

**Notes on the non-marine molluscs of Borneo 10. The genera *Bruggennea*, *Gulella* and *Sinoennea* (Gastropoda, Pulmonata, Streptaxidae)**

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The species of the genera *Bruggennea*, *Gulella* and *Sinoennea* (Streptaxidae) occurring in Borneo are revised. Five species are dealt with, including *Bruggennea luminifera* spec. nov. and *Sinoennea kennethi* spec. nov.

Key words: Gastropoda, Pulmonata, Streptaxidae, *Bruggennea*, *Gulella*, *Sinoennea*, taxonomy, Malaysia, Borneo.

INTRODUCTION

On Borneo, streptaxid molluscs do not occur in abundance, but certainly the island is home to a suite of particularly odd species. This paper presents a short revision of the genera with a more or less ellipsoid to cylindrical shell. For lenticular shells, like in *Platycochlium* Laidlaw, 1950, see Vermeulen (1991). For species with a partly free last whorl, like in *Diaphera* Albers, 1850, see Vermeulen (1990). This paper would have completed the revision of Bornean streptaxids if not, meanwhile, another half-dozen new *Diaphera* species had been found in eastern Kalimantan.

For collections, the following abbreviations are used: NMW, National Museum of Wales, Cardiff; RMNH, Nationaal Natuurhistorisch Museum Naturalis, Leiden; V, Colln J.J. Vermeulen, Leiden.

SYSTEMATIC PART

Family Streptaxidae Gray, 1860

Key to the genera in Borneo (characters apply to Bornean species only)

- 1a. Shell wider than high, lenticular ..... *Platycochlium* (see Vermeulen, 1991)
- 1b. Shell higher than wide, (ob-)ovoid, ellipsoid or cylindrical ..... 2
- 2a. Last whorl partly free, not attached to the spire ..... *Diaphera* (see Vermeulen, 1990)
- 2b. Last whorl entirely attached to the spire ..... 3
- 3a. Whorls distinctly crenellated below the suture ..... *Huttonella*
- 3b. Whorls not crenellated below the suture ..... 4
- 4a. Umbilicus open; whorls with varices imperfectly arranged in two rows .....  
on opposite sides of the spire ..... *Bruggennea*
- 4b. Umbilicus closed; whorls with varices irregularly arranged around the spire .....  
..... *Sinoennea*

*Bruggennea* Dance, 1972

Shell. – Shell slightly flattened laterally, apex slightly oblique. Whorls attached to one another down to the aperture, with 3-4(-5) varices imperfectly arranged in two rows on opposite sides of the spire, with one row approximately above the aperture. Sculpture absent, or restricted to 2-7 deep, well spaced radial grooves above the aperture. Apertural teeth on palatal and basal side without indentation in the outer shell surface. Umbilicus open, narrow.

Distribution. – Sarawak, endemic. All three species restricted to the same limestone hill in Sarawak: Tatau River Basin, Bukit Sarang.

Notes. – The only character unique to *Bruggennea*, when compared to *Sinoennea* Kobelt, 1904, is the position and the distinctness of the varices. A lateral flattening occurs in, for instance, *S. irregularis* (Moellendorff, 1900), from Vietnam, and *S. malaccana* (Moellendorff 1902), from peninsular Malaysia. The latter also has patches of congested radial ribs on the spire which are arranged as the varices in *Bruggennea*. *Sinoennea* seems to be a composite genus accommodating species with very different shells, and *Bruggennea* may need re-delimitation within this context. In fact, the character set: 'shell laterally flattened, varices arranged in two rows on opposite sides of the spire', is shared with *Platycochlium*; perhaps its closest phylogenetic relatives are to be found there.

*Bruggennea* is endemic to two small (total surface c. 0.3 sqkm) limestone hills in the Tatau Basin, Sarawak. *B. laidlawi* occurs in large numbers, but the two other species are remarkably rare. Even extensive sampling has yielded only very few specimens.

## Key to the species

- 1a. Shell 2.1-2.2 mm high. Whorl above the aperture smooth ..... *B. bongi*
- 1b. Shell 3.4-4.2 mm high. Whorl above the aperture with 2-7 deep, radial grooves ... 2
- 2a. Shell ellipsoid, at most slightly (ob-)ovoid. Upper palatal tooth deep inside the aperture, short, not connected to the palatal swelling in the peristome ..... *B. laidlawi*
- 2b. Shell distinctly ovoid. Upper palatal tooth a long lamella, connected to the palatal swelling in the peristome and almost touching the parietal lamella over its entire length ..... *B. luminifera*

*Bruggennea bongi* (Dance, 1970) (fig. 1)

*Sinoennea bongi* Dance, 1970: 155; holotype ("Bukit Sarang"), leg. Bong, NMW (not seen).

*Bruggennea bongi* (Dance, 1970); Dance, 1972: 131.

Material seen. – Sarawak, 2<sup>nd</sup> div.: Lower Tatau River valley, Bukit Sarang group (leg. Serena Lee, V 11852/1); do., Bukit Anyi, NW. side (V 12980/1).

Shell. – Shell minute to very small, ovoid, with a rounded apex, very slightly laterally flattened, somewhat translucent white, glossy. Whorls 4 1/4-4 5/8, slightly convex, with 3-4 low to moderately high varices which are at most slightly concave on the anterior side; the uppermost varix at c. 2 1/2 whorl from the apex. Suture impressed. Protoconch smooth. Teleoconch smooth. Umbilicus open, 0.2-0.3 mm wide; last whorl without swelling on the umbilical and basal side. Aperture oblong, with rounded lower edges.

Peristome simple, a thick glazing on the parietal side, with a slight notch in the margin over the parietalis, elsewhere distinctly reflected, with a slight thickening to a moderately distinct knob on the palatal side; above this the peristome recedes somewhat. Apertural teeth: a prominent parietal lamella starting on the peristome and continuing deeply inside; a short, very inconspicuous palatal lamella deep inside the aperture, partly hidden from view behind the knob on the peristome, a basal knob deep inside the aperture; a columellar lamella starting deep inside and continuing deeper inside. Height 2.1-2.2 mm; width 1.4-1.5 mm. Apertural height 0.8-0.85 mm, width 0.75-0.8 mm.

Ecology. – Lowland rainforest on limestone bedrock.

Distribution. – Sarawak, 2<sup>nd</sup> div.: Tatau River Basin, Bukit Sarang. Endemic.

Notes. – Smaller than the other two species, and without radial grooves above the aperture. It occurs in very small numbers. Only two shells were found among hundreds of *B. laidlawi*. In fully adult shells the two palatal teeth anterior to the last varix before the aperture are not retained (one observation).

*Bruggennea laidlawi* (Dance, 1970) (fig. 2)

*Sinoennea laidlawi* Dance, 1970: 154; holotype ("Bukit Sarang"), leg. Bong, NMW (not seen, paratypes V 13260/5).

*Bruggennea laidlawi* (Dance, 1970); Dance, 1972: 131.

Material seen. – Sarawak, 2<sup>nd</sup> div.: Lower Tatau River valley, Bukit Sarang group (leg. M. Bong, V 13260/5, paratypes, see above; leg. Serena Lee, V 11850/>10); do., Bukit Anyi, NW. side (V 12975/>10); do., Bukit Anyi, SE. side (V 12976/>10); do., Bukit Lebik, ground level (V 12977/>10); do., Bukit Lebik, sediment deposits c. 40 m above ground level (V 12978/>10).

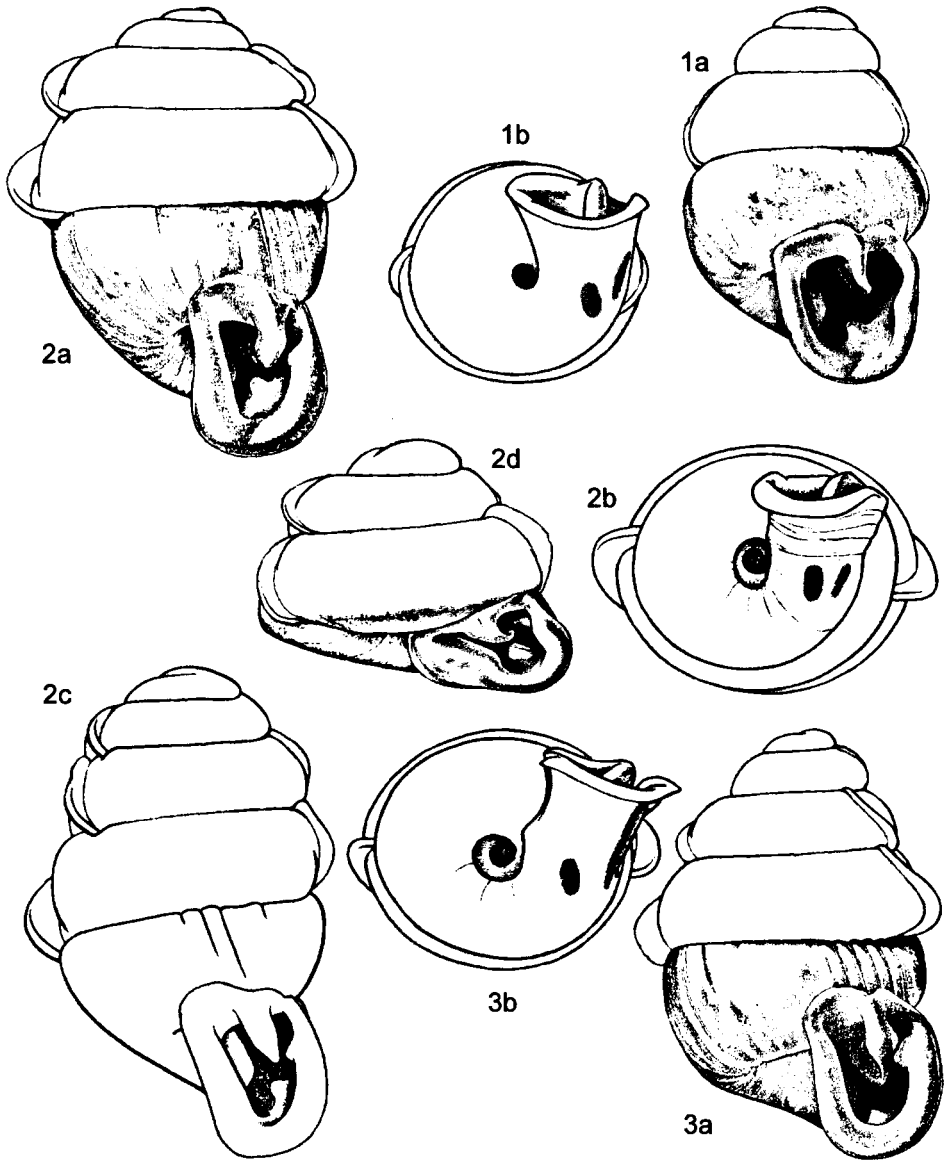
Shell. – Shell very small, ellipsoid to slightly (ob-)ovoid, with a broadly rounded apex, somewhat laterally flattened, somewhat translucent white, glossy. Whorls 4 1/8-5 1/2, slightly convex, with 4-5 distinct, high varices which are distinctly concave on the anterior side, in particular towards the base of the whorls; the uppermost varix at 1 5/8-2 1/8 whorl from the apex. Suture impressed. Protoconch smooth. Teleoconch smooth apart from a few weak growth lines and 2-7 deep radial grooves immediately above the aperture. Umbilicus open, 0.3-0.4 mm wide; last whorl on the umbilical and basal side with a slight swelling 0.27-0.35 mm from the peristome. Aperture slightly obliquely oblong, with rounded edges. Peristome simple, a thick glazing on the parietal side, with a slight notch in the margin over the parietalis, elsewhere distinctly reflected, with a slight thickening to a distinct knob on the palatal side; above this the peristome recedes strongly. Apertural teeth: a prominent parietal lamella starting on the peristome and continuing deeply inside; a short, inconspicuous palatal lamella deep inside the aperture, hidden from view behind the knob on the peristome, opposed to the parietal lamella; a basal knob deep inside the aperture; a columellar lamella starting deep inside and continuing deeper inside. Height 3.4-4.2 mm; width 2.1-2.4 mm. Apertural height 1.2-1.5 mm, width c. 1 mm.

Ecology. – Lowland rainforest on limestone bedrock.

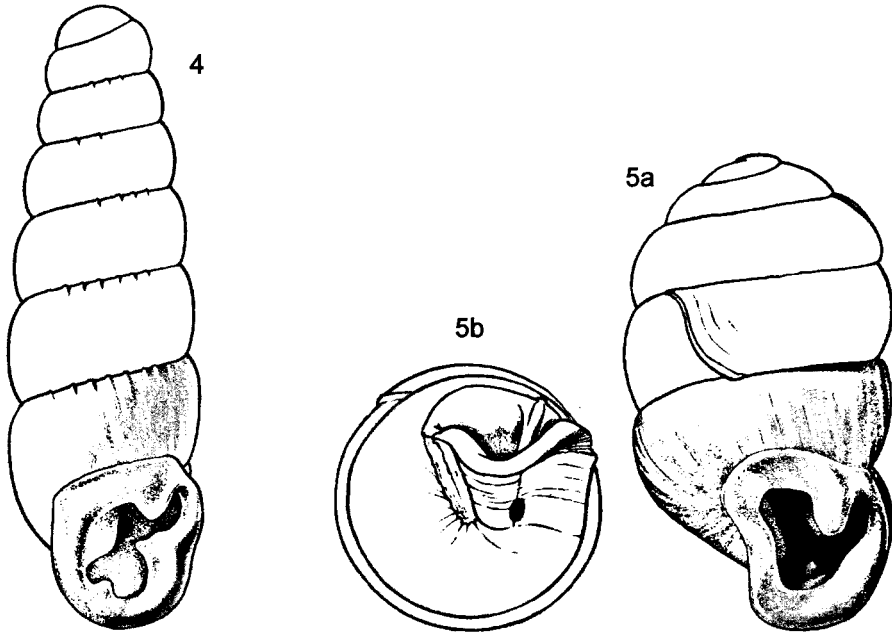
Distribution. – Sarawak, 2<sup>nd</sup> div.: Tatau River Basin, Bukit Sarang. Endemic.

Notes. – Adult animals also develop a second shell wall inside the original one in the top whorls, apparently to reduce the living space inside the shell, as was observed in *Diaphera moellendorffi* (Hidalgo, 1889) and several other species of that genus (Fulton, 1907: 364), including the Bornean.

Each varix on the spire indicates the position where a thickened peristome was



Figs 1-3. *Bruggennea* species. 1, *B. bongi* (Dance, 1970), Malaysia, Sarawak, Bukit Sarang. a, frontal view (V 11852, shell height 2.1 mm); b, umbilical view (V 12980, same magnification). 2, *B. laidlawi* (Dance, 1970), Malaysia, Sarawak, Bukit Sarang. a, frontal view (V 12975, shell height 3.7 mm); b, umbilical view; c, frontal view (V 12975, shell height 4.2 mm); d, frontal view, juvenile shell (V 12975, shell height 2 mm). 3, *B. luminifera* spec. nov., holotype, Malaysia, Sarawak, Bukit Sarang (V 12979, shell height 3.4 mm). a, frontal view; b, umbilical view.



Figs 4-5. *Gulella* and *Sinoennea* species. 4, *G. bicolor* (Hutton, 1834), Indonesia, Bali, Banyuputih (V 4426, shell height 5.5 mm), frontal view. 5, *S. kennethi* spec. nov., holotype, Malaysia, Sarawak, Gunung Mulu National Park (V 5645, shell height 3.6 mm). a, frontal view; b, umbilical view.

formed during development. Juveniles at the stage of the last varix before adulthood (see fig. 2d) have a more or less conical shell, obtusely angular at the periphery, with and obtusely triangular aperture which is distinctly wider than high. The dentition is basically identical to that in adult shells, but the parietal lamella has an outwards curved crest, and the columellar lamella is entirely hidden behind a conspicuous widening and thickening of the peristome on the columellar and basal side. In fully adult shells the two palatal teeth anterior to the last varix before the aperture are usually persistent.

*Bruggennea luminifera* spec. nov. (fig. 3)

Material seen. – Sarawak, 2<sup>nd</sup> div.: Lower Tatau River valley, Bukit Sarang group (leg. Serena Lee, V 11851/2 paratypes); do., Bukit Anyi, NW. side (V 12979/4 paratypes, RMNH 109087/holotype).

Shell. – Shell very small, ovoid, with a rounded apex, somewhat laterally flattened, somewhat translucent white, glossy. Whorls 4 1/8-5 1/2, top whorls moderately convex, others slightly convex, with 4 distinct, high varices which are distinctly concave on the anterior side, in particular towards the base of the whorls; the uppermost varix at 2 1/4-2 1/2 whorl from the apex. Suture impressed. Protoconch smooth. Teleoconch smooth apart from a few weak growth lines and 5-7 deep radial grooves immediately above the aperture. Umbilicus open, 0.3-0.45 mm wide; last whorl on the umbilical and basal side with a slight swelling c. 0.5 mm from the peristome. Aperture slightly obliquely oblong, with

rounded edges. Peristome simple, a thick glazing on the parietal side, with a slight notch in the margin over the parietalis, elsewhere distinctly reflected, with a distinct knob on the palatal side; above this the peristome recedes strongly. Apertural teeth: a prominent, bulbous parietal lamella starting on the peristome and continuing deeply inside; a long palatal lamella starting at the knob on the peristome, opposed to the parietal lamella so that, over most of its length, the crests of the two almost touch; a basal knob deep inside the aperture; a columellar lamella starting deep inside and continuing deeper inside. Height 3.4-3.6 mm; width 1.5-2.1 mm. Apertural height 1.1-1.3 mm, width 1.0-1.1 mm.

Ecology. – Lowland rainforest on limestone bedrock.

Distribution. – Sarawak, 2<sup>nd</sup> div.: Tatau River Basin, Bukit Sarang. Endemic.

Notes. – Differs from *B. laidlawi* in having an ovoid shell, and a much longer palatal lamella that starts at the peristome and over most of its length almost touches the parietal lamella so as to form a barrier separating the angular corner from the rest of the aperture.

Like *B. bongi*, it only occurs in small numbers.

#### *Gulella* Pfeiffer, 1856

Shell. – Shell not laterally flattened, apex not oblique. Whorls attached to one another down to the aperture, without varices. Sculpture: a crenellation below the suture, radial ribs near the aperture. Apertural teeth on palatal and basal side with a deep indentation in the outer shell surface. Umbilicus closed, not covered by the peristome.

Note. – The description applies to Bornean species only.

#### *Gulella bicolor* (Hutton, 1834) (fig. 4)

*Pupa bicolor* Hutton, 1834: 86; holotype (India, "Mirzapur... at the base of the walls of my bungalow... between Agra and Neemuch") (not seen).

*Ennea bicolor* (Hutton, 1834); Issel, 1874: 51.

*Huttonella bicolor* (Hutton, 1834); Dance, 1970: 153.

Material seen. – Sarawak, 1st div.: Penrissen valley, Gunung Segu, roadside between bridge and Kampong Bunuk (V 11860/1). 4th div.: Niah Caves National Park, S. side of limestone area, W. of quarry (DANIDA survey 2003, report loc. 8, V/10328/1). SABAH. Interior Prov.: Pinangah valley, Batu Urun (V 1173/2). Kudat Prov.: Banggi Island, S. end, beach drift material (V 1419/1); do., Karakit Hill (V 1452/>10; V 9468/2, V 9481/4). Tawau Prov.: Segama Valley, hill NW. of crossing road Sandakan-Lahad Datu with the Segama River (V 1677/1); Semporna area, Pulau Bumbum near Semporna (leg. G.W.H. Davison, V 11865/4); do., Pulau Selakan near Semporna (leg. G.W.H. Davison, V 11864/1).

Kalimantan. Kalimantan Timur: Sangkulirang Peninsula, Gua Ampanas near Kampong Pengadan (leg. TNC Survey 2004, V 11862/9); do., Gua Mardua near Kampong Pengadan (leg. TNC Survey 2004, V 11863/6); near Samarinda, Kampong Air Putih (leg. TNC Survey 2004, V 11861/4); do., small limestone outcrop between Bontang and Samarinda (leg. TNC Survey 2004, V 12667/1). Kalimantan Selatan: Meratus Mts., W. flank, Nateh near Batu Tangga, c. 18 km E. Barabai (V 3037/2); do., Telaga Langsung (V 3446/6); do., Batu Apoh (V 3312/>10); Meratus Mts., E. of mountains, Batu Tunga near Sarungga, W. of road Batulicin to Benualawas (V 272/>10).

Shell. – Shell (very) small, cylindrical but somewhat tapering towards the apex, with a broadly rounded apex, somewhat translucent white, glossy. Whorls 6 1/8-7 3/8, slightly convex, without varices. Suture impressed. Protoconch smooth. Teleoconch smooth apart

from a distinct crenellation below the suture, which develops into low, rounded, well spaced radial ribs on the last portion of the last whorl. Umbilicus closed; last whorl without swelling on the umbilical and basal side. Aperture about rectangular with rounded edges, with two distinct dents in the outer surface, on the palatal and basal side, corresponding with apertural teeth. Peristome simple, a thin glazing on the parietal side, without a notch in the margin over the parietalis, elsewhere thickened and somewhat reflected, only slightly receding on the upper palatal side. Apertural teeth: a prominent but rather short parietal lamella starting on the peristome; a distinct, more or less conical palatal tooth on the inner rim of the peristome, a basal knob slightly deeper inside; a columellar lamella starting close to the peristome and continuing deeper inside. Height 5.4-7 mm; width 1.3-1.7 mm. Height aperture 1.1-2.0 mm, width 1.0-1.5 mm.

Ecology. – Gardens, agricultural land, secondary woodland, also in dry coastal areas. Introduced, but not observed to be invasive in primary vegetation.

Distribution. – Borneo. Scattered localities in Sarawak, Sabah and Kalimantan. Very common; the low number of records reflects a collecting bias against the habitat preferred by the species. Natural range uncertain; introduced, accidentally or deliberately (to control *Achatina fulica*), into the tropics worldwide (Cowie, 1997: 31).

#### *Sinoennea* Kobelt, 1904

Shell. – Shell not laterally flattened, apex not oblique. Whorls attached to one another down to the aperture, with 3 varices about 2/3 whorl distant from one another. Sculpture absent. Apertural teeth on palatal and basal side without indentation in the outer shell surface. Umbilicus closed, covered by the peristome.

Note. – The description applies to Bornean species only. The inclusion of *S. kennethi* is doubtful but inspired by overall similarity with the two species mentioned in the notes with its description. In fact, it occupies a position within the genus as marginal as the species of *Bruggennea*, but I prefer not to create yet another monotypic genus without addressing the delimitation of *Sinoennea*.

#### *Sinoennea kennethi* spec. nov. (fig. 5)

Material seen. – Sarawak, 4<sup>th</sup> div.: Gunung Mulu National Park, Camp 5 (leg. Schuiteman, V 5683/1 paratype, fragment); do., Sungei Melinau Paku headwaters, Gunung Api (leg. Nilong, V 11414/1 paratype; leg. Schuiteman, V 5444/1 paratype, fragment; RMNH 109088/holotype).

Shell. – Shell very small, ellipsoid-cylindrical, with a broadly rounded apex, white, glossy. Whorls c. 5, slightly convex, with 3 rather inconspicuous, low, rounded, varices, the uppermost at c. 1 7/8 whorl from the apex. Suture impressed. Protoconch smooth. Teleoconch smooth apart from a few radial grooves anterior to the last varix preceding the aperture. Umbilicus closed; last whorl without swelling on the umbilical and basal side. Aperture triangular with rounded edge and a concave columellar side. Peristome simple, a thick glazing on the parietal side, without a notch in the margin over the parietalis, elsewhere thickened and somewhat reflected, with a knob on the palatal side; above this the peristome recedes strongly. Apertural teeth: a prominent, thick parietal lamella starting on the peristome and continuing deeply inside; a basal knob deep inside the aperture; a columellar lamella starting deep inside and continuing deeper inside. Height c. 3.6 mm; width c. 2 mm. Apertural height c. 1.2 mm, width c. 1.3 mm.

Ecology. – Forest on limestone soil. Found at 150-1400 m asl.

Distribution. – Sarawak, 4<sup>th</sup> div.: Gunung Mulu National Park. Endemic.

Notes. – The character set: 'varices present, distinct; radial sculpture largely absent; aperture triangular with a concave columellar side' uniquely identify this species within *Sinoennea*. *Sinoennea splendens* (Moellendorff, 1882), from southern China looks more or less similar but has a convex columellar peristome with two large teeth on the palatal side. *Sinoennea ovulum* (Bavay & Dautzenberg, 1912), from northern Vietnam, differs in the same characters but also in having distinct crenellations below the suture. *Sinoennea austeni* (Peile, 1929), from India, seems to have distinct growth interruptions, or perhaps small varices (indicated in the drawing, but not described) in a similar position as *S. kennethi*. It has no sculpture, but the aperture is more or less rectangular with a rounded lower side.

Named after Mr. Kenneth Nilong, who undertook the steep climb to the pinnacle area to collect soil samples especially to obtain this species.

#### ACKNOWLEDGEMENTS

Special thanks are due to Mr. S.P. Dance, who donated type material of *Bruggennea laidlawi*. Mr. Kenneth Nilong, ranger at Gunung Mulu National Park, is remembered with pleasure, in particular his ability to tread lightly and with ease on perilously steep slopes with sharp limestone outcrops where the average tourist, the author included, at best stumbles ignominiously along in fear for his health and worse. I name a creature after him that may be as sure-footed as he is, but definitely slower. The hospitality and support of The Nationaal Natuurhistorisch Museum, Leiden (NNM) should, once more, be mentioned. Dr. A.C. van Bruggen was so kind to advise on the position of *Sinoennea kennethi*.

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