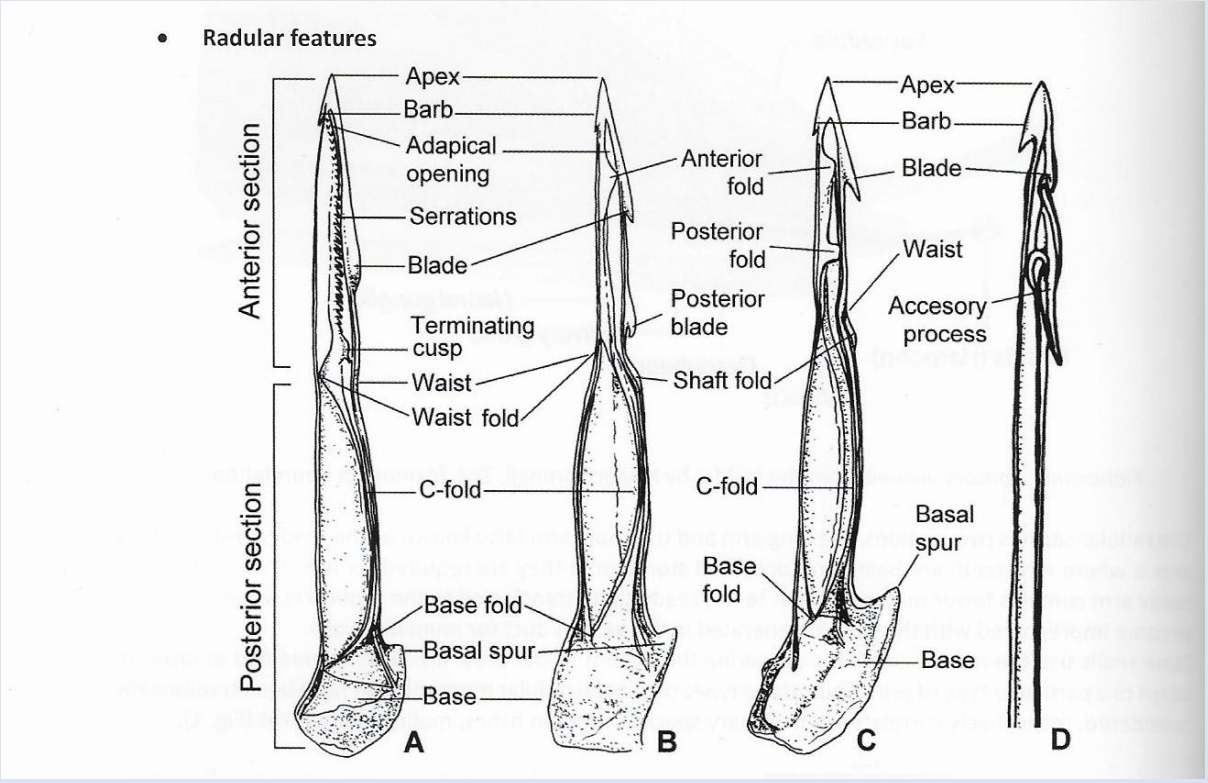
Radulae of Angolan cones

Given the problems of identifying Angolan cones by shell morphology, the radula mechanism which controls the ability to harness prey was developed as a definable characteristic of any species. The radula does change its form as the specimen matures so comparisons may benefit from using mature specimens or specimens of a similar size as appropropriate.

The features of the radula are well illustrated and discussed in a paper by Manuel Tenorio and Loic Limpalaër within the 2018 Taxonomic Iconography book Vol1.



Reproduced from Tenorio and Limpalaër in Monnier, Limpalaer, Robin, Roux, 2018.

The radula was first considered by Trovão in 1975 as a second characteristic in addition to shell morphology in trying to define species boundaries. Given that the radula is the prey mechanism, then a significant difference in radula between specimens would suggest that species evolution has occurred.

Using the radula in identification, presents a difficult challenge to the shell collector who lacks the skills and facilities to analyse the radula.

The radula of most currently accepted species has been analysed and published and are illustrated here in a seperate document(Radula_illustrations).

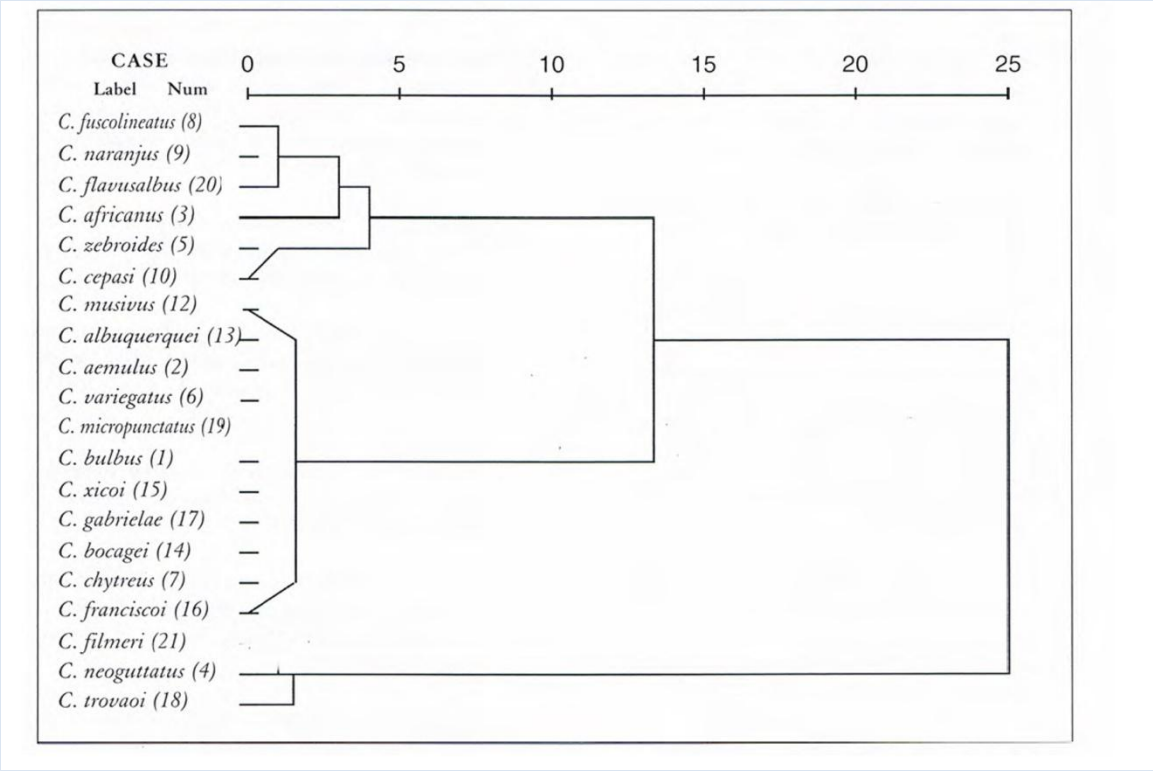
Small differences in radula structure do occur among specimens within a population of a species and such differences increase between populations.

The text of Rolan and Rockel, 2000/2001 describes the differences in radula for each species. It highlights that *C. musivus* and *C. bulbus* have almost identical radulae; similarly *C. albuquerquei* and *C. nobrei*. However they concluded that these were separate species based on factors such as shell morphology, distribution etc.

By encoding the features of the radula , statistical analysis can suggest the degree of difference between the different radula. In 2001, Rolan published a statistical analysis based on 5 key factors

1) number of teeth in the radula (ND),
2)number of denticles in serration (D).
3)length of the shell/length of the radular tooth (LC/DR) (ratio)
4)total length of radular tooth/apical portion (DR/PA) (ratio)
5) extension of the apical portion covered by the blade (F) (100*F/PA), shown as (%PA).

The results are illustrated in tree and table format



The tree shows clear differences between 3 groups but minimal differences between species within any one of the three groups.

Tucker & Tenorio, 2009 took a similar approach in their classification encoding 11 key attributes of the radula plus shell morphology characteristics. The results were used to formulate a genus/subgenus classification which showed the Angolan endemic species to be in one genus.

To identify most Angolan cone specimens based solely on shell morphology is challenging; some good advice would be to limit label identities to shells with a form similar to the type specimen and from the type locality or a locality from which shell radulas have been tested. If in doubt, there is always the opportunity to use “aff species” or even “species” on the label. Avoid shells with poor locality data.

Major differences in radula can be used to suggest groups of similar species which may define a genus or subgenus grouping or to assist in the species identification of specimens. However, it still is debatable how much small differences in the radula can be used as a key criteria to evaluate species boundaries.

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