Insecticide-impregnated bednets

Pierre Guillet of the World Health Organization and his co-workers at the Institut Pierre Richet in the Ivory Coast (Guillet *et al, Medical & Veterinary Entomology*, **15**(1), 105–112), describes the development of "two-in-one" mosquito nets impregnated with pyrethroids and carbamates. Not only are "two-in-one" nets more effective at controlling the malaria-carrying *Anopheles* mosquito, but they are also better at controlling the nuisance mosquito *Culex*. The latter is important in encouraging wider uptake of insecticide-treated nets. The use of a combination of two insecticides should also help to reduce the spread of pyrethroid resistance among *Anopheles* mosquitoes, which is becoming a problem in some areas of Africa, Central America, Turkey and the Middle East. The authors claim that nets can be more effective if treated on the upper part with a carbamate and with a pyrethroid on the lower part … This new approach is based on the observed behaviour of mosquitoes flying around a bednet and occasionally settling on it. From sleepers under the bednet, heat and carbon dioxide emanate and move upwards thermally within the net, which acts like a chimney. Consequently, foraging females tend to begin exploring nets on the upper part, proceeding downwards looking for any bloodmeal opportunity.

…Janet Hemingway and colleagues at Cardiff University describe an important new test for measuring pyrethroid concentrations on mosquito *nets (Medical & Veterinary Entomology*, **15**(1), 58–63). Based on a simple iodine volumetric titration which can be read by eye, the new assay is a major advance on other tests which are too complex or too expensive to be used in the field in malaria zones. A simple and cost-effective means of monitoring the amount of pyrethroid is a key part of antimalaria strategies based on mosquito nets.

…according to a recent report (*British Medical Journal*, 2001, **321**, 270–273), mosquito nets treated with insecticide and distributed as part of a large scale social marketing programme can substantially reduce the prevalence of malaria and anaemia in very young children in Tanzania. This strategy has high potential in the control of malaria in sub-Saharan Africa. The study of a random sample of 748 children, aged under 2 years, living in 18 villages in southwest Tanzania found that ownership of treated nets rose rapidly, from 10% to 61%. The prevalence of severe anaemia decreased from 49% to 26% in the two years studied, and the mean haemoglobin level in the children rose from 80 g/l to 89 g/l. Treated nets had a protective efficacy of 63% against both malaria and anaemia. Treated mosquito nets might therefore be able to deliver feasible and effective malaria prevention on a large scale in areas where malaria is highly endemic.

Phytophthora-resistant genes?

The potato and other related varieties of the *Solanum* species contain scores or perhaps even hundreds of genes that can give the plant a degree of resistance to *Phytophthora infestans*, according to a doctoral thesis by Vivianne Vleeshouwers, who conducted her studies at Plant Research International and Wageningen University. According to the thesis, research scientists and breeders should be made aware of the fact that *Phytophthora infestans* is not fungus but an oomycete. It is therefore more closely related to plants and algae than to fungi. The results could open up new perspectives for the development of potato varieties with sustained resistance. Until recently this kind of immunity was considered to be founded on a totally different mechanism than the non-sustained form of resistance. Species with this type of resistance carry resistance genes (called the R genes) which bring about a hypersensitive reaction in potato plants. The reaction causes plant cells to die wherever the pathogen enters the plant, resulting in the pathogen itself dying off. The genes responsible for this are not active against all forms of the pathogen, which makes the resistance non-sustainable. Vleeshouwers discovered that all plants are, to a certain extent, resistant to *Phytophthora infestans*. All plants that come into contact with the pathogen show a more rapid rate of cell death. The speed and effectiveness of the hypersensitive reaction, however, is different for each plant. The hypersensitive mechanism is therefore not only responsible for non-sustained resistance, but plays an essential role in all forms of resistance, including sustained resistance. Vleeshouwers makes the assumption that potatoes and related species are 'overflowing' with genes that could contribute to the development of varieties with a sustained resistance to *Phytophthora*. Plants showing a hypersensitive reaction must therefore certainly not be rejected in the course of the cultivating process. (http://www.plant.wageningen-ur.nl/news/2001-01_en.htm)

Biologicals

…a bioherbicide

Japan Tobacco has introduced Camperico as a selective bioherbicide for the control of annual bluegrass. The product contains strains of *Xanthomonas campestris* that are pathogenic to annual bluegrass (*Poa annua*). The bacterium produces a polysaccharide (xanthan) that interferes with the upward movement of water through xylem causing wilting. Camperico is the world's first commercialised bacterial herbicide.

…a biofungicide

Botokiller WP is an isolate of the naturally occurring common spore forming bacterium, *Bacillus subtilis*. The product has been jointly developed by Idemitsu Kosan, Tomen and Nihon Nohyaku. *Bacillus subtilis* acts as an antagonist *of Botrytis cinerea* on eggplant, tomato and strawberry, or *Sphaerotheca aphanis* on strawberry (fruit, leaves and petals). Botokiller also has preventive activities to *Botrytis* and *Sphaerotheca* by foliar application.

…using fungi to combat mites and beetles in grain stores

The phasing out of methyl bromide and criticism of the use of organophosphate insecticides is stimulating research into new methods of controlling pests in grain stores. The Central Science Laboratory, York has identified two myco-insecticides for use on the fabric of storage buildings. Laboratory results have given full control of beetles and promising control of mites. Unfortunately the compounds are highly specific which is expected to raise control costs. Application is expected to be by conventional spraying. CABI Bioscience, a project collaborator, already markets Green Muscle, a mycoinsecticide for the control of Kenyan locusts.

…biological for control of aphids, whitefly, thrips and mites

An IPM-compatible biological control agent has recently been included in the UK's Assured Produce protocols. This is expected to benefit cucumber, tomato, pepper, aubergine and ornamental crops. Biological Crop Protection's Eradicoat controls aphids, whitefly, thrips, and mites by physical rather than pesticidal means. Because there is no harvest interval, Eradicoat can be used to control pest hot spots during cropping.

Reduction in European pesticide consumption?

According to a professor in Wageningen University's Plant Production systems

DOI: 10.1039/b102654m

group, the quantity of pesticide active ingredients used in Europe could be reduced from 315 M tonne/y to 10–40 M tonne/y provided farmers were to convert to using the most advanced technology and the highest quality soil. In addition, the area of land cultivated could be cut from 140 M hectares to 70 M hectares. It is claimed that most pesticide consumption is down to mismanagement, with farmers spraying diseases and infestations which are the natural enemies of major plagues such as aphids and white fly.

Ten-year biodiversity study

A 10-year study comparing conventional, organic and integrated farming systems at Aventis CropScience's Boarded Barns Farm in Essex, UK, has provided a wealth of independent data on the effects of these three systems on farm biodiversity. The principal lesson from the study is that field margin management, whether it be a grass margin, hedgerow or ditch, is of great importance in enhancing the wildlife value of the farm. So too is the provision of green corridors such as beetle banks. It is in these areas that most species can be found irrespective of the farming system used in the cropped area. The type of crop and the method of cultivation, however, do impact on many species:

- wood mice appear to favour ploughed land. More were recorded in the conventional and organic fields than in the integrated. Fear of predation seems to prevent then moving out into the ICM unploughed crops
- the vast movement of soil associated with potato production devastates many species, including ground beetles and other predatory arthropods.
- carabids do better in beans than in wheat, possibly because more light penetrates the foliage, thus increasing the temperature at soil level where the beetles live. Interestingly, when pirimicartb was used to control a high population of aphids in beans, the numbers of beetles soared as the dying aphids fell to the ground providing a rich food source for the beetles.

Carbon dioxide for wood preservation

The Australian research institute CSIRO is studying the use of carbon dioxide as a vehicle for wood preservatives. It believes that carbon dioxide will allow hardwoods such as messmate eucalyptus to be treated as well as difficult softwoods such as cypress pine. When in supercritical phase, the carbon dioxide acquires an ability to penetrate fine structures such as the micropores of wood. Researchers report a much better preservative penetration and retention. The institute is seeking a patent for its carbon dioxide technique.

Wax block impregnated with aluminium phosphide

The Australian research institute CSIRO has developed a wax block impregnated with aluminium phosphide for the control of insects in stored grain. The project was in cooperation with the Indian company United Phosphorus and the Australian firm AusBulk Ltd. The block allows controlled continuous release of phosphine in a special generator. It is currently in commercial-scale field trials in Australia. Existing products, which react with moisture in the grain to produce phosphine, are often slow and uncontrolled.

Blown film barriers reduce methyl bromide emissions

It is claimed by blown film processors that 3–5 layer blown barrier traps can reduce emissions of methyl bromide into the atmosphere. A 34% reduction in emission levels can be achieved by using a special co-extruded multi-layer gas barrier film called virtually impermeable film. A 5-layer structure is considered as superior to 3-layer web structures, as it offers elevated protection of the intermediate layers which may have water-soluble pigments and additives that are easily washed out of 3-layer solutions. Repsol-YPF of Madrid, Spain, is proposing an alternative blown-film web structure for glasshouses that taps the properties of CP224AB, a PE compound based on a combination of organic UV absorbers, to arrest the growth of plant diseases caused by viruses and fungi. In trials of the product on tomato plants, *Bemisa tabaci* (white flies), a known transmitter of the Tomato Yellow Curl Leaf Virus, did not enter the glasshouse due to a perception of a darkened environment not attractive to them. The UV blown film filters the light coming into the glasshouse to generate the effect. The film also arrests the growth of certain fungi that need UV light to produce spores.

Natural resistance the glandular way

Many plants have tiny glands, called trichomes, through which they secrete chemicals than can deter insect pests. Researchers have identified a cytochrome P450 enzyme unique to plant trichome glands which is involved in the production of these natural pesticides. When the activity of this enzyme was turned down in tobacco plants, the concentration of a diterpene was elevated about 20-fold. The modified secreted more of the diterpene through their glands, preventing aphids from attacking and forming colonies (*Nature Biotechnology*, April 2001, 371).

Plants' night-time defences

Scientists at the US Department of Agriculture, Agricultural Research Service published new insights into how plants defend themselves against insect attacks at night (*Nature*, 29 March 2001). They found that tobacco plants (used as a laboratory tool) release herbivore-induced plant chemicals during both day and night, and that several volatile compounds are released predominantly at night. These chemicals were highly repellent to female moths searching for sites to deposit their eggs. If the moths sense a chemical aroma it indicates that the crop is already larvae infested, and they find another, safer location for their offspring to develop. The researchers will conduct further studies that could help plant breeders develop new crop varieties with enhanced defence systems.