Banana genome

A global consortium of publically funded institutes from 11 countries meeting recently in Washington DC, USA, has announced that the banana is to be the first edible fruit and the first exclusively tropical crop to have its genetic code unravelled. Unlike the huge genomes of many hybrid crop plants, the banana genome is relatively small and it is hoped to complete the task within 5 years. The International Network for the Improvement of Banana and Plantain (INIBAP), based at Montpellier, France, is the driving force behind the genome effort. INIBAP is part of the Rome-based International Plant Genetics Resources Institute (IPGRI). Other organisations in the consortium are the International Institute for Tropical Agriculture (IITA), based in Nigeria and the Institute for Genomic Research (TIGR) and organisations from Australia, Belgium, Brazil, The Czech Republic, France Germany, India, Mexico, the UK, and the USA.

Half the world's edible bananas, including the Cavendish, are seedless and sterile, and cannot be bred at all. Instead, they are propagated by taking the plantlets that appear at the base of old banana plants each year. Because they have been in evolutionary standstill for thousands of years, the edible varieties are particularly vulnerable to pests and disease. As a result, the banana is one of the most heavily sprayed crops in the world. It is hoped that if disease-resistant banana varieties can be developed than there could be a significant reduction in the present reliance on the use of fungicides and other pesticides.

As a result, instead of sequencing one of the edible varieties, the consortium will sequence a wild banana from east Asia – *M. acuminata*, from which the majority of edible bananas are descended. This species should contain useful genes that could be added to edible varieties to improve ripening and increase resistance to disease and pests. For example, a gene that protects against the black Sigatoka fungus[1], which destroys banana leaves, and was first discovered in Honduras in the 1980s, would be particularly valuable. Because interbreeding is impossible, genetic modification is the only way to insert such genes into commercial varieties.

[1]Ploetz, R. (2000). Black sigatoka disease on bananas. *Pesticide Outlook*, **11**(1), 19.

Locust plagues

Spring 2001 has brought with it plagues of locusts that are devastating huge areas in North America, Russia and China. In the USA, an agricultural emergency has been declared in Utah where the insects have caused crop losses of more than $18 million. Russia is experiencing its worst plague for over 40 years in an area of over 70,000 hectares in Dagestan near the Caspian Sea. The insects have already destroyed 12,500 hectares of summer wheat and are threatening the winter pasture for 1.5 million sheep. In north-west China, locust swarms have infested over a million hectares and the Chinese government has flown in hundreds of thousands of ducks that, it is hoped, will help in the control by eating the insects. There are said to be many reasons for the spread of locusts including the rising global temperature that opens up new habitats for them and, in poorer countries, the lack of pesticides to treat infested land.

Pesticide links to diseases

…with leukemia

According to a report (in *Cancer Research*) from a professor at Edinburgh University, mothers who were exposed to propoxur and other carbamate repellents made for the control of mosquitos were ten times more likely to have a baby that developed leukaemia than those not exposed.

….with Parkinson's disease

Research at the University of Rochester School of Medicine & Dentistry has shown that when rats were exposed to a combination of the paraquat and the maneb they developed symptoms like those of Parkinson's disease. And another study (Stanford University School of Medicine) reports that a group of 496 people with Parkinson's disease were twice as likely to have been exposed to pesticides in the home and garden as people without the disease.

…with endocrine disruption

A recent report from a National Toxicology Program (NTP) Panel says there is credible scientific evidence that some chemicals that are thought to disrupt the hormone system can affect bodily functions of laboratory animals at very low levels. The panel found sufficient evidence of low-level effects to recommend additional studies on bisphenol A. The report also recommends more studies on chemicals suspected of imitating or blocking male hormones, including the fungicide vinclozolin.

….with premature births

Researchers at the National Institute of Environmental Health Sciences in Bethesda, MA, claim that exposure to DDT may have caused an increase in premature births in the USA during the 1960s. The conclusion is based on analysis for DDE (the breakdown product of DDT) in archived blood samples from 2380 mothers, as part of the Collaborative Perinatal Project (CPP). The CPP took blood samples from 42,000 pregnant women between 1959 and 1966, and followed them and their 55,000 children for 7 years. The researchers found that the likelihood of premature birth in their sample increased with increasing DDE concentrations (*Lancet* 2001, **358**, 110–114).

Insects as herbicides?

The US Department of Agriculture (USDA) is looking at new, natural ways to control alien weeds. Cape ivy (*Delairea odorata*) was introduced into the USA from South Africa in the late 1800s and soon escaped and became established in the coastal areas in California and up into Oregon. In South Africa, the weed is hard to find because it has several natural enemies. Extensive collaboration between scientists at USDA and Plant Protection Research Institute in Pretoria has identified the Cape ivy gall fly (*Parafreutreta regalis*) and a small moth (*Acrolepia* sp.) that have the potential to reduce the competitiveness of the Cape ivy and thereby reducing the damage caused to willow forests. (http://www.nps.ars.usda.gov).

In another study, USDA-ARS scientists have introduced flea beetles (*Aphthona lacertosa*) to control leafy spurge (*Euphorbia esula*) an alien weed introduced into the USA in 1827 that now infests over 2.2 million hectares in 35 states. When these flea beetles are used in conjunction with grazing sheep very effective control is achieved. The beetles do not survive in sandy or wet areas and the search is now on to locate other biological solutions.

The saltcedar tree (*Tamarix* spp.) is another alien tree that can grow to a height of over 10 metres and will outcompete native species, increase soil salinity and divert natural streamflow. The USDA has introduced Chinese leaf beetles (*Diorhabda elongata*) at sites in California, Texas, Colorado, Utah, Nevada and Wyoming where the growth of the saltcedar trees has been slowly reduced allowing beneficial plant and animal species to re-establish in severely infested areas.

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IPM in US potatoes

In the US Pacific Northwest, the biggest threat to potatoes is leaf roll virus transmitted by the green peach aphid (*Myzus persicae*). USDA-ARS workers in Wapato, Washington, have shown that combinations of specific aphicides and the fungus *Beauveria bassiana* givemore effective control than either used alone. In addition, combinations of *B. bassiana* and *Bacillus thuringiensis* gave better control of the secondary pest Colorado potato beetle (*Leptinotarsa decemlineata*) than either product alone.

Morley and NIAB announce merger talks

Philip Richardson (chairman of Morley Research Centre) and John Heading (chairman of NIAB) have announced that the two organisations are engaged in talks that may lead to a merger of the two organisations. It is believed that a merger would improve the services provided to members and customers. A positive decision on the merger would lead to the formal process of merging beginning at the end of 2001 with completion expected by spring 2002.

Key to cockroach resistance

Steven Valles of USDA-ARS Center for Medical, Agricultural and Veterinary Entomology has discovered a unique esterase bound to the membranes of German cockroach (*Blatella germanica*) that detoxifies certain insecticides, thereby increasing their resistance to those compounds. In addition, it was discovered that the German cockroach had several mutations in the kdr mechanism that made them more resistant to pyrethroid and related insecticides.

Mosquito control

…xanthan gum

work at Purdue University has shown that xanthan gum spread on the surface of ponds and other stretches of open water gives good control of mosquito larvae without affecting associated pond life. The xanthan forms a temporary film on the surface of the water and this smothers the larvae when they return to the surface. There is a fear that the xanthan will need to be applied at too high a rate to be commercially viable but the use of the gum as a floating carrier for insecticides where it will be prevented from sinking to the bottom of the water and associated pond-life are under way (*Environmental Entomology*, 2001, **30**, 388-93).

…sponging livestock

In South Asia where malaria-transmitting mosquitoes feed mainly on domestic animals, researchers from the London School of Hygiene and Tropical Medicine have shown that sponging animals with insecticide is more effective and cheaper than indoor spraying of houses. Trials in six Afghan refugeee settlements in Pakistan have shown that the treatment reduces incidence of malarial infection by more than 90% and the cost of the sponging regime was 80% lower than that of indoor spraying.

Biodegradable pellets protects sugar beet

Cellulose capsules are to be used in future to treat nematodes that attack sugar beet. Wolff Cellulosics, together with two German institutes, has managed to incorporate *Hirsutella rhossilensis* and a nutrient used in the development of the fungus in biodegradable pellets. Sugar beet growers should profit from the development as they have been able to do little about the nematodes since the banning of chemical pesticides. The nematodes are infected and killed when the cellulose capsule opens and releases the microorganisms. Wolff Cellulosics is part of the Bayer group.

Insecticidal properties of DE under study

Diatomaceous earth (DE) is derived from phytoplankton fossils found in chalk deposits. Ground into dust the product has potential for the control of insects in stored grain in a more environmentally safe manner than conventional insecticides. DE is being studied at the Natural Resources Institute where it has been demonstrated that mixing the product with grain results in the waxy covering of infesting insects being absorbed resulting in dehydration and death. Trials in Zimbabwe have found DE to be as effective as organophosphates, giving control up to 8 months.

'Natural' biopesticide to be developed

BTG aims to hasten the development of DMDP (dihydroxymethyl-3*R*,4*R*- dihydroxypyrrolidine), a compound that protects crops against nematodes, by forging an alliance with several organisations. The firm is collaborating with ECOS of Costa Rica, INBio, the Scottish Crop Research Institute, Kew and the Royal Botanic Gardens on the project. DMDP is derived naturally from the Costa Rican tree, *Lonchocarpus felipei* and is claimed to be systemic, moving into the crops roots following foliar application. The partnership calls on the Costa Rican groups to develop DMDP in tropical crops such as banana, while BTG will coordinate trials in temperate crops such as potatoes. A licensing agreement was signed between BTG and a top agrochemical company that is evaluating DMDP's effectiveness in potatoes. About 10% of global crop losses are attributed to nematodes, with an estimated $80 bn/y in cost in major crops alone.

Snippets

….trials are underway in France and the USA of an algae product that is claimed to boost the resistance of crops to diseases. The active ingredient, code-named GL32, is derived from a brown alga. The compound has proved effective against mildew, septoria, rusts and other fungal diseases. It has protected wheat for 6 to 8 weeks following application at ear stage.

….BASF's new, more curative strobilurin fungicide, pyraclostrobin (F500), gives a yield boost beyond that expected solely from disease control. Its mode of action in this regard appears to be different from kresoxim-methyl. F500 appears to have a much larger effect on nitrogen reductase, so the plant can assimilate more nitrogen. It also has a much stronger hormonal effect.

….Loveland Industries, UK, has launched a new dual-action adjuvant for use with vegetable and pea fungicides and insecticides. The product is a mix of organosilicone wetter and latex sticker, which gives it properties which are particularly useful on the waxy leaves of brassicas, onions and pulses.

EVER THOUGHT OF WRITING AN ARTICLE FOR PESTICIDE OUTLOOK?

The Editor would welcome readable up-to-date articles on any pesticide-related topic. Please send manuscripts to Hamish Kidd, *Pesticide Outlook*, The Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge CB4 0WF. FAX +44 (0)1223 432160; email KIDDH@RSC.ORG.