

SCALE INSECTS ASSOCIATED WITH roseau cane IN LOUISIANA



Nipponaclerda biwakoensis (Hemiptera:Aclerdidae)
Aclerda holci (Hemiptera:Aclerdidae)

Background

In Louisiana, two species of scales can be found feeding on Roseau cane, *Phragmites australis*. Roseau cane scale, *Nipponaclerda biwakoensis*, is an invasive species native to Asia. The invasive scale was discovered in North America during the fall of 2016 in Plaquemines Parish, Louisiana, when it was observed that large stands of previously healthy Roseau cane were dying and collapsing,

leaving patches of open water (Figure 1). While searching for *N. biwakoensis*, scientists discovered a native scale, *Aclerda holci*, also present in Roseau cane. These findings have sparked an interest in understanding the role of the scales in the die-offs. By becoming familiar with characteristics of the scale and its host, local citizens can help scientists gain a better understanding of the distribution and impact that this insect may have across southern Louisiana.



Figure 1. As the cane dies, the lack of regrowth results in patches of old stubble and open water, leaving the coast vulnerable to erosion and storm surge. Photo taken April 19, 2017, Plaquemines Parish.

Roseau cane

Roseau cane is an important component of the Mississippi River Delta, providing critical defense for coastal marshes against wave action, storm surges and erosion. Roseau stands provide important estuarine habitat for a number of fish and wildlife species, and loss of the cane will have significant environmental and economic impacts. As stands of Roseau cane retreat, the

vacant space is colonized by invasive plants like elephant ear, water hyacinth and salvinia. These plants are less suitable for wildlife and less resilient to the scouring action and saline waters pushed into the marsh by storms. Beyond the loss of habitat for popular fish and wildlife, loss of cane is expected to accelerate land loss in the delta, expose oil and gas infrastructure and cause increased sedimentation in shipping channels.

Visit our website: www.lsuagcenter.com

Four varieties of Roseau cane are known to occur in Louisiana, and all have been found infested with the invasive scale. The most common variety in the Mississippi River Delta is referred to as the Delta variety. Although different varieties are difficult to distinguish without genetic testing, the stalks of the Delta variety are generally taller with very fine silvery hairs on the underside of leaves. Another variety, European Roseau cane, is also found in patches throughout the marsh and is distinguishable by its shorter stems, waxy and hairless leaves, and red to purple flowers (Figure 2). This European variety is generally considered an invasive weed in much of the coastal United States, but initial data suggest it may be less susceptible to the scale than the Delta variety. The Greeny variety is much rarer in the marsh. While Greeny is genetically distinct from European, the two varieties are similar in appearance and in resistance to the scale. Greeny is generally distinguished from European as having a deeper green to bluish hue, but genetic testing is required for positive confirmation. The fourth variety, Gulf, tends to have reddish, woody stems that commonly branch at the nodes. This variety is common throughout coastal Louisiana; however, it tends to grow in upland and disturbed habitats and is not common in the lower marsh.



Figure 2. European cane variety in flower.

We are determining possible resistance of the different varieties of Roseau cane by investigating the impacts the scale has on each variety. If one variety of Roseau cane is found to be resistant to the scale, it could provide a restoration alternative to the problem we are facing.

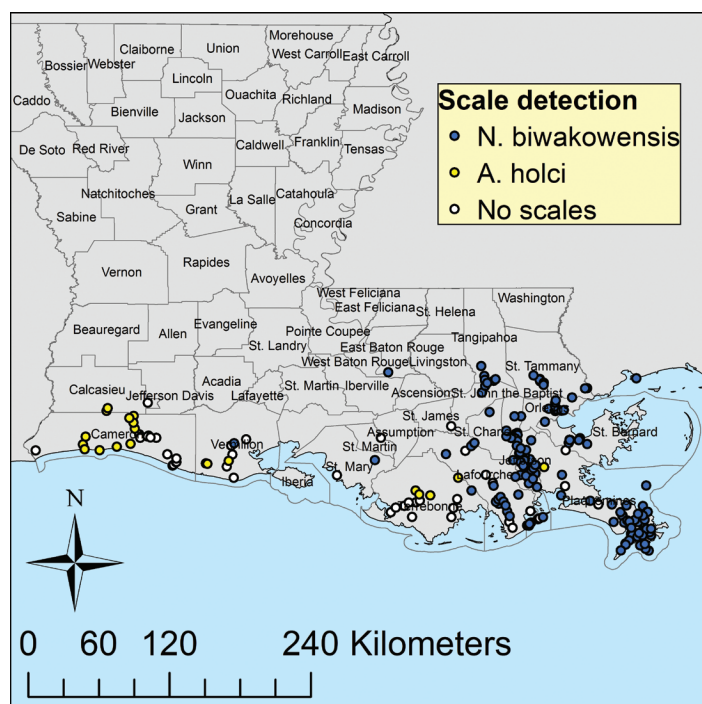


Figure 3. Current known distribution of native and invasive scale across southern Louisiana as of December 2017.

The invasive scale

It is unknown when and how the Roseau cane scale *N. biwakowensis* arrived in Louisiana. The scale was first described in Japan, and its known range includes the coastal provinces of China north of Shanghai. The scale belongs to a relatively understudied family of insects, Aclerdidae, commonly called the flat grass scales. A statewide sampling effort has shown that the scale is now present in the Gulf Coast across the lower Mississippi River Delta as far west as Vermilion Parish and as far north as Lafitte in Jefferson Parish (Figure 3). As more sites are inspected, the LSU AgCenter will be updating the distribution map.

In China and Japan, the major host of the scale is Roseau cane, or common reed as it is known elsewhere. Additional reported hosts include wheatgrass (*Agropyron* sp.) and rush (*Juncus* sp.) (Wang 1994). The ability of the scale to infest native rushes and grasses of ecological importance, including saltmarsh cordgrass, giant cutgrass and maidencane, is currently unknown. Host range testing will be conducted to determine if this scale is a threat to other ecologically and economically important grasses.

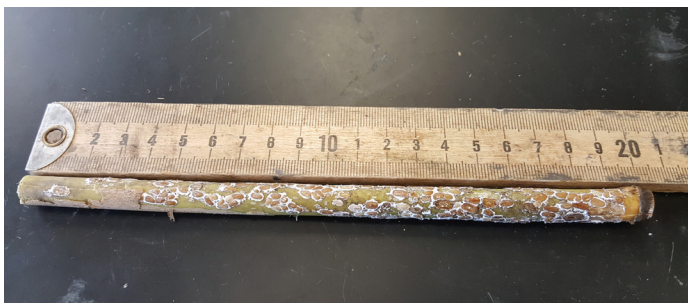


Figure 4. Hundreds of scales can be found in just one approximately 8-inch segment of cane.

Scales are found on the stems of Roseau cane beneath the leaf sheath. To determine whether a stem is infested, the leaf sheaths can be peeled back to reveal scales in all different life stages affixed to the stem. The scales can generally be found on any section of the stem above the waterline and below the newest growth at the top of the stems. There may be as few as a single scale insect on a stem; however, heavy infestations often result in several hundred scales per plant (Figure 4). It is important to be cautious when coming in contact with infested stems to help mitigate the spread of the scale. Stems should not be moved, especially between infested and non-infested parishes. Thoroughly washing boats and equipment is one recommended step to help prevent the spread of the scale.

The invasive scale has a different appearance as it progresses through its various life stages. The most recognizable life stage is the mature female, which is generally half an inch in length, ruddy brown in color and often full of eggs (Figure 5). This is also the stage in which the scale overwinters and, depending on the time of year, may be the only life stage present. The eggs hatch inside the mother and emerge as the first stage, known as crawlers, which is the mobile stage responsible for

Figure 5. Mature females appear dark brown and hold eggs during the winter until temperatures are warm enough for the eggs to emerge as crawlers.



Figure 6. Crawlers are small enough to fit on the tip of a ballpoint pen. They emerge from the female and climb up the stalk until they find a place to settle and begin sucking sap from inside the plant stem.

dispersal (Figure 6). Though the scales are wingless over their entire lives, the crawlers are very small and may be dispersed over long distances by wind or by animals and birds that congregate in Roseau cane stands. It is during the crawler stage that the scales explore the stem in search of a feeding site. Once the crawlers settle on a stem and become nymphs, they are immobile. Nymphs feed by using their piercing mouthparts to suck nutrients out of the plant stem. Heavy infestations may affect a plant's ability to transport and store energy in their roots. Settled nymphs are oval, pale pink to white in color and smaller than mature scales (Figure 7). Unlike the females, males are mobile as adults (Figure 8).



Figure 7. Pale pink immature scales (nymphs) on an approximately 2-inch segment of stem.



Figure 8. Female scales are considerably larger than their male counterparts (left). Close up of mobile male Roseau cane scale (right).

The native scale

Little is known about the native scale, *Aclerda holci*, which also belongs to the family Aclerdidae. The primary host of *A. holci* is johnsongrass, but it has also been reported as a non-pest insect occurring on sugarcane and was only recently found to infest Roseau cane. The current known distribution of the native scale is limited, but it has been found in five parishes in southern Louisiana.

A. holci is similar in size and appearance to the Roseau cane scale, and the two species can only be distinguished as adults. The adults of *A. holci* remain pale in color as they mature except for a dark brown point on the posterior section. This characteristic distinguishes *A. holci* from the Roseau cane scale, which is generally uniform in color with smoothly rounded margins (Figure 9). The native scale has not been observed at the high densities seen with the Roseau cane scale and likely has minimal impact on plant health. Preliminary observations show that the native scale typically occurs at densities of fewer than 10 scales per stem, as compared to the hundreds often observed with the invasive. At this time the native scale is not believed to be a significant cause of the Roseau cane die-offs in the Mississippi River Delta.



Figure 9. The native scale (right) can be easily distinguished from the invasive scale (left) by a dark brown sclerotized point on one end of its body.

Natural enemies

While some predation of the scales by ladybug beetles and birds has been observed, the primary natural enemies of the scales are parasitoid wasps. These wasps deposit eggs inside developing scales. When the eggs hatch, the wasp larvae will feed on the female scale from the inside. Wasp larvae or pupae may be visible through the scale's exoskeleton as distinct compartments within the scale (Figure 10). The wasps eventually kill their hosts and emerge as adults, leaving a small exit hole in the exoskeleton (Figure 11).



Figure 10. The larvae of the parasitic wasp develop inside the body of the scale. They utilize the scale for nutrients until they are ready to emerge as adults.

Three species of parasitic wasps have been found on the Roseau cane scale. They are all known to attack the scale in its native range and were likely introduced with the invasive scale. The parasitic wasps include *Neastymachus japonicus*, *Astymachus japonicus* and *Boucekiella depressa* (Figure 12) (Kaneko, 2004). These parasitoids play an important role in controlling the



Figure 11. Dead parasitized scales with exit holes.



Figure 12. This parasitic wasp, *Neastymachus japonicus* (left), lays its eggs inside the body of the scale. Its larvae use the scale for nutrients as it develops, and the adult wasp emerges from the body of the dead scale. *Astymachus japonicus* (middle) and *Boucekiella depressa* (right) also use the invasive scale as a larval host.

populations of the Roseau cane scale. The wasps have also been found developing in the native scale species. The host range and preference of these native and introduced wasps are currently unknown.

Control

Research is being conducted by the LSU College of Agriculture Department of Entomology and the LSU College of Science Department of Biological Sciences to understand and develop management strategies for the Roseau cane scale. Natural enemies appear to provide significant control of the Roseau cane scale in its native range. Practices such as burning, removal of overwintering stems and flooding of fields have been effective at controlling scale populations in China where Roseau cane is an important commercial commodity (Brix et al., 2014). However, these tactics are impractical

in Louisiana because of the current distribution of the scale in sensitive wetland habitat and its proximity to oil and natural gas infrastructure. Chemical control options are also limited because of the environmental impacts of applying insecticides to aquatic ecosystems.

Further studies are underway to characterize the potential resistance or tolerance of one of the four Roseau cane varieties to the scale and to determine if any of the Roseau cane varieties would be a viable option for revegetation. Other control methods in the future may include mechanical, chemical or biological control pending the results of these investigations.

Selected References

- Brix, H., Ye, S., Laws, E. A., Sun, D., Li, G., Ding, X., Yuan, H., Zhao, G., Wang, J., and Pei, S. 2014. Large-scale management of common reed, *Phragmites australis*, for paper production: A case study from the Liaohe Delta, China. *Ecological Engineering* 73:760 – 769.
- Kaneko, S. 2004. Within-plant vertical distributions of the scale insect *Nipponaclerda biwakoensis* and its five parasitoids that exhibit frequent successful multiparasitism on the common reed. *Entomological Science*. 7:331 – 339.
- McConnell, H.S. 1954. A classification of the coccid family Acleridae (Coccoidea, Homoptera). *Bulletin of the Maryland Agriculture Experiment Station A75*: 1 – 121.
- Wang, T. 1994. Economic insect fauna of China: Homoptera: Coccoidea: Coccidae, Asterolecaniidae, Lecanodiaspididae, Cerococcidae, Acleridae. Vol. 43. Beijing, P. R. China: Science Press. 302 pp.
-



Authors: Madeline Gill,
Ian Knight, Jim Cronin,
Todd Baker, Blake Wilson
and Rodrigo Diaz

William B. Richardson, LSU Vice President for Agriculture
Louisiana State University Agricultural Center
Louisiana Agricultural Experiment Station
Louisiana Cooperative Extension Service
LSU College of Agriculture

Pub. 3625-A (online only) 03/18

The LSU AgCenter and LSU provide equal opportunities in programs and employment.

Visit our website: www.lsuagcenter.com