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Aliens of Xamayca

a newsletter on non-indigenous species in Jamaica

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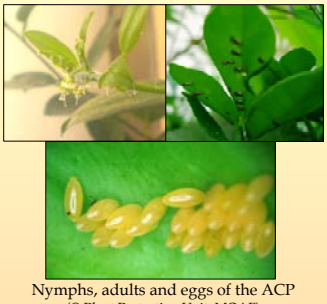
CITRUS GREENING IN JAMAICA

Citrus Greening huanglongbing (HLB) is a devastating disease on citrus species worldwide, which was first recorded in the late 1800s in southern China. Since then, this disease has spread to major citrus producing countries (e.g. China, Spain, Brazil, Mexico and United States of America).

The disease was detected in Brazil (2004), Florida (2005) and Jamaica (2009). In the Caribbean, the disease has also been reported in Cuba, Puerto Rico, and the Dominican Republic. There is no cure for citrus greening HLB. In most citrus producing countries, this disease is believed to be the major factor limiting citrus production and quality of the fruits.

The citrus industry in Jamaica is valued at $4 billion dollars and is expected to be severely impacted in terms of production, employment, and food security particularly in the rural areas. In Jamaica, citrus greening HLB is caused by the Asian form of the bacteria, *Candidatus Liberibacter asiaticus*, which affects the food conducting tissue of the citrus plant.

The disease is transmitted by the Asian Citrus Psyllid (ACP), *Diaphorina citri* and the use of infected grafted plant material. The eggs of the ACP are oval shaped, yellow or orange in colour and 0.3mm long. They are laid singly or in small clusters mainly on the tips of growing shoots, in the crevices of the tiny, unfolded flush (feather flush), and in small cracks on stems or on leaves damaged by adult feeding.



Nymphs, adults and eggs of the ACP
(© Plant Protection Unit, MOAF)

The nymphs are less than 0.3 mm long, orange in colour, dorso-ventrally flattened and typically covered with curly waxy tubules. The adults are brown in colour, 3 – 4 mm in size and the wings of both males and females have a mottled brown band around most of the outer edge of the forewing. Their bodies are normally set at a 45° angle to the plant leaf or stem during feeding. The complete life cycle of ACP ranges from 15 to 47 days and is temperature dependent. Adults may survive up to two months during cool weather.

Newly formed citrus leaves can become deformed and die due to the feeding activity of numerous adult psyllids. The production of honeydew by both nymphs and adults promotes the growth of sooty mould which covers the leaves and reduces photosynthesis.

Ants may also be present as they are attracted by the sugary sweet honeydew. Injection of salivary toxins during feeding stops terminal elongation and causes malformation of leaves and shoots. Psyllids also feed on the ornamental Orange Jasmine or Myrtle (*Murraya paniculata*).

Notching and twisting of leaves
(© Plant Protection Unit, MOAF)

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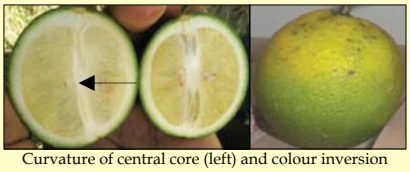
CITRUS GREENING IN JAMAICA CONT'D

The symptoms of the disease are normally displayed on the leaves and fruits. Citrus greening typically causes blotchy mottle, which is a diagnostic symptom found on young and older leaves where the mottling patterns are asymmetrical using the mid-rib as a central line. Other leaf symptoms include vein corking and green islands. Fruit symptoms include colour inversion, aborted seeds, curvature of the central core and a bitter taste.

Blotchy mottle with light and dark green patches, no symmetry (left) and corky raised veins (right) (© Plant Protection Unit, MOAF)



Curvature of central core (left) and colour inversion (right) (© Plant Protection Unit, MOAF)

Management

Several measures have been undertaken to address citrus greening in Jamaica. In 2010, the citrus greening management programme was implemented by the Ministry of Agriculture and Fisheries (MOAF). This programme was funded by the Food and Agricultural Organization of the United Nations (FAO).

The goal of the programme was to sustainably manage citrus greening HLB especially on small farmer holdings using five strategies: 1) facilitating the capacity to diagnose and detect HLB, 2) developing a system to produce certified clean planting material, 3) providing improved infrastructure, 4) designing a coordinated area-wide integrated management programme for HLB, and 5) implementing a public education programme.

Several persons from the MOAF and partner agencies were also trained to diagnose HLB using molecular diagnostic tools and to conduct shoot tip grafting, which is a technique used internationally to produce clean grafting material. Laboratory facilities at the Post Entry Quarantine (PEQ) facility were upgraded to develop a molecular laboratory for testing citrus greening and to conduct shoot tip grafting.

An Area-Wide Integrated Management System (AIMS) was developed to target citrus farmers and residents in areas that are in close proximity to major citrus growing areas across the island. The goal of the system is to reduce the primary spread of the pest and allow the trees to produce in the presence of the disease.

AIMS involve the formation of clusters among citrus farmers in all major growing areas through which specific management tactics will be applied initially in pilot areas in St. Catherine and Clarendon. These tactics include: timely application of selected pesticides, release of the parasitoid wasp, *Tamarixia radiata*, the use of a nutritional programme, and clean planting material.

To date, 100 persons including RADA extension officers and selected citrus farmers have been trained as resource persons to train other players in the industry to implement the AIMS. The Plant Protection Unit, Research and Development Division, MOAF is leading a programme to monitor the psyllid population, which will be used to guide the timing of the spray programme and determine the effectiveness of the AIMS. The outcome of the programme will provide information that will guide a national programme, particularly to other major citrus growing areas and also the management programmes of other countries in the region.

The public education component seeks to inform ~75% of small farmers across the island and the communities surrounding them. To date, seven public relation products have been produced and are available on the MOAF's website (http://www.moa.gov.jm/PlantHealth/Citrus_greening.php).

Future plans to further combat HLB include the construction of a budwood facility at Bodles (PEQ facility) to house citrus grafted clean plants as a source of budwood material to supply the industry. A demo-nursery will also be constructed that meets required specifications to reduce the risk of infected citrus seedlings being sold to farmers and the public.

Contributor: Michelle Sherwood, Plant Protection Unit, Research and Development Division, MOAF

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INVADERS FROM THE SEA: THE PROBLEM OF SHIPS' BALLAST WATER

Shipping is vital to Jamaica's economic sustainability as an island state with over 90% of all commodities imported and exported from the country arriving by sea. Each year, about 3,500 ship calls are made to various ports in Jamaica and thousands more transit our territorial waters en route to other countries.

While these ships carry vital goods to support our economy, they also carry unwanted alien species, many of which are invasive. The primary pathways for the introduction of marine invasive alien species (IAS) and pathogens are bio-fouling and ballast water.

Bio-fouling occurs when there is an inordinate accumulation of marine species on the submerged parts of the hulls of vessels. Thousands of spores, eggs or larvae may be released from a single fertile organism attached to the hull, which has resulted in the introduction of non-native crabs, molluscs, plankton, and fish. The International Maritime Organization (IMO), responsible for the regulation of vessel source pollution, has reported that in some regions of the world, more than 50% of invasive aquatic species introductions have occurred through bio-fouling.

Ballast water on the other hand, is used to control the stability of a ship to ensure its safe operation when it is empty (in ballast) or partially laden. With the replacement of wood with steel as the material of choice for the construction of ships came the decline of the use of stones in favour of seawater as the source of ballast. It is currently estimated that 3 to 4 billion tonnes of ballast water carry small invertebrates, unwanted bacteria, as well as the eggs, cysts and larvae of marine species that are transferred annually by ships. About 7,000 different stowaway marine species and pathogens are also transported in the water column of ballast tanks as well as in the sediments, which accumulate at the bottom of ships' ballast water tanks each year.

As ships increase in size and speed, the resulting reduction in transit times have had a twofold effect of reducing the role of natural barriers in restricting the spread of IAS as well as increased the survivability of non-native organisms, which once introduced, can become the dominant species.

Using Jamaica as an example, when a vessel leaves New Orleans to load bauxite in Jamaica, it pumps in thousands of gallons of seawater from its coastal waters. On reaching the port of loading in Jamaica, the vessel discharges the seawater into Jamaica's marine environment, thus transferring marine species from the USA to Jamaica. In 1998, the Indo Pacific Green Mussel (*Perna viridis*) was discovered thriving on mangrove prop and drop roots in the Port of Kingston; its pathway was identified as ballast water.

Although the economic and public health risks have not been fully explored, there is ample evidence of the smothering of mangroves as well as the fouling of berth pilings and intake cooling pipes of power plants, both of which have adverse economic impacts. In the USA, about 1 billion dollars was spent from 1989 to 2000 to reduce the impact of the Zebra Mussel (*Dreissena polymorpha*) in the water ways of the Great Lakes while the North American jellyfish (*Mnemiopsis leidyi*) has been the primary cause for the collapse of the sturgeon population with devastating effects on the Black Sea fisheries. Invasive aquatic species in the form of 'red-tide' algae (toxic dinoflagellates) have also resulted in shellfish poisoning resulting in public health risks such as paralysis and death.

The public health risks associated with pathogens carried in ballast water cannot be ignored. Pathogenic bacteria in the form of *Vibrio cholerae* can be spread by ballast water and was identified as the source of the cholera outbreak in Peru in 1991, which resulted in the deaths of over 5,000 persons. *Vibrio cholerae* has also been identified in the Gulf of Mexico. Ships calling at Jamaican ports arrive from areas where cholera is present and the risk of the bacteria being introduced has to be reduced by the implementation of preventative measures.

The global community has responded to the challenge posed by IAS transferred in ships' ballast and sediment with the adoption of the International Convention for the Control and Management of Ships' Ballast Water and Sediments (2004). The Convention requires *inter alia* that ships conduct mid ocean ballast water exchange and treatment systems have been approved for installation on ships.

In the case of Jamaica, a multi-agency national task force has been established to develop the legal and policy framework for implementing the Convention to which Jamaica is expected to accede in 2013.

Contributor: Bertrand Smith, Maritime Authority of Jamaica

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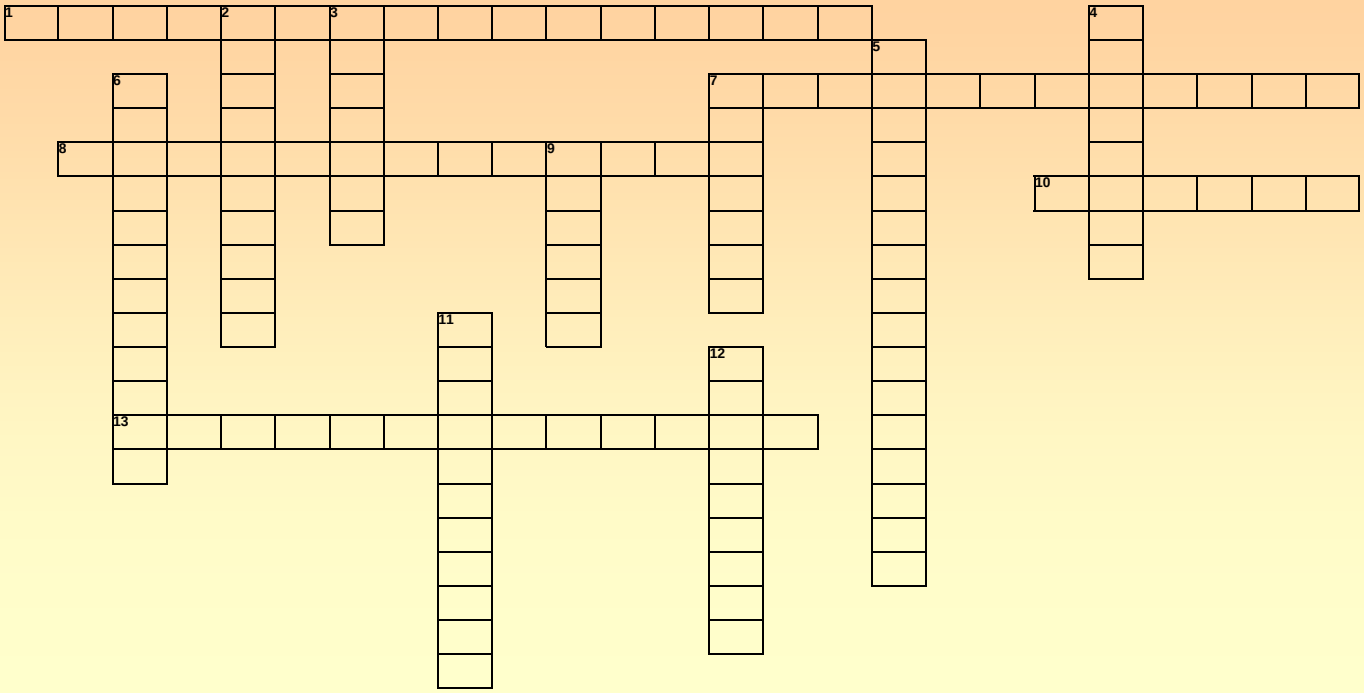
WHY DO WE NEED WETLANDS? CROSSWORD PUZZLE



Use the words below to help you to answer the clues for this puzzle.

Soil conservation	Fishing	Photography	Hiking
Clean water	Nursery	Pollution control	Rest stops
Cranberry bogs	Bird watching	Canoeing	
Flood control	Nature tourism	Beauty	

ACROSS

1. Wetland plants reduce erosion, making them important for _____
7. By acting as natural sponges and sinks, wetlands collect water and help with this.
8. A fruit featured at Thanksgiving time can be found growing here.
10. If you want to do this in a wetland, make sure you bring your boots, and step carefully if you want to keep them dry!
13. Vacationers who visits scenic wetlands to view wildlife and the great outdoors are part of this growing business.

DOWN

2. By straining our pollutants, wetlands help to ensure a supply of _____
3. By offering protection for many young animals, wetlands act as a type of _____
4. Want to stay dry as you explore a wetland? Try _____
5. Wetlands help with _____ since they filter and break down unhealthy substances.
6. Looking for feathered friends who make their homes in wetlands is called _____
7. With so much food for scaly friends, wetlands are an ideal place to cast our your line and try your luck at this.
9. Wetlands have plenty of this. It is often said to be "in the eye of the beholder."
11. Great scenery in marshes, swamps, and bogs lead to great "shots" for those who enjoy this hobby.
12. Wetlands are used as _____ by birds flying to and from their winter homes.