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Hastula strigilata revisited: Part I. Pacific Japan, with the description of two new species (Gastropoda: Conoidea: Terebridae)

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Abstract: The complex of species previously regarded as *Hastula strigilata* (Linnaeus, 1758) in Japan is reassessed and two new species are added to the Japanese fauna.

Introduction: Based on available material from various private and institutional collections, we must admit that *Hastula strigilata* (Linnaeus, 1758) has been ill-studied and even underappreciated. Largely due to the iconographic work of Bratcher & Cernohorsky (1987), the so-called intraspecific variability of *H. strigilata* was readily accepted by subsequent authors, including the present second author in the past (Terryn, 2007). Recent molecular results (Gorson et al., in prep.) also hint towards a number of cryptic species in what we would have called *H. strigilata* in the past. Material from all over the Indian and Pacific Ocean is scattered in various collections, often lacking discriminative features such as complete and accurate locality data, protoconch, soft tissue etc…, making an overall study virtually impossible within a lifetime.

Here we embark on a first of probably many articles, which will cautiously try to unravel some of the cryptic species surrounding the taxon *H. strigilata.* Here we attempt a first, yet partial revision of the complex in Japanese waters, at present excluding the complex of species surrounding *Hastula verreauxi* (Deshayes, 1857). The latter complex will be revised at a later stage as a whole and not per geographic area, as we have encountered a smaller number of cryptic species compared to the *H. strigilata*-complex.

As most of the cryptic species in the *H. strigilata*-complex possess a protoconch of less than 2.5 whorls, which is in line with preliminary findings of their respective (much smaller) ranges (in contrast to the general belief that the species is present throughout the Indo-Pacific). Therefore the complex will be largely tackled per smaller geographical area (i.e. Indian Ocean, remote Pacific islands, Indonesia, Australia etc…), and the study will revise a number of morphologically allied species at the same time.

Here a first result is shown for the "*H. strigilata*-complex" in Japanese waters. *Hastula hamamotoi* Tsuchida & Tanaka, 1999 is figured and annotated, *Hastula nipponensis* Kuroda & Oyama *in* Kuroda, Habe & Oyama, 1971 is assessed and lifted out of oblivion and often poor use ànd additionally two new, previously undocumented species are described: *Hastula ogasawarana* sp. nov. and *Hastula kiiensis* sp. nov. Surprisingly, the presence of the actual taxon *H. strigilata* in Japanese waters remains unconfirmed.

Abbreviations:

LSL:	Linnean Society of London, England
MC:	Private collection of Mitsuo Chino, Japan
MNHN:	Muséum national d'Histoire naturelle, Paris, France
NHMUK:	Natural History Museum, London, England
NSMT:	National Museum of Nature and Science, Tokyo, Japan
YT:	Private collection of Yves Terryn, Belgium

Systematics: We define the *H. strigilata*-complex shell-morphologically as follows: Indo-Pacific species of *Hastula* with generally a characteristic brown-dotted subsutural area and round-crested or blunt axial ribs. At present (WoRMS – 11/2018), the following species would be included: *Hastula strigilata* (Linnaeus, 1758)

(see Pl. 1, Fig. 13) (*H. argenvillii* Deshayes, 1859 (here regarded as sole confirmed synonym; see Pl. 1, Fig. 12), *H. hamamotoi* Tsuchida & Tanaka, 1999 (Pl. 1, Figs 14-16), *H. acumen* (Deshayes, 1859) (see Pl. 1, Fig. 10) and *H. parva* (Baird, 1873) (see Pl. 1, Fig. 9). Fedosov et al. (in prep.) already raises *Hastula verreauxi* (Deshayes, 1857), rendering a total of 5 valid species.

Excluded from this complex are thus *Hastula matheroniana* (Deshayes, 1859) and *H. rufopunctata* (E. A. Smith, 1877) based on their different axial rib-morphology, which clearly separates them from the aforementioned species.

Preliminary findings suggest that there is a number of cryptic species surrounding *Hastula verreauxi* (Deshayes, 1857) (see Pl. 1, Fig. 11), which is generally a more obese and heavier shell, justifying treating it as a separate complex, the topic of a future revision. While *H. parva* has a white and discretely sculptured shell, it is also easily set apart from the remaining species. What remains are only three at first sight well-separable taxa, but study of a vast amount of material from the Indian and the Pacific Ocean shows that there are a number of cryptic species within the complex, in the past often identified as *H. strigilata,* merely based on intraspecific variability. Yet, we have found that these differences, although at first sight small, are constant and often geographically limited. As material from various collections containing Japanese specimens became available for study, we thought it would be appropriate to tackle this fauna first.

We here discuss five species within the "*H. strigilata*-complex", one of which is raised out of oblivion and 2 are newly described. The species in the other "complexes" (*verreauxi*, *matheroniana*, *rufopunctata*) will be tackled separately.

The systematics for the species described and discussed in the present paper follows the systematics as proposed by Fedosov et al. (in prep.). For information on types held in the NHMUK, we refer to Salvador & Pickering (2017)

Class **GASTROPODA** Cuvier, 1797
Order **NEOGASTROPODA** Wenz, 1938
Superfamily **CONOIDEA** Fleming, 1822
Family **TEREBRIDAE** Mörch, 1852
Subfamily **Terebrinae** Mörch, 1852
Genus ***Hastula*** H. & A. Adams, 1853

Hastula hamamotoi Tsuchida & Tanaka, 1999
Pl. 1, Figs 14-16

A rather recently-described and well-documented species, virtually absent from collections, with a characteristic yellow to orange coloration, larger maximum size than all other *Hastula* from Japan, possessing a mammilate protoconch of about 2 whorls (*fide* Tsuchida & Tanaka, 1999, authors' material without (complete) protoconch) and a reduced or almost obsolete axial sculpture that only consists of faint riblets, confined to a small subsutural section on mature whorls; the remainder of the whorl is smooth.
The species is reported from depths between 80 and 120 m, yet the figured material (Figs 14 & 16) originates from much shallower depths (10 m). The species is reported from the Izu Islands south to the Amami island group, to Taiwan and the Solomons, but the latter two localities (*fide* Tsuchida & Tanaka: 1999: 160) remain unconfirmed to us. The species was not present in material from various MNHN-expeditions to Taiwan and the Solomon Islands.

Hastula nipponensis Kuroda & Oyama *in* Kuroda, Habe & Oyama, 1971
Pl. 1, Figs 7-8

Originally (and perhaps understandably) described as a subspecies of *H. strigilata* possessing the characteristic brown-dotted white subsutural band and a white, well-defined line at the periphery. Although *H. nipponensis* attains similar sizes as *H. strigilata* (s.s.), it is more obese, has a reduced axial ribbing and a constant coloration of bluish brown, in contrast to the slenderer shape of *H. strigilata* with well-defined axial ribs. They have a similar number of protoconch whorls (2.0-2.5), but the overall size or maximum width of the protoconch of *H. nipponensis* is larger than that of *H. strigilata* (Pl. 1, Figs 11-12). The range comprised by the type material and of studied material in the authors' collections is restricted from Shizuoka to Chiba Prefecture and off-shore Izu Islands. The true range is unknown as many reports are based on misinterpretations and mis-identifications (e.g. Tsuchida *in* Okutani, 2000: 668-669 - as *H. rufopunctata*, understandably caused by the consensus surrounding the opinion of Bratcher & Cernohorsky, 1987). Although *H. nipponensis* was described in 1971, Bratcher and Cernohorsky did not include it in their iconographic work in 1987, hence the taxon was largely forgotten by subsequent authors.

Hastula cf. ***parva*** (Baird *in* Brenchley, 1873)
Pl. 1, Fig. 9

Originally described from "New Caledonia", the species is characterised by a white base colour, an elongated shell with flattened axial ribs, which are confined to the upper third of the whorls, appearing almost obsolete, remainder of whorl virtually smooth; subsuturally ornamented with orangish brown flecks; protoconch translucent brown and of about 1.5 whorls; spirally coloured with a darker brown line which appears to continue as a spiral area of a bluish hue at midwhorl in the teleoconch whorls.

The presence of the species off Okinawa is under further investigation. A fine example of what at first sight appears to be *H. parva* is illustrated by Tsuchida & Kubo (2017: pl. 334, fig. 4 (right specimen only!)), which was earlier figured as *H. acumen* by Tsuchida (2000: pl. 333, fig. 5)). Specimen in question or comparable specimens have not become available for study yet.

Specimens originating from off Australia, in general appearance close to *H. parva* differ from specimens originating from off New Caledonia. The first may prove to be another hitherto undescribed species that will be discussed in a future paper.

Hastula ogasawarana sp. nov.
Pl. 1, Figs 1-2

Type material: Holotype: NSMT-Mo 79010, 17.6 mm. **Paratypes:** all from the type locality: **Paratype 1:** MNHN-IM-2014-7007, 17.1 mm; **Paratype 2:** MC, 19.6 mm; **Paratype 3:** YT, 17.0 mm.

Type locality: Japan, Ogasawara Islands, Chichijima, Miyano-hama Beach, dived at 2 m.

Description (*holotype*): Shell shiny; background colour dark grey with a reddish hue, brown interior of the aperture and columella, columellar fold white; area below the periphery darker tinged. Outline of whorls straight. A subsutural white band is adorned with regularly shaped, relatively large reddish brown spots (as wide as the white band). The protoconch consists of about 1.0-1.5 purplish whorls; transition to teleoconch evident. Spiral sculpture and subsutural band demarcation absent. The axial ribs are broad and flattened, clearly marked at and somewhat protruding above the suture, tinged in the base colour, but fading adapically, becoming obsolete. Columella short, triangular shaped; aperture elongate, siphonal canal somewhat curved outwardly.

Additional information: Largest specimen known measures 19.6 mm (paratype 2). The sculpture and colour/pattern is constant throughout the type series. The protoconch consists of about 1.0-1.5 whorls, consistent with a probably restricted range for a *Hastula*; the brown spotting below the suture is relatively large in comparison to the shell and to the spotting in other species within the complex, yet seems a characteristic feature for *H. ogasawarana, nipponensis* and *hamamotoi* by which they are distinguished from many others in the *H. strigilata*-complex.

Distribution: Only known from the type locality.

Comparison and discussion: Because of its relatively heavier and more obese shell, *H. ogasawarana* sp. nov. is only comparable with *H. nipponensis* and *H. hamamotoi*. The protoconch whorl-count is: 1.0-1.5; about 2.0; about 2.0 (mamillate), respectively, and all are noticeably larger than that of *H. strigilata. H. ogasawarana* sp. nov. lacks the white band at the periphery present in both others; its colour is significantly darker than that of *H. nipponensis*; it has a slightly narrower apical angle and is more prominently rounded at the suture and bears adapically flattened axial ribbing, which is much finer, denser-set and virtually obsolete in the mature whorls of *H. nipponensis* and *H. hamamotoi*.

Derivatio nominis: The species *H. ogasawarana* is named after its type locality, i.e. an island of the Ogasawara Islands.

The proposed Japanese name for the species is *Ogasawara-shichiku.*

Hastula kiiensis sp. nov.
Pl. 1, Figs 3-6

Tsuchida, E. & H. Kubo, 2017: pl. 334, fig. 4 (left specimen only – as *H. parva*)

Type material: Holotype: NSMT-Mo 79011, 23.5 mm. **Paratypes: Paratype 1**: MNHN-IM-2014-7008, from type locality, 21.3 mm; **Paratypes 2-5**: MC, idem, 21.2-22.1 mm; **Paratype 6:** NSMT-Mo 79012, Japan, Okinawa, Zanpa, 19.2 mm; **Paratypes 7-9:** MC, idem, 21.2-24.5 mm; **Paratypes 10-15:** YT, from type locality; 20.7- 22.6 mm.

Type locality: Japan, Wakayama Prefecture, off Minabe.

Description (*holotype*): Shell somewhat shiny, having a somewhat amorphous texture; base colour yellowish tan with a diffuse white band at the periphery and darker-stained below; with a white subsutural band, about a quarter of the width of the whorl, ornamented with diffuse, evenly-spaced, dark-orange to brown circular dots which are half as wide as the white band. Protoconch consisting of about 1.5-2.0 white whorls, transition to teleoconch gradual. Outline of whorls slightly convex. Spiral sculpture and subsutural band demarcation absent. The axial ribs are broad and flat, marked at and only slightly protruding above the suture; only slightly fading at the adapical fifth part of the whorl. Columella short, with a paler plica; aperture elongate, siphonal canal somewhat curved outwardly.

Additional information: The largest specimen known measures 24.5 mm (paratype 9). The sculpture and colour/pattern are constant throughout the type series, with only the base colour varying from light tan to orangish yellow. The protoconch consists of about 1.5-2.0 whorls, consistent with a probably restricted range for a *Hastula*. The species was already figured as *H. parva* (Baird, 1873) by Tsuchida & Kubo (2017: pl. 334, fig. 4 (left specimen only)). The second specimen, the one on the right, under fig. 4, is *H. parva* (specimen originally figured as *H. acumen* by Tsuchida (2000: pl. 333, fig. 5).

Distribution: Known from the type locality and from Cape Zanpa, Yomitan Village, Okinawa Island. The range is probably continuous throughout, although restricted to isolated smaller areas with favourable biotope.

Comparison and discussion: The species is similar to *H. strigilata* in general appearance, but clearly differs in the fainter, broader, more flattened axial ribs, size and shape of subsutural spots, presumably a smaller adult size and the peripheral white band, which is diffuse in *H. kiiensis* and well defined in *H. strigilata*.

H. kiiensis can be further compared with *H. parva* (Baird, 1873) from which it differs in axial sculpture and general coloration. The base colour of *H. parva* is usually white with a bluish hue while *H. kiiensis* has a yellowish tan coloration. Moreover, the axial sculpture is continuous from suture to suture and coarser compared to the more discrete axial sculpture of *H. parva*, which is usually limited to the upper half of the whorl, appearing smooth on the remaining lower half of the whorl. *H. parva* has a slightly wider apical angle, larger-sized protoconch and larger brown dots on the subsutural area.

A species related to *H. kiiensis* from the Indonesian archipelago is under study: it shows a remarkable overall resemblance, yet with a slightly different apical angle, size, shape and colour of protoconch and density and shape of the axial ribs as a few of the more prominent differences.

Derivatio nominis: The species *H. kiiensis* sp. nov. is named for its type locality, Kii Province - the historic name of the present Wakayama Prefecture.

The proposed Japanese name for the species is *Kishuu-shichiku.*

Discussion: The validity of *H. nipponensis* is confirmed, *H. hamamotoi* briefly further discussed and an additional 2 species in the genus *Hastula* are added to the Japanese terebrid fauna. There are reports of specimens from either the abovementioned species (or perhaps others) in the southern part of the Sea of Japan to further southwards to the Ryukyu Islands-chain, but none were available for study. If additional species within the "*H. strigilata*-complex" are encountered in collections, an addendum will be published to discuss the additional information.

The four species discussed and described here all possess a remarkably short-whorled, yet relatively large protoconch for a *Hastula*, indicative of their relatively limited range (contrary to the general belief that "*Hastula strigilata*" is present in the whole Indo-Pacific), which is probably demarcated in the north around the Chiba Prefecture where the waters become too temperate or cold for **Terebridae** and the biotope in general becomes less favourable.

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Plate

1-2: ***Hastula ogasawarana*** sp. nov.
Japan, Ogasawara Islands, Chichijima, Miyano-hama Beach, dived at 2 m.
1a: Holotype, NSMT-Mo 79010, 17.6 mm.
1b: Detail of protoconch.
2: Paratype 1, MNHN-IM-2014-7007, 17.1 mm.

3-6: ***Hastula kiiensis*** sp. nov.
3-5: Japan, Wakayama Prefecture, off Minabe.
3: Paratype 11, YT, 21.0 mm;
4a: Holotype, NSMT-Mo 79011, 23.5 mm.
4b: Detail of protoconch; **5.** Paratype 10, YT, 20.7 mm.
6: Paratype 8, MC, Japan, Okinawa Island, Cape Zanpa, 22.2 mm

7-8: ***Hastula nipponensis*** Kuroda & Oyama *in* Kuroda, Habe & Oyama, 1971
7: MC, Japan, Chiba Prefecture, Tateyama, Heisaura, beached, 28.1 mm.
8a: Holotype, NSMT-Mo 18476, Japan, 'Sagami Bay', 29.5 mm;
8b: Detail of protoconch.

9: ***Hastula parva*** (Baird *in* Brenchley, 1873)
Lectotype,NHMUK 1979153, "New Caledonia", 22.78 mm.

10: ***Hastula acumen*** (Deshayes, 1859)
Lectotype, MNHN, no type locality originally given - Indonesia, Alor Island (SD by Bratcher & Cernohorsky, 1987), 21.2 mm.

11: ***Hastula verreauxi*** (Deshayes, 1857)
Lectotype, MNHN, no type locality originally given, 37.7 mm.

12-13: ***Hastula strigilata*** (Linnaeus, 1758)
12: Syntype of *Hastula argenvillii* Deshayes, 1859, MNHN, no type locality originally given, 35.0 mm.
13: Probable syntype of *Hastula strigilata* (Linnaeus, 1758), LSL, "in O. Asiatico" – Indo-Pacific, 27.2 mm.

14-16: ***Hastula hamamotoi*** Tsuchida & Tanaka, 1999
14: MC, Japan, Tokyo Metropolis, Izu Islands, Hachijo Island, in sand pumping from 10 m, 37.1 mm.
15: YT, idem, 41.9 mm.
16: Holotype, NSMT-Mo 71435, Japan, Waka-yama Prefecture, West offshore area Kushi-moto, ca. 80 m, 48.1 mm.


Plate 1
1a
2
3
4a
5
6
7
9
8a
1b
4b
8b
10
11
12
13
14
16
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