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THE BOOK OF THE WEEK

Jules Pretty unearths the roots of epic tales of life and death

An Orchard Invisible: A Natural History of Seeds
By Jonathan Silvertown
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Darwin was a worrier. He was from the Wedgwood family and married into yet more china and porcelain. His wife Emma was his cousin; his wife's brother married his sister. Darwin knew the power of natural selection to remove disadvantaged individuals, and so he watched his family with constant fear. When his eldest child, Annie, died at the age of nine, he wrote that his "dread is hereditary ill-health". He suffered too, but probably because of parasites picked up on the *Beagle's* travels. What Darwin left us, of course, was the intellectual tool-box to understand and explore natural selection.

How very appropriate, then, that Jonathan Silvertown should produce a fabulous book on the natural history of seeds and their evolution 200 years after Darwin's birth, and 150 years after the publication of *On the Origin of Species*. Our understanding of

evolution by natural selection has changed the world. It has also intertwined the life histories of individual scientists with those of animals and plants. It has exposed the constant dance for supremacy. It's been a mother of all battles.

Darwin held off publication of his masterwork for more than two decades as he gathered compelling evidence, and only just got to press in time. The Moravian monk, Gregor Mendel, was less fortunate. His paper on pea crosses appeared seven years after Darwin's *Origin*, but gathered dust for 34 years. Mendel had made the wrong choice for further research. After peas, he chose the hawkweed, *Hieracium*, which, unfortunately, is an apomictic plant that requires pollination to set seed but that produces seed with only maternal genes. No wonder his experiments did not work. In 1900, long after his death, three scientists famously and independently rediscovered

Mendel's work. Two, Hugo De Vries and Carl Correns, were already bitter rivals, and claim and counter-claim deepened their battles.

Silvertown's skills are in telling stories. Expect wonders too. This is a book about seeds, designed by evolution to store food. They are packed with energy stored as starch or fat, often with plenty of protein too, and are frequently protected with poisons or repellent chemicals. Animals eat them. We rely on them. And some have become very successful. We and our livestock eat a couple of billion tonnes of cereals annually, and we drink more than 400 billion cups of a dark brown aromatic liquid made from seeds that contain a chemical poisonous to insects, slugs and snails, and capable of preventing the growth of bacteria, fungi and plants. But we still drink it. Its young leaves contain ten times the concentration of caffeine of your

last cup of espresso, which is why the early domesticators of the coffee plant used the leaves to make a tea-like infusion drink.

It may be obvious why some seeds are poisonous, but why are many not? Plants have many strategies to get their genes into the next generation. The most extraordinary is the coco de mer or double coconut, the seed of a Seychellois palm weighing in at 23kg (think of your luggage allowance for the next trip to sunnier climes). How can such a giant seed get away from the canopy of its mother? By the cleverest mechanism – it sends out an underground rope up to 10m long, from the end of which the new plant sprouts.

The most potent seed poison is ricin, found in castor. It did for the Bulgarian dissident Georgi Markov in the 1970s, and is still a cause for security concern.

Another seed compound requiring Sherlock Holmes-like powers of investigation is called Beta-methylamino-L-alanine, or BMAA. It comes from cycad seeds, which the Chamorro people of Guam use to make fadang tortillas. But in the middle of the last century, it was found that a tenth of adults were dying from a spreading paralysis known locally as *lytico-bodig*. Oliver Sacks visited the island in the 1990s and made the link to the poison in the cycad. But the mystery remained. Sometimes the onset of the disease would come decades after exposure, and the Chamorro, cognisant of the dangers, carefully wash fadang – just as the Miwok washed acorns in California to leach out their tannins.

Then the leap of insight: botanist Alan Paul Cox realised that the toxin might be biomagnified in flying foxes that fed on cycad seeds. In certain ceremonies, the Chamorro, especially the males, eat flying foxes, and these were found to contain 10,000 times the concentration of BMAA as the cycad seeds. The disease is now disappearing, although not because of this scientific understanding. One species of fox is now extinct, and another near-extinct. And the source of the poison? Not the cycad, but cyanobacteria that live in the roots of the trees, which pass on the poison in return for a safe home.

Much worse, though, has been the tragedy of ergot, a fungus that

hitched a ride on cereals, in particular rye and caused at least 130 epidemics of ergotism across Europe over a thousand years. Ergot contains toxic alkaloids, one of which is lysergic acid, used to make LSD. Oliver Cromwell may have died of ergotism, which tended to occur after very cold winters and damp springs. Such conditions occurred in the early 1690s in New England. In 1692, children began to suffer contortions, utter bizarre sounds and complain that their skin was being pricked by pins. The local

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doctor in Salem was a fool. He diagnosed witchcraft, and 20 women and men were eventually executed. Ergot turns bread red, and this is just the colour of the bread used in the sacrament given by the Reverend Parris, father of the first victim.

What Silvertown also tells us is that evolution hasn't stopped. In the 1970s, a debilitating disease appeared around Lyme in Connecticut, and this has been tied to the cycles of oak mast, the booms of white-footed mice and the increase in prevalence of deer. These have created the conditions for the black-legged tick to find a new host – us. The lesson – stay out of the woods two years after a mast year.

An understanding of evolution

saved the French wine industry in the mid-19th century. Enthusiastic Darwinist Charles Valentine Riley realised that French vines, that were on their knees owing to the accidental introduction of the the sap-sucking aphids of the genus *Phylloxera*, could be saved by using as rootstock North American vines that evolved in the presence of the insect and were probably resistant to it. Riley was awarded the Legion d'Honneur for his insight.

The English elm was less lucky, and there has sadly been no saviour. Its invader was a new strain of Dutch elm disease in the 1970s. The elm is strange. It never sets seed, and spreads only by underground suckers. Genetic analysis has shown that the entire species is a single clone that the Romans brought to Britain. The elm has almost no genetic variation and, save for a few notable remote specimens, most adult trees were sadly wiped out, changing the face of England's countryside forever.

In this book, Silvertown has produced a gem. "Convince me that you have a seed there," said naturalist Henry David Thoreau, "and I am prepared to express wonders." Read this book as a gardener, scientist, food aficionado, historian, botanist or naturalist, and you'll not be disappointed.

Jules Pretty is professor of environment and society, University of Essex. His most recent book is *The Earth Only Endures* (2007), and he will shortly publish *This Luminous Coast* (2009).

THE AUTHOR

THE WEEK IN BOOKS

