including 7+7 branched rays; dorsal unsegmented caudal-fin rays 8; ventral unsegmented caudal-fin rays 8; longitudinal scale count 33/34; transverse scale count from anal-fin origin dorsoanteriorly to first dorsal-fin base 17/18; transverse scale count from anal-fin origin dorsoposteriorly to second dorsal-fin base 13/13; transverse scale count from second dorsal-fin origin ventroposteriorly to anal-fin base 11/11; predorsal scales 11; circumpeduncular scales 12; gill rakers 3+10/3+10; pseudobranchial filaments 10/9.

Color when alive or fresh [based on Fig. 2B and the underwater photographs found in, e.g., Senou *et al.* (2004: 367)]. Ground color of head and body pale, slightly grayish dorsally; belly pale white; five narrow dusky, vertical or slightly diagonal bars on head and body, posterior 4 of which tinged with yellow; first bar from nape downward to operculum, second bar from posterior part of base of first dorsal fin downward to middle of belly, third bar from middle of base of second dorsal fin (between third and seventh rays) downward to just above anterior part of anal-fin base (between first and third soft rays), fourth bar from anteriormost part of dorsal surface of caudal peduncle downward to just above posteriormost part of anal-fin base (between tenth and eleventh soft rays), and fifth and posteriormost bar at caudal-fin base; horizontally-elongate triangular yellow patch beneath eye; a short, narrow bright sky-blue line along posteroventral margin of eye; occipital region with short diagonal yellow lines and small spots; cheek scattered with many various-sized (all smaller than pupil) yellow spots; operculum with 3 short, almost vertical yellow lines, dorsalmost of which extending dorsally to nape; numerous minute dust-like yellow dots scattered on dorsal part of body; first dorsal fin translucent and slightly whitish, with narrow yellow lines along spines; second dorsal fin translucent and slightly whitish, with 2 vague yellow basal blotches and narrow yellow submarginal line; short yellow lines along middle of spine and rays of second

Table 1. Proportional measurements of five species of *Vanderhorstia*.

	V. hiramatsui sp. nov.		***V. kizakura*** sp. nov.	***V. puncticeps***		***V. longimanus***	***V. rapa*** sp. nov.
	NSMT-P 73120 Male	NSMT-P 73121 Female	NSMT-P 73010 Female	NSMT-P R798 Male	BSKU 77244 Male	ZMA 110.978 Female	NSMT-P 73119 Female
Standard length (SL)	65.1	62.9	34.9	39.9	33.3	25.2	50.3
% of SL							
Head length	29.0	29.7	26.1	26.9	25.9	28.7	28.4
Head width	16.0	15.9	15.5	14.5	12.6	13.7	15.4
Head depth	18.0	18.3	17.9	16.0	15.6	14.5	17.1
Snout length	6.6	7.3	5.9	5.4	5.6	5.1	5.8
Eye diameter	8.9	8.9	9.9	9.5	7.7	10.7	8.6
Interorbital width	1.7	1.7	1.5	1.2	1.3	1.2	1.4
Nape width	12.5	12.9	11.7	10.5	10.4	9.4	10.3
Jaw length	14.5	14.5	13.2	12.5	12.7	12.4	14.4
Body depth	17.5	17.4	17.8	15.1	14.9	13.0	15.9
Body width	13.1	13.0	15.4	13.0	13.1	9.1	13.8
Predorsal length	34.7	36.2	33.7	29.4	32.9	34.2	34.2
Prepelvic length	34.3	33.9	30.3	35.1	32.6	33.9	32.5
Preanal length	61.1	60.5	56.9	55.1	55.4	56.4	58.7
Caudal-peduncle length	19.2	19.7	20.6	21.0	20.8	19.8	20.6
Caudal-peduncle depth	11.6	11.6	11.1	9.9	9.1	9.4	10.7
D_1 base	20.9	21.7	21.1	19.6	19.2	21.9	20.8
D_2 base	26.9	27.4	28.4	26.4	30.0	26.9	26.1
A base	23.3	22.6	24.7	26.3	26.3	21.9	22.6
P_1 length	30.5	30.5	29.1	26.2	26.5	25.8	27.4
P_2 length	27.5	27.0	25.3	19.0	19.6	22.9	21.8
C length	35.5	36.3	35.8	37.2	39.7	37.2	33.3
Length of 1st spine of D_1	17.1	19.6	17.0	24.4	22.8	24.1	21.4
Length of 2nd spine of D_1	21.0	23.2	19.2	24.5	22.1	27.3	23.1
Length of 3rd spine of D_1	24.1	28.9	19.6	24.5	21.0	37.0	23.1
Length of 4th spine of D_1	18.0	20.4	15.0	21.7	19.0	23.2	18.7
Length of D_2 spine	13.1	13.7	10.1	9.9	10.3	—	11.7
Length of 1st ray of D_2	14.9	15.2	13.8	12.8	12.8	—	14.1
Length of longest ray of D_2	24.0	21.5	18.9	22.2	20.9	—	21.2
Length of A spine	9.0	8.6	8.0	8.4	7.3	—	7.3
Length of 1st ray of A	11.5	11.8	10.2	10.5	10.7	—	9.6
Length of longest ray of A	22.8	20.6	20.2	21.4	—	—	19.9
Length of P_2 spine	8.7	8.1	8.6	6.7	5.8	7.3	6.9
Length of 1st ray of P_2	13.6	14.0	11.4	8.9	10.0	11.7	10.8
Length of 4th ray of P_2	26.2	26.2	23.1	16.6	18.2	21.0	20.2
Length of 5th ray of P_2	25.7	25.2	23.9	17.9	18.1	21.7	20.3

Abbreviations: A, anal fin; C, caudal fin; D_1, first dorsal fin; D_2, second dorsal fin; P_1, pectoral fin; P_2, pelvic fin.

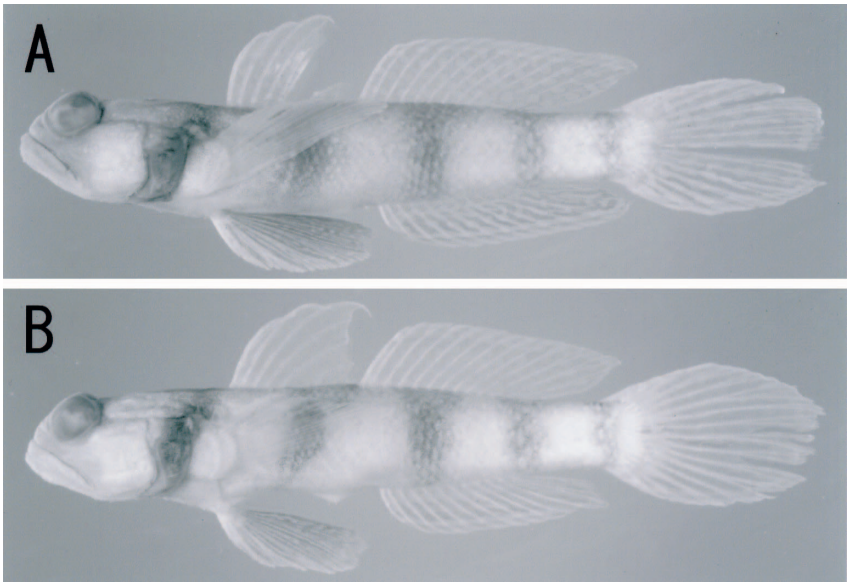

Fig. 3. Preserved specimens of *Vanderhorstia hiramatsui* sp. nov. A) NSMT-P 73120, holotype, male, 65.1 mm SL, Kashiwa-jima Island, Kochi Prefecture, Japan; B) NSMT-P 73121, paratype, female, 62.9 mm SL, Kashiwa-jima Island, Kochi Prefecture, Japan. Photographed by K. Shibukawa.

dorsal fin; anal fin slightly whitish, with a yellow submarginal line margined by blue dorsally and ventrally; spine and soft anal-fin rays tinged with yellow; caudal fin subtranslucent and slightly whitish; submarginal yellow line margined by blue dorsally and ventrally on dorsal and ventral part of caudal fin; distal part of branched caudal-fin rays tinged with yellow distally; pectoral fin translucent; pelvic fin pale white.

Color in alcohol. Similar to live coloration, except as follows: ground color of head and body pale yellow or pale brown, becoming darkener dorsally; all yellow spots on head, body and fins turn to pale; bluish areas of fins turn to dark brown; iris entirely blackish.

Distribution and habitat. The new species *Vanderhorstia kizakura* is described based on a single specimen from Kashiwa-jima Island, off southwest coast of Shikoku, Japan. Senou *et al.* (2004) reported that this species was known from Kochi Prefecture of Shikoku and the Ryukyu Islands (Amami-oshima Island, Okinawa-jima Island and Kume-jima Island). It is found in sandy gentle slope below coral-reef drop-off (45 m or more depths), and symbiotically associates with the alpheid shrimps (Anker, 2000; Senou *et al.*, 2004).

Etymology. The new specific name, *kizakura*, is the Japanese vernacular name for a variety of the cherry tree with turmeric-colored blossoms, in reference to the bright yellow dots and lines scattered on head and body of this species. The name should be treated as noun in apposition.

Remarks. When this new species was discovered, it was first considered to be an undescribed species of *Amblyeleotris* because of its general physiognomy, e.g., almost separated pelvic fins and characteristic banded pattern on head and body. Subsequent our examination reveals that it has longitudinal pattern of sensory-papillae rows on cheek, suggesting that it belongs to *Vanderhorstia* (vs. several transverse rows of sensory papillae below eye in *Amblyeleotris*).

Amblyeleotris is distinguished from *Vanderhorstia* based chiefly on this discrepancy in the configuration of sensory-papillae rows below eye. However, each transverse row of sensory papillae on cheek appears to correspond to each sensory papillae of rows *a*, *c*, and *cp* in the large-

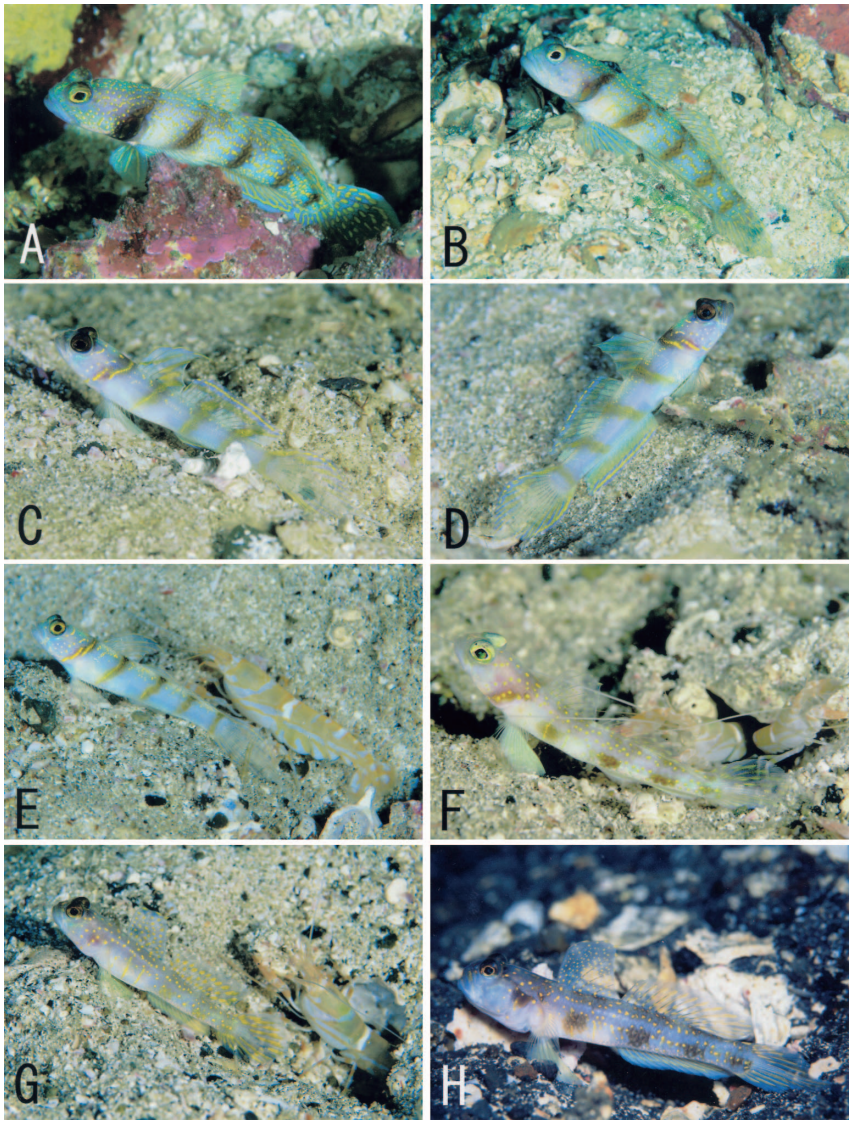

Fig. 4. Underwater photographs of three species of *Vanderhorstia*. A: *Vanderhorstia hiramatsui*, ca. 8 cm TL, Tsutome-zaki Point, Kochi Prefecture, Japan, 44 m depth, 4 Oct. 1998; B: *Vanderhorstia hiramatsui*, ca. 7 cm TL (total length), Tsutome-zaki Point, Kochi Prefecture, Japan, 39 m depth, 26 Apr. 1998; C: *Vanderhorstia kizakura*, ca. 4 cm TL, Kashiwa-jima Island, Kochi Prefecture, Japan, 35 m depth, 29 Apr. 1996; D: *Vanderhorstia kizakura*, ca. 5 cm TL, Kashiwa-jima Island, Kochi Prefecture, Japan, 35 m depth, 23 Nov. 1995; E: *Vanderhorstia kizakura*, ca. 5 cm TL, Kashiwa-jima Island, Kochi Prefecture, Japan, 35 m depth, 2 June 1996; F: *Vanderhorstia rapa*, ca. 4.5 cm TL, Kashiwa-jima Island, Kochi Prefecture, Japan, 36 m depth, 20 July 1997; G: *Vanderhorstia rapa*, ca. 4 cm TL, Kashiwa-jima Island, Kochi Prefecture, Japan, 35 m depth, 29 Apr. 1996; H: *Vanderhorstia rapa*, 5 cm TL, Izu-oshima Island, Izu Islands, Japan, 37 m, 14 Nov. 2005. Photographed by T. Hirata (A–G) and Y. Miyamoto (H).

scale group of *Vanderhorstia* and its putative relative, *Ctenogobiops*; in addition, number of sensory papillae in each transverse row varies between the species of *Amblyeleotris* (see, e.g., Akihito *et al.*, 2002). Similar proliferation/reduction of sensory papillae is found in various gobiid genera with essentially "longitudinal pattern" of sensory-papillae rows, e.g., *Acentrogobius*, *Favonigobius*, *Glossogobius*, *Oligolepis*, and *Rhinogobius*, as intrageneric variation (e.g., Hoese, 1983; Akihito *et al.*, 2002). To ascertain the interrelationships of the close-knit group of the genera *Amblyeleotris*, *Ctenogobiops* and *Vanderhorstia* is beyond the scope of this study, and herein we tentatively follow the generic definition currently recognized. Discovery of *Vanderhorstia kizakura*, having the intermediate appearance between *Vanderhorstia* and *Amblyeleotris*, suggests that a reevaluation of their statuses is required.

Vanderhorstia longimanus (Weber, 1909)

(Fig. 5; Table 1)

Gobius (*Oxyurichthys*) *longimanus* Weber, 1909: 154 (original description); Weber, 1913: 478, fig. 97 (description and line drawing).

Oxyurichthys longimanus: Koumans, 1953: 41–42, fig. 10 [description and line drawing (after Weber, 1913)].

?*Vanderhorstia longimanus*: Hutchins, 2001: 44 (checklist; Western Australia).

Materials examined. ZMA 110.978, holotype of *Gobius* (*Oxyurichthys*) *longimanus*, female, 25.2 mm SL, Ceram, Indonesia (2°28.52′S, 131°3.30′E), 118 m depth, 22 Aug. 1899, collected by M. Weber.

Diagnosis. *Vanderhorstia longimanu*s is distinguished from the congeners in having the following combination of characters: 11 segmented rays on second dorsal fin; 30–31 longitudinal scale count; single predorsal scale; 8–9 transverse scale count from origin of second dorsal fin backward and downward to anal-fin base; pectoral-fin base scaled; anterior 3 spines of first dorsal fin greatly prolonged and filamentous, extending posteriorly to a little beyond base of seventh segmented ray of second dorsal fin; caudal fin long, lanceolate; in preservative, cheek, operculum and nape with several pale spots; a series of 4 dusky blotches on side of body.

Description. In the following description, the values where we take bilaterally are separated by a slash, the first value representing the left count. Dorsal-fin rays VI-I, 11; anal-fin rays I, 11; pectoral-fin rays 19/19; pelvic-fin rays I, 5/I, 5; longitudinal scale count 31/30; transverse scale count from anal-fin origin dorsoanteriorly to first dorsal-fin base 10/9; transverse scale count from anal-fin origin dorsoposteriorly to second dorsal-fin base 9/8; transverse scale count from second dorsal-fin origin ventroposteriorly to anal-fin base 8/9; predorsal scale 1; circumpeduncular scales 12; gill rakers 3+8; pseudobranchial filaments 8.

Color in alcohol. Head and body pale brown; dorsal, anal, caudal and pectoral fins pale; all pigmented patterns already faded, except for middle of pelvic fins dusky. Color in the line drawing of the holotype provided by Weber (1913) and Koumans (1953) is as follows: a series of 4 dusky blotches on midlateral body; first dorsal fin entirely covered by numerous dense melanophores; cheek and upper part of operculum covered by numerous dense melanophores, with several small pale spots (Koumans noted "some pearl like spot on cheek, opercle and nape").

Distribution and habitat. The holotype of this species was collected from the Ceram Sea, Indonesia, at the depth of 118 m. It had been known only by the holotype until recently; although we have not examined the voucher specimen(s), Hutchins (2001) reported it from Western Australia.

Remarks. Weber (1909) described *Gobius* (*Oxyurichthys*) *longimanus* based on a single specimen from the Ceram Sea. Later, Koumans (1953) listed it as *Oxyurichthys longimanus*. Koumans correctly accounted that this species had "In interorbital anteriorly and posteriorly in median line an open pore"; as confirmed in this study, this means that it has unpaired pores C and D, indicating it belongs to the gobiid subfamily

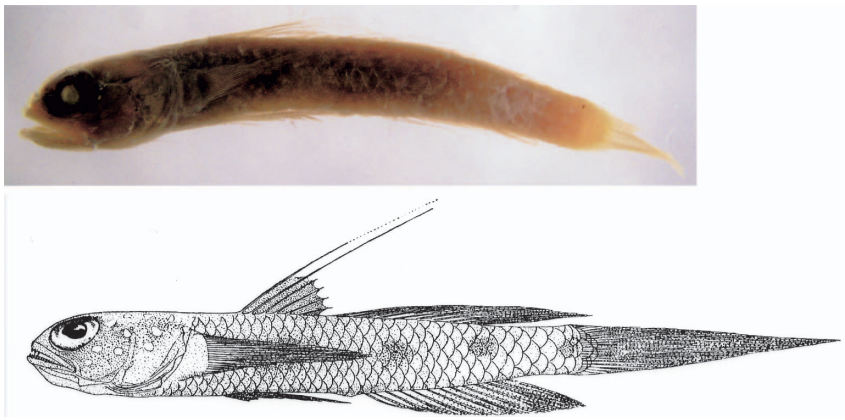

Fig. 5. *Vanderhorstia longimanus.* Top) ZMA 110.978, holotype of *Gobius* (*Oxyurichthys*) *longimanus*, female, 25.2 mm SL, Ceram, Indonesia, photographed by K. Shibukawa; bottom) line drawing of the holotype [after Weber, 1913 (horizontally reversed)].

Gobiinae (sensu Pezold, 1993). *Oxyurichthys* Bleeker, 1857, is the gobionelline genus (sensu Pezold, 1993), and has a paired pore C (Akihito *et al.*, 1984, 1993, 2002; Pezold, 1991, 1993, 1998).

On the contrary, there are several differences between the description made by the previous authors and the actual features of the holotype in the number of scales [e.g., Koumans (1953) noted "Nape naked before first dorsal fin"], fin rays (i.e., "9?" and "12" segmented rays in second dorsal and anal fins, respectively), and teeth rows (i.e., "Teeth in upper jaw in one row") on jaws. Actual meristic counts in the holotype are given above; also, likewise the other species of *Vanderhorstia*, there are 3–4 rows of teeth anteriorly on each jaw in the holotype. Furthermore, according to the description and illustration made by the previous authors, first and second spines of first dorsal fin are prolonged in the holotype (see Fig. 4); nevertheless, actually, anterior 3 spines are greatly elongate and filamentous (third spine longest, its length 37.0% of SL).

Arrangement of cephalic sensory-papillae rows of the holotype (=only examined specimen) of *Gobius* (*Oxyurichthys*) *longimanus* is quite difficult to see, and not illustrated here. Nevertheless, the second author confirmed at least the following features on the specimen: row *a* comprising 3 papillae; row *c* comprises 4 papillae; anterior end of row *b* at mid-point between anterior end of row *a* and posterior end of row *c* (at least on right side of head); condition of row *cp* and posterior part of row *b* uncertain; a pair of sensory papillae just behind chin (=row *f*).

In addition to these features, the other general characteristics of the holotype of *Gobius* (*Oxyurichthys*) *longimanus* also agree well with those of the large-scale group of *Vanderhorstia*. This species, *V. longimanus*, is most similar to the other deep-dwelling congener, *V. puncticeps*, sharing relatively slender body (its depth 13.0–15.1% of SL), short jaws (jaw length 12.4–12.7% of SL), slender caudal peduncle (its depth 43.9–47.1% of its length) and long, lanceolate caudal fin, as well as similar meristic counts (e.g., usually VI-I, 11 dorsal-fin rays; I, 11 anal-fin rays; 19–20 pectoral-fin rays; 26–31 longitudinal scales; 8–9 transverse scales from origin of second dorsal fin downward and backward to base of anal fin); these are also similar in their small body size (largest known specimen, 39.9 mm SL). *Vanderhorstia longimanus* is, however, readily distinguished from *V. puncticeps* in having: scales on base of pectoral fin (vs. base of pectoral fin naked in *V. puncticeps*); single predorsal scale (vs. none); anterior 3 spine of first dorsal fin greatly prolonged and filamentous, extending

posteriorly to slightly beyond base of seventh segmented ray of second dorsal fin when adpressed (vs. spines of first dorsal fin slightly prolonged, extending posteriorly to base of first, second or third segmented ray of second dorsal fin); pale spots on head and nape more or less circular (vs. irregular shaped pale markings on cheek, operculum and nape).

Vanderhorstia puncticeps (Deng and Xiong *in* Xu *et al.*, 1980)

(New Japanese name: Ho'obeni-otohime-haze)

(Figs. 1D and 2B; Table 1)

Ctenogobius puncticeps Deng and Xiong *in* Xu *et al.*, 1980: 180 (original description); Cheng and Zheng, 1987: 446, 1336 (brief description in key and line drawing).

Vanderhorstia sp. Shibukawa and Suzuki, 2004: 118 (note on specimen; Sagami Bay, Pacific coast of Honshu, Japan).

Material examined. BSKU 77244, 1 specimen, male, 30.3 mm SL, Tosa Bay, off Kochi Prefecture of Shikoku, Japan (33°18.22′N, 133°36.08′E–33°17.00′N, 133°34.22′E), 120–123 m depth, 2 Feb. 2006, R/V *Kotaka-maru*; BSKU 77247, 1 specimen, Tosa Bay, off Kochi Prefecture, Shikoku, Japan (33°18.42′N, 133°36.28′E 33°17.85′N, 133°35.82′E), 120–121 m depth, 2 Aug. 2005, R/V *Kotaka-maru*; NSMT-P R798, 1 specimen, male, 39.9 mm SL, Kan'non-tsukadashi, Amadaiba, Sagami Bay, Pacific coast of Honshu, Japan, 60 m depth, 20 July 1952.

Diagnosis. *Vanderhorstia puncticeps* is distinguished from the congeners in having the following combination of characters: 11–12 (usually 11) segmented rays on second dorsal fin; 26–27 (−30?) longitudinal scale count; no predorsal scales; 8 transverse scales from origin of second dorsal fin backward and downward to anal-fin base; pectoral-fin base naked; anterior 3 spines of first dorsal fin frequently elongate and filamentous, extending posteriorly to base of first, second or third segmented ray of second dorsal fin; connecting membrane between innermost rays well developed; when freshly collected, irregular shaped yellow (pale in preservative) markings on cheek and operculum; oblique narrow yellow line from posterior end of eye to nape; small bright yellowish red spot on center or anteroventral part of operculum; ca. 9 narrow yellow vertical bars on body; distal tip of first dorsal fin vivid red; narrow yellow longitudinal band on middle of anal fin.

Description. Following descriptions are chiefly based on 2 of 3 specimens examined, i.e., BSKU 77244 and NSMT-P R798; many characteristics of the remaining examined specimen, BSKU 77247, are not confirmable, since the specimen is heavily damaged. The frequency of each count is given in the parentheses following relevant count. Dorsal-fin rays VI-I, 11 (2) or VI-I, 12 (1); anal-fin rays I, 11 (2); pectoral-fin rays 20 (5); pelvic-fin rays I, 5 (6); segmented caudal-fin rays 9+8 (2), including 7+7 (1) or 8+8 (1) branched rays; dorsal unsegmented caudal-fin rays 7 (1) or 8 (1); ventral unsegmented caudal-fin rays 7 (2); longitudinal scale count 26 (1) or 27 (3); transverse scale count from anal-fin origin dorsoanteriorly to first dorsal-fin base 9 (2) or 10 (2); transverse scale count from anal-fin origin dorsoposteriorly to second dorsal-fin base 8 (3) or 9 (1); transverse scale count from second dorsal-fin origin ventroposteriorly to anal-fin base 8 (4); predorsal scales 0 (2); circumpeduncular scales 12 (2); gill rakers 2+9 (1) or 3+9 (1); pseudobranchial filaments 8 (1) or 9 (1).

Coloration when freshly collected (based on color photographs of BSKU 77244, Fig. 2C). Ground color of head grayish white tinged with pink ventrally, light orange brown or dark grayish brown dorsally; cheek and operculum with several irregular-shaped small yellow markings, those along posterior part of upper jaw longest; a small bright yellowish red spot on center of anteroventral part of operculum; iris dull yellow or bronze, darkened dorsally; narrow oblique yellow line from posterior end of eye to nape; ground color of body grayish white, slightly tinged with pink; belly pale; about 9 narrow vertical yellow bars on side of body; a series of 4 irregularly shaped dark brown blotches on midlateral body, the posteriormost one at middle (or slightly posterior part) of caudal peduncle; first dorsal fin translucent, tinged with light gray, many yellow spots or yel-

low longitudinal line; dorsal tip of first dorsal fin bright red; second dorsal fin translucent, tinged with light gray (darkened dorsoposteriorly), with many small yellow spots; anal fin white, tinged with gray distally, with a narrow yellow longitudinal stripe at middle; caudal fin translucent, margined narrowly with yellow dorsally, with a narrow arc-shaped yellow line at anterior part, indistinct dusky blotch just behind base of the fin, several yellow elongate spots or short lines at middle and posterior parts, and a narrow submarginal yellow band along ventral margin; dorsal part of caudal fin narrowly margined with yellow; middle of caudal fin with several yellow spots or short lines; pectoral fin translucent; pelvic fin pale, with numerous minute melanophores.

Color in alcohol. Similar to color when freshly collected, except as follows: all yellowish, pinkish and reddish markings on head body turn to pale; all whitish, yellowish and reddish markings of fins turn to translucent.

Distribution and habitat. The specimens examined here were collected from off the Pacific coasts of temperate area of Japan, 60–123 m depths. Type specimens of *Ctenogobius puncticeps* (=*Vanderhorstia puncticeps*) were collected at the depths of 76–98 m in the East China Sea, off Wenzhou, Zheijiang Province of China.

Remarks. The examined specimens agree well with the original description of *Ctenogobius puncticeps* made by Deng and Xiong *in* Xu *et al.* (1980). The species is clearly assigned to the large-scale group of *Vanderhorstia* by having all diagnostic features of this group listed above. *Ctenogobius* is the gobionelline genus (Pezold, 1993, 2004), known only from the Americas; it is readily distinguished from *Vanderhorstia* in having, e.g., paired pore C (vs. unpaired), distinct transverse pattern of sensory-papillae rows on cheek (vs. longitudinal pattern), P-V 3/I II II I 0/9 (vs. 3/II II I I 0/9), 2 epurals (vs. single).

Although almost all color patterns have been already faded, the specimen (NSMT-P R798) reported as unidentified species by Shibukawa and Suzuki (2004) is re-identified as *Vanderhorstia puncticeps* in this study. The specimen, collected from Sagami Bay of Honshu, Japan, represents the northernmost record for the species.

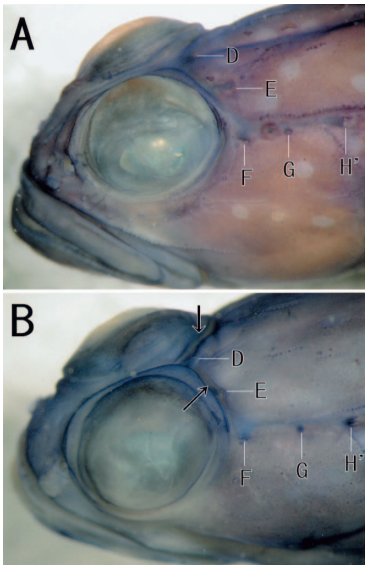

Fig. 6. Dorsolateral views of heads of two species of *Vanderhorstia*, showing cephalic sensory canal pores (indicated by roman uppercase letters) and trough just behind eye (indicated by arrows). A: *Vanderhorstia auropunctata*, KPM-NI 2791, female, 58.7 mm SL; B: *Vanderhorstia rapa*, NSMT-P 73119, holotype, female, 50.3 mm SL. Photographed by K. Shibukawa.

Vanderhorstia rapa sp. nov.

(New Japanese name: Nanohanafubuki-haze)

(Figs. 1E, 2C, 4F–G and 6B; Table 1)

Vanderhorstia sp. 7: Senou *et al.*, 2004: 367 (underwater photograph and short description; Kochi Prefecture, Shikoku, Japan)

Holotype. NSMT-P 73119, 50.3 mm SL, female, off Sankakubae, Kashiwa-jima Island, off southwest coast of Shikoku, Japan, 37 m depth, 23 July 1997, collected by A. Iwata.

Diagnosis. *Vanderhorstia rapa* is distinguished from the congeners in having the following combination of characters: 11 segmented rays on second dorsal fin; 33–35 longitudinal scale count; no predorsal scales; 11–12 transverse scale count from origin of second dorsal fin

backward and downward to anal-fin base; pectoral-fin base naked; third spine of first dorsal fin longest, slightly elongate and filamentous; sensory-papillae row *c* comprising four sensory papillae; a deep trough along posterior margin of eyes (Fig. 5B); first dorsal fin with numerous minute scattered yellow spots and no yellow submarginal lines; four faint brownish (tinged with yellow) mid-lateral blotches (rather than saddle-like bars) on body.

Description. In the following description, the values where we take bilaterally are separated by a slash, the first value representing the left count. Dorsal-fin rays VI-I, 11; anal-fin rays I, 11; pectoral-fin rays 20/21; pelvic-fin rays I, 5/I, 5; segmented caudal-fin rays 9+8, including 7+7 branched rays; dorsal unsegmented caudal-fin rays 8; ventral unsegmented caudal-fin rays 8; longitudinal scale count 33/35; transverse scale count from anal-fin origin dorsoanteriorly to first dorsal-fin base 16/16; transverse scale count from anal-fin origin dorsoposteriorly to second dorsal-fin base 11/11; transverse scale count from second dorsal-fin origin ventroposteriorly to anal-fin base 12/11; predorsal scales 0; circumpeduncular scales 12; gill rakers 3+11/3+10; pseudobranchial filaments 12/11.

Color when alive or fresh [based on color photographs of holotype, Fig. 2C, and underwater photographs found in, e.g., Senou *et al.* (2004: 367)]. Ground color of head and body pale, slightly grayish dorsally; cheek, operculum, occipital region, nape and body scattered with numerous small vivid-yellow spots (smaller than ca. one-third of pupil); 2 vertical yellow lines on belly; suborbital area slightly darkened, with a broad yellow vertical bar; yellow line along dorsal margin of upper jaw; 4 large, faint brownish (tinged with yellow) blotches on mid-lateral body; first blotch below first dorsal fin, second blotch below anterior half of second dorsal fin, third blotch on anteriormost part of caudal peduncle, and fourth and posteriormost blotch at caudal-fin base; 4 indistinct, shallow saddles on body; first saddle around posterior half of first dorsal-fin base, second saddle at middle of second dorsal-fin base, third saddle just behind posterior end of second dorsal fin, and fourth and posteriormost saddle just above lateral blotch at caudal-fin base; first dorsal fin translucent and slightly whitish, with ca. 8–9 irregular longitudinal rows of small yellow spots; second dorsal fin translucent and slightly whitish, with 3 longitudinal rows of small yellow spots (spots on distal row larger than those on proximal two rows); anal fin slightly whitish, a little tinged with blue distally; soft anal-fin rays tinged with yellow; caudal fin translucent and slightly whitish, with many elongate yellow spots on middle and upper part; rays of ventral half of caudal fin tinged with yellow; fin membranes of lower part of caudal fin a little tinged with blue; pectoral fin translucent; pelvic fin pale white.

Color in alcohol. Similar to live coloration, except as follows: ground color of head and body pale yellow or pale brown, becoming darkened dorsally; all yellow spots on head, body and fins pale (these spots on body quite indistinct, exclusive of those on dusky areas); bluish areas of fins dusky; iris entirely blackish.

Distribution and habitat. *Vanderhorstia rapa* is described based on a single specimen from Kashiwa-jima Island, off southwest coast of Shikoku, Japan. It is found in the coarse sandy bottom around rubble area (25–50 m depths) in Kochi Prefecture of Shikoku, and symbiotically associates with the alpheid shrimps (Senou *et al.*, 2004). A specimen (Fig. 4H), photographed at the depth of 39 m in Izu-oshima Island of Izu Islands, is provisionally identified as *V. rapa*, judging from its coloration of head, body and fins, and squamation.

Etymology. The new species is named *Vanderhorstia rapa* (Latin *rapum*, meaning "turnip" or "rape"), comparing its minute golden yellow spots on head, body and fins to the rape blossoms.

Remarks. *Vanderhorstia rapa* quite resembles *V. auropunctata* in general physiognomy, and we have once considered that the former might be possibly the intra-specific color variant of the latter. However, subsequent detail examination

based on the actual specimens reveals that these 2 are distinguished in size of jaws (jaw length 50.8% of head length in *V. rapa* vs. 43.9–44.1% in *V. auropunctata*), shape of trough along posterior margin of eyes (distinct and deep in *V. rapa* vs. indistinct and shallow in *V. auropunctata*), elongation pattern of spines of first dorsal fin (third spine longest in *V. rapa* vs. fourth spine subequal or longer than third spine in *V. auropunctata*), and number of sensory papillae on row *c* (4 in *V. rapa* vs. 5 in *V. auropunctata*), as well as discrepancies in coloration of fins and body. Because all examined specimens of these species are females, it appears to suggest that these differences are not linked to gender.

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Literature Cited

Akihito, Prince. 1984. Suborder Gobioidei. Pages 236–238 *in* H. Masuda, K. Amaoka, C. Araga, T. Uyeno and T. Yoshino, eds. The Fishes of the Japanese Archipelago. English text. Tokai Univ. Press, Tokyo.

Akihito, A. Iwata, K. Sakamoto and Y. Ikeda. 1993. Gobioidei. Pages 997–1087 *in* T. Nakabo, ed. Fishes of Japan with Pictorial Keys to the Species. Tokai Univ Press, Tokyo. (In Japanese).

Akihito, K. Sakamoto, Y. Ikeda, K. Sugiyama. 2002. Gobioidei. Pages 1139–1310 *in* T. Nakabo, ed. Fishes of Japan with Pictorial Keys to the Species. Tokai Univ Press, Tokyo.

Allen, G. R. and P. Munday. 1995. Description of four new gobies (Gobiidae) from the western Pacific Ocean. *Revue Francaise d'Aquariologie Herpetologie*, 22(3/4): 99–104.

Allen, G. R. and J. E. Randall. 2006. *Vanderhorstia nobilis*, a new species of shrimpgoby from Indonesia and the Philippines. Auga, *International Journal of Ichthyology*, 12(1): 39–44.

Allen, G. R., R. Steen, P. Humann and N. DeLoach. 2003. Reef Fish Identification. Tropical Pacific. New World Publications, Inc., Florida, and Odyssey Publishing, California. 480 pp.

Anker, A. 2000. Taxonomic problems of the goby-associated species of *Alpheus* (Decapoda, Alpheidae). I.O.P. *Diving News*, 11(8): 2–7. (In Japanese with English abstract.)

Barnard, K. H. 1937. Further notes on South African marine fishes. *Annals of the South African Musum*, 32(6): 41–67, pls. 6–8.

Birdsong, R., E. O. Murdy and F. Pezold. 1988. A study of the vertebral column and median fin osteology in gobioid fishes with comments on gobioid relationships. *Bulletin of Marine Science*, 42(2): 174–214.

Bleeker, P. 1857. Index descriptionum specierum piscium bleekerianarum in voluminibus I ad XIV diarii societatis scientiarum indo-Batavae. *Natuurkd. Tijdschr. Neder. Indië*, 14: 447–486.

Bleeker, P. 1874. Notice sur les genres *Amblyeleotris*, *Valenciennesia* et *Brachyeleotris. Versl. Akad. Amsterdam* (Ser. 2), 8: 372–376.

Cheng, Q. and B. Zheng. 1987. Systematic synopsis of Chinese fishes. Science Press, Beijing. xxiii+1458+iii pp. (In Chinese.)

Fourmanoir, P. 1957. Poissons Téléostéens des eaux malgaches du Canal de Mozambique. *Memoires l'Institut Scientifique de Madagascar*, Ser. F, 1: 1–316.

Franz, V. 1910. Die Japanischen Knochenfische der Sammlungen Haberer und Doflein. Abhandlungen der Math.-Phys. Klasse der K. Bayer, *Akademie der Wissenschaften*, 4(Suppl. 1): 1–135, pls. 1–11.

Greenfield, D. W. and K. R. Longenecker. 2005. *Vanderhorstia bella*, a new goby from Fiji (Teleostei: Gobiidae). *Proceedings of the California Academy of Sciences*, 56(32): 619–623.

Hayashi, M. and T. Shiratori. 2003. Gobies of Japanese Waters. TBS Britannica Co. Ltd., Tokyo.

Hoese, D. F. 1983. Sensory papilla patterns of the cheek lateralis system in the gobiid fishes *Acentrogobius* and *Glossogobius*, and their significance for classification of gobioid fishes. *Records of the Australian Museum*, 35: 195–222.

Hubbs C. L. and K. F. Lagler. 1958. Fishes of the Great

Lakes Region. Cranbrook Institute of Science, Bloomfield Hills, Michigan. vii+213 pp., 44 pls.

Hutchins, J. B. 2001. Checklist of fishes of Western Australia. *Records of the Western Australian Museum*, Supplment, (63): 9–50.

Klausewitz, W. 1974. *Eilatia latruncularia* n. gen. n. sp. und *Vanderhorstia mertensi* n. sp. vom Golf von Aqaba (Pisces: Gobiidae: Gobiinae). *Senckenbergiana Biologica*, 55(4/6): 205–212.

Koumans, F. P. 1953. Gobioidea. Pages i-xiii+1–423 *in* M. Weber and L. F. de Beaufort, eds. Fishes of the Indo-Australian Archipelago, X. E.J. Brill, Leiden.

Kuiter, R. H. and T. Tonozuka. 2001. Indonesian Reef Fishes. Zoonetics, Melbourne. vi+893 pp.

Lachner, E. A. and J. F. McKinney. 1981. A new fish species of the genus *Vanderhorstia* (Teleostei: Gobiidae) from the Amirante Islands, Indian Ocean. *Proceedings of the Biological Society of Washington*, 93(4): 963–970.

Leviton, A. E., R. H. Gibbs, Jr., E. Hartel and C. E. Dawson. 1985. Standards in herpetrogy and ichthyology: Part I. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia*, 1985(3): 802–832.

Miller, P. J. 1986. Gobiidae. Pages 1019–1085 *in* P. J. P. Whitehead, M.-L. Bauchot, J.-C. Hureau, J. Nielsen & E. Tortonese, eds. Fishes of the North-easternAtlantic and the Mediterranean. UNESCO, Paris.

Mishiku, A. and H. Senou. 1996. *Vanderhorstia auropunctata* (Tomiyama, 1955). *I.O.P. Diving News*, 7(11): 1.

Pezold, F. 1991. The status of the gobioid genus *Paroxyurichthys*. *Japanese Journal of Ichthyology*, 37(4): 344–353.

Pezold, F. 1993. Evidence for a monophyletic Gobiinae. *Copeia*, 1993(3): 634–643.

Pezold, F. 1998. Three new species of *Oxyurichthys* (Teleostei: Gobiidae) from the Indian and Pacific Oceans. *Copeia*, 1998(3): 687–695.

Pezold, F. 2004. Phylogenetic analysis of the genus *Gobionellus* (Teleostei: Gobiidae). *Copeia*, 2004(2): 260–280.

Randall, J. E., K.-T. Shao and J.-P. Chen. 2003. A review of the Indo-Pacific gobiid fish genus *Ctenogobiops*, with descriptions of two new species. *Zoolical Studies*, 42(4): 506–515.

Satapoomin, U. and R. Winterbottom. 2002. Redescription of the gobioid fish *Cryptocentrus pavonioides* (Bleeker, 1849), with notes on sexual dichromatism in shrimp gobies. Aqua, *Journal of Ichthyology and Aquatic Biology*, 5(2): 53–64.

Senou, H., T. Suzuki, K. Shibukawa and K. Yano. 2004. A Photographic Guide to the Gobioid Fishes of Japan. Heibonsha, Tokyo. 536 pp.

Shibukawa, K. and A. Iwata, 2005. Review of the Shrimp-associated gobies of the genus *Flabelligobius* (Perciformes, Gobiidae) from Japan, with comments on limit of the genus. Page 199. The 7th Indo-Pacific Fish Conference. Abstract book.

Shibukawa, K. and T. Suzuki. 2004. *Vanderhorstia papilio*, a new shrimp-associated goby from the Ryukyu Islands, Japan (Perciformes: Gobiidae: Gobiinae), with comments on the limits of the genus. *Ichthyological Research*, 51(2): 113–119.

Smith, J. L. B. 1956. An interesting new gobioid fish from Madagascar, with a note on *Cryptocentrus oni* Tomiyama, 1936. *The Annals & Magazine of Natural History*, 12th series, Zoology, Botany, and Geology, 9(104): 553–556.

Smith, J. L. B. 1959. Gobioid fishes of the families Gobiidae, Periophthalmidae, Trypauchenidae, Taenioididae and Kraemeriidae of the western Indian Ocean. *Ichthyological Bulletin*, (13): 185–25, pls 9–13.

Tomiyama, I. 1955. Notes on some fishes, including one new genus and three new species from Japan, the Ryukyus and Pescadores. *Japanese Journal of Ichthyology*, 4(1/2/3): 1–15.

Yanagisawa, Y. 1978. Studies on the interspecific relationship between gobiid fishes and snapping shrimp. I. Gobiid fishes associated with snapping shrimps in Japan. *Publications of the Seto Marine Biological Laboratory*, 24(4/6): 269–325.

Weber, M. 1909. Diagnosen neuer Fische der Siboga-Expedition. *Notes Leyden Museum*, 31(note 4): 143–169.

Weber, M. 1913. Die Fische der Siboga-Expedition. E. J. Brill, Leiden. i–xii+1–710 pp., 1–12 pls.

Winterbottom, R. and M. Burridge. 1993a. Revision of the species of *Priolepis* possessing a reduced transverse pattern of cheek papillae and no predorsal scales (Teleostei; Gobiidae). *Canadian Journal of Zoology*, 71: 494–514.

Winterbottom, R. and M. Burridge. 1993b. Revision of Indo-Pacific *Priolepis* species possessing a reduced transverse pattern of cheek papillae and predorsal scales (Teleostei; Gobiidae). *Canadian Journal of Zoology*, 71: 2056–2076.

Winterbottom, R., A. Iwata and T. Kozawa. 2005. *Vanderhorstia nannai*, a new species of burrow-associated goby from Palau and the Philippines (Pisces: Gobiidae). *Aqua, Journal of Ichthyology and Aquatic Biology*, 9(3): 109–114.

Xu, C., S. Deng, G. Xiong and H. Zhan. 1980. Two new fishes from East China Sea. *Oceanologia et Limnologia Sinica*, 11(2): 179–184. (In Chinese with English abstract.)

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