

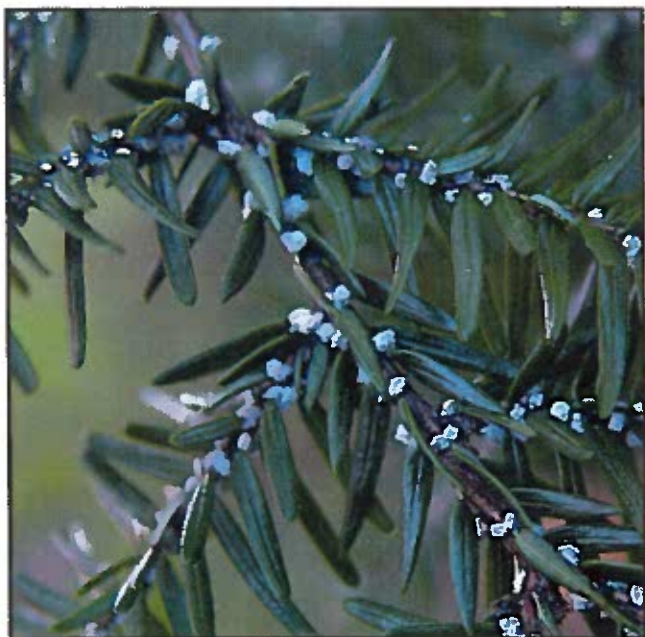


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The Use of Classical Biological Control to Preserve Forests in North America

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Forest Health Technology Enterprise Team

XXX SOAPBERRY BORER

(*Agrilus prionurus* Chevrolat) (Coleoptera: Buprestidae)

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DESCRIPTION OF PEST

Taxonomy

The soapberry borer, *Agrilus prionurus* Chevrolat, is a native North American beetle in the subfamily Agrilinae, genus *Agrilus*, subgenus *Agrilus*. French entomologist Louis Alexandre Auguste Chevrolat first described *A. prionurus* in 1838 from a specimen presumably collected in Mexico (Chevrolat, 1838, labeled the holotype only as "Mexique"). The genus *Agrilus* (family Buprestidae - commonly called jewel beetles or metallic wood boring beetles) is a cosmopolitan genus that contains 2,783 described species (Bellamy, 2008), including numerous species in North America. It is believed to be the largest genus in the entire animal kingdom (Bellamy, 2003). *Agrilus* species are primarily twig and branch borers, using recently dead wood for larval development. A few species are recognized as tree-infesting pests, e.g., *Agrilus anxius* Gory (bronze birch borer) and *Agrilus bilineatus* (Weber) (two lined chestnut borer). Others, like *A. prionurus*, are not considered major pests in their native ranges, but have become highly damaging in new areas. The latter include *Agrilus planipennis* Fairmaire (emerald ash borer) (Cappeart et al., 2005; Poland and McCullough, 2006) and *Agrilus auroguttatus* Schaeffer (goldspotted oak borer) (Coleman and Seybold, 2008).

Distribution

The soapberry borer is believed to be native to northern Mexico (Wellso and Jackman, 2006; Westcott and

Hespenheide, 2006). It was first reported in Texas (USA) in 2003, infesting and killing western soapberry, *Sapindus saponaria* var. *drummondii* (Hook. & Arn.) L. Benson in Travis Co. (Wellso and Jackman, 2006) (Fig. 1). This tree is the borer's only known host. Western soapberry is a small- to medium-sized deciduous tree (7.7–15.4 m tall) found in Texas and surrounding states as well as in northern Mexico.



Figure 1 Western soapberry (*Sapindus saponaria* var. *drummondii*) trees can be distinguished from Chinaberry trees (*Melia azedarach* L.) by the single sets of compound leaves and the off-set midveins and lack of serration on the individual leaflets. Ronald F. Billings, Texas Forest Service, Bugwood.org.

In the United States, it is valued for its fruits, colorful fall foliage, and utility as a landscape tree (Fig. 2) (Little, 1950; Phillips and Gibbs, 1953; Dirr, 1990). *Sapindus saponaria*, used for medicinal purposes in Mexico, is found in various states, including Sonora, Guerrero, Oaxaca, Quintana Roo (Argueta et al., 2012), San Luis Potosi (Rzedowski, 1978), Tamaulipas, and Veracruz (Westcott and Hespeneheide, 2006).

The native range of the insect is unknown, but is presumed to be Mexico because of the origin of the type specimen. A specimen in the Texas A&M University insect collection in College Station was labeled as collected in 1978 in Rio Sabinas, El Encino, in the State of Tamaulipas, Mexico (Westcott and Hespeneheide, 2006). Another specimen was collected in 1984 from 80 km south of Ciudad Victoria, also in the State of Tamaulipas (Wellso and Jackman, 2006). How this insect arrived in Texas, assuming it is not native, remains unknown. Texas and

Mexico are separated by semiarid grasslands with scattered non-host shrubs and cactus along the southern border and by arid desert along the western border. This hostile environment creates an environmental barrier that has historically prevented tree-infesting insects from invading Texas from the south. But increased planting of western soapberry as an ornamental in Texas and possibly northern Mexico and a series of mild, frost-free winters may have favored the natural spread of the insect to the north. Conceivably, the insect could have arrived in infested firewood, a common means of long-distance transport for wood-boring insects.

Reports by landowners and arborists indicate that the insect had probably been infesting soapberry trees in Texas since the 1990s. Infested trees were observed in Travis and McLennan counties as early as 1998 (J. Pulley, personal communication). In 2009 and 2010, the Texas Forest Service received many reports from residents near

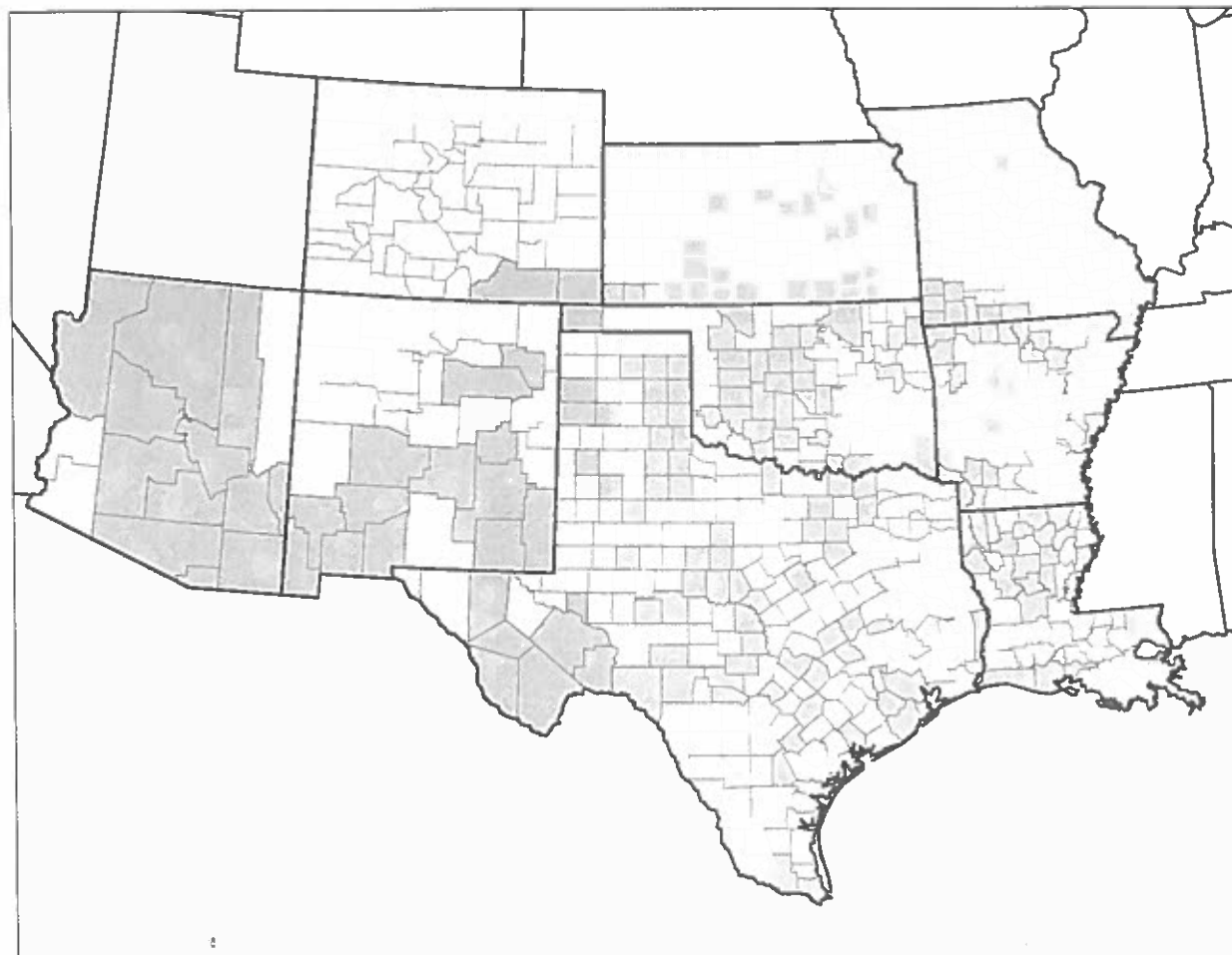


Figure 2 Counties (shaded) with western soapberry in the United States, based on USDA Natural Resource Conservation Service records.

Houston and Dallas of soapberry borers killing soapberry trees in urban and rural settings. In addition, Texas Forest Service entomologists observed multiple-tree infestations in Fort Bend, Brazos, and Dallas counties during this period (Billings et al., 2012).

Damage

Type Damage from this borer is similar to that of other wood borers in the genus *Agilus*. Larvae feed under the bark in the phloem, and if numerous, can girdle and kill trees in a manner similar to that of the more familiar emerald ash borer.

Extent As of January 2012, infestations of this insect had been reported in 50 counties in Texas, including areas near or within the cities of Fort Worth, Dallas, Waco, College Station, Austin, Houston and Corpus Christi (Fig. 3). No infestations have been observed or reported from adjacent states.

In 2009–2011, it was common for *A. prionurus* to kill essentially every western soapberry tree larger than 6 cm in diameter at breast height (dbh) upon invading an area (Billings et al., 2012). However, in the past year, new infestations have been few and reports from concerned landowners have subsided, presumably due to the freezing temperatures experienced in February 2011. Infested areas are being monitored to determine if this invasive insect will recover and continue its spread in Texas and beyond. It is too early to know the full impact of *A. prionurus* on soapberry trees in the United States, as is the case with a related wood borer, the European oak borer, *Agilus sulcicollis* Lacordaire. This latter insect was first collected from oaks in Michigan in 2003 (Jendek and Grebennikov, 2009) and subsequently in New York, and Ontario, Canada (J. Zablotny, personal communication), but its economic impact on North American oaks remains to be determined.

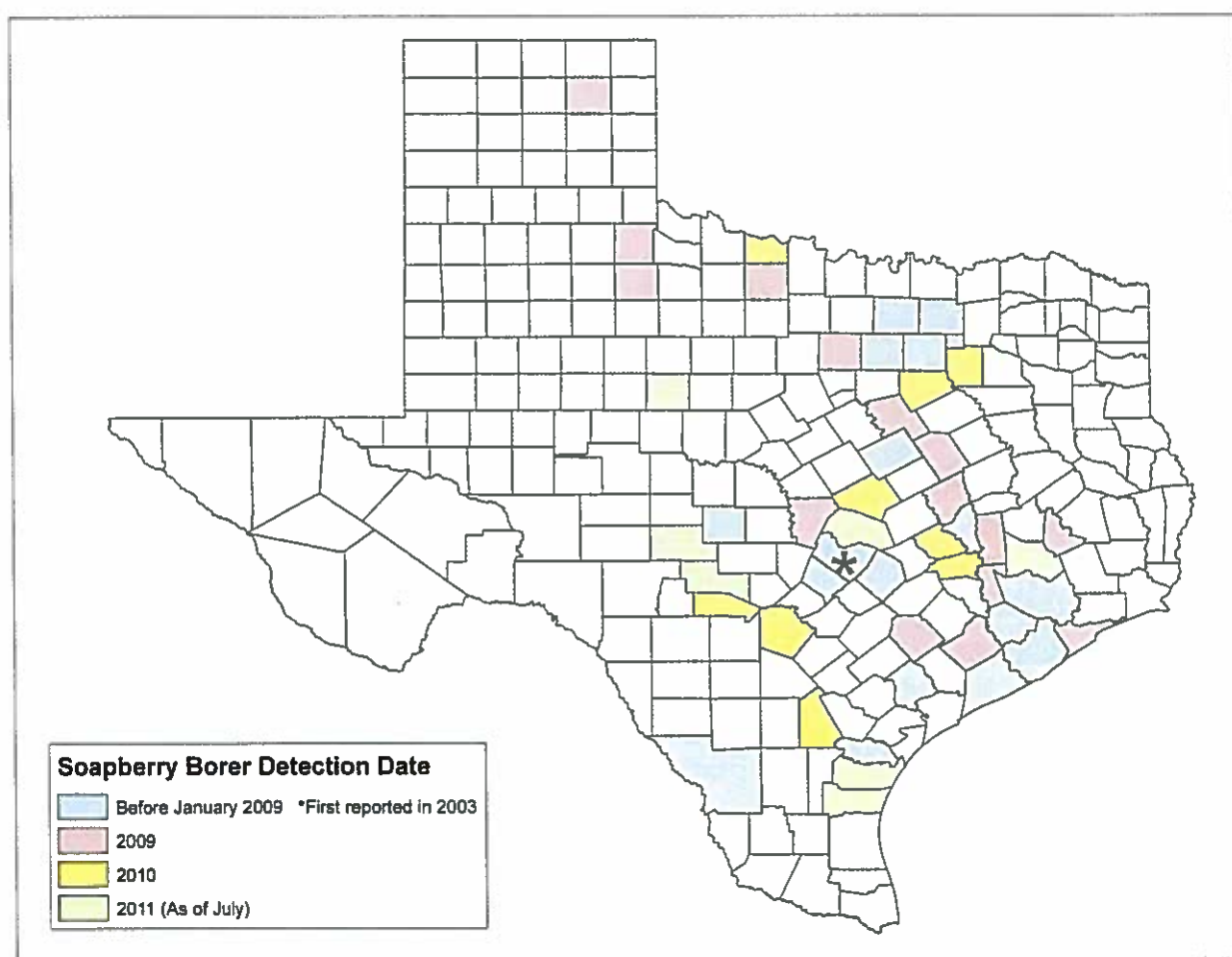


Figure 3 Counties in Texas known to be infested by *Agilus prionurus* (soapberry borer) in Texas by year of detection as of April 2012 showing spread since the insect was first detected in Travis County (*) in 2003.

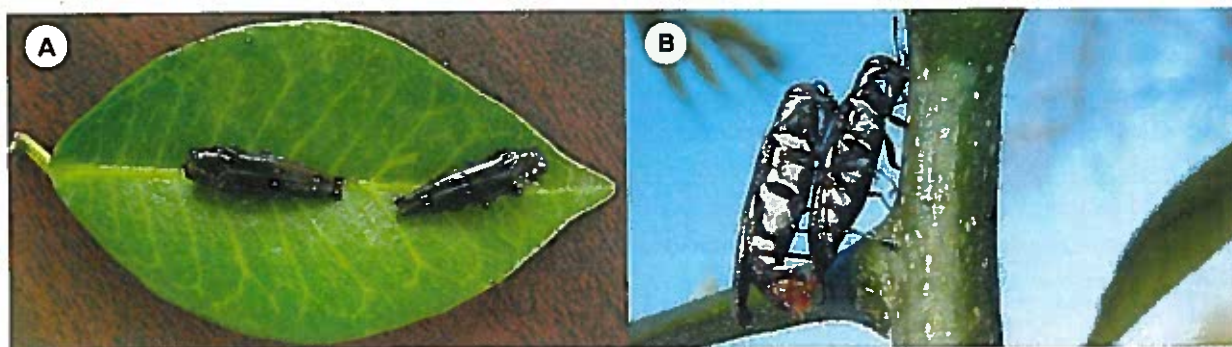


Figure 4 (A) Adults of *Agrilus prionurus* are about 10 mm long and have shiny black bodies with four white dots on the elytra. Ronald F. Billings, Texas Forest Service, Bugwood.org. (B) Adults of the native *Agrilus limbiae* Knull are common on soapberry, but are smaller (about 5 mm long) and have white markings on the underside of the abdomen.

Biology of Pest

The adult of *A. prionurus*, 8–12 mm long, has a shiny, black to slightly green body that is distinctively marked with four white dots on the elytra (Fig. 4A). The adult female lays eggs on the bark of live western soapberry trees, and the larvae develop beneath the bark in winding galleries (Fig. 5). The larvae are up to 3 cm long when mature. After feeding beneath the bark, the larvae bore into the wood to complete development and pupate. New adults emerge through the bark, leaving “D”-shaped exit holes, characteristic of all species of *Agrilus*.



Figure 5 Galleries and larvae of *Agrilus prionurus* under bark of infested western soapberry. Ronald F. Billings, Texas Forest Service, Bugwood.org.

Signs of soapberry borer infestations are similar to those of the destructive emerald ash borer, a close relative not yet found in Texas (Wilson and Rebek, 2005). The first sign of soapberry borer infestation usually noticed by landowners is large chips of bark that flake off the bole (Fig. 6) and accumulate at the base of the infested tree,

a result of woodpeckers feeding on the larvae. Infested trees eventually die back from the top, often producing abundant epicormic shoots on the lower trunk (Fig. 7). Infested trees typically die within two or three years after the initial attack.



Figure 6 The first signs of soapberry borer infestation are trees with bark missing from the tree bole and bark chips at the tree base. Ronald F. Billings, Texas Forest Service, Bugwood.org.

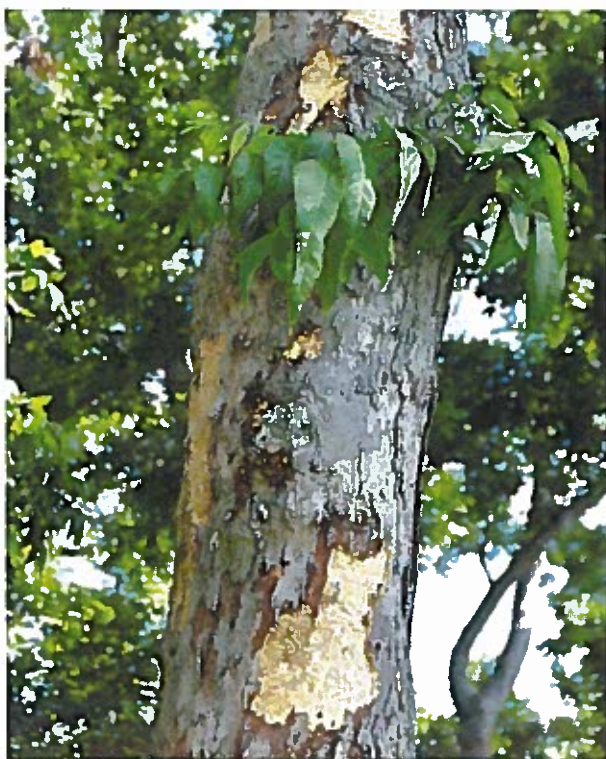


Figure 7 The winding larval galleries are visible on the bark chips and sapwood. Infested trees characteristically die from the top downward and exhibit numerous epicormic shoots along the lower trunk. Ronald F. Billings, Texas Forest Service, Bugwood.org.

The authors have conducted several rearing studies to determine when *A. prionurus* adults emerge in Texas. Peak emergence occurred in May from infested log sections collected near Houston and Austin and as late as August from infested material collected near Dallas. In 2004, some beetles were observed to emerge as early as February 29 (from infested logs collected near Austin in September, 2003). No emergence occurred after August in any of the rearing studies.

Purple and green sticky traps developed for the emerald ash borer have proven largely ineffective in catching soapberry borer adults, even in established infestations (Billings et al., 2012). In one survey, 16 traps were deployed within four known soapberry borer infestations in mid-June (six traps near Richmond, and two near College Station, Texas in 2009; six in Allen and two in Mesquite, Texas in 2010) and monitored until mid-August, only two adult soapberry borers were collected from these traps, both from Brazos County and both from the single unbaited trap. One adult was collected on June 23 and the second on July 2, 2009. The presence of manuka oil on nine

of the traps did not increase trap catches. The fact that peak emergence of *A. prionurus* was determined from rearing studies to occur in May in Texas suggests that the traps may have been placed in the field at sub-optimal times. Data from rearing and trapping studies suggest that the soapberry borer has one generation per year in Texas, with adult emergence occurring primarily from May through mid-August.

ANALYSIS OF RELATED NATIVE INSECTS IN THE UNITED STATES

Native Insects Related to the Pest (Nontarget Species)

Large numbers of a related native borer, *Agrilus limbiae* Knull, were collected from both the survey traps and rearings of infested soapberry logs (Billings et al., 2012). Adults of *A. limbiae* were observed mating on foliage of western soapberry in Dallas County on April 1, 2011 (Fig. 4B, above). *Agrilus limbiae* is one of seven native buprestids known to occur on western soapberry in the United States. Unlike *A. prionurus*, all the native species are believed to be secondary woodborers, infesting only dying or dead trees, including *Agrilus egeniformis* Champlain & Knull, *Agrilus exsapindi* Vogt, *A. limbiae* Knull, *Agrilus ornatulus* Horn, *Agrilus sapindi* Knull, *Agrilus scitulus* Horn, and *Agrilus taeniatus* Chevrolat. Stan Wellso collected adults of *A. exsapindi* and *A. taeniatus* from western soapberry on the Santa Ana Wildlife Refuge in Hidalgo County near the Texas-Mexico border. Interestingly, one specimen of *A. exsapindi* was collected in Mexico at the same site that John Jackman collected *A. prionurus*. Several of these native species might be at risk if nonnative biological control agents were imported to control *A. prionurus*. The potential for this side effect to occur should be evaluated before release of new species of natural enemies against soapberry borer.

Native Natural Enemies Affecting the Pest

To date, no natural enemies have been reared from *A. prionurus* or host material infested with its immature stages in Texas. Natural enemies of this wood borer within its native range of northern Mexico are unknown.

HISTORY OF BIOLOGICAL CONTROL EFFORTS

Area of Origin of Insect

The authors know of no collections of *A. prionurus* between 1838, when Chevrolat described the species, and 1978, when a specimen was collected in Rio Sabinas, El Encino, State of Tamaulipas, Mexico (Westcott and Hespenheide, 2006). In 1984, entomologist John Jackman (Texas A&M University) collected this insect using a sweep net along a primitive road 80 km south of Ciudad Victoria, Mexico (Wellso and Jackman, 2006). Based on a specimen in the Museum National d'Histoire Naturelle (Paris, France), the insect also has been collected from Córdoba in the State of Veracruz, Mexico (Westcott and Hespenheide, 2006). The location where Jackman collected the insect in Mexico is ~450 km from the Texas border. The host at the time was unknown. Interestingly, Wellso and Jackman also collected another species of *Agrilus* from a *Sapindus* species in the same area of Mexico. This beetle, subsequently described as *A. lantuelliformis* Hespenheide, is considered a secondary wood borer and has not been found in Texas.

RECOMMENDATIONS FOR FURTHER WORK

To date, no attempts have been made to conduct a biological control program against *A. prionurus*. If this insect continues to be a pest on western soapberry in Texas or other states in the southwest United States, a biological control project, modeled after the ones being developed for *A. planipennis* (emerald ash borer) in Michigan (Bauer et al., 2008) or *A. auroguttatus* (goldspotted oak borer) in California (Seybold and Coleman, 2010), would be warranted. Studies to identify parasites or predators of various life stages of *A. prionurus* in Mexico and to explore the possibility of introducing these into Texas for biological control have yet to be conducted.

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