

## Myakka bug, *Ischnodemus variegatus* (Signoret) (Insecta: Hemiptera: Blissidae)<sup>1</sup>

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### Introduction

West Indian marsh grass, *Hymenachne amplexicaulis* (Rudge) Nees (Poaceae), is a robust, stoloniferous, semiaquatic, perennial grass native to the Neotropics (tropical Central and South America). This perennial grass is considered valuable forage in its native range (Tejos 1978, Enriquez-Quiroz et al. 2006). It reproduces from stolons or seeds in areas with fluctuating water levels and can survive long periods of flooding, but only persists along the edges of permanent deep water (Tejos 1980). West Indian marsh grass is especially adapted to low lying fresh water wetlands and flood plains containing high nutrient and sediment influx (Csurches et al. 1999).

In the 1970s and 1980s, *H. amplexicaulis* began invading wetlands in Florida (Langeland and Craddock-Burks 1998). Although the introduction pathway of this grass into Florida is uncertain, intentional introduction into Florida is possible due to its high forage value (Antel et al. 1998, Diaz et al. 2009, Kibbler and Bahnisch 1999). *Hymenachne amplexicaulis*, a Florida Exotic Pest Plant Council Category I invasive plant, competitively displaces

native vegetation in wetland areas due to its aggressive growth patterns during the rainy season (Diaz et al. 2009, FLEPPC 2009).

In 2000, the "Myakka bug," *Ischnodemus variegatus* (Signoret) (Hemiptera: Blissidae), was first reported causing severe damage to *H. amplexicaulis* at Myakka River State Park, Sarasota County, Florida (Brambila and Santana 2004). *Ischnodemus variegatus* was identified as a new record for the continental United States by the Florida Department of Agriculture and Consumer Services (FDACS) (Halbert 2000). Research was conducted by University of Florida scientists on the biology, host specificity, and potential impact for this newly introduced, exotic insect species.

### Synonymy

The taxonomic status of this species was reviewed by Slater (1987) who raised *I. variegatus* (Signoret) from synonymy with *Ischnodemus oblongus* Fabricius.

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## Distribution

The native distribution of *I. variegatus* includes Central and South America. Collection records indicate *H. amplexicaulis* may be the only host (Baranowski 1979, Slater 1987).

As mentioned above, both *I. variegatus* and *H. amplexicaulis* now occur in Florida.

In 1988, *H. amplexicaulis* was released in Queensland for use as "ponded pasture" (Csurhes 1999).

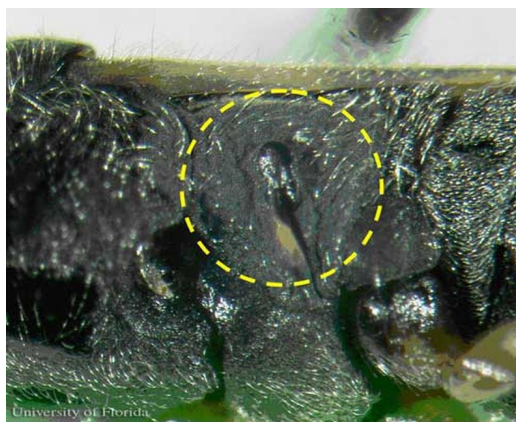
## Description

Members of the genus *Ischnodemus* are characterized by elongate, parallel sided bodies, closed fore coxal cavities, terete (cylindrical) antennae, a straight apical (tip) margin, and a forewing membrane with a distinctive morphological texture (i.e. the clausure and corium are well differentiated) (Slater and Wilcox 1969). Slater (1976) classified this genus as a "Type I" body shape which includes species with elongate, slender body shape that is usually slightly flattened. The "Type I" body shape is advantageous for insects living on the stems of grasses.

Laboratory and field observations indicate the 1st through 4th instars are typically found in aggregations while 5th instars and adults are often observed exploring as individuals. If nymphs or adults are disturbed, they secrete a strong odor from the scent glands located in the thorax and abdomen (Diaz et al. 2008).

**Adults:** Females (7.23 mm in length,  $\pm 0.56$ ,  $n=28$ ) are larger than males (6.05 mm in length,  $\pm 0.22$ ,  $n=49$ ) and both genders have a distinctive "M" pattern at the base of the hemelytra. Female sclerites (hardened plates) at the ventral, or top side, tip of the abdomen are triangular in shape. The last sclerites of males are more rounded.

Adult flying is restricted to short hops of a few meters or less. Gravid females mostly walk, possibly



**Figure 1.** Scent gland of an adult Myakka bug, *Ischnodemus variegatus* (Signoret). Photograph by: Rodrigo Diaz, University of Florida



**Figure 2.** Adult female Myakka bug, *Ischnodemus variegatus* (Signoret). Photograph by: Rodrigo Diaz, University of Florida



**Figure 3.** Differences between the ventral sclerites at the tip of the abdomen of adult Myakka bugs, *Ischnodemus variegatus* (Signoret). Female sclerites (left); male sclerites (right). Photographs by: Rodrigo Diaz, University of Florida

due the large size of their abdomens (Diaz et al. 2008).

**Eggs:** The egg length is approximately 3 mm (0.1 inches). Eggs are laid in masses (averaging 12 eggs per mass, with a range of 1 to 38) between the leaf sheath and the culm (or stem of the plant), preferentially near the node. Newly deposited eggs are white and older eggs turn bright red (Diaz et al. 2008).



**Figure 4.** Egg mass of the Myakka bug, *Ischnodemus variegatus* (Signoret), on culm of the West Indian marsh grass *Hymenachne amplexicaulis*. The eggs are 2.97 mm in length ( $\pm 0.13$ ,  $n=25$ ).

**Nymphs:** *Ischnodemus variegatus* has five nymphal instars. Instars initially remain aggregated near the site of oviposition, or egg laying. Later nymphal instars migrate to tightly appressed spaces between leaves and stems. Fourth and 5th instars are darker in color than early instars.



**Figure 5.** First instar nymph of the Myakka bug, *Ischnodemus variegatus* (Signoret). Average length is 1.45 mm ( $\pm 0.28$ ,  $n=23$ ). Photograph by: Rodrigo Diaz, University of Florida



**Figure 6.** Second instar nymph of the Myakka bug, *Ischnodemus variegatus* (Signoret). Average length is 2.70 mm ( $\pm 0.39$ ,  $n=47$ ). Photograph by: Rodrigo Diaz, University of Florida

## Life Cycle and Biology

Average total development time from egg to adult is 40 days. Eggs take an average of 12 days to hatch at 30.5° C (86.9°F). The nymphal stage reaches adulthood in an average of 29 days at 30.5° C (86.9°F). The preoviposition period is about



**Figure 7.** Third instar nymph of the Myakka bug, *Ischnodemus variegatus* (Signoret). Average length is 3.06 mm ( $\pm 0.31$ ,  $n=42$ ). Photograph by: Rodrigo Diaz, University of Florida



**Figure 8.** Fourth instar nymph of the Myakka bug, *Ischnodemus variegatus* (Signoret). Average length is 3.95 mm ( $\pm 0.32$ ,  $n=53$ ). Photograph by: Rodrigo Diaz, University of Florida



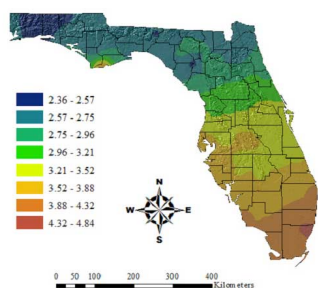
**Figure 9.** Fifth instar nymph of the Myakka bug, *Ischnodemus variegatus* (Signoret). Average length is 5.45 mm ( $\pm 0.43$ ,  $n=46$ ). Photograph by: Rodrigo Diaz, University of Florida

seven days at 28°C (82.4°F) (Diaz et al. 2008). Females lay their eggs in tight spaces between the leaf sheath and the stem. When the eggs hatch, the 1st instar nymph remains together near the site of emergence (Diaz et al. 2008).

Scientists developed a temperature-dependent development model to predict the number of generations that *I. variegatus* could complete per year at different locations in Florida. In North Florida, the model predicts that *I. variegatus* can complete two to three generations per year. In South Florida, the predicted number of generations increases to four to five per year (Diaz et al. 2008).

The optimal temperature range for development and survival is between 28°C (82.4°F) and 33°C (91.4°F). These ideal conditions for *I. variegatus* development match with the weather conditions in central Florida from April to October (Diaz et al. 2008).





**Figure 10.** Geographical information system map showing the predicted number of generations of the Myakka bug, *Ischnodemus variegatus* (Signoret), in Florida. Illustration by: Rodrigo Diaz, University of Florida

Developmental time and survival of eggs as well as immature stages are affected by temperature. When *I. variegatus* is exposed to low temperatures from 8°C (46.4°F) to 18°C (64.4°F) and to a high temperature of 38°C (100.4°F), low survivorship occurs. Nymphs died within a few days at higher temperatures of 38°C (100.4°F) and after weeks at lower extreme temperatures, suggesting that *I. variegatus* has a broader lower temperature threshold compared to the upper threshold.

## Hosts

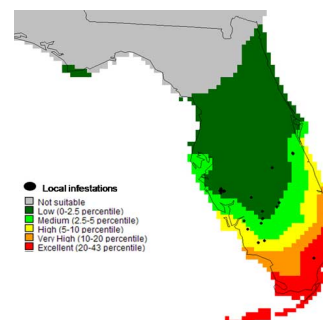
Due to economic and ecological importance of grasses, scientists at the University of Florida studied the host range of *I. variegatus*. They found that *H. amplexicaulis* is the preferred host of *I. variegatus* in laboratory and field conditions. In laboratory conditions, developmental host range of *I. variegatus* was examined on 57 plant species across seven plant families. Complete development was obtained from *H. amplexicaulis* (23.4%), compared to water paspalum, *Paspalum repens* (0.4%); beaked panicgrass, *Panicum anceps* (2.2%); and fire flag, *Thalia geniculata* (0.3%). In field experiments, *H. amplexicaulis* had higher densities of *I. variegatus* than other species (Diaz et al. 2009).

The seasonal cycle of *H. amplexicaulis* in Florida begins in spring during seed germination and new shoot growth. Increases in the water level as well as favorable day-length and temperature in the summer allow the grass to grow aggressively. Maximum biomass for *H. amplexicaulis* is reached by late summer. Later in the fall, short days trigger flower production (Tropical Weeds Research Centre 2006). During winter, some parts of the grass die, but the



**Figure 11.** Monoculture of West Indian marsh grass, *Hymenachne amplexicaulis* (Rudge) Nees (Poaceae), at Myakka River State Park, Sarasota County, Florida. August 2003. Photograph by: Rodrigo Diaz, University of Florida

stolons and seeds remain dormant underwater until spring. Based on herbarium specimens collected in the native range, a predictive model of the potential distribution of *H. amplexicaulis* in Florida was created suggests that its northern limit in Florida will be Alachua County.



**Figure 12.** Model prediction of climate suitability for West Indian marsh grass, *Hymenachne amplexicaulis* (Rudge) Nees (Poaceae), in Florida, using herbarium specimens from New York and Missouri Botanical Gardens. Illustration by: Rodrigo Diaz, University of Florida

## Damage

Damaged leaves turn dark red, due to the accumulation of anthocyanins (a type of pigment in the host plant). Persistent infestations eventually result in leaves turning brown and dying. Feeding effects of *I. variegatus* diminish carbon dioxide assimilation, growth rate, photosynthetic capacity and biomass of *H. amplexicaulis* (Overholt et al. 2004). Greenhouse experiments demonstrated that *I. variegatus* feeding damage negatively affected growth of *H. amplexicaulis* seedlings (Diaz 2008).

## Economic Importance

Population outbreaks of *I. variegatus* during the summer produce a major stress on West Indian marsh grass plants growing in poor conditions (shallow



**Figure 13.** West Indian marsh grass, *Hymenachne amplexicaulis* (Rudge) Nees (Poaceae), exhibiting signs of stress induced by feeding damage from the Myakka bug, *Ischnodemus variegatus* (Signoret). Photograph by: Rodrigo Diaz, University of Florida

canals). However, plants growing in resource rich environments (deep floodplains, high nutrients runoff) can sustain some damage by *I. variegatus* without impact on the plant's reproductive output (Diaz 2008).

### Natural Enemies

*Ischnodemus variegatus* has two natural enemies in Florida: the egg parasitoid *Eumicrosoma* sp. (Hymenoptera: Scelionidae) and the entomopathogen *Beauveria bassiana* (Balsamo) Vuillemin (Deuteromycotina: Hyphomycetes). The egg parasitoid was identified as a potentially accidentally introduced, non-native species for North America (T. Nuhn 2005, personal communication). It attacks young and old eggs, and parasitized eggs turn black. Field sampling in Florida demonstrated that the impact of these natural enemies is minimal to *I. variegatus* populations.

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