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Notes and Commentary

Identification and Control of Invasive Privets (*Ligustrum* spp.) in the Middle Southern United States

Victor Maddox, John Byrd, Jr., and Brett Serviss*

The identification of privet in the middle southern United States can be difficult. Because most introduced species of privet can be invasive, and recent mapping projects seek location and species population data, proper identification is important. Without proper identification of privet species, data on species distributions and other pertinent information regarding invasiveness could lead to improper conclusions. Currently, information on privet identification is scattered throughout a number of reference materials. The purpose of this publication is to assist with the proper identification of escaped privet species, and suggest management options.

Nomenclature: Fosamine ammonium; glyphosate; hexazinone; imazapyr; metsulfuron; triclopyr; 2,4-D; 2,4-DP; Amur privet, *Ligustrum obtusifolium* Sieb. & Zucc. var. *suave* (Kitagawa) Kitagawa (Syn. *L. amurense* Carrière); border privet, *Ligustrum obtusifolium* Sieb. & Zucc. var. *obtusifolium*; California privet, *Ligustrum ovalifolium* Hassk.; Chinese privet, *Ligustrum sinense* Lour.; common privet, *Ligustrum vulgare* L.; glossy privet, *Ligustrum lucidum* Ait.; Japanese privet, *Ligustrum japonicum* Thunb.; waxyleaf privet, *Ligustrum quihoui* Carrière.

Key words: Invasive species, management.

Since the 1700s, at least nine species of privets have been introduced into the United States; it is probable that all were introduced as ornamentals. They have been very successful as ornamentals and continue to be marketed for such purposes. In addition to these species, there are many hybrids and cultivars (Dirr 1998). However, in the United States all privets are nonnative and most have escaped from cultivation. They are native from Europe to North Africa and east to Asia and Australia. Amur [*Ligustrum obtusifolium* Sieb. & Zucc. var. *suave* (Kitagawa) Kitagawa], Chinese (*Ligustrum sinense* Lour.), and waxyleaf (*Ligustrum quihoui* Carrière) privets are native to China; border (*Ligustrum obtusifolium* Sieb. & Zucc. var. *obtusifolium*) and California (*Ligustrum ovalifolium* Hassk.) privets are native to Japan; common or European privet (*Ligustrum vulgare* L.) is native to Europe and North Africa; glossy privet (*Ligustrum lucidum* Ait.) is native to China, Korea, and Japan; and Japanese privet (*Ligustrum japonicum* Thunb.) is native to Korea and Japan. The most common species in the southern portion of the middle southern region is Chinese privet, although Amu, border, California, common or European, glossy, Japanese, and waxyleaf or Quihoui privets also have escaped (USDA–NRCS 2009). In the southern United States, most privet species readily escape cultivation and naturalize in areas surrounding sites of cultivation. Chinese, common, and waxyleaf privet form dense monocultural stands once established.

Most species are widespread in cultivation, and thus are not regulated by noxious weed regulations. However, Chinese privet is included on all state invasive species lists in the southeast (Miller et al. 2004). It is considered one of the top ten weeds in Alabama and Georgia, and a Category 1 invasive plant in Florida. In Kentucky, South Carolina, and Tennessee, it is a severe threat and is included on state invasive plant lists in Mississippi and Virginia. Common privet is a Rank 1 (severe) threat and Japanese privet is a Rank 2 (significant) threat in Tennessee natural areas (Miller et al. 2004).

Description of Privet Species

There are approximately 40 species of *Ligustrum* which are native from Europe to Asia and northern Australia. Privets are in the Oleaceae family, and thus generally are

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* Postdoctoral Associate, Geosystems Research Institute, Mississippi State University, Mississippi State, MS 39762; Extension Research Professor, Mississippi State University, Mississippi State, MS 39762; Associate Professor of Biology, Henderson State University, Arkadelphia, AR 71999-0001. Corresponding author's E-mail: vmaddox@gri.msstate.edu

Interpretive Summary

Several species of privet are invasive in the middle southern United States. Recent mapping projects seek location and species population data; thus proper identification is important. Without proper identification of privet species, data on species distributions and other pertinent information regarding invasiveness could lead to improper conclusions. Currently, information on privet identification is scattered throughout a number of reference materials. The authors believe the information provided in this publication will assist with the proper identification of escaped privet species. Management of invasive species is a valuable tool. Currently, management options also are scattered throughout a number of reference materials. Although various researchers continue to conduct privet control studies, current management suggestions for privet are provided in this publication.

recognized as a group by their simple, opposite (rarely whorled) leaves with entire margins (Figure 1) and four-lobed corollas (Figure 2). Flowers are white in dense or open, terminal or subterminal axillary panicles (Figure 2). The fragrance of the flowers is loved by some, but hated by others. Privets produce drupes containing one to four seeds.

Although some species are very similar in appearance, most can be identified to species without extreme difficulty. Amur, border, California, common, and waxyleaf privets

Figure 1. Leaf comparison of different privets. Left to right are: Border privet (*Ligustrum obtusifolium* var. *obtusifolium*), Amur privet (*L. obtusifolium* var. *suave*), California privet (*L. ovalifolium*), waxyleaf privet (*L. quihoui*), Chinese privet (*L. sinense*), Japanese privet (*L. japonicum*), and glossy privet (*L. lucidum*). Images taken from material collected on same site in Webster County, Mississippi on February 5, 2009. Note discoloration of border and Amur privet, a deciduous characteristic; plants had very few remaining leaves. Common privet (*L. vulgare*) had no leaves (deciduous) and is not shown (photo by Victor Maddox, MSU–Geosystems Research Institute).

Figure 2. Chinese privet (*Ligustrum sinense*) (A) along a fencerow on a forest margin; (B) flowers in dense panicles; (C) foliage showing leaf shape and arrangement; (D) flowers showing four-lobed corollas and exerted purple stamens; and (E) fruit in winter showing color and shape of drupes (photos by Victor Maddox, MSU–GRI).

are similar in appearance to Chinese privet, especially at a glance. A closer look is generally required to separate this group of species. In summer, all generally have leaves; thus deciduous species may look similar to evergreen species during the growing season. There are some distinct groups, but most privets have relatively small leaves. Glossy and Japanese privets have larger leaves compared to other privet species discussed in this publication (Figure 1); both are evergreen. Border and common privet are deciduous, although other species such as Amur, California, Chinese, and waxyleaf privet can be deciduous in the northern parts of the middle southern United States. Amur privet, border privet, California privet, Chinese privet, common privet, and waxyleaf privet are escaped species with smaller leaves (Figure 1). A key to privet species escaped in the MidSouth is provided to facilitate identification (Appendix 1). Other keys for various privet species can be found in Bailey

(1951), Nesom (2009), Radford et al. (1968), Shu (1996), Smith (1994), and Wunderlin (1998). High-resolution images of several privet species also are available on the web (Serviss 2010).

Chinese privet has eight recognized botanical varieties in Asia (Shu 1996). However, most varieties are restricted to China. *Ligustrum sinense* var. *sinense* apparently is the variety commonly escaped in the United States and is discussed here as Chinese privet. Common to the MidSouth, it is a semievergreen (north) to evergreen (south) shrub that can reach 10 m (33 ft) (Figure 2). Very large shrubs can have the appearance of a small tree. Chinese privet can produce many stems to form dense thickets (Figure 2). The bark is typically brownish to grayish, sometimes greenish, thin, and usually smooth, with light-colored lenticels. Branching often is at near right angles from the main trunk. Leaves usually are opposite, rarely whorled, and typically ovate to elliptic with a rounded tip (Figure 2). Leaves are approximately 1.25 to 3.5 cm (0.5 to 1.4 in) long and 1.0 to 3.0 cm wide. Leaves are dull to lustrous green above and paler green with a hairy midvein (midrib) beneath. Leaf blades are relatively thin compared to glossy or Japanese privets. Leaf shapes vary in size and shape on all small-leafed species, but Figure 1 illustrates some minor differences.

Floral features, when present, can be used to identify the various species (Table 1; Appendix 1). Flowering time, flower position, corolla tube to corolla lobe length, corolla length, and anther position can be important characteristics for identifying privet species. Chinese privet abundantly produces flowers from April to June (Figure 2; Table 1), but flowering varies with species (Table 1) as depicted in Figure 3 with glossy and Japanese privet. Flowering typically starts in June for Amur, California, and Japanese privets in the Carolinas (Radford et al. 1968). Some reflowering also can occur in certain species such as Amur, California, Chinese, and Japanese privets in the fall. Flowers range from sessile to pedicellate. Corolla length varies with species and ranges from 3.5 to 10 mm (0.14 to 0.4 in) (Table 1). Stamens are typically exerted beyond the corolla in Chinese (Figure 2), but vary with privet species (Table 1). Butterflies and other insects frequently visit the flowers.

Fruits are persistent and can be attached to limbs from July to March. Immature fruits are green then turn dark blue or black by winter (Figure 2). Fruit of Chinese privet are ovoid to globose (Figure 2), but vary in both size and shape with privet species (Table 1). Occasionally fruit can be hook-shaped on species such as glossy privet (Figure 3), unlike Chinese privet (Figure 2). The fruits, which are drupes, typically are formed in dense clusters that hang on the stems.

A recent study indicates that border privet might have a chemical defense against herbivores (Konno et al. 1999). It

Table 1. Flower and fruit characteristics of invasive privet (*Ligustrum* spp.) in the middle southern United States.

Common Name	Scientific Name	Flowering Time	Flower	Ratio[a]	Corolla Length (mm)	Anther Position[b]	Fruit Length (mm)	Fruit Shape
Japanese privet	*Ligustrum japonicum*	May–July	Sessile to subsessile	~1	4.7–6	Exserted	6–10	Globose to slightly ellipsoid
Glossy privet	*L. lucidum*	July–August	Sessile to subsessile	≤ 1	4–5	Slightly inserted or equal	7–10	Obovoid or reniform
Border privet	*L. obtusifolium* var. *obtusifolium*	June–July	Short-pedicelled	2–3	5–10	Slightly inserted or equal	6–8	Subglobose to broadly ellipsoid
Amur privet	*L. obtusifolium* var. *suave*	May–June	Short-pedicelled	1.5–2.5	5–10	Slightly exserted or equal	6–8	Subglobose to broadly ellipsoid
California privet	*L. ovalifolium*	June–July	Almost sessile	2–3	4.5–6 (8)	Slightly exserted	5–7	Ovoid to subglobose
Waxyleaf privet	*L. quihoui*	September–October	Sessile to subsessile	≤ 1	4–5	Exserted	5–9	Subglobose to ellipsoid
Chinese privet	*L. sinense*	April–June	Pedicellate	≤ 1	3.5–5.5	Slightly exserted or equal	5–8	Subglobose to obovoid
Common privet	*L. vulgare*	May–July	Pedicellate	≤ 1	4–5	Inserted	6–8	Ovoid to globose

[a] Corolla tube to corolla lobe ratio.

[b] Anther position with regard to corolla tube.

Figure 3. Japanese privet (*Ligustrum japonicum*) (left) and glossy privet (*L. lucidum*) (right) (A) showing flowering, foliage, and canopy differences and (B) glossy privet foliage and young fruit showing size and color (notice the open panicle and hooked fruit) (photo by Victor Maddox, MSU–GRI).

is possible that other species have similar mechanisms (Sung et al. 2006). Fruit of common privet have been considered toxic, with some child fatalities reported (Mabberley 1997). However, the fruit of other species, such as Japanese privet, have been used medicinally in other countries. Other medical studies on privet species also have revealed potentially benefits to human health (Chen et al. 1993; Lau et al. 1994; Ma et al. 2001; Sung et al. 2006).

Habitat

Privets can be highly aggressive, often forming nuisance thickets. They often are found on disturbed ground, in old fields, along fencerows and rights-of-way, on ditch banks, along forest margins, or in open-canopy forests. Often, more than one species occur together, complicating identification. Some, if not all, privet species primarily are dispersed by birds and other animals, which eat fruit and disperse the seeds. Swearingen et al. (2002) states that birds and other animals excrete seeds undamaged. Seed of Chinese privet are viable and hundreds of seedlings can be seen under one parent, despite a low germination rate of 5 to 25%. Other privets, such as border and glossy privet, also can establish well from seed. In an old field in Illinois, border privet averaged over 2,400 plants per acre (Remaley and Bargeron 2003), which illustrates its invasive potential. Once established, privets can produce sprouts from roots that are underground or near the surface, or from stumps. This is particularly true for Chinese privet, but it also has been reported in glossy and Japanese privet (Miller 2003). It can be difficult to control an established stand of privet.

Distribution

Most privet species were early introduced into cultivation in the United States. Dirr (1998), for example, indicates that glossy privet was introduced in 1794; Japanese privet was introduced in 1845; California privet was first cultivated in 1847; Chinese privet was introduced in 1852; and Amur and border privets were introduced in 1860. Because these are early reports, it is possible that some were introduced into cultivation even earlier and there might have been multiple introductions of each species. For example, Mabberley (1997) reports the use of common privet in hedging as early as 1548 in Europe where it is native. Thus, privets have had many years to spread across landscapes in the United States and other countries.

According to the USDA–NRCS (2009), only Chinese privet is escaped in all five MidSouth states. Amur privet is escaped in all but Louisiana and Mississippi, common privet in all but Mississippi, Japanese privet in all but Arkansas, and glossy privet in all but Arkansas and Tennessee according to USDA–NRCS (2009). However, both Japanese and glossy privet are naturalized in Arkansas (Serviss 2010). Border, California, and waxyleaf privets are less common and have escaped in Tennessee, Mississippi, and Arkansas, respectively. However, much more distribution data is needed on each species. For example, USDA–NRCS does not list Chinese privet for Oktibbeha County, Mississippi, although it is visible from offices on the Mississippi State University Campus, Starkville, MS where it readily has escaped cultivation and became established. However, MISS (2009) has records for Chinese privet from Oktibbeha County, Mississippi and three other species on their Mississippi checklist: Amur, Japanese, and glossy privet. LSU (2009) listed Chinese, common, glossy, and Japanese privets in their Louisiana checklist. Thus, Chinese privet is the most widespread species in the MidSouth and continues to spread. Other species, such as glossy, Japanese, and waxyleaf privets, seem to escape into surrounding lands from urban areas where they often are planted. Maps and georeferenced locations for some privet species can be

Table 2. Suggested management methods for woody plants such as privets (*Ligustrum* spp.).

Herbicide Name[a]	Method[b]	Rate ha^{-1} or Percent Solution
2,4-D + 2,4-DP (0.2 + 0.1 kg ae L^{-1})	High volume	1 to 1.5%
	Basal, cut stump, frill	3 to 4% in diesel or oil
metsulfuron methyl (60% ai)	Low volume	70 to 210 g
	High volume	35 to 140 g
imazapyr (0.24 kg ae L^{-1})	Low volume	2.4 to 7.2 L or 2%
	Frill or soil application	2%
imazapyr (0.48 kg ae L^{-1})	Low volume	1.2 to 3.5 L or 1%
	Frill or soil application	1%
fosamine ammonium (0.51 kg ai L^{-1})	Low volume	14 to 56.1 L or 30%
hexazinone (0.24 kg ai L^{-1})	Soil application	18.7 to 74.8 L
triclopyr (0.48 kg ae L^{-1})	Low volume	2%
	Basal, cut stump, frill,	20% in diesel or oil
triclopyr (0.36 kg ae L^{-1})	Low volume	2%
	Basal, cut stump, frill	20% in diesel or oil
triclopyr (0.09 kg ae L^{-1})	Basal, cut stump, frill	Ready-to-use
glyphosate (0.48 kg ae L^{-1})	Low volume in fall	2%
Imazapyr + glyphosate (0.08 + 0.18 kg ae L^{-1})	Low volume, cut stump, frill	9.3 to 18.7 L
Imazapyr + metsulfuron methyl (63.2% ae + 9.5% ai)	High volume, broadcast	1.8 kg
Method	Remove seedlings by hand to prevent future reproduction.	
	Remove mature plants by chainsaw and hand or heavy equipment prior to fruit ripening to avoid seed dispersal. Because stump regrowth is possible, treating stumps with herbicide will assist with control.	
	Destroy by burning or dispose of in sanitary landfill any mature fruit to prevent spread.	

[a] ae = acid equivalent; ai = active ingredient.

[b] Low and high volume applications refer to herbicide applications to foliage or soil at volumes of less than 379 and greater than 379 L ha^{-1}, respectively. Basal applications are made to the entire lower 30 to 50 cm of the main stem with either diesel fuel or basal bark oil as the carrier and are effective on main stems 15 cm diameter or smaller. Basal treatments are most effective when applied just prior to bud break. Cut stump applications are made to the outer cambium layer of stumps immediately after cutting. Frill applications are made by cutting the bark and cambium layer of the stem and applying the herbicide to the cut area.

found on the Early Detection and Distribution Mapping System website at www.eddmaps.org and the Invasive Plant Atlas of the MidSouth website at www.gri.mstate.edu/ipams.

Management of Privets

Although young seedlings can be pulled up easily, privets generally are prolific seed producers, and prevention (not planting) could be the best means of control. Privets easily can re-establish on treated sites by seed dispersed by birds. Because privet fruits are dispersed by birds, one should always consider adjacent landowners when planting privets in the landscape.

No biological controls are in widespread use, although deer and other animals can feed on privet. Privets tolerate a wide range of environmental conditions; thus, physical controls such as shading often are ineffective. An example of this is the presence of Chinese privet under dense stands of kudzu [*Pueraria montana* (Lour.) Merr. var. *lobata* (Willd.) Maesen & S. Almeida]. In addition, privet seed can germinate in moist mulch commonly used to control weeds in landscapes. However, Remaley and Bargeron (2003) indicate that privet does not produce fruit in low light.

It might be feasible to pull young seedlings by hand when they are few in number or where herbicides are not permissible. Mowing close to the ground at least annually can partly control privet, but will not eradicate it (Remaley and Bargeron 2003).

There are several chemical control options for managing privet (Table 2; Miller 2003; MSU–MAFES 2009). These include high (2,4-D + 2,4-DP, imazapyr + metsulfuron methyl, or metsulfuron methyl) and low (fosamine ammonium, glyphosate, imazapyr, imazapyr + glyphosate, metsulfuron methyl, or triclopyr) volume applications, as well as basal (2,4-D + 2,4-DP, or triclopyr), cut stump (2,4-D + 2,4-DP, imazapyr + glyphosate, or triclopyr), and frill (2,4-D + 2,4-DP, imazapyr, imazapyr + glyphosate, or

triclopyr) applications. It should be noted that some older herbicide labels recommend basal applications with diesel as the primary carrier for improved woody stem penetration (Table 1). More environmentally friendly basal oil alternative carriers exist and can be used rather than diesel. Imazapyr (0.24 or 0.48 kg ae L^{-1} [2 or 4 lb ae gal^{-1}]) and hexazinone (0.24 kg ai L^{-1}) can be soil applied. Imazapyr + metsulfuron methyl (63.2% + 9.5%) can be broadcast for effective privet control.

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Appendix 1.
Key to MidSouth privet species (*Ligustrum* spp.).

1a. Leaves 7.5 to 10 cm long
  2a. Leaves 10–15 cm long, acuminate, margins light green; tube of corolla equaling lobes . . . . . *L. lucidum*
  2b. Leaves 7.5–10 cm long, short-acuminate to nearly obtuse, margins not light green; tube of corolla slightly longer than lobes . . . . . *L. japonicum*
1b. Leaves less than 7.5 cm long
  2a. Branchlets and leaves smooth, usually glossy . . . . . *L. ovalifolium*
  2b. Branchlets minutely hairy
    3a. Leaf blades narrowly oblong-elliptic to oblanceolate-elliptic or narrowly obovate, usually broadest slightly above the middle; flowers sessile to subsessile . . . . . *L. quihoui**
    3b. Leaf blades variously shaped; flowers sessile to pedicellate
      4a. Inflorescence terminal and lateral; corolla tube equal to or exserted from the calyx tube . . . . *L. sinense**
      4b. Inflorescence terminal; corolla tube distinctly exserted from the calyx tube.
        5a. Branchlets glabrous to hairy with straight to upcurved hairs of relatively even length; leaf blade apices obtuse to acute . . . . . *L. vulgare*
        5b. Branchlets with hairs of uneven length; leaf blade apices obtuse to rounded
          6a. Calyx hairy . . . . . *L. obtusifolium* var. *obtusifolium*
          6b. Calyx smooth . . . . . *L. obtusifolium* var. *suave**

* Denotes species that tend to be deciduous in the north, but evergreen in the south.

Terms in key: Acuminate = tapering to a point; acute = abruptly pointed; calyx = sepals at base of petals (greenish); corolla = petals which are fused into a tube on privets (whitish in color); corolla tube = tubular part of flower; limb = wider or spreading part of flower at end of corolla, essentially the width of flower; Lobe = rounded petal ends at end of petals (corolla); midrib = midvein; obtuse = blunt; panicle = inflorescence type in privet; pedicellate = stalked; sessile = without a stalk; and stamens = male part of flower, either within tube or exserted at apex.