All Things Weird and Wonderful

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Dicrocoelium Dendriticum is the Latin name for a tiny parasitic organism some 8 to 14 mm long, which is better known as the Lancet Liver Fluke. In spite of its humble appearance it has a life cycle that utilizes three different hosts in an improbable train of events that almost defies belief.

The hermaphroditic adult flukes can be found in the livers of grazing farm animals. After mating, the eggs of the fluke are excreted in the feces of the host, such as cattle, sheep or goats. The eggs are then ingested by a particular species of terrestrial snail. Inside the new host the eggs hatch into larvae which bore through the intestinal and stomach linings of the snail to reside in the digestive tract. Larvae develop into the juvenile stage which becomes coated by the snail's immune defences to form small cysts. These in turn are excreted by the snail in long trails of slime.

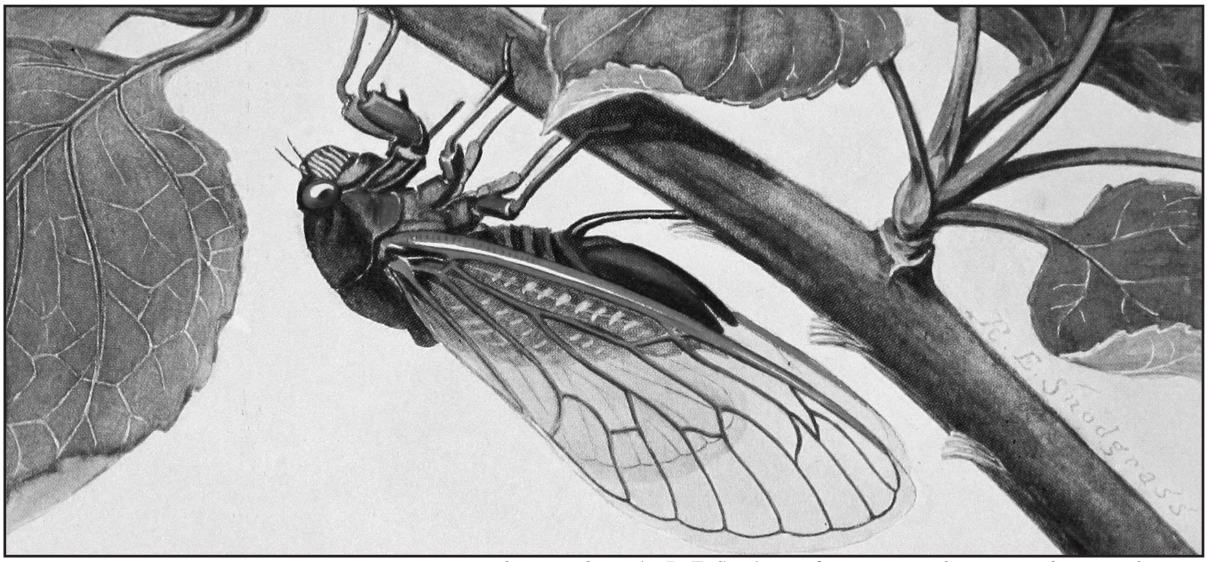
Marauding ants then swallow the cysts while feeding on the slime trails, at which point the plot thickens rapidly. In the ant's digestive tract the juveniles migrate throughout the host's body and mature into adult flukes. One particular rogue fluke travels to the brain of the ant, where it manipulates the brain, causing the ant to climb a blade of grass. Once at the tip of the blade, the fluke forces the ant to clamp its jaws to the grass and remain stationary until dawn. A passing sheep or cow will devour the grass along with the ant, thereby ensuring the flukes return to their original host to complete the cycle.

Just how this complicated sequence was unravelled by biologists is food for conjecture. One can imagine scores of lab-coated scientists crouching in meadows peering at blades of grass with magnifying glasses and note books in hand!

But then consider the monarch butterfly. This beautiful insect with the distinctive orange and black wing markings is found in many countries. However it is in North America that it has been most extensively studied. It is best known for its annual migrations between southern Canada and central Mexico, following two main corridors. One stretches from southern British Columbia and Washington State to the Oyamel forests in Mexico. The other begins in southern Ontario and follows a route down the eastern half of the USA before switching to a south-westerly course terminating in the same Mexican overwintering site.

Feeding exclusively on nectar from milkweed, these tiny fragile creatures begin their southward journey in the Fall, travelling distances up to 5,000 km, averaging about 80 km per day at speeds up to 19 km per hour. This epic journey is repeated in reverse every spring. What is less well known is the fact that every fourth generation of monarchs has a life span of around eight months. This is the generation that undertakes the long migrations. The intermediate three generations live for only two to six weeks. During the northward migration in the spring, the monarchs lay eggs on the milkweed flowers along the route, with the eggs hatching into larvae before changing into a chrysalis. From this emerges a new fully developed adult which will continue the northern journey started by its parents.

It is estimated that up to 300 million monarchs spend the winter in Mexico, but only about half of these survive the winter to begin the journey north. Many die en route, with survivors initiating another population build up to



Magicicada septendecim, by R. E. Snodgrass, from *Insects, Their Way and Means of Living*.

compensate for losses on the return trip south in the fall.

In contrast to the wide-ranging monarch butterfly, there exists another species of insect with a very different life cycle. The cicada, or more specifically, the *magicicada*, or periodic cicada inhabits eastern North America. This cicada has a life span of 17 years, or 13 years in the more southerly states.

After mating, the adult female lays several hundred eggs inserted into the bark of a tree. The eggs hatch into nymphs which descend the tree and burrow into the ground to depths ranging from 30 cm to two and a half metres. There they remain for the next 17 years, subsisting on sap drawn from the roots of the tree.

At the appointed time, as if on cue, swarms of nymphs emerge from their underground burrows simultaneously, climb the nearest tree and attach themselves to the bark. There they shed their skin and a fully grown cicada emerges complete with outsized eyes and translucent wings. For the next few weeks the surrounding trees are festooned with thousands of glittering wings and resonate with the incessant siren songs of amorous cicadas. After mating the adults die, but not before ensuring that the next generation will be launched on its strange journey through life.

Scientists have long been fascinated by the life cycle of *magicicada*. It has been noted that 17 and 13 are both prime numbers. Could it be that this periodicity has evolved as a mechanism to ensure the survival of the insect from decimation by predators such as the praying mantis and killer wasp? With a population explosion occurring every 17 or 13 years the chance of the cicada's emergence coinciding with a predator's population explosion is much reduced.

Many other questions come to mind. How does one maverick liver fluke decide it is time to hijack the brain of its host ant? Is there a voting process or do its companions draw lots? How does a newly hatched monarch butterfly in Kentucky know that it has to follow a prescribed migration route north to Canada? How on earth do several thousand cicada nymphs nestled underground know that, after 17 long years locked away in pitch darkness, now is the time to make a desperate dash for a few climactic weeks of freedom above ground?

Presumably, over several hundred thousand years these particular survival strategies have evolved by natural selection through a painful process of trial and error. For those that believe that this is the work of an all knowing and powerful Creator, there is evidence that a sense of humour ranging from the macabre to the bizarre has guided the creation.

On the other hand perhaps, in the case of *Dicrocoelium Dendriticum* at least, it is nothing more than a series of lucky flukes!

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