Non-Target Effects on Biological Pesicides Transgenic Crops

Workshop paper. Wednesday, 20:00 **199**

The impact of herbicide tolerant crops on non-target organisms

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Tolerance to broad spectrum herbicides is the most worldwide cultivated transgenic trait and millions of hectares have been sown with herbicide tolerant (HT) soybeans, maize, and canola. Among potential effects of this kind of genetically modified (GM) crops on the environment are those on non-target organisms (NTOs). A NTO is any species that is not the direct target of the GM crop and may include non-target plants (particularly in the margins and nearby habitats), plant pathogens, arthropods birds and wildlife, and a diversity of soil organisms. The impact of HT crops on non-target organisms may be exerted through three main mechanisms: (i) the direct effect of the trait introduced into the plant on the NTO, (ii) the effect of the herbicide on the NTO, and (iii) through the food web. While there are no records in the literature of any effect through the first mechanism to our knowledge, and relatively very few through the second one, more effects have been described through trophic relationships mainly originated by the alteration of the abundance, composition and phenology of weed flora. This presentation is mainly focused on this third mechanism and particularly on weed- arthropods relationships as the first trophic interaction that leads to build complex food webs in agroecosystems. According to the experience of Spanish field trials with HT maize, few changes in NTO populations may be expected if modifications of weed flora are not dramatic. Potential benefits derived from the flexibility of timing broad spectrum herbicide sprayings are discussed.

Workshop paper. Wednesday, 20:15 **200**

Your Right to Know What You Eat: On the Occurrence of Viable*Bacillus thuringiensis* in Commercial Food Products

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It is widely recognized in the scientific community that genetically engineered crops are safe for human consumption. Yet serious concerns continue about the safety of these foods, despite consumption of approximately two trillion meals by people over the past decade with no known ill effects. During 2013, for example, new laws were proposed in California and Washington State to label foods containing genetically modified organisms (GMOs), the rationale being that people have a right to know what they eat. Although both laws failed, there is little doubt the public remains concerned about GMO food safety. Unknown to the public and many scientists is that *Bacillus thuringiensis* (Bt), the source of the insecticidal proteins used in insect-tolerant crops such as Bt corn and Bt soybeans, occurs naturally and commonly on many vegetables, grains, and nuts, including products based on these such as flour and flour products (bread, pasta), cereals, soup, salami, candy and puddings. Moreover, and ironically, the only insecticides permitted for use on organic crops are Bts that contain viable spores and the same Cry proteins used in GMO crops. Whether due to natural occurrence or the use of Bt insecticides, these foods can contain hundreds to thousands of viable spore/crystal mixtures per gram or cm^2. In this presentation, I will review the data showing that Bt occurs naturally and commonly in our food supply, and that the diversity of strains and insecticidal proteins which people consume is much greater than those used in commercial Bt insecticides or GMO crops.

Workshop paper. Wednesday, 20:30 **201**

Environmental risk assessment of genetically engineered crops for spiders

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Before genetically engineered (GE) crops can be grown commercially, potential risks to the environment need to be assessed. Environmental risk assessment (ERA) ensures that desired ecological functions (protection goals), such as biological control, pollination, and decomposition are not harmed. We will present the process of non-target ERA for GE plants producing insecticidal proteins derived from *Bacillus thuringiensis* (Bt). Spiders are among the most abundant biological control agents in arable systems and we will use examples from our research to illustrate the different ERA steps.
The populations of species associated to the ecosystem services to be protected represent assessment endpoints for the ERA. Knowledge on the community inhabiting the GE crop grown in a certain region (receiving environment) is combined with knowledge on potential exposure and sensitivity to the insecticidal compound to focus the assessment and to formulate relevant risk hypothesis to be tested. The different risk hypotheses are then addressed in the analysis phase of the ERA following a tiered approach. Early-tier testing is conducted under worst-case exposure conditions in the laboratory. Surrogate test species are selected that are most likely to reveal an adverse effect. More complex and realistic semi-field or field studies supplement the ERA when uncertainty about the level of risk to non-target species remains high after early tier laboratory studies are conducted. We will discuss important criteria to consider when designing non-target studies, which can only inform the ERA if they are reproducible, reliable, and test clearly defined risk hypotheses.

Workshop paper. Wednesday, 20:45 **202**

Conclusions from 10 years of accumulated evidence from publicly funded field trials research with Bt-maize in Germany

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Publicly funded research into the environmental risks of genetically modified plants has been performed in Germany for more than a decade. The Bt-maize events MON810, MON88017 and MON89034 x MON88017 were assessed in field trials. Each of the trials lasted for 3 years and lead to the further refinement of trial designs and assessment methods. The combined results on non-target organism effects show that a) the assessed Bt-maize events do not harm the communities of NTOs typical for maize; b) conventional treatments with

insecticides can have profound negative impacts; c) conventionally bred maize varieties can differ substantially in their impact; d) different management practices have profound impacts on populations on-crop and off-crop. A number of conclusion can be drawn from the assessments: 1. The NTO ERA for Bt-maize should more strongly rely on early tier experiments; 2. Field trials are only sensible if results from earlier tiers show the possibility for negative NTO impacts; 3. A comparative approach to ERA is without alternative, also looking at conventionally bred varieties and alternative management approaches; 4. The methods and trial designs used are able to detect differences in impact of different maize varieties; 5. To fully assess the potential impacts of the cultivation of Bt- and other genetically modified plants a systems approach is needed, that also takes into account the benefits of using these plants; 6. A decision is needed on what we really want to protect and thus need to assess.

THURSDAY - 7 August

SYMPOSIUM 7 (Dis. of Benef.l Inverteb.) Thursday, 8:00-10:00

Emerging Tools for Aquatic Pathogen Discovery and Description

Symposium. Thursday, 8:00. **203**

Early mortality syndrome is an infectious disease with a bacterial etiology

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Beginning in about 2009, a new, emerging disease called "Early Mortality Syndrome or EMS" (more descriptively called Acute Hepatopancreas Necrosis Syndrome or AHPNS) began to cause significant production losses in shrimp farms southern China. By 2010 the range of affected farms in China had expanded, and by 2011 EMS/AHPNS was confirmed in Vietnam and Malaysia, and in Thailand in 2012. EMS/AHPNS disease has caused serious losses in the areas affected by the disease, and it has also caused secondary impacts on employment, social welfare, and international market presence. EMS/AHPNS was first classified as an idiopathic disease because no causative agent had been identified. Preliminary studies conducted in Vietnam in 2012 by the Laboratory of Aquaculture Pathology at the University of Arizona (UAZ-APL) have indicated that EMS/AHPNS is infectious. Since early in 2013, the UAZ-APL was able to isolate and identify the causative agent of EMS/AHPNS in pure culture. In several separate challenge experiments, the same EMS/AHPNS pathology was reproduced consistently in experimental shrimp. In addition, the same identical agent was recovered from the challenged animals and several subsequence challenge tests using the recovered agent could also reproduce EMS/AHPNS pathology with very consistent results. The agent was identified as a unique strain of *Vibrio parahaemolyticus* that is commonly found in marine environment. Hence, EMS/AHPNS has a bacterial causative agent that satisfies Koch's Postulates to be a typical infectious disease. Further studies focusing on the agent of AHPNS revealed that the agent could produce toxin(s) causing the primary pathology in affected shrimp.

Symposium. Thursday, 8:30. **204**

Policy, phylogeny, and the parasite

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Animal diseases gain political attention by their inclusion on lists of global bodies such as those of the World Organisation for Animal Health. Currently, the OIE lists 116 diseases caused by viral, bacterial, fungal, protistan, and metazoan pathogens. Each is afforded a specific chapter in the regularly updated OIE 'Manual of Diagnostic Tests' series. Of these, 30 diseases are caused by eukaryotic (fungal, oomycete, protistan, and metazoan) parasites. Inclusion necessitates national governments to report outbreaks promptly but may lead to trading restrictions between nations in an attempt to limit spread. Detection therefore has consequences that may directly impact from farm to state levels. Here, we consider current approaches to discrimination of listed parasites from related, but unlisted, counterparts. We outline problems with defining 'species', propose the necessary drivers that should be required for discrimination of important taxa, and highlight how this process may be influenced by national policies. Further, we propose a set of 'best practice' measures, broadly based upon current taxonomic philosophies for protists and metazoans that should be applied when defining taxa for listing as notifiable. We will illustrate these principles with topical issues associated with the taxonomy and listing of aquatic invertebrate pathogens.

Symposium. Thursday, 9:00. **205**

The Next Generation of Crustacean Health: Disease Diagnostics Using Modern Transcriptomics

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Commercial crustacean fisheries on the Atlantic coast of Canada represent over $(CAD) 1 billion annually. The American lobster (*Homarus americanus*) fishery alone represents over $(CAD) 600 million with harvests in recent years breaking records for amount of lobster that has been landed. The Canadian and Maine USA lobster populations remain healthy but the once vibrant lobster fisheries in Southern New England USA have been devastated by a mixture of disease, ocean acidification, global warming and anthropogenic stressors. Conventional gross anatomic, microscopic and histological analysis remain the backbone of