

## A new subspecies of *Amphidromus palaceus* (Mousson, 1849) from Sukabumi Regency, West Java, Indonesia

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**ABSTRACT** This paper describes a new subspecies of *Amphidromus palaceus* (Mousson 1849b) from Nyalindung, West Java, Indonesia. Both subspecies have a similar animal coloration and produce dextral or sinistral shells. The shell of the new subspecies differs from nominotypical *A. palaceus* by having pale-colored stripes marking resting stages, lack of brown subsutural spots or blotches and the presence of a smoother sculpture, less recurved lip margin and thicker white parietal callus.

**KEY WORDS** *Amphidromus*, *palaceus*, *nyalindungensis*, Nyalindung, Sukabumi Regency, Java, Indonesia, new subspecies

### INTRODUCTION

Late in 2020, the second author (JA) received images of shells from a colleague (PHA) in Nyalindung, West Java, which looked like *Amphidromus palaceus* (Mousson 1849b), but the shells have a much smoother surface. A search of the literature failed to uncover any record of that species found in the vicinity. Dharma (2007) cited the nearest localities where *A. palaceus* lives, all near Sukabumi City, West Java Province: 1) Baru Benteng, Karawang, 2) Gunung Guruh and 3) Situ Gunung, Cisaat. Shells from these locations were unavailable for comparison.

COVID-19 restrictions delayed receipt of the shells from Nyalindung until May 2021. We then fruitlessly searched the literature for a published name given to similar shells as a variety, subspecies or species. A review of images on the BioPortal website for the Naturalis Biodiversity Center, known for its images of Indonesian shells, and the Global Biodiversity Information Facility (GBIF)

website found nothing we considered as a close match to the original published images of *A. palaceus* or our new Nyalindung material. It was not until December 2021 before PHA, who discovered the colony, allowed John to collect and photograph live snails on his property. Based on a similarity of the animal coloration and differences in resting stage markings, lack of brown subsutural spots or blotches, sculpture, parietal callus and other subtle features, we herein described the Nyalindung snails as a new subspecies of *A. palaceus*.

### Materials and Methods

Three shells make up the type series, the holotype (MNHN) and two paratypes (JAC) and comparative material comprised of shells from one private collection (JPC ex-JAC).

**Abbreviations used for museums and private collections:**

JAC:	John Abbas collection
JPC:	Jeff Parsons collection
MN:	Museum für Naturkunde, Leibniz Institute for Research on Evolution and Biodiversity, Berlin, Germany
MNHN:	Muséum national d'Histoire naturelle, Paris, France
SMF:	Senckenberg Naturmuseum, Frankfurt, Germany
ZMUZH	Zoologisches Museum der Universität Zurich, Zurich, Switzerland

**Abbreviations for shell morphometry and other:**

D:	shell width (abbreviation for 'diameter' as per literature usage)
H:	shell height
H/D:	shell height/shell width ratio
JA	John Abbas
JP:	comments, data, images, observations or other by Jeff Parsons
N:	whorl count
PHA	Pak Haji Ali, a colleague from Nyalindung
W:	shell weight

Shells were measured using digital Vernier callipers (0.01 mm resolution), examined under low magnification (10x) using a jeweller's loupe for surface detail, and weighed using a pocket-sized electronic scale (capacity 300 g x 0.01 g). Whorl count included the apex and with a precision of  $\pm 0.125$ . 'Paries' (adj. parietal) refers to the inner apertural wall and 'palatum' (adj. palatal) is the outer apertural wall. Relative shell sizes for *Amphidromus*: small < 40 mm, medium 40-60 mm, and large > 60 mm.

A search of the relevant literature and museum websites (MHNG, MN, SMF, ZMUZH) did not locate Mousson's type material of *A. palaceus* collected by Zollinger, or candidate specimens previously owned by von dem Busch, or L. Pfeiffer. Therefore, we chose five adult shells from Pangandaran Bay, West Java matching the species description to use in this study. A comparison with those shells and details from the literature found the Nyalindung material to be easily separable from *A. palaceus*. The description and variation of the new subspecies were determined from empty shells obtained by

PHA. Photography credits are as indicated below figures and the plate.

**Taxonomic and nomenclatural remarks**

*Amphidromus palaceus* (Mousson 1849b)

The authors consulted the pre-1860 works of Pfeiffer (1848 and 1850) and Mousson (1849a, 1849b and 1850) to have a better appreciation of the original concept of this species. Both Pfeiffer and Mousson placed it in the *Amphidromus perversus* (Linnaeus, 1767) group.

**Synonymy**

*Bulimus palaceus* von dem Busch in litt. listed as a synonym of *Bulimus perversus* var. *ι* [iota] Pfeiffer, 1848 (p. 39)

*Bulimus palaceus* von dem Busch in Mousson 1849a ['1848'] (p. 266) nomen nudum

*Bulimus palaceus* von dem Busch in Mousson 1849b (p. 28 and 108; pl. 3, fig.1)

**Remarks.** Pfeiffer (1848) referenced a letter from von dem Busch as the first usage of the name *Bulimus palaceus*. The current Code (ICZN 1999) does not consider that a published

work, even if the letter contained a description or definition; therefore the name is not accredited to von dem Busch. One could argue that Pfeiffer's "very brief" definition to distinguish the shell from other varieties of *B. perversus* satisfies Article 12.1 (ICZN 1999). However, he clearly treated the shell studied as a variety (var. *t*) of *B. perversus*, and since the Code (ICZN 1999) does not cover varietal names, that means *B. palaceus* is not available from this work. Although Mousson (1849b) accredited the name of *B. palaceus* to von dem Busch, the text indicates that Mousson provided the description and figures, and thus made the name available with sole authorship given to Mousson.

## SYSTEMATICS

Family Camaenidae Pilsbry 1895

Genus and Subgenus *Amphidromus* (masc.)  
Albers 1850

Type species *Helix perversa* (fem.) Linnaeus  
1758

*Amphidromus palaceus nyalindungensis*  
Parsons and Abbas new subspecies  
Figures 1, 2, 3A-3D, 3I and 3J

**Description.** Shell medium-sized, sinistral, conic-ovate in shape, thick and quite solid, weakly translucent. Spire moderately long with a flattened profile and blunt apex, not protruding (chipped); protoconch surface worn smooth. Teleoconch surface somewhat smooth, glossy; spiral striations very fine on lower spire, faint on last whorl and worn apically, overlain by growth lines and threads on the upper whorls. Last two whorls pliculate with interstitial growth lines and threads; the pliculae are coarser on the base versus weaker and flatter on the upper surface. Tips of pliculae weakened

before reaching the sutural margin and tips of growth threads puckered just below it.

Whorls 6½, convex apically and following ones flatly convex. Last whorl not inflated, convex above and below the obsoletely sub-angular periphery, noticeable next to the aperture, and last quarter slightly descending. Suture impressed, somewhat deep apically and with a sub-irregular margin on lower whorls, which is weakly or not affected by transverse sculpture. Subsutural region not sub-compressed. Periostracum isabelline colored, present as a trace near the aperture and preserved below the parietal callus. Shell plain except for an opaque white infrasutural fillet, more distinct on upper whorls, and three faint whitish stripes marking growth stoppages (morae; Parsons, 2014) on the last whorl, seen more clearly in transmitted light and each bordered by a grey resting line. Apex creamy (chipped) and lower whorls pale cream buff, greyed on spire.

Aperture moderately large, sub-elliptical, and oblique both ventrally and laterally. Palatal surface faintly whitened, and the external color shows through under strong light (as in Figure 1). Parietal callus a thin colorless film internally, allowing the underlying preserved isabelline periostracum to show through it. Outer parietal margin bordered by a translucent white zone and thickened outwardly to form a slightly raised edge in the middle. Posterior parietal tubercle sub-triangular and connected to lip terminus; anterior tubercle falcate and extends from the columellar margin; both tubercles white and barely distinguishable from the white callus connecting them. Outer lip white, strongly reflected, expanded throughout and thick; lip terminus distinctly elevated; lip face flat, lateral profile subconvex and edge slightly recurved to form a thick, low rim. Columella white, moderately wide, straight and sub-vertical; its margin cuneate, flatly dilated and

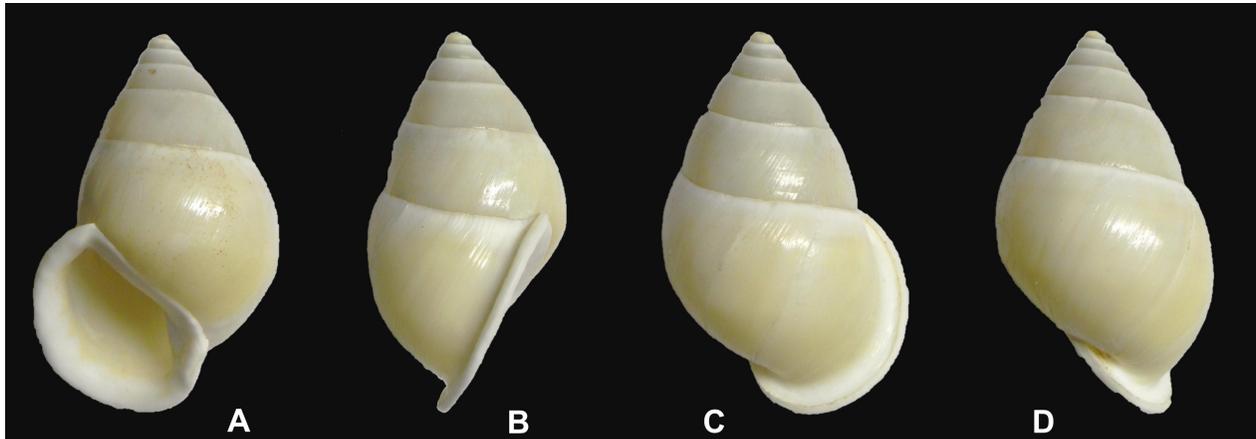


Figure 1. Holotype of *A. (A.) palaceus nyalindungensis* n. ssp. [photos by JP].

thick, with a secondary thick ridge formed beside its edge. Umbilicus rimate and lacks a whitish zone around the columella.

**Type Material.** Three adult shells collected at the type locality, collected by PHA. Holotype: sinistral shell (MNHN-IM-2000-38515, Figures 1, 3I and 3J), H 41.07 mm, D 26.82 mm, H/D 1.53, N 6.5 and W 3.80 g. Paratypes: 2 sinistral shells (JAC, unnumbered, Figure 3A, B), H 41.75-44.96 mm, D 25.56-27.23 mm, H/D 1.53-1.69, N 6.125-6.375 and W 2.80-3.47 g.

**Other Material Examined.** Two adult shells from the type locality, 1 sinistral and 1 dextral, collected by PHA (JPC, Figure 3C, D), H 40.10-41.76 mm, D 26.14-26.29 mm, H/D 1.53-1.60, N 6.0-6.125 and W 2.21-3.03 g.

**Type locality.** Mountain slopes east of Nyalindung at 1,040 m altitude, Nyalindung District, Sukabumi Regency, West Java Province, Indonesia.

**Distribution.** Currently known only from the type locality.

**Ecology/Habitat.** Moist evergreen hill forests.

**External animal coloration.** Head, neck and flanks are light to pale grey; postero-dorsum (dorsal area behind the neck) off-white to pale grey (paler than flanks). Upper and lower tentacles are grey, their tips and eyes zinc orange; pigment-patch on top of the head and nape (cephalo-nuchal patch), mantle, tail and foot pale cream to buff; mantle collar dull greenish black and sole amber yellow. All upper surfaces sprinkled with paler granules, except for the tentacles [Figure 2].

**Soft parts.** Not available for study.

**Etymology.** Named after Nyalindung District with the Latin suffix -ensis meaning “of or from”.

#### Shell variation of the new subspecies.

All shells studied are medium sized; a little thin to thick, somewhat solid to quite solid and strongly to weakly translucent. Of eleven specimens, (five empty shells and six live snails), seven are “whitish” and four yellow with two dextral and nine sinistral, suggesting dextral specimens are uncommon. Shell shape is

narrow to wide with H/D ratios ranging from 1.53 to 1.69 and ovate-conical to high conical or oblong-ovate. The moderately long, conical spire has a flattened or slightly convex profile with a spire angle of about 59-66°. Protoconch is obtuse-conical with an obtuse and somewhat protruding apex on most shells, damaged on the holotype. The shell surface is glossy and somewhat smooth with the sculpture as per the holotype or less flattened pliculae on the upper surface, which first appear on the antepenultimate whorl (Figure 3A). Spiral striations are as on the holotype or fine (slightly coarser) on most of the post-apical spire whorls and base, obsolete on the upper surface of the last whorl.

Teleoconch whorls are flattened (flatly convex) on the entire spire or flattened on the upper

spire and subconvex on the penultimate. The last whorl convex and not inflated, sometimes slightly descending in front and the periphery rounded throughout (Figure 3B), obsoletely sub-angular (Figure 3I) or sub-rounded next to the aperture (Figure 3A, 3C and 3D). The base is convex, not tapered. Sutural margin is subirregular due to the tips of pliculae weakened before reaching its edge and the tips of growth threads puckered just below it. Suture bordered below by an opaque white or albous (dull white) infrasutural fillet. Subsutural region not compressed and without brown subsutural spots or blotches. Of five shells, faint whitish morae or growth stoppage stripes only seen on the holotype (Figures 1C-1D).



**Figure 2.** Live *A. (A.) palaceus nyalindungensis* n. ssp. showing variation in animal coloration due to lighting conditions: **A**= lit by dim sunlight versus **B**= shaded [photos by JA].

The lip, columella, paries and palatum have a shiny lustre or it is dull due to some post-mortem degradation of the surface. The aperture obliqueness, shape and size are similar for all five shells studied, although the base is effuse on one shell due to a growth error behind the lip (Figure 3A). The umbilicus is widely rimate or ovately perforated and small relative to the shell width. Two shells have a whitish zone around the columella, seen as a small whitish patch near the umbilicus (specimen shell 2 and paratype 1). Shells have a strongly to weakly translucent palatum, its surface is whitened faintly on “whitish” shells and very faintly on yellow shells, allowing the external colour to show through under strong illumination (as in Figure 3A-3D).

The parietal callus is a colourless film internally, allowing the colour of the previous whorl’s surface or preserved periostracum below it to show through, or partially whitened due to post-mortem degradation. The translucent white zone at the parietal margin is about 3 mm wide medially and thickened outwardly so that the edge is slightly raised in the middle (Figure 3I), slightly thicker (Figure 3D) or much thinner with a colourless central area on a less mature shell (Figure 3C). Parietal tubercles shaped as per holotype, variously thickened and indistinguishable from the connecting white callus on most shells, except on one shell with a poorly developed marginal callus (Figure 3C).

Outer lip is expanded throughout, 2.01\*-3.73# mm wide (#holotype and \*specimen shell 1 with a less developed lip) and 1.02-1.27\* mm thick, including the recurved edge (\*holotype). The lip face is flat or sub-rounded, and the lateral profile is straight, curved outward or sub-sinuuous (result of a growth flaw; Figure 3A). Outer lip terminus is barely to distinctly ascending. Outer lip’s edge is slightly recurved and forms a thick, low rim about 1 mm thick, or

a narrower and lower rim, except near the umbilicus (paratype 2). Columella is moderately wide (2.60-2.84 mm), vertical or sub-vertical and straight. Columellar margin is cuneate, 3.22-4.32 mm wide and 1.02-1.18 mm thick (four shells), except very thick on the holotype (1.64 mm, excluding its thick ridge), and convexly dilated above the umbilicus or flat (holotype). Only the holotype has a secondary thick ridge formed beside along the columellar margin’s edge, (about 1.5 mm wide).

The three “whitish” shells have an isabelline periostracum (pale brownish yellow) with h more of it preserved on the dextral shell; hence, it has more of a brownish tinge (Figure 3D). The protoconch is greyish or coloured as per the last whorl, except a darker tone (Figure 3D) and has a creamy apex. The last whorl is actually creamy white (Figure 3B), cream (Figure 3D) or as pale cream buff (Figure 3I) and slightly greyed on the spire. Internal parietal colour is isabelline due to preserved periostracum below the colourless interior part of the parietal callus.

The periostracum on the yellow shells is very slightly darker than the ground colour and is invisible except for some blistering on the last whorl; the apex is albous or greyed, and the protoconch is a slightly darker yellow than on the spire. Ground colour is wax yellow and the same tone of yellow throughout (Figure 3A) or citron yellow with slightly greyed early whorls on a thinner shell (Figure 3C). Internal parietal colour is the same tone as the external surface beside the parietal margin or slightly darker. Whether the difference in apical colour between the creamy and yellow shells is the same for the whole population is unknown.

The shell colour of live snails is influenced by their food and two distinct colorations observed. The “whitish” shells have a bluish-green appearance (pale bluish glaucous to turquoise

green, e.g., Figure 2B) and the yellow shells have a slight greenish tinge (pale greenish yellow to viridine yellow, e.g., Figure 2A). In terms of animal coloration variation, the foot on one snail was amber yellow with a pale cream margin. This darker coloration is possibly due to greater moisture absorbed post-collection relative to its neighbours.

### DIFFERENTIAL DIAGNOSIS

The following differential diagnosis uses five shells of *A. p. palaceus* (data below) chosen for their similarity to the original figures in Mousson (1849b) and supplemented with details from the literature.

**Nominotypical subspecies.** Five adult shells from Pangandaran Bay, West Java, 4 sinistral and 1 dextral (JPC, Figure 3D-3H, 3K and 3L): H 47.00-53.66 mm, D 27.50-32.12 mm, H/D 1.59-1.84, N 5.75-6.625, and W 2.93-5.23 g.

**Distribution.** Banten, West Java, and Central Java Provinces (van Benthem Jutting 1950)

In general, *A. p. nyalindungensis* differs from *A. p. palaceus* by having a smoother sculpture, the presence of pale-coloured morae (varices of authors) and the lack of brown subsutural spots or blotches. It also differs in the lip margin being less recurved, and the parietal margin has stronger parietal tubercles connected by a thicker white callus with a raised edge at maturity. The protoconch is 0.03 to 0.5 mm smaller than the protoconch on shells of *A. p. palaceus* that are 2.5 to 13.7 mm larger (five shells JPC).

In contrast, shells of *A. p. palaceus* commonly have translucent to opaque, brown to black morae, 1 to 3 in number, sometimes more or absent. They are often solitary on the penultimate or last whorl and may form pairs or

groups on the last whorl with some pairs separated only by a hairline gap. The colour is uniform, inconsistent (pale and dark sections) or faint and vestigial; sometimes with a darker or paler border and may be connected to one of the brown spots or blotches below the suture.

The parietal margin of *A. p. palaceus* is white callused like that of *A. p. nyalindungensis*, except it forms a narrower white zone, only a white cord of callus along the border or it is absent. The parietal tubercles are thinner, similarly shaped and often undeveloped as smudges of white callus on shells without a white marginal zone (Figure 3C). In terms of the parietal callus, Dharma (2007) described the thickened parietal margin and tubercles as "...sometimes thickened white at (its) two ends and margin." Periostracum absent on the shells of *A. p. palaceus* studied, all denuded.

The outer lip of *A. p. palaceus*<sup>▲</sup> is relatively narrower than that of the smaller shells of the new subspecies\* (2.48-2.89<sup>▲</sup> mm vs. 2.01-3.73\* mm) and appears thicker (1.60-2.30<sup>▲</sup> mm vs. 1.02-1.29\* mm) due to the more recurved margin, up to two thirds of the lip width (i.e. wider). It has an outwardly curved lateral profile and rounded lip face, compared to that of the new subspecies, which also has a straight lateral profile and flat or sub-rounded lip face. Shell surface of *A. p. palaceus* differs in being less polished (shiny) and rougher with plicae on the last two whorls, sometimes coarser on the base and has fewer interstitial growth lines and threads on the last whorl than on the penultimate whorl. Remainder of the spire as per the new subspecies or worn, and the spiral striations are faint and very fine or obsolete.

The shell of *A. p. palaceus* is strongly to moderately translucent, and the conical spire has an unflattened profile with a lower spire angle of about 55-61°. Whereas *A. p.*

*nyalindungensis* has a strongly to weakly translucent shell, sometimes its spire has a flattened profile and a spire angle of about 59-66°. Whorl convexity constant or reduced anteriorly and generally subconvex on the teleoconch, except with some lateral compression on oblong shells, on the contrary *A. p. nyalindungensis* whorl convexity increases anteriorly with a flattened upper teleoconch. The last whorl differs from that of the new subspecies in occasionally being somewhat inflated and the periphery on the shells studied is not obsoletely sub-angular.

“Whitish” shells of *A. p. palaceus* differ from those of the new subspecies in being grey-tinted and not cream-tinted, slightly greyed on the lower whorls and darker tinted on the upper spire, and the apex is white, never creamy. Other shells of *A. p. palaceus* have the same hue (yellow or other colour) on the teleoconch whorls or have darker upper whorls (Pilsbry 1900; van Benthem Jutting 1950; Dharma 2007). The yellow is variable and of different tints or tones than yellow shells of *A. p. nyalindungensis*, clear (e.g. lemon yellow or canary yellow) or with a brownish tint (e.g. buff yellow).

*Amphidromus p. palaceus* generally has a weakly impressed suture on the last two whorls, compared to an impressed suture on *A. p. nyalindungensis*, or it sometimes briefly appressed near flaws. The subsutural region may be non-compressed like that of the new subspecies, briefly flattened or weakly compressed. The sutural margin differs from that of the new subspecies in being sub-crenulated by the tips of plicae and growth threads, and the infrasutural fillet sometimes partially replaced by a brown or reddish (rufous) band on the fourth whorl or several early whorls (Pilsbry 1900; van Benthem Jutting 1950).

Unlike the “whitish” shells of *A. p. nyalindungensis*, there is no periostracum preserved below the parietal callus and the aperture of *A. p. palaceus* is a little less rounded and ovate or oblong-semielliptical. Shells of *A. p. palaceus* also differ in having the paries of the same hue as per the exterior or slightly darker; the columella is sometimes slightly twisted, and the columellar margin not occasionally flattened. The whitish zone around the columella seen on some shells of *A. p. nyalindungensis* is absent, and whitening seen near the umbilicus on some yellow shells of *A. p. palaceus* is due to post-mortem degradation or discoloration. Although the shells of *A. p. palaceus* studied are larger, both subspecies have very similar dimensions for the umbilicus, columella, columellar margin and aperture, and this means these characters are relatively larger or wider on the new subspecies for the same sized shell.

### Final comments

Based on the eleven specimens of *A. p. nyalindungensis* studied, only the holotype has whitish morae marking growth stoppages and all lack brown subsutural spots or blotches, both of which are brown to black and often present on *A. p. palaceus*. This suggests that *A. p. nyalindungensis* lacks the ability to produce melanin pigments. However, it has a dull greenish black mantle collar and both pairs of tentacles are grey, meaning eumelanin is present in those parts of the animal. The “whitish” shells have cream-tinted lower whorls and an isabelline periostracum, which indicates the presence of yellow phaeomelanin. The only explanation left is that the mantle of the new subspecies does use melanin while forming the shell layers, thus making only whitish morae and it simply does not produce subsutural spots or blotches. The “whitish” shells have a trace or minor amount of yellow phaeomelanin resulting

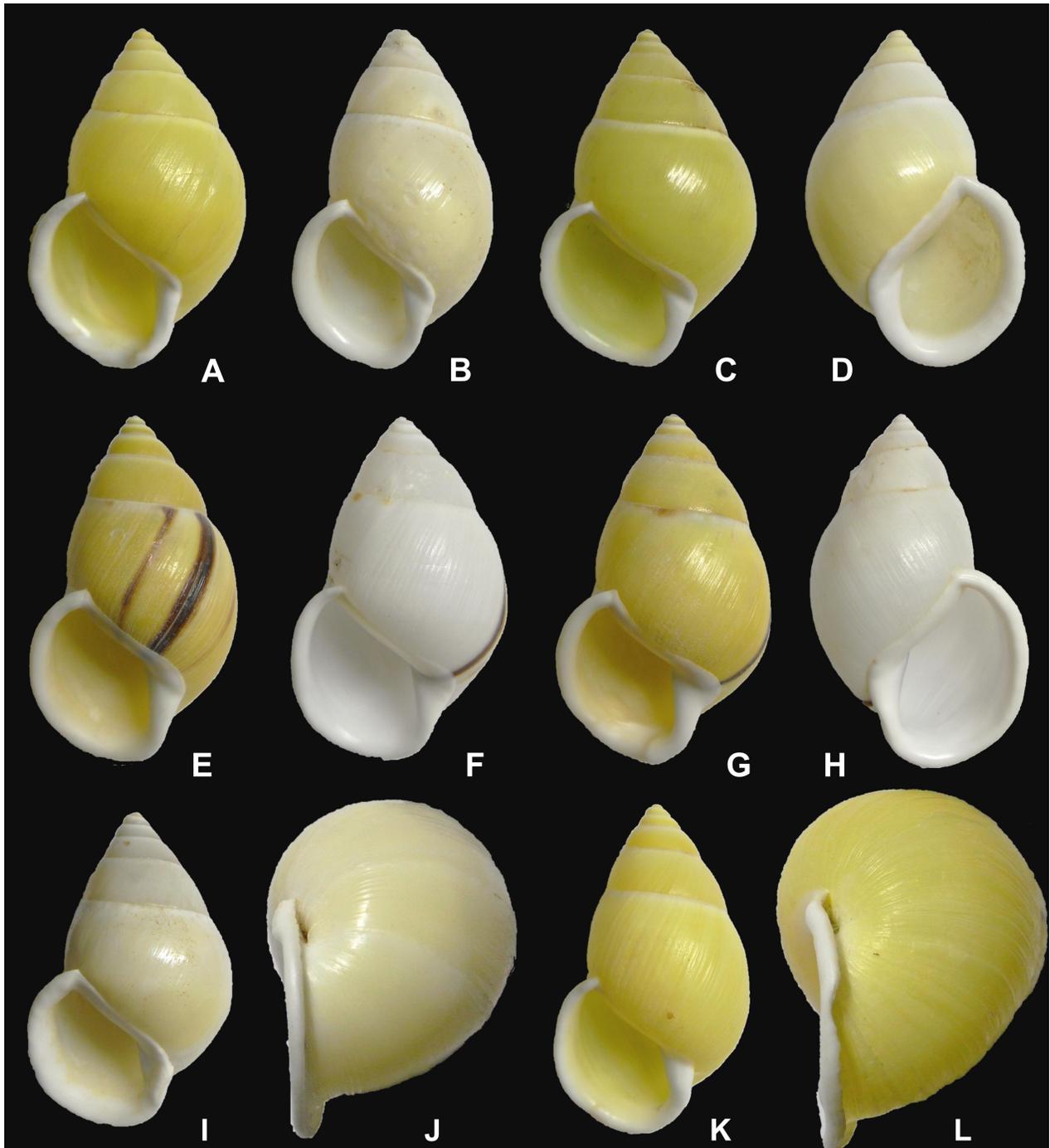
in a creamy tint and so best described as an “isabelline” morph, which lack red phaeomelanin and would be a flesh-coloured morph if present. Such pale pinkish-brown shells are sometimes seen in *A. p. palaceus* (e.g., Plate 10, figures 2 and 5 in Dharma, 2007), unless their pinkish tint is due to another pigment. The absence of true “white” shells of *A. p. nyalindungensis*. suggests that the yellow shells are an albinistic morph due to a lack of both melanins in the shell layers.

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**Figure 3.** Comparison and contrast between both subspecies of *A. (A.) palaceus*. **A-D**= *A. (A.) p. nyalindungensis* n. ssp. **A**= Paratype 1 (JA), **B**= Paratype 2 (JA), and **C, D**= specimen shells (JP). **E-H**= *A. (A.) p. palaceus* specimen shells (JP). **I-L**= comparison of shell sculpture for both subspecies using ventral and umbilical views: **I, J**= *A. (A.) p. nyalindungensis* n. ssp. of the Holotype, and **K, L**= *A. (A.) p. palaceus* specimen shell (JP). [Shells shown at approximately the same scale within each row; and image credits: **A-L** JP.]