

Brazilian Peppertree Seed Chalcid: Wasp Wages War on Widespread Weed

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Introduction

Brazilian peppertree, *Schinus terebinthifolius* Raddi (Anacardiaceae), is an evergreen shrub or small tree native to Argentina, Paraguay and Brazil (Ewel et al. 1982). Introduced into Florida as a landscape ornamental in the late 19th century, the popularity of Brazilian peppertree as an ornamental plant was attributed to the numerous bright red drupes produced during the holiday season in Florida. Brazilian peppertree is now recognized as a highly invasive species that quickly dominates disturbed sites as well as natural communities where it forms dense thickets that completely shade out and displace native vegetation. Brazilian peppertree is the most widespread of Florida's invasive weed species (Schmitz 1994), and is considered one of the most important threats to biodiversity because it disrupts native plant and animal communities. Birds occasionally become intoxicated following ingestion of the drupes (or fruits) that remain on the trees for several months (Campello and Marsaioli 1974). Furthermore, volatiles produced by the flowers can cause sinus and nasal congestion in sensitive humans, and direct contact with the plant's sap can irritate the skin and cause allergic reactions similar to poison ivy. The distribution of Brazilian peppertree extends from the Keys to Duval County on the east coast and to Levy County on the west coast of Florida (Fig. 1) (Wunderlin and Hansen 2000).

In the 1980s, surveys of the arthropods associated with Brazilian peppertree were conducted in Florida as a first step towards developing a classical (or importation) biological control program

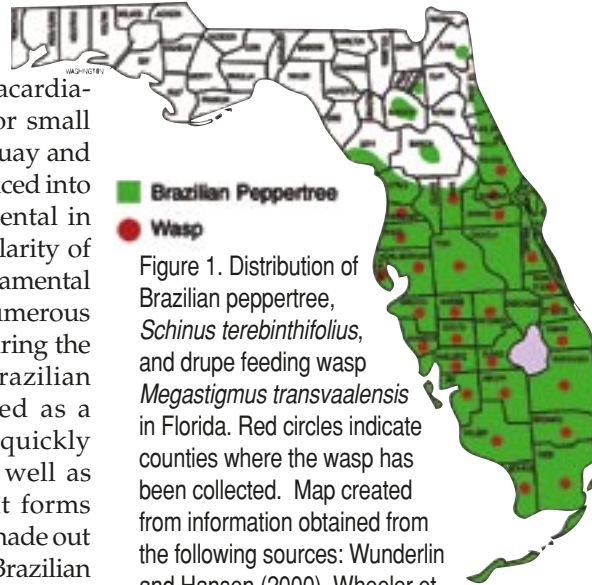


Figure 1. Distribution of Brazilian peppertree, *Schinus terebinthifolius*, and drupe feeding wasp *Megastigmus transvaalensis* in Florida. Red circles indicate counties where the wasp has been collected. Map created from information obtained from the following sources: Wunderlin and Hansen (2000), Wheeler et al. (2001) and D. H. Habeck, unpublished data.

against this highly invasive weed (Casani 1986, Cassani et al. 1989). One of the reasons for conducting these domestic surveys was to conserve limited resources and valuable time that would otherwise be wasted surveying for natural enemies in Brazil that might already be established in Florida. Although an extensive list of insects associated with Brazilian peppertree was compiled during these surveys, none of the insects identified severely damaged the drupes of the plant. Because Brazilian peppertree reproduces and spreads mostly by seeds (Langeland and Burks 1998, Tobe et al. 1998), the introduction of a natural enemy that preferentially attacks the drupes would contribute to the biological control of this invasive weed by limiting the production and dispersal of the seeds. The importance of seed predation was recognized in an earlier biological control program against Brazilian peppertree in Hawaii, and eventually led to the introduction of the seed-feeding beetle *Lithraeus atronotatus* (Pic) (Coleoptera: Bruchidae) into the islands in the 1950s (Julien and Griffiths 1998).

In 1988, an insect previously unknown to Florida was reared from the drupes of Brazilian peppertree collected in Palm Beach County (Habeck et al. 1989). The insect was subsequently identified as *Megastigmus transvaalensis* (Hussey) (Hymenoptera: Torymidae), a phytophagous seed chalcid wasp (see cover). The Brazilian peppertree seed chalcid *M. transvaalensis*, also known as the Brazilian peppertree drupe feeding wasp, is an adventive species that probably arrived in Florida as a contaminant of the fruits sold as pink peppercorns in gourmet food stores (Habeck et al. 1989). Other possible modes of arrival in Florida include wasp-infested drupes of Brazilian peppertrees imported as ornamental plants (Grissell and Hobbs 2000), or infested drupes sold at craft stores for holiday decorations (Wheeler et al. 2001).

Distribution

Worldwide, the Brazilian peppertree seed chalcid has been reared from drupes of *Schinus* spp. collected in Argentina (Wheeler et al. 2001), Brazil (Grissell and Hobbs 2000), the Canary Islands (Grissell 1979), Réunion, Mauritius (Habeck et al. 1989) and South Africa, where it is considered a native species (Grissell 1979). In the United States, the wasp has been reported from California (Harper and Lockwood 1961), Hawaii (Beardsley 1971), and Florida (Habeck et al. 1989). In Florida, the insect has been recovered from Brazilian peppertree drupes collected in the following counties: Brevard, Broward, Charlotte, Collier, Dade, DeSoto, Glades, Hardee, Hendry, Hernando, Highlands, Hillsborough, Lake, Lee, Martin, Orange, Palm Beach, Pasco, Pinellas, Polk, Sarasota, Seminole, St. Lucie, and Volusia (Fig. 1) (Wheeler et al. 2001, D. H. Habeck, unpublished data).

Description

Adult. Adults of the Brazilian peppertree seed chalcid are pale yellow-brown

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in color (see cover photo). Males range in size from 2.3 to 2.9 mm whereas females tend to be larger. Body length for female wasps ranges from 3.1 to 3.4 mm; the length of the abdomen and ovipositor range in size from 1.2 to 1.4 and 1.5 to 1.9 mm, respectively. Almost half of the overall body length in females is attributed to the ovipositor (Hussey 1956). Gravid females of *M. nigrovariegatus*, another *Megastigmus* wasp for which there is more published descriptive information, normally contain 10 to 25 eggs (Milliron 1949). Presumably, females of *M. transvaalensis* are capable of producing the same number of eggs.

Egg. The egg stage of *M. nigrovariegatus* is composed of three parts: a long narrow anterior stalk, an elongate-oval body, and a short spur-like posterior stalk (Fig. 3) (Milliron 1949). Individual eggs range in size from 0.99 to 1.5 mm in length, are grayish white in color, and the entire surface is glossy and smooth, lacking ornamentation. The eggs of *M. transvaalensis* probably are similar in shape, size and texture.

Larva. The Brazilian peppertree seed chalcid presumably has five instars, the same number of instars reported for *M. nigrovariegatus* (Milliron 1949). Although more than one egg may be deposited inside a drupe, the larvae are cannibalistic and usually only one larva (Fig. 4) is capable of completing its development. Occasionally, a single drupe will support complete development of two larvae.

Pupa. After the larvae of the Brazilian peppertree seed chalcid attain their maximum size, they transform into the pupal stage (Fig. 5) and remain in a prolonged diapause (or resting) period for several months. Adult emergence seems to be photoperiod-induced and occurs when the drupes containing viable pupae are exposed to short daylength (12-hr photoperiod), which coincides with the flowering phase of Brazilian peppertree during the fall of the year (Wheeler et al. 2001).

Life Cycle

The complete life history of *M. transvaalensis* has not been investigated but a generalized biology of seed-attacking *Megastigmus* wasps was described by (Milliron 1949). After mating, the female deposits an egg

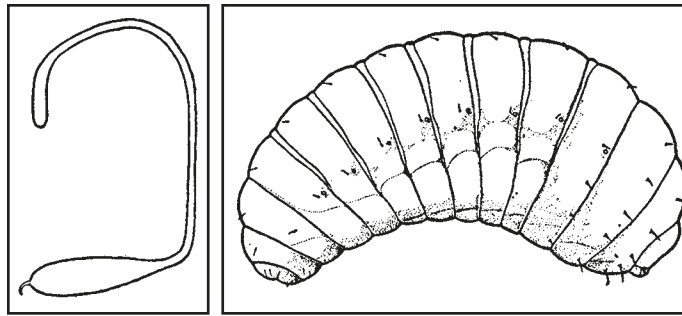


Figure 3. Line drawing of egg stage of *Megastigmus* wasp. Source: H. E. Milliron (1949).

inside the developing drupe where all life stages of the wasp are passed. The egg incubation period is short, and larvae probably hatch in 4 to 5 days. After several months, a single adult emerges from the drupe. However, this period may be shorter in *M. transvaalensis* as adults emerged a few weeks after flower initiation (G. S. Wheeler, unpublished data). Prior to emergence of the adult wasp, it is difficult to distinguish between attacked and unattacked drupes because there apparently is no external evidence of the insect developing inside until the adult chews a circular emergence hole in the wall of the drupe.

The Brazilian peppertree seed chalcid apparently has two generations per year that are synchronized with the winter and spring drupe production periods of its host plant. The sex ratio of wasps emerging from drupes of Brazilian peppertree averaged over a two-year period was 2:1 (females: males) (Wheeler et al. 2001).

Host Plants

The Brazilian peppertree seed chalcid is capable of developing and reproducing on plants in the genera *Rhus* and *Schinus*. The host range of the insect includes at least three *Rhus* spp. native to South Africa, including *Rhus laevis* L. and *R. angustifolia* L. (Hussey 1956, Grissell 1979, Yoshioka and Markin 1991). *Schinus molle* L. and *S. terebinthifolius*, both native to South America, are considered novel host plants (Hussey 1956, Habeck et al. 1989). No native members of the Anacardiaceae, or cashew family, found within the Florida distribution of Brazilian peppertree are attacked by the wasp despite numerous attempts to rear the insect from the drupes of high-risk species such as winged sumac, *Rhus copallina* L. (Wheeler et al. 2001).

Importance

Megastigmus transvaalensis inhibits

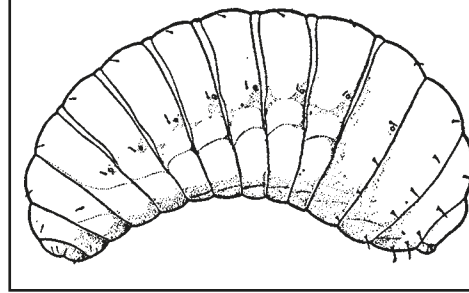


Figure 4. Line drawing of mature larva of *Megastigmus* wasp. Source: H. E. Milliron (1949).

Figure 5. Female pupa of *Megastigmus* wasp prior to adult emergence. Note ovipositor curved over the back of the abdomen. Source: H. E. Milliron (1949).



seed production and may reduce the spread of Brazilian peppertree into natural areas where this invasive weed is displacing native species. In a two-year study, up to 31% and 76% of the Brazilian peppertree drupes were damaged by the wasp during the winter and spring fruit production periods, respectively (Wheeler et al. 2001). The single seed developing inside the drupe also fails to germinate when damaged by the wasp.

An augmentation program is currently underway in the Everglades National Park (G. S. Wheeler, personal communication). Wasps are being reared and released in remote areas infested with Brazilian peppertree where the insect is not established. Further research is needed to determine why a higher incidence of wasp-damaged drupes was observed in Brazilian peppertree plants occurring north of Lake Okeechobee and in more inland rather than coastal sites (Wheeler et al. 2001).

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