

## A New Putative Hybrid in *Conomurex* Fischer, 1884 (Mollusca, Neostromboidae, Strombidae) with Notes on the Types of Hybrids

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### ABSTRACT

The propensity for hybridisation is well established in Strombidae. I propose that there are three forms of hybridisation: first the *true hybrids*; second *reticulatory hybrids*; and third *diversificatory hybrids*. The illustrated putative *true hybrid* between *Conomurex decorus* and *Conomurex luhuanus* is known from a single example from central Indonesia and represents the first example of intrageneric hybridization for *Conomurex*. Furthermore, this paper introduces and illustrates the novel concept of *diktyzonos* for regions of morphological reticulation within and between taxa, and how hybrids can be classified after assessing this *diktyzonotic* region.

**Keywords:** *Conomurex*, *diktyzonos*, Hybrid, Species.

### INTRODUCTION

In this paper I present a putative hybridisation event in the family Strombidae. While hybrids fall outside the rules that govern the zoological code for nomenclature [1]; notwithstanding, it is often worth providing a name as a reference marker rather than for placement at any nominal taxonomic rank. Not all hybrids should be considered taxonomically valid to be recognised within the nomenclature, and in terms of circumscribing taxa the assessment of hybrids needs to be considered carefully [2].

In clades where there is evidence for strong hybridisation in extant taxa, these hybrids will generate a plethora of forms and varieties in the clade, each of which may indicate processes of reticulation, where two species are introgressing, and/or speciating, or may just be indicators of random mating events. While three forms of hybridisation are well recognised in the literature among a diverse set of organisms, these have not been delineated or defined. To address this, I propose the following terms (Figure 1): 1) *true hybrids*, which are isolated examples of the congruence of two species and not viable; 2) *reticulatory hybrids*, that are evidence of the merging of two species; and 3) *diversificatory hybrids*, which are the product of hybridisation between two species that results in a new species being formed. The question then is, when is a hybrid to be recognised in the literature as a new species? I suggest that it is *diversificatory hybrids*, where the hybrid population has established a permanent presence alongside parental stock giving rise to a new taxonomic entity, which should be given taxonomic status within the nomenclature [2-8].

Therefore, there also needs to be an understanding of the potential role of hybridisation when seeking to understand the evolution of a set of organisms. Is the hybridisation a random

infertile mating event? Do the hybrids represent the reticulation of two species? Or is the hybridisation the birth of a new species? One way to answer these questions is to visualise the hybrids in terms of the *diktyzonos* the parental and hybrid taxa fill [2; Figure 2). A *diktyzonos* is the region in which a set of organisms are morphologically bound, and contains all the phenotypic variability that the organism exhibits. The classification of hybrids into distinct classes, each of which has a potential differing outcome for the understanding of hybrids in the evolution of a set of organisms enables a robust understanding of how hybrids are affecting current evolutionary trends. This is particularly important when considering taxa which have a high propensity to hybridise and the morphological variability of the resulting hybrids. In populations where there is a high degree of variability in the hybrid offspring, and the hybrids differ in the morphological characters they express leading to some tendency to favour the morphology of either parent, the *diktyzonos* between the two parental stock tends to become blurred. In contrast, where there is low variability in the morphospace occupied by hybrids and they form and cluster somewhere between the parental stock, this gives rise to three distinct regions of clustered organisms with differing morphological characteristic, and may lead the taxonomist to infer that there are three regions of *diktyzonism* and an inference that there are three species within the morphospace.

## METHODS

This paper is based on morphological comparison of the putative hybrid with type material of each putative parent, and other regional forms. The morphological characteristics include the columella, aperture and structures such as the anterior canal. The hybrid material used in this study was obtained from the collection of Messrs Bradfield, who collected during the last century while yachting. Comparative material was obtained from fisherman and dealers who legally obtained the material with appropriate permits.

The putative *Conomurex* hybrid between *C. decorus* (Linné, 1758) and *C. luhuanus* (Röding 1798) is only known from a single example, and there is no evidence to suggest at present that a population with the characteristics of the putative hybrid has established, thus currently invalidating it for species consideration [2].

## SYSTEMATIC PART

### *Conomurex* Fischer, 1884

**Type Species:** *Strombus luhuanus* Linné, 1758, p. 744, no. 432 [9, p. 670], by monotypy.

**Original Description:** “5° *Conomurex*, Bayle.1884, Labre non dilaté; coquille conique; spire courte (*S. luhuanus*, Linné)” [9, p. 670].

**Supplementary Diagnosis:** The shell of this genus is cone shaped, with a blunted spire and a long narrow aperture. The outer lip is not dilated and runs parallel to the inner body whorl. The spire is rarely with varices.

**Remarks:** The genus *Conomurex* is a widely distributed Indo-Pacific genus, with one Lessepsian migrant, or possibly introduced, member found in the Mediterranean [10]. Two taxa from which the hybrid is derived can be found converging in Indonesia [11]. At present there is only Pacific Ocean species *C. luhuanus* and the Indian Ocean *C. decorus* from that region described. The exact distribution of these *Conomurex* taxa in Indonesia is not known at this time.

### ***Conomurex decorus* (Röding, 1798)**

Figures 3A-C

**Type Material:** Lectotype – Chemnitz [12] *Conchylien Cabinet*, volume 10, Fig. 1499-1500 [13 p. 62, no. 777].

**Type Locality:** Mauritius (designated by Abbott [11]).

**Original Description.** “Die zierliche Flügel Schnecke, Gmel. *Strombus luhuanus*. sp.16 γ” [13, p. 62].

**Supplementary Description.** Shell “solid, heavy, somewhat conic in shape... . Whorls 9-10. Teleoconch usually moderately raised, rarely high, rarely low. Nuclear whorls 3, glossy, smooth, rounded. First three postnuclear whorls with 7 to 9 microscopic, incised spiral lines crossing numerous, small axial riblets, about 24 per whorl. Top of teleoconch with 6 to 8 small, whitish, rounded, swollen former varices. Whorls rounded in the teleoconch and, in the penultimate whorl, bearing 14 to 16 small, well-rounded axial ribs or knobs. The last whorl may be smoothish at the shoulder or bear 4 to 6 prominent knobs. Base of shell smoothish. Columella callus very thin... Interior of aperture light-orange to rose, with a broad white border. Inner wall of body whorl with exceedingly fine, numerous spiral threads. Stromboidal notch moderately deep. Posterior siphonal notch moderately developed and bordered above by a ... tongue-like flap which is adherent to the previous whorl” [11, pp. 137-138].

**Distribution:** Literary Records – Indian Ocean [14]. India: Port Blair [15]. Thailand: Phuket, Bay of Bengal [16]. Indonesia: Poelau Berhala, Sumatra [11]; off Deli, Sumatra [11]. Myanmar: Mergui Archipelago [11].

**Remark:** The broad white border on the interior of the labrum is distinctive of this species. Further, the anterior canal is almost straight whereas in *C. luhuanus* it is bends to the right.

### ***Conomurex luhuanus* (Linné, 1758)**

Figures 3E-I

**Type Material:** Syntypes – Linnean Society of London Collection: LSL 430.

**Type Locality:** Luhu Island, Indonesia (restricted by Abbott [11]).

**Original Description:** “432. S. testæ labro prominulo, dorso lævi, anfractibus rotundatis æqualibus” [17, p. 744]

**Supplementary Diagnosis:** Shell “solid, well shouldered, conic, with a black columella and orange-red aperture. ... Whorls 8 or 9. Nuclear whorls three, bulimoid, glossy, smooth ... . First postnuclear whorl with 15-18 microscopic spiral threads which are axially crossed by much smaller scratches. In later whorls numerous fine, axial riblets develop. Teleoconch with 8-10 small ... swollen, former varices. After the fourth postnuclear whorls (sic), the rounded shoulder has about 20 short, even-sized, well-rounded, ribs per whorl. These disappear on the last whorl. Base of shell with about 2 dozen obsolete spiral threads. Interior of body whorl with about 100 very fine spiral striae which do not reach the edge of the sharp outer lip. Basal sinus usually well-developed. A similar notch occurs at the shoulder, a little below the well-indented, almost channeled, suture. Columella smooth, glossy... but poorly developed” [11, pp. 135-136].

**Distribution:** Indian Ocean [14]. Indonesia: Ambon [14]; Banka [14]; Tjilatjap, Java [14]; Wagéoe [14]; Batjan [14]; Bouro Island, Molluccas [11]; Roti Island, Timor [11, 14]; Wodo Island, Halmahera [11]; Poeloe Boeton, Celebes [11]; Dutch New Guinea [11]; Bunguran Island, Natuna Besar Islands [18]; Ansus Island [19]; Jobi [19]; Aru [19]; Kei Bandan [19]; Sorong [19].

**Remark:** This species is easily identified by the strawberry red aperture in combination with the black stripe on the columella.

***Conomurex decorus* (Röding, 1798) x *Conomurex luhuanus* (Linné, 1758)**

Figures 3D

**Material:** Panjang Island, Lampas, Indonesia, 1990.

**Description:** Shell solid and conic with a distinctive shoulder and smooth body whorl. Spire moderately depressed, smooth and rounded. The columella is not well developed and smooth with black colouration. The inner aperture is reddish and the outer aperture white toward the border. The outer lip is thicker posteriorly, becoming thin and sharp after the stromboidian sinus. Further it has the bend anterior canal similar to *C. luhuanus*, not the straight as in *C. decorus*.

**Remarks:** The shell has the aperture colouration of *C. decorus*, and is similar in form to that species from Malaysia (Figure 3A). However, the shell as the distinctive black columella of *C. luhuanus*. Other than colouration of the aperture and columella, the who putative parents *C. decorus* and *C. luhuanus*, are difficult to split morphologically. However, as you move away from the Indonesian archipelago and associated central coral triangle, the two species start to form distinctive morphological kinds, that may be recognised as species in time. This is the first reported putative hybrid within *Conomurex* [2], the other hybrid is intergeneric between *C. decorus* and *Gibberulus gibberulus* (Linné, 1758) [10].

## DISCUSSION

Mapping hybridisation across a phylogeny will enable a more accurate assessment of the reticulatory potential between species and facilitate a more compressive understating of the relationships between reticulation-driven speciation reflected in the fossil taxa. This will also enable the distinguishment of new species, with narrow diversicatory *diktyzonotic* parameters, from a broader *diktyzonos* of true hybrids between the putative parental stock, or those that are undergoing a process of reticulation with a broad spread of hybrid forms without a region of morphologically stable clustering.

When undertaking a systematic revision into a set of organisms, it is imperative that consideration is given to the representative taxa in the fossil record to identify *diktyzonotic* regions, and also determine the form of hybridisation. Failure to include hybridisation in speciation modelling for a set of organisms will potentially have a negative impact on the determination of a phylogeny because of the consequence of trickle-down discordance. When seeking to estimate the potential impact of hybridisation on a phylogeny, it is worth examining descendant extant taxa to determine the current level of hybridisation across a clade. Thus, there is a necessity to consider the reticulatory potential of a set of organisms when defining clades, and also in the determination of their phylogenetic internal resolution.

## CONCLUSION

This paper provides the first example of intragenetic hybridisation in *Conomurex* from Indonesia. This organism is an illustration of a single putative hybrid that lacks the physical evidence to support recognition as a species and which does not form part of a *diktyzonotic* morphological zone. It is therefore considered a *true hybrid*. The three forms of hybridisation that are defined herein provide a classificational framework that enables taxonomists to assess the status of a set of hybrid organisms with the goal of determining if the hybrids warrant recognition in the nomenclature.

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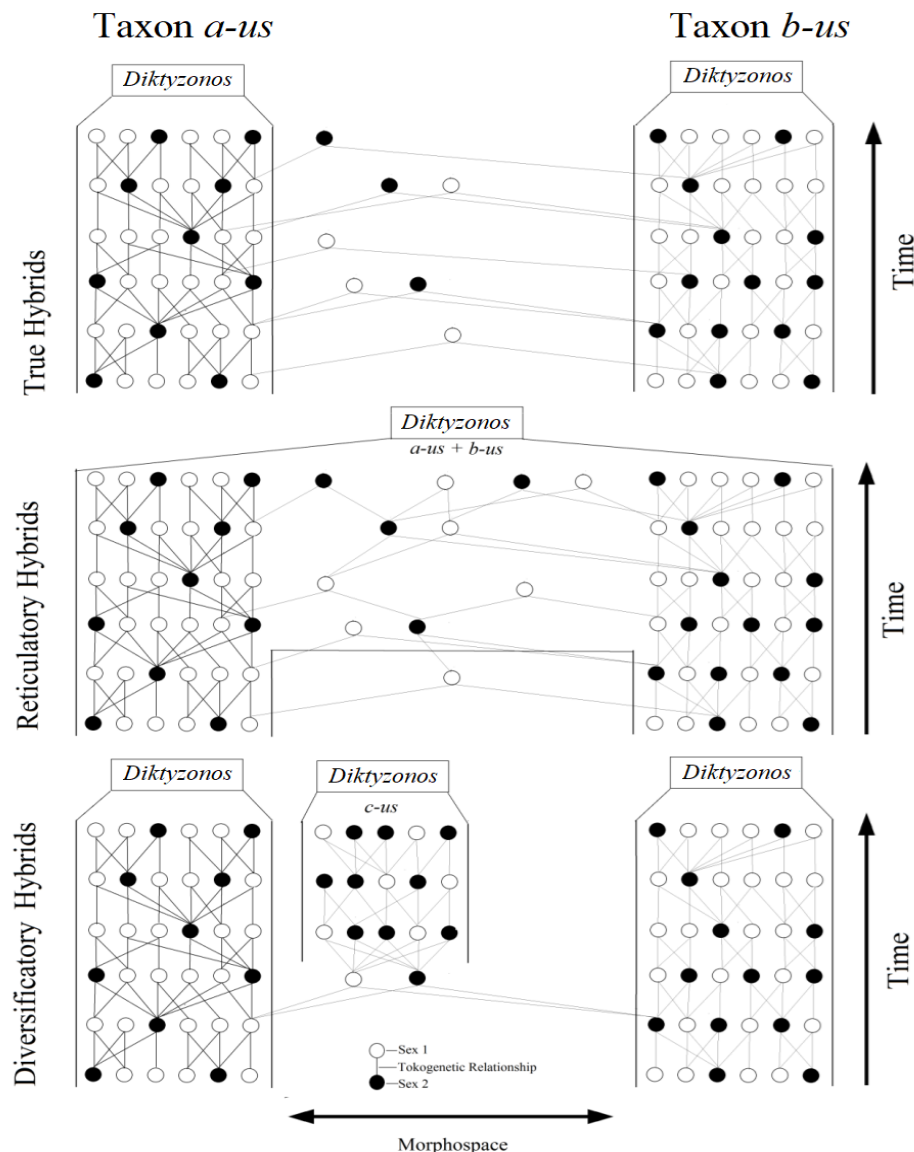
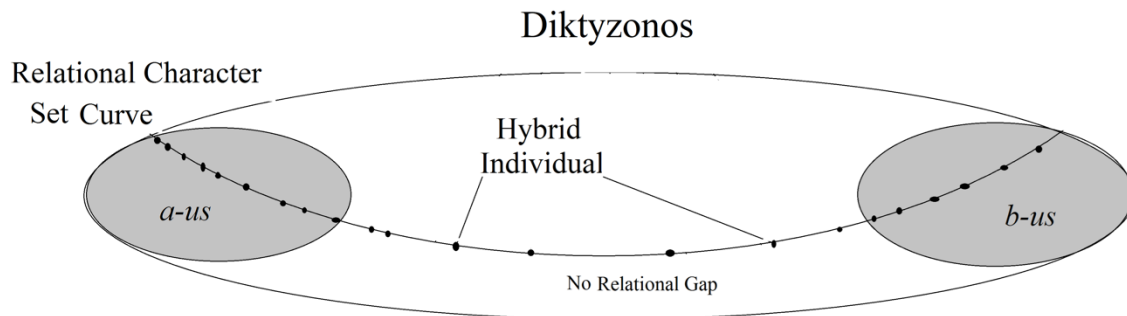


**Figure 1: The *diktyzonotic* regions of reticulation within a species, and which occurs between species leading to three forms of hybridisation: A) *true hybrids*, which are sporadic infertile outcomes of the mating of two taxa; B) *reticulatory hybrids*, which are generated when two species come together and generate viable offspring that then cause the merging of the two**

parental taxa; and C) *diversifactory hybrids*, where two species hybridise and produce viable offspring that then form a taxon (*c-us*) that is distinguishable from both of the parental taxa

## High Variability in Hybrids



## Low Variability in Hybrids

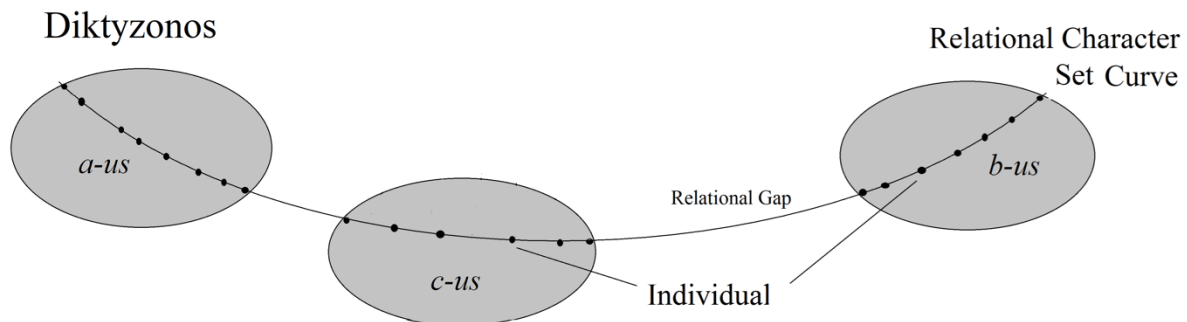


**Figure 2: The two forms of expressed hybridisation between species: level of high variability with a large *diktyzonotic* region which may blur the character set limits for each of the parental taxa; and low variability hybrids which may lead the taxonomist to concur that there are three distinct regions of *diktyzonism* indicating that there may three species, and a test of establishment needs to be considered to determine if a speciation event has occurred**

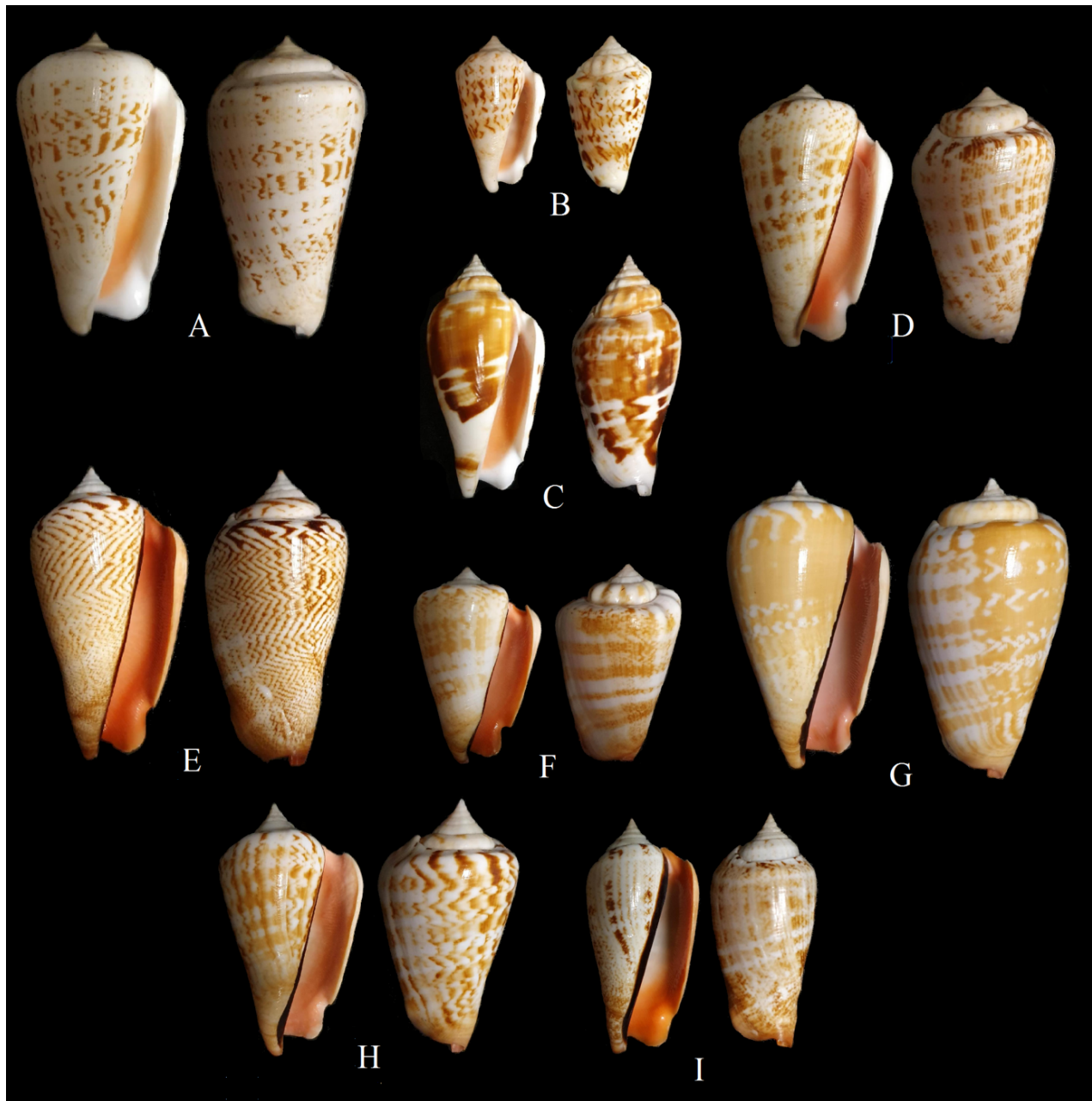


**Figure 3: A study in *Conomurex* [shown to scale]: Variations of *C. decorus* (Röding, 1798): A – Palau Pangkora, Malaysia, 1974, 61 mm (SMC 45.003); B – Nacala Bay, Mozambique, 2000, 31 mm (SMC 43.006); C – Mauritius, 1980, 47 mm (SMC 43.002); The *C. luhuanus* (Linné, 1758) x *C. decorus* (Röding, 1798) hybrid: D – Panjang Island, Lampas, Indonesia, 2000, 52 mm (SMC 47.027); Variations in form and colour of *C. luhuanus* (Linné, 1758): E – Balicasag Island, Philippines, 2015, 60 mm (SMC 47.040); F – Medang, Papua New Guinea, 39 mm (SMC 47.030); G – Tokunoshima, Japan, 2008, 58 mm (SMC 47.028); H – Coolgaree Bay, Queensland, 50 mm (SMC 47.026); I – Cebu Island, Philippines, 46 mm (SMC 47.029)**