Finding the chink in the fruit fly's armour

The spotted-wing drosophila fruit fly (*Drosophila suzukii*), an exotic species from Asia, is fast developing into a threat for Dutch fruit growers. Researchers at Wageningen UR are examining every last detail of the fly to find its weak spot. **TEXT** RIK NIJLAND

INFOGRAPHIC ANKE NOBEL **PHOTOGRAPHY** MICHAEL DURHAM

In between a row of kiwi berry trees on Wageningen UR's experimental farm in Randwijk hangs a trap containing a nice-smelling fruit drink. Herman Helsen uses it to snare gullible flies – small, fragile but not nearly as harmless as they look. 'The spotted-wing drosophila fruit fly is the most significant new insect pest for fruit growers in 50, maybe a 100 years,' explains Helsen. 'It is creating havoc in the fruit-growing sector. Last year we didn't have a single kiwi berry that wasn't affected.' The prospects for 2015 don't look much better as many spotted-wing fruit flies have survived the mild winter.

The Southeast Asian fruit fly officially arrived in the Netherlands in 2012. That was the year when the Netherlands Food and Consumer Product Safety Authority hung up its first traps and immediately got a hit. But Helsen suspects the fruit fly has been in the Netherlands for much longer. 'The first signs of damage in southern Europe were seen in 2008. There was no stopping them after that. So much fruit is imported with eggs that the spotted-wing drosophila fruit fly must have got a foothold here before 2012.'

The newcomer may well have been overlooked as the spotted-wing drosophila does not look that different from the ordinary fruit flies we see gathering around the bins in the summer or on rotting fruit in the fruit bowl. In fact, there is one important difference. The native fruit flies lay their eggs in fruit that is already rotting and therefore worthless. The female spotted-wing drosophila fruit flies, on the other hand, use their ovipositor to penetrate the skin of fruit that is ripening or ripe. The larvae then munch their way through the pulp, causing the fruit to become soft, collapse and start to go mouldy and rot. Many commercially grown fruit crops are affected by the fly, especially those with thin skins such as currants, blueberries, cranberries, strawberries, cherries, plums, blackberries, raspberries, loganberries, kiwi berries, grapes, elderberries and rose hips.

Fruit growers with long harvest periods and fruit crops that ripen slowly are particularly vulnerable. Helsen says that there were many cherry orchards last year where the final crop was not harvested. 'The growers have different cultivars that ripen at different times. They do this so that they can supply cherries continuously from June onwards for two months. The fruit fly population increases enormously during that period whereas the number of cherries in the orchard decreases. So more and more fruit flies are targeting fewer and fewer cherries. Blueberry growers also stopped early because of the spotted-wing drosophila.'

DAMAGE IN VINEYARDS

Wageningen UR is currently carrying out research on how the fly lives to identify the new enemy's weak spots. 'We are trying to pool all the expertise,' explains the Randwijk researcher. 'One of our tasks is to figure out what implications new insights have for the Dutch situation and for fruit growers in practice.' What happens in the lab is not always the same as what happens in practice. Vineyard owners, for instance, complained they suffered major damage last autumn whereas it cost a great deal of effort to get the spotted-wing drosophila to reproduce on grapes in the laboratory.

Helsen is trying to find out more about the new insect pest and its weak spots by studying the spotted-wing drosophila fruit fly's annual cycle in the Netherlands. The population peaks in the summer and autumn. Most of the flies do not make it through the winter but there are a few that hide away and survive to see the spring. It is not clear where they go. 'In the spring we mainly see them around the edge of woods and in rough growth. We've wrapped fine-mesh netting around bushes and the grass under fruit trees to see whether flies emerge.' The flies that survive the winter form the base for the next year's plague.

The females that emerge in the spring do not need much. Just some sap or nectar from plants to build up their strength and some yeast for the necessary proteins. The ovaries are full by April but where do they lay their eggs? 'We are trying to find out whether they can use the berries of wild plants or garden plants, such as holly and cotoneaster, to bridge the two months until the first

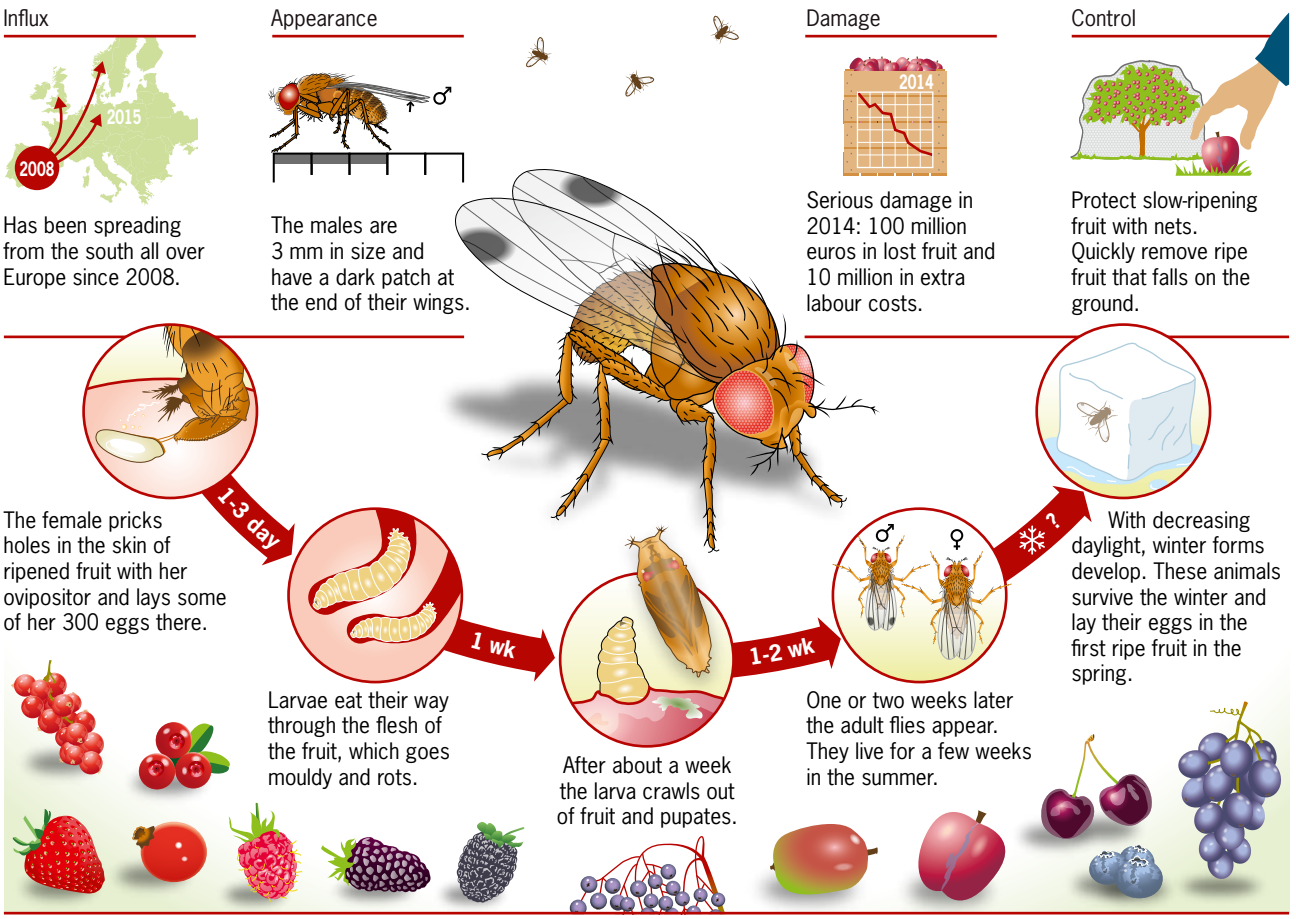
PHOTO GUY ACKERMANS

HERMAN HELSEN,
Researcher Applied Plant Research (PPO)

'The flies often prefer the real fruit to the bait in the traps'

The story of the spotted wing drosophila fruit fly

Drosophila suzukii, commonly known as the spotted-wing drosophila fruit fly, first appeared in the Netherlands in 2012. This exotic species, which originates from south-east Asia, poses a threat to fruit farming because the females lay their eggs in ripe and ripening fruit. The fruit is unmarketable within days. Every effort is now being made to find out more about the newcomer's life cycle and weak points.



cherries start to ripen. If so, we could break the cycle by removing all bushes of that kind from the area around fruit farms.'

The ultimate aim of the research is to outwit the spotted-wing fruit fly. For the moment, the emphasis is on hygiene measures. For example, growers should avoid leaving ripe fruit lying around on the ground in their fruit-growing plots. This is easier said than done. In the case of blueberries for example, 10 to 15 percent of the crop falls on the ground. 'It's really difficult to pick up all that fruit,' says Helsen. 'The challenge is to work out how we can avoid that fruit becoming the source of the next generation of flies.'

LOSS OF 10 MILLION EUROS

Jaco van Bruchem, a policy officer at NFO, the Dutch fruit growers' association, suspects the spotted-wing drosophila fruit fly was causing damage even in 2013. >

PHOTOS HOLLANDSE HOOGTE

The spotted-wing fruit fly is a growing problem in vineyards. The females lay their eggs in ripening fruit, and the larvae (top right) eat their way through the flesh, causing it to rot. Affected fruit has to be cut out whenever possible.

'But it got completely out of hand last year. We estimate the loss in damaged fruit at 10 million euros plus additional labour costs of another 10 million due to hygiene measures and having to take more care when picking and sorting the fruit.' Van Bruchem expects losses to reach a similar figure in 2015. 'A positive aspect is that the growers are much more aware now. They will probably be much stricter in clearing away the fallen fruit. We also hope that the Ministry of Economic Affairs will authorize more pesticides for use.' With strict restrictions, the use of organic insecticide Tracer is permitted on blackberries, raspberries, strawberries and smaller berries. For cherries and plums no effective pesticides were authorized last year.

Organic pest control can also play a part. On Wageningen Campus, Gerrie Wiegers from Plant Research International, part of Wageningen UR, demonstrates a culture medium that has turned dark green from the spores of the fungus *Metarhizium*; another agar plate is completely white with *Beauveria* spores. They may be future weapons in the war on the spotted-wing drosophila. Spores of the two fungi have successfully been tested on cockchafer larvae and crane-fly larvae respectively. But there is a much bigger arsenal of insect-killing fungi available, as researcher Rob van Tol explains. 'There will undoubtedly be one that can take on *Drosophila*. But that's not the end of the matter. In what phase of the life cycle are the flies susceptible? Are we talking about the adult animals or the larvae? The larvae are inside the fruits – can the fungal spores even reach them?' Wiegers and Van Tol will be carrying out an infection experiment with fruit flies in cages. If they release a few flies infected with a fungus, will they quickly transmit the spores to the other flies? Or is it better to lure the flies to a trap with ripe fruit and infect them with the fungus there? 'It's still debatable even then whether that would be enough,' says Van Tol. 'Will the female stop laying eggs as the fungal spores spread or will she keep going until she drops dead? If the latter, it's a useless pesticide. If this doesn't work, we still have parasitic nematodes in reserve.'

COVERED WITH NETTING

The growers will have to manage on their own for the time being. That is why large-scale cherry growers are thinking about covering their trees with netting, says Helsen. A number of years ago, growers switched from the traditional trees with long trunks to higher yielding trees with short trunks. They are often kept under plastic to keep out the rain and wrapped in netting to stop the birds getting at them. 'Then it's not such a big step to use nets with a finer mesh,' says Helsen, 'but that has disadvantages too, such as less light and less air circulation.' He doesn't expect such protection to keep all the flies out. 'Tractors are being driven in and out and the fruit gets picked so some fruit flies are bound to get in then. That's why I think they need to have segregation as well. If you grow the early cherries and the late cherries in different compartments, you can avoid the situation where the early cherries are a source of infection for the late harvest.'

'The spotted-wing drosophila fruit fly is the first new insect pest for fruit growers in maybe a 100 years'

There are recommendations everywhere, including on the Internet, for traps as a way of dealing with the fruit flies. Helsen has serious doubts about their effectiveness. 'Of course every creature you catch is one less. But in general the flies prefer the real fruit to the bait that's in the traps, and there's always lots more real fruit on offer. If you catch a female, it's highly likely to have already laid eggs. Until we can come up with much more enticing bait, I don't think investing thousands of euros in traps and labour is justified.'

Despite all the uncertainties, the researcher is optimistic. 'In five years' time, the spotted-wing drosophila fruit fly will be a run-of-the-mill pest for fruit growers, one you can keep under control with a strategy tailored to the specific crop using a set of instruments that are gradually being developed and refined.' He also expects there to be solutions for organic farms. 'They are even more vulnerable because of the mix of different crops, which means there is ripe fruit available all year round. Ideal for this fly. But eventually we'll find solutions for organic farms too.' ■

www.wageningenur.nl/suzuki-fruit-fly