

Darwin's darlings

"*Opisthostoma fraternum*": a live specimen of *O. fraternum* from Sukau, Malaysia. Photo: Peter Koomen.



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KOTA KINABALU: If Darwin had not gone to the Galápagos Islands, his theory on the origin of species could have been born in Sabah's Kinabatangan valley.

An international team of scientists has discovered that the limestone hills there are a veritable evolution's workshop. The team, led by Dr. Menno Schilthuizen of Universiti Malaysia Sabah, studied the land snail fauna on 13 limestone outcrops that dot the Kinabatangan valley in Eastern Sabah.

Including the famous and spectacular Gomantong caves, these hills are the geological remnants of ancient coral reefs of millions of years ago when this part of Borneo was still covered by sea.

Because the rocks are of calcium carbonate, the same material that snails make their shells of, they harbour many unique land snail species.

The researchers focused on the so-called *Opisthostoma* snails, famous for their weirdly twisted shells, adorned with ribs and spines. As they report in the September issue of the journal *Evolution*, they found that each hill has an *Opisthostoma* population with a different-looking shell. Some of these are so different that they belong to separate species, like *O. mirabile*, which lives on Gomantong and nowhere else on earth (this is why it is placed on the international Red List of endangered species). When the researchers studied the snails' DNA, they found that the differences in shell shape were not just determined by the populations' genetic relatedness. In other words: they must be adaptations to some mysterious factor in the limestone environment.

The mystery was solved when Schilthuizen and field worker Berjaya Elahan of the Sukau-based Kinabatangan Orangutan Conservation Project (concerned not just with the apes themselves but with their entire ecosystem) started observing the snails at night. To their surprise, they discovered that the *Opisthostoma*'s worst nightmare is a nocturnal slug, a new species of a genus called *Atopos*, which uses its rasp-like tongue to bore holes in the shells and suck the occupant out.

When they then compared the predator's behaviour on different hills, they found that in each place, it had different table manners. On the hill Tandu Batu, for example, the predator likes to attack the bottom of the shell, whereas on Gomantong it prefers to enter its prey from the tip of the shell. Analysis of the arrangement of the spines, ribs, and flanges on the shell showed that each population adapts its shell to defend against the local predator behaviour.

The new study shows a rare insight in the evolution of new species by adaptation to the environment, says Japanese evolutionary biologist Satoshi Chiba of Tohoku University, adding "It is a great story."

Schilthuizen adds that the results highlight the importance of conserving limestone hills. A study by his student Liew Thor Seng published last year showed that *Opisthostoma* snails are among the ones hardest hit by fire, logging, and quarrying on limestone hills.

"The Kinabatangan valley is not just a haven for wildlife," he says. "It is a valuable natural laboratory of evolution."