NICARAGUAN MAXIMUM DIVERSITY OF TERRESTRIAL MOLLUSCS ENRICHED BY FALLEN TREES

"Seek a good tree and find a safe haven"

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Storms and hurricanes often fell trees, and the wood can be saved for lumber or firewood. However they are also valuable just lying fallow and slowly decaying while they return to soil, environment and living beings the nutrients formerly obtained from them.

At the Hacienda Santa Maura, Jinotega Department, Northern Nicaragua and by order of the proprietor, Ing. Jorge Armando Chaves, trees are left in place where they fall, that they may contribute to soil richness as they slowly decay. The wisdom of this norm and the benefits it accrues to a good ecological economy were visited upon me some days ago when I took some time off to dedicate just one hour to search for land snails in the Hacienda forest and obtained the most diverse and abundant collection I have ever seen in such a limited area: 29 species from a scant 1 m^2 , 11 of them undetermined, without moving from the same location..

"Roberto Zarruk" Biodiversity Station in the midst of the Santa Maura forest was donated to the Universidad Centroamericana, (UCA) for the purpose of studying and preserving the surrounding forest and its diversity. Preliminary studies have been made on themes such as Coffeculture, Entomology, Hidrology, Malacology, Molecular Biology, Parasitology, and Silviculture. Because of fortuitous circumstances the author has been able to dedicate considerable time to researching the molluscs over the Hacienda territory, so that their diversity is well documented.

Generally speaking, the number of molluscs in the soil can be very large, reaching 4.5 to 11.5 million / ha of tropical rain forest, gnawing on dead leaves and fungi and in an open field there can be 566.000 snails and 87.000 slugs per hectare, silently conditioning the soil. In spite of their inobtrusive style, molluscs play a large, important role in the economy of nature. Their principal function is to decompose organic material into simple compounds that can be recycled by plants and other living beings (Solem, 1974). Even in deserts, where plant productivity can be very limited due to lack of Nitrogen, a case has been documented where tiny pupillid snails of the genus *Euchondrus,* by means of their feces insert some 25 mg / m^2 of Nitrogen into the soil, which represents 11% of the total Nitrogen supply (Jones & Shachak, 1990).

The Santa Maura Biological Station is at an elevation of close to 1,200 m in the midst of a tropical cloud forest. This makes for a constantly humid habitat so the earth is always moist and fresh, even during the dry season of the year, especially where there is a good cover of decaying leaves, often half a metre thick, or under a fallen log.

Previous studies in Nicaraguan comparative diversity of land molluscs (López, 2001), have shown in the first place the difference in diversity between the malacofauna of the dry forest and savannah lowlands and that of the alpine meadows and rain forest situated at 1,000 m or higher elevation. The most

outstanding difference is the dense presence of subulinids in the dry forest, but practically absent in the highlands, and replaced by their look-alike spiraxids in the rain forest, in turn almost totally lacking in the lowlands. Another family characteristic of the rain forest is the Charopidae, completely absent from the dry forest.

In second place there is a marked difference in the number of species that make up snail communities, with the lion´s share going to the Departments of Northern Nicaragua, Matagalpa and Jinotega, where we have collected a total of 144 species (López, 2000) compared to 89 species found in the dry forests and savannah of the Nicaragua Pacific slope (Pérez & López, 2002). And within the general distribution there are localities of small extension where molluscs concentrate in almost unbelievable densities because they find the three essential conditions for their welfare: cover, humidity and food. One such is trees.

Trees have a powerful drawing effect on land snails which tend to concentrate at the base, especially in the spaces and crevices formed between the uncovered parts of the roots, and also in the nooks and corrugations of the tree bark. We have record of a location on the shores of Apoyo volcanic lake where at the foot of a single tree we collected a lot of 22 species, including 650 specimens of *Lamellaxis micra* .

Tree-trunks decaying on the ground are an added attraction for molluscs of all kinds, which nestle between the wood and the bark, in bark crevices and especially under the parts of the trunk in contact with the ground, obtaining humidity, shelter and the nutrients that leach from the wood,. The result is a remarkable increment of diversity in a very small area, several times the “usual” value of 5 to 12 species and living in microsympatry. The slogan at the heading “Seek a good tree and find a safe haven” is a clumsy translation of the well known Spanish proverb: *“Quien a buen arbol se arrima, buena sombra le cobija”* and applied here to the protection offered by trees to numerous creatures of the forest, especially invertebrates.

This enrichment of diversity is illustrated by the case of the fallen tree mentioned at the beginning, a “cedro real” (*Cedrella odorata)* by the forest margin, some 2 m in diameter and about 20 m long. The wood is decayed in patches but firm in others, and the bark still covers a good area of the trunk.

The soil and fine gravel under and by the side of the trunk was examined in two different patches, distant three m and over a total area of 1 m^2, yielding about 30 snails between 2 and 10 mm long. The top 5 cm thick layer of this soil was gathered in a plastic bag for a total of ca 2 litres. Later in the lab, under a X15 magnification with a stereoscopic microscope, many more minute molluscs were detected, ranging from 0.3 to 5 mm.

In all, 125 specimens were collected, the largest, *Bulimulus corneus*, 12 mm long, the smallest a 0.3 mm *Drymaeus* sp. protoconch. Most outstanding was a lot of 11 species of Spiraxidae, only three of which are determined. This family is characteristic of the rain forest, their habitat usually damp, partly decaying wood, under the tree-bark. In general they are rare and difficult to find. But in this case the habitat is just right for them and their presence is overbearing. Even rarer and less seldom seen are the Charopidae, typical of the rain forest soil, and two species are present here. Four other species, indicators of the rain forest

environment and found in the lot are *Charychium exiguum, Gastrocopta pentodon, Microconus pilsbryi* and *Xenodiscula taintori*.. Yet other species were four systrophids, four helicarionids, two *Thysanophora, Leptinaria guatemalensis* the only subulinid present, though abundant, and finally *Zonitoides arboreus*, a pest snail common in the rain forest but scarce in the dry forest.

Under the heading SUGGESTIONS FOR FUTURE WORK, Solem (1984) says that "*Vast regions of the tropics are uncollected…for land snails"* and so studies in the tropics are an urgent necessity, since a fair portion of the total number of land snail species are contained in them, much of it unknown at this time and in threat of extinction. And that these are studies which can be undertaken away from the major museums of the world, and indeed " ***must be done primarily by resident naturalists ".***

His puzzling contention that in tropical forests "*Snails… generally are neither diverse nor abundant"* may well be true elsewhere but here Is amply refuted by the values of maximum diversity we have encountered in the Nicaraguan rain forest (López, 2000, 2001) and data from authors like Emberton (1995) from Madagascar, Kentucky and New Zealand, Jaume (1945) from Cuba and others.

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