Is there honey still for tea?

Honey bees are dying out and no one's sure why. What to do? **Tiffany Daneff** asks Francis Ratnieks, Britain's only Professor of Apiculture. Portrait by **Pål Hansen**

"AT THE MOMENT EVERYONE'S RUNNING ROUND LIKE HEADLESS CHICKENS WANTING TO HELP." We are only half an hour into our conversation and Professor Francis Ratnieks's frustration is already manifest. He is Britain's first and only Professor of Apiculture and his ground-breaking research into "hygienic" bees looks like being our best hope of reversing the dramatic decline over the last decade of honey crops and the honey bees.

This is a worldwide problem with potentially profound repercussions. Honey bees produce one billion kilos of honey a year (a cupful for each person on the planet), and are the world's most important pollinator. And yet, despite persistent lobbying for desperately needed Government funds, Prof Ratnieks's lab still operates on Heath Robinson principles and a patchwork of charitable donations.

"Hygiene," he says, with the innate distrust of the dogged scientist for the headline-seeking journalist, "is not a magic bullet but one of several ways that help the management of disease.

"It's not sexy," declares Prof Ratnieks of his insistence on old-fashioned observation-based experiments. He cites recent research into Colony Collapse in America, where samples from apiaries were subjected to intense analysis by a ton of shiny new technology. By contrast, his Flower Constancy Project, recently undertaken by third-year undergraduates, was constructed using drinking straws, laminated paper and Plasticine flowers: total spend £10 at Asda. Depending on which colour paper flower the bees landed on, they were rewarded with a dose of nectar from a pipette. The

What is it that draws bees to certain flowers? Coloured shapes like these were used in one of many tests to explore bee behaviour

...and it was proved that they don't give a damn about the colour of a flower. It's the amount of nectar that counts

work was aimed at understanding why bees returned to particular flowers. It may sound simple but the hard-won data has been included in a scientific paper. Meanwhile, despite being at the sharpest edge of computer technology, not one of the 62 factors the American scientists looked at proved significant. "They ended up," says Prof Ratnieks, "knowing less than they thought they did before they started."

We are sitting in the Laboratory of Apiculture and Social Insects (LASI), at the University of Sussex. This is the largest research group of its kind in the country, with a team of 17 scientists. The university, which has been hugely supportive of Prof Ratnieks's work, paid for the renovation of the lab, though everyone from professor to undergraduate picked up shovels and picks to help build the two apiaries on site.

On one of the first sunny mornings of spring the bees are flying. While some are setting off to forage for nectar and pollen, others are returning, either to one of the wooden box hives or to painted markers on the walls of the lab that lead to six observation hives inside.

Each consists of a sheet of wax comb sandwiched between two plates of glass. From these hang a series of weighted plumb lines. A camera is trained on one glass hive and the Professor points out a worker bee nudging the others into action. "It's the start of the season and they need a bit of encouraging." The large bee with the green blob on its back is the queen. At a computer, an undergraduate watches the image relayed from the hive as a returning bee begins to perform a "waggle dance". The bee will repeat this figure-of-eight movement up to a 100 times or more. The length of the waggle tells other workers how distant the forage is. The angle of the bee's body to the sun (measured on screen using a protractor lined up along those plumb lines) tells the bees (and the humans) at what angle it lies from the sun. Five undergraduates and researchers have been analysing the data since August 2009, as part of the £1.9 million Sussex Plan for Honey Bee Health and Well Being.

This was conceived and is run by Prof Ratnieks, with offers of funds being received from a wide range of sources, from nine-year-old children to 80-year-old philanthropists. The Plan covers hygiene, forage, the parasitic varroa mite and other causes of disease. The aims are to breed "hygienic" bees (they naturally remove dead brood which prevents disease build-up); to discover which plants bees most need; to test which methods work best against varroa; and to study other causes of mortality in hives. It is slow, dedicated work.

Colony Collapse, which has affected US hives in particular, is unlikely to have one simple cause. "I think everyone now agrees that it is varroa-related but it is not going to be as simple as finding one pathogen. Colonies can collapse for all kinds of reasons.

"The thinking is that with modern technology you can bypass basic experimentation, but my feeling is that we need basic long-term observation of hives." Which takes us back to the lab, where a typical project demands long hours of close observation. It's a mindboggling business tracking these fuzzy beasts as they wriggle and jive and you have to admire the ▶

◀ dedication of the undergraduates, who have analysed 50 hours of dances a week.

And the point of the experiment? "We want to provide information on what plants to grow at which times of year, for everyone from gardeners to park and estate managers." With 97 per cent of herb-rich meadows lost since 1947 and 20 per cent of heather moorland gone (less in Scotland), loss of forage is thought to be a key factor in the honey bees' decline. And although people are keen to sow bee-friendly flowers, they're not always doing this to best effect.

"Even a recent TV gardening programme told people that bees like lavender. It's a popular misconception that bees only like blue flowers. They like flowers with nectar. They don't give a damn what colour it is." In fact, what's needed most are late-flowering plants which will give nectar to bees in September and October, when fewer flowers bloom. But it's not all bad news. He cites the planting in Richmond Park of avenues of limes. "A brilliant plant for bees."

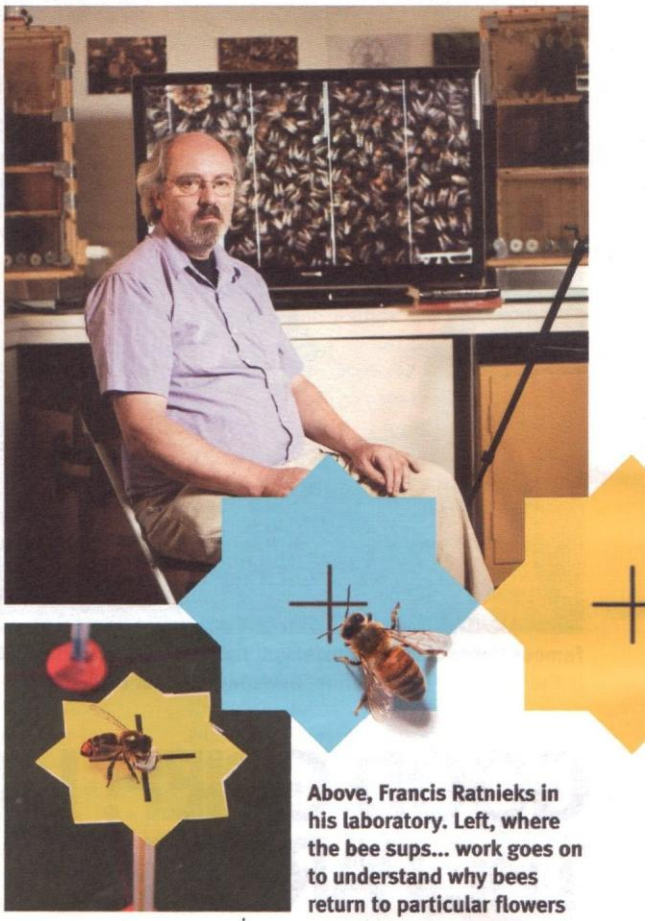
Of the £1.9 million required, Prof Ratnieks has already found £750,000 from generous individuals, trusts and foundations, beekeepers' associations and businesses such as Rowse Honey Ltd, Burt's Bees and Waitrose. More money, though exactly how much is yet to be determined, should come from the Government.

The £10 million Pollinator Decline Fund, for research into the health of bees and other pollinators, is made up of some Government money but with most from the Biotechnology and Biological Sciences Research Council (BBSRC), Natural Environment Research Council (NERC), the Scottish Government, and the Wellcome Trust. To the great frustration of many in the bee world, this has already dispersed some of its money to third parties with no direct involvement in actual research.

Prof Ratnieks did his Masters and PhD on honey bees at Cornell University in upstate New York, where he moved in 1982. He continued his research at the University of California and proved that undertaker bees, by removing dead larvae from cells, can help fight against diseases.

But he has never confined his focus to the microscope. He worked on an almond farm in California (where bees are crucial pollinators) and kept 180 hives producing such exotic-sounding delights as black sage honey. He has also taught at universities from Thailand to Sao Paulo. In South Africa, the result of 20 years' research into "worker policing" finally came good. (This was the work for which he is most famous and showed that worker bees will destroy rogue eggs laid by other workers, to maintain the queen's egg-laying authority.)

But back to those "hygienic" bees. They sound like the Holy Grail of honey bees and yet, says Prof Ratnieks, we have known about them for more than 70 years. Hygienic hives are those where dead brood (pupae) are removed from cells within 48 hours. Currently, only 12 per cent of British hives are hygienic. Why that is we don't know. However, Prof Ratnieks thinks that within three years his breeding programme will have reached the stage where he can offer beekeepers hygienic queens to trial. Hygiene travels down the male line and young queens have to be DNA-tested by taking a minute wing-tip sample. Even this was based on previous research to find a tiny scalpel or pair of scissors capable of making a snip small enough not to affect the bee's flight.



Above, Francis Ratnieks in his laboratory. Left, where the bee sups... work goes on to understand why bees return to particular flowers

I leave the lab with an equal mix of hope and impotent rage. It comes as a great relief that the work being done at LASI is built on solid foundations and to sense that it could lead, eventually, to a solution. But why, when the Government and its quangos throw money at swish advertising campaigns that no one pays any heed to, can they not see that with the relatively paltry sum of £2 million they could fund some genuinely practical science?

"We would really like to be doing an ongoing programme, not just for hygiene but to breed our black native honey bee," says Prof Ratnieks. There are, shockingly, no wild honey bee colonies left in Britain. And what would his ideal bee be like? The answer comes straight back: it would suffer less disease, it would not be highly defensive, it would make a lot of honey and it wouldn't swarm a lot.

Somehow you know, that despite the frustrations, Prof Ratnieks could one day realise his dream. ■

A percentage of the British Beekeepers' Association's Adopt a Beehive scheme, sponsored by Saga (see page 36), will go to LASI. To find out more or donate direct to the Sussex Plan, visit www.sussex.ac.uk/lasi