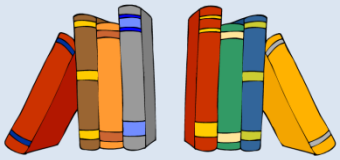

Publication History

Prior to the 1960's, there were few collectors in Angola who analysed specimens, the localities, and published information. Shells, brought back to Europe by traders and seamen, were analysed by conchologists of the time, based on shell morphology and pattern.

The earliest descriptions were *C. genuanus* by Linneaus, 1758 , *C. ermineus* Born, 1778 and *C. pulcher* by Lightfoot, 1786; all West African species but found in Angola.

Reeve in his 1843/1844 publication of cones introduced *C. tabidus* together with the first two of the species endemic to Angola ie C. *aemulus a*nd *C. bulbus*.

Kiener, 1845 described *C. guttatus,* a name deemed to be a homonym and replaced by Da Motta in 1991 as *C. neoguttatus.*

Kiener in 1848 introduced three more endemic cones ie *C. africanus, C. variegatus* and *C. zebroides*.

Sowerby III described *C. carnalis* in 1879 and *C. fuscolineatus* in 1905.

Tryon in his 1884 series of monographs published *C. chytreus.*

Paes-Da Franca described two species in 1957, *C. lucirensis* and *C. angolensis*. Both species have been consistently accepted as junior synonyms of *C. chytreus* and *C.bulbus*.

By the 1970's Trovão and several Portuguese began collecting in an organised manner in Angola. Given, the diversity in colour pattern and form of specimens in any population, identifying the species boundaries became a problem, so Trovão introduced other factors into his descriptions of new species, the animal features, the periostracum, and the radula.

His 1975 and 1978 publications contained several new species. *C. musivus, C. cepasi C. nobrei* and *C. naranjus* in 1975 and *C. bocagei* and *C. albuquerquei* in 1978. In 1978, he altered the name from *C. musivus* to *C. tevesi* ; a decision based on advice that the name musivus was already used. In developing his ideas of species boundaries among differing phenotypes, several of Trovão's codenames for populations were used to circulate shells in the dealer market creating much confusion.

Kaicher 1977 introduced her large set of cards, including some Angolan cones, which illustrated specimens and gave brief descriptions of species including some which she thought erroneously had been described by Trovão or Paes da Franca. Being brief and probably not intended as new descriptions, the Kaicher species were ignored by the taxonomists and conchologists. It was not until a surprise ICZN decision in 2003 that approved the names as usable, which resulted in *C. alexandrinus , C. lineopunctatus, C. negroides, C. lobitensis* becoming slowly accepted.

Trovão faced widespread criticism of his new species and his innovation of using the radula as a differentiation feature was largely ignored by the established conchologists of the time.

Walls in his well respected 1979 book Cone Shells –A synopsis of Living Conidae did not hold back on his criticism and vented his frustration in trying to identify Angolan cones.

"C variegatus species seems to have a different pattern in every population. Certain workers have determined to name each variety as a full species with numerous manuscript names already in circulation among dealers and collectors. Like other western African shells, *C. variegatus* usually is a real dog with heavily eroded and distorted spires, often areas of erosion on the body whorl, heavy axial flaws and scars, and badly broken lips. The pattern may be indistinct with a very dull surface"

On the basis that there seemed to be such variation in pattern and that intermediates could be found between specimens of many of the different species, Walls proposed that there were just two species; those with an axial pattern *C. bulbus* and those with a horizontal pattern *C. variegatus*.

"C *variegatus* is very similar to *C. bulbus*, which is about the only species which is likely to be confused with it. The two species probably hybridize, but for the moment they are kept separate as the variations and tendencies of the patterns are quite different. In *C. bulbus* the patterns are basically axial, sometimes vaguely tented, while in *C. variegatus*, the patterns are all modifications of spiral rows of dashes or narrow brown hairlines, sometimes heavily obscured by brown areas, not axial or tented. *C. bulbus* is also somewhat thinner and narrower than *C. variegatus*, which is a thick, strongly convex shell. "

Regarding *C. bulbus* "If desired by collectors, four forms of this species can be recognised, none very distinct and all easily joined with the other forms through intermediates. Typical *C. bulbus*, has rather straight thin lines over the body whorl and seldom exceeds 25mm in length. The form *zebroides is* larger, narrower, often with a higher spire, and tends to have fewer and broader lines over the body whorl. In *C. naranjus*, the lines are extremely fine and broken into several spiral rows; the shell is exceptionally broad, and the brown blotching at the shoulder and base is reduced. *C.musivus* is a very attractive form with the lines irregularly branched and overlapping to produce a tented appearance over at least part of the shell. *Doubtless the relentless describer (of which there appears to be no shortage) will he able to find dozens of other local variants and individuals worthy of nomenclatural immortality."*

The early years of the 1980's saw two publications which addressed the challenges of Angolan cones.

Moolenbeek and Coomans began a major series in Basteria reviewing all cones. Unfortunately they stopped when they reach the alphabetic names starting with "F".

However their description of C africanus suggests that they leaned towards supporting the species as described at that time ..... or maybe they were species within a species complex!!!

"Conus africanus - Because of the great variability of colour and pattern, there is much confusion about the taxonomy of the West African Conidae (Trovão, 1978: Ramalho &

Soares, 1979). In recent years about ten ‘new’ Conus species from Angola were described by Paes da Franca and Trovao. However, it is not impossible that these belong to only a few valid species in one species complex. The first described species in this complex is *Conus bulbus* Reeve, 1843, from Cabinda, north of the mouth of the Congo river. Provisionally we consider *Conus africanus* Kiener to be a valid species “.

Another major series of articles was published, specialising in Angolan cones and was published in La Conchiglia by Röckel and Fernandes in 1982/3. Francisco Fernandes was a very experienced local Angolan collector. Their articles largely supported the described species, based on the shell morphology, localities and details of the colour pattern of the animal. No information was given on the radula. No new species were described. In the last article they illustrated 12 sets of specimens as interesting specimens, possibly potential species.

In 1987, Röckel published a description of *Conus xicoi* named after the nickname “Xico” of Fernandes. The description covered the shell, the animal, periostracum and also the radula as analysed by Emilio Rolán. This demonstrated the gradual acceptance of the shell, animal and radula as a sound basis for the separation of Angolan species. All new descriptions since that date to 2018, have been based on these characteristics.

In 2000 and 2001, Rolán and Röckel having available large numbers of specimens from the Fernandes collection went back to first principles in reviewing the Angolan endemic species. Holotypes were inspected, lectotypes created and then matched to existing known populations and used as a basis of redefining type localities. The shells were analysed based on the shell morphology, animal, periostracum, and radula, restraining their interpretation of any species largely to the type locality specimens or other populations where all the features including the radula could be evaluated. This resulted in confirmation of the previously defined species and several new ones including *C. filmeri, C. flavusalbus, C. franciscoi and C. micropunctatus, C gabrielae* and *C. trovaoi.* In a follow- on paper in 2001 they added *C.anabelae, C. babensis and C. tenuilineatus.*

Within the paper, distribution spreadsheets were developed showing the range of each species and comments made about many populations for which they had insufficient data to justify them as new species or to allocate them to the accepted species.

Some key hypothesis were proposed.

1) That species of the northern province of Luanda were endemic to that area.
2) That species from the southern coasts of Benguela, Namibe were endemic to that area.
3) That the outflow of the Bentiaba river tended to split most of the latter southern species into two groups.
4) Features were defined and codified to provide a basis for comparison between the different radula types.

Emilio Roláan published a follow on paper in 2001 in which he codified the features of the different radulae for Angolan species and then generated a statistical chart which demonstrated the affinity of each species based only on radula features.

In Rolán & Röckel 2000 stated “The radular teeth of most species have minor differences, but in some species the teeth appear to be closely related, as is in *C. naranjus, C. neoguttatus* and *C. trovaoi*; *C. carnalis* seems to have close relationship with *C. tabidus* and *C. ambiguus*, while *C. franciscoi* has a tooth differing from most of the other species”.

In 2001, the Rolán analysis based on radula features found that 3 groups could be recognised:
1). fuscolineatus. naranjus,flavusalbus, africanus, zebroides, cepasi
2). Neoguttatus(=lineopunctatus), trovaoi
3). aemulus and xicoi, plus nine other species from the south.

The Iconography of West African Conidae published in 2004 by Monteiro, Tenorio and Poppe followed the content of Rolán & Röckel, 2000. Illustrations were largely confined to those populations cited by Rolán & Röckel. These illustrations provided a good overview and demonstrated the extensive variability in pattern and form of each species, both within individual populations and between populations.

Tucker & Tenorio developed a classification for Conidae by codifying the shell morphology features together with the radula features. Their 2009 publication assigned the majority of the endemic Angolan cones to the self contained group Varioconus with the only exception being the inclusion of *C. jourdani* from St Helena. The West African cones found within Angola were placed in Monteiroconus(tabidus), Genuanusconus(genuanus), Kalloconus(pulcher). *C. carnalis*, endemic to Angola was allocated to a separate new genus Pseudonoduloconus based on the unusual structure of its spire.

In 2008, Bozzetti described *C. allaryi* from San Antonio in Benguela province, based only on shell morphology and pattern.

In 2014, 3 new species were published by António Monteiro, Carlos Afonso, Manuel J. Tenorio, José Rosado & David Pirinhas. *Varioconus petuchi, V. inesae* and *V. medvedevi* based on shell and radular morphology

During 2014, the first major DNA assessment of worldwide Conidae was published as a classification by N. Puillandre, T. F. Duda, C. Meyer, B.M. Olivera and P. Bouchet. In terms of Angolan cones, the Varioconus group was found to be closely related to the Cape Verde cones and the group was reallocated to the Lautoconus group.

In 2018, Chris Schönherr, an experienced collector in Angola described 4 new cones. *Lautoconus annegretae, L. nunesi, L. equiminaensis and L. eusebioi* based on the shell morphology and radula.

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