Canadian Food Inspection Agency | Agence canadienne d'inspection des aliments

PLANT SCIENCE SCAN

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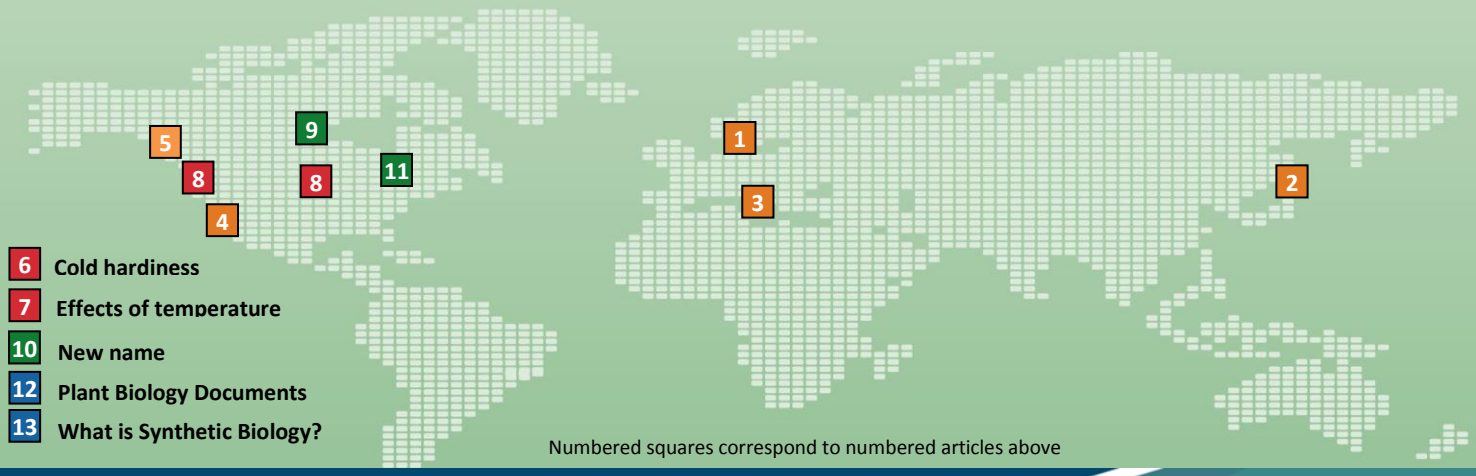
BACKGROUND: The Plant Health Science Division of the Canadian Food Inspection Agency routinely scans external sources to identify information that might be of possible regulatory significance or interest to Canada's national plant health. This Plant Science Scan report was prepared by the Canadian Food Inspection Agency's staff as a mechanism to highlight potential items of interest, raise awareness and share significant new information related to plant health.

Index of Articles



Canada

Pathology

1 Susceptibility of North American species of *Fraxinus* (ash) to *Hymenoscyphus fraxineus* (ash dieback)

The susceptibility of several Asian, European and North American *Fraxinus* species to *Hymenoscyphus fraxineus* (ash dieback) was evaluated in an Arboretum in Horsholm, Denmark. The results demonstrated that North American *Fraxinus* species have overall moderate susceptibility to ash dieback. Among the most common North American species assessed, *F. nigra* (black ash) was found to be highly susceptible to ash dieback. *Fraxinus americana* (white ash) and *F. pennsylvanica* (red ash) exhibited clear disease symptoms, but were considered less susceptible to the pathogen.

The results of this study are in line with previous reports on the susceptibility of North American *Fraxinus* spp. to *H. fraxineus*, however, further analysis of the results suggest that tree susceptibility is correlated with the phylogenetic relationship of the species. The genus *Fraxinus* is divided among six different sections, from which section Fraxinus (e.g. *F. nigra*, *F. excelsior* and *F. angustifolia*), Melioides (e.g. *F. americana* and *F. pennsylvanica*) and Ornus were found to have high, low to medium and low susceptibility to the pathogen, respectively.

Hymenoscyphus fraxineus is an important invasive species that has devastated native ash populations in Europe. Based on this study, the authors emphasized that the introduction of *H. fraxineus* in North America would pose an additional pressure on Fraxinus spp. population already greatly impacted by *Agrilus planipennis* (emerald ash borer). *Hymenoscyphus fraxineus* has been added to Canada's regulated pest list in 2014 (CFIA 2014) and strict phytosanitary requirements are currently in place to mitigate the risk of introducing this pathogen to Canada.

SOURCES: Canadian Food Inspection Agency. (2014) RMD-13-08: Pest risk management document – Hymenoscyphus fraxineus (ash dieback pathogen). [Online] Available: http://www.inspection.gc.ca/plants/plant-pests-invasive-species/directives/risk-management/rmd-13-08/eng/1415974481233/1415974483905#a8.0

Nielsen, L. R., McKinney, L. V., Hietala, A. M. and Kjær, E. D. (2017) The susceptibility of Asian, European and North American Fraxinus species to the ash dieback pathogen Hymenoscyphus fraxineus reflects their phylogenetic history. European Journal of Forest Research 136(1):59-73.

2 First report of *Hymenoscyphus fraxineus* on healthy, asymptomatic Manchurian ash trees (*Fraxinus mandshurica*) in its native environment

Ash dieback, caused by the ascomycete *Hymenoscyphus fraxineus*, is a devastating tree disease in Europe. Two ash species, *Fraxinus excelsior* (European ash) and *F. angustifolia* (narrow-leafed ash) were observed to be highly susceptible to *H. fraxineus*. Manchurian ash (*Fraxinus mandshurica*), native to Southeast Asia and planted as an ornamental tree in areas of Europe highly infested with *H. fraxineus*, demonstrated tolerance to the fungus, suffering only minimal damage in comparison to European and North American ash species. *Hymenoscyphus fraxineus* has also been reported on rotten blackened rachis and petioles of Manchurian ash in Japan, north-eastern China and Korea but disease symptoms were not observed on

living trees. These observations led to speculations that the pathogen was introduced into Europe from East Asia, where it occurs on Manchurian ash without causing any symptoms. In a recent study, *H. fraxineus* was investigated on Manchurian ash trees in its native range in Primorye region of Far East Russia. This pathogen was identified, for the first time, on healthy, asymptomatic leaves of Manchurian ash trees within its natural distribution range. This study confirmed that *H. fraxineus* is hemi-biotrophic and causes symptomless infections on Manchurian ash and provided a new example that organisms with harmless endophytic or symbiotic relationships with their co-evolved hosts may behave as severe pathogens in contact with evolutionary naïve hosts in introduced areas. It is near impossible to predict the invasiveness of these species in a new environment.

SOURCE: Cleary, M., Nguyen, D., Marčiulynienė, D., Berlin, A., Vasaitis, R. and Stenlid, J. (2016) Friend or foe? Biological and ecological traits of the European ash dieback pathogen Hymenoscyphus fraxineus in its native environment. Scientific reports 6:21895.

3 First report of *Hymenoscyphus fraxineus* in Montenegro and Serbia

In Montenegro, dieback symptoms were noticed on 4-6 year old ash trees (*Fraxinus excelsior*) naturally regenerating in a riparian area around Lake Biograd in August 2016. Morphological analysis of samples randomly collected from 20 symptomatic trees confirmed that the causal agent of the disease was the fungus *Hymenoscyphus fraxineus* (teleomorph: *Chalara fraxinea*). In Serbia, symptoms of ash dieback were observed for the first time in September 2015 during a survey carried out on approximately 100 ash trees (*F. angustifolia* and *F. excelsior*) growing in natural forests at Debelo Brdo, Molovin and Tara. Morphological and molecular analyses confirmed the presence of H. fraxineus. These are the first reports of *H. fraxineus* in Montenegro and Serbia and the new findings expand on the known distribution of this pathogen in Europe.

Hymenoscyphus fraxineus has been reported in Asia and Europe but it is not known to occur in North America; it is a regulated pest for Canada.

SOURCES: Keča, N., Kirisits, T. and Menkis, A. (2017) First Report of the Invasive Ash Dieback Pathogen Hymenoscyphus fraxineus on Fraxinus excelsior and F. angustifolia in Serbia. Baltic Forestry 23(1):56-59.

Milenković, I., Jung, T., Stanivuković, Z. and Karadžić, D. (2017) First report of Hymenoscyphus fraxineus on Fraxinus excelsior in Montenegro. Forest Pathology.

4 Identification of *Spissistilus festinus* as a vector of grapevine red blotch-associated virus

Potential vectors of the recently identified grapevine red blotch-associated virus (GRBaV) were investigated in California based on previous report of its spread to wild grapes (Bahder et al. 2016; Cieniewicz et al. 2017). Among many candidates, the treehopper, *Spissistilus festinus*, was determined to successfully transmit GRBaV under laboratory conditions with some evidence for field transmission. Although *S. festinus* is known to be present in New York and Washington, spread of GRBaV within vineyards in those states has not been observed. The low incidence of the treehopper may explain the lack of spread in these areas.

GRBaV was detected in Ontario in 2013 and more recently in British Columbia (B.C.). In Canada, *S. festinus* is known to occur in B.C. only and it remains unclear if it could have a role in disease spread (Maw and Canada

2000). GRBaV is currently not considered a quarantine pest to Canada.

SOURCES: Bahder, B. W., Zalom, F. G., Jayanth, M. and Sudarshana, M. R. 2016. Phylogeny of Geminivirus Coat Protein Sequences and Digital PCR Aid in Identifying Spissistilus festinus as a Vector of Grapevine red blotch-associated virus. Phytopathology 106(10):1223-1230.

Cieniewicz, E. J., Pethybridge, S. J., Gorny, A., Madden, L. V., McLane, H., Perry, K. L. and Fuchs, M. 2017. Spatiotemporal spread of grapevine red blotch-associated virus in a California vineyard. Virus Research.

Maw, H. E. L. and Canada, N. R. C. 2000. Checklist of the Hemiptera of Canada and Alaska. NRC Research Press.

5 Detection of grapevine red blotch-associated virus in British Columbia

A survey for grapevine red blotch-associated virus (GRBaV) in grape-growing areas of British Columbia (B.C.) was undertaken in the summers of 2014 and 2015. Out of 2000 composite samples (10 000 vines), 32 samples (1.6%) were found to be positive for GRBaV. Based on this study and current knowledge, it was determined that the virus was likely introduced between 2011 and 2014. Sequence comparisons between B.C .and Ontario isolates suggest that the infection may have originated from a single source.

GRBaV was first isolated in North America and has been found to occur in Ontario and in several states in the United States. This report confirms the presence of GRBaV at low levels in vineyards in B.C.

SOURCE: Poojari, S., Lowery, D. T., Rott, M., Schmidt, A. M. and Úrbez-Torres, J. R. (2017) Incidence, distribution and genetic diversity of Grapevine red blotch virus in British Columbia. Canadian Journal of Plant Pathology:1-11.

Entomology

6 Effect of three species of host tree on the cold hardiness of overwintering larvae of *Anoplophora glabripennis* (Coleoptera: Cerambycidae)

The Asian longhorned beetle (ALHB), *Anoplophora glabripennis* (Coleoptera: Cerambycidae), is a destructive pest of forests that can attack many different host tree species. It is primarily found in China but has been introduced and is under eradication in a small area of Canada (Mississauga/Toronto), and parts of the United States and Europe. Currently, *A*. *glabripennis* has been recorded feeding on 18 plant genera, with the main host trees being *Salix matsudana*, *Populus opera* and *Populus tomentosa*. Larvae of this beetle usually overwinter inside the trunk of their hosts, however, little is known about the effect that different host plants may have on the ability to overwinter. In order to investigate this, the authors of this study compared the cold hardiness of *A*. *glabripennis* larvae that fed and overwintered on *S*. *matsudana*, *P. opera* and *P*. *tomentosa*. Cold hardiness was evaluated by measuring the supercooling point (SCP), fresh mass, protein content, and concentrations of low molecular weight substances. It was found that the species of host tree had a significant effect on the SCPs and protein contents of the overwintering larvae. Larvae collected from *S*. *matsudana* had the lowest SCPs, differing significantly from larvae of *P*. *opera*, which had the highest SCPs recorded. The protein contents of the larvae collected from *P. opera* and *P*.

tomentosa were significantly higher than those collected from *S*. *matsudana*. The results from this study show that the overwintering larvae of *A*. *glabripennis* that fed on *S*. *matsudana* have a higher supercooling capability than those that fed on *P*. *opera* and *P*. *tomentosa*, which suggests that the cold hardiness of these larvae is greatly affected by the host tree species they develop in.

Anoplophora glabripennis is a regulated quarantine pest for Canada as it poses a significant risk to Canadian trees. Since Canada is a country with a cold climate, this research could help us predict the survival of this beetle in different host trees. This in turn could impact the CFIA eradication programs and detection surveys for ALHB.

SOURCE: Feng, Y., Tursun, R., Xu, Z., Ouyang, F. and Zong, S. (2016) Effect of three species of host tree on the cold hardiness of overwintering larvae of Anoplophora glabripennis (Coleoptera: Cerambycidae). European Journal of Entomology 113:212-216.

7 Effects of Temperature on Development of *Lymantria dispar asiatica* and *Lymantria dispar japonica* (Lepidoptera: Erebidae)

The name Asian gypsy moth (AGM) designates a complex of closely-related *Lymantria* species (*L. dispar asiatica, L.dispar japonica, L. umbrosa, L. albescens* and *L. postalba*) which are currently regulated by the CFIA. Populations of AGM have not yet been established in North America, however periodic introductions have been threatening forests and interrupting foreign trade. While AGM is similar morphologically to the European gypsy moth (EGM: *L. d. dispar*), a species that is already established in eastern North America, members of the complex possess several traits that increase their potential threat, in particular the flight capability of females as well as a broader reported host range which includes more coniferous species.

While studies on the effects of temperature on this species exist, none have been conducted on the Asian subspecies. To gain a better understanding on the biological tolerances of AGM, Limbu et al. (2017) evaluated the effect of a range of temperatures (10°C, 15°C, 20°C, 25°C, 30°C) on the development, survivorship and fertility of eight populations of AGM subspecies (*L. d. asiatica* and *L. d japonica*) distributed across Russia, China and Korea.

Results indicated that temperature had a significant effect on the life history and development of the two AGM subspecies. Based on modelling of the results, the lower and upper temperature thresholds were predicted to be 7-9°C and 30-31°C, respectively. The developmental rate for most populations increased with temperature from 10°C to 25°C, and declined at 30°C. Survival to adulthood was found to decline at 15°C and 30°C, while there were no significant difference in the mean proportion of survivors to adulthood within a population at 20°C and 25°C. At 30°C, it was observed that fitness and fertility were negatively affected, and female AGM had reduced pupal and adult weights at 15°C and 30°C compared with those reared at 20°C and 25°C.

Studies on biological tolerances and epidemiological traits of invasive species provide useful information for pest managers as they conduct risk assessments and develop effective management and monitoring strategies. A collaborative research project, co-led by the CFIA, UBC and Université Laval, is taking full advantage of the increase in genome sequencing capacity to develop molecular

methods capable of accurately distinguishing between AGM subspecies and identifying invasive traits, such as flight capability. The four-year project was awarded through Genome Canada's 2015 Large-Scale Applied Research Project Competition, *Natural Resources and the Environment: Sector Challenges – Genomic Solutions* with co-funding from Genome BC, Genome Quebec, CFIA, Natural Resources Canada and FPInnovations. The project is also receiving support from collaborators at McGill University and the University of Victoria.

The following news release provides additional information on the BioSAFE project: https://www.genomebc.ca/news-events/news-releases/2017-news-releases/combatting-invasive-alien-species-groundbreaking-research-taking-charge-intrusive-pests-and-pathogens/

SOURCE: Limbu, S., Keena, M., Chen, F., Cook, G., Nadel, H. & Hoover, K. (2017) Effects of temperature on development of Lymantria dispar asiatica and Lymantria dispar japonica (Lepidoptera: Erebidae). 1-12.

8 Predicting costs of alien species surveillance across varying transportation networks

The gypsy moth is a regulated species for Canada: both the European and Asian forms. In particular, the Asian form (*Lymantria dispar asiatica*) is a threat because the females are capable of flight, conifers are suitable hosts, and natural spread is therefore expected to be swift. To efficiently find outbreaks of either form requires well-directed surveys. The cost of these surveys can be high, and minimising these costs is a goal of every survey effort. This research indicated that road density has a negligible effect on surveillance costs – high density roads tend to be urban roads with lower speed limits -- and suggests that total surveillance costs can be realistically estimated based solely on the survey point density. Equations are given to do so. While road density may not have a strong effect on surveillance costs, it may still be strongly associated with the probability of an alien species colonizing an area; alien species, including the gypsy moth, are more likely to arrive in densely populated areas. Such an association may still drive optimal surveillance activities to be concentrated in urban environments even though trapping costs may not be significantly lower in these areas. The results also suggest that mapping the survey route using Travelling Salesman Problem solutions will likely not find the optimal route if there are more than 10 stops.

The authors state that their model provides a means for estimating the cost of broad-scale surveillance and can be applied to a wide range of biological monitoring programmes. In the case of invasive species, when combined with a species landscape establishment model, these predictions will optimize efficiency of detection and eradication efforts.

SOURCE: Blackburn, L., Epanchin-Niell, R., Thompson, A. and Liebhold, A. (2017) Predicting costs of alien species surveillance across varying transportation networks. Journal of Applied Ecology 54(1):225-233

Botany

9 First report of waterhemp in Manitoba

Waterhemp (*Amaranthus tuberculatus* (Moq.) J.D. Sauer (= *A. rudis* J.D. Sauer)), a troublesome weed for soybean growers in the

Midwest U.S., was recently reported in Manitoba. The weed was found last fall in a soybean field southeast of Winnipeg, more than 70 km from the U.S. border. This was the first report of waterhemp from western Canada. Waterhemp occurs in neighbouring states and provinces, including Ontario (since 2002), Minnesota, and North Dakota where it has been spreading northwards. It is a significant problem in the U.S., where populations exhibit resistance to multiple herbicides. Seed from one of the plants found in Manitoba has been sent for resistance testing. Waterhemp is not regulated as a pest under Canada's Plant Protection Act but is a Class 2 Primary Noxious Weed Seed on the Weed Seeds Order (Seeds Act). Its appearance in western Canada is a concern for soybean producers, and an example of the growing problem of herbicide resistant weeds.

SOURCES: Arnason, R. (2017) Waterhemp found in Manitoba. The Western Producer. [Online] Available: http://www.producer.com/2017/01/waterhemp-found-in-manitoba/

Gaultier, J. (2017) Waterhemp now a Manitoba weed. Crop Chatter Manitoba. [Online] Available: http://cropchatter.com/waterhemp-now-a-manitoba-weed/

10 New name for leafy spurge

A new taxonomic treatment of leafy spurge indicates that the widespread, troublesome weed in North America is actually *Euphorbia virgata* Waldst. & Kit., not *Euphorbia esula* L. as previously believed. Volume 12 of the Flora of North America released in early 2017 states that the two species are distinct, though closely related, and that most North American records of leafy spurge are *E. virgata*, previously misidentified as *E. esula*. Both species are part of a taxonomically complex group native to Eurasia, and there has been much confusion about the naming of the species established in the New World. *E. esula* is now recognized as a more restricted and less weedy European species only present as a waif in North America and excluded from the flora because it is not persistent. Most major taxonomic databases have been updated accordingly (e.g., GRIN, https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysimple.aspx ; VASCAN, http://data.canadensys.net/vascan/search). This change may have implications for Canadian legislation or regulations that list weed species by scientific name (e.g., *Weed Seeds Order* 2016).

SOURCE: Flora of North America Editorial Committee (1993+) Flora of North America North of Mexico. 12+ vols., New York and Oxford. [Online] Available: http://www.fna.org/FNA/

11 Weed risk assessment for aquatic plants

Actinidia arguta (Recent research has shown that weed risk assessment (WRA) models developed primarily for terrestrial plants do not always perform well for aquatic plants. For example, tests using the Australian WRA system to evaluate aquatic plants in the U.S. showed it was much less successful at distinguishing between major, minor and non-invaders when compared to results obtained for terrestrial plants. In response, a number of WRA models have been developed and tested specifically for aquatic plants, perhaps the most prominent being the NZAqWRA developed in New Zealand and subsequently applied in Australia and Micronesia, as well as adapted for use in the U.S.

In Canada, two reports released recently have applied WRA approaches to aquatic plants present in the aquarium and water garden

trade, resulting in lists of high, medium and low risk species. The first is a Department of Fisheries and Oceans Canada (DFO) research report (Gantz et al. 2014) which applied the modified NZAqWRA following the approach taken in the U.S. Among the highest-risk species identified were: *Alternanthera philoxeroides* (alligator-weed), *Crassula helmsii* (swamp stonecrop), *Egeria densa* (Brazilian elodea), *Eichhornia crassipes* (water-hyacinth), *Glyceria maxima* (reed sweet grass), *Hydrilla verticillata* (hydrilla), *Myriophyllum aquaticum* (parrot's feather), *Myriophyllum spicatum* (Eurasian water-milfoil), *Nymphoides peltata* (yellow floating-heart), *Pistia stratiotes* (water-lettuce), *Salvinia molesta* (giant salvinia), *Salvinia minima* (water spangles).

A second report from university researchers in Ontario (Azan et al. 2015) took a different approach, ranking plants according to their prevalence in the aquarium and ornamental pond industries in the Greater Toronto Area (pathway risk potential) as well as their biological characteristics (organism risk potential). This resulted in an entirely different list, with the highest risk species including: *Cyperus papyrus* (papyrus sedge), *Hygrophila balsamica*, *Hygrophila corymbosa* (temple plant), *Hygrophila difformis* (water wisteria), *Microsorum pteropus* (syn. *Leptochilus* pteropus) (Java fern), *Spathiphyllum* sp. (peace lily), *Taxiphyllum barbieri* (Java moss), *Teucrium scordium* (water germander), and *Typha minima* (dwarf bulrush).

The popularity of aquarium and water garden plants is on the rise worldwide, and freshwater aquatic and plants have a higher probability of becoming invasive than terrestrial species (e.g., see Gordon et al. 2012). Indeed, many current aquatic invaders are the result of intentional imports, as plants sold for use in aquaria or outdoor water features are often disposed of in natural waterways where they can establish and spread. These risk assessment approaches for aquatic plants merit further examination and may provide a useful starting point for the future regulation of aquatic plant imports in Canada.

SOURCES: Azan, S., Bardeck, M. and Laursen, A. E. (2015) Invasive aquatic plants in the aquarium and ornamental pond industries: a risk assessment for southern Ontario (Canada). Weed Research 55: 249–259. DOI: 210.1111/wre.12135.

Gantz, C., Mandrak, N. E. and Keller, R. P. (2014) Application of an Aquatic Plant Risk Assessment to Non-Indigenous Freshwater Plants in Trade in Canada. Application of an aquatic plant risk assessment to non-indigenous freshwater plants in trade in Canada. DFO Can. Sci. Advis. Sec. Res. Doc. 2013/096 v + 31 p.

Gordon, D. R., Gantz, C. A., Jerde, C. L., Chadderton, W. L., Keller, R. P. and Champion, P. D. (2012) Weed risk assessment for aquatic plants: Modification of a New Zealand system for the United States. PLoS ONE 7(7): e40031. DOI: 40010.41371/journal.pone.0040031.

Biotechnology

12 Plant Biology Documents: An Update on Recent Domestic and International Efforts

The Organisation for Economic Cooperation Working Group on the Harmonisation of Regulatory Oversight in Biotechnology (i.e. OECD Working Group), of which Canada is a member, aims to promote international harmonization in the regulation and resulting environmental safety assessment of organisms produced through modern biotechnology. This work takes account of developments in the science and application of biotechnology in order to identify and address emerging issues relevant to environmental safety assessment.

The OECD Working Group ensures that the information used in environmental safety assessment, as well as the methods used to collect such information, is as similar as possible among countries. This is to improve mutual understanding, increase the efficiency of environmental safety assessment, avoid duplication of effort, and reduce barriers to trade. The OECD Working Group focusses its work on the development of free-of-charge "consensus documents". These documents are intended to be mutually recognized among OECD member countries and provide critically important background information on the biology of organisms such as plants, trees, animals and micro-organisms.

In the past 5 years, the OECD Working Group has published numerous consensus documents on the biology of plants including:

- Consensus Document on the Biology of Sugarcane (*Saccharum* spp.) (2013)
- Consensus Document on the Biology of Cassava (*Manihot esculenta*) (2014)
- Consensus Document on the Biology of Common Bean (*Phaseolus vulgaris*) (2015)
- Consensus Document on the Biology of Cowpea (*Vigna unguiculata*) (2015)
- Consensus Document on the Biology of Sorghum (*Sorghum bicolor*) (2016)
- Consensus Document on the Biology of Tomato (*Solanum lycopersicum*) (2016)

The consensus documents on the biology of maize (*Zea mays*) and wheat (*Triticum aestivum*), originally drafted in 2003 and 1999, respectively, are currently being updated. In addition, the consensus document on the biology of apple (*Malus domestica*), which also includes quince (*Cydonia oblonga*) and pear (*Pyrus* sp.), is a new document currently under development.

All consensus documents published by the OECD Working Group can be accessed online at http://www.oecd.org/science/biotrack/consensusdocumentsfortheworkonharmonisationofregulatoryoversightinbiotechnology.htm

The Canadian Food Inspection Agency's Plant and Biotechnology Risk Assessment (PBRA) Unit is responsible for assessing the potential risk from the release of plants with novel traits (PNTs) into the Canadian environment. Safety assessments conducted by the PBRA Unit require biological information about the plant species being assessed. As such, safety assessments are conducted in conjunction with species-specific biology documents that provide the necessary biological information, much like the OECD consensus documents, however these documents describe the characteristics of a particular species in the Canadian environmental context. They help identify potential risks associated with a PNT under review relative to its counterpart of the same species already present in the Canadian environment. These biology documents are fundamental resources for the safety assessment of PNTs.

Previously, an agricultural biotechnology company was responsible for drafting a biology document if it was the first applicant for a particular PNT species. Consequently, the quality and consistency of biology documents differed depending on the author. In 2008, the responsibility of drafting biology documents shifted from applicants to the CFIA. Since 2008, the PBRA Unit has established a revised format and standardized

template for biology documents as a means of improving their quality and utility during the safety assessment process. Consequently, some of the older biology documents were identified for revision and are currently under development, namely the biology documents of canola (*Brassica napus*), corn (*Zea mays*), and soybean (*Glycine max*). The PBRA Unit has recently published a new biology document on *Sorghum bicolor* (L.) Moench (Sorghum) and one more will be posted shortly, the biology document of *Brassica carinata*.

All biology documents published by the CFIA can be accessed online at http://www.inspection.gc.ca/plants/plants-with-novel-traits/applicants/directive-94-08/biology-documents/eng/1330723572623/1330723704097.

13 What is Synthetic Biology? Good question!

Synthetic biology is a broad domain of science and technology without a widely accepted definition. Some experts describe it as the application of engineering principles to biological systems while others see it as just the next iteration of biotechnology. To the first group, carving out a unique scientific domain apart from biotechnology is important because they see a clear distinction. Consider that agricultural biotechnology is mostly being used to transfer useful traits (e.g. herbicide tolerance, insect resistance) that already exist in nature between plant populations. On the other hand, synthetic biology is creating new synthetic life and identifying the minimal genome necessary to support life.

With this in mind it's not surprisingly that synthetic biology has captured the attention of international and leading scientific institutions like the United Nations (UN), the Organisation for Economic Co-operation and Development (OECD), and the National Institutes of Health (NIH) to name a few. These organizations have adopted synthetic biology definitions that fit with their organizational mandates, and they are all working to address the real or perceived challenges the technology presents. The OECD has published a comprehensive review of emerging policy issues with synthetic biology (OECD, 2014). The NIH has assembled experts to address potential public health threats related to synthetic biology projects. The UN's scientific advisory body for the Convention on Biological Diversity has been advocating for a precautionary approach to synthetic biology risks, while soliciting advice on the benefits and costs associated with the technology.

So while the international and scientific communities are working hard to prepare for synthetic biology, we still are presented with the challenge of communicating what exactly synthetic biology is. And when a survey of 20 synthetic biology experts failed to form any meaningful consensus (Greenwood, 2009), we're left with the prospect that the nuanced differences between synthetic biology and biotechnology that exist for the moment may only be useful for discussions within the community of scientific experts, but not elsewhere. As a result, for the moment we might consider synthetic biology synonymous with biotechnology when communicating with the general public, or even for government regulatory purposes.

The Canadian product based regulatory system is well positioned to address plants generated using synthetic biology, whenever

those products arrive. It should be pointed out that our comparative approach to pre-market safety assessments will require special attention. Identifying an appropriate comparator to evaluate product safety will become more challenging as products become more divergent from familiar comparators, and at the moment there's no clear solution to this challenge.

SOURCES: Greenwood, J. (2009) Focus on synthetic biology: what's in a name, Nature Biotechnology, 27(12): 1071

OECD. (2014) Emerging policy issues in synthetic biology, OECD Publishing, Paris.
DOI: http://dx.doi.org/10.1787/9789264208421-en

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Canadian Food Inspection Agency
Plant Science Scan
Tower 1, Floor 1, 1400 Merivale Road
Ottawa, ON, Canada K1A 0Y9
PSS-SSV@inspection.gc.ca