

“*Ptychodon*” *misoolensis* ADAM & VAN BENTHEM JUTTING, 1939
 a New Guinea Strobilopsid Land Snail
 and Review of the Genus *Enteroplax*

BY

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(1 Text figure; 1 Map)

SINCE PUBLISHING A REVIEW of Pacific Island land snail distributions (SOLEM, 1959 a), I have written several papers (SOLEM, 1959 b, 1964 a, 1964 b) concerning the family position of puzzling genera whose accepted family assignment produced geographically discordant data. During preparation of major monographic reviews on the Pacific Island, Australian, Melanesian and New Zealand endodontid land snails, many additional changes in family position have been discovered. The reclassification of *Ptychodon misoolensis* ADAM & VAN BENTHEM JUTTING, 1939, as *Enteroplax misoolensis* is presented separately because of the great zoogeographic interest inherent in this change.

Basic data on the Strobilopsidae have been summarized by PILSBRY (1927 - 1931, pp. 1 - 63 and 1948, pp. 848 to 868). Subsequent descriptions by HO & LEONARD (1961) of fossil *Strobilops* from the Great Plains and of the Bermuda *S. (Discostrobilops) pilsbryi* and the West Mexican *S. (D.) sinaloa* by MORRISON (1953) do not alter the basic patterns.

The family is common in the Eocene to Pliocene fossil beds of Western Europe, but is absent from the European Pleistocene and Recent faunas. Several species live in the United States and Canada south of about 52° N Latitude and generally east of the 100th meridian. Mid-Pliocene fossils are known from the High Plains regions of Kansas and Oklahoma (TAYLOR, 1960). Records are sparse for Northern Mexico. *Strobilops aenea mexicana* PILSBRY (1927, pp. 32 - 33) is known from near Monterrey, Nuevo Leon and Necaxa, Puebla (also see PILSBRY, 1953, p. 165); *S. sinaloa* MORRISON, 1953, probably from Sinaloa; *S. hubbardi* (A. D. BROWN, 1861) from San Luis Potosi, Mexico (PILSBRY, 1927, p. 49); *S. strebeli* (PFEIFFER, 1862) and *S. veracruzensis* PILS-

BRY, 1927 (pp. 33 - 37) from Vera Cruz; and *S. hannai* PILSBRY, 1931, from Socorro Island, West Mexico. *Strobilops strebeli guatemalensis* HINKLEY, 1927 and *S. salvini* (TRISTAN, 1863) are known from Guatemala. There are three peripheral South American records - *S. helleri* (DALL, 1900) from the Galapagos; *S. brasiliiana* FRED BAKER, 1913 from Pará, Brazil; and *S. morsei* (DALL, 1885) from Puerto Cabello, Venezuela. *Strobilops piratica* PILSBRY, 1930, from Old Providence Island, *S. wenziana* PILSBRY, 1930, from Grand Cayman and forms of *S. hubbardi* (A. D. BROWN) from Bermuda, Cuba and Jamaica comprise the West Indian records. Data on the above are summarized by PILSBRY (1927 to 1931).

Two Asian groups complete the known taxa. The section *Eostrobilops* PILSBRY, 1927, consists of 4 species - *Strobilops nipponica* PILSBRY, 1927 from Yonezawa, Uzen, Japan; *S. hirasei* PILSBRY, 1927 from Cheju, Quelpart Island, Korea; *S. coreana* PILSBRY, 1927, from Pyong-Yang, North Korea; and *S. diodontina* HEUDE, 1885 from Tchen-k'ou, China (probably is Ch'êng-k'ou, northeast Ssuch'uan Province = Szechwan, at about 108° 47' long., 31° 56' lat.).

Enteroplax GUDE, 1899, previously was thought confined to the Philippine Islands. There are 5 named taxa representing 4 species, with available data on the previously included species summarized by PILSBRY (1927 to 1931, pp. 50 - 56). *Strobilops quadrasi* (MOELLEN-DORFF, 1893) from Northern Luzon and *S. polyptychia* (MOELLEN-DORFF, 1887) from Cebu Island are easily recognizable as distinct species. *Strobilops trochospira* (MOELLEN-DORFF, 1887) from Mt. Licos, Cebu Island is quite similar to *E. misoolensis*. FAUSTINO (1930, p. 116) listed these as “*Plectopylis*” in the “*Helicidae*” together

with the endodontid *Stenopylis coarctata* (MOELLENDORFF, 1894). GUDE (1899, p. 149) separated *Enteroplax* as a section, but indicated it probably was of generic level separation. A review of this taxon is presented below.

Enteroplax GUDE, 1899

Low conic to discoidal shells with prominent radial ribs above threaded periphery and in umbilicus, sculpture absent on body whorl below periphery. Edge of parietal callus strongly elevated, upper parietal lamella fusing with it anteriorly. Parietal lamellae 2, extending posteriorly about $\frac{1}{2}$ whorl, upper high and blade-like, smooth or serrate on expanded upper edge, 2nd much lower and usually slightly recessed, rarely with a short and deeply recessed interparietal lamella, sometimes a callus connecting the inner ends of the parietals. No columellar lamella. Palatal wall with 3 to 10 short to long lamellae recessed about $\frac{1}{4}$ to $\frac{1}{3}$ whorl behind aperture, connected posteriorly by a transverse callus. Anatomy unknown.

Type Species: *Plectopylis quadrasi* MOELLENDORFF, 1893, by OD.

Originally considered as related to the corillid genus *Plectopylis*, their strobilopsid nature was recognized by PILSBRY, 1908. References to the early literature are contained in PILSBRY (1927 - 1931, pp. 50 - 56). They are not repeated here in the list of references, although included in the synonymies. While PILSBRY (1948, pp. 848 - 868) continued to treat the family Strobilopsidae as monotypic on the generic level, ZILCH (1959, p. 178) raised *Enteroplax* to generic level. I concur with this decision, since there is a greater morphologic gap between the shell of *Enteroplax* and those classified as subgenera or sections of *Strobilops*, than between any of the latter. The elevation of the parietal callus and development of a threaded edge to the periphery are not extraordinary changes, but their presence in *Enteroplax* and absence from all other groups of *Strobilops*, *s. l.* is sufficient for generic recognition.

The 3 Philippine Island species were previously reported from Luzon, Siquijor, Bohol and Cebu Islands. A new record from Mindanao is added below. The Misool Island *Ptychodon misoolensis* ADAM & VAN BENTHEM JUTTING, 1939, proved to be a fourth species. Specimens of *Enteroplax quadrasi* and *E. polyptychia* were available at Field Museum of Natural History (hereafter FMNH). Through the kindness of Dr. Adolf Zilch, Natur Museum Senckenberg, Frankfurt am Main (hereafter SMF), it was possible to examine specimens of *E. trochospira*. Study of the Misool species was possible through the cooperation of Mrs. W. S. S. van Benthem

Jutting (Zoologisch Museum, Amsterdam, ZMA) and Dr. W. Adam (Institut Royal des Sciences Naturelles de Belgique, IRB). This work was supported by National Science Foundation grants G-16419, GB-3384 and GB-6779. For preparation of the illustrations I am indebted to Miss Margaret Moran. Mrs. Sandra Rendleman, Mrs. Lynda Hanke and Mrs. Rita Mecko assisted in various aspects of this study.

Measurements of the specimens are summarized in Table 1 and enable separation of the entities. All measurements were made with an ocular micrometer to the nearest 0.035 mm. It soon became obvious that the characters used to separate species - number of palatal lamellae, presence or absence of an interparietal lamella, presence or absence of a transverse palatal callus, and degree of serration on the parietals - were highly variable and, in certain cases, that species definitions were based on aberrant conditions. Only 26 adult examples were available. A few statements concerning similarities of populations are possible, but considerably more material will be required before the exact relationships of *Enteroplax quadrasi*, *E. trochospira* and *E. misoolensis* are clarified. The latter species apparently lacks serrations on the parietal lamellae, but the two former have the same apertural dentition and are separable only on size and overlapping shape differences that may be bridged when more populations are sampled.

Outline figures of the Philippine Island taxa, drawn with the aid of a camera lucida on a Wild M-5 microscope, are presented in Figure 1 to indicate the rather subtle shape differences separating *Enteroplax quadrasi* and *E. trochospira*. All indications of radial sculpture have been omitted from the drawings, since there is no interspecific variation in sculptural characters and addition of this feature would have been very time-consuming.

Enteroplax quadrasi (MOELLENDORFF, 1893)

(Figures 1 b, 1 c)

Plectopylis quadrasi MOELLENDORFF, 1893, Nachr. deut. Malak. Gesell. 25 (11-12): 172 - 173 - Siamiam, northern Luzon, Philippine Islds.; GUDE, 1897, Science Gossip 4 (39): 71; figs. 54a - 54e; MOELLENDORFF, 1898, Abhdl. naturf. Ges. Görlitz 22: 122; FAUSTINO, 1930, Philippine Journ. Sci. 42 (1): 116

Plectopylis quadrasi subsp. *boholensis* MOELLENDORFF, 1898, Abhdl. naturf. Ges. Görlitz 22: 123 - Bohol, Philippine Islands (nude name)

Helix (Plectopylis) quadrasi (MOELLENDORFF), HIDALGO, 1891, Mem. Real. Acad. Cienc. Madrid 14: 167 - Buguey, Sitio Siam-Siam en Clavería Sitios Dimacapac y Cabayo en Palanen, Camino de Ambubuc, Prov. Cagayán, Luzon (not the cited figs. on pl. 156, figs. 9, 10)

Table 1
Local Variation in *Enteroplax*

	Number of Specimens	Ribs	Height	Diameter	H/D Ratio	Whorls	D/U Ratio
<i>Enteroplax quadrasi</i>							
Luzon							
FMNH 48337-8	4	87.3 ± 4.19 (82-97)	2.13 ± 0.036 (2.04-2.20)	3.58 ± 0.068 (3.42-3.75)	0.596 ± 0.0038 (0.588-0.606)	5 $\frac{3}{4}$ - (5 $\frac{1}{2}$ -6)	3.66 ± 0.085 (3.45-3.86)
Bohol							
FMNH 48341-2	3	88.5 ± 2.04 (86-91)	2.16 ± 0.044 (2.07-2.20)	3.66 ± 0.058 (3.55-3.75)	0.590 ± 0.0062 (0.583-0.598)	6 $\frac{1}{8}$ - (5 $\frac{7}{8}$ -6 $\frac{1}{4}$)	3.35 ± 0.097 (3.17-3.50)
Mindanao							
FMNH 54943	1	107	2.40	3.68	0.652	6 $\frac{1}{4}$	4.31
<i>trochospira</i>							
Cebu							
SMF 9287/6	8	96.8 ± 1.57	2.32 ± 0.030	4.14 ± 0.026	0.561 ± 0.0070	5 $\frac{5}{8}$ +	3.63 ± 0.050
SMF 118092/2		(90-101)	(2.20-2.43)	(4.05-4.24)	(0.535-0.597)	(5 $\frac{1}{2}$ -5 $\frac{3}{4}$)	(3.41-3.88)
<i>misoolensis</i>							
Misool							
ZMA, IRB	6	79.8 ± 8.29 (67-104)	2.63 ± 0.055 (2.43-2.80)	4.18 ± 0.066 (3.88-4.34)	0.629 ± 0.0144 (0.573-0.664)	6 $\frac{1}{8}$ (5 $\frac{7}{8}$ -6 $\frac{3}{8}$)	4.22 ± 0.068 (4.00-4.45)
<i>polyptychia</i>							
Cebu							
FMNH 48339-40	4	115	1.48 ± 0.036 (1.38-1.55)	4.03 ± 0.028 (3.98-4.08)	0.368 ± 0.0109 (0.339-0.388)	5 $\frac{3}{8}$ + (5 $\frac{1}{4}$ -5 $\frac{1}{2}$)	2.83 ± 0.031 (2.75-2.88)

Plectopylis trochospira var. *boholensis* GUDE, 1898, Science Gossip 4 (46): 285, fig. 74 - Bohol, Philippine Islds.

Strobilops (Enteroplax) quadrasi (MOELLENDORFF), WENZ, 1916, Nachr. deutsch. Malak. Gesell. 48 (4): 189; PILSBRY, 1931, Man. Conch. (2) 28: 55-56; pl. 11, figs. 11-14

Strobilops (Enteroplax) quadrasi var. *brunnescens* "MOELLENDORFF," WENZ, 1916, Nachr. deutsch. Malak. Gesell. 48 (4): 189 - nude name

Strobilops (Enteroplax) boholensis (GUDE), PILSBRY, 1931, Man. Conch. (2) 28: 54 - 55; pl. 11, figs. 1 - 4, 7 - 10

Range: Luzon, Bohol and Mindanao, Philippine Islands.

Material: LUZON - Tayabas (1 specimen, FMNH 48388); Palanan (3 specimens, FMNH 48337). BOHOL - Batuan (1 specimen, FMNH 48341); Vilar (2 specimens, FMNH 48342). MINDANAO - east slope of Mt. McKinley, Davao at 7000 feet elevation (1 specimen, FMNH 54943).

Remarks: Separation into two species seems to have resulted from chance inspection of aberrant specimens. The Luzon Island *Enteroplax quadrasi* was reported by MOELLENDORFF as having only 3 palatals, but 3 of the 4 specimens seen by me had 4 palatals and only one had 3 palatals. Similarly, the form described as *boholensis* was

recorded to have an interparietal lamella and 5 palatals, but all material that I saw lacked the interparietal and had only 4 palatals. The size and shape of the Luzon and Bohol specimens are identical except in whorl count and a statistically insignificant difference in D/U ratio (Table 1). Without more differences than revealed by study of these specimens, separation of these populations cannot be maintained. Reported differences in parietal serration are a factor of wear after death and correlate with worn versus unworn external sculpture.

A single shell collected on Mindanao (Figure 1c) has been referred here provisionally. Although identical in size to the other *Enteroplax quadrasi* samples, the shell is obviously higher and with a narrower umbilicus. It has typical parietals and 4 palatals. Whether this is another atypical specimen, or is representative of populations that are consistently higher and with narrower umbilici cannot be known without further collections. In the latter case, subspecific separation may be justifiable.

Enteroplax quadrasi differs from both *E. trochospira* and *E. misoolensis* in size. Other differences are bridged by variation between populations and probably have no great significance.

Enteroplax trochospira (MOELLENDORFF, 1887)

(Figure 1 a)

Plectopylis trochospira MOELLENDORFF, 1887, Jahrb. deutsch. Malak. Gesell. 14 (3): 273-274; plt. 8, figs. 9a-9c - Mt. Licos, Cebu, Philippine Islds.; MOELLENDORFF, 1890, Ber. Senckenb. naturf. Gesell. 1890: 221; MOELLENDORFF, 1897, Abhdl. naturf. Ges. Görlitz 22: 123; GUDE, 1898, Science Gossip 4 (46): 285; figs. 73a-73e; FAUSTINO, 1930, Philippine Journ. Sci. 42 (1): 116

Helix (Plectopylis) trochospira (MOELLENDORFF), HIDALGO, 1890, Mem. Real. Acad. Cienc. Madrid 14: 118, 167 (1891) - Sitio Cambaque en Vilar y Sierra Bullones, Bohol, Philippine Islds. (not cited figs. on plt. 156)

Strobilops (Enteroplax) trochospira (MOELLENDORFF), WENZ, 1916, Nachr. deutsch. Malak. Gesell. 48 (4): 189; PILSBRY, 1931, Man. Conch. (2) 28: 52-53; plt. 11, figs. 5a-5c, 6a-6e

Range: Cebu, Philippine Islands.

Material: CEBU - Mt. Licos (8 specimens, SMF 9287/6 paratypes, SMF 118092/2).

Remarks: Differences in spire shape and elevation (see Figures 1 a to 1 c) between *Enteroplax quadrasi* and *E. trochospira* are subtle. Extremes of both species show a slight overlap. There is a distinct size difference (Table 1) with the height and diameter not overlapping, although the whorl counts are nearly identical. Examined specimens of *E. trochospira* showed 4 (5 specimens) or 5 (1 specimen) palatals that were connected posteriorly by a transverse callus and showed no structural differences from the lamellae seen in *E. quadrasi*. With some hesitation I am accepting them as distinct species.

In size, *Enteroplax trochospira* and *E. misoolensis* are identical, but the latter is distinctly more elevated, has a narrower umbilicus, the parietal lamellae are not serrated above, and averages $\frac{1}{2}$ whorl more.

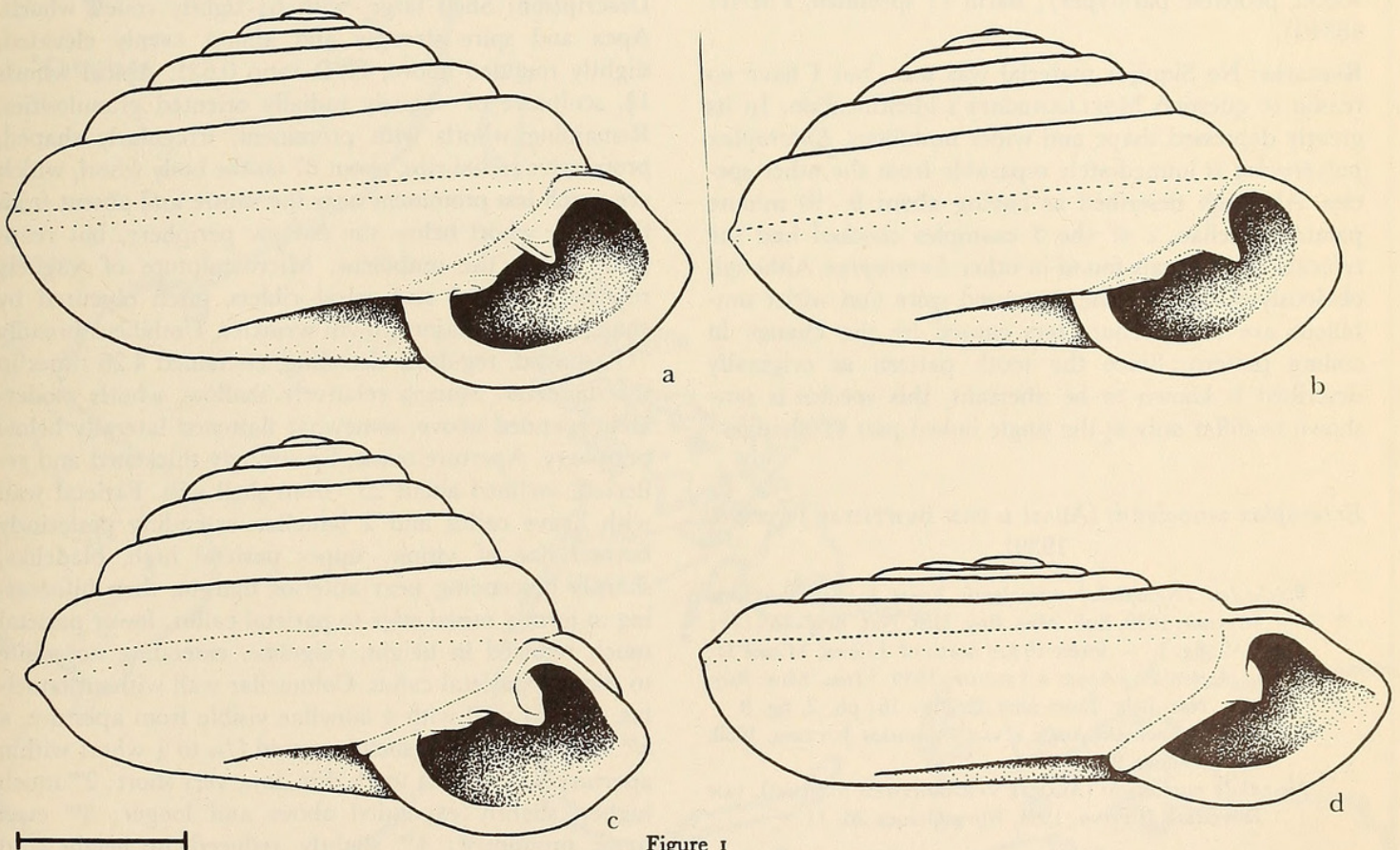


Figure 1

Shells of

a: *Enteroplax trochospira* (MOELLENDORFF), Mt. Licos, Cebu, Philippine Islands; SMF 9287/6; Paratype. b, c: *Enteroplax quadrasi* (MOELLENDORFF), b: Palanan, Luzon, Philippine Islands. FMNH 48337; c: Mt. McKinley, Davao, Mindanao, Philippine Islands; FMNH 54943; d: *Enteroplax polyptychia* (MOELLENDORFF), Mt. Licos, Cebu, Philippine Islands; FMNH 48339. Probable paratype. Scale line equals 1 mm

Enteroplax polyptychia (MOELLENDORFF, 1887)

(Figure 1 d)

Plectopylis polyptychia MOELLENDORFF, 1887, Jahrb. deut. Malak. Gesell. 14 (3): 272-273; plt. 8, figs. 8a-8c - Mt. Licos, Cebu, Philippine Islds.; MOELLENDORFF, 1890, Ber. Senckenb. naturf. Gesell. 1890: 221; MOELLENDORFF, 1897, Abhdl. Naturf. Ges. Görlitz 22: 122 - Siquijor, Philippine Islds.; GUDE, 1898, Science Gossip 4 (40): 102; figs. 55a-d; FAUSTINO, 1930, Philippine Journ. Sci. 42 (1): 116

Helix (Plectopylis) polyptychia (MOELLENDORFF), HIDALGO, 1890, Mem. Real. Acad. Cienc. Madrid 14: 118, 167 (1891) - not the cited figures on plt. 156

Strobilops (Enteroplax) polyptychia (MOELLENDORFF), WENZ, 1916, Nachr. deut. Malak. Gesell. 48 (4): 188 to 189; PILSBRY, 1931, Man. Conch. (2) 28: 52; plt. 12, figs. 14-16

Range: Cebu and Siquijor, Philippine Islands.

Material: CEBU - Mt. Licos (3 specimens, FMNH 48339, probable paratypes); Barili (1 specimen, FMNH 48340).

Remarks: No Siquijor material was seen, but I have no reason to question MOELLENDORFF's identification. In its greatly depressed shape and wider umbilicus, *Enteroplax polyptychia* is immediately separable from the other species. Although described as having about 9-10 minute palatal lamellae, 2 of the 3 examples checked had the typical 3 or 4 palatals found in other *Enteroplax*. Although obviously distinctive, the depressed spire and wider umbilicus are linked characters caused by the change in coiling pattern. Since the tooth pattern as originally described is known to be aberrant, this species is now shown to differ only in the single linked pair of changes.

Enteroplax misoolensis (ADAM & VAN BENTHEM JUTTING, 1939)

Ptychodon (Nesophila) misoolensis ADAM & VAN BENTHEM JUTTING, 1939, Bull. Mus. Roy. Hist. Nat. Belg. 15 (17): 1-3; fig. 1 - forest 10 km north of Lilinta, Misool Is., in *Asplenium*; ADAM & LELOUP, 1939, Mem. Mus. Roy. Hist. Nat. Belg. (hors ser.) 2 (20): 16; plt. 2, fig. 9

Ptychodon misoolensis ADAM & VAN BENTHEM JUTTING, 1958, Nova Guinea 9 (2): 327

Nesophila misoolensis (ADAM & VAN BENTHEM JUTTING), VAN BENTHEM JUTTING, 1964, Nova Guinea 26: 11

Diagnosis: Shell large, diameter 3.89-4.35 mm (mean 4.18 mm) with $5\frac{7}{8}$ - $6\frac{3}{8}$ tightly coiled whorls. Apex and spire strongly elevated, slightly rounded above, H/D ratio 0.573-0.664 (mean 0.629). Umbilicus broadly "U"-shaped, barely decoiling, contained 4.00-4.45 times (mean 4.22) in the diameter, with somewhat shouldered

margins. Upper surface of shell with irregularly protractive radial ribs, 67-104 (mean 79.8) on the last whorl, whose interstices are less than twice their width. Major ribs absent from below periphery of body whorl but reappearing within umbilicus. Periphery of body whorl protrudingly and narrowly keeled. Aperture ovate, inclined about 25° from the shell axis. Parietal lamellae 2, extending well beyond line of vision: upper high, blade-like, attaining its greatest height at anterior end, becoming bifurcated and forming raised edge to parietal callus; lower less than $\frac{1}{2}$ the height of the upper, stopping short of parietal callus edge. Palatal wall with 4-5 short lamellae recessed $\frac{3}{16}$ to $\frac{1}{4}$ whorl within aperture.

The smooth parietal lamellae, moderately narrower umbilicus, slightly more elevated spire and higher whorl count separate *Enteroplax misoolensis* from the Philippine *E. trochospira*. *Enteroplax quadrasi* is perhaps most similar in shape, but differs in its smaller size and serrated parietal lamellae.

Description: Shell large, with $6\frac{1}{4}$ tightly coiled whorls. Apex and spire strongly and almost evenly elevated, slightly rounded above, H/D ratio 0.621. Apical whorls $1\frac{5}{8}$, sculpture of vaguely radially oriented granulosities. Remaining whorls with prominent, irregularly shaped, protractive radial ribs, about 67 on the body whorl, which are much less prominent near the suture and absent from the body whorl below the narrow periphery, but reappear within the umbilicus. Microsculpture of vaguely reticulated radial and spiral riblets, often obscured by changes in the major growth wrinkles. Umbilicus broadly "U"-shaped, regularly decoiling, contained 4.26 times in the diameter. Sutures relatively shallow, whorls moderately rounded above, somewhat flattened laterally below periphery. Aperture ovate, lip strongly thickened and reflected, inclined about 25° from shell axis. Parietal wall with heavy callus and 2 lamellae extending posteriorly beyond line of vision: upper parietal high, bladelikey, sharply descending near anterior margin, then bifurcating to form a raised edge to parietal callus; lower parietal much reduced in height, ridgelikey, extending not quite to edge of parietal callus. Columellar wall without lamellae. Palatal wall with 4 lamellae visible from aperture, a 5th seen through the shell, recessed $\frac{3}{16}$ to $\frac{1}{4}$ whorl within aperture. Uppermost tooth thin, low, very short; 2nd much higher, slightly expanded above and longer; 3rd even more prominent; 4th slightly reduced in height and length; 5th trace apparently even shorter. Height of holotype 2.70 mm, diameter 4.35 mm.

Holotype: New Guinea: Misool Island. Collected February 26, 1929 in forest 10 km north of Lilinta, on *Asplenium*. Musée Royal d'Histoire Naturelle de Belgique no. 9223.

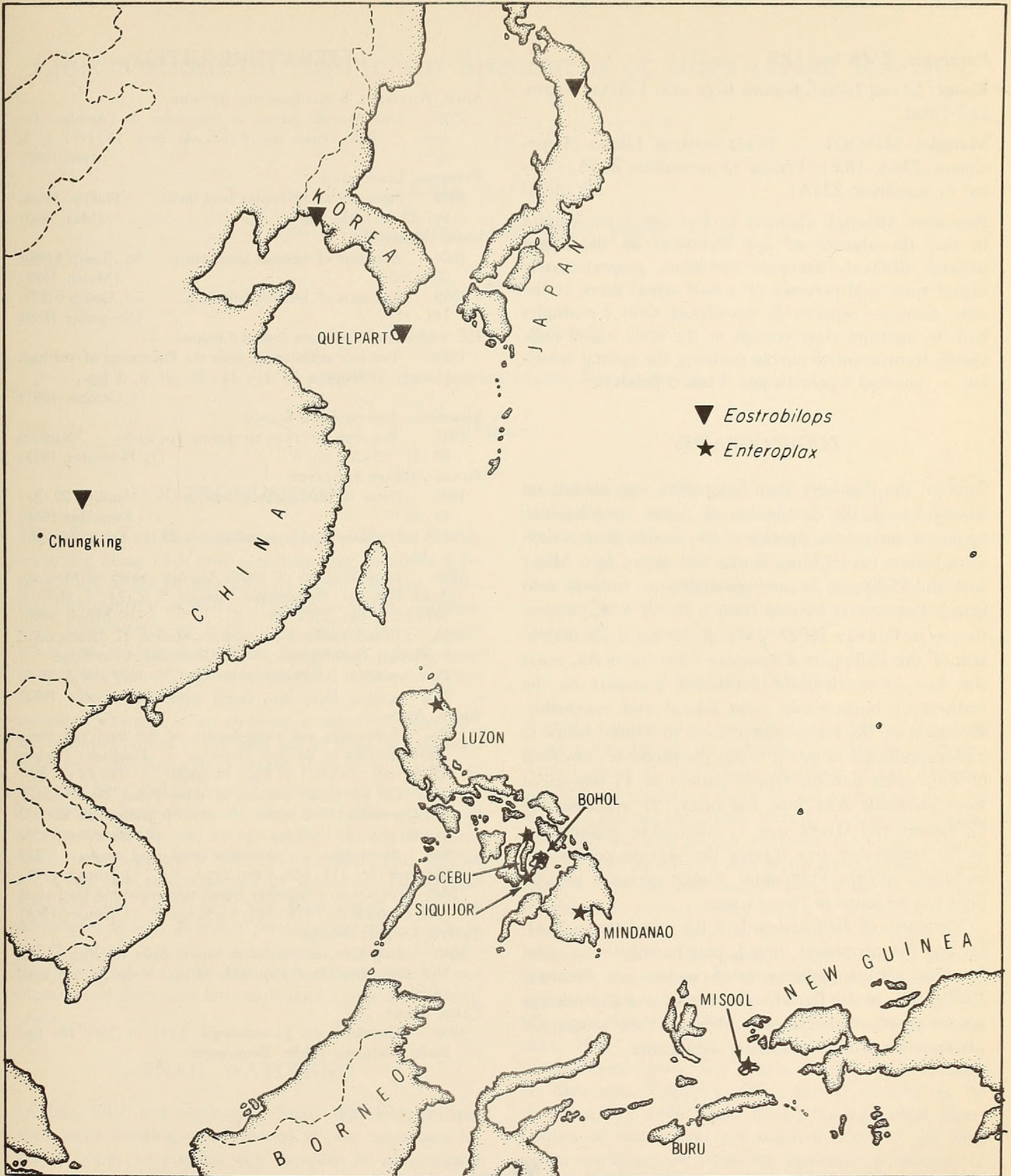


Figure 2

Distribution of *Enteroplax* (★) and *Strobilops* (*Eostrobilops*) (▼)

Paratypes: ZMA and IRB.

Range: Misool Island. Known from near Lilinta, Waima and Fakal.

Material: MISOOL - 10 km north of Lilinta (4 specimens, ZMA, IRB); Waima (3 specimens, ZMA); Fakal (1 specimen, ZMA).

Remarks: Although identical to *Enteroplax trochospira* in size, the absence of any serrations on the upper parietal, distinctly narrower umbilicus, proportionately higher spire, and presence of a half whorl more at the same diameters separate *E. misoolensis*. Only 4 examples had the aperture clear enough or the body whorl sufficiently transparent to enable counting the palatal lamellae - one had 5 palatals and 3 had 4 palatals.

ZOOGEOGRAPHY

Prior to the discovery that *Enteroplax* was present on Misool Island, the distribution of Asian Strobilopsidae appeared anomalous. Species of the section *Eostrobilops* were known from China, Korea and Japan (see Map) with the Philippine Islands containing an endemic subgenus, *Enteroplax*. Viewed from a North Pole perspective, as in PILSBRY (1927 - 1931, p. 15, fig. 2), a derivation of the Philippine *Enteroplax* from the north, using the *deus ex machina* of accidental transport on the feathers of birds would seem logical and reasonable. Extension of the known distribution to Misool Island is highly significant in that it brings the probable derivation of *Enteroplax* into the typical pattern of 1) movement from southeast Asia into Indonesia; 2) reaching the Philippines and Misool; and 3) followed by replacement in the Indonesian area leaving the isolated populations in Misool and the Philippines. Almost certainly populations will be found in New Guinea.

Specimens of *Eostrobilops* lack the raised parietal callosity and the peripheral thread, plus having the parietal lamellae with superior serrated nodes (see PILSBRY, 1927 - 1931, pl. 10, fig. 14). *Enteroplax* and *Eostrobilops* are not closely related to each other and their geographic juxtaposition has no systematic significance.

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