

## THE GENUS *ACTINIDIA* (ACTINIDIACEAE) IN NORTH AMERICA NORTH OF MEXICO

**BRETT E. SERVISS**

Department of Biological Sciences  
Henderson State University  
Arkadelphia, Arkansas 71999  
servisb@hsu.edu

### ABSTRACT

Actinidiaceae in North America north of Mexico is represented by three species of *Actinidia*, all of which are introductions. Both *A. arguta* and *A. chinensis* are known from multiple states in the USA, along with a single occurrence (*A. arguta*) from Ontario, Canada. *Actinidia polygama* is known only from New York. *Actinidia kolomikta*, although not currently documented as naturalized in North America, should be expected in the flora and is included in this treatment. Keys to identification, photographs, descriptions, and ecological characteristics of the *Actinidia* species are provided, including potential for invasiveness.

*Actinidia* is an Asiatic genus consisting of about 55 species of lianas, with its center of diversity in China (Krüssmann 1976; Li et al. 2007) — 52 of the world's species occur in China, 44 of which are endemic there (Li et al. 2007). The genus is distributed over much of East Asia, from China, Korea, and Russia to Japan and Malaysia (Krüssmann 1976; Li et al. 2007). Two species clearly are naturalized in the North American flora north of Mexico: *A. arguta* (Sieb. & Zucc.) Planch. ex Miq. and *A. chinensis* Planch. A third species, *A. polygama* (Sieb. & Zucc.) Planch. ex Miq., sometimes is long-persistent from cultivation, with possible limited establishment on a localized basis. This paper provides descriptions, photographs, geographical ranges, and ecological attributes of these taxa prior to publication of the Flora of North America treatment of the Actinidiaceae.

Some species of *Actinidia* are important as ornamentals for their showy and often colorful foliage and flowers, and a few species are important for their edible fruits, including *A. arguta*, *A. chinensis*, and *A. kolomikta* (Bailey 1949; Bailey & Bailey 1976; Krüssmann 1976; Griffiths 1992; Li et al. 2007; Serviss 2021). *Actinidia* species have been introduced into North America primarily for their fruits. Skrypchenko and Latocha (2017) provided details pertaining to cultivation of cold-hardy *Actinidia* species, along with characteristics of growth habit and various fruit attributes, such as ripening times and flavor.

*Actinidia chinensis* var. *deliciosa* (A. Chev.) A. Chev. is the standard kiwifruit of commerce and represents one of the few temperate fruit crop species to have been domesticated in the last 100 years (Ferguson 1999). The kiwifruit industry began in 1904 when seeds collected from China were brought to New Zealand, and by 1970, the green kiwifruit had been developed into a production crop (Ferguson & Bollard 1990). Over one million metric tons of kiwifruit are produced worldwide annually, most of which is grown in four countries — Italy, China, New Zealand, and Chile (World Kiwifruit Review 2009) — and although only small amounts are produced commercially in the USA and Canada, the kiwifruit has become a popular commodity in North America (Ferguson 1999). *Actinidia arguta* is grown commercially on a smaller scale (in the USA), and investigation into the feasibility of *A. kolomikta* as a commercial fruit crop also is occurring (University of Minnesota Extension 2022). Except for commercial production of kiwifruit, the Actinidiaceae is of minor economic importance (Ferguson 1999; Dressler & Bayer 2004).

**KEY TO ACTINIDIA SPECIES NATURALIZED  
IN NORTH AMERICA NORTH OF MEXICO**

1. One- to two-year-old stems densely strigose to hispid with large, red or white trichomes; fruits densely hispid to glabrous with lenticels present, brown to greenish-brown at maturity ..... **Actinidia chinensis**
1. One- to two-year-old stems glabrous, sometimes finely tomentose-puberulent, but not densely strigose or hispid; fruits glabrous and without lenticels, green, purplish-green, reddish-purple, purple, orange, yellow-orange, or pinkish-orange at maturity.
  2. Pith of stems lamellate; leaf blades not variegated, only green in color without any white, yellow, or pink coloration; inflorescence a 1–7-flowered cyme; anthers dark purple to black; fruits green, purplish-green, reddish-purple, or purple at maturity ..... **Actinidia arguta**
  2. Pith of stems solid or lamellate (*A. kolomikta*); leaf blades often variegated with some amount of white to yellow or pink coloration; inflorescence a 1–3-flowered cyme or fascicle; anthers yellow or brown; fruits orange, yellow-orange, pinkish-orange, or greenish-orange at maturity.
    3. Pith of stems solid and white in color; flowers white; fruits rostrate at apex and calyx generally persistent ..... **Actinidia polygama**
    3. Pith of stems lamellate and brown in color; flowers white or pink; fruits not rostrate and calyx sometimes caducous ..... **Actinidia kolomikta**

**ACTINIDIA** Lindley, Nat. Syst. Bot., 439. 1836. — **Plants** deciduous, lianous, polygamous or functionally dioecious. **Stems** lenticulate; lenticels usually linear; pith solid or lamellate. **Leaves** blade membranous, papery [or leathery]; venation reticulate. **Inflorescences** 1–7[–12+]–flowered, bracteate; bracts minute. **Flowers** fragrant; stamens usually with shorter filaments and sterile anthers in functionally pistillate flowers; ovary usually rudimentary in functionally staminate flowers; styles radiating. **Fruits** (berries) globose, ovoid, or oblong, glabrous or pubescent, sometimes lenticulate, many-seeded.

*Actinidia* species have flowers that are functionally dioecious — plants have perfect flowers (with both pistils and stamens); however, one of the two whorls is reduced and generally nonfunctional, rendering the flowers (functionally) pistillate or staminate. *Actinidia* is represented in the North American flora by three introduced species, *A. arguta*, *A. chinensis*, and *A. polygama*. A fourth species, *A. kolomikta*, regularly is cultivated and apparently has potential for naturalization.

1. **ACTINIDIA ARGUTA** (Sieb. & Zucc.) Planch. ex Miq., Ann. Mus. Bot. Lugduno-Batavi 3: 15. 1867. *Trochostigma argutum* Sieb. & Zucc., Abh. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. 3: 727. 1843. Tara vine, Hardy kiwi, Bower berry (Fig. 1).



**Stems** to 25 m, twining, glabrous to puberulent, tomentose when young; pith white or pinkish-white to brown, lamellate. **Leaves** petiole red or pinkish brown, 3–6(–10) cm, glabrous or sometimes tomentose or setose; blade ovate, sometimes broadly so, orbiculate, sometimes ovate-oblong or elliptic-ovate, 6–12 x (4.5–)5–10 cm, membranous to papery, base rounded to cordate, rarely broadly cuneate, sometimes oblique, rarely broadly cuneate, margins serrate, apex abruptly acuminate, abaxial surface green, glabrous or tomentose or strigillose, especially on main veins, adaxial surface dark green, glabrous; lateral veins conspicuous, 10–14 in number.

**Inflorescences** cymes, 1–7-flowered, brown-tomentose; peduncle 7–10 mm. **Pedicels** 8–14 mm. **Flowers** white to greenish-yellow, slightly fragrant; sepals 4–6, ovate to oblong, 3.5–5

mm, glandular-tomentose, sometimes only puberulent to glabrous abaxially, ciliate on margins; petals 4–6, cuneate-ovate to orbiculate-ovate, 7–9(–12) mm; anthers dark purple to black; ovary bottle-shaped, glabrous. **Fruits** greenish-yellow, green, green with some red or purple coloration, or purplish-red at maturity, globose to oblong, 2–3 cm, glabrous, lenticels absent, calyx typically absent.

Flowering Apr–May; fruiting Aug–Oct. Upland woods, woodland edges, thickets, streamsides, moist places, disturbed sites, and waste places; 0–600 m; introduced and native to China, Japan, Korea, and Russia. Escaped or naturalized in Connecticut, Maine, Massachusetts, New Jersey, New York, Ohio, and Pennsylvania (USA); Ontario (Canada).

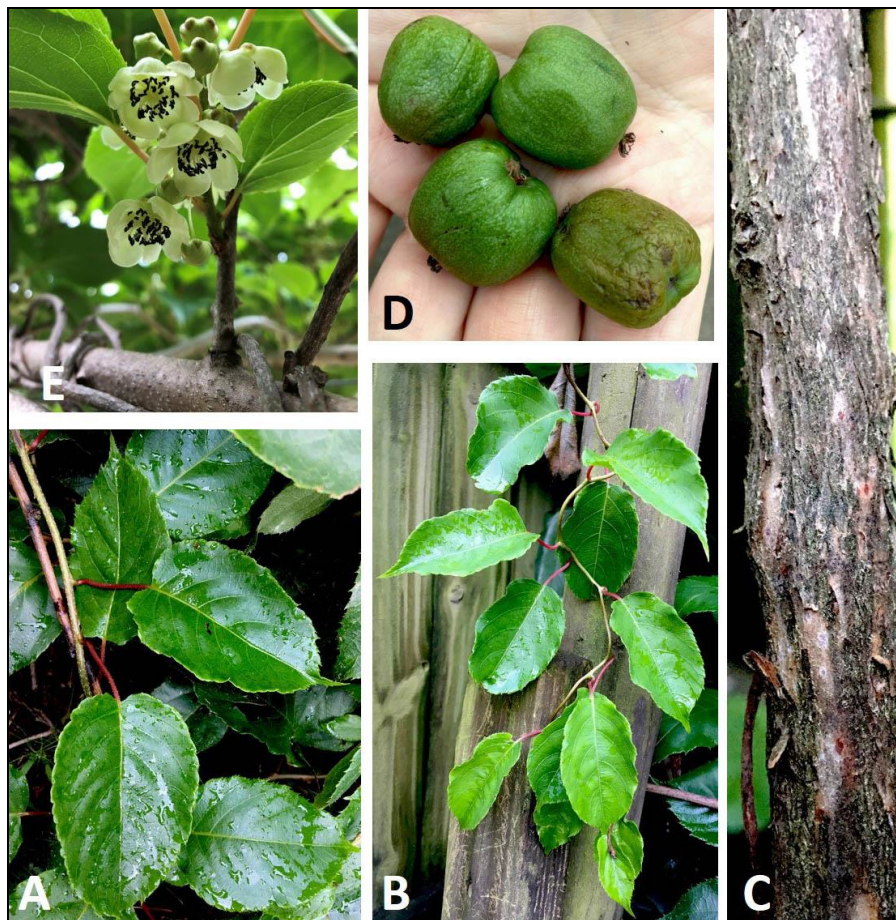


Figure 1. A–E. *Actinidia arguta* plant and habit. A–B. Leaves and stems. C. Bark. D. Mature fruits; fruits can range in color from essentially green to purplish-green or reddish-green to red or purple. E. Flowers; notice the purple anthers, which help to distinguish this species from *A. kolomikta* and *A. polygama*, both of which have yellow (or sometimes brown in *A. kolomikta*) anthers. Photo credit: E: University of Minnesota Extension.

*Actinidia arguta* is naturalized in the north-central and northeastern USA, where it has spread locally from areas where cultivated and sometimes become invasive (Wilder & McCombs 2002; Haines 2011; Hale & Connolly 2014; Berkshire Environmental Action Team 2019; Weakley 2020; Serviss 2021). It should be expected in other states, especially in the vicinity of where plants of the species are cultivated and/or fruits are discarded. *Actinidia arguta* also has been documented from the Canadian flora in Ontario.

2. **ACTINIDIA CHINENSIS** Planch., London J. Bot. 6: 303. 1847.

1a. **Actinidia chinensis** Planch. var. **deliciosa** (A. Chev.) A. Chev., Rev. Bot. Appl. Agric. Trop. 21: 241. 1941. *Actinidia latifolia* (Gardner & Champion) Merrill var. *deliciosa* A. Chev., Rev. Bot. Appl. Agric. Trop. 20: 12. 1940; *Actinidia deliciosa* (A. Chev.) Liang & Ferguson. Green kiwi, Kiwifruit, Chinese gooseberry (Figs. 2–4).



**Stems** to 8 m, twining, densely strigose to hispid pubescent, trichomes persistent, red, white, or brown in color; pith white to brown, lamellate. **Leaves** petiole green to yellowish-green, sometimes appearing whitish-green or red due to white or red-colored trichomes, especially on new growth, 3–10 cm, densely white or brown-pubescent, strigose, or hispid-setose; blade broadly ovate to obovate or suborbiculate, 6–17 x (6–)7–17 cm, papery, base cordate, truncate, or rounded, margins denticulate, apex truncate to emarginate to cuspidate or short-acuminate, abaxial surface white to brown, stellate-tomentose, adaxial surface dark green, glabrous to puberulent; lateral veins conspicuous on abaxial surface, 10–16 in number. **Inflorescences** cymes, 1–3-flowered, white-tomentose to brown-velutinous; peduncle 7–15 mm. **Pedicels** 9–15 mm. **Flowers** whitish-cream to pale yellow-orange, fragrant; sepals (3–)5(–7), ovate to oblong-ovate, 6–10 mm, densely yellow-tomentose; petals (3–)5(–8), rarely with a second whorl of 2 smaller petals, obovate, 10–20 mm; anthers yellow; ovary globose, densely villous. **Fruits** pale tan to brown in color at maturity, sometimes tinged greenish, subglobose to cylindric or ovoid, 4–6(–7) cm, densely hispid when young, sparsely to densely hispid at maturity, lenticels present, calyx persistent, sometimes reflexed. There are five recognized varieties of the species; only *A. chinensis* var. *deliciosa* is naturalized in the flora area.

Flowering Apr–Jun; fruiting Sep–Oct. Upland woods, woodland edges, thickets, disturbed sites and waste places; 120–400 m; introduced and native to China. Escaped or naturalized in Arkansas, Georgia, Missouri, North Carolina, Ohio, South Carolina, Tennessee, and Virginia; also in Europe.



Figure 2. Escaped juvenile plant of *Actinidia chinensis* var. *deliciosa* in Clark Co., Arkansas. This plant was present in a highly disturbed, urban environment.



Figure 3. Escaped plants of *Actinidia chinensis* var. *deliciosa* in Saline Co., Arkansas. These plants grew at the edge of a disturbed, urban woods and greenbelt that itself was in the vicinity of a sewer access point. Plants were large lianas that had climbed into the canopy for several meters. Seeds of *A. chinensis* var. *deliciosa*, which are extremely small, may have been deposited at the site from an overflow event and subsequently produced the escaped plants.

*Actinidia chinensis* var. *deliciosa* is easy to distinguish from other vines in eastern North America by the combination of the dense indument of large, red, reddish-brown, or whitish-tan, setose or hispid trichomes that cover the young stems and leaves, relatively thick, robust stems, and large (at maturity — up to 20 cm long), cordate-acuminate, pubescent, prominently-veined leaves. The large leaves and colorful new growth give the plant a tropical appearance.

*Actinidia chinensis* var. *deliciosa* is the standard kiwifruit of commerce and represents one of the few temperate fruit crop species to have been domesticated recently (Ferguson 1999). It is cultivated locally in the southern USA and is grown for commercial fruit production in California, Florida, Texas, and southern British Columbia on Vancouver Island.

This species has been recorded as escaped in Austria and Germany (Kasperek 2004; Essl & Stoehr 2006), in addition to the USA (Serviss et al. 2012; Ladd & Thomas 2015; Tepe & Conover 2019; Weakley 2020; Serviss 2021; Serviss & Tumilson 2021). Based on its relative cold hardiness, seed viability, and popularity as a fruit commodity, it is not surprising that *A. chinensis* var. *deliciosa* has been documented outside of cultivation in numerous instances in North America. Escaped or naturalized plants should be expected in areas where cultivated and/or fruits are discarded.

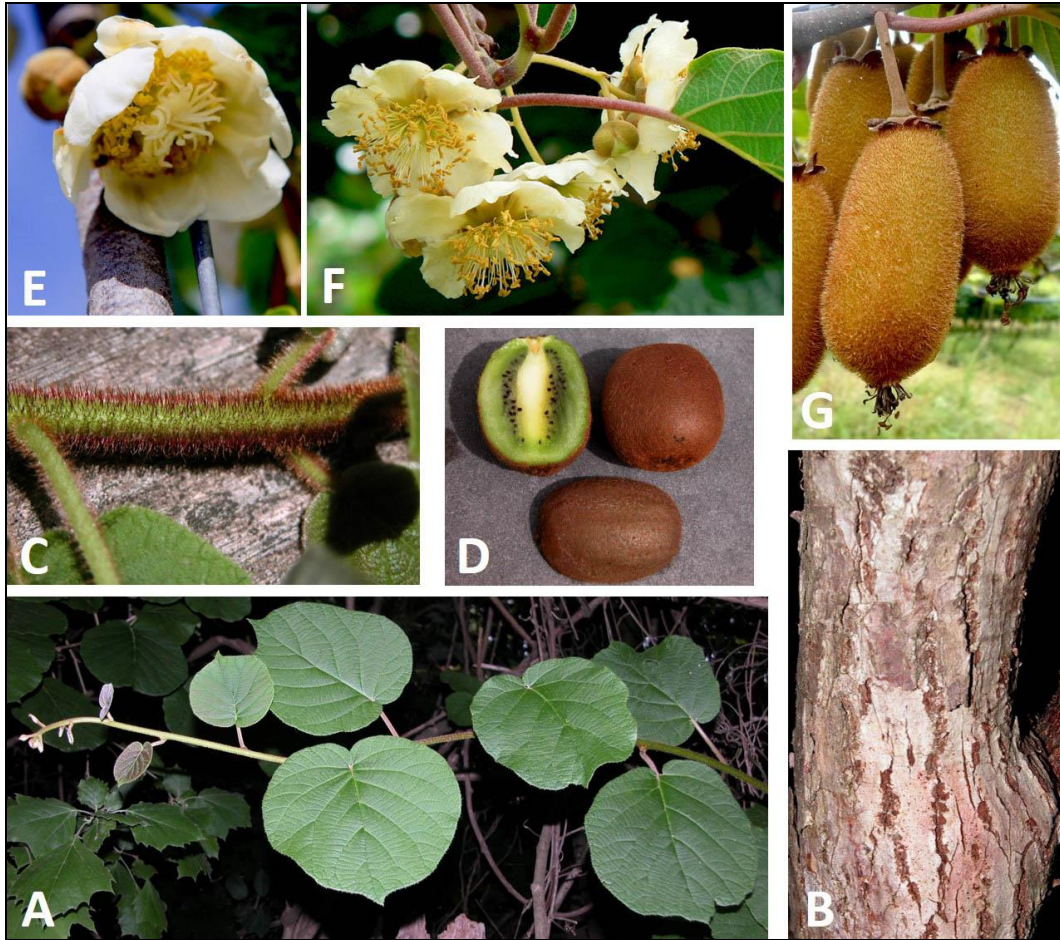


Figure 4. A–G. *Actinidia chinense* var. *deliciosa* plant and habit. A. Leaves and stem. B. Bark. C. Close-up of stem tip and leaf petiole showing stiff, hirsute, red-colored trichomes (trichomes also can be white or brown). D, G. Mature fruits; notice the variation in the amount of pubescence that can be present. E–F. Flowers. Photo credits: E–F: Gerald Holmes, Strawberry Center, Bugwood; G. Juergen Schrenk, CalPhotos.

**3. ACTINIDIA KOLOMIKTA** (Maxim. & Rupr.) Maxim., *Mém. Acad. Imp. Sci. St.-Pétersbourg Divers Savans.* 9: 63. 1859. *Prunus kolomikta* Maxim. & Rupr., *Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg* 15: 129. 1856. *Actinidia gagnepainii* Nakai; *Kalomikta mandshurica* Regel, nom. illeg. superfl.; *Trochostigma kolomikta* (Maxim. & Ruprecht) Ruprecht. Kolomikta vine, Variegated kiwi vine, Arctic beauty (Fig. 5).

**Stems** to 15 m, glabrous; pith brown, lamellate. **Leaves** petiole yellowish-white to reddish-brown, 2.5–5 cm, glabrous to sparsely pubescent; blade broadly ovate to oblong-ovate or oblong-obovate, 6–15 x 3–10(–12) cm, membranous to papery, base cordate to occasionally rounded or truncate, equal or oblique, margins serrate to biserrate, apex acute to acuminate, abaxial surface pale green, glabrous to subglabrous, sometimes with patches of white trichomes in the vein axils, adaxial surface green to white and/or pink (sometimes lamina is predominantly green with only a small amount of white and/or pink color), sparsely strigillose; lateral veins conspicuous abaxially, 6–8 in number. **Inflorescences** cymes, 1–3-flowered, peduncle 8–12 mm. **Pedicels** 6–8 mm, glabrous to yellowish-brown and tomentose. **Flowers** white or pink, fragrant; sepals 5, ovate to oblong-ovate, 4–6 mm, glabrous but with ciliate margins; petals 5–6(–8), obovate, 6–10 mm; anthers yellow, sagittate

at base; ovary globose, glabrous. **Fruits** pale orange, ovoid, 2–2.5 cm, glabrous, lenticels absent, calyx sometimes caducous.

Flowering Apr–Jul; fruiting Sep–Nov. Upland and open areas, disturbed sites, and waste places; introduced and native to China, Japan, Korea, and Russia. Not presently naturalized in North America but should be expected outside of cultivation.



Figure 5. A–D. *Actinidia kolomikta* plant and habit. A. Leaves and nearly mature fruits (fruits will be greenish-orange to pale orange at maturity). B. Leaves (leaves can be entirely green or have different combinations of additional colors: pink only, white only, or both pink and white coloration together). C. Functionally staminate flower. D. Functionally pistillate flowers. Photo credit: A–D: Seth Wannemuehler, Department of Horticultural Science, University of Minnesota.

*Actinidia kolomikta* morphologically is similar to and potentially easily confused with *A. polygama*. It is unequivocally distinguishable from *A. polygama* by its brown, lamellate pith. The pink coloration sometimes present on the laminas also is helpful. In contrast, *A. polygama* has white, solid pith and leaf blades that lack pink coloration. It is possible to encounter plants of both species with entirely green leaves and *A. kolomikta* plants with white variegation but no pink coloration on the leaves.

Though not currently documented outside of cultivation in North America, *A. kolomikta* is cultivated for its winter hardiness, variegated foliage, and edible, fruits. Based on regularity of cultivation and its ability to produce fruits and seeds in North America, *A. kolomikta* should be expected in the escaped or naturalized condition, similar to that observed with *A. arguta* and *A. polygama*.

4. **ACTINIDIA POLYGAMA** (Sieb. & Zucc.) Planch. ex Maxim., Mém. Acad. Imp. Sci. St.-Pétersbourg Divers Savans 9: 64. 1859. *Trochostigma polygamum* Sieb. & Zucc., Abh. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. 3: 728. 1843 (as *polygama*). Silver vine (Figs. 6–8).



**Stems** to 6 m, twining, glabrous, sometimes sparsely to moderately puberulent when young; pith white, solid. **Leaves** petiole-purplish red, 1.5–3.5(–4.5) cm, glabrous; blade ovate to oblong-ovate, 7–14 x 4.5–8 cm, membranous to papery, base acute to cuneate or rounded, rarely slightly cordate, margins serrulate, apex acuminate, sometimes abruptly so, abaxial surface pale green, sparsely strigillose, adaxial surface green to white or yellow (sometimes lamina is predominantly green with only a small yellow or whitish-yellow patch), glabrous to sparsely tomentose, sometimes strigillose on major veins; lateral veins conspicuous, 12–14 in number.

**Inflorescences** fascicles, 1–3-flowered, green to greenish-brown or tan, sparsely puberulent, peduncle (3–)4–16 mm. **Pedicels** 6–8 mm. **Flowers** white to pale cream, fragrant; sepals (4–)5, ovate to oblong-ovate, 5–7 mm, glabrous or sparsely puberulent; petals 5, obovate to oblong-obovate, 8–13 mm; anthers yellow or brown; ovary bottle-shaped, glabrous. **Fruits** yellow-orange or pink-orange to orange and sometimes semi-translucent at maturity, ovoid to cylindric-ovoid or oblong-ovoid with beaklike extension at apex, 2.5–3 cm, glabrous, lenticels absent, calyx persistent.

Flowering Jun–Jul; fruiting Sep–Nov. Upland woods, woodland edges, thickets, streamsides, disturbed sites, and waste places; 200–360 m; introduced and native to China, Japan, and Korea. Long-persistent from cultivation, with some possible localized establishment in New York.



Figure 6. Spontaneous plant (possible root sucker or offshoot from buried stems) of *Actinidia polygama* in Orange Co., New York. This plant probably originated from persistent, once cultivated material of *A. polygama*, as some possible limited and localized spread of the initially cultivated plants at the site may have occurred. Photo credit: David Werier, Botanical and Ecological Consultant, Willseyville, New York.





Figure 7. Persistent (from possible previous cultivation) and possibly spreading plants of *Actinidia polygama* in Orange Co., New York. Several stems with leaves may be seen on the rubbish pile — plants were cut and treated with herbicide after discovery. Additional *A. polygama* plants may be seen around the rubbish pile. Photo credit: David Werier, Botanical and Ecological Consultant, Willseyville, New York.

*Actinidia polygama* is rare outside of cultivation in North America; and has been reported as naturalized from a single population of the species in New York (Mitchell 2000). However, Werier (2017; Pers. Comm., 2022) does not consider it to be naturalized, but rather persisting from former cultivation or introduction and at most spreading very slightly from that initial introduction. *Actinidia polygama* could be expected as persistent or locally escaping elsewhere in North America, especially in the vicinity of where it is cultivated.

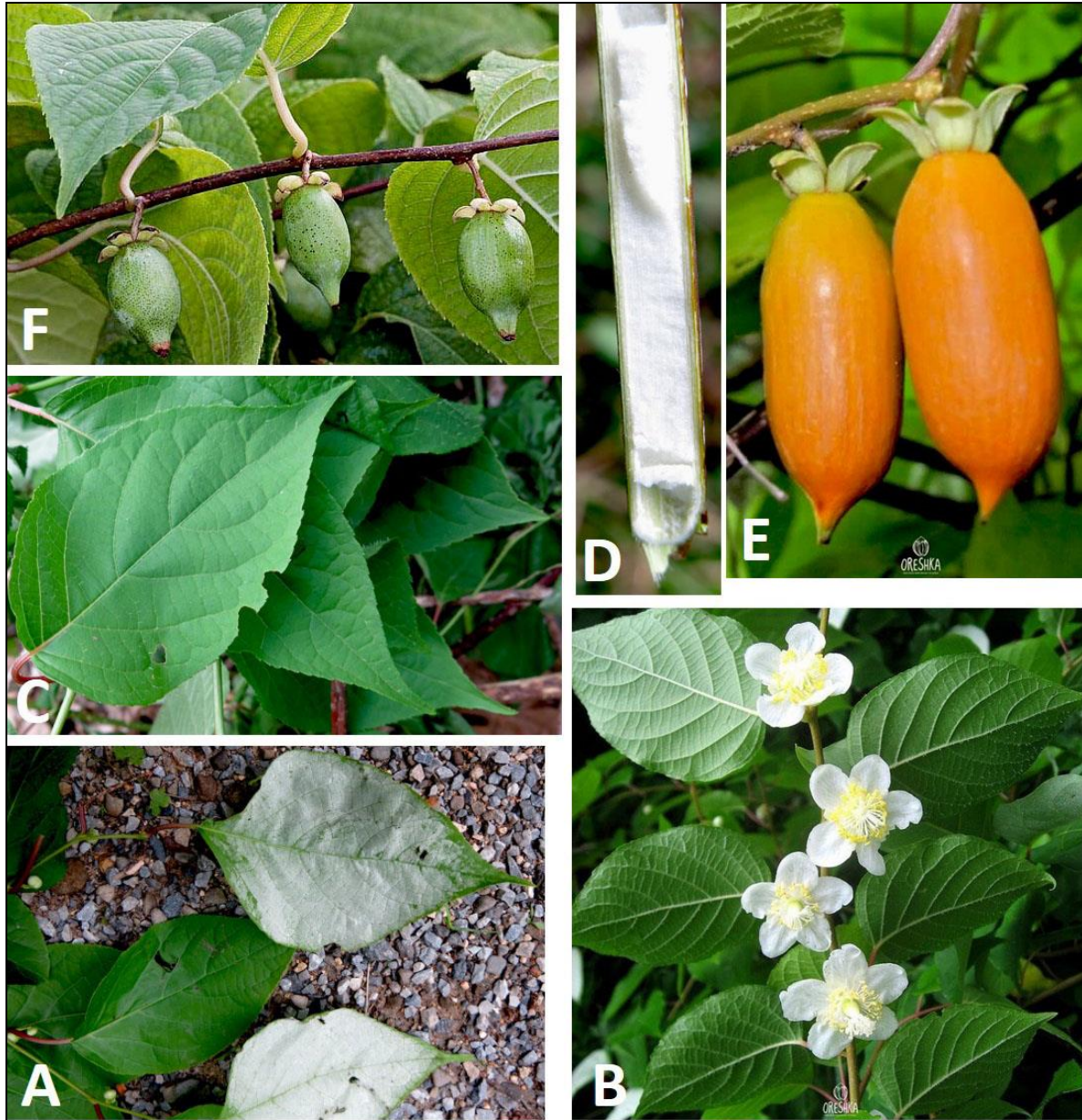


Figure 8. A–F. *Actinidia polygama* plant and habit. A, C. Leaves and stems; the white coloration shown on two of the leaves in Fig. 7A may be absent on some or all leaves. B. Functionally pistillate flowers. D. White, solid pith (as opposed to the brown, lamellate pith in stems of *A. kolomikta*) — differences in pith characteristics between *A. polygama* and *A. kolomikta* provide the most reliable method to distinguish them. E–F. Fruits; they are rostrate, compared to the strictly cylindrical fruits of *A. kolomikta* shown in Fig. 5A; the fruits in Fig. 7E are mature. Photo credits: A, C–D: David Werier, Botanical and Ecological Consultant, Willseyville, NY; B, E: Oreshka Seeds; F: Nick Kurzenko, CalPhotos.

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