

## Beating the beetles

African farmers who rely on pesticidal plants to protect their harvests are quick to notice when something isn't working. Generations of farmers in southern Africa have added crushed or powdered leaves of *Tephrosia vogelii* to stored beans to protect them from attack by bruchid beetles. Because it's a legume, *T. vogelii* also fixes nitrogen and enriches the soil. As it's easily cultivated, outreach projects promote it to small-scale farmers as a cheap alternative to commercial pesticides and for improving soil fertility. During a survey of farmers in Malawi, however, many reported that while the plant improved their soil, it failed to protect their beans. As part of a larger project on pesticidal plants, funded by the McKnight Foundation, Phil Stevenson of Kew's Jodrell Laboratory turned detective to find out why.

With Steve Belmain at the University of Greenwich and colleagues in the UK and Malawi, Stevenson discovered why the *Tephrosia* treatment wasn't working. 'We found that this species has two distinct "chemotypes". The plants look the same, but their chemistry differs. One contains rotenoids and is toxic to beetles, while the other contains a variety of other compounds and has no effect.'

The toxic effects of *T. vogelii* are well known. One of its common names is the fish bean, because fishermen use the plant to stupefy and then catch fish. After discovering the variation in chemistry, Stevenson and Belmain then performed tests with insects to confirm for the first time that the rotenoids accounted for



One in four *Tephrosia vogelii* plants was found to lack the toxic compounds responsible for killing beetle pests

the pesticidal properties. The most important of the rotenoids was deguelin (*Journal of Agricultural and Food Chemistry*, vol 60, p10,055).

In a detailed survey of the plant's chemistry, the team showed that 75 per cent of plants being grown by farmers at 13 sites in Malawi contained the toxic rotenoids, but the remainder did not (*Phytochemistry*, vol 78, p135). 'So one in four farmers was being encouraged to

grow a plant for use in controlling insects that simply did not work,' says Stevenson.

At the moment, the only way to tell the two forms apart is by chemical analysis in the laboratory. 'We've been doing some analyses at Kew for various outreach projects so that they can provide farmers with the correct material to grow on their farms. Ideally, in future, there will be a simpler test appropriate for more people in more places.'