Abstract

Traditional taxonomy methods and molecular surveys were used to probe into the phylogeny of an arboreal Satsuma albida species complex from Taiwan, called Satsuma albida species complex. In this study, fifteen species were identified and described as new species from the group. Two subspecies of S. albida, S. a. insignis and S. a. mollicula were promoted to independent species based on the characters of their reproductive system and the molecular phylogenetic relationships from other taxa. An explicit phylogenetic relationship of all Camaenidae land snails from Taiwan are shown ad infinitum, which is based on the molecular markers of mtDNA and nuclear genes reflecting their evolutionary history. Species formation can be promoted via ecological reasons, such as spatial allocation in the group of arboreal snails, or via single-gene mutation such as chiral reverse from sinistral to dextral shells. Such can cause mismatch mating and procure incipient species formation. Speciation can also be happened with a long term evolutionary process, through the vicariance or dispersal events and cause a monophyletic clade within high diversity taxa on the species level within a genus, even though confined through an island.

Introduction

Concerning the Satsuma albida
- R. Swinhoe’s collections and the unfinished itinerary
- Mising information of original type specimen and locality
- Similar neighbors from Ryukyu Isl.

Aftermath: Pilsbry & Hirase’s tour, two subspecies of S. albida Satsuma albida insignis (Pilsbry & Hirase, 1905)
- Satsuma albida mollicula (Pilsbry & Hirase, 1909)

And others… unsolved enigma. WHO ARE THEY?

Materials and Methods

To track back evidence of types, S. albida and others:
- One Long Argument
- 45 sampling localities around the Taiwan Isl., sample size = 625 of these arboresial snails.
- Taxa were distinguished via traditional taxonomy method and molecular survey.
- Molecular markers: partial sequence of mtDNA CO1 and 16S genes, 5.8S RRNA, ITS2, 28S RRNA.

Comparative evidences of BSC and PSC
- The explicit phylogenetic relationship of all Camaenidae land snails from Taiwan Isl., 52 taxa were distinguished in > 10 /

Results

Evolutionary history of these Satsuma snails from Taiwan concerning species formation can be promoted via several different pathways.

First, species formation can be promoted via ecological reasons, so called "spatial allocation" in the group of arboreal species S. albida and its akin. Ancestors of this clade of arboreal snails moved upon trees to a new environment, the allocated space and invasion into a whole empty niche for snails. Then the species formation events happened through the new world and caused the high diversity of these arboreal species.

The second species formation pathway of these Satsuma snails is due to chirality reverse of the so known “single-gene speciation”, this kind of species formation happened for at least three times from dextral ancestors to the sinistral descents, and twice from sinistral ancestors to dextral descents. Due to the shell chirality from dextral to sinistral is more difficult as to sinistral to dextral is more facile, this only appeared once in the Japanese land snail EuHadra spp. group. The Taiwanese Satsuma revealed three times of chirality reverse from dextral to sinistral, a special evolutionary pattern. Furthermore, through this study the author discovered a species underwent a peculiar species formation, from dextral to sinistral, then from sinistral back to dextral followed by from dextral to sinistral again. This may be the unique chirality reverse speciation model of all known hermaphrodite snails.

The third speculation of these Satsuma snails can also happen within a long term evolutionary process, through the vicariance or dispersal events along with the geographical distribution, the well known speciation mechanism.

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