

Ailanthus altissima (Miller) Swingle, TREE OF HEAVEN, STINK TREE. Small to medium-sized tree, winter-deciduous, clonal by root suckers, with 1–several trunks, branches spreading and ascending, 5–12(–20) m tall; mostly appearing functionally dioecious (4 types of individuals); shoots with large leaves having drooping leaflets, short-hairy and with minute short-stalked glandular hairs (especially on immature leaves), ill-smelling when handled; bark dull gray, tight. **Stems:** ± cylindrical but initially very thick (> 9 mm diameter), green with vertical white lenticels, in year 2 with chestnut-brown bark and large, shield-shaped leaf scars, narrow scars subtending leaf = bud scale scars from dormant bud; pith wide, spongy. **Leaves:** helically alternate, appearing odd-1-pinnately compound with an odd or even number of leaflets, having (2–)6–14 pairs of opposite or subopposite lateral leaflets (the first leaf arising from winter bud often 1-foliolate and obovate), (130–)300–700(–900) mm long, petiolate, without stipules; petiole with a swollen base (pulvinuslike) and cylindrical, 35–150 mm long, often reddish on exposed sides, puberulent and minutely glandular-hairy; rachis cylindrical, with hairs and colored like petiole, leaflet pairs 35–50 mm apart; petiolules 3–10 mm long, with two ridges descending from leaflet blade, with glandular hairs and short hairs; blades of leaflets ovate to broadly lanceolate or broadly ovate, 70–150(–200) × 25–60(–90) mm, terminal leaflet sometimes with 1 or 2 lobes and sometimes having a linear, aborted leaflet primordium at its base, ± asymmetric and subcordate to truncate at base, typically entire on margins except near base (below midpoint) with 1(–3) pairs of teeth each having a large gland (extrafloral nectary), acuminate at tip, pinnately veined with midrib raised on upper surface and principal veins raised on lower surface, appearing ± glabrate except short-villous on margins and especially densely short-hairy along lower midrib, upper surface commonly dark green, often glossy and with minute glandular hairs scattered on surface but hairs at higher density along principal veins, old glandular hairs with red heads, lower surface pale green and dull with fewer glandular hairs. **Inflorescences:** panicles, terminal and subterminal-axillary on new growth following expansion of foliage leaves, on separate plants staminate, pistillate, with all bisexual flowers, or mixed with staminate + pistillate + bisexual flowers, bracteate, short-hairy and with minute short-stalked glandular hairs; staminate inflorescence 130–160 × 15–35 (including peduncle 12–40 mm long), dense, with alternate to subopposite lateral branches, lateral branches 10–20-flowered; pistillate inflorescence 120–240 × 90–200 mm (including peduncle 20–80 mm long), with spaced, alternate lateral branches, lateral branches 2–20-flowered; inflorescence of bisexual flowers 160–210 × 35–60 mm (including peduncle 45–65 mm long), with mostly alternate lateral branches, lateral branches 18–40-flowered; mixed inflorescence 100–160 × 20–85 mm (including peduncle 25–40 mm long), very dense, with alternate lateral branches, lateral branches 25–30-flowered; bract subtending lateral branch obovate to lanceolate or elliptic, 2–35 × 0.4–17 mm, often cupped, long-tapered at base, entire and pale green on margins to remotely serrate (large bracts) or ciliate (small bracts), acuminate at tip; bractlet subtending pedicel awl-shaped to narrowly triangular, 0.6–1 mm long, red, with ascending, stiff, short hairs, often abscising before flower opens; pedicel 4–7.5 mm long increasing 2× in fruit. **Staminate flower:** radial, 7.5–8 mm across, strong-smelling; **calyx** (4–)5(–6)-lobed, green; tube broadly cup-shaped, ca. 0.3 × 1.5 mm, glabrous; lobes ascending, deltate, 0.7–1.1 mm, minutely ciliate on margins; **petals** (4–)5(–6), free,

spreading widely to slightly recurved, ovate when flattened but margins curved up and inward forming a cupped scoop, 3.5–3.7 mm long, yellow-green but paler on margins, densely short-villous on incurved portions (surfaces and margins), upper surface sparsely short-hairy but decreasing to tip; **stamens** (8–)10(–12), in 2 whorls, free, 1 whorl opposite and cradled by petals until after anthesis, the other whorl (appearing as an inner whorl) opposite sepals ascending and dehiscent first; filaments 3.6–4.2 mm long, not straight, whitish, conspicuously short-villous below midpoint; anthers dorsifixed, dithecal, oblong with cordate base, 1.1–1.3 × 0.8–0.9 mm, bright greenish yellow, longitudinally dehiscent; pollen light yellow; **nectary disc** 5-lobed, each lobe opposite calyx lobe and positioned at base of a stamen, visible on outside of bud before anthesis, dark yellow-green, nectar production scanty; **pistil** aborted but base (gynophore) present, gynophore irregularly domelike and 5-lobed, 1.5 mm across, abutting inner bases of filaments, lobes heart-shaped in ×-section. **Pistillate and bisexual flowers:** radial, 8–9.5 mm across; **calyx** (4–)5(–6)-lobed, green; tube broadly cup-shaped to cymbal-shaped (rotate), ca. 0.3 × 1.5 mm, glabrous; lobes ascending, deltate, 0.7–1.1 mm, minutely ciliate on margins; **petals** (4–)5(–6), spreading widely to slightly recurved, ovate when flattened but margins curved up and inward forming a cupped scoop, 3.5–4 mm long, yellow-green but paler on margins, densely short-villous on incurved portions (surfaces and margins), upper surface sparsely short-hairy but decreasing to tip; **stamens** 10 in 2 whorls, free, with sterile anthers (pistillate) or fertile anthers (bisexual); filaments ascending to erect, 2–3 mm long (not held by petals), straight, whitish, conspicuously short-villous below midpoint; fertile anthers dorsifixed, dithecal, < 0.5 mm long, whitish; **nectary disc** 5-lobed, each lobe opposite calyx lobe, dark yellow-green, producing copious, thin nectar covering base of pistil; aging moundlike at and around developing fruit; **pistil** 1, at pollination 2–2.3 mm long, on a base (gynophore), gynophore irregularly domelike and 5-lobed, 1.5 mm across, abutting inner bases of filaments, lobes heart-shaped in ×-section; ovary superior, conspicuously 5-lobed but fused only at base with gynophore, ovary lobes erect to ascending, whorled, earlike to oblong or elliptic, 1 mm tall, glossy green after pollination turning bright orange to deep rose-salmon, 5-chambered, each chamber with 1 ovule; styles 5, nearly free but twisted around each other, erect, attached on inner side at center of chamber near position of ovule, longitudinally grooved; stigma 5-lobed appearing fountainlike, spreading, star-shaped, 1.2–1.5 mm across, light green. **Fruit:** schizocarp, of 1–5 winged, 1-seeded, samaralike segments (mericarps); mericarps stiffly pendent and arising out of headlike receptacle, elliptic-oblong to oblong, (35–)50–58 × 11–13 mm, typically tapered at base and rounded at tip, twisted above midpoint or with wavy margin, when drying losing bright pigmentation maturing dull tan (gray) and papery; seed present near middle opposite the notch where style formerly attached and just below the widest portion of wing. **Seed:** fused to pericarp, central, lenticular-obovate, ca. 7 × 5 mm. Early May–late June.

Naturalized. Aggressive, invasive tree species that has become established along roadsides, where it spreads via root suckers, but also establishes from seed. *Ailanthus altissima* is called stink tree because of the odor produced from these plants when crushed, and flowers have a strong musty odor, typical for beetle pollination. There are four types

of plants, individuals with either staminate or pistillate flowers, individuals with only bisexual (perfect) flowers, and individuals with staminate, pistillate, and bisexual flowers on the same inflorescence. In staminate flowers, anthers of stamens opposite the calyx lobes dehisce before those of stamens opposite, and initially cradled by, the petals. In functionally pistillate flowers, stamens are formed but anthers produce no pollen and anthers are not cradled by petals. Bisexual and pistillate flowers produce copious amounts of nectar from the nectary disc. There is a problem with interpreting the structure of the pistillate organ because it is positioned on a platform (gynophore) that becomes enlarged in fruit and is fused to the nectary disc. The pistillate organ consists of five units scarcely fused at the base and by the styles, although it appears to have five separate pistils. Technically speaking, the fruit must be classified as a schizocarp of five winged mericarps, although otherwise fruits like this are generally termed samaras. The immature fruits are brightly colored and glossy; during fruiting it is easy to observe that within a population the individuals lacking fruits are staminate, but the complexity of the other forms can only be investigated at flowering time.

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