General News

Heather Beetle: from Doom to Boom?

Seven years after it was introduced to New Zealand, the first outbreak of a beetle agent introduced to control heather (*Calluna vulgaris*) has been reported. Having overcome a series of setbacks, this project seems set to become a good demonstration of classical biological control as an effective management tool of an invasive alien weed in conservation areas.

Heather was introduced into the Tongariro National Park in central North Island as part of an unsuccessful and misguided attempt to set up a grouse moor in the early 20th century. The spread of heather into native red tussock (*Chionochloa rubra*) communities of this World Heritage Site has become a major conservation problem. Heather also invades other subalpine vegetation, and is now threatening the important Moawhango ecological zone, which is home to many rare New Zealand endemic plants. In 1991, CABI Bioscience (at that time the International Institute of Biological Control, IIBC) were brought in to survey in Europe for possible biocontrol agents. The heather beetle, *Lochmaea suturalis*, looked like being the answer. Heather beetle 'outbreaks' occur typically at 5-10 year intervals in northern Europe, sometimes causing complete mortality of heather over many hectares. The beetle is regarded as a pest of heather moorland used for grouse shooting, and causes damage to valuable areas of heather in lowland nature reserves in both the UK and the Netherlands.

As a potential biocontrol agent for release in conservation areas, host specificity testing was rigorous and extensive. However, during 5 years' testing in the UK, it was found to be completely specific to heather apart from one incidence of feeding on the New Zealand alpine species *Pentachondra pumila* in no-choice tests. Field tests were conducted in the UK on root-washed *P. pumila* imported from New Zealand before the beetle was declared safe for importation. At the end of 1992, shipments were dispatched with high hopes to New Zealand where Landcare Research was to complete screening.

During routine screening in 1994 the imported beetles were found to be infected with a microsporidian disease. Painstaking rearing and hygiene procedures finally led to the establishment of a disease-free colony, and the first beetles from this were released in 1996. Then a series of eruptions by Mt Ruapehu covered some of the release sites with thick ash, and for 3 years searches turned up nothing. In December 1999, as hope had all but faded, a few adults and larvae were found at one release site at Te Piripiri – the site that been inundated with most ash in autumn/winter 1996. By the following spring (December 2000) beetle numbers there had grown to outbreak proportions: one patch of dying heather was found to contain thousands of beetles.

Just how widespread heather beetle is now is still unknown. It may yet establish at some of the other 20 original sites it was released at from 1996-1999. The adults drop to the ground when disturbed, and are hard to spot unless large numbers are present. The main focus now, however, is on redistributing the beetles to as many other areas as possible, as the Te Piripiri site contains only a small patch of heather (perhaps 50 m²), which is now all heavily damaged. Vegetation monitoring plots are all in place to measure the hoped-for decline in heather abundance and document the recovery of native vegetation. Of course, if the heather beetle is rapidly effective, then other issues may need to be considered such as the increased fire risk, and management options to limit invasion by 'replacement weeds'.

In the existing small outbreak site, we can confirm that despite the severe damage to heather, no native plant species appear to been attacked at all. As luck would have it, the one native species that was nibbled by heather beetle during testing (*P. pumila*) is present under dead and dying heather at Te Piripiri: gratifyingly, it looks perfectly healthy despite the thousands of heather beetle larvae and adults finishing off the heather! Other native plants such as *Dracophyllum* spp. (also on the test plant list) are very visible as 'islands' of undamaged foliage in the patch of dead and dying heather. These observations provide confirmation of the accuracy of predictions about the host range of the beetle from pre-release testing.

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Living in Clover

The weevil *Sitona lepidus* was first discovered infesting white clover (*Trifolium repens*) in New Zealand in 1996. It was soon recognized to occur at far higher densities (typically 300 but as high as 1400/m²) than in its home range in Europe. It inflicts significant damage to valuable pasture in the northern part of New Zealand's North Island and is spreading southwards at the rate of 30-40 km/year. Weevil adults feed on the leaves but most damage is inflicted by the larvae, which attack the root nodules. This not only causes nitrogen stress and loss of plant vigour in clover, but also affects other pasture species through decreased soil fertility, and ultimately farm production. Treatment with post-grazing low-rate nitrogen fertilizer treatment has provided some interim improvement to pasture vigour, but clearly, a long-term solution is needed. Given the success in New Zealand with biological control of exotic weevils in lucerne and ryegrass by introduced parasitoids, this seemed a promising avenue for New Zealand's AgResearch scientists to follow.

Exploration for natural enemies of *S. lepidus* in Europe and the USA began in 1998. The focus narrowed to Europe in 1999 and 2000 as it became clear that the Old World material was yielding more promising results. New Zealand researchers worked with a number of collaborators in Europe, including the Institute of Grassland and Environmental Research (IGER) in Devon (UK), the US Department of Agriculture European Biological Control Laboratory (USDA EBCL) in Montpellier (France) and the CABI Bioscience Switzerland Centre in Delémont. Notably, they benefited from interactions with scientists associated with COST (European Cooperation in the field of Science and Technology) 814, which was aimed at crop development for the cool and wet regions of Europe; amongst other things, scientists were studying overwintering and spring growth of white clover in different climatic zones. With the help of this network of researchers, a collection of some 8500 *S. lepidus* was amassed from 15 locations in 11 countries. Four parasitoid species were collected, but by far the most common was the braconid *Microctonus aethiopoides* (reared from an average of 1.4% of weevils collected, with a high of 16.9% at one site in Finland). Interestingly, this parasitoid has never been reared from *S. lepidus* in New Zealand, although *M. aethiopoides* is widespread in New Zealand pastures following its introduction against *S. discoideus* in lucerne. *Microctonus aethiopoides* was reared from specimens collected across Europe: from Ireland, Great Britain, France, the Netherlands, through Norway and Sweden to Finland, and from Italy and Romania.

Microctonus aethiopoides collected from the different *S. lepidus* populations in Europe can be continuously reared in the laboratory on *S. lepidus* from New Zealand as well as Europe. (The other parasitoid species collected could not be reared in the laboratory.) Sufficient *M. aethiopoides* were reared for cultures of each geographical population of the parasitoid to be sent to New Zealand where research is continuing on host range and biological characteristics (e.g. searching efficiency) of the ecotypes. There are, however, a number of obstacles to releasing these new strains. Although *M. aethiopoides* was introduced into New Zealand for control of the lucerne weevil, it has been recorded attacking a number of other species [see *BNI* **22(1)** (March 2001) Taste of its own medicine?] so host specificity testing for the European strains will be rigorous. It will also be necessary to assess the impact the new strain(s) would have on the existing *M. aethiopoides* population in New Zealand. To this end, the extent, if any, of reproductive isolation between populations will be ascertained. If such isolation can be demonstrated, it would remove worries about adverse impacts on biological control in lucerne, for example, but such a strain would technically represent a cryptic species and hence far more rigorous pre-release testing would be necessary than normal.

A pathogen may present a complement to the parasitoid. Thirty-four isolates of *Beauveria bassiana* were found on weevils collected in 2000 in Wales, England, France, the Netherlands and Romania, and preliminary assays indicate these to be up to ten times more virulent against *S. lepidus* than an isolate already present in *S. lepidus* in New Zealand. The attack rate, host range, field efficacy and genetics of these new isolates are now being assessed in quarantine in New Zealand.

Developing effective application methods for microbial biocontrol agents is crucial and it is recognized that poor application often limits efficacy [see *BNI* **21(4)**, 96N-100N (December 2000) Rational pesticide use: an alternative escape from the treadmill?]. Research is therefore being conducted into improving storage life and UV tolerance (and hence persistence in the field) of the *B. bassiana* strains. This research has been funded by a number of sources, but in particular the New Zealand Foundation for Research, Science and Technology and contributions from the New Zealand pastoral producer boards.

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Garlic Mustard: Whiff of Success

Garlic mustard (*Alliaria petiolata*) is currently one of the most serious invasive species in forested areas of the northeastern and midwestern USA, and appears to be spreading in the Pacific Northwest. It is one of the few non-indigenous herbaceous species able to invade and dominate the understorey of North American forests. This results in a significant decline in native herbs and some rare native butterflies, and possibly also affects ground-nesting birds, small mammals and amphibians. Physical, chemical and mechanical controls have failed to provide effective long-term control.

Garlic mustard is native to Europe (from Sweden and Britain south to the Mediterranean), but its range extends east through Russia to the Himalayas, India and Sri Lanka. It has also been introduced to New Zealand. It is a weed, however, only in North America where it was first recorded in the 1860s. Surveys for natural enemies conducted by CABI Bioscience Switzerland Centre, Delémont in western Europe turned up 69 insect species and seven fungi attacking *A. petiolata*. The most important natural enemies were weevils, chrysomelids and Lepidoptera. Although many of these were considered not sufficiently host specific, interest is focusing on weevils in the genus *Ceutorhynchus*, which appear to have a narrow host range.

In particular, five *Ceutorhynchus* species have been found occupying different spatial niches on garlic mustard. Adult weevils feed on the leaves, while the larvae mine the shoots, petioles and/or root crowns, or feed on the developing seeds. At high weevil densities, plants were observed to wilt prematurely without producing seeds. All five species are reported as monophagous on *A. petiolata*, but this is to be investigated further.

A flea beetle (*Phyllotreta ochripes*), which attacks the leaves as an adult and the roots as a larva, has also been studied. However, the larvae have been shown also to complete development on species of *Rorippa* and *Brassica*. It appears that this species is not sufficiently host specific to consider introduction to North America.

Work is now focused on impact and interaction studies to assess the effects of these natural enemy species on garlic mustard performance and reproduction, and on detailed assessments of host specificity. Specificity testing will be based on procedures described by Wapshere[1], with some 50 plant species included, particularly native North American and cultivated crucifers, and other native plants in forest habitats of the weed's adventive range.

In conclusion, the *Ceutorhynchus* species currently under study in Switzerland appear host specific, they can reach high attack rates and appear to limit population size of garlic mustard in Europe. Populations covering more than a few hundred square metres are uncommon in Europe whereas populations of garlic mustard in North America can extend over many hectares (>10,000 m^2). The prospects for a successful biological control programme appear excellent. Introduction of the first control agent is anticipated within the next 3 years. A standardized long-term monitoring protocol is under development in North America which will be used to assess changes associated with the introduction of biological control agents.

[1]Wapshere, A.J. (1989) A testing sequence for reducing rejection of potential biological control agents of weeds. *Annals of Applied Biology* **114**, 515-526.

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Biocontrol Programme for Hoary Cress

Hoary cresses or whitetops (*Cardaria* spp.) currently infest large and valuable areas of pasture, rangeland and riparian habitat in Washington, Oregon, Idaho, Montana, Wyoming, Utah, California, and Alberta. In addition, they are serious weeds of grain, alfalfa and some orchard crops. They also serve as an alternative host for the cabbage seed pod weevil (*Ceutorhynchus obstrictus* = *C. assimilis*), a major pest of canola and oilseed rape in Alberta. Recent studies by Darryl Jewett at the US Department of Agriculture – Agricultural Research Service (USDA-ARS) Northern Plains Agricultural Research Laboratory (Sidney, Montana) have demonstrated that they act as reservoirs for economically important plant diseases. They are declared noxious weeds in 14 US states and three Canadian provinces.

Hoary cresses are deep rooted, hardy perennial mustards with stout stems that grow up to 60 cm tall. The root system consists of persistent vertical and lateral roots from which new rosettes and flowering shoots arise, thus allowing the plants to develop into thick stands. The root system means that cultural control is difficult: it survives thatching treatment, and repeated cutting or cultivation. Grazing is unpromising as a control measure, as sheep do not graze established plants, and cows avoid it (and produce tainted milk if they do eat it). Some success has been achieved with metsulfuron or 2,4-D, but chemical control is considered difficult.

Mustard weeds are often thought to be difficult candidates for biological control, as they are related to many important crop plants. There are exceptions – the article above describes a programme for biocontrol of garlic mustard on the East Coast of the USA, which is looking very promising. This, together with the severity of the problems caused by hoary cresses, and the absence of effective management measures, have led to a new biological control programme being initiated. The programme currently involves the Wyoming Biocontrol Steering Committee, Idaho Department of Agriculture, researchers at the universities of Idaho, Wyoming and Montana, Alberta Agriculture and Rural Development Board, the USDA Animal and Plant Health Inspection Service (APHIS), ARS and Bureau of Land Management (BLM), and the US Department of the Interior Bureau of Indian Affairs (USDI BIA).

Hoary cresses are indigenous to southwestern and central Asia, southeastern Europe and the Mediterranean region. They were probably introduced to the New World in the late 19th century in contaminated alfalfa seed, and plants were first noted around seaports along both east and west coasts. Foreign exploration will be conducted by André Gassmann and Hariet Hinz from the CABI Bioscience Switzerland Centre, Delémont, and coordinated with the USDA European Biological Control Laboratory (EBCL) in Montpellier, France. Mark Schwarzländer, University of Idaho, will begin to study the distribution, ecology and possibilities for integrated control of hoary cress.

Sources: Schwarzländer, M. (2001) Hoary cress biocontrol program launched. *WYOBIO* **4(3)**, p. 2.
Anon. (2000) Noxious weed found to harbour viruses. Northern PlainFacts September/October.

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Insects Suit Water Hyacinth Biocontrol

The success of the water hyacinth (*Eichhornia crassipes*) biocontrol programme on Lake Victoria has not meant that the weed is no longer a priority. Far from it, participants in biocontrol programmes against this invasive weed around the World have if anything intensified their efforts. Calls for action at the International Organization for Biological Control (IOBC) Beijing meeting (reported in the last issue) attest to that. New successes with insect agents have been reported recently, and the hunt continues for yet more natural enemies to add to the existing arsenal.

From Mexico comes a report of the *Neochetina* weevils once again bringing the weed under control. In Sinaloa, on the Pacific coast of Mexico, water hyacinth mats were causing severe problems in irrigation systems, obstructing canals and clogging ditches. US Department of Agriculture – Agriculture Research Service (USDA-ARS) and Mexican scientists released more than 8600 *N. bruchi* and 14,500 *N. eichhorniae* in Sinaloa between January 1995 and August 1996, and within 2-3 years had brought about colossal reductions in water hyacinth coverage. The initial system-wide total coverage of 3041 ha of water hyacinth was reduced to 1180 ha (an overall reduction of 61%). At the largest reservoir in the Humaya system, the 492-ha Mariquita reservoir, cover was reduced from 394 ha (80%) to 98.4 ha (20%). In reservoirs varying in size between 12 and 134 ha, coverage of 95-100% in 1995 was reduced to 1-3% by 1998.

There is an added twist to this story: scientists looking at the fecundity of weevil breeding cultures discovered that microsporidian-like infection in some of them was reducing the proportion of females laying eggs. By eliminating these infected lines, they were able to optimize the performance of the weevils after release. Studies by Teresa Rebelo (from the Faculdade Ciencias/Centro Biologia Ambiental, Universidade Lisboa, Portugal) on the impact of microsporidia on *Neochetina* spp. show that *N. eichhorniae* populations are more heavily infested with microsporidia than *N. bruchi* (9% vs. 6%). Further, the former exhibit systemic infections involving the midgut, fat body, and Malpighian tubules whereas in *N. bruchi* the microsporidian infects only the gut, and the number of spores found in *N. eichhorniae* is generally higher than in *N. bruchi*. Analyses being done using TEM (transmission electron microscopy) and molecular techniques are suggesting that each weevil species is infected by a different microsporidia species, but both are in the genus *Nosema*. Infected weevils show subtle signs characteristic of a chronic infection. Studies in progress suggest infection causes a 40% reduction in fertility and a slightly shortened life span.

In South Africa, the Plant Protection Research Institute (PPRI) is focusing on developing a suite of agents to improve and extend the varying levels of control exerted by the weevils. The latest recruit is a mirid, *Eccritotarsus catarinensis,* from South America. Although mirids were recovered in early surveys for biocontrol agents in the 1960-70s, this species was only identified in 1989, by the late J.C.M. Carvalho, from material collected in Brazil by PPRI staff. Host specificity testing in South Africa showed that the mirid was not monophagous, and could feed on two African species (*Monochornia africana* and *Heteranthera callifolia*). However, release of the mirid was approved in South Africa because the native species were inferior hosts, and were considered to be more at risk from competition from water hyacinth than from mirid feeding. (In contrast, the mirid was rejected as a candidate for release in Australia because of it fed on several native *Monochoria* species there.)

The mirid, which causes severe chlorosis in water hyacinth, is beginning to have an impact at sites being monitored in Kwa-zulu-Natal. Mirids were first released at one in 1996, and by the end of 1999 every plant in the dam had 50-100 nymphs on it. By the start of 2001, large patches of the plant were yellowed and appeared to be sinking. From here, in August 2000, truck-loads of infested plants were transported to another weed-infested site on the Coast near Durban. By October, large brown patches were evident in the water hyacinth mats and the mirid had spread throughout the site. It has since dispersed to a third site some 20 km away, where the mirid population is now huge.

Altogether, the mirid has been released at 21 sites throughout South Africa, and has established at five of them. Encouragingly these include high-altitude as well as tropical sites, for *Neochetina* weevils have not generally been successful at the higher altitudes. The mirid has failed to establish at six sites, and the others have yet to be assessed. With evaluation still at an early stage, the effect the chlorosis has on water hyacinth performance in the field in South Africa has still to be assessed. Also under investigation is the mirid's thermal tolerance, to allow predictions to be made about where in South Africa it has most chance of establishing.

The mirid is the first of what may be a new wave of agents to be released, and a number more are currently under investigation. Recent surveys in South America (Argentina and in the upper reaches of the Amazon) by USDA, CABI Bioscience and PPRI staff have turned up a hitherto unexpected richness of new material (both insects and pathogens). In particular, species of the dolichopodid fly, *Thrypticus*, and planthoppers in the genera *Taosa* and *Megamelus* are considered promising. Pathogens, some of which were found associated with some of these insect species, provide even more material for investigation. It seems likely, then, that more agents will become available in the near future. The prospect of designer-tailoring biocontrol solutions to water hyacinth problems may be coming closer.

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CBD Invasives Initiative Spelt Out

The global agenda to tackle invasive alien species which threaten biodiversity is developing fast, spearheaded by the Convention on Biological Diversity (CBD). Invasive alien species were the main topic for discussion at the sixth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) in March 2001, and an unprecedented amount of time for a single topic –3 full days – was given over to them. They will be discussed in depth again at the sixth meeting of the Conference of the Parties (COP) to be held in the Netherlands in April 2002.

The CBD and its underlying concepts can be difficult to communicate. The Convention itself may seem buried in an impenetrable jungle of bodies and organizations whose relationships to each other and to the Convention are hard to unravel. But do read on, for as the CBD is now taking an active role in the issue of controlling invasive alien species, this has relevance for everyone working in biocontrol.

Rough Guide

The CBD was the first global agreement on the conservation and sustainable use of biological diversity, and gained rapid and widespread acceptance. It was signed at its inception by over 150 countries at the UN 'Earth Summit' in Rio de Janeiro in 1992, and now (April 2001) has 180 signatories. It stands as a landmark in international law. It recognizes for the first time that the conservation of biological diversity is 'a common concern of humankind' and is an integral part of the development process. Importantly, the Convention is legally binding: countries that join it are obliged to implement its provisions.

The CBD, as an international treaty, identifies a common problem, sets overall goals and policies and general obligations, and organizes technical and financial cooperation. However, the responsibility for achieving its goals really rests with the countries themselves. Private companies, landowners, fishermen and farmers take most of the actions that affect biodiversity. Governments need to provide the critical role of leadership, particularly by setting rules that guide the use of natural resources, and by protecting biodiversity where they have direct control over the land and water. Under the CBD, governments undertake to conserve and sustainably use biodiversity. They are required to develop national biodiversity strategies and action plans, and to integrate these into broader national plans for the environment and development.

Thus, the Convention's success depends on the combined efforts of the world's nations. The Convention has created a global forum (actually a series of meetings) where governments, NGOs, academics, the private sector, and other interested groups or individuals share ideas and develop harmonized strategies. How does this work? At its heart is a series of processes:

- The Conference of the Parties (COP) is the Convention's ultimate authority and its governing body. It consists of representatives of all governments (and regional economic integration organizations) that have ratified the treaty. It meets to review progress under the Convention, agree recommendations from the 'technical groups' that comprise SBSTTA (see below), identify new priorities, and set work plans for members. Each government that is signatory to the Convention reports on what it has done to implement the accord, and how effective this is in meeting the objectives of the Convention. The national reports, particularly when seen together, are one of the key tools for tracking progress in meeting the Convention's objectives. COP can also make amendments to the Convention, urge expert advisory bodies, and collaborate with other international organizations and agreements.
- The Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) is a committee composed of experts from member governments competent in relevant fields. It is the interface between countries and COP, and is the powerhouse in terms of how

things get done – SBSTTA actions the demands of COP.

- The Clearing House Mechanism is an Internet-based network that promotes technical and scientific cooperation and the exchange of information.

The mechanism for organizing these processes is the Secretariat, based in Montreal (which is linked to the United Nations Environment Programme, UNEP). Its main functions are to organize meetings, draft documents, assist member governments in the implementation of the programme of work, coordinate with other international organizations, and collect and disseminate information.

In addition, recognizing that developing countries will need international assistance to action the requirements of the CBD, the CBD has a funding mechanism through the Global Environment Facility (GEF). Bilateral and multilateral support for capacity building and for projects and programmes is available through GEF, which has been supported by UNEP, the UN Development Programme (UNDP) and the World Bank.

COP has launched thematic programmes to address conserving the biodiversity of various ecosystems, but it has explicitly directed that consideration of certain cross-cutting issues of relevance to all areas should be integrated into the thematic work programmes. Such issues are seen as playing an important role in bringing cohesion to the work of the Convention as they provide the substantive bridges or links between the thematic programmes. One of the cross-cutting issues that COP has identified is invasive alien species. Article 8(h) of the CBD states: "Each Contracting Party shall, as far as possible and as appropriate... Prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species." This was expanded on during COP-5 (held in Nairobi, May 2000) in Decision V/8, 'Alien species that threaten ecosystems, habitats or species', which urged Parties, other governments and relevant bodies to give priority to the development and implementation of invasive alien species strategies and action plans. It called for case studies by countries, particularly focusing on thematic assessments. It called for information sharing and harmonization of approaches. It suggested priority issues to address, including mechanisms for transboundary cooperation and regional and multilateral cooperation, and including exchange of best practice. It identified bodies to lead in the international arena, and called for a focus on (bio)geographically isolated ecosystems.

Guiding Principles are to be issued by COP to advise Parties how to go about fulfilling their obligations under the CBD. COP-5 issued 'Interim Guiding Principles for the Prevention, Introduction and Mitigation of Impacts of Alien Species'. These were one of the topics under consideration at SBSTTA-6.

SBBSTA-6 and Invasive Alien Species

SBSTTA-6 was attended by expert representatives from 128 nations, the European Union, 12 UN bodies and specialized agencies, and seven secretariats of treaty bodies, together with observers from a host of other stakeholder organizations. The recommendations of this meeting will go COP-6, to be held in the Netherlands in April 2002. The main agenda item (Agenda Item 4) for SBSSTA6 was invasive alien species and addressing Article 8(h) of the CBD.

In the opening plenary, Paul Chabeda (UNEP) emphasized the substantial scientific input needed for developing environmental agreements. He noted that issues involving invasive (and migratory) species required more coordination with other relevant agreements and bodies. Hamdallah Zedan, CBD Executive Secretary, noted that the submission of thematic reports on alien invasive species by 49 countries was testament to the major challenge these represent to the international community.

Keynote speakers highlighted problems with tackling invasive species. Hal Mooney (former Chair, Global Invasive Species Programme (GISP)) pointed out that society depends on the movement of biological material, and called for efforts to be concentrated on invasives that threaten ecosystems, habitats and species. He said that vectors of transmission are both accidental and intentional, and that invasives come from all taxonomic groups. He gave a chilling overview of the range of ecological and economic damage they can inflict. He also identified problems in addressing invasive problems: they alter biological systems, and can evolve quickly; there are often lag times in identifying their effects, and information about them and how to manage them is often inadequate. He identified some key needs: prediction models, environmentally benign and cost-effective control, and means to regulate the movement of invasives. Jeff Waage (Chair, GISP) noted the limitations in the capacity of most countries to tackle invasive species problems, and called for support to national programmes. He emphasized the importance of improving information availability and increasing public awareness. He also pointed out that gaps in knowledge needed to be filled in, and stressed the importance of good taxonomy and understanding pathways of invasions.

One of the two working groups of the meeting (Working Group I, chaired by Anastasios Legakis, Greece) then spent 3 days considering invasive alien species through a series of presentations (including case studies) and discussion on key topics. It discussed the nature and importance of the issue, how to respond to Article 8(h) using an integrated approach, international cooperation, prevention, early detection, eradication, control, options for future work and revisions to the Guiding Principles. In a wrap up plenary on the last day, the recommendations to COP-6 were finalized

Discussions were wide-ranging but some common themes emerged, above all the need for better information and ways of achieving this through cooperation at all national and international levels. Cooperation and partnership building was widely suggested for achieving harmonization of procedures, filling gaps in knowledge and developing effective management programmes. Key gaps in knowledge were identified, including current extent of distributions, pathways and rate of spread, and impact over time. The importance of taxonomy and the need for shared expertise were also highlighted. The costs and funding of invasives management were widely discussed – ranging from who should bear the costs of invasives, to the needs of developing countries, to calls for the engagement of commercial interests. Of particular relevance to the biocontrol sector, there was a recommendation for governments to promote and carry out, as appropriate, research and assessments on (amongst other things) costs and benefits of the use of biocontrol agents to control and eradicate invasive species.

The revised Guiding Principles, 'Alien Species that Threaten Ecosystems, Habitats or Species' were finalized (some with alternatives to be considered) for submission to COP-6. The Chair of the Working Group on invasives stressed, however, the non-binding nature of the Guiding Principles. Below is a brief summary of them, and readers are urged to refer to the link below for the complete version being submitted to COP-6.

The Principles point to the unpredictability of pathways and impacts on biological diversity of invasive alien species. They urge that efforts to identify and prevent unintentional introductions as well as decisions on intentional introductions should be based on the precautionary approach (set out in Principle 15 of the 1992 Rio Declaration on Environment and Development, and subsequently elaborated): lack of scientific certainty about the various long-term implications of an invasion should not be used as a reason for postponing or failing to take appropriate eradication, containment or control measures.

The Principles call for priority to be given to prevention as it is generally far more cost-effective and environmentally desirable than post-invasion measures. If introduction occurs, the Principles emphasize the importance of early detection and rapid action to prevent establishment, and give guidance on mitigation of impacts with eradication as the first choice; if eradication is not possible, containment and long-term control measures should be implemented (see below), with any costs and benefits analyses taking a long-term view. They recommend an ecosystem approach to invasives management. They lay out the responsibilities of member states in terms of the risks each poses as a potential source of invasives, and the measures to take both individually and cooperatively to minimize risk. The Principles make recommendations for research and monitoring (stressing the importance of a baseline taxonomic study of biodiversity and continuing monitoring), education and public awareness. For prevention, they endorse the importance of border control and quarantine measures based on risk assessment. They call for exchange of information and emphasize the need for cooperation and capacity building.

On the issue of introduction of species, the Principles give guidance on risk assessment and authorization procedures for intentional introductions. They outline provisions to address unintentional introductions and call for common pathways to be identified. For mitigation of impacts they advise: eradication where acceptable, safe, feasible and cost-effective; containment (limiting spread) by local eradication backed up by regular monitoring where eradication is not appropriate; and control measures focused on reducing the damage as well as reducing numbers. They suggest effective control will often rely on a range of integrated management techniques (mechanical, chemical and biological control and habitat management). Where biological control is implemented, this should be in line with existing national regulations and international codes, and introductions made only after risk assessment and authorization are completed.

Information sources:
A ‘diary’ of the meeting including the outcome of discussions is on the Internet at: http://www.iisd.ca/biodiv/sbstta6/

The CBD website contains a wealth of further information. A large number of background documents were prepared on the invasive alien species issue for SBSTTA-6, and these are at:
http://www.biodiv.org/doc/meeting.asp?lg=0&wg=sbstta-06
The full report of the meeting including the revised Guiding Principles is at:
http://www.biodiv.org/doc/meetings/cop/cop-06/official/cop-06-03-en.pdf

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New SP-IPM Coordinator

The CGIAR Systemwide Program on IPM (SP-IPM) has seen recent changes in its Secretariat based at the International Institute of Tropical Agriculture (IITA). Dr Peter Neuenschwander (Director, IITA-Plant Health Management Division) takes over from Dr Lukas Brader (Director General, IITA) as Leader of the programme, whilst Dr Braima James replaces Dr Richard Markham as SP-IPM Coordinator. Over the past 3 years, Braima worked closely with Richard on a number of SP-IPM tasks, and that eased the hand over.

Braima brings on board 20 years of post-PhD experience in strengthening pest management research, training and implementation in Africa. He holds a BSc (Hons) degree in Zoology from the University of Sierra Leone (his home country) and a PhD in Agricultural Biology from the University of Newcastle-upon-Tyne in the UK. Prior to joining IITA in 1993, Braima was a tenured faculty at the University of Sierra Leone and an FAO national plant protection expert in that country. He adds to SP-IPM a wide range of IPM implementation experiences on diverse projects and activities on food crops (e.g. root and tuber crops/cassava, grain legumes/cowpea, cereals/rice and maize), thematic networks (e.g. WAFRINET, the West African LOOP of the global taxonomic network BioNET INTERNATIONAL) and the CGIAR NGO-IPM network in Africa. Braima is keen on participatory extension and farmer training and shares such knowledge and experience through publications that aim to increase farm-level awareness and adoption of IPM. To pursue these interests, he participates actively in various in-country, regional and international meetings, conferences, study-visits and workshops to plan for the further development of IPM tools for research, training and implementation and to develop project proposals. Braima has held many important posts in civic/public/international affairs, is currently a Member of the Entomological Society of Southern Africa and of the African Association of Insect Scientists; had served as Vice President of the Sierra Leone Science Association, and was formerly a Fellow of the Royal Society of Entomology and Chartered Biologist (Institute of Biology).

Braima is married with 4 children, none of whom shows interest in ‘bug work’!

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IPM Systems

This section covers integrated pest management (IPM) including biological control, and techniques that are compatible with the use of biological control or minimize negative impact on natural enemies.

IPM Steaming Ahead in Basmati Rice

The foothills of the Himalayas are blessed with fertile soil irrigated by the phosphorus-rich waters of the Ganges and the Indus, and it is here that the world-famous basmati rice is grown. The Government of India is currently embroiled in a fierce battle to protect the name from being patented by foreign interests. Meanwhile, the National Centre for IPM (NCIPM) is helping the farmers of Uttar Pradesh by developing an IPM module for this crop.

The word ‘basmati’ comes from a Sanskrit word meaning earth, and basmati rice is recognized by its distinctive aroma. The extra-long grained, soft textured, aromatic rice has been cultivated since time immemorial in the foothills of the Himalayas, and it is the rare agro-climatic conditions of this region that endow it with its unique characteristics, which are not amenable to replication. This makes basmati a premium product in the international market and, so the argument runs, the uniqueness needs to be preserved and protected. India’s basmati rice exports are worth some Rs 12 billion [~US$ 250 million] annually.

Shikohpur village in Baghpat District was chosen as the location for a large (100 acre/ 40.5 ha) field validation trial in 1999, because a socioeconomic survey had revealed the village to be a site of excessive pesticide use in recent years. Some farmers had been making 10-12 applications per year in a vain attempt to combat insect pests (leaf folder, *Cnaphalocrocis medinalis*, yellow stem borer, *Scirpophaga incertulas* and gundh bug, *Leptocorisa acuta*) and diseases (sheath blight, *Rhizoctonia solani* and bacterial leaf blight, *Xanthomonas oryzae* pv. *oryzae*), yet their final yields fell substantially short of expectations. It was surmised that excessive chemical use had eliminated the beneficial natural fauna from the fields and this had contributed to an unusually high incidence of pests.

The IPM strategy comprised:

- seed treatment with carbendazim for controlling seed-borne diseases
- monitoring yellow stem borer by pheromone trapping
- releasing *Trichogramma japonicum* against leaf folder and yellow stem borer
- applying insecticide against these and other insect pests only as a last resort, if they reach pest status
- monitoring sheath blight and other diseases and applying fungicides on a needs-only basis
- balanced fertilizer and water management

In the event, only a few of these options were needed and weekly monitoring led to timely and directed intervention against what problems did arise. Two releases of *T. japonicum* made against leaf folder and stem borer, and a dusting of methyl parathion (10 kg/acre) to manage gundh bug on about 2 ha were the main insect pest treatments applied. Sheath blight became important in some fields and was managed by spraying these sites once with 0.1% carbendazim. Thus widespread pesticide application was avoided. In contrast, farmers applied insecticides (phorate), fungicide (carbendazim) and bactericide (streptocycline) three to four times in 12 ha of non-IPM control fields.

Monitoring of IPM and non-IPM plots indicated differences in pest populations and disease incidence. Infestations of leaf folder in IPM plots 50 days after transplanting (DAT) were just over half those in non-IPM plots (8.75% c.f. 15.0%), which indicates the efficacy of the parasitoid releases. A further release reduced incidence to less than 5% at 75 DAT, while it remained at 14.5% in the non-IPM plot. It was a similar story with sheath blight, the major disease in the area that season, which was at far lower levels in IPM plots throughout the season. Incidence topped 13% in the non-IPM plot by 55 DAT, but it was under half this in the IPM plot thanks to timely and targeted application of fungicide.

The mean yield from the 40-ha trial (5.7 t/ ha) was 11.6% higher than the mean for the non-IPM plots. The economic gains were even more striking: the mean cost per hectare of plant protection for the IPM fields, at Rs 658, was only 28% of the cost in non-IPM fields. The cost benefit ratio for IPM was 1:7.51.

A website on basmati rice has been set up through collaboration between NCIPM and the National Informatics Centre.

Cottoning On

NCIPM has continued with participatory trials of its successful rainfed cotton IPM module [*BNI* **21(2)**, 32N-33N (June 2000) Indian cotton IPM is material success]. Now in their third year, these were conducted in Ashta village (Maharashtra). The IPM module was applied to 300 acres/120 ha of cotton and activities (supported by a Farmer Field School) included:

- good field sanitation, soil fertilization and crop husbandry before sowing
- trials to investigate best planting time
- maize and cowpea border cover crops, and *Setaria* perches (to encourage birds that prey on *Helicoverpa* bollworm larvae) every tenth row
- monitoring *Helicoverpa* with pheromone traps
- *Trichogramma chilonis* release to coincide with bollworm egg laying
- need-based 5% neem seed kernel extract (NSKE) spraying
- need-based ecofriendly insecticide/ fungicide application

Imidacloprid was not available for seed treatment to guard against sucking pests, and metasystox was applied 40 days after planting instead.

Although aphid numbers were initially higher in the IPM plot, and jassids up to mid-season, both their numbers declined below those in the non-IPM controls. The measures adopted to conserve beneficial species had a positive effect on coccinellids, with 7.5 times as many recorded in the IPM plots. Sprays of NSKE and *Helicoverpa* nucleopolyhedrovirus (HaNPV) were applied for *Helicoverpa* control. Monitoring of shed bolls and fruiting bodies indicated bollworm infestation levels of <2% throughout the season in IPM plots, up to four times lower than in non-IPM plots. Grey mildew appeared during the second lint picking, and carbendazim was applied.

In practical terms, this meant an average of two pesticide applications (0.19 kg/ha in total) in the IPM trial area in Ashtra, compared to eight (5.78 kg/ha) in the adjacent non-IPM village of Murli. The average seed cotton harvest in the Ashta IPM trial was 1350 kg/ha, more than twice that in Murli. The cost benefit ratios for the two villages were 1:2.08 and 1:1.34, respectively.

As NCIPM wind down the trials in Ashta, there are encouraging signs that the IPM message is being heard more widely and the technology is beginning to be adopted in many adjacent villages.

An IPM module for irrigated cotton is now being developed for Haryana in collaboration with Excel Industries Ltd.

Chickpea and Mustard

Chickpea IPM is in the second year of village trials. A Farmer Field School was used to mobilize field sanitation and land preparation of 50 acres/20 ha in October-November 1999. This laid the groundwork for timely planting of a wilt-resistant variety that had been seed-treated with *Trichoderma*. Coriander or linseed was planted as a cover crop. Pheromone traps and physical collection were used to monitor *Helicoverpa* pod borers. Birds that prey on pests were encouraged with bird perches and cooked rice spread on the field as an attractant. Sprays of HaNPV and other eco-friendly insecticides were made on a needs-only basis.

Seedling mortality (from *Fusarium* and *Sclerotium* infection) was a problem where sorghum had been the previous crop. But disease remained below 1% in IPM fields throughout the season; overall seedling mortality was below 5% and no intervention was made. Pod borer levels rose above economic threshold level twice and were controlled with one application each of HaNPV and NSKE. Monitoring showed that the population otherwise remained below the threshold. The situation in the non-IPM field was varied: pod borer was sometimes absent altogether, but then numbers rose and chemical sprays were applied, whereupon they fell again. Levels of *Helicoverpa* parasitism in IPM fields were higher than in non-IPM fields. These observations and the various treatments together translated into yields of 0.88 t/ha in the IPM field, compared to 0.50 in the non-IPM field.

A second year of on-station trials of mustard IPM were conducted at Bawal (Hisar), where the principal pest and disease constraints are mustard aphid and white rust, respectively. The effects of seed and soil treatment with *Trichoderma viride*, varying planting density and use of farmyard manure were assessed. Pest insects (aphid and sawfly) were not observed in IPM plots. Combined soil and seed treatment with *Trichoderma* gave most consistent protection from rust in three mustard varieties, but all treatments improved yield considerably (on average they were 23% higher than for an untreated control).

Forewarned is Forearmed

The Centre, together with a number of collaborators, has been making considerable progress in developing forecasting systems for India's most devastating pests. For example, field data on *Helicoverpa* catches and meteorological information were used to develop a model of weekly pest populations. Testing at the University of Agricultural Sciences Campus, Raichur (Karnataka) showed that the fit of the model with actual catches from 1987 to 1994 was strikingly accurate. Similarly rewarding results were obtained with a forecasting systems for potato aphids (*Myzus persicae*), which accurately reflected observed populations at sites in West Bengal and Gujarat. Modelling work on groundnut pests (aphids, jassids and thrips) is underway.

Distribution maps are being prepared for pests and diseases of major crops, to pinpoint problem 'hot spots' in the country so appropriate action can be targeted more effectively. So far, 66 maps have been prepared for 11 cotton pests (six insects and five diseases) for 1992-97. From these, 'hot spot' maps have been produced which show geographical areas that have been moderately to severely affected by pests and diseases during recent years.

More about these projects and other activities of NCIPM (including assessing threats from exotic pests and diseases; monitoring and surveillance of nematodes in the rice-wheat cropping system; biocontrol agent rearing; computer software including electronic keys for plant parasitic nematodes and the Pest Management Information System for cotton; and other technology transfer activities) are described in the report cited below.

Source: NCIPM (2000) Annual report 1999-2000. National Centre for Integrated Pest Management,
Indian Council for Agricultural Research,
Lal Bahadur Shastri Building,
Pusa Campus, New Delhi – 110 012,
India, 88 pp.

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SP-IPM: Through the Eye of the Storm

Since the Systemwide Program on Integrated Pest Management (SP-IPM) was launched in 1995 it has weathered fair and foul conditions. It has emerged from the storms a little battered but seaworthy. In particular, its flagship whitefly project has come through with flying colours and has made substantial advances in line with the aims and ideals of the programme. Other initiatives, while functionally becalmed through lack of funds, have been making quiet but significant progress that has put them in a strong position to move forward when the financial climate eases. Undeterred by previous setbacks, in 2000, the SP-IPM launched the Pilot Sites Initiative, aimed at creating a matrix of IPM trial sites each managed by a consortium of stakeholders. Beginning with sites spread through Africa, national and international research organizations, extension services and NGOs are teaming up to help farmers develop and test 'best bet' IPM options that offer most promise of providing solutions to crop health problems.

SP-IPM was set up by the CGIAR (Consultative Group for International Agricultural Research) in response to its own recognition that it was falling short in its goal to provide solutions for tropical agricultural problems: farmer uptake of the IPM technologies developed by the international agricultural research centres (IARCs) was all-too-often poor. The CGIAR recognized that it had placed perhaps too much reliance on host plant resistance as the only worthwhile strategy for crop protection, and to have acquiesced at, or actively encouraged, the use of chemical pesticides as a stop-gap where resistance was hard to achieve. It recognized missed opportunities for joining forces across disciplines and developing truly integrated crop management strategies. It recognized that poor communication between IARCs meant that interactions were not always as fruitful as they could be. The CGIAR saw that fundamentally different approaches and new methods of working were needed if its goals were to be fulfilled – and hence SP-IPM was born.

SP-IPM signalled a sea change in the way in which IARCs pursue the CGIAR Mission: "through research and related activities...contribute to sustainable improvements in the productivity of agriculture, forestry and fisheries in developing countries in ways that enhance nutrition and well-being, especially of low-income people". In this regard, IARCs affirm that IPM is their preferred plant and animal health strategy and that, through research and training/learning methods, they will promote IPM adoption by farmers. Their shared objectives are to:

- develop mechanisms and linkages to strengthen partnerships for IPM development
- establish more holistic IPM approaches to increase the ability of farmers to make informed IPM decisions based on an understanding of ecological and economic principles of production
- promote more effective communication between farmers, extensionists and researchers to ensure that research efforts are clearly focused on farmers' needs, and encourage the integration of traditional and 'science-based' knowledge
- become effective public advocates of IPM

The work of SP-IPM is guided by the Inter-Center Working Group on IPM, which meets annually and reviews progress and emerging challenges in the achievement of the objectives. The latest of these meetings was held in Nairobi, Kenya in March 2001. The agreed programme is implemented by partner organizations, under the leadership of the SP-IPM Lead Centre, which is currently the International Institute of Tropical Agriculture (IITA).

In its first 3 years, SP-IPM sought to identify problems for which inter-regional inter-institutional effort could make a difference, and to develop ways of promoting a policy environment favourable to IPM implementation. The 17 task forces created in the first 3 years of operation to examine key issues and develop a coherent response to them indicated the zeal with which the programme set out to fulfil its ambitious plans. Each task force, led by an IARC, drew together key stakeholders from within and without the CGIAR system. At the beginning of 1998, SP-IPM was set to launch a full fleet of activities. But then a series of funding crises progressively trimmed the sails of the programme. Since 1998, a rebuilding process has been underway. Here, we chart progress to date and outline future plans. We begin with an outline of the achievements and future plans of the first full-scale research project in the programme.

Whitefly: Model Flagship

The 'Sustainable Integrated Management of Whiteflies as Pests and Vectors of Plant Viruses in the Tropics' began with DANIDA (Danish International Development Assistance) funding for the diagnosis and characterization of whiteflies from Latin America and Africa. The first major technical report of this project will provide the most comprehensive overview so far of the importance of whiteflies in tropical food crops. The first phase of the project has, however, excited such interest that the diagnostic work has been extended geographically (e.g. to Asia), scientifically (e.g. to include host plant resistance and biocontrol) and organizationally. A raft of new funding agencies and institutions have joined the project, which now provides the anchor for a diverse range of activities in whitefly IPM including:

- ACIAR (Australian Centre for International Agricultural Research), AVDRC (Asian Vegetable Research and Development Centre) and CSIRO (Commonwealth Scientific and Industrial Research Organisation, Australia) collaboration on diagnostic/characterization work for whiteflies in eight Asian countries
- USAID (US Agency for International Development) and CIAT (Centro Internacional de Agricultura Tropical) exploration for indigenous parasitoids of major whitefly pest species of mixed cropping systems in South America
- New Zealand MFAT (Ministry of Foreign Affairs and Trade) funding for CIAT to look at the mechanisms and genetics of host plant resistance
- USAID OFDA (Office of Foreign Disaster Assistance) emergency programme in East Africa to help alleviate a crisis situation caused by African cassava mosaic disease (ACMV)
- Rockefeller Foundation funding for gene mapping of resistance to ACMV
- REDCAHOR (Collaborative Network for Research and Development of Vegetables in Central America, Panama and the Dominican Republic), AVDRC, IICA (Instituto Interamericano de Ciencias Agricolas) and IDB (International Development Bank) development of a regional network for whiteflies in vegetable crops in Central America

The clear research and development framework established at the outset by a broad-based consortium of stakeholders has proved a major strength as the project has grown in size, scope and linkages. Now, with new partners, a constellation of donors and a global network of activities, the SP-IPM whitefly project is a model of what-might-be elsewhere. Will this be the first of a line of successes? Yes, if donors can be brought on board, for there are plenty of ideas.

Taking Soundings

The progress of the whitefly project provides encouragement for the squadron of other SP-IPM initiatives outlined below which have yet to secure adequate funding. However, with the limited resources that have been at their disposal, many of them have been laying the groundwork and developing partnerships for the future.

To begin with, the SP-IPM initiative provided an opportunity for a fresh look at well-known problems. For example, the cereal stem borer task force led by CIMMYT (Centro Internacional de Majoramiento de Mais y Trigo) facilitated a UNDP (UN Development Programme)-funded and much-needed comprehensive screening of IITA and CIMMYT germplasm. ICIPE (International Centre for Insect Physiology and Ecology) and IITA have continued to exchange parasitoids for evaluations in sites with differing agroclimatic conditions. However, the aim of the task force to establish 'best bet' options for stem borer management has yet to be realized, and for this it is still seeking funding. ICIPE has made hallmark progress in developing habitat management options for stem borers, and these are now being trialled under the Pilot Sites Initiative in western Kenya (see below). At the Nairobi meeting, the remit for this task force was redefined as 'Quantifying losses and investment opportunities for IPM'.

The task force 'Parasitic flowering plants' has been piloted by IITA. At the Nairobi meeting, coordination of the task force was assumed by ICRISAT. Partners have made progress with developing host plant resistance to two major parasitic weeds: *Striga* by CIMMYT, ICRISAT (International Crops Research Institute for the Semi-Arid Tropics) and IITA and *Orobanche* by ICARDA (International Center for Agricultural Research in Dry Areas). However, to maximize the benefit of the new varieties, farmers need to be able to integrate their use with other appropriate management practices. To do this they need to understand better the nature of parasitic plant problems. This year, weed-resistant cultivars were included on IPM pilot sites established in West and East Africa (see below), but this is just a beginning, and much wider participation is needed.

Grain legumes are a vital source of dietary protein, especially for low-income groups in the tropics. Pest-induced losses are often severe and insecticide misuse only compounds the difficulties. The diversity of pest problems, though, has made it difficult to identify major shared problems that would benefit from unified inter-regional effort. The 'Grain legume pests' task force under the leadership of ICRISAT has identified the pod borer *Maruca vitrata* as a possible candidate. Originally from the New World, it could be a target for classical biocontrol in the Old World.

SP-IPM has also highlighted some less-well known issues. Soil biota are amongst the most under-estimated and least understood causes of lost plant production in tropical agricultural systems. Microorganisms, for example, are involved in nitrogen fixation, nutrient recycling and biocontrol as well as disease. The challenge is to develop strategies to manage healthy soil biota while minimizing pathogen and pest outbreaks. This is being tackled by the newly formed 'Soil biota' task force, led by CIAT. This task force incorporates the former task force on white grubs, pests that cause widespread damage in many graminaceous crops yet often go unrecognized by farmers.

Setting a Course

The task force 'Beneficial microorganisms' has been led by IITA. Some microbial agents can directly replace more hazardous synthetic chemical pesticides. But whilst some IARCs have successfully developed and used microbial products, poor understanding of technical and regulatory aspects has deterred others. The task force has promoted exchange of expertise and information, but recognized that lack of a regulatory framework is the key constraint. It has organized a survey of current regulations worldwide, as a first step towards producing a set of guidelines to help countries accelerate the registration process. SP-IPM is promoting international collaboration in this arena, in an initiative spearheaded by the Society for Invertebrate Pathology and the International Consortium for Biopesticide Development.

Farmer participatory research (FPR) techniques in agriculture assume that research can be made more useful by improving communication between researchers and farmers. With proponents of various participatory research paradigms in dispute over effective methods, there is arguably more competition than constructive dialogue currently. In collaboration with FAO (UN Food and Agriculture Organization) Global IPM Facility and the Systemwide Program on Participatory Research and Gender Analysis, the SP-IPM task force 'FPR-IPM', now coordinated by CIP (International Potato Centre), with part funding from SDC (Swiss Development Cooperation), is organizing a series of study-exchanges between successful projects that are using different models of participatory research and learning. These exchanges will form the basis for a comparative analysis, expected to generate practical recommendations on how to choose and use the best participatory approaches to IPM available worldwide.

There are other concepts that have yet to be translated into something practical. ICIPE leads the task force 'Agro-biodiversity', set up at the Nairobi meeting to integrate initiatives on functional agrobiodiversity and rice weed management. The problem this task force addresses is encapsulated by two extreme conditions: a rice monoculture is not diverse enough to be stable, yet a humid tropical forest is too diverse to be productive; intuitively, there is an equilibrium point somewhere between the two that is both stable and productive. The principles and processes involved in deciding how much biodiversity needs to be retained for a balance to be achieved are not understood. An experimental approach for determining how to measure and manage this needs to be defined.

Pilots Aboard

In 2000, SP-IPM launched the Pilot Sites Initiative to develop, test, apply and publicize more effective models for introducing novel IPM options to farming communities. The initiative aims to establish close partnerships between stakeholders, using participatory approaches to enhance cooperation among farmers, researchers and extensionists.

It aims eventually to establish a series of sites in key agro-ecologies around the tropical world, which will serve as focal points for developing and implementing new models of partnership and new options in IPM, and to bring the fruits of these efforts to the attention of a wider public, both locally and worldwide. The initiative is being trialled first in Africa, focusing on the cereal-legume system. Six sites were selected for immediate development, but these were reduce to four at the Nairobi meeting to allow each coordinating Centre in Africa to focus on just one 'showcase' site, which farmers could visit and learn from. SP-IPM collaborators also agreed to sharpen participatory approaches, and address the need for scaling up and rapid spread of proven technologies.

The sites between them encompass dry (Sahel), moist (Guinea) and mid-altitude savanna (Burkina Faso, Nigeria and Kenya, respectively), together with rain-fed systems of North Africa (Morocco). The selected sites represent major cropping systems or agro-ecologies, where 'pests' (*sensu lato*) are important constraints, where newly-available IPM options have the potential to alleviate those constraints and where there are significant opportunities for wider adoption of those options.

- At the first trials to be planted, in the Lambwe valley, Western Kenya, over 100 farmers are experimenting with an ICIPE-developed system. In this weed and cereal stem borer IPM strategy, the fodder legume *Desmodium* is used to suppress *Striga* and improve soil fertility in maize plots. In addition, the plots are surrounded by rows of Napier grass (another fodder crop) to trap stemborers away from the crop and increase biocontrol of the insect pests. The system has a high potential for integrating maize and livestock farming, as well as providing alternative market opportunities through the sale of fodder harvest.
- Trials to investigate weed IPM and soil fertility in maize-based systems are underway at Kaduna in northern Nigeria. There, 58 farmer experimenters are testing *Striga*-stimulant grain legumes in IITA-developed intercropping patterns (with *Striga* tolerant varieties), double cropping and crop rotation schemes to cause suicidal germination of the parasitic weed and enhance soil fertility.
- In Morocco, the focus is on weed IPM and soil fertility enhancement in wheat-based systems. Farmers in communities known as *douar*s have established eight large-scale demonstration trials to learn, validate and implement IPM information on the hessian fly (*Mayetiola destructor*) in bread wheat.

At all sites, SP-IPM activities facilitate stakeholder understanding and ownership of trials, trial processes and results.

Outlook Fair

So despite all the problems that have beset its early years, SP-IPM can report that it has contributed to strengthening the framework of IPM, and in particular in strengthening inter-institutional and other partnership linkages. The whitefly project is a model of what can be achieved and provides substance to the SP-IPM vision, and elsewhere ideas have blossomed in the financial doldrums. Now, in launching the FPR-IPM study tour/learning workshop and Pilot Sites Initiative with emphasis on participatory approaches and fostering partnerships for IPM adoption, SP-IPM continues to push IPM up the agricultural research agenda. The CGIAR have called for broader awareness and adoption of its IPM policy by the IARCs. SP-IPM needs both that, and further faith and funding from donors to bring the burgeoning ideas to fruition.

Sources: SP-IPM (2000) Systemwide Program on Integrated Pest Management. Progress report 1998-2000. 28 pp.
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SP-IPM Secretariat (2001) CGIAR Systemwide Program on Integrated Pest Management (SP-IPM). Report on the Annual Inter-Center Working Group Meeting, 8-14 March 2001, ICIPE, Nairobi, Kenya.

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Diamondback Moth on Peas, Really

A new host plant record for diamondback moth (DBM; *Plutella xylostella*) in Kenya has been reported: sugar snap and snow (mangetout) peas (both *Pisum sativum*) grown for export.

In the second half of 1999, vegetable export growers came to the International Centre of Insect Physiology and Ecology (ICIPE) in Nairobi, Kenya and complained about DBM attacking sugar snap peas. At first, we dismissed these reports as completely improbable: DBM is known to be restricted to host plants in the crucifer family. Furthermore, DBM is such a well-studied insect with worldwide occurrence that something similar should surely have been observed elsewhere. In spite of all doubts, a field visit to Naivasha confirmed the farmers' observations: the larvae, pupae on the peas, the feeding damage symptoms and moths flying in the sugar snap peas crop were unmistakably *P. xylostella*. Samples of larvae and pupae were taken, reared to adult and sent for identification: Koen Maes, a microlepidopterologist currently based at the National Museum of Kenya in Nairobi, confirmed our preliminary identification.

Nothing much was done about the pest for almost a year, until a biocontrol project for DBM in Eastern and Southern Africa was initiated by ICIPE and the Kenya Agricultural Research Institute (KARI) with financial support from the German Federal Ministry of Economic Cooperation and Development. In the meantime, DBM had also invaded mangetout pea fields, which had been free of the pest in 1999. A research programme was developed to elucidate the reasons for this change to a new host completely outside the original host plant range. First data show that there is really a new strain with biological differences: while the cabbage strain of DBM cannot normally survive on peas, the new strain fares equally well on both hosts. However, this adaptation to peas seems to have come at some cost: the pea strain develops slower and average pupal weights tend to be lower than for the normal strain, the sex ratio seems also to be slightly affected in favour of males.

Research is under way to study egg-laying behaviour of moths, host plant plasticity of different DBM populations, and reaction of local DBM parasitoids to the host switch. While searching for possible candidates for introduction to Kenya, host finding on peas will play an important role in the assessment of candidates.

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Training News

In this section we welcome all your experiences in working directly with the end-users of arthropod and microbial biocontrol agents or in educational activities on natural enemies aimed at students, farmers, extension staff or policymakers.

Implementing the FFS Approach in Ethiopia

Save the Children Fund (SC (UK)) and the Ethiopian Ministry of Agriculture (MoA) are working together to adapt the Farmer Field School (FFS) approach for farmers in the northeastern highlands of Ethiopia. SC (UK) is the United Kingdom's leading international children's charity, working in more than 60 countries to help children in the world's most impoverished communities. It first delivered aid to Ethiopia (or Abyssinia as it was then) in 1932. The charity's main emphasis in Ethiopia is on food security and protecting children's livelihoods, which means helping rural families to achieve secure and sustained access to food. SC (UK)'s work in Ethiopia's Wollo Province during and since the famines of 1973-74 has put in place systems that allow it to respond quickly to crises, as well as contribute to establishing sustainable agricultural systems.

This area of Ethiopia is dominated by moderate- to high-altitude hills and mountains, interspersed with gorges, canyons and escarpments. The vast majority of the population today are small-scale subsistence farmers. Agricultural systems vary with altitude, but comprise mixed farming with varying reliance on crop production. Both pre- and post-harvest losses owing to pest infestation, erratic rainfall patterns, soil erosion and high population pressure (resulting in smaller farms) lead to food insecurity. In 1997, agricultural pest losses in Amhara Region were estimated as 164,000 tonnes, representing some 42% of total production.

The FFS project is the latest in a series of initiatives by SC (UK) to secure sustainable improvements in agricultural productivity in the province. An Emergency Pest Control Program, which began in 1994, was focused on containing outbreaks of – local rather than migratory – acridid pests (the Wollo bush cricket or 'degeza' (*Decticoides brevipennis*) and grasshoppers) and also rodent pests. The programme concentrated on provision of immediate relief in the form of pesticides and spraying equipment – and safety training for staff. Once the emergency was contained, SC (UK) began an Agricultural Rehabilitation Project, funded by the European Union, which made the transition from emergency pest control to agricultural rehabilitation activities (including crop protection and production, livestock restocking and veterinary activities, and capacity building). This two-pronged programme included a coordinated chemical pesticide spraying programme and, simultaneously, the start of IPM training for MoA partners to raise awareness of alternatives to chemical pesticides. It was recognized that the use of chemical pesticides was not sustainable. Thus the supply of free pesticides was replaced by a system that made them available on credit, and this led to a subsequent reduction in pesticide use.

The current EU-funded Agricultural Development Project began in 1998 with five pilot FFSs in North Wollo. The project is focused on the promotion of IPM through farmer participatory research (FPR). It is using the FFS approach to introduce farmers to sustainable pest management methods, and so reduce hazards posed by pesticides to human and (nontarget) animal health and the environment. It aims to reduce the proportion of farm income spent on agrochemical inputs by seeking locally available alternatives appropriate for resource-poor farmers. Specifically, it is looking at the potential of botanicals and products such as ash and urine as biological pesticides.

SC (UK) opted for a strategy of direct partnership with the MoA, working with and through their development agents and extension supervisors, rather than developing a parallel network, because it recognized that large scale and sustainable change will only be achieved by building the capacity of government services. The project is focused on assessing whether the successful participatory FFS approaches developed elsewhere (especially discovery learning and FPR methodology) could serve as a useful model for the smallholder mixed cropping systems in the northeast highlands of Ethiopia. The project incorporates the following features:

- Training of Trainers (TOT) for government extension workers (i.e. crop protection experts at national, regional and district (woreda) level)
- Cascading down the principles of participatory approaches at the community level through training of development agents (the field-level extensionists) and supervisors by TOT graduates
- Trickling down the principles and practices to farmers through FFSs facilitated by trained development agents and supervisors

This is in contrast to the conventional FFS model because it ends rather than begins with the farmer. However, acceptance of a farmer participatory approach by national agricultural bodies has been hard to achieve in many countries, and the journey from farmer's field to government office has often been long and gruelling. In Ethiopia, on the other hand, government agricultural staff are being challenged from above to change their way of thinking. In June 1999, SC (UK) and CABI Africa Regional Centre

(ARC) staff held a TOT in Kobo, at which the pilot FFSs were reviewed, and 24 governmental and NGO staff were trained in the IPM FFS approach at the community level. The stage was set for bringing farmer participation to a wider audience through a further 20 FFSs.

The first step was to raise awareness about FPR and create a shared vision, the next to get down to detailed planning. The process began with a zonal pre-planning workshop, which laid out a timetable and outlined roles and responsibilities for different stakeholders. A planning workshop and training on participatory research activities then took place at the woreda level. This included training of development agents and supervisors in participatory methods, during which checklists for baseline data were agreed. Next, action planning took place at the community (peasant association) level through public meetings at which the fundamentals of participatory research were explained by teams comprising development agents and supervisors. At these meetings, key problems and possible solutions were suggested by the community. The extension workers used skills learned during training in the planning exercise, and were able to practise their newly-acquired participatory techniques. A woreda feedback meeting completed the planning process, with each team reporting on the planning procedure and activities agreed with 'their' community.

Trainers at the 20 FFSs focused on developing participatory approaches for IPM suitable for local farming systems and addressing local needs. They involved farmers in all aspects and at all stages of the research process. This is leading to the generation of IPM technologies that farmers are more likely to adopt, because they understand what they are based on. With one exception, the FFSs generated enormous enthusiasm, and farmers took to experimentation with a vengeance. The major crops in the region are teff, wheat, barley, peas and lentils. Wollo bush cricket (especially), aphids, 'black beetles' and rats were identified as the major pests to be targeted. As the FFSs progressed, farmers' motivation, enthusiasm and confidence in their ability to conduct research and gain meaningful results mounted, as did the sense of team spirit as they worked together to solve problems. They demonstrated a deep well of indigenous technical knowledge and resourcefulness. Extracts of various parts of 24 plant species were tested, as fresh or fermented products, and many of these proved effective against a variety of pests. Farmers were already familiar with many of these as traditional remedies of various kinds, and had chosen to experiment with them for that reason.

Debeko in North Wollo was the setting for one successful FFS. Development agents trained 24 farmers (22 men and 2 women) selected by the community during the participatory planning exercise. They chose to focus on one crop (teff) and one pest (Wollo bush cricket). One farmer donated two 500 m^2 plots for IPM and control treatments, and the participants, in groups of six, met every Sunday for 9 weeks during the 1999/2000 season. Each group carried out agroecosystem analysis (AESA), observing and recording insect and disease problems, and also collected general agronomic data. At the end of each session, the groups met to share findings and agree action to overcome problems encountered. They found that fermented cow urine, sisal, melia (*Melia azedarach*), 'merez' (*Acokanthera* (formerly *Carissa*) *schimperi*), 'azohareg' (*Dracaena steudneri*/*Grewia ferruginea*), 'antharfa' (*Acanthospermum* sp., 'starburr'), 'tobia' (*Calotropis procera*, Sodom apple) and wood ash had insecticidal/antifeedant properties against the cricket. These were also effective against household and storage pests, and indeed have established ethnoveterinary, medical and household uses in this community.

The implementation of FFS during one season made the FFS farmers in Debeko highly motivated and enthusiastic about the new skills and knowledge they had acquired. There was also an encouraging dissemination of information to non-FFS members: 272 other farmers (including 56 women) learned about FFS experimentation, and in many cases began to experiment with natural pesticides themselves. This was achieved through formal and informal methods (from organized field days to simply talking). Overall there was 35% less pesticide use in 2000 than pre-FFS (1995-99). Although lower pest pressure may be partly responsible, the result is encouraging.

An evaluation workshop was held at the end of the season, in January 2000, to give stakeholders a chance to discuss achievements and identify problems. The sense of achievement of the community leaders and other stakeholders was high. A wealth of possibilities for further experimentation was identified, and it was recognized that farmers will continue to need training and backstopping to enable them to progress. A beginning was made on collating all the information generated and a number of priorities were set. The need for systematic recording of data was agreed and, importantly, for criteria to be set for trials. For example, what part of plants are most effective, at what concentration, and when applied fresh or fermented. Mixtures of extracts were popular and were found effective during the FFSs; it was agreed that limiting the number of constituents to two or three will allow the relative contribution of components to be determined more easily. Conservation of populations of some relatively rare plants used will be addressed, and the possibility of planting exotics with known pesticidal properties (such as neem) is being considered. In addition, aspects often ignored for 'natural' compounds will be considered: residues on produce and nontarget effects (indeed, burning of both skin and plants by fermented urine was recorded by some farmers in some of these FFSs).

The project is also notable for promoting mutual collaboration between farmers, researchers and extension workers, and it engaged the involvement of Sirinka Agricultural Research Center to this end. How well this worked is illustrated by what happened when researchers went out to meet with farmers in their fields for the first time, and were overwhelmed by the enthusiasm of the farmers for experimentation. The researchers and farmers worked together to identify priority activities to be undertaken in the laboratory, and agreed that the results would be reported back to the farmers.

The way in which the farmers have taken to experimentation is remarkable, both within FFS communities and beyond, to the extent that the current network is fully stretched trying to meet the clamour for FFS training from farmers. Wollo may continue to be beset by unforgiving climatic events and pest invasions, but by allowing farmers to take charge of the future of their agriculture, SC (UK) and the MoA are helping to ensure the future security and health of the people of this region.

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Weaver Ants in Citrus: a Revival

Improving citrus pest IPM and its uptake in Vietnam is focusing on the revival of centuries-old traditional practices together with the development of new and complementary control measures for pests and diseases. The biggest challenge, however, is disseminating knowledge and understanding effectively to stakeholders so uptake of IPM technology is improved.

The Mekong Delta region of Vietnam has long been its largest rice bowl, providing half the country's yield and contributing significantly to export earnings. Now, however, with world demand not supporting further growth in this sector, yet with some 60% of GDP for the region dependent on rice production, there is a drive to diversify agriculture. Tree fruits are traditional crops in this region – indeed, the Mekong delta is the country's principal fruit as well as rice bowl. A great diversity of fruit is grown. Most households have an orchard planted with fruit trees that have been found to do well at that site, so there is an enormous functional diversity. Citrus varieties, in particular, have been popular, both in home garden and intensive fruit production systems.

Since the late 1980s, there has been a fall-off in the traditional use of the weaver ant *Oecophylla smaragdina* as an endemic biocontrol agent. An analysis of the reasons for this turns up some familiar stories: low cost pesticides, aggressive marketing by pesticide companies, unfavourable market conditions for IPM and technically oriented extension activities promoting increased use of agrochemicals. More recently, there has been a drive to safeguard and improve the wider distribution of traditional knowledge along with the uptake of other IPM techniques in this crop, with interest focusing on farmer participatory methods.

Vietnam has been developing effective farmer participatory training and research (FPTR) methods through the Farmer Field School approach in rice for about 10 years and more recently in vegetable systems [see *BNI* **21(1)**, 10N-11N (March 2000) Vietnam showcase]. Despite its superficial informality, there is a strong underlying structure to successful FPTR. The effective transfer to vegetables of methods used in rice was based on problem prioritizing, the development and validation of suitable training exercises, and the rigorous planning of training sessions in accordance with crop growth cycles.

A multi-stakeholder workshop held in Tien Giang Province in February 2001 assessed the potential for using FPTR to promote IPM in citrus fruits. Participants identified a number of differences and obstacles to be tackled in making the transition from field to tree crops:

- The perennial tree fruit cropping cycle is too long to go through in the traditional FFS manner (from planting to fruit harvest); significant periods in the cycle will have to be focused on for meetings and training sessions.
- Tree height makes monitoring pests and natural enemies (agro-ecosystem analysis) more difficult, and adapted exercises will need to overcome this. A strong focus will have to be put on visualization of ecological concepts.
- There is a wider variation in orchard design and cultural practices than is the case in field crops, which makes the traditional trial comparison of IPM *vs* farmers' practice plots difficult.
- Follow-up in the form of farmer-to-farmer training seems to be good, but needs a stronger structure and backstopping by regular feedback to and from extension/scientists and farmer groups. Due attention will have to be paid to the fact that competition is stronger between fruit farmers than between those growing field crops.

Ancient yet Modern

The workshop focused on promoting the use of weaver ants as generalist biocontrol agents against a range of pests. Using ants in citrus is the oldest form of biocontrol we know, first recorded in China in the 4th century (and cited in just about every modern biocontrol textbook!). Hsi Han described in 'Records of the plants and trees of the Southern Regions', written in 304 AD, how ants in bags of rush matting were sold at local markets in southern China. These were hung up in mandarin orange trees to kill not the fruit, but the insects that ate the fruit. Farmers built systems of miniature bamboo bridges to connect trees so ants could move easily between trees. A supply industry grew up, and by the 12th century, entrepreneurs were hanging up animal bladders filled with fat next to nests to attract the ants, which could then be sold on.

Ants have traditionally been used by farmers in their citrus orchards in the Mekong Delta region, and farmer experts in their use were amongst participants at the workshop. However, as pesticide use increased over the last decade, outbreaks of pests such as citrus leaf miner (*Phyllocnistis citrella*) and mites became widespread, and many farmers concluded that the ants were no longer effective. There has therefore been a fall-off in their use and there is a danger that the indigenous knowledge, traditionally passed on from generation to generation, will be lost.

During the first 2 days of the workshop, participatory tools were used with experienced citrus farmers in order to analyse and document their knowledge, and to define constraints and options for further spreading this traditional practice. The level of the farmers' indigenous knowledge about the ants astonished scientists and extension staff at the workshop, while farmers professed that it was a novel experience to be contributors rather than recipients of information at such a meeting. The discussions led to some useful outputs. For example, a number of farmers said leaf drop was a problem in the dry season, because it limited nesting materials. This topic was therefore identified as a priority for further study. It was agreed that research was needed to underpin the development of planned functional year-round orchard biodiversity, so ants would have a continuous supply of nesting habitat and food.

On the other hand, scientists were able to help farmers understand the leafminer problem. This was identified as a serious pest by some farmers, and one that cannot be controlled by the ants. Yet scientific evidence suggests this is not so. Scientists were able to explain about the relationship between increased pesticide use and leafminer outbreaks, something that farmers were not aware of, and about the role of parasitoids, about which none of the farmers had any knowledge. This was identified as an important topic for developing training exercises and participatory research.

Knowledge of diseases and how to manage them without interfering with the ant was limited, and few farmers were aware of the role of sanitation. Farmers' ability to diagnose disease was also limited. The relationship between greening disease (yellow leaves syndrome) with its vector, *Diaphorina citri*, was largely not known. Although most farmers recognized the insect, they did not know it transmitted the disease and was thus a pest. Only one farmer was familiar with the use of petroleum spray oils (PSOs) for controlling the vector and hence the disease – another key topic identified for training exercises and participatory research.

Spreading the Word

During the third and last day of the workshop, more researchers and extension staff, policy makers, and representatives of farmers' associations and NGOs joined in. The workshop was invaluable in bringing together stakeholders to share knowledge and to begin to identify the gaps where research and extension is most needed. Its outputs illustrate the value of involving all stakeholders in this exercise. The big challenge, though, is to reach more farmers in a way that stimulates increased validation of the traditional practice of using ants in combination with the uptake of new IPM technologies. Participants were enthusiastic about the FPTR approach followed during the workshop, and saw this as the natural way forward. There is a wealth of indigenous knowledge to be tapped, particularly about the use of ants in a variety of tree crops, but research and training in the use of many other biocontrol agents (leafminer parasitoids, predatory mites) would be invaluable. The use of natural enemies can be complemented by other advances in biological methods, such as sanitation and the use of biopesticides, but most farmers currently know little if anything about these. There is much to be done, but prospects for improving citrus health and production by integrated methods are bright. Because farmers' knowledge, their cropping practices and the orchard habitats are highly diverse, additional funds are required to organize similar activities in each of the major fruit growing provinces.

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Announcements

Are you producing a newsletter, holding a meeting, running an organization or rearing a natural enemy that you want other biocontrol workers to know about? Send us the details and we will announce it in BNI.

Jump To It!

The Eighth International Conference on Orthopteroid Insects takes place in Montpellier, France on 19-22 August 2001. Local organization is by Prifas, the operational acridology laboratory of the Center of International Cooperation in Agricultural Research for Development (CIRAD, and the scientific committee includes Maria M. Cigliano (Argentina), Theodore J. Cohn (USA), Michel Lecoq, (France), Jeffrey A. Lockwood (USA) and My Hanh Luong-Skovmand (France). The conference will address the main concerns in current orthopteroid insect research in the field of pest management, ecology, systematics and behaviour. There will be simultaneous French–English translation.

Website: http://os2001.cirad.fr/

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Fax: +33 4 67 59 38 73

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Asian-Pacific Entomology Meeting

The Fourth Asia Pacific Conference of Entomology takes place in Kuala Lumpur, Malaysia on 14-17 August 2001, jointly organized by the Malaysian Plant Protection Organization and the Entomological Society of Malaysia, with support from the Ministry of Science, Technology and Environment. The conference provides comprehensive coverage of all aspects of entomology. Amongst the 34 sessions on different topics, are ones on biological control, insect pathology/microbial pesticides, cultural control, and IPM/ICM.

Website: http://www.mapps.org.my/mapps/APCE.html

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Invasives in Latin America and the Caribbean

IABIN, a biodiversity informatics initiative of the Americas, is developing a directory of institutions, organizations, and individuals in Latin America and the Caribbean that actively participate in invasive species projects. We are particularly interested in the organizations or institutions that are the points of coordination for, or leaders in, the research and management of invasive species in their country. There may be opportunities in the future for collaboration between Latin American and Caribbean organizations and the US National Biological Information Infrastructure [www.nbii.gov] to share experiences in dealing with invasive species, and this directory would be a first step in that direction.

Forward information to:
iabinteam@usgs.gov
For more information on IABIN,
the Inter-American Biodiversity Information Network,
see: www.iabin.org or www.iabin-us.org

Contact Andrea Grosse at:
International Biological Informatics Program, US Dept. of the Interior,
1849 C Street, NW (MS 2646),
Washington, DC 20240, USA
Fax: +1 202/208 4962
or US Geological Survey,
302 National Center,
Reston, VA 20192, USA
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Exotic Birds List

A new Spanish group for the study and management of exotic bird species is creating a list of specialists working on exotic bird invasions, biology and control throughout the world. Send the following information: name, institution, address (e-mail), country, area of work (species and geographic area), main publications on this issue, and any other relevant information or suggestions to Jorge Fernández Orueta at:
Email: jorge@casanet-a.net.ma
with 'Exotic Birds' in the subject field of the email.

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Biocontrol-l Moves

The Biocontrol-l listserv and the International Information System on Biological Control have a change of email address. Subscribers both old and new should (re)register by sending a message to:
listproc@cnpma.embrapa.br
Leave the subject field blank, and in the body of the message write: "subscribe biocontrol-l *your full name*"

Messages to the list should be addressed to: biocontrol-l@cnpma.embrapa.br

Contact: Luiz Alexandre Nogueira de Sà,
Embrapa Meio Ambiente,
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Entomology Discussion List

The discussion list of the 'Sociedade Entomológica do Brasil', SEB-list, is dedicated to all those interested in exchanging entomological information. It is not restricted to Brazilian Entomological Society members, and has about 200 members.

To subscribe send a message to:
seb-l-request@lesma.ciagri.usp.br
and write 'Subscribe' in the Subject item.

To send a message to the list, the address is:
seb-l@lesma.ciagri.usp.br

Contact: Roberto Zucchi
Email: razucchi@carpa.ciagri.usp.br

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USDA Biocontrol History

This volume gives a complete chronicle of the US Department of Agriculture's biological control programmes, beginning with the first (unsuccessful) one to control imported cabbage worm by introducing *Cotesia glomeratus* in 1883-84. Although many topics are necessarily dealt with in summary, it provides a complete catalogue of the biological control initiatives undertaken, and a full list of references allows readers to follow up projects in more detail. The publication is organized into four sections (1883/4-1933, 1934-52, 1953-72 and 1973-93) corresponding to four periods initiated by major organizational change in USDA. An epilogue deals with events to 1999, and summarizes accomplishments and current status of classical and microbial biological control. The history concerns biocontrol activities of the divisions and bureaux that were combined in 1952-53 to form the Agricultural Research Service (ARS), or placed in the US Forest Service (USFS). In 1971, some of the units were moved from ARS to form the Animal and Plant Health Inspection Service (APHIS). All of these are dealt with. In particular, the volume gives detailed coverage of the history of ARS insect pathology research (125 pp), and of biological control within the US Forest Service (145 pp).

Coulson, J.R.; Vail, P.V.; Dix, M.E; Nordlund, D.A.; Kauffman, W.C. (2000) 110 years of biological control research and development in the United States Department of Agriculture, 1883-1983. Washington, DC; USDA-ARS, 645 pp.
Obtainable from: Biological Control Documentation Center, USDA, ARS, National Program Staff, NAL, 4th Floor, 10301 Baltimore Avenue, Beltsville, MD 20705-2351
Email: jcoulson@nal.usda.gov
Fax: +1 301 504 6355

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Liriomyza Bibliography and Directory

Although *Liriomyza* species are not new to the Philippines, only in late 1999 did they achieve important pest status. As part of the response to the threat they present, members of the Potato Leaf Miner Task Force (PLMTF) from the Department of Agriculture, Regional Field Unit, Cordillera Administrative Region have produced a selected bibliography[1] on economically important *Liriomyza* species, and an international directory[2] of researchers in this field. The PLMTF are currently developing webpages on *Liriomyza* species, and welcome suggestions.

The bibliography is intended as an initial step in providing information to fill knowledge gaps, and to provide better understanding of research methods, ecology and management of *Liriomyza* species. It provides lessons from a number of countries showing that optimum leafminer management involved the 'best mix' of IPM options rather than relying on pesticides alone. The directory is complementary to the bibliography, and lists 57 individuals and eight organizations involved in *Liriomyza* research; as well as providing contact details it indicates their specialist areas. The authors welcome additional information for future updates of both publications.

[1] Joshi, E.E.; Joshi, R.C.; Verzola, E.A.; Baucas, N.S. (2000) A selected bibliography on economically important leafmining flies, *Liriomyza* spp. (Diptera: Agromyzidae), 32 pp.

[2] Joshi, R.C.; Joshi, E.E.; Verzola, E.A.; Baucas, N.S. (2000) International directory of researchers on harmful agromyzid flies (*Liriomyza* spp.).

Both are published by,
and can be obtained from:
Department of Agriculture,
Cordillera Administrative Region Field Unit (CARFU), BPI Complex, Guisad, 2600 Baguio City, Philippines.

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Striga CD and Video

The Systemwide Program on Integrated Pest management (SP-IPM) have produced 'Breaking the cycle', a 20 minute public awareness video/CD on the *Striga* research of the CGIAR (Consultative Group on International Agricultural Research) centres. This is available from the SP-IPM secretariat

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CABI Bioscience Website

CABI *Bioscience* is pleased to announce the launch of its new website. Now more interesting, more interactive and easier to navigate than ever before, you can read about CABI *Bioscience*'s groundbreaking work in 104 countries around the world.

Check it out at: http://www.cabi-bioscience .org

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New Organic Website

CABI *Publishing* has launched organic-research.com – a new online community for organic farming and food. The content of the site, available to members on subscription, includes over 100,00 abstracts selected from the CAB ABSTRACTS® database, news (searchable and updated weekly), a selection of research papers, job vacancies, and a bookshop devoted to organic and sustainable agriculture for browsing and buying securely online.

Free/guest membership allows access to limited information including news headlines, jobs, laws and regulations, educational courses and an events 'diary'.

For more information visit the website at: www.organic-research.com

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Conference Reports

International Knapweed Symposium

The First International Knapweed Symposium of the 21st century was held on 15-16 March 2001, at the Coeur d'Alene Resort in Idaho, USA. This is the fourth Knapweed Symposium in the series.

The Symposium featured speakers from six countries. In addition, participants from 11 western States and two Canadian provinces helped to comprise the total of 350 participants. Sixty-seven presentations, split between oral and poster formats, were given to this larger-than-expected audience. The goal of the symposium was to share new information on the major invasive knapweed species in North America, namely diffuse, spotted, squarrose, and Russian knapweeds (*Centaurea diffusa, C. maculosa, C. squarrosa* and *C. repens*, respectively), and yellow starthistle (*C. solstitialis*). The diversity of subject matter presented included recent advances in field-based knapweed research, integrated knapweed management within the framework of multi-disciplinary, multi- agency, cooperative programmes, applying ecological principles of knapweed management, recent advances in biological control, new approaches to technology transfer, mapping and database management, restoration and revegetation (including the planned use of livestock to manage weeds), and current taxonomic research.

Information sharing and camaraderie were apparent outside the meeting rooms, as folks continued their discussions and renewed old acquaintances. The proceedings of the Symposium are available on CD ROM. To obtain one, please contact Linda Wilson (details below). For more information, please visit the symposium web site at: http://www.sidney.ars.usda.gov/knapweed

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African Biopesticide Meeting

A 'Pan-African Workshop on Biopesticide Registration' was held in West Africa from 29 January to 2 February 2001 at the Plant Health Management Division of the International Institute of Tropical Agriculture (IITA) in Cotonou, Benin. The workshop was sponsored by Virginia Polytechnic Institute and State University, USA (Virginia Tech) and IITA. The event was part of Virginia Tech's US Agency for International Development (USAID) funded project to develop biopesticides for locust and grasshopper control in sub-Saharan African using indigenous insects. USAID support came from the Africa Emergency Locust and Grasshopper Assistance (AELGA) project in the Africa Bureau of USAID.

The workshop was attended by 40 representatives of plant protection services, pesticide registration authorities, and other stakeholder organizations from fifteen countries across Africa. The Food and Agriculture Organization of the UN (FAO), the FAO Emergency Prevention Service (EMPRES), the Inter-African Phytosanitary Council of the Organization for African Unity (OAU), and the Pesticide Action Network (PAN) were represented. An expert on biopesticide registration from the US Environmental Protection Agency also participated.

The group spent 5 days reviewing how different microbe-based biological control products work, understanding how they are currently used in Africa and other parts of the world, and examining the current national and regional regulatory frameworks for registering biopesticides in Africa. Of particular interest to participants was the contribution from the South African representative who explained the procedures by which Green Muscle™ was registered in South Africa. The participants developed recommendations regarding how existing regulations and guidelines for the registration of synthetic chemical pesticides can be better adapted to the unique properties of biocontrol agents.

Following the workshop, working groups for West Africa and Eastern Africa spent 3 days drafting relevant documents for their regions based on the recommendations. The West African working group revised its draft biopesticide registration guidelines and initiated the design for a decision document for use by the Comité Sahelien des Pesticides (Sahelian Pesticide Committee, CSP) of the Permanent Interstate Committee for Drought Control in the Sahel (CILSS). This document will be used to consistently evaluate biopesticide registration dossiers in the regional CSP system, which comprises nine countries. Through the USAID/Virginia Tech biopesticide project, two components of the guidelines had been previously prepared with the leadership of Senegal's Direction de la Protection des Végétaux (DPV). These documents have been drafted at the request of the CSP.

In Eastern Africa there is no regional system comparable to the CSP, although the South and East African Regional Committee on Harmonization (SEARCH) is working to harmonize data requirements for synthetic pesticides. The objective of the Eastern Africa working group was to develop a framing document that can be used by countries in Eastern Africa to harmonize national guidelines and regulations on pesticide registration with respect to microbial biopesticides. The working group represented pesticide registration authorities from five countries (Eritrea, Ethiopia, Kenya, Tanzania and Uganda). During the workshop and working group sessions, the individual team members made plans for how these recommendations can be put to use to facilitate biopesticide registration, including their presentation to national regulatory bodies, SEARCH, and the OAU Inter-African Phytosanitary Council.

The organizing committee believes that the adoption and uptake of recommendations by regional and international bodies will be crucial to the long-term successful achievement of the workshop's objectives. Proceedings from the conference are being prepared and will be available in during 2001.

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