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Bizarre twists

By TAN CHENG LI

The oddly coiled shell of a tiny snail has left scientists puzzled.

IT measured no bigger than a pinhead, yet when a scientific description of the microsnail *Opisthostoma vermiculum* was published in the scientific journal *Biology Letters* in January last year, it created a stir in the scientific world. Various websites discussed the find, and it even got its discoverer Reuben Clements into the *New York Time*s and the scientific journal *Nature*.

Last month, *O. vermiculum* was in the news again: it was voted into the list of top 10 species discovered last year, alongside Sabah's *Phobaeticus chani,* the longest stick insect ever found.

Marvellous molluscs: Opisthostoma obliquedentatum are among the many species of snails that thrive in the alkaline and calcium-rich soil of limestone outcrops. Most karsts harbour endemic species of snails that are not found anywhere else. – Pic by PETER KOOMEN

Ironically, on either occasion, *O. vermiculum* did not make it into local newspapers despite it being new to science and found only on one limestone karst in the Kinta valley of Perak.

But that's hardly surprising seeing that snails, and one that measures a mere 1mm at that, are unlikely to match the appeal quotient of mega-fauna such as the orang utan, tiger or elephant.

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But within the field of malacology (the study of molluscs), *O. vermiculum* has created quite a buzz – and all because its shell coils on four axes, a first in the world of snails. Most of us would be familiar with shells that coil tightly around a single axis, making for a simple spiral. But some shells have two axes, starting out coiling one way during the early stages of growth, and then curving by 90° or 180°.

Wild digs: In his search for snails in the limestone karsts of Malaysia, biologist Reuben Clements has found at least three new species.

Many species of *Opisthostoma* snails have three axes of coiling, with a final twist at the end of their growth. The *O. vermiculum*, however, has defied the established rules of shell growth and form by creating a home that twists in four independent directions. That is one more than any other known snail.

One look at the oddly twisted tube of *O. vermiculum* and what comes to mind is a deformed shell whose growth has gone awry. That, too, was Clements' initial reaction: "I thought it was a mutant as the way it coiled was unusual. It was only after I found many similar specimens that I thought it could be a new species."

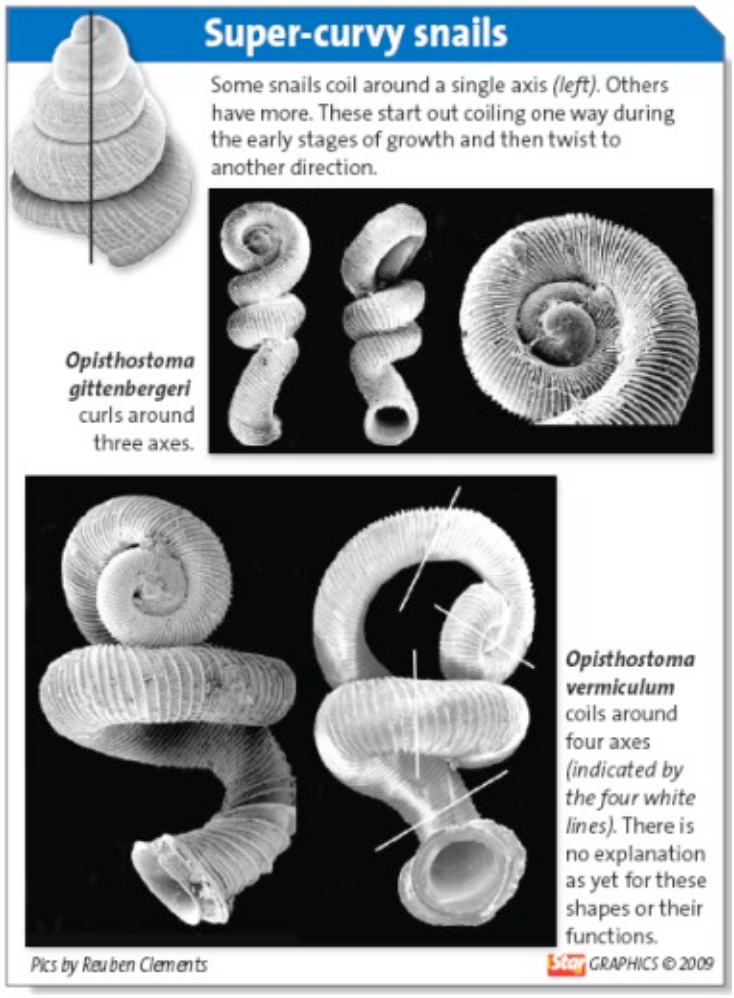
Snail hunt

Clements had unearthed the new microsnail (snails smaller than 5mm) while pursuing his Master's degree on the conservation of limestone hills and microsnails.

In 2005 and 2006, he surveyed 16 karsts in Peninsular Malaysia, scooping up bags of earth from each hill. It was in the dirt dug from Gunung Rapat in Ipoh, that *O. vermiculum* sprung up.

"When I showed it to a Dutch specialist, he was astonished. All the 38 specimens collected had a uniform pattern and followed a consistent coiling strategy. The whorls thrice detached and twice reattached to

preceding whorls in a fairly consistent manner, which suggests that the coiling strategy is under some form of strict developmental gene control," says the Singaporean biologist who is species conservation manager with WWF-Malaysia.



The unusual curling pattern of *O. vermiculum* (which means "worm-like") has baffled scientists. "It is strange indeed. We know of something like 100,000 coiled molluscs, and this is the only one I know with four axes," Bernard Tursch, a biologist at the Free University of Brussels in Belgium, who specialises in marine shells, told *Nature*.

Without a live specimen, it is unclear why *O. vermiculum* twists in such a bizarre way and how this benefits the snail. Because of the collection technique – the earth was mixed with water, then filtered to extract the shells, which were then dried – none of the snails survived. Clements did not find a live snail when he returned to the site but he is not giving up yet as questions persist.

"We don't know what the snail looks like or how it moves, let alone anything about its biology and ecology. It's a very clumsy-looking snail and with such a shell, it ought to be difficult to move. Won't soil particles get stuck in between the whorls and restrict its movement? Won't the snail find it difficult to ascend rocks with all that increased torque? The next step would be to find live individuals for further studies," says

Clements, 30.

Form and function

Why shells coil the way they do and what purpose these serve remain an enigma for scientists.

“Some hypothesise that it is an adaptative strategy, while others say that it helps with flotation to increase the snail’s survival chances in wet conditions. And yet others say it could be due to a stressful event or to cope with predation. But these are all wild conjectures. There is still a lack of understanding of the relationship between the form and function of shells,” says Clements.

His interest in shells stemmed from childhood trips to Sentosa island in Singapore. “The wide variety of shells fascinated me and I started collecting and buying seashells. But then, I realised that I cannot collect all the shells of the world, and it was bad for nature, so I stopped.”

Another new species of snail discovered by Reuben Clements is the Oophana tiomanensis (described in 2006), a carnivorous snail which preys on its own kind and lives only on Gunung Kajang in Tioman island. – Pic by REUBEN CLEMENTS

In 2001, the National University of Singapore undergraduate, then 21 years old, rented a car and headed for Kelantan. Near Gua Musang, he found himself in an amazing terrain: “Flanking the road were all these impressive towering karsts. I was awed and decided that one day, I will come back and study them.”

And he did. His surveys of 16 limestone outcrops uncovered 198 morphospecies (species identified from morphology or physical features alone, and not from anatomy or DNA) of microsnails.

Of these, 20 are believed to be new to science but Clements has only described two from the lot – *O. vermiculum* and *O. gittenbergeri* which curls on three axes and is found only on Gunung Datuk, Perak.

A third discovery is the *Oophana tiomanensis* (described in 2006), a carnivorous snail which preys on its own kind and lives only on Gunung Kajang in Tioman island.

Endangered karsts

Their puny size has left terrestrial microsnails much ignored – which means that there should be new species awaiting discovery. “With over 500 limestone outcrops in Peninsular Malaysia, imagine what else we can find,” quips Clements.

Snails are generally neglected in the bigger scheme of things when, in fact, they play important ecological roles.

“They are primarily decomposers, and so aid in nutrient recycling. They decompose detritus such as leaves, otherwise the whole forest will pile up with dead leaves. They are also food for birds and reptiles,” says Clements.

Their low abundance, high endemicity and threatened habitats have pushed many Malaysian microsnails onto the endangered list of the IUCN Red List. Limestone karsts, with their calcium-rich soils, support large colonies of snails. Even Batu Caves are known to harbour some endemic snails.

“Generally, 20% of the snails found on a limestone hill are site-endemic. But the escalating rates of limestone quarrying are likely to cause the extinction of many new species before they are even discovered,” laments Clements.

Aside from being groundwater catchments, limestone karsts are refuge for countless flora and fauna, including bats, an important pollinator, without which trees such as the durian will not fruit.

Based on the factors of irreplaceability and vulnerability, Clement has picked out these outcrops as those in need of protection: Gunung Jaya and Panjang in Kelantan; Serdam and Gelangi in Pahang; Datuk, Rapat, Lanno, Pondok and Kantan in Perak; and Batu Caves in Selangor.

“We should protect the larger hills as they will have more species diversity and endemic species because of the larger habitat,” he says.

*Reuben Clements had described **Opisthostoma vermiculum** together with Thor-Seng Liew, Dr Jaap Jan Vermeulen and Dr Menno Schilthuizen.*

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