Symbiosis

Ants, acacias and shameless bribery

Lazy insects get bigger rewards

AESOP'S FABLES are supposed to illustrate a moral point. If he had lived in Central America rather than Greece, though, he might have thrown in the towel at writing one entitled "The Ant and the Acacia Tree". For, as Sabrina Amador-Vargas and Finote Gijsman of the Smithsonian Tropical Research Institute, in Panama, have discovered, the moral of this particular tale is that laziness pays.

Acacias are a widespread group, but one member in particular, *Vachellia collinsii*, is famous for its symbiotic relationship with ants. The ants attack herbivorous insects which eat the tree's leaves, remove encroaching vegetation, and also protect it from disease by distributing antibiotics synthesised by bacteria living on their legs. In return, the tree rewards ants with food in the form of protein-rich Beltian bodies (the white objects in the picture above) and sugar-rich nectaries, and with secure housing inside hollow thorns that have evolved specifically for the purpose.

A cosy arrangement, then. But, like all bargains, one that is subject to negotiation. One of the best known ant symbionts of acacias is *Pseudomyrmex spinicola*. Members of this species do everything expected of them and help the plants to thrive. *Crematogaster crinosa*, by contrast, are less desirable tenants. They are lazy defenders against herbivores, fail to clear encroaching vegetation and are not known to spread antibiotics. Given the different services these species provide, Dr Amador-Vargas and Ms Gijsman wondered whether the plants paid them different wages. And, as they write in the *Science of Nature*, they found that they did. But not in a way that Aesop would have approved of.

For three months, the researchers monitored specimens of *V. collinsii* at two sites, one of which supported both types of ant and the other only *P. spinicola*. They paid particular attention to the trees' thorns, Beltian bodies and nectaries, but also collected evidence of leaves having been chewed by herbivores. For comparison, they looked at acacias lacking ant colonies.

The quality and quantity of accommodation provided was, they discovered, the same in all circumstances. Even when ants were absent, acacias grew similar numbers of hollow thorns. The food rewards on offer, however, varied a lot.

In particular, trees with ants sported 75% more nectaries than those without. This came as no surprise. But the plants also treated the two types of tenant differently. Though the distribution of Beltian bodies remained unchanged, acacias supporting colonies of *P. spinicola* only produced nectaries along the bases of their leaves. Those supporting *C. crinosa* did this too, but also sported such structures at the tips of their leaves, encouraging otherwise recalcitrant workers of that species to traverse the leaves to reach an extra reward. That brings these ants into contact with pests they might not otherwise have encountered, driving those pests away. But from an anthropomorphic point of view it hardly seems fair on the industrious workers of *P. spinicola*, which need no such bribe to achieve the same goal. ■

How tea gets its flavour

Milk, sugar and microbes, please

Micro-organisms play a bigger part in tea-making than was realised

TEA IS FAMILIAR around the world. People drink more than 2bn cups of it each and every day. Even so, it can pull surprises, as Ali Inayat Mallano and Jeffrey Bennetzen of Anhui Agricultural University, in China, have just shown.

Tea producers long assumed that the flavours of the most widely drunk varieties of this beverage, so-called black teas like Darjeeling, Assam and English Breakfast, were a consequence of some of the chemicals in tea leaves being oxidised while those leaves were being dried. Dr Mallano and Dr Bennetzen suspected, however, that, like the flavours of more expensive and rarefied "dark" teas such as kombucha, Pu-erh and anhua, black-tea flavours are at least partly a product of fermentation. This would mean they could be manipulated by tweaking the mix of micro-organisms doing the fermenting.

To test their hypothesis they obtained some leaves from the Dongzhi tea plantation in Anhui province. As they explain in the *Journal of Agricultural and Food Chemistry*, they then sampled the microbes thereon before sterilising half of the leaves in mild bleach for five minutes. After that (having washed the sterilised leaves thoroughly, to get rid of the bleach) they processed both the sterilised and the unsterilised leaves in the normal way. In other words, they withered, rolled, oxidised and dried them. They then tested them all for microbes once more. They also tested the result of all this treatment in a more time-honoured manner, by brewing numerous cups of tea.

If oxidation were the main cause of chemical change in black-tea leaves as they were processed, the sterilisation would have made little difference either to the chemistry or the taste of the final product. But this was not the case. Black tea brewed from unsterilised leaves had, as per normal, lots of catechins and theanine, both of which made it flavourful. Tea made from sterilised leaves did not, and its taste suffered as a consequence. Black tea, then, seems to get its flavour in the same way that dark tea does.

The next job, which Dr Mallano and Dr Bennetzen are now engaged in, is to identify the bugs involved. Once they have done that, tweaking the microbial mixture to produce novel flavours should become possible. And that is good news for tea snobs everywhere. ■