General News

BIOCAT to be Updated and Made Open Access

For many years, the late David Greathead, former Director of CABI's International Institute of Biological Control[1], together with his wife Annette Greathead, developed and maintained a global database of classical biological control introductions of insects to control insects: BIOCAT. Originally a card index, BIOCAT was developed with different software as computers became more accessible. It reached its current form in the 1990s, as described in Greathead & Greathead[2], and since then was maintained by David Greathead in his retirement, until his untimely death in 2006. Now a new initiative with support from IOBC (International Organization for Biological Control), CABI and others will bring BIOCAT up to date under the umbrella of CABI's Invasive Species Compendium initiative.

Many will already be familiar with CABI's Crop Pest Compendium (www.cabi.org/compendia/cpc/). The Invasive Species Compendium will be a similar database, but addressing invasive species. It will be internet-based and open access.

The BIOCAT database consists of records for each introduction based on the published literature only, which limits the coverage, but ensures its credibility. At the time of Greathead & Greathead's analysis it contained 4769 records, and when David Greathead stopped updating it in 2006, it contained 5558 records. Each country–agent combination is one record, and each record includes, as far as available: *Pest* – the target pest or principal target pest; *Other pest* – target pests apart from the principal target pest; *Classification of pest* – order and family; *Origin of pest* – zoogeographical origin of the pest; *Crop* – where it was hoped to control the pest; *Country* – name of the country or island where the release was made; *Year* – year or years of release; *Agent* – name of the parasitoid or predator biological control agent; *Classification of agent* – order and family; *Origin of agent* – zoogeographic region and country of original source; *Result* – in six categories from failure to establish to complete success, or unknown; *Source* – a key reference, usually a global or regional review when available; and *Note* – other information worth recording that doesn't fit any field.

The database should be a key information source for (1) practitioners to identify what introductions have been made before and with what results, (2) ecologists wishing to test various theories regarding biological control and the introduction of species, (3) regulators of biological control, to know whether biological control agents, or species closely related to them, have been used before, and with what results, (4) those concerned with genetic resources, to assess what biological control agents have been obtained from and used in different countries, and (5) taxonomists, to locate how different biological control species have been distributed, and so on. Just as one example, when the IOBC Global Commission on Biological Control and Access and Benefit Sharing set out to address the question of who has supplied genetic resources and who has used genetic resources for biological control, BIOCAT was an invaluable resource[3]. Even so, it was necessary to review all entries in the field 'Country', and make sure that these represented political countries.

In a new initiative, CABI is updating and revising BIOCAT, to make it available through the open access Invasive Species Compendium, which should be available in 2011. This is being done with partial support from IOBC, and in a partnership with the Center for Biological Control, Florida A&M University, USA. The following steps are envisaged for the first phase: (1) check all existing records in BIOCAT and modify them to a new structure to facilitate analysis and meet some of the identified uses and needs (e.g. political countries will be identified as well as areas or islands within countries), and (2) update BIOCAT with new introductions published over the last 5 years. At the same time, the project will work on: (3) expanded coverage to include all invertebrates used for the biological control of invertebrates.

Later, we plan to add more information for all records, including information on biology of pest and agent, host specificity, reports of non-target effects, availability of cost–benefit information, etc., etc. but this will take longer. We will begin by adding this information for introductions into Europe and the Americas, and will tackle the other continents later as resources permit. Ways to include pathogens in BIOCAT will also be explored.

For more information or offers of help (financial, information, verification), please contact CABI's Chief Scientist, Dr Matthew Cock (m.cock@cabi.org).

[1]Murphy, R.J. & Cock, M.J.W. (2007) David Greathead: a life in biological control. *Biocontrol News and Information* **28**, 1N–9N.

[2]Greathead, D.J. & Greathead, A.H. (1992) Biological control of insect pests by insect parasitoids and predators: the BIOCAT database. *Biocontrol News and Information* **13**, 61N–68N.

[3]Cock, M.J.W., van Lenteren, J.C., Brodeur, J., Barratt, B.I.P., Bigler, F., Bolckmans, K., Cônsoli, F.L., Haas, F., Mason, P.G. & Parra, J.R.P. (2010) Do new access and benefit sharing procedures under the Convention on Biological Diversity threaten the future of biological control? *BioControl* **55**, 199–218.

Collaborative Research between UK and India Paves the Way for Exporting Potential Biocontrol Agents

Since the enactment of the Indian Biological Diversity Act 2002, governed by the National Biodiversity Authority (NBA), there are two pathways available to non-Indian residents seeking to export genetic material from India. Researchers can either submit an application directly to NBA or, if the research is in collaboration with a public sector organization in India which has approval from a Central Government Department of India, with legal status, an application is made under a Material Transfer Agreement.

In 2009, a Memorandum of Understanding was signed between CABI and the National Bureau of Plant Genetic Resources (NBPGR), a constituent institute of ICAR (Indian Council of Agricultural Research), to facilitate a collaborative research project on 'The study of biological control of invasive plant species and Indian natural enemies'. This included two distinct work packages for two individual plant species/groups, namely Himalayan balsam (*Impatiens glandulifera*), a European and North American invasive, and the *Hedychium* or wild ginger species complex of herbaceous, subtropical invasives, both of which share the common attribute of having part of their native range within Indian borders.

For the success of any classical biological control project, in-country collaboration is not only essential to facilitate export of natural enemies to the target country but also a crucial factor in facilitating the engagement of local scientific expertise. In-country scientists are better able to access national scientific resources and expertise to help identify natural enemies (often species identifications are a prerequisite before export is permitted). In addition, research into the phenological and ecological interactions of the host and potential biocontrol agents is often better undertaken in the plant's country of origin, where there is also potential to conduct open-field tests and collect observational data on an agent's host range.

In 2009, scientists from CABI and NBPGR surveyed populations of Himalayan balsam in the Kullu valley in Himachal Pradesh, India. Collections of arthropods and plant pathogens were hand-carried back to the containment facility at NBPGR for further research. Three surveys were conducted during the plant's growing season, timed to coincide with the three life stages of the most promising biocontrol agent, a *Puccinia* sp. that had been observed as highly damaging to Himalayan balsam populations during an initial scoping study in 2008.

In the last quarter of 2009, five natural enemies were prioritized for further investigation, based on field observations and research: three beetle species, *Metialma scenica, Languriophasma cyanea* and *Alcidodes westermanni,* and two plant pathogens, a *Puccinia* rust and a *Septoria* leaf spot.

For the *Hedychium* spp. complex, two surveys were undertaken in 2009 to the eastern Himalayan foothills, in the small state of Sikkim, which had been previously identified as a native hotspot for the *Hedychium* targets. A number of highly damaging tip-mining flies, leaf-feeding lepidopteran caterpillars and fruit-boring beetles were identified as holding potential as well as a *Puccinia* rust on the most invasive of the complex, *H. gardnerianum*. Collections of plants, insects and pathogens were again taken to NBPGR containment facilities for further rearing and preliminary identifications. In addition, collaborations in Sikkim itself were developed with the Department for Environment, Forest and Wildlife Management to facilitate acquisition of permits to survey in this ecologically diverse and sensitive state.

A Material Transfer Agreement application requesting the export of prioritized species for both the *I. glandulifera* and *Hedychium* work packages, including Indian biotypes of the plants, to CABI Europe – UK's quarantine facility for research purposes, was submitted to the Plant Genetic Resources Export Facilitation Committee (PGR-EFC) for consideration, and subsequently approval was granted and endorsed by the Department of Agricultural Research and Education (DARE).

An early-season survey in June 2010 saw CABI and NBPGR scientists conduct further collections of the prioritized Himalayan balsam agents, and all three invertebrate species and the *Puccinia* sp. were later exported to CABI's quarantine facility for further research.

With the *Impatiens* project paving the way and successfully testing the administrative protocols and logistics for export, collaboration with NBPGR for the *Hedychium* project includes a survey planned for October 2010 to collect and export prioritized agents and begin host-range testing for New Zealand and Hawaiian sponsors.

Restrictions due to access and benefit sharing procedures (or lack of them) for genetic resources are proving a growing constraint to many biological control programmes worldwide and, whilst the national collaborations and diplomatic negotiations need to be addressed on a case-by-case and country-by-country basis, it is important for scientists in the biocontrol community to share experiences, raise awareness internationally and highlight the benefits of developing linkages and agreements with international partners to resolve problems, so that new international protocols can be formulated to facilitate research and, more importantly, so that biological control can continue to be adopted and promoted as a viable management option for the growing threat of invasive species.

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Rodolia Knocks over *Icerya*: Success for the First Classical Biocontrol Project in the Galapagos Islands

Invasive insects constitute 23% of the Galapagos insect fauna. One of these pests is the cottony cushion scale, *Icerya purchasi*, a sap-sucking bug native to Australia that has successfully invaded many areas of the world. Uncontrolled populations are most notorious for the damage they cause to citrus. The pest was the subject of the world's first classical biological control programme in California, USA, in 1888–89. This project resulted in the importation of a highly host-specific and efficacious coccinellid predator, *Rodolia cardinalis*, that quickly suppressed *I. purchasi* populations in California citrus.

In addition to citrus, *I. purchasi* can infest more than 200 species of woody plants, including native and ornamental species. Following the successful establishment of *I. purchasi* in the Galapagos Islands in 1982, populations exploded and the pest, assisted by wind and human commerce, rapidly moved throughout the archipelago. Populations built to alarming densities on a variety of plants that were either native or endemic to the Galapagos. Plant death and general overall decline were viewed as serious conservation threats by the Galapagos National Park Service (GNPS) and the Charles Darwin Foundation (CDF). In 1996, a Technical Advisory Committee was formed and concluded that classical biological control of *I. purchasi* was the only feasible strategy for permanently controlling this pest in fragile and ecologically sensitive habitats. In 1999, *R. cardinalis* was imported from Brisbane in Australia into quarantine at CDF on the island of Santa Cruz. Following safety testing against 16 native insect species, it was concluded that *R. cardinalis* did not pose an unacceptable risk to native species, and it was released into the Galapagos in 2002. The first ever biological control project in the Galapagos Islands had now been realized.

Rodolia cardinalis established readily, and it appeared to quickly suppress *I. purchasi* throughout the Galapagos. To confirm these initial observations, a collaborative project between the University of California – Riverside, GNPS, CDF, and the University of Massachusetts – Amherst, USA, was launched in late 2009. This project intends to provide a comprehensive evaluation of the *Rodolia–Icerya* biological control programme in the Galapagos. The goals of the ongoing project are: (1) to confirm that *I. purchasi* is suppressed by *R. cardinalis* in different natural habitats on the islands of Santa Cruz and San Cristóbal, and (2) to confirm the results of quarantine findings that indicated *R. cardinalis* is host specific and feeds only on *I. purchasi* in the Galapagos. Although these studies are scheduled for completion in mid 2011, preliminary results strongly support earlier initial findings that: (1) suppression of *I. purchasi* is extremely pronounced in most habitats, (2) *R. cardinalis* has tracked *I. purchasi* onto islands on which it was not released, and (3) extensive field observations and behavioural studies in large walk-in field cages have found zero evidence of *R. cardinalis* feeding on non-target insect species.

Further information on this project, with lots of colour photographs, can be found at:
www.biocontrol.ucr.edu/rodolia/rodolia_icerya_biocontrol_galapagos.html

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Planthopper Released Against Water Hyacinth in the USA

A new insect agent has been released against water hyacinth (*Eichhornia crassipes*) in the USA by USDA-ARS (US Department of Agriculture – Agricultural Research Service) scientists and cooperators.

Water hyacinth, a free-floating aquatic plant native to South America, infests US freshwater ecosystems from North Carolina to California but is especially problematic in the southeastern USA. The plant affects water traffic, water quality, infrastructure for pumping and hydroelectric operations, water use and biodiversity. Other problems include fish kills due to low oxygen levels and increases in populations of vectors of human and animal diseases.

ARS entomologists Philip Tipping and Ted Center, both with the ARS Invasive Plant Research Laboratory (IPRL) in Ft. Lauderdale, Florida, have worked closely with scientists at the ARS South American Biological Control Laboratory (SABCL) in Hurlingham, Argentina in their search for new agents, which included surveys in the basins of the Paraná and Uruguay rivers in Argentina and the basin of the Amazon river in Peru and Brazil. The delphacid planthopper *Megamelus scutellaris* was the most abundant insect collected on these trips; it was found to be sympatric with water hyacinth throughout the native range of the plant, from Peru to as far south as Buenos Aires Province, Argentina. The researchers collected adults of *M. scutellaris* from Argentina in April 2006 and brought them to the quarantine facility in Ft. Lauderdale where extensive host-range studies indicated that it is highly host specific, and would not pose a threat to native or economically important species. It was also shown to damage water hyacinth. All life stages feed on the sap of water hyacinth. The insect's population increases rapidly, which it is hoped will enable it to quickly impact the water hyacinth population.

Herbicides are the primary method for reducing water hyacinth in the USA, but their use directly interferes with the biocontrol agents currently

deployed against the weed there. *Megamelus scutellaris* nymphs are active and readily hop, even off the surface of the water. Tipping and Center believe that the planthopper may integrate better with existing herbicide programmes because of its mobility, which should improve its survival in such highly managed systems.

Tipping and Center joined representatives from the Florida Fish and Wildlife Conservation Commission, which provided more than US$300,000 in financial support for the project, and the US Army Corps of Engineers to celebrate the first release of the agent on 18 May 2010 at the Edgefield Regional Stormwater Treatment Facility owned by the St Johns River Water Management District near Palatka, Florida. Tipping is currently conducting field evaluations on the impact of *M. scutellaris* on water hyacinth with the assistance of personnel from the South Florida and St Johns River Water Management Districts and the Florida Department of Forestry.

Main source: ARS news service.
Web: www.ars.usda.gov/is/

Better the Devil You Know… Spiked Watermilfoil in South Africa

South Africa (SA) has a long history of aquatic weed invasions, the majority of which are free-floating weeds that are now largely under successful integrated control. There are few control programmes, however, against submerged plant invasions in comparison to countries such as the USA, New Zealand and Australia where invasion by submerged aquatics has received a lot of attention. Very little research has been conducted on the control of these weeds in SA perhaps because they are not as obvious as floating weeds, or because they have been competitively excluded by indigenous submerged flora or by floating weeds in disturbed systems.

The successful control of floating weeds that has resulted in denuded habitats, and the continued creation of impoundments, have opened the door to invasion by submerged aquatic species. Surveys have revealed very few submerged plant invasions in SA, e.g. *Hydrilla verticillata*, *Myriophyllum spicatum* (spiked watermilfoil) and *Egeria densa*, but the potential for these species to spread, and for others, such as *Cabomba caroliniana,* to invade is great owing to the nature of SA's aquatic systems.

Although spiked watermilfoil has been recorded in SA in the past, it has never previously been regarded as a troublesome weed. It was declared a Category 1 weed as a precautionary measure based on the problems it causes in other parts of the world. Recently however, it has become more dominant in large parts of the Vaal river, SA's largest river system. The increase in its occurrence is probably due to the great reduction in water hyacinth (*Eichhornia crassipes*) infestations in these areas as the result of effective integrated management, allowing spiked watermilfoil to proliferate in the absence of a serious competitor. It has major impacts on the Vaal river system which range from clogging irrigation pumps in this agriculturally important area, to preventing access to the river by boaters. Control is currently limited, as there is no herbicide registered against it, and use of herbicide products such as paraquat is prohibited in these sections due to the agricultural activity in the area.

Spiked watermilfoil, which is indigenous to Europe, Asia and North Africa, is the most important waterweed in continental USA, causing millions of dollars to be spent on its control. Like most submerged weeds, it negatively affects aquatic biodiversity and hinders recreational water use. It reproduces from seed, and fragmentation of the stem, which is the most likely mode of spread. Typical of most aquatic weed control programmes, the use of mechanical and herbicidal control methods has limited impact on the weed. However, a successful biocontrol programme has been implemented in the USA, using two accidental introductions from Europe, a pyralid moth, *Acentria ephemerella*, and an aquatic midge, *Cricotopus myriophylli*, plus a native North American weevil, *Euhrychiopsis lecontei*, which appears to be the most damaging.

Based on the experience in the USA, biocontrol scientists Julie Coetzee and Martin Hill from Rhodes University are initiating a biocontrol programme for spiked watermilfoil in SA. This is a unique programme for weed biocontrol because the native North American milfoil weevil, which is considered a new association on spiked watermilfoil in the USA, is being tested as a potential host-specific control agent in SA. In the USA, the weevil prefers *M. spicatum* over its natural host plant, *Myriophyllum sibiricum*. There is only one indigenous plant in the milfoil family in SA, which means host-specificity testing should be relatively quick and easy, and based on the weevil's performance in the USA, it should be a damaging agent in SA too.

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Controlling Gum Leaf Skeletonizer in New Zealand

A moth that threatens New Zealand's eucalypt forests is to be targeted by releases of a *Cotesia* sp. wasp, following approval by ERMA NZ (Environmental Risk Management Authority of New Zealand) of an application by Scion, the Crown Research Institute specializing in forestry research.

The gum leaf skeletonizer, *Uraba lugens,* has the potential to defoliate thousands of hectares of *Eucalyptus* plantations as well as ornamental *Eucalyptus* grown for shade and shelter throughout New Zealand. Repeated defoliation by the pest can slow the tree's growth, or even kill individual trees.

It was first found in New Zealand in Mt Maunganui in the 1990s. With fears that outbreaks like those seen in eucalypt forests in Australia could happen in New Zealand, an eradication campaign was set in

motion by the Ministry of Agriculture and Forestry (MAF), which proved successful. However, in 2001 it was discovered in Auckland, and this time it was already too widespread for eradication to be feasible. It has now spread throughout the Auckland region, is also present in Waikato, Coromandel and Bay of Plenty, and is likely to continue spreading. Its occurrence in urban areas highlights its status as a hazard to humans: contact with caterpillar hairs can cause a painful skin irritation.

Scion has been involved in research into the gum leaf skeletonizer since it was first detected in New Zealand. A team led by Lisa Berndt has been working on its biological control since 2007, as part of an MAF Sustainable Farming Fund project. Interest focused on the Australian braconid wasp *Cotesia urabae*, which three years of testing showed to be specific to *U. lugens*. Armed with these results and after consultation with a wide range of industry and community groups, Scion made its application to ERMA on behalf of the Gum Leaf Skeletoniser Stakeholder Group. With a view to climatic matching, the material to be released in New Zealand will be sourced from Tasmania, aided by Geoff Allen (University of Tasmania/Tasmanian Institute of Agricultural Research).

The Sustainable Farming Fund project will run for another 12 months during which time the wasp will be brought into New Zealand and released, with the help of the Gum Leaf Skeletoniser Stakeholder Group and any landowners or community groups associated with the release location. The release is likely to be made in the Auckland region where gum leaf skeletonizer is most abundant. The success of the release and ongoing impacts will be closely monitored over the next few years.

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Leaf-spot Fungus Fails to Establish on *Lantana camara* in South Africa

Lantana camara has proved a difficult target for biological control. This is attributed to the difficulty of finding agents that can thrive in the varied environmental conditions lantana has adapted to, and are also effective against the many commercial hybrids that have become invasive. This is certainly true in South Africa, where 22 insect species have been introduced under a biological control programme that began in the early 1960s, with variable results.

Following earlier work by Drs Harry Evans and Robert Barretto on the mycobiota of lantana in its native range, several field surveys were conducted in South and Central America in 1987–97. Based on these two bodies of work the leaf-spot fungus *Passalora lantanae* var. *lantanae* (=*Mycovellosiella lantanae* var. *lantanae*) was selected as the most promising agent against South African biotypes of the weed.

An isolate collected in Florida, USA, in 1995 was established in the quarantine laboratories at the Agricultural Research Council (ARC), Plant Protection Research Institute (PPRI) in Stellenbosch. Host-specificity testing showed it to be completely host specific to *L. camara*. This and a further nine isolates, collected in Florida in 1997, were then compared in pathogenicity tests, and three isolates were identified as the most virulent, and because they were pathogenic against different South African *L. camara* biotypes. Since this fungus had already been proven to be host specific, permission to release was granted in September 2001.

The agent was released as a classical biological control agent, rather than a mycoherbicide, since the isolates grew slowly and sporulated irregularly. The spores of the fungus mainly disperse by water splash or short distance wind dispersal. The inoculum, produced at PPRI-Stellenbosch, was formulated in two ways: as aqueous and oil-based spore suspensions. Releases were made in 2002 and 2003 in the early summer, at the beginning of the rainy season. Release sites were chosen in Mpumalanga and in both coastal and inland areas of KwaZulu-Natal and Eastern Cape provinces to determine which climate would be more suitable for the fungus in the field.

First results were encouraging: monitoring conducted 12 weeks after release, towards the end of the rains, before the dry winter, found lantana leaves were exhibiting symptoms resembling the angular leaf spots caused by *P. lantanae* var. *lantanae*, which was confirmed with the re-isolation of the fungus in the lab.

Establishment occurred at eight sites: three of six in Kwa-Zulu Natal, three of seven in Eastern Cape (although heavy infection occurred at only one of these), and two in Mpumalanga (another two sites were destroyed). The fungus established well in the coastal, warm and humid areas. Most sites where the fungus did not establish were in colder and much dryer areas. The aqueous formulation performed best at all sites; almost no infection occurred with the oil-based formulation.

Due to staffing and funding problems, this project was then put on hold. Only five years later, in May 2009, were all the sites of initial establishment revisited. Disappointingly, although leaf symptoms were observed on most plants at all sites, some resembling those of *P. lantanae* var. *lantanae*, no *P. lantanae* var. *lantanae* was re-isolated from material taken back to the lab. The cause of the observed symptoms remains unknown; several fungi have been recorded on *L. camara* in South Africa but do not cause significant levels of disease.

The failure of the fungus to establish in South Africa, despite promising early signs, may have been due to the high levels of leaf senescence which occur during the dry winter months. In Florida, where the fungal strains originated, lantana is evergreen. Renewed attempts to release *P. lantanae* var. *lantanae* at new sites where lantana remains evergreen were not possible, as the isolates had lost their pathogenicity during long-term storage. Further attempts to estab-

lish it in South Africa will not be made because of the perceived climatic limitations; however it is likely that this fungus remains a good potential agent in areas of the world with less pronounced wet and dry seasons, where year-round infection can be maintained.

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Terrestrial Invasive Weeds in Africa: a Role for Biological Control

The GEF/UNEP (Global Environment Facility/ United Nations Environment Programme) project 'Removing barriers to invasive plant management in Africa' has highlighted the impacts of invasive alien terrestrial and aquatic weeds in sub-Saharan Africa and the potential for classical biological control. Despite a number of successful biocontrol programmes against invasive aquatic weeds in sub-Saharan Africa, applying the approach to terrestrial invasive weeds has been neglected in the region, apart from in South Africa, where results underline what it has to offer.

This project, which came to an end in July 2010, aimed to strengthen policy, create awareness, build capacity and improve management of invasive plant species in Ethiopia, Ghana, Uganda and Zambia. It was led by CABI Africa, assisted by IUCN (International Union for the Conservation of Nature) and in collaboration with CSIR (Council for Scientific and Industrial Research, Ghana), ECZ (Environmental Council of Zambia), EIAR (Ethiopian Institute of Agricultural Research) and NARO (National Agricultural Research Organisation, Uganda).

Although surveys suggest there are far fewer invasive plant species in sub-Saharan Africa than in South Africa or even other continents, the ones present tend to be very widespread and have a significant impact on livelihoods and biodiversity. An overwhelming majority of the African population rely on agriculture and natural resources for their survival, and weeds have a large impact on agriculture and biodiversity in Africa; estimates suggest up to 25% of crop production is lost through weeds in least-developed countries and this was prior to the introduction of *Parthenium*. Invasive weeds also significantly reduce pasture quality and carrying capacity, and this particularly affects Africa's pastoralists living in semi-arid regions, particularly in North and East Africa. Besides the human impacts, weeds have invaded protected areas and threaten the continent's indigenous biodiversity. Adding a further layer to the problem, there is often a reluctance to control invasive plants which have come to be considered useful. This is often down to a lack information about their real impacts and unsubstantiated claims about benefits, but invasive plant management in Africa is also hampered by scant resources.

Under the GEF/UNEP project, the participating countries were supported in four general areas: (1) in strengthening invasive alien species (IAS) policy, (2) establishing strategies for controlling invasive alien plants, which included giving decision makers the information they need on the risks, impacts and management of invasive species (see below), (3) in raising awareness of invasive weed issues among policy makers and the public through development of publicity and information materials and websites, and (4) in building capacity in all sectors, from including IAS issues in school curricula to setting up training programmes for all stakeholders, from community members and other affected groups to officials under whose remit they come, e.g. quarantine officials.

With the project winding up, National Invasive Species Strategies and Action Plans have been developed for each country. Procedures for invasive alien species risk analysis, early detection and rapid response mechanisms have also been developed in all countries. National invasive plant lists are being produced, and ecosystem and management plans for pilot sites have been developed. Methods of control for a number of invasive weeds are being trialled at pilot sites using various techniques. Of great importance is the establishment of a single body in each country to coordinate IAS activities, a National IAS Coordination Unit, which it is hoped will also facilitate IAS management, especially the introduction of host-specific biocontrol agents. Biological control programmes often suffer where responsibility is fragmented between various government bodies.

According to GEF/UNEP project leader, Arne Witt, while manual and/or chemical methods are traditionally used for weeds in Africa, biological control has much to offer. He is calling for bigger investments to be made in the integrated management of invasive plants, with an emphasis on biological control as the most cost-effective management strategy for developing economies. Moreover, many of the most troublesome weeds in sub-Saharan Africa are under biological control elsewhere; where weed biological control programmes have already been conducted and a suite of potential agents identified, the cost is further reduced. Obviously there will be costs associated with some additional host-range tests but these are significantly lower than initiating a biocontrol programme from scratch. The spread of participating countries in this project across different regional bodies and ranges of habitats and species was deliberate, so that project outcomes could be applied to invasive species issues across sub-Saharan Africa. The project has facilitated the introduction of biocontrol agents to some of the four countries and it is hoped that this will lead to further introductions throughout the continent – classical biocontrol remains the only realistic option for cash-strapped governments in Africa and should be supported by donors.

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Conference Reports

Climate Change: Challenge or Threat to Biocontrol?

The climate is changing and it may have a negative impact on the biocontrol of plant pathogens. At the same time biocontrol could offer sustainable tools to counteract the effect of climate change and emerging diseases. These were the main topics of the 11th Conference of the IOBC (International Organization for Biological and Integrated Control of Noxious Animals and Plants) Working Group on Biocontrol of Plant Pathogens held in Graz, Austria, from 7 to 11 June 2010 and organized by Gabriele Berg (Graz University of Technology). More than 170 experts in biocontrol of plant diseases from 28 countries participated in the discussions. Setting out one view, Ilaria Pertot (S. Michele all'Adige, Italy), convenor of the IOBC Working Group pointed out: "Being living organisms, microbial biocontrol agents (BCAs), which are the active ingredient of several biopesticides, are strongly influenced by environmental conditions. Unfortunately no projections of the effect of climate change on BCAs and biocontrol are available. The concrete risk is that climate change could hamper the use of biocontrol in areas where it is already a common practice." In addition, Sylvia Blümel (Vienna, Austria) emphasized: "Climate change will modify the distribution and relevance of pest and diseases, especially regarding quarantine pests and therefore BCAs can offer a sustainable tool for adaptation."

Subsequent speakers made many pertinent comments. Even if few data are currently available and in the future more efforts from science are expected on this subject, it is clear that "changing management practices and environments will impact on soilborne plant diseases and suppression by introduced and indigenous biocontrol agents," as Linda Thomashow and David Weller (Pullman, USA) described. Especially under Mediterranean conditions we expect major changes because of a decrease in precipitation and increase in temperature, explained Blanca B. Landa (Cordoba, Spain). "The use of molecular tools to unravel the complex interaction of biological control strains, pathogens and indigenous microbial communities" will be crucial, said Kornelia Smalla (Braunschweig, Germany). This assertion was also clear in the presentation by Christian Kubicek (Vienna, Austria) who explained how recently acquired knowledge on "genomics and transcriptomics gave important insights into the mycoparasitic lifestyle of *Trichoderma* biocontrol strains". Finally, we did not overlook aspects related to commercialization. In developed countries registration is still expensive and time consuming and limits the number of available commercial biofungicides. In contrast alternative and faster approaches are increasing in developing countries with implementation models of *Trichoderma* BCAs, as described by Matteo Lorito (Neapel, Italy).

Other topics covered in presentations included: the effect of climatic factors on disease development and biocontrol; environmental and climatic stress and biocontrol; case studies of biocontrol and integrated disease management in different environments; commercial use of microbial BCAs for management of diseases at present and under climate change; new bio-resources for biocontrol; mechanisms and signalling in biocontrol; and approaches to commercialization including mass production, formulation methods and risk assessment.

Thanks to increased awareness that biocontrol can help in reducing the risks from chemical pesticides in integrated production, increased demand for organic food by consumers and a better outlook for registration of low-risk substances in the European Union, renewed enthusiasm has invaded the world of biocontrol. And climate change is one of the challenges that biocontrol will face in the future.

By Ilaria Pertot.

ENToM 2o1o in Antibes – Juan-les-Pins

ENToM 2o1o was held on 5–7 May 2010 in Juan-les-Pins in southeastern France.

This workshop, organized by Xavier Fauvergue and Nicolas Ris (INRA [*Institut National de la Recherche Agronomique*] Sophia-Antipolis), was an avatar of the now classic 'Journées des Entomophagistes'. The latter meeting has, for 40 years, gathered most of the French scientific community (along with a few francophone or francrophile colleagues) interested in entomophagous organisms. The specific objectives of ENToM 2o1o were: (1) to broaden the discussion to entomophagous organisms which are often underrepresented (insect predators, entomopathogenic nematodes and even carnivorous plants!), and (2) to reinforce the link between academic and applied research with a particular focus on biological control.

The workshop was attended by 70 participants including numerous PhD students. Thirty-two oral communications were presented, covering the research fields generally associated with entomophagous insects (behavioural ecology, biological control, host–parasitoid interactions). Novel approaches and questions linked to global change, such as biological invasions and climatic change, also emerged from ENToM 2o1o. A high scientific standard was provided by no less than five invited talks from: Laurence Gaume-Vial (on the fascinating world of carnivorous plants), Eric Lombaert (on the population genetics of the invasive ladybird, *Harmonia axyridis*), Patrick Tailliez and Ivan Hiltpold (an overview of research on entomopathogenic nematodes with a particular focus on their use as biocontrol agents) and, last but not least, Jérôme Casas (on recent advances in the physical ecology of prey–predator interactions). A special place was also given to biological control and IPM practitioners from the French institutes AREXHOR (Association Régionale d'Expérimentation Horticole), ARVALIS (Institut du

Végétal) and GRAB (Groupe de Recherche en Agriculture Biologique).

ENToM 2010 was sponsored by the Scientific Department 'Plant Health & Environment' of INRA, the University of Nice Sophia-Antipolis, the 'Conseil Régional de Provence-Alpes-Côte d'Azur', and three research units from the INRA Institute in Sophia-Antipolis. The next 'Journées des Entomophagistes' meeting will be organized in 2012 in Montpellier (France) by Patrick Tailliez and Nathalie Volkoff.

Further information:
https://colloque.inra.fr/entom2010

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Fumigants and Pheromones

Insects Limited and Roca Defisan hosted the 9th Fumigants and Pheromones Conference and Workshop on 3–5 March 2010 in the Mediterranean coastal city of Valencia, Spain. This international conference on stored product protection was well attended with over 200 pest managers representing 43 countries. The conference theme was 'Reducing customer complaints'. The conference opening speaker was Dr Pedro Palomo, with the Grain & Feed Trade Association (GAFTA). There were 20 invited international speakers who shared their stored product experiences, new technologies, and replacements for methyl bromide in structures and quarantine applications. The first day ended with a Gala Dinner where the attendees were entertained with Spanish food and flamenco dancers.

We moved locations on the third day from the famous Congress Palace to the busy Port of Valencia for a hands-on practical workshop consisting of eight work-stations that ranged from new fumigation techniques to advanced pheromone trapping to a visit to 500-year-old organic grain silos – all with the idea of implementing these strategies to 'Reduce customer complaints'. David Mueller, conference organizer, expressed his enjoyment in seeing the groups from the various countries get together and exchange ideas and form friendships.

The 10th Fumigants & Pheromones Conference will be held in Indianapolis, USA, in May 2012.

By: Kalah Schmitz.
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Announcements

International IPM Symposium

The 7th International IPM Symposium, 'IPM on the World Stage', will be held in Memphis, Tennessee, USA on 27–29 March 2012. Symposium sessions will address integrated pest management (IPM) across disciplines, internationally, in the market place, urban setting, greenhouse, etc.

The 6th IPM Symposium, held in 2009, attracted more than 700 research, education, government, industry and environmental and health professionals from 29 countries for three days of presentations, networking and organizational meetings on key pest management issues.

Further information:
Web: www.ipmcenters.org/ipmsymposium12/

Insect Pathogens and Entomoparasitic Nematodes

The 13th European Meeting of the IOBC/WPRS Working Group 'Insect Pathogens and Entomoparasitic Nematodes' will be held in Innsbruck, Austria, on 19–23 June 2011, on the theme 'Biological control in IPM systems'.

Further information:
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Intractable Weeds and Plant Invaders

The 3rd International Symposium on Environmental Weeds & Invasive Plants (Intractable Weeds and Plant Invaders) will be held in Ascona, Switzerland on 2–7 October 2011.

Further information:
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BIOLIEF 2011

BIOLIEF 2011, the 2nd World Conference on Biological Invasions and Ecosystem Functioning will be held in Mar del Plata, Argentina, on 21–24 November 2011. This will be a forum for the presentation, discussion and synthesis of research on biological invasions in its broadest sense, with emphasis on studies concerning the impact of invasive species on ecosystem functioning and/or services, irrespective of taxonomic groups or ecosystem types. Studies on other ecological aspects of biological invasions will be welcome. Topics such as the spread of invasive species into ecosystems, the biogeography and history of species introductions, and the community- or species-level impact of biological invasions will have significant coverage.

Further information:
Web: www.grieta.org.ar/biolief