OBCL Newsletter

November 2016
Issue 1

Overseas Biological Control Laboratories
U.S.D.A, Agricultural Research Service

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In This Issue

Introduction

Welcome to the first issue of the OBCL Newsletter. OBCL is a group of overseas laboratories that support the domestic research carried out by ARS with the aim of "finding solutions to agricultural problems that affect Americans every day from field to table".

The **Australian Biological Control Laboratory (ABCL)** is based in Brisbane, Australia. The facility is run through a Specific Cooperative Agreement between USDA-ARS and Australia's Federal research body, CSIRO. This has been a long term relationship originating in 1985. Contact: Matthew Purcell, matthew.purcell@csiro.au .

The **European Biological Control Laboratory (EBCL)** is based in Montpellier, France, and has a satellite laboratory in Thessaloniki, Greece. It has a permanent staff of 1 American and 7 foreign scientists, 8 technicians and 5 administration/ support. Contact: Lincoln Smith, Link.Smith@ars.usda.gov .

The Foundation for the Study of Invasive Species (FuEDEI) is based in Hurlingham, Argentina and is operated as a nonprofit research organization. Contact: Guillermo Cabrera Walsh, gcabrera@fuedei.org .

The Sino-American Biocontrol Laboratory (SABL) is based in Beijing, China. Contact: Liu Chenxi, liuchenxi@caas.cn .

Australian Biological Control Laboratory -ABCL

Staff Changes at ABCL

by Matthew Purcell, Raghu Sathyamurthy

ABCL is embedded with the CSIRO Biocontrol Team, and staff are shared across biological control projects. Recently there was an injection of funding into weed biological control research in Australia through an AUD 6.2 million grant to the Rural Industries Research and Development Corporation (RIRDC) to find new ways of controlling weeds that impact agricultural profitability. Significant amounts of these funds have been directed to CSIRO for biological control research.

With additional financial support from ABCL, four new staff have been recruited in Brisbane. Michelle Rafter (research scientist), Kumaran Nagalingam (postdoc), Christine Goosem and Tim Vance (technical officers) will join long term staff members Matthew Purcell (Director of ABCL), Raghu Sathya-murthy, Jeff Makinson, Ryan Zonneveld, Brad Brown, Gio Fichera, Andy White and Nadia Querengasser who currently make up the weed biocontrol team in Brisbane.

New staff at ABCL: Kumaran Nagalingam, Tim Vance, Michelle Rafter and Christine Goosem.

This is a significant increase in research capacity which will bolster the ability of ABCL to conduct exploration for weed targets and evaluation of biological control agents in Australia, Asia and the Pacific for use in the United States.

Currently ABCL targets include the climbing fern, *Lygodium microphyllum*, downy rose myrtle, *Rhodomyrtus tomentosa*, hydrilla, *Hydrilla verticillata*, ear leaf Acacia, *Acacia auriculiformis*, melaleuca, *Melaleuca quinquenervia*, Australian Pine, *Casuarina* spp. and Chinese tallow, *Triadica sebiferum*. The CSIRO Biocontrol Team targets include sowthistle, *Sonchus oleraceus* and four other agricultural weeds.

Stem-borers for Old World Climbing Fern

by Matthew Purcell, Jeff Makinson, Ryan Zonnveld, Bradley Brown

Old World climbing fern (*Lygodium microphyllum*) is native to tropical regions of Africa, Australia, Asia and the Pacific and is arguably Florida's worst weed. The perennial fern climbs vegetation and chokes out tree islands and cypress domes in wetland systems that comprise the Greater Everglades Region.

To date, three biological control agents including an Eriophyidae mite and two defoliating Musotiminae moths, have been introduced into Florida but only the mite, *Floracarus perrepae*, and the moth *Neomusotima conspurcatalis*, have established in Florida, but better control and more agents are required. Four stem-boring Musotiminae moth species occur throughout the native range in Australia and Asia but these have proven difficult to rear and colonize.

ABCL is currently focusing on an undescribed species found in a very restricted region on the Cape York Peninsula in far north Queensland, Australia. This is a remote area only accessible by four wheel drive outside the monsoon season. The larva of the moth are very destructive especially when they penetrate the stem above the rhizome, killing the plant above the point of entry. One larvae can inflict more damage than hundreds of defoliating moth larvae. Being an Australian native species, this moth can be evaluated outside of the restrictions of quarantine which isn't currently possible for the borers found elsewhere in Asia. A similar species in the Genus *Siamusotima* has been collected and shipped from Hong Kong by ABCL staff directly to the USDA ARS Invasive Plant Research Laboratory in Fort Lauderdale, Florida, for further evaluation.

An undescribed species of stem-borer attack-ing the climbing fern, *Lygodium microphyllum*, on Cape York, Queensland, Australia.

The origins of monoecious hydrilla introductions

by Matthew Purcell

Hydrilla, *Hydrilla verticillata*, is a serious invasive alien aquatic weed across the US which includes two genetically distinct biotypes: monecious and dioecious. Several agents have been released but only a leaf mining fly, *Hydrellia pakistanae*, established, and it has minimal impact on hydrilla, particularly the dioecious biotype. This insect has less impact on monoecious hydrilla, possibly due to the inability of this insect to overwinter on this biotype which thrives in cooler climates. Monoecious hydrilla is

spreading north in the US and has the potential to invade the Great Lakes.

The geographic origin of the monoecious biotype introduced to the US was thought to be Korea. ABCL staff in conjunction with staff at the US Army Corps of Engineers ERDC have surveyed hydrilla in the Republic of Korea (ROK) and northern China since 2013, and several sites have been located in both countries which contain the US monoecious biotype. ABCL has been collaborating with the Chinese Academy of Sciences and Henan University in China, as well as Korea University in ROK to survey these sites for herbivores that could be used as biological control agents of monoecious hydrilla in the USA. It is possible that *Hydrellia* flies adapted to the US monoecious biotype have greater potential to control it, which should be evaluated.

Dr Hong and Dr Mo from Korea University surveying hydrilla in the Republic of Korea with Nathan Harms of the US Army Corps of Engineers. ERDC.

European Biological Control Laboratory - EBCL

Staff Changes at EBCL

by Lincoln Smith

In 2016 EBCL hired a new Quarantine Officer/Research Entomologist, Gaylord Desurmont. He has a strong background in chemical ecology and has begun working on studies of host searching behavior of a psyllid (*Arytinnis hakani*) that attacks French broom (*Genista monspessulana*). He is also analyzing the relationship between host specificity of a weevil (*Ceutorhynchus assimilis*), volatile odors of target (hoary cress [*Lepidium draba*]) and nontarget host plants, and their taxonomic phylogeny, in collaboration with CABI and Neuchatel University. Gaylord has also been collecting biological control agents of the olive psyllid (*Euphyllura olivina*) and giant reed (*Arundo donax*) to send to U.S. cooperators.

A new permanent technician (Michail Miaoulis) was hired to assist Alexandra Chaskopoulou in Thessaloniki, Greece, who conducts research on integrated management of mosquitoes and sandflies. A new permanent technician (Ludovic Maanagardoo) was hired to assist Mélanie Tannières, who conducts microbiological research at EBCL in France.

Temporary scientists working at EBCL during 2016 include:

- Brian G. Rector (USDA-ARS, Rector, Reno, Nevada), conducting foreign exploration for eriophyid mites attacking medusahead, cheat grass, and red brome.
- Dorothy Maquire (postdoc at Boise State U., Idaho), working on habitat niche modeling of Ventenata grass.
- Floriane Chardonnet (EBCL, France), working on biology and rearing of *Psyttalia ponerophaga* for biological control of olive fly.
- Francesca Marini (BBCA, Italy), studying biology and rearing of *Psyttalia lounsburyi* for biological control of olive fly.
- Ioannis Giantsis (American Farm School, Greece), working on molecular genetics of mosquitoes and sandflies.
- Matthew Augé (BBCA, Italy), working on biological control of leafy spurge.
- Steve Novak (Professor, Boise State U.), working on genetics of Ventenata, Medusahead and cheatgrass
- Vincent Lesieur (SupAgro, France), working on molecular genetics of wheat stem sawfly and whitetop root weevil, a prospective agent of hoary cress.

Bagrada bug egg parasitoids

by Lincoln Smith, Marie-Claude Bon, René Sforza

Bagrada bug (*Bagrada hilaris*) first appeared in California in 2008 and is spreading across the southern U.S. and Mexico. It attacks many crop species, but is especially damaging to cole crops (broccoli, cabbage, mustards, etc.). The native range is considered to include South Africa, eastern Africa, and the Indian subcontinent.

Genetic analysis conducted at EBCL indicates that individuals from North America are most closely related to those from Pakistan. Bagrada bugs from South Africa are more distantly related.

Cooperators at CABI-Pakistan collected two species of parasitoids that attacked Bagrada bug eggs exposed in the field and shipped them to EBCL to establish colonies inside our quarantine laboratory. The species have been tentatively identified as *Trissolcus hyalinipennis* and *Gryon* nr. *gonikopalense* (Playgastridae) by Elijah Talamas (USDA-ARS-SEL). We found that both species of parasitoids successfully parasitize and complete development on fresh Bagrada bug eggs originating from California and South Africa. These preliminary results indicate that both these parasitoid species have the potential to attack Bagrada bug from the USA, and thus warrant further study of their host specificity and potential to control the pest under natural conditions. Both parasitoid species have been sent to ARS cooperators in Stoneville, MS (W. Jones) and Albany, CA (B. Hogg) to conduct host specificity tests. We plan to continue exploration for potential biological control agents in Africa and Pakistan.

CABI staff collecting parasitized eggs of Bagrada bug in Pakistan.

Olive fruit fly biological control

by Lincoln Smith and Marie-Claude Bon

The olive fruit fly (*Bactrocera oleae*) is an alien species that first appeared in California in 1998. It directly damages olive fruit, causing major losses in coastal areas, especially for organic producers. EBCL previously collected several species of parasitoids, of which two have been permitted for release in the U.S. During the past four years EBCL has mass-reared the parasitic wasp *Psyttalia lounsburyi* and shipped them to collaborators in California for field release to help control the olive fruit fly. The wasp cannot be mass-reared in California because the host insect is not available all year and the factitious host, medfly, used in mass-rearing is prohibited in California. During the past year EBCL mass-reared 206,000 wasps and shipped them to collaborators in California (CDFA, U.C. Berkeley) for field release. This biological control agent is now becoming widely established and is beginning to attack the target pest at high rates.

Arnaud Blanchet mass rearing the olvie fruit fly parasitoid, Psyttalia lounsburyi, for release in California.

Visiting ARS scientist - Biological control of grasses

by Brian Rector and Lincoln Smith

EBCL is testing a new strategy to facilitate short-term overseas research by ARS scientists. This year we supported travel and living expenses for an entomologist (B.G. Rector, Reno, NV) to conduct foreign exploration for

eriophyid mites attacking invasive grasses (medusahead, cheat grass, red brome). Dr. Rector spent six months in Europe, travelled to nine countries, and successfully found mites on medusahead and cheat grass. He also collaborated with acarologists in Italy, Bulgaria, Serbia and Poland, to work on genetic and morphological characterization of the mites, some of which are believed to be undescribed species, and to develop methods to rear them in the laboratory. Eriophyid mites are often highly host specific, and these species will be interesting to evaluate as prospective biological control agents.

Origin of wheat stem sawfly

by Marie-Claude Bon

Wheat stem sawfly (*Cephus cinctus*) is an important pest of wheat in the Northern Plains, causing stems to break before the grain can be harvested. It has long been suspected that this species was introduced from Asia, which is critical to know in order to direct where to search for prospective biological control agents. Molecular genetic techniques (sequencing CO1 and 16S, and microsatellites) were used to determine that North American wheat stem sawflies are distantly related to species found in Asia, and thus are not an invasive alien species. Furthermore, results suggest that recent outbreaks in Colorado are caused by local adaptation of the pest, and that there are three genetically distinct clusters of populations of the pest in the USA. These clusters may respond differently to control tactics, which should be studied. Biological control efforts should focus on the conservation, and possibly augmentation, of indigenous biological control agents rather than exploration for agents in Asia.

Giant reed

by Javid Kashefi, Gaylord Desurmont and Lincoln Smith

Giant reed (*Arundo donax*) has invaded waterways and riparian habitats in many parts of the semiarid west, obstructing water flow, reducing biodiversity, and interfering with security along the Mexican border. The invasive population originated from the western Mediterranean.

EBCL has supported exploration and evaluation of the host specificity of insects to biologically control this weed. During the past year, we collected thousands of natural enemies (the scale insect [*Rizaspidiotus donacis*] and the leafmining midge [*Cryptonevra*] sp.) in Spain, Italy and Crete and shipped them to collaborators in Texas (ARS, Edinburg, TX) for field release and laboratory studies, respectively. The scale and a previously released gall wasp (*Tetramesa romana*) are reportedly beginning to reduce the impact of this weed in the Rio Grande valley.

Arundo armored scale (*R. donacis*), **left**, attacks the base of the plant, and the leaf-mining fly (*Cryptonevra* sp.), **right**, damages stem tips.

French broom

by René Sforza

French broom (*Genista monspessulana*) is an invasive shrub in the Pacific Western U.S. EBCL, in conjunction with CSIRO-Europe, is studying the life history traits and host specificity of a weevil, *Lepidapion argentatum*, which is native to Southwestern Europe. The weevil reproduces by either feeding on developing seeds or by galling branch stems. Adult weevils from emerging pods are in reproductive diapause (univoltine), whereas those from stem galls can reproduce immediately (multivoltine). This weevil is currently undergoing host specificity testing on brooms, lupines and other close relatives. Live weevils were shipped to an ARS

cooperator in California (P.J. Moran, USDA-ARS, Albany, CA) to study diapausing behavior and evaluate specificity on other endemic Californian lupines.

Grassmapper website

by René Sforza and Dorothy Maguire

Invasive alien grasses can reduce forage and biodiversity of rangelands, but they are not easy to identify, and mapping information is needed to help guide management decisions. Scientists at EBCL, Boise State University in Idaho, and the Biotechnology and Biological Control Agency in Rome, Italy have created a new website, www.grassmapper.org. The site provides basic biological information of three invasive grass species (ventenata, medusahead, and cheatgrass). An interactive map of the occurrence of ventenata grass is available, and will soon be accompanied by the other two species. The site was developed to aid scientists, land managers, and especially the general public to identify, and report the presence of these invasive grass species.

Identification of mosquitoes and sandflies

by Alexandra Chaskopoulou and Ioannis Giantsis

Mosquitoes and sandflies are important pests and vectors of disease of humans and domestic animals, but it is extremely difficult to identify species of adults and often impossible for larvae. Scientists at the EBCL Laboratory in Thessaloniki Greece developed a new technique, called Mild-Vectolysis, which permits extracting DNA from mosquito or sandfly specimens without damaging their external morphological characters. DNA barcoding (CO1) correctly identified all three mosquito and six sandfly species analyzed. This provides a relatively fast and cheap method to identify specimens that can be retained for morphological study or preserved as museum vouchers. This technique will be useful to researchers and pest managers who need to know what species they are targeting so that they can use appropriate techniques and strategies to manage them.

Foundation for the Study of Invasive Species - FuEDEI

Invasive ants

by Luis Calcaterra, Nadia Jiménez, Andrés Sánchez Restrepo

The behavior of ants that become invaders can be better understood by comparing ecological dominance among ants in both native and introduced communities. Several prominent invasive ant species occur naturally in Argentina, such as black imported fire ant *Solenopsis richteri* and Argentine ant *Linepithema humile*. These two species are ecologically co-dominant in northeastern Buenos Aires, with *S. richteri* being numerically the most abundant ant and *L. humile* being the best at recruiting to new food sources. However, these ants co-exist with many other species of ants, including several that are also invasive. Competition may not be the primary factor in structuring these communities, reducing the impact of species with high competitive abilities.

Little fire ants (LFA, *Wasmannia auropunctata***)**. Life history and biology of the LFA within its native range showed that it was widespread at the southernmost limit of its native distribution mainly in anthropic habitats. The social organization was mainly supercolonial in all habitat types. The reproductive system was mainly clonal in anthropic habitats, mixed in partially disturbed sites and floodplains, and sexual in natural sites. LFA had a lower competitive ability than expected, indicating that interspecific competition is not the most important factor associated with its success. Natural expansion to higher latitudes of South America probably preadapted the species to colder and seasonal climates, key to its establishment in the Mediterranean region.

Leaf-cutter ants (LCA, *Atta* and *Acromyrmex* spp.**)**. LCA are one of the most important pests in the Neotropics, from Argentina to southern US (Texas and Louisiana). LCA species are being surveyed in vineyards and willow forestations in Argentina to understand the phylogenetic relationships and phylogeographic history of

the most detrimental species in relation to their geographical distribution. Additionally, nest density, foraging activity, and diet are being studied in the field in order to estimate the magnitude of their impact on vegetation, especially on cultivated plants.

Imported Fire ants (IFA, *Solenopsis* spp.). The native populations of the South American fire ants often decrease over a period of several years in a pattern consistent with animal disease outbreaks. Interestingly, this pattern of population collapse is not observed in the US, where populations of introduced fire ants rarely or never decline. The lack of natural enemies, such as pathogens, in the introduced area is the most likely cause of this pattern. The objective of this project is to find additional pathogens of fire ants using a method of etiologic exploration.

Susceptibility to ionizing radiation of queens of the red fire ant *Solenopsis invicta* was studied to determine a dose that prevents reproduction. Results are consistent with previous findings for three other invasive ants that are hitchhiker pests on fresh horticultural commodities. A radiation dose of 150 Gy (also used for control tephritid fruit flies) is proposed as a phytosanitary treatment to prevent reproduction in ants.

Tawny Crazy Ant (TCA, *Nylanderia fulva*). Little is known about the geographical distribution of the source population introduced in the US. Consequently, we cannot be predict the potential area of expansion in regions where this pest ant has been or could be introduced in the future. We believe that the invasion may have originated from the Rio Paraná basin. Thus, studies will be mostly initiated in that region.

Brazilian pepper tree

by Fernando Mc Kay

Testing prospective biocontrol agents and searching for new ones in Argentina and Brazil continues to be our top priorities for the Brazilian pepper (BP, *Schinus terebinthifolius*) project. Recent surveys revealed the presence of cryptic species among the leaf feeding moth, *Paectes* sp. (Lepidoptera: Euteliidae). Preliminary results of male and female genitalia dissections of *Paectes* specimens indicate that there are new *Paectes* species in Argentina that deserve further host specificity evaluation (Figure 1). The defoliating sawfly, *Heteroperreyia hubrichi* (Hymenoptera: Pergidae) (Figure 2), has been intensively studied as a prospective biocontrol agent for BP. However, possible toxicity of the larvae to nontarget predators has delayed issuing a permit for this species. Thus, additional toxicity studies are underway to determine the existence of toxic peptides in this species, and to estimate the realistic magnitude of the hazard.

Recent Publications by EBCL

Augé, M., Bon, M-C., Hardion, L., Le Bourgeois, T., Sforza, R.F.H. 2016. G**enetic characterization of a red color morph of *Euphorbia esula* subsp. *esula* (Euphorbiaceae) in the floodplains of Saône (Eastern France).** Botany. 10.1139/cjb-2016-0067.

Bon, M., Hoelmer, K.A., Pickett, C.H., Kirk, A., He, Y., Mahmood, R., Daane, K.M. 2015. **Populations of *Bactrocera oleae* (Diptera: Tephritidae) and its parasitoids in Himalayan Asia.** Annals of the Entomological Society of America. 109:81-91. doi: 10.1093/aesa/sav114.

Brabbs, T., Collins, D., Herard, F., Maspero, M., Eyre, D. 2015. **Prospects for the use of biological control agents against *Anoplophora* in Europe.** Pest Management Science. 71:7-14.

Cameron, M., Acosta-Serrano, A., Bern, C., Boelaert, M., Den Boer, M., Chapman, L., Chaskopoulou, A., Coleman, M., Croft, S., Courtney, O. et al. 2016. **Understanding the transmission dynamics of Leishmania donovani to provide robust evidence for interventions to eliminate visceral leishmaniasis in Bihar, India.** Parasites & Vectors. 9:25 DOI: 10.1186/s13071-016-1309-8.

Chaskopoulou A., Giantisi I.A., Demir S., Bon M.C. 2016. **Species composition, activity patterns and blood meal analysis of sand fly populations (Diptera: Psychodidae) in the metropolitan region of Thessaloniki, an endemic focus of canine leishmaniasis.** Acta Tropica. 158:170-176.

De Biase, A., Colonelli, E., Belvedere, S., La Marca, A., Cristofaro, M., Smith, L. 2016. **Genetic and morphological studies of *Trichosirocalus* species introduced to North America, Australia and New Zealand for the biological control of thistles.** Bulletin of Entomological Research. 106(1): 99-113. doi:10.1017/S000748531500084X.

Deletre, E., Schatz, B., Bourguet, D., Chandre, F., Williams Iii, L.H., Ratnadass, A., Martin, T. 2016. **Prospects for repellent in pest control: current developments and future challenges.** Chemoecology. 26:1-16.

Giantsis I.A., Chaskopoulou A., Bon M.C. 2016. **Mild-Vectolysis: A Nondestructive DNA Extraction Method for Vouchering Sand Flies and Mosquitoes.** Journal of Medical Entomology. 53(3):692-695.

Hongsheng, P., Yanhui, L., Chunli, X., Huihui, G., Xiaoming, C., Xiaoling, S., Yongjun, Z., Williams, L., Wyckhuys, K.A., Kongming, W. 2015. **Volatile fragrances associated with flowers mediate the host plant alternation of a polyphagous mirid bug.** Scientific Reports. 14805; doi: 10.1038/srep14805.

Jacquet S., Garros C., ... Chaskopoulou A., ... et al. 2015. **Colonization of the Mediterranean basin by the vector biting midge species *Culicoides imicola*: an old story.** Molecular Ecology. 24(22):5707-5725.

Kim, M-S., Lee, H-L., Ku, D-S., Hérard, F., Gould, J.R., Williams, D.W., Kim, I-K., Hong, K-J. 2016. **Discovery of *Spathius ibarakius* Belokobylskij et Maeto (Hymenoptera: Braconidae) as a larval ectoparasitoid of citrus longhorned beetle in Korea.** Korean J. Appl. Entomol. 55(3): 285-291.

Lesieur, V., Jeanneau, M., Martin, J., Bon, M. 2016. **Development and characterization of 11 microsatellite markers in the root-gall-forming weevil, *Ceutorhynchus assimilis* (Coleoptera: Curculionidae).** Applied Entomology and Zoology. 51:495–500.

Roy, L., Bon, M.C., Cesarini, C., Serin, J. and Bonato, O., 2016. **Pinpointing the level of isolation between two cryptic species sharing the same microhabitat: a case study with a scarabaeid species complex.** Zoologica Scripta 45:(4):407-420.

Saadat, D., Seraj, A., Goldansaz, S., Williams III, L.H. 2016. **Factors affecting reproductive success and life history parameters of *Bracon hebetor* Say (Hymenoptera: Braconidae) from three host-associated populations.** Biological Control. 96: 86-92.

Uludag, A., Gbehounou, G., Kashefi, J., Bouhache, M., Bon, M., Bell, C., Lagopodi, A.L.2016. **Management of *Solanum elaeagnifolium* in the Mediterranean Basin.** European Plant Protection Organization Bulletin. 46:139-147.

Von Virag, A., Bon, M., Closca, C., Diaconu, A., Haye, T., Weiss, R., Muller-Scharer, H.,Hinz, H. 2016. **Phenology and temperature-dependent development of *Ceutorhynchus assimilis*, a potential biological control agent for *Lepidium draba*.** Journal of Applied Entomology. DOI:10.1111/jen.12322.
