SALICACEAE WILLOW FAMILY

Part Two: **Salix** L. Willow

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Shrubs or trees, not clonal or clonal by root suckers. WINTER BUDS with one external budscale; budscale margins coalescent or free and overlapping. STEMS erect or spreading, pendulous in some naturalized trees, flexible or brittle at base, not, or thickly, glaucous. LEAVES: stipules leaflike, rudimentary or absent, usually not strongly glandular; petioles lacking glandular dots near base of blade, dotted or lobed; proximal leaves on vegetative shoots or leaves on flowering branchlets entire, gland-dotted or toothed; mature blades linear to broadly obovate, the margins entire to toothed, the surfaces hairy, glabrous or becoming so, the hairs white or white and rust-colored. INFLORESCENCES cylindrical or subspherical catkins, sessile or on short leafy branchlets, emerging before (precocious), with (coetaneous), or after (serotinous) the leaves. FLOWERS subtended by a bract; pistillate floral bracts persistent after flowering or deciduous; stamens (1-) 2(-8); pistils sessile or stipitate, subtended by 1 to several flattened, rod-like, square or cupulate nectaries. FRUIT lanceolate or ovate. $x = 19, 22$. --Ca. 450 spp. worldwide, especially n temp., arctic. (Ancient name for willow). Argus, G. W. 1986. Syst. Bot. Monog. 9:1-170. Argus, G. W. and C.-E. Granfelt. 1988. Madroño 35:5. Argus, G.W. & C.L. McJannet. 1992. Brittonia 44: 461-474; Dorn, R.D. 1976. Canad. J. Bot. 54: 2769-2789; Dorn, R.D. 1977. Rhodora 79: 390-429.

Taxonomically difficult and often highly variable. Not all specimens will key easily; sprout shoots and other extreme variants are not included in keys.

1. Specimens flowering or fruiting.
   2. Specimens pistillate ..... Key 1
   2. Specimens staminate ..... Key 2

1' Specimens vegetative ..... Key 3

KEY 1 - PISTILLATE SPECIMENS

1. Ovaries hairy
   2. Floral bracts brown, black, or bicolored, persistent after flowering.
      3. Branches thickly glaucous; flowering coetaneous; catkins 7-13 mm long, subspherical ..... ***S. geyeriana***
      3' Branches not glaucous or thinly so; flowering precocious; catkins 15-65 mm long, cylindrical.
         4. Shrubs or trees, 3-20 m tall; stipes 0.8-2.3 mm long styles 0.2-0.6 mm long ..... ***S. scouleriana***
         4' Shrubs 0.15-2 mm tall; stipes 0.3-0.8 mm long; styles 0.5-1.4 mm long ..... ***S. planifolia*** subsp. ***planifolia***
   2' Floral bracts tawny, persistent or deciduous after flowering.
      5. Stipes 0-0.3 mm long; adaxial floral nectary longer than stipe; leaf blades very narrow, 1.1-4.4 mm wide ..... ***S. taxifolia***
      5' Stipes 1.2-5 mm long; adaxial floral nectary shorter than the stipe; leaf blades 9.5-33 mm wide.
         6. Floral bracts deciduous after flowering; budscale margins free and overlapping; leaves narrower, blades about 4.5-12 times as long as wide ..... ***S. gooddingii***

6' Floral bracts persistent after flowering; budscale margins coalescent; leaves broader, blades about 2-4 times as long as wide ..... ***S. bebbiana***

1' Ovaries glabrous.

7. Floral bracts brown, black or bicolored, persistent after flowering.

8. Branches thickly glaucous ..... ***S. irrorata***

8' Branches not glaucous or thinly so.

9. Margin of proximal leaves on vegetative shoots or leaves on flowering branchlets entire.

10. Flowering precocious or subprecocious; flowering branchlets lacking, rarely 1 mm long; floral bract densely hairy all over, the apex broadly rounded to rarely acute ..... ***S. lasiolepis***

10' Flowering coetaneous; flowering branchlets 0-8 mm long; floral bracts mainly hairy at distal end or glabrous, the apex acute or rounded.

11. Branches yellow or gray-yellow; floral bracts usually straight-hairy .... ***S. lutea***

11' Branches usually red-brown, sometimes yellow-brown; floral bract usually curly hairy ..... ***S. ligulifolia***

9' Margin of proximal leaves on vegetative shoots or leaves on flowering branchlets gland-dotted or serrulate.

12. Leaf blades glaucous on lower surface, dull on upper surface.

13. Styles 0.6-1.1 mm long; stipes 0.6-1.6 mm long; catkins densely flowered ..... ***S. monticola***

13' Styles 0.2-0.6 mm long; stipes 0.9-3.4 mm long; catkins densely to loosely flowered.

14. Branches yellow or gray-yellow; floral bracts usually with straight hairs ..... ***S. lutea***

14' Branches usually red-brown, sometimes yellow-brown; floral bracts with curly hairs ..... ***S. ligulifolia***

12' Leaf blades not glaucous on lower surface, shiny on upper surface.

15. Floral bract apex acute to obtuse; branches becoming glabrous; adaxial floral nectary slender, as long as stipe ..... ***S. arizonica***

15' Floral bract apex rounded; branches glabrous, pilose, or villous; adaxial floral nectary broad, shorter than stipe ..... ***S. boothii***

7' Floral bracts tawny, persistent or deciduous after flowering.

16. Shrubs; budscale margins coalescent.

17. Petiole gland-dotted or lobed at base of blade, 13-30 mm long; leaf blade broader, ca. 3-10 times as long as wide; margins serrulate ..... ***S. lucida*** subsp. ***lasiandra***

17' Petiole not glandular at base of blade, 2-8 mm long; leaf blade narrower, ca. 6-28 times as long as wide; margins entire or remotely spinulose-serrulate.

18. Catkins 10-50 mm long; petioles 2-6 mm long ..... ***S. exigua*** subsp. ***exigua***

18' Catkins 6-23 mm long; petioles 0.2-1.5 mm long ..... ***S. taxifolia***

16' Trees; budscale margins coalescent or free and overlapping.

19. Branches strongly pendulous, sometimes to the ground; floral bracts persistent after lowering; stipes 0-0.3 mm long; petioles tomentose ..... ***S. babylonica***

19' Branches erect (weakly pendulous in a cultivar of *S. alba*); floral bracts deciduous after flowering; stipes 0-3.2 mm long; petioles glabrous, pilose, villous, silky.

20. Budscale margins coalescent; stigmas 0.16-0.6 mm long.

21. Petiole not glandular at base of blade; floral bract apex acute or obtuse; stipes 0-0.3 mm long; adaxial floral nectary longer than stipe; leaf blade margins entire or gland-dotted ..... ***S. taxifolia***

21' Petiole with glandular dots or lobes at base of blade; floral bract apex rounded; stipes 0.2-2 mm long; adaxial floral nectary shorter than or equal to stipe; leaf blade margins serrate to serrulate.

22. Margins of proximal leaves on vegetative shoots or leaves on flowering branchlets gland-dotted or serrulate; stipules strongly glandular; stipes 0.8-2 mm long ..... ***S. lucida*** subsp. ***lasiandra***
22' Margins of proximal leaves on vegetative shoots or leaves on flowering branchlets entire; stipules not strongly glandular; stipes 0.2-0.8 mm long ..... ***S. alba***

20' Budscale margins free and overlapping; stigmas 0.2-0.4 mm long.
23. Petioles not glandular at base of blade.
24. Branches villous to becoming glabrous; petioles villous or becoming glabrous; leaves ca. 3-6 times as long as wide; flowering branchlets 3-20 mm long ..... ***S. laevigata***
24' Branches glabrous; petioles pilose; leaves ca 4-12 times as long as wide; flowering branchlets 2.5-11 mm long ..... ***S. bonplandiana***
23' Petioles glandular-dotted at base of blade.
25. Leaf blades not glaucous on lower surface; petioles pilose .. ***S. gooddingii***
25' Leaf blades glaucous on lower surface; petioles glabrous or villous.
26. Branches, branchlets, and petioles villous or becoming glabrous ..... ***S. laevigata***
26' Branches, branchlets, and petioles glabrous ..... ***S. amygdaloides***

KEY 2 - STAMINATE SPECIMENS

1. Floral bracts brown, black, or bicolored.
2. Filaments hairy, at least at very base.
3. Catkins 5-7 mm long, subspherical; branches thickly glaucous ..... ***S. geyeriana***
3' Catkins 10-37 mm long, cylindrical; branches not glaucous or only thinly so.
4. Leaf blades not glaucous on lower surface ..... ***S. boothii***
4' Leaf blades glaucous on lower surface.
5. Leaves serrulate, with an average of 7 teeth per cm; flowering precocious to coetaneous; floral bract apex rounded to acute; floral nectary 0.6-0.9 mm long ..... ***S. monticola***
5' Leaves entire, if serrulate then with an average of 4 teeth per cm; flowering precocious; floral bract apex acute to obtuse; floral nectary 0.4-0.5 mm long ..... ***S. planifolia*** subsp. ***planifolia***

2' Filaments glabrous.
6. Flowering coetaneous; catkins on distinct flowering branchlets.
7. Leaf blades glaucous on lower surface, dull or shiny on upper surface.
8. Branches yellow or gray-yellow; leaves dull or shiny on upper surface ..... ***S. lutea***
8' Branches usually red-brown, sometimes yellow-brown; leaves dull on upper surface ..... ***S. ligulifolia***
7' Leaf blades not glaucous on lower surface, shiny on upper surface.
9. Catkins 5-15 mm long; leaf base usually cordate ..... ***S. arizonica***
9' Catkins 20-25 mm long; leaf base usually acute to rounded ..... ***S. boothii***

6' Flowering precocious or subprecocious; catkins sessile or on very short flowering branchlets.
10. Branches thickly glaucous ..... ***S. irrorata***
10' Branches not glaucous or thinly so.
11. Leaf blades not glaucous on lower surface; margins of proximal leaves on vegetative shoots or leaves on flowering branchlets entire, gland-dotted or serrulate; branches glabrous or pilose ..... ***S. boothii***

11' Leaf blades glaucous on lower surface; margins of proximal leaves on vegetative shoot or leaves on flowering brachlets entire or gland-dotted; branches glabrous or tomentose, becoming glabrous.
12. Floral bracts broadly rounded, densely hairy with short straight or wavy hairs, the margins entire ..... ***S. lasiolepis***
12' Floral bract apex acute to obtuse, sometimes rounded in *S. scouleriana*, densely hairy with long straight hairs, the margins entire or toothed.
13. Low to mid-sized shrubs. 0.15- 2 m tall; stipules absent or rudimentary; petioles pilose ..... ***S. planifolia*** subsp ***planifolia***
13' Tall shrubs to trees, 3-10 m tall; stipules leaflike; petioles velvety or villous ..... ***S. scouleriana***

1' Floral bracts tawny.
14. Stamens more than 3 per flower.
15. Stipules prominent at flowering, the margins strongly gland-dotted; budscale margins coalescent ..... ***S. lucida*** subsp. ***lasiandra***
15' Stipules not prominent at flowering, the margins not strongly gland-dotted; budscale margins free and overlapping.
16. Filaments hairy on lower 1/2; leaf blades glaucous or not on lower surface.
17. Leaf blades glaucous on lower surface ..... ***S. amygdaloides***
17' Leaf blades not glaucous on lower surface ..... ***S. gooddingii***
16' Filaments hairy only at base; leaf blades glaucous on lower surface.
18. Petioles glandular at base of blade.
19. Branches hairy, sometimes becoming glabrous; catkins densely to loosely flowered; leaf blades shiny to glossy on upper surface ..... ***S. laevigata***
19' Branches glabrous; catkins densely flowered; leaf blades dull or slightly shiny on upper surface ..... ***S. amygdaloides***
18' Petioles not glandular at base of blade.
20. Catkins not borne in leaf axils; branches villous, becoming glabrous ..... ***S. laevigata***
20' Catkins often borne in leaf axils; branches glabrous ..... ***S. bonplandiana***
14' Stamens 2 per flower.
21. Shrubs or small trees; abaxial nectaries absent ..... ***S. bebbiana***
21' Trees; abaxial nectaries present.
22. Leaf blades narrow, 1.1-8 mm wide, the margins entire to remotely spinulose-serrulate, with 1-6 teeth per cm; plants clonal by root suckers.
23. Floral bract apex rounded to truncate; petioles sparsely pubescent ..... ***S. exigua*** subsp. ***exigua***
23' Floral bract apex acute to obtuse; petioles silky ..... ***S. taxifolia***
22' Leaf blades broader, 9-20 mm wide; margins serrate, serrulate, or closely spinulose-serrulate, with 4-10 teeth per cm; plants not clonal.
24. Branches strongly pendant, yellow-brown to gray-brown; branchlets and juvenile leaves glabrous to sparsely hairy; adaxial floral nectary a slender, flattened rod; floral bract hairs wavy ..... ***S. babylonica***
24' Branches erect or weakly pendant, generally yellow, sometimes gray to red-brown; branchlets and juvenile leaves densely silky; adaxial floral nectary broad; floral bract hairs straight ..... ***S. alba***

KEY 3 - VEGETATIVE SPECIMENS

1. Lower leaf surface obscured by hairs, or if not, then not glaucous.
   2. Petioles glandular at base of blade; budscale margins free and overlapping; leaf blade apex acuminate ..... ***S. gooddingii***
   2' Petioles not glandular at base of blade; budscale margins coalescent; leaf blade apex acute.
      3. Leaf blade usually linear, about 6-28 times as long as wide, 1.1-8 mm wide, the margins entire or remotely serrulate spinulose; hairs on lower surface appressed, straight; plants clonal by root suckers.
         4. Leaf blades 30-143 mm long; petioles 1.5-6 mm long ..... ***S. exigua*** subsp. ***exigua***
         4' Leaf blades 13-42 mm long; petioles 0.2-1.5 mm long ..... ***S. taxifolia***
      3' Leaf blades usually ligulate to broadly elliptic, about 1.5-5 times as long as wide, 8-31 mm wide, the margins serrulate; hairs on lower surface divergent, wavy; plants not clonal.
         5. Branches becoming glabrous; leaf blade base round or cordate; teeth 7-21 (av. 16) per cm ..... ***S. arizonica***
         5' Branches glabrous, pilose, or villous; leaf blade base acute to rounded, rarely cordate; teeth 2-19 (av. 7) per cm ..... ***S. boothii***
1' Lower leaf surface not obscured by hairs, glaucous.
   6. Petioles gland-dotted or lobed at base of blade.
      7. Budscale margins free and overlapping.
         8. Leaf blades shiny or glossy on upper surface; stipules usually leaflike, sometimes rudimentary; branchlets hairy, rarely becoming glabrous ..... ***S. laevigata***
         8' Leaf blades usually dull, sometimes shiny, on upper surface; stipules usually rudimentary; branchlets glabrous ..... ***S. amygdaloides***
      7' Budscale margins coalescent.
         9. Stipules strongly glandular, the apex obtuse, but pointed; petioles glabrous or pilose; leaf blades glossy on upper surface; native ..... ***S. lucida*** subsp. ***lasiandra***
         9' Stipules not strongly glandular, the apex acute to caudate; petioles tomentose or silky; leaf blades dull on upper surface; naturalized.
            10. Stems pendulous almost to ground; juvenile leaves sparsely hairy; petioles tomentose ..... ***S. babylonica***
            10' Stems erect or slightly pendulous; juvenile leaves very densely hairy; petioles silky ..... ***S. alba***
   6' Petioles not glandular at base of blade.
      11. Branches thickly glaucous.
         12. Branchlets yellow-brown; juvenile leaf blades glabrous or sparsely villous; mature leaf blades glabrous or pilose on lower surface; leaf hairs white ..... ***S. irrorata***
         12' Branches red-brown to violet; juvenile leaf blades densely silky; mature leaf blades glabrous to moderately short silky on lower surface; leaf hairs rust-colored or a mixture of white and rust-colored ..... ***S. geyeriana***
      11' Branches not glaucous or thinly so.
         13. Margins of budscales free and overlapping.
            14. Branches villous or becoming glabrous; leaf blades broader, about 3-6 times as long as wide ..... ***S. laevigata***
            14' Branches glabrous or pilose; leaf blades narrower, about 4-12 times as long as wide ..... ***S. bonplandiana***
         13' Margins of budscales coalescent.
            15. Leaf blades shiny or glossy on upper surface.
               16. Petioles pilose; leaf blade about 1.5-4 times as long as wide ..... ***S. planifolia*** subsp. ***planifolia***
               16' Petioles villous, tomentose, or velvety; leaf blade about 1.5-10 times as long

as wide.
17. Leaf blades usually oblanceolate ranging from narrowly elliptic to obovate, about 1.5-4 times as long as wide ..... ***S. scouleriana***
17' Leaf blades usually ligulate to narrowly oblong, sometimes oblanceolate, about 3-10 times as long as wide ..... ***S. lasiolepis***

15' Leaf blade dull on upper surface (sometimes shiny in ***S. lutea***).
18. Branches strongly pendulous, highly brittle at base; base of leaf blades cuneate, naturalized ..... ***S. babylonica***
18' Branches erect, flexible at base; base of leaf blades acute to rounded; native.
19. Stipules absent or rudimentary; plants clonal by root suckers; leaf blades 1.1-4.4 mm wide ..... ***S. taxifolia***
19' Stipules leaflike; plants not clonal; leaf blade 10-33 mm wide.
20. Leaf blade tomentose or long silky becoming glabrous on lower surface; petioles puberulent; leaf blade margins entire, crenate, or remotely serrate, with 2-5 teeth per cm; blade about 2-4 times as long as wide ..... ***S. bebbiana***
20' Leaf blades glabrous or pilose on lower surface; petioles glabrous, villous, tomentose, or velvety; leaf blade margins serrate, serrulate, or entire, with 5-13 teeth per cm; blade about 2-6 times as long as wide.
21. Branches yellow to gray-yellow ..... ***S. lutea***
21' Branches usually red-brown, sometimes yellow-brown.
22. Stipule apex acute; petioles villous; leaf blades very thickly glaucous on lower surface; margins prominently serrate or serrulate, with 5-9 teeth per cm; blades broader, about 2-4 times as long as wide ..... ***S. monticola***
22' Stipules obtuse, but pointed, or rounded; petioles glabrous, tomentose, or velvety; leaf blades moderately glaucous on lower surface; margins serrulate or entire but not as conspicuously toothed, with 6-13 teeth per cm; blades narrower, ca. 3-6.5 times as long as wide ..... ***S. ligulifolia***

Salix alba L. (dead white). White Willow. --Tree to 25 m tall. STEMS: branches flexible or brittle at base, gray- to red-brown, silky becoming glabrous; branchlets erect, drooping, or pendulous, yellowish, gray- to red-brown, silky, pilose, or villous. LEAVES: petioles 3-13 mm long, silky, gland-dotted at base of blade; young leaves silky; mature blade narrowly oblong or very narrowly elliptic to lanceolate, 63-115 mm long, 10-20 mm wide, 4.2-7.3 times as long as wide, the lower surface glaucous, very densely to sparsely silky becoming glabrous, the upper surface dull, silky becoming glabrous, the base acute to cuneate, the margins flat, serrate to serrulate, with 5-9 teeth per cm, the apex acute to acuminate. INFLORESCENCES: coetaneous; floral bracts tawny, 1.6-2.8 mm long, glabrous or with straight hairs, the apices rounded; pistillate floral bracts deciduous after flowering. STAMINATE FLOWERS in moderately to densely flowered catkins 30-35 mm long; flowering branchlets 3-13 mm long; filaments hairy; nectaries 1 abaxial and 1 adaxial, broad, 0.3-0.7 mm long. PISTILLATE FLOWERS in loosely flowered catkins 35-60 mm long; flowering branchlets 10-25 mm long; ovaries glabrous; stigmas 0.32-0.56 mm long; styles 0.2-0.4 mm long; stipes 0.2-0.8 mm long; nectary square, 0.3-0.4 mm long, as long as or shorter than stipe. $2n = 76$. --Gardens or disturbed places, mostly near settlements; Apache, Coconino, Navajo cos.; Apr-Jun; throughout N. Amer; native of Europe, cultivated and naturalized. Most commonly cultivated and naturalized in AZ are *S.* X *rubens* Schrank (*S. alba* X *S. fragilis*) and *S. alba* var. *vitellina* (L) Stokes, with bright yellow or golden, spreading or pendulous (cv.'pendula') branchlets. Plants with pendulous, brown to olive branchlets are probably *S.* X *sepulcralis* Simon (*S. alba* X *S. babylonica*). Figure 1.

Salix amygdaloides Anderson (almondlike). Peachleaf Willow. --Tree to 20 m tall. STEMS: branches brittle at base, yellowish to gray-brown, glabrous; branchlets yellowish, yellow- to red- or gray-brown, glabrous; budscale margins free and overlapping. LEAVES: stipules usually rudimentary; petioles 7-21 mm long, glabrous to sparsely hairy, usually gland-dotted at base of blade; proximal leaves on vegetative or flowering branchlets gland-dotted or serrulate; young leaves glabrous or pilose; mature blade very narrowly elliptic to lanceolate or oblanceolate, 55-130 mm long, 24-37 mm wide, 2.8-6 times as long as wide, the lower surface glaucous, the upper surface dull or slightly shiny, the base acute to rounded, the margins flat, serrulate, with 6-12 teeth per cm, the apex acuminate. INFLORESCENCES coetaneous; floral bracts tawny, 1.5-2.8 mm long with wavy hairs, the apices acute to rounded; pistillate floral bracts deciduous after flowering. STAMINATE FLOWERS in densely flowered catkins 38-60 mm long; flowering branchlets 8-20 mm long; stamens 3-7; filaments hairy; nectaries 1 adaxial, 1 or 0 abaxial, slender half-cup-shaped, 0.3-0.4 mm long. PISTILLATE FLOWERS in loosely flowered catkins 25-90 mm long; flowering branchlets 4-35 mm long; ovaries glabrous; stigmas 0.24-0.4 mm long; styles 0.2-0.4 mm long; stipes 1.4-3.2 mm long; nectaries 1 to several adaxial, square to ½ cup shaped, 0.1-0.5 mm long, shorter than stipe. $2n = 38$. [*S. wrightii* Andersson]. --Forests along rivers, streams, and irrigation ditches; Apache, Navajo, Pima, Yavapai cos.; 1600-2100 m (5000-6400 ft); Mar-Jun; B.C. e to Que., Can; s in mountains and Great Basin Region to UT and NM, e to KY and NY. Occasionally hybridizes with *S. gooddingii*. Figure 2.

Salix arizonica Dorn (of Arizona). Arizona Willow. --Shrubs to 2.6 m tall. STEMS: branches red- to yellow-brown, becoming glabrous but remaining pilose at the nodes; branchlets yellow-green, red-brown, or brownish, villous to pilose. LEAVES: petioles villous or pubescent becoming glabrous, 3-7.5 mm long; proximal leaves on vegetative branchlets or flowering branchlets gland-dotted or serrulate; young leaves glabrous or pilose; mature blade elliptic to broadly elliptic, 20-50 mm long, 10-31 mm wide, 1.6-3.6 times as long as wide, the lower surface non-glaucous, glabrous or pilose, the upper surface shiny, glabrous or pilose, the base cordate to rounded, the margins flat, glandular-dotted to serrulate, with 7-21 teeth or glands per cm, the apex acute, abruptly short acuminate to obtuse. INFLORESCENCES: coetaneous; floral bracts brown, black, or bicolored, 1-2 mm long with wavy hairs, the apices acute to obtuse. STAMINATE FLOWERS in densely flowered catkins 5-15 mm long; flowering branchlets 1-4 mm long; filaments glabrous; nectary 1, slender or broad, 0.4-0.8 mm long. PISTILLATE FLOWERS in densely flowered catkins 11-40 mm long; flowering branchlets 2-10 mm long; ovaries glabrous; stigmas 0.14-0.36 mm long; styles 0.5-1.2 mm long; stipes 0.2-1 mm long; nectary slender or broad, 0.5-1mm long, equal to or exceeding stipe length. --Subalpine; sedge meadows and wet drainage ways; Apache Co.; 2800-3300 m (8500-10000 ft); May-Jun; AZ, UT. Thought to be endemic to AZ until a specimen, collected in UT in the Sevier National Forest at 10,000 ft in 1913, was found in the Rocky Mt. Herbarium by R. Dorn. Numerous Utah populations have since been found in Garfield, Sevier, and Iron cos. Figure 3.

Salix babylonica L. (of Babylon). Weeping Willow. --Tree to 20 m tall. STEMS pendulous almost to the ground; branches highly brittle at base, yellow- to gray-brown, becoming glabrous; branchlets yellowish or yellow-brown, villous, especially at the nodes, becoming glabrous. LEAVES: petioles tomentose, 7-12 mm long, sometimes gland-dotted at base of blade; proximal leaves of vegetative branchlets or leaves on flowering branchlets entire or gland-dotted; young leaves glabrous or sparsely silky; mature blade ligulate, very narrowly elliptic or narrowly lanceolate, 70-140 mm long, 9-18 mm wide, 6.5-13 times as long as wide, the lower surface glaucous, short silky becoming glabrous, the upper surface dull, glabrous or short silky becoming glabrous, the base cuneate, the margins flat, serrulate to spinulose-serrulate, with 4-10 teeth per cm, the apex acuminate. INFLORESCENCES: coetaneous, floral bracts tawny, 1.2-2 mm long, wavy hairy, the apices acute to rounded. STAMINATE FLOWERS in densely flowered catkins 25-35 mm long; flowering branchlets to 3 mm long; filaments hairy; nectaries 1 abaxial, 1-several adaxial, broad to ovate, 0.5-0.64 mm long. PISTILLATE FLOWERS in densely flowered catkins 18-22 mm long; flowering branchlets 4-10 mm long; ovaries glabrous; stigmas 0.16-0.36 mm long; styles 0.15-0.2 mm long; stipes 0-0.3 mm long; nectaries broad, 0.5-0.7 mm long, longer than stipe. $2n = 76$. [*S. matsudana* Koidz.]. --Gardens or disturbed areas mostly near settlements; Coconino, Maricopa, Navajo cos.; Mar-Apr;

throughout warmer parts of N. Amer from CA to se U.S.; cultivated, sometimes naturalized; native of Asia. Hybridizes with *S. alba*. Figure 4.

Salix bebbiana Sarg. (for Michael S. Bebb). Gray Willow, Bebb's Willow. --Shrub or tree, 0.5-10 m tall; branches dark red-brown, pilose, becoming glabrous; branchlets red-brown, villous. LEAVES: petioles puberulent, 2-9(-12) mm long; proximal leaves on vegetative or flowering branchlets entire or gland-dotted; young leaves pilose, tomentose, or silky; mature blade narrowly oblong, narrowly elliptic to elliptic, or oblanceolate to obovate, 20-60(-80) mm long, 10-20(-33) mm wide, 2-3.8 times as long as wide, the lower surface glaucous, densely to sparsely tomentose or silky becoming glabrous, the hairs wavy, the upper surface dull, pubescent to short-silky becoming glabrous, the base acute to obtuse, the margins flat, entire, crenate or irregularly serrate, with 2-5 teeth or glands per cm, the apex abruptly acute to obtuse. INFLORESCENCES: coetaneous to subprecocious; floral bracts tawny, 1.2-2 mm long, wavy hairs, the apices acute to rounded. STAMINATE FLOWERS in moderately to densely flowered catkins, 6-20 mm long; flowering branchlets 0-5 mm long; filaments glabrous or hairy; nectary broad, 0.3-0.6 mm long. PISTILLATE FLOWERS in loosely flowered catkins 25-60 mm long; flowering branchlets 3-15 mm long; ovaries short silky; stigmas 0.32-0.64 mm long; styles 0.1-0.4 mm long; stipes 2-5 mm long; nectary broad, 0.3-0.6 mm long, shorter than stipe. $2n = 38$. --Montane; thickets along streams, lake shores, cienegas, and seeps; Apache, Coconino, Greenlee, Navajo, Yavapai cos.; 2000-3300 m (6000-10200 ft); May-Jun; CA, e OR, mountains from AK, s to NM, e to IA, MD; Newfoundland, Can. Figure 5.

Salix bonplandiana Kunth (for Aimé Jacques Alexander Bonpland). Bonpland's Willow. --Trees to 13 m tall. STEMS: branches yellow- to red-brown, glabrous; branchlets yellow-brown or tawny streaked with red, glabrous to pilose, tomentose at nodes; budscale margins free and overlapping. LEAVES: stipules rudimentary or absent; petioles pilose, 4-16 mm long; young leaves glabrous or puberulent; mature blade very narrowly elliptic to lanceolate, 58-155 mm long, 7-27 mm wide, 4.6-10.7 times as long as wide, the lower surface glaucous, the upper surface dull or shiny, glabrous or becoming so, the base acute, cuneate to obtuse; margins flat, serrulate, serrulate-crenate, or gland-dotted, with 6-12 teeth or glands per cm, the apex acuminate to acute. INFLORESCENCES: coetaneous to serotinous; catkins typically borne in axils of leaves; floral bracts tawny, 0.6-2.2 mm long, with wavy hairs, the apices rounded; pistillate floral bracts deciduous after flowering. STAMINATE FLOWERS in moderately to densely flowered catkins 12-50 mm long; flowering branchlets 0-16 mm long; stamens 4-7; filaments hairy at base; nectaries 1 abaxial and 1 adaxial, broad to ovate, 0.2-0.6 mm long. PISTILLATE FLOWERS in loosely flowered catkins 15-53 mm long; flowering branchlets 2.5-11 mm long; ovaries glabrous; stigmas 0.2-0.3 mm long; styles 0.2-0.24 mm long; stipes 0.8-2.4 mm long; nectary broad to half-cup-shaped, 0.3-0.6 mm long, shorter than the stipe. $2n = 38, 42$. --Forests along streams and dry washes; Cochise, Graham, Greenlee, Navajo, Pima, Pinal, Santa Cruz cos.; 750-1900 m (2400-5800 ft); Mar-Jun and throughout the year; s to Guatemala. Figure 6.

Salix boothii Dorn (for W. E. Booth). Booth's Willow. -- Shrubs to 6 m tall. STEMS: branches gray- to red-brown, glabrous, villous to pilose; branchlets yellow- to gray-brown, glabrous, villous to pilose. LEAVES: petioles villous to pilose, 3-17 mm long; proximal leaves on vegetative or flowering branchlets gland-dotted or serrulate; young leaves pilose or villous; mature blade ligulate to narrowly oblong or narrowly elliptic to broadly so, 26-102 mm long, 8-30 mm wide, 2-5.2 times as long as wide, the lower surface non-glaucous, glabrous or pilose, the hairs white, or white and rust-colored, the upper surface shiny to highly glossy, pilose becoming glabrous, the base acute to rounded, rarely cordate, the margins flat or slightly revolute, entire, gland-dotted, or serrulate, with 2-12 teeth or glands per cm, the apex acute to abruptly short acuminate. INFLORESCENCES: coetaneous or subprecocious; floral bracts tawny or dark brown, 0.7-2 mm long with wavy hairs, the apices rounded. STAMINATE FLOWERS in densely flowered catkins 20-25 mm long; flowering branchlets 0-5 mm long; filaments glabrous or hairy; nectary 1, slender or broad, 0.6-1.3 mm long. PISTILLATE FLOWERS in densely to moderately flowered catkins 10-70 mm long; flowering branchlets 0-15 mm long; ovaries glabrous; stigmas 0.2-0.48 mm long; styles 0.3-1 mm long; stipes 0.5-2.5 mm long; nectary broad, 0.3-0.8 mm long, shorter than stipe. $2n = 76$. [*S. myrtillifolia*

auct., *S. pseudocordata* Andersson]. --Subalpine; rare in wet meadows and along streams; White Mts. Apache Co.; 3000-3100 m (9000-9500 ft); May-Jun; mountains s Alberta, British Columbia, Can.; s to CA, CO, NM, UT. Figure 7.

Salix exigua Nutt. (very small, meager, poor). Narrowleaf Willow, Coyote Willow. --Shrub to small tree 0.5-6 m tall, clonal by root suckers. STEMS: branches gray-, red-, to yellow-brown, glabrous or tomentose becoming glabrous; branchlets glabrescent to hairy. LEAVES: stipules leaflike to absent; petioles glabrous or hairy, 1-9 mm long; proximal leaves on vegetative or flowering branchlets entire or gland-dotted; young leaves long silky; mature blade linear or ligulate, 30-160 mm long, 2-9 mm wide, 10-28(-37.5) times as long as wide, the lower surface glaucous or densely silky to silky-villous, the upper surface shiny, glabrescent or sparsely white villous to long silky, the base cuneate, the margins slightly revolute, remotely spinulose-serrulate or gland-dotted, with 1-5 teeth or glands per cm, the apex acuminate or acute. INFLORESCENCES: coetaneous or serotinous; floral bracts tawny, 1.2-3.5 mm long, glabrous or hairy, the apices acute or rounded; pistillate floral bracts deciduous after flowering. STAMINATE FLOWERS; densely flowered catkins 9-55 mm long; flowering branchlets 2-180 mm long; filaments hairy; nectaries 1 abaxial and 1 adaxial, slender or broad, 0.3-1.2 mm long. PISTILLATE FLOWERS in loosely flowered catkins 10-100 mm long; flowering branchlets 4-180 mm long; ovaries glabrous to sparsely silky; stigmas 0.28-0.72 long; styles 0-0.2 mm long; stipes 0.2-0.9 mm long; nectaries 1 adaxial, 1 or 0 abaxial, 0.5-2.7 mm long, shorter to longer than stipe. $2n = 38$. --2 subspp. in N. Amer.

Subsp. **exigua** --Shrub 0.5-5 m tall. STEMS: branches hairy becoming glabrous, branchlets yellow- to red-brown, short-silky, tomentose, silky-villous, or puberulent. LEAVES: stipules leaflike or rudimentary; petioles pubescent. INFLORESCENCES: floral bracts 1.2-1.6 mm long, with wavy or straight hairs, the apices rounded. STAMINATE FLOWERS: nectaries broad, 0.3-0.8 mm long. PISTILLATE FLOWERS in catkins 10-50 mm long; flowering branchlets 4-65 mm long; ovaries glabrous, sometimes sparsely hairy on beak; stigmas 0.28-0.44 mm long; nectary broad to half-cup-shaped. $2n = 38$. [*S. argophylla* Nutt., *S. exigua* var. *stenophylla* (Rydb.) C. Schneider] --Warm temperate; thickets along rivers, cienegas, and wet ditches; all counties except La Paz Co.; 350-2800 m (1100-8500 ft); Mar-Jun and throughout year; s Alberta, British Columbia, Can.; s in mountains and Great Basin to NM, w TX; s to adj. Mex. Figure 8.

Salix geyeriana Andersson (for Carl Andreas Geyer). Geyer's Willow. --Shrub to 5 m tall. STEMS: branches red-brown to violet, glaucous, glabrous or becoming so; branchlets red-brown to violet, glabrous, pubescent or short-silky. LEAVES: stipules absent or rudimentary; petioles short-silky to velvety, 2-5.5 mm long; proximal leaves on vegetative or flowering branchlets glandular-dotted; young leaves usually silky; mature blade linear to ligulate or narrowly elliptic, 40-89 mm long, 5.5-12.5 mm wide, 5-11.3 times as long as wide, the lower surface glaucous, glabrous or short-silky becoming glabrous, the hairs rust-colored or white and rust-colored, the upper surface shiny, short-silky, the hairs rust-colored or white and rust-colored; base acute to rounded, the margins flat or slightly revolute, entire to serrulate, with 1-6 teeth or glands per cm, the apex acute or acuminate. INFLORESCENCES: coetaneous; catkins subspherical; floral bracts dark brown or black, 1.3-2 mm long, with wavy hairs, the apices rounded to acute. STAMINATE FLOWERS in densely flowered catkins 5-7 mm long, sessile; filaments hairy; nectary broad to ovate, ca. 0.32 mm long. PISTILLATE FLOWERS in densely flowered catkins 7-13 mm long; flowering branchlets 0-5 mm long; ovaries short-silky; stigmas 0.2-0.32 mm long; styles 0.2-0.6 mm long; stipes 0.4-2.8 mm long; nectary broad to ovate, 0.28-0.4 mm long, shorter than stipe. --Subalpine to montane; sedge meadows, thickets along rivers, cienegas, seepages and lake shores; Apache, Coconino, Greenlee, Navajo, Yavapai cos.; 1800-3100 m (5600-9500 ft); Apr-May; s British Columbia, Can.; s to CA and NM, e to CO and MT. The populations of *S. geyeriana* in AZ and NM differ from the species in having shorter stipes, 0.4-0.9 mm vs 1-2.8 mm long. Figure 9.

Salix gooddingii Ball (for Leslie Newton Goodding). Goodding's Black Willow. --Tree to 30 m tall. STEMS: branches flexible to brittle at base, yellow- to gray-brown, glabrous or becoming so; branchlets yellowish to yellow-green, sometimes reddish-brown, glabrous, pilose, or velvety becoming glabrous;

budscale margins free and overlapping. LEAVES: stipules leaflike or rudimentary; petioles pilose, 4-10 mm long, gland-dotted at base of blade; proximal leaves on vegetative branchlets or on flowering branchlets entire, gland-dotted, or serrulate; young leaves pilose to velvety; mature blade linear to ligulate or very narrowly elliptic, 67-130 mm long, 9.5-16 mm wide, 4.7-12.4 times as long as wide, the lower surface non-glaucous, the upper surface shiny, the base acute to cuneate; margins flat, serrulate or serrate, with 5-10 teeth or glands per cm, the apex acuminate. INFLORESCENCES: coetaneous; floral bracts tawny, 1.4-2.4 mm long with wavy hairs, the apices acute or rounded; pistillate floral bracts deciduous after flowering. STAMINATE FLOWERS in densely to loosely flowered catkins, 35-70 mm long; flowering branchlets 5-25 mm long; stamens 4-8; filaments hairy; nectaries 1-3 slender abaxial lobes. 1-2 square or ovate adaxial lobes, 0.25-0.5 mm long. PISTILLATE FLOWERS: in loosely flowered catkins 22-65 mm long; flowering branchlets 4-25 mm long; ovaries glabrous to sometimes villous; stigmas 0.2-0.32 mm long; styles 0.1-0.3 mm long; stipes 1.2-3.2 mm long; nectary square to half-cup-shaped, 0.2-0.6 mm long, shorter than stipe. $2n = 38$. [*S. gooddingii* var. *variabilis* C. Ball, *S. nigra* auct., *S. nigra* Marshall var. *vallicola* Dudley]. --Warm temperate to subtropical; forests along rivers cienegas, seepage areas, washes, and meadows; all cos.; 50-2500 m (150-7500 ft); Mar-Jun; CA e to w TX. Hybridizes with *S. amygdaloides* and *S. laevigata.* Figure 10.

S. irrorata Andersson (dewy). Dewy-stemmed Willow. --Shrub to 7 m tall. STEMS: branches highly brittle to flexible at base, red-brown to violet, thickly glaucous, glabrous; branchlets yellow-brown, glabrous, tomentose, or velvety becoming glabrous. LEAVES: stipules absent to leaflike; petioles velvety, 4-14 mm long; proximal leaves on vegetative or flowering branchlets entire or glandular-dotted; young leaves glabrous or villous; mature blade ligulate to narrowly oblong, narrowly elliptic, or narrowly oblanceolate, 47-115 mm long, 8-22 mm wide, 3.5-7.7 times as long as wide, the lower surface glaucous, glabrous, sparsely tomentose, or short silky becoming glabrous, the upper surface shiny or highly glossy, glabrous or pilose, the base cuneate to acute, the margins slightly revolute to flat, entire, gland-dotted, or remotely and irregularly serrate (undulating), with 2-7 teeth or glands per cm, the apex acute to acuminate or obtuse. INFLORESCENCES: precocious or subprecocious; catkins sessile, rarely on flowering branchlets to 5 mm long; floral bracts dark brown to black, 1.3-2.5 mm long, with straight or wavy hairs, the apices rounded. STAMINATE FLOWERS in densely flowered catkins 18-30 mm long; filaments glabrous; nectary slender to broad, 0.3-0.7 mm long. PISTILLATE FLOWERS in densely flowered catkins 18-42 mm long; ovaries glabrous; stigmas 0.15-0.6 mm long; styles 0.3-0.9 mm long; stipes 0.7-1.2 mm long; nectary slender to broad, 0.32-0.6 mm long, shorter than stipe. $2n = 38$. --Montane; thickets along rivers and creeks, and wet meadows; Apache, Gila, Greenlee, Navajo cos.; 1450-3000 m (4500-9200 ft); Apr-May; WY s to CO, NM; Baja C. e to Dur. and Coah., Mex. Differs from *S. lasiolepis* in its thickly glaucous branches and in chromosome numbers. The 2 taxa have separate ranges but overlap in the White Mountains where they appear to intergrade. Figure 20.

Salix laevigata Bebb (smooth and polished). Red Willow. --Tree to 15 m tall. STEMS: branches gray- or yellow-brown, villous becoming glabrous; branchlets yellow- or red-brown, villous, pilose, or velvety becoming glabrous, except at nodes; budscale margins free and overlapping. LEAVES: stipules rudimentary to leaflike; petioles villous becoming glabrous, 3.5-18 mm long, gland-dotted or not at base of blade; young leaves glabrous, pilose, or silky; mature blade ligulate to narrowly oblong, narrowly elliptic, lanceolate, or obovate, 53-190 mm long, 11-35 mm wide, 2.8-9 times as long as wide, the lower surface glaucous; upper surface shiny or highly glossy, glabrous or becoming so, the base rounded or subcordate to acute, the margins flat, crenate or very finely serrulate and appearing entire, with 7-12 teeth per cm, the apex acuminate to acute. INFLORESCENCES: coetaneous; floral bracts tawny, 1.6-3.4 mm long, with wavy hairs, the apices rounded to acute; pistillate floral bracts deciduous after flowering. STAMINATE FLOWERS in densely to loosely flowered catkins, 18-90 mm long; flowering branchlets 2-32 mm long; stamens 3-7; filaments hairy at base only; nectaries 1 abaxial, 1 adaxial, broad to ovate, 0.3-0.6 mm long. PISTILLATE FLOWERS in loosely flowered catkins 22-70 mm long; flowering branchlets 3-30 mm long; ovaries glabrous; stigmas 0.2-0.28 mm long; styles 0.12-0.24 mm long; stipes 1.4-2.8 mm long; nectary

square or half-cup-shaped, 0.2-0.5 mm long, shorter than stipe. [*S. laevigata* Bebb var. *araquipa* (Jepson) C. Ball]. --Warm temperate; forests along rivers and creeks, seepage areas, springs, subalkaline or brackish lake shores, canyons, and ditches; Coconino, Gila, Maricopa, Mohave, Navajo, Pinal, Yavapai cos.; 550-2200 m (1700-6900 ft); Feb-May; CA, n NV, s OR; Baja C., Mex. Closely related to the more southerly *S. bonplandiana* but differing in having catkins borne on leafy branchlets and not sessile in the axil of leaves. The ranges of the 2 overlap in central AZ and in Baja C., Mex., but intergradation has not been documented. Figure 11.

Salix lasiolepis Benth. (shaggy- or woolly-scaled). Arroyo Willow. --Shrub to 6 m tall. STEMS: branches yellow- or red-brown, tomentose becoming glabrous; branchlets yellowish to red-brown, villous, tomentose, or velvety becoming glabrous. LEAVES: stipules lacking to leaflike; petioles tomentose or velvety becoming glabrous, 3-16 mm long; young leaves silky to tomentose; mature blade ligulate to narrowly oblong, narrowly elliptic, or oblanceolate to obovate, 36-125 mm long, 6-32 mm wide, 3.2-9.6 times as long as wide, the lower surface glaucous, sparsely or densely tomentose or silky becoming glabrous, the hairs white or white and rust-colored, the upper surface glossy, tomentose or short-silky becoming glabrous, the base cuneate to acute, the margins slightly revolute, entire, gland-dotted, or remotely and irregularly serrate (undulating), with 2-4 teeth or glands per cm, the apices acute to obtuse. INFLORESCENCES: precocious to subprecocious; catkins sessile, flowering branchlets sometimes to 5 mm long; floral bracts dark brown, 1.2-2.4 mm with straight or wavy hairs, the apices rounded. STAMINATE FLOWERS in densely flowered catkins 17-55 mm long; stamens 2; filaments glabrous; nectary slender to ovate, 0.5-1.2 mm long. PISTILLATE FLOWERS in densely flowered catkins 15-60 mm long; ovaries glabrous; stigmas 0.12-0.28 mm long; styles 0.1-0.6 mm long; stipes 0.5-2.4 mm long; nectary broad, 0.2-0.9 mm long, shorter than stipe. $2n = 76$. --Montane; thickets along rivers and creeks, marshes, meadows, springs, and rocky bluffs; all cos except La Paz, Maricopa, Pinal, and Yuma cos.; 1200-2600 m (3900-8000 ft); Mar-May; WA s to CA e to ID and NM. See *S. irrorata* for comment. Figure 12.

Salix ligulifolia (C. Ball) C. Ball ex C. Schneider (strap-shaped leaves). Strapleaf Willow. --Shrub 1-8 m tall. STEMS: branches yellow-, gray-, or red-brown, glabrous or moderately villous becoming glabrous; branchlets yellow-green or yellow-brown, glabrous, villous or velvety becoming glabrous. LEAVES: stipules leaflike; petioles glabrous, tomentose or velvety, 3-18 mm long, with or without glandular dots at base of blade; proximal leaves on vegetative or flowering branchlets entire, gland-dotted, or serrulate; young leaves glabrous to pilose or silky; mature blade ligulate to narrowly oblong or very narrowly elliptic, 60-133 mm long, 12-30 mm wide, 2.9-6.4 times as long as wide, the lower surface glaucous, glabrous; upper surface dull, glabrous or becoming so, the base acute to rounded, the margins flat, serrate, serrulate, or gland-dotted, rarely entire, with 6-13 teeth or glands per cm, the apex acuminate to acute. INFLORESCENCES: coetaneous; floral bracts brown, 0.8-1.6 mm long, glabrous to wavy hairy, the apices acute to rounded. STAMINATE FLOWERS in densely flowered catkins 12-38 mm long; flowering branchlets 0-3 mm long; filaments glabrous; nectary filiform to broad, 0.3-0.6 mm long. PISTILLATE FLOWERS in moderately to densely flowered catkins, 15-50 mm long; flowering branchlets 0-5 mm long; ovaries glabrous; stigmas 0.16-0.4 mm long; style 0.2-0.6 mm long; stipes 0.9-2.5 mm long; nectary broad, 0.3-0.8 mm long, shorter than stipe. $2n = 38$. [*S. rigida* Muhl. subsp. *ligulifolia* (C. Ball) E. Murray; *S. lutea* auct. non Nutt.]. --Montane; forests and thickets along rivers and creeks and cienegas; Apache, Coconino, Gila, Graham, Navajo, Pima, Yavapai cos.; 1150-2900 m (3500-8900 ft); Mar-May; CA e to NM and SD. Often referred to as "entire-leaved", but its leaves are usually serrulate. Vegetative plants are often difficult to distinguish from *S. monticola*, but *S. ligulifolia* generally occurs at lower elevations. The 2 species grow together along Nutrioso Creek, near Nutrioso, where the possibility of intergradation could be studied. Figure 13.

Salix lucida Muhl. (shining). Shining Willow. --Shrub or tree, to 11 m tall. STEMS: branches flexible or brittle at base, branches and branchlets yellow-, gray-, or red-brown; branchlets glabrous, pilose, or villous becoming glabrous. LEAVES: stipules strongly glandular; petioles glabrous or pilose, gland-dotted

or lobed at base of blade, 13-30 mm long; proximal leaves on vegetative or flowering branchlets gland-dotted or serrulate; young leaves glabrous, villous, or silky; mature blade narrowly oblong, very narrowly elliptic to lanceolate, or oblanceolate, 24-170 mm long, 9-43 mm wide, 2.5-9.8 times as long as wide, the lower leaf surface glaucous or not, glabrous, pilose, or silky becoming glabrous, the hairs white, or white and rust-colored; upper surface glossy, glabrous, pilose or silky becoming glabrous; base acute, rounded, or obtuse, the margins flat, serrulate, with 6-14 teeth per cm, the apex caudate to acuminate. INFLORESCENCES: coetaneous; floral bracts tawny, 1.5-4 mm long, glabrous to wavy hairy, the apices rounded, entire, toothed, or erose; pistillate floral bracts deciduous after flowering. STAMINATE FLOWERS in densely flowered catkins 17-50 mm long; flowering branchlets 8-25 mm long; stamens more than 3; filaments hairy at base only; nectaries 1 abaxial and 1 adaxial, square or ovate, 0.3-0.5 mm long. PISTILLATE FLOWERS in densely to moderately flowered catkins 20-100 mm long; flowering branchlets 6-65 mm long; ovaries glabrous; stigmas 0.16-0.42 mm long; styles 0.2-0.8 mm long; stipes 0.5-4 mm long; nectary square or half-cup-shaped, 0.2-0.5 mm long, shorter than stipes. $2n = 76$. --2 subspp. in w N. Amer., AK to Nfld., Can., s to CA, NM, WV.

Subsp. **lasiandra** (Benth.) E. Murray (shaggy-stamened). Pacific Willow. LEAVES: mature blade lower surface glaucous except when young. $2n = 76$. [*S. lasiandra* var. *lancifolia* (Andersson) Bebb]. Common. --Montane; thickets along streams, lake shores, meadows, and seepage areas; Apache, Coconino, Gila, Graham, Greenlee, Navajo, Yavapai cos.; 1200-2700 m (3700-8300 ft); Mar-Jun; AK, and w N.W.T. to Sask., Can., s to CA, NM, WY. The report of *S. lucida* subsp. *caudata* (Nutt.) E. Murray from AZ (Argus 1986) was an error based on juvenile specimens which often lack leaf glaucescence. Figure 14.

Salix lutea Nutt. (yellow). Yellow Willow. --Shrubs or trees, 1.5-7 m tall. STEMS: yellowish, yellow-brown, or gray-brown, glabrous, villous, or glabrescent, sparsely pilose at buds; branchlets yellow-brown or gray-brown, glabrous, villous, or velvety. LEAVES: stipules leaflike; petioles glabrous or pubescent, 3-27 mm long, without glands at base of blade; mature leaf ligulate, narrowly elliptic, elliptic, or oblanceolate, 42-116 mm long, 10-31 mm wide, 2.2-5.6 times as long as wide, the lower surface glaucous, glabrous, glabrescent, or pilose, the upper surface dull, glabrous, glabrescent, or pilose, especially on midrib; base acute to rounded, the margins slightly revolute or flat, entire, gland-dotted, or serrulate, with 5-12 teeth or glands per cm, the apex acuminate to acute. INFLORESCENCES: subprecocious or coetaneous; floral bracts brown, 0.6-2 mm long, glabrous or with straight, wavy, or curly hairs, the apices acute to rounded. STAMINATE FLOWERS in moderately to densely flowered catkins, 15-50 mm long; flowering branchlets 0.2 mm long; filaments glabrous; nectary slender, 0.4-0.7 mm long. PISTILLATE FLOWERS in loosely flowered catkins 20-75 mm long; flowering branchlets 0.8 mm long; ovaries glabrous; stigmas 0.16-0.36 mm long; styles 0.2-0.6 mm long; stipes 1-3.4 mm long; nectary slender or broad, 0.2-0.6 mm long, shorter than stipe. $2n = 38$. [*S. lutea* Nutt. var. *desolata* Kelso]. --Montane; thickets along rivers and creeks; Coconino Co.; 1200-1300 m (3800-4100 ft); Mar-May; N.W.T., Ont., to Alta., Can.; s to CA, CO, NE. Only 2 populations are known from AZ. The Grand Canyon population, named var. *desolata* by Kelso, is characterized by villous branches and velutinous branchlets. It does not deserve formal recognition. Figure 15.

Salix monticola Bebb (of the mountains). Mountain Willow. --Shrub to 6 m tall. STEMS: branches yellow- or red-brown, glabrous; branchlets yellow- or red-brown, glabrous or villous. LEAVES: petioles villous, 5.5-14 mm long; proximal leaves on vegetative or flowering branchlets gland-dotted or serrulate; young leaves villous or silky; mature blade oblong, narrowly elliptic to lanceolate, or oblanceolate to obovate, 35-95 mm long 11-33 mm wide, 2-3.9 times as long as wide, the lower surface glaucous, glabrous; upper surface dull, glabrous or pilose, especially on midrib, the base acute to rounded, the margins slightly revolute to flat, serrulate to serrate, with 5-9 teeth per cm, the apex acute to subacuminate. INFLORESCENCES: precocious, subprecocious, or coetaneous; floral bracts brown, black, or bicolored, 1.4-2 mm long, with curly or straight hairs, the apices rounded to acute. STAMINATE FLOWERS in densely flowered catkins 10-37 mm long; flowering branchlets 0-3 mm long; stamens 2, the filaments hairy; nectary slender, 0.6-0.9 mm long. PISTILLATE FLOWERS in densely flowered catkins 15-57 mm long; flowering

branchlets 0-8 mm long; ovaries glabrous; stigmas 0.24-0.56 mm long; styles 0.6-1.1 mm long; stipes 0.6-1.6 mm long; nectary slender to broad, 0.4-1 mm long, shorter than or equal to stipe. $2n = 114$. [*S. pseudomonticola* auct. non C. Ball]. --Subalpine to montane; thickets along rivers and creeks, cienegas, meadows and springs; Apache, Coconino, Navajo cos.; 2200-3100 m (6900-9500 ft); May; UT, WY, s to NM. Figure 16.

Salix planifolia Pursh (flat-leaved). Planeleaf Willow. --Shrub to 4 m tall, erect or decumbent on ground. STEMS: branches yellow- or red-brown, glabrous to becoming so; branchlets yellow- to dark red-brown, glabrous or short-silky. LEAVES: stipules leaflike to lacking; petioles glabrous or pilose, 2-9 mm long; proximal leaves on vegetative or flowering branchlets entire or gland-dotted; young leaves glabrous or silky; mature blade narrowly oblong to elliptic, 20-48 mm long, 5-15 mm wide, 1.5-5 times as long as wide, the lower surface glaucous, glabrous or sparsely silky becoming glabrous, the hairs white or white and rust-colored, the upper surface highly glossy, sparsely silky becoming glabrous, the base acute, the margins flat to revolute, entire to crenate, with 2-8 glands per cm, the apex acute. INFLORESCENCES: precocious; floral bracts brown or black, 1-3.2 mm long, with straight hairs, the apices acute to obtuse. STAMINATE FLOWERS in densely flowered catkins 11-22 mm long, sessile or on flowering branchlets up to 3 mm long; filaments glabrous or hairy; nectary broad, 0.4-0.8 mm long. PISTILLATE FLOWERS in densely flowered catkins 15-60 mm long, sessile or on flowering branchlets to 2 mm long; ovaries silky; stigmas 0.36-0.92 mm long; styles 0.5-1.8 mm long; stipes 0.3-0.8 mm long; nectary 1, slender to broad, 0.4-1.3 mm long, shorter, equal to, or longer than stipe. $2n = 76$. Throughout boreal Can. extending s into western mountains.

Subsp. **planifolia**. --Shrub to 1 m tall in ours. LEAVES: stipules absent or rudimentary; petioles pilose; mature blades 20-54 mm long, 5-23 mm wide, the margins entire or gland-dotted. PISTILLATE FLOWERS in catkins 15-45 mm long; nectary 0.4-0.9 mm long; $2n = 76$. [*S. monica* Bebb, *S. planifolia* var. *monica* (Bebb) C. Schneider]. --Subalpine; meadows and stream banks; Apache Co.; 3200-3280 m (9900-10000 ft); May-Jun; throughout boreal Canada, mountains from ID and MT s to NM. Figure 17.

Salix scouleriana J. Barratt ex Hook. (for John Scouler). Scouler's Willow. --Shrub or tree to 10(-20) m tall. STEMS: branches gray-, yellow-, or red-brown, tomentose becoming glabrous; branchlets yellow-green to yellow-brown, velvety, villous, or tomentose. LEAVES: petioles velvety or villous, 2-13 mm long; young leaves villous to silky; mature blade narrowly elliptic to oblanceolate or obovate, 29-80 mm long, 9-36 mm wide, 1.7-3.9 times as long as wide, the lower surface glaucous, short silky or tomentose with white and rust-colored hairs or white-woolly, the upper surface shiny, pilose or silky, becoming glabrous; base cuneate to rounded, the margins strongly revolute, entire, gland-dotted to irregularly serrate, with 1-4 teeth or glands per cm, the apex acute to rounded. INFLORESCENCES precocious; floral bracts dark or light brown or bicolored, 1.5-4.5 mm long, with straight hairs, the apices rounded or acute. STAMINATE FLOWERS in densely flowered catkins 15-45 mm long, sessile; filaments glabrous; nectary broad, 0.4-0.8 mm long. PISTILLATE FLOWERS in densely flowered catkins 25-65 mm long; flowering branchlets 0-6 mm long; ovaries silky; stigmas 0.4-1.04 mm long; styles 0.2-0.6 mm long; stipes 0.8-2.3 mm long; nectary broad, 0.2-0.7 mm long, shorter than stipe. $2n = 76, 114$. [*S. flavescens* Nutt., *S. scouleriana* var. *coetanea* C. Ball]. --Montane; dry to moist slopes in high elevation forests, meadows, springs; Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Pima, cos.; 2100-3400 m (6400-10600 ft); May-June, second flowering in Jul; AK e to Man., Can.; s to CA and in mountains to w SD and NM; Chih., Son., Mex. Figure 18.

Salix taxifolia Kunth. (yew-like leaves). Yew-leaf Willow. --Tree or shrub to 16 m tall, clonal by root suckers. STEMS: branches red- to yellow- or gray-brown, silky becoming glabrous; branchlets yellow-brown, silky to villous becoming glabrous. LEAVES: stipules absent or rudimentary; petioles silky, 0.2-1.5 mm long; proximal leaves on vegetative or flowering branchlets entire or gland-dotted; young leaves silky, mature blade linear to ligulate or narrowly oblanceolate, 13-42 mm long, 1.1-4.4 mm wide, 5.8-24.6 times as long as wide, the lower surface glaucous or not, silky to villous becoming glabrous; upper surface shiny, silky becoming glabrous, the base acute; margins flat entire or gland-dotted, sometimes toothed, 1-6 glands

per cm, the apex acute, apiculate. INFLORESCENCES: coetaneous on short flowering branchlets or serotinous on long flowering branchlets; floral bracts tawny, 1.3-2.8 mm long, with straight hairs, the apices acute to obtuse; pistillate floral bracts deciduous after flowering. STAMINATE FLOWERS in densely flowered catkins 7-20 mm long; flowering branchlets 1.5-290 mm long; stamens 2; filaments hairy; nectaries (0-)1 abaxial, 1 adaxial, broad to slender, 0.5-0.8 mm long. PISTILLATE FLOWERS in densely to loosely flowered catkins 7-23 mm long; flowering branchlets 6-160 mm long; ovaries silky to pilose becoming glabrous; stigmas 0.44-0.6 mm long; styles 0-0.3 mm long; stipes 0-0.3 mm long; nectary slender to broad, 0.4-1.4 mm long, longer than stipe. --Warm temperate to subtropical; forests along streams; Cochise, Pima, Santa Cruz cos.; 750-1700 m (2300-5200 ft); Feb-Apr and throughout the year; s AZ to w TX; Baja C., to Coah., Mex. Related to *S. microphylla* Kunth which occurs in Mex. s to Guatemala. Figure 19.

ACKNOWLEDGEMENTS

I acknowledge the Canadian Museum of Nature for supporting field work, in 1985 and 1986, and the herbarium research that made this study possible. The descriptive data was handled using DELTA and the keys were written with the assistance of PANKEY. I thank the curators and collections managers who made collections available for study: A, ARIZ, ASC, ASU, ASUF, CO, GH, HPC, LL, MNA, MO, NA, NMC, NY, RSA, SMU, TEX, UNM, US, UTEP, WIS, WTS. All specimen label data was computerized by Barbara Kobolak and was used in mapping.

I thank Carl-Eric Granfelt, Pinetop, Arizona, for his help in the field, for making numerous special collections, and for his extensive correspondence filled with valuable observations on the identification and distribution of willows in Arizona. I also am indebted to the Whiteriver Apache Tribe for permission to collect on the reservation and for allowing Mr. Granfelt to continue to collect for me. Anton Reznicek provided information on an early collector of *S. irrorata* and John Argus served for two field seasons as a volunteer field assistant.

The distribution maps were plotted by Cheryl McJannet and the illustrations were drawn by Susan Laurie-Borque.

Figure 1.

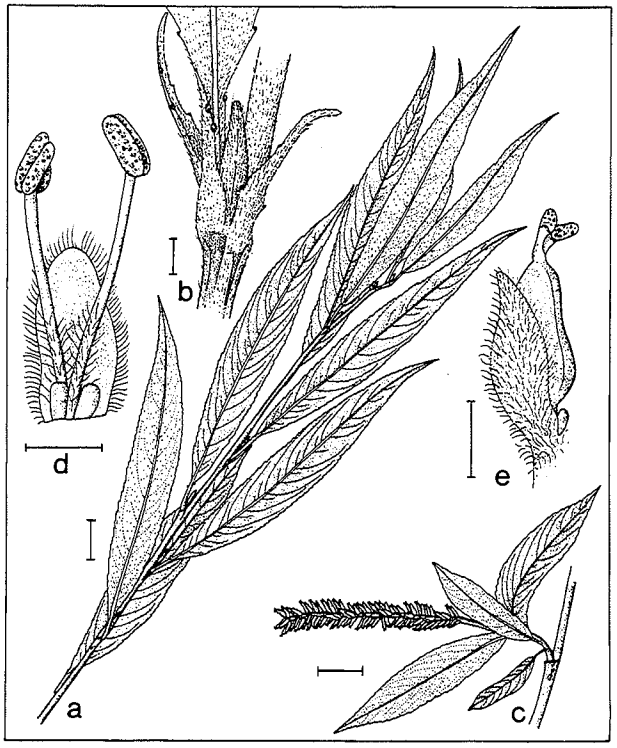
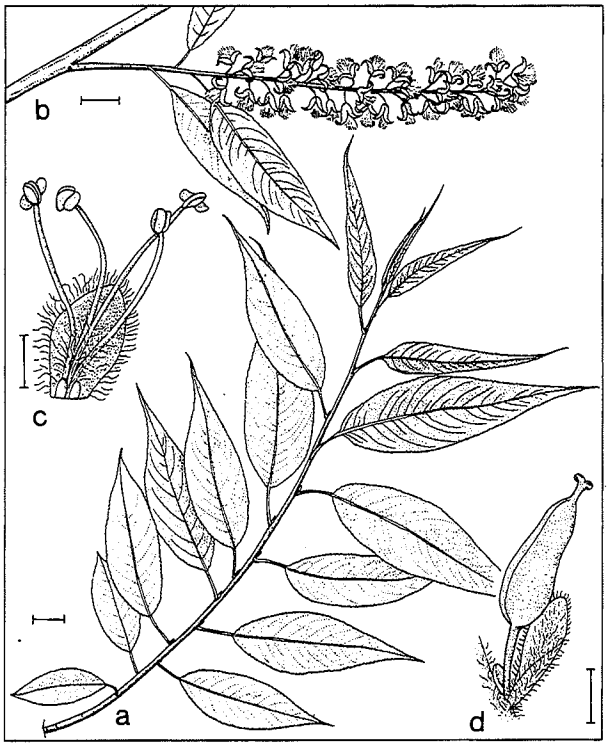
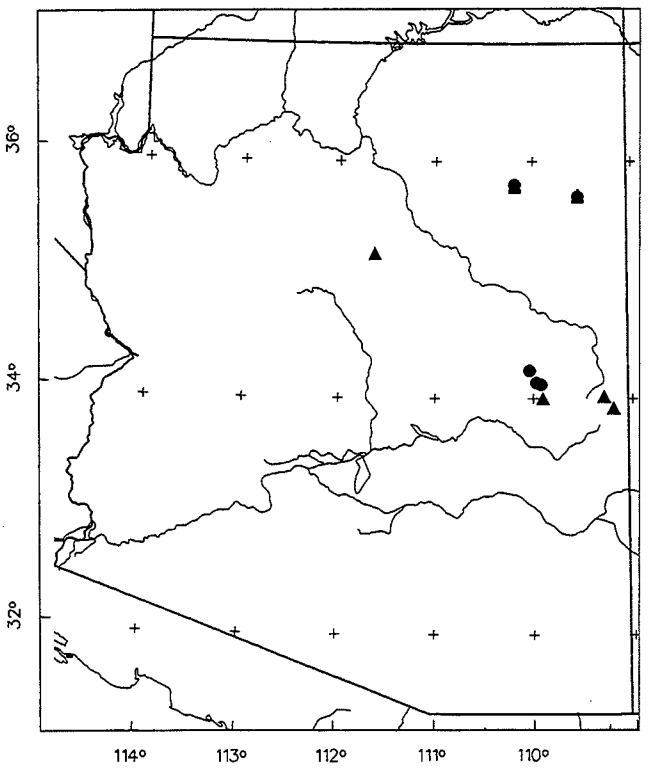


Figure 2.





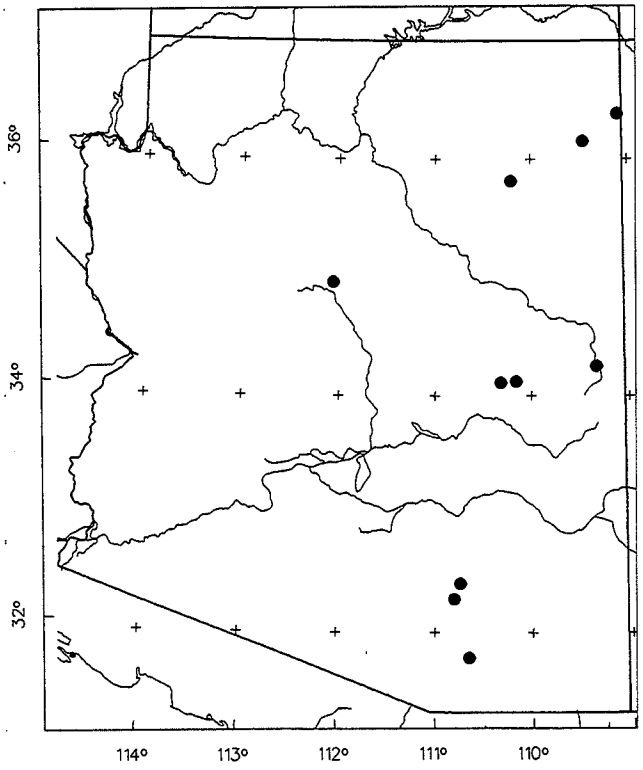
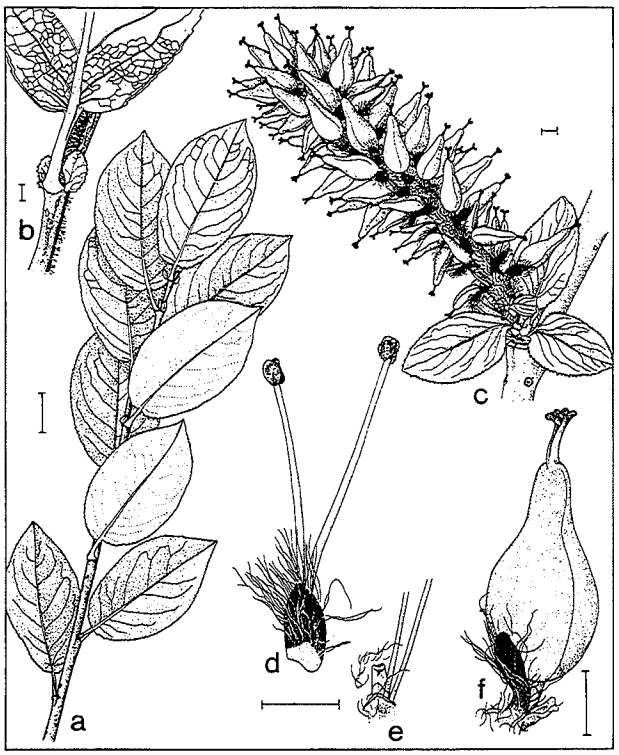
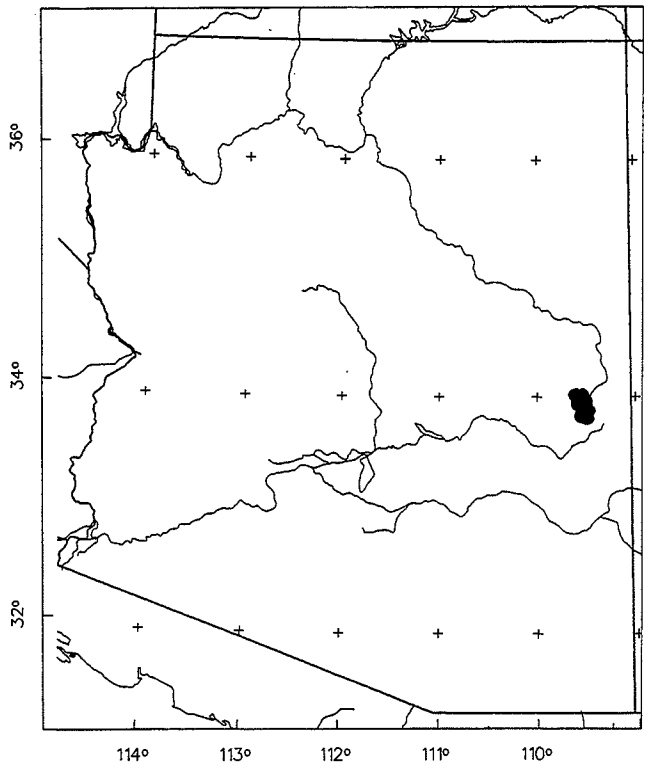


Figure 1. *Salix alba*. a. Vegetative branch (scale 1 cm), b. Detail of base of leaf, narrow stipules, glands at distal end of petiole (scale 1 mm), c. Pistillate catkin on leafy flowering branchlet (scale 1 cm), d. Staminate flower (scale 1 mm), e. Pistillate flower (scale 1 mm).

Figure 2. *Salix amygdaloides*. a. Vegetative branch (scale 1 cm), b. Pistillate catkin on leafy flowering branchlet, proximal leaves deciduous (scale 1 cm), c. Staminate flower, floral nectaries adaxial (scale 1 mm), d. Pistillate flower (scale 1 mm).

Figure 3.





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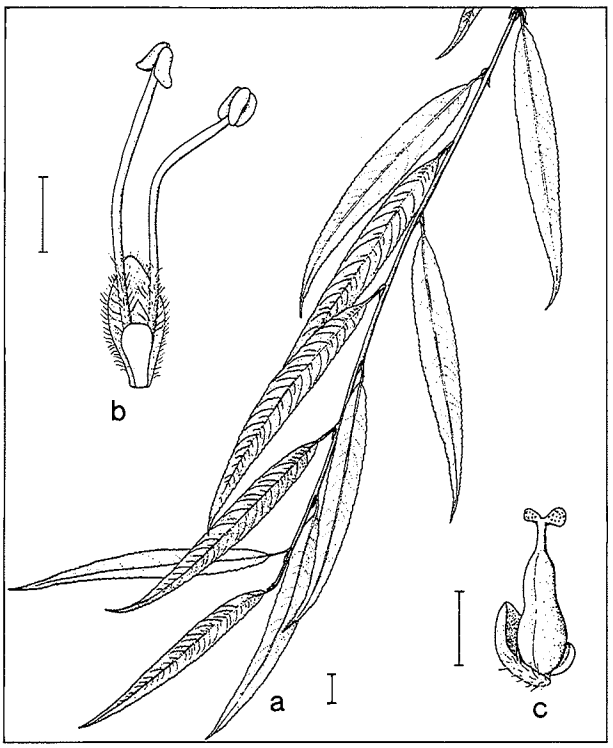


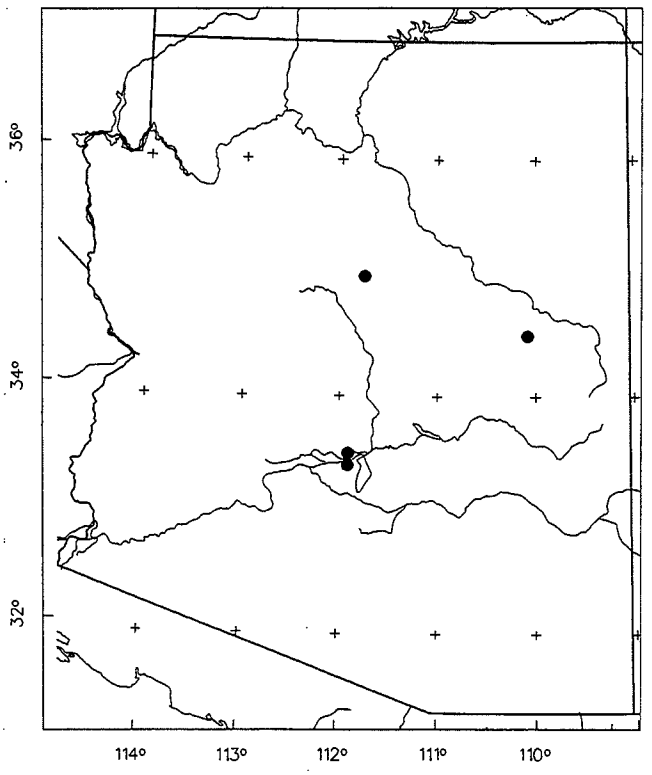
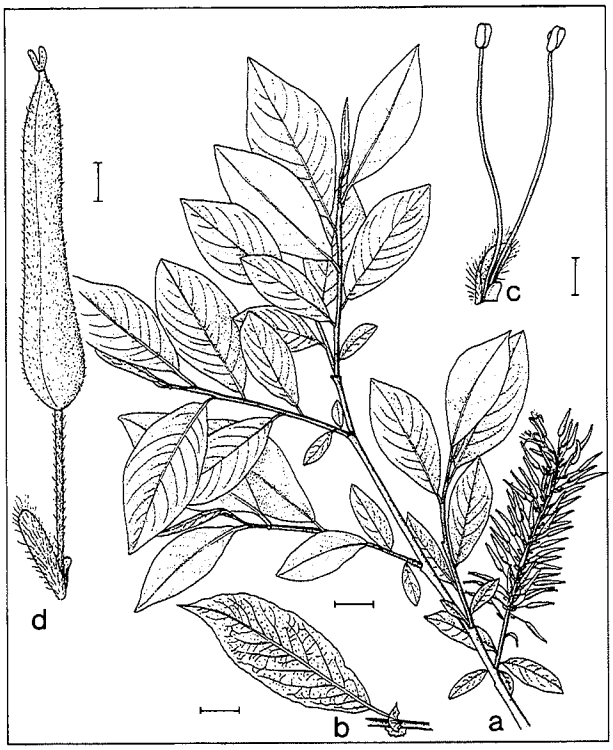
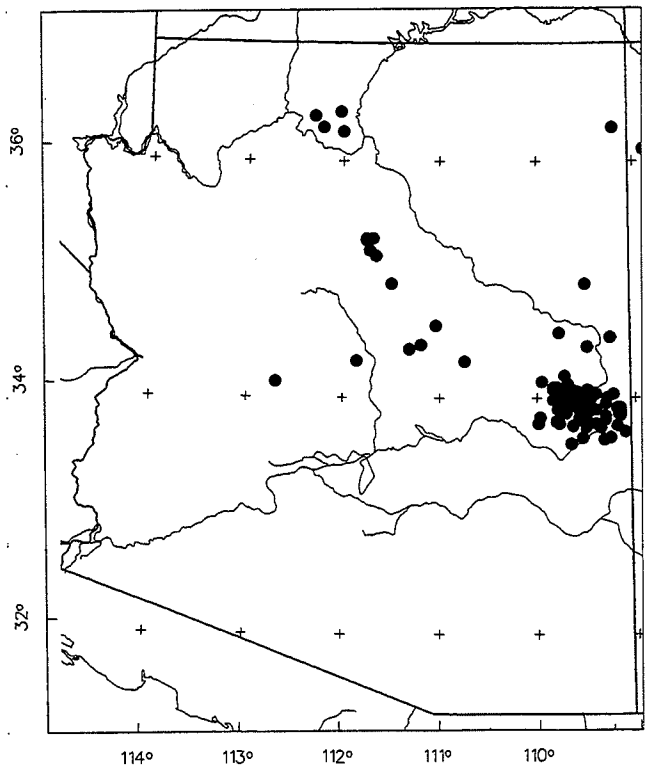


Figure 3. *Salix arizonica*. a. Vegetative branch (scale 1 cm), b. Detail of base of leaf showing stipules (scale 1 mm), c. Pistillate catkin on very short flowering branchlet (scale 1 mm), d. Staminate flower (scale 1 mm), e. Base of staminate flower, floral bract removed to show adaxial floral nectary, f. Pistillate flower (scale 1 mm).

Figure 4. *Salix babylonica*. a. Pendulous vegetative branch (scale 1 cm), b. Staminate flower (scale 1 mm), c. Pistillate flower (scale 1 mm).

Figure 5.





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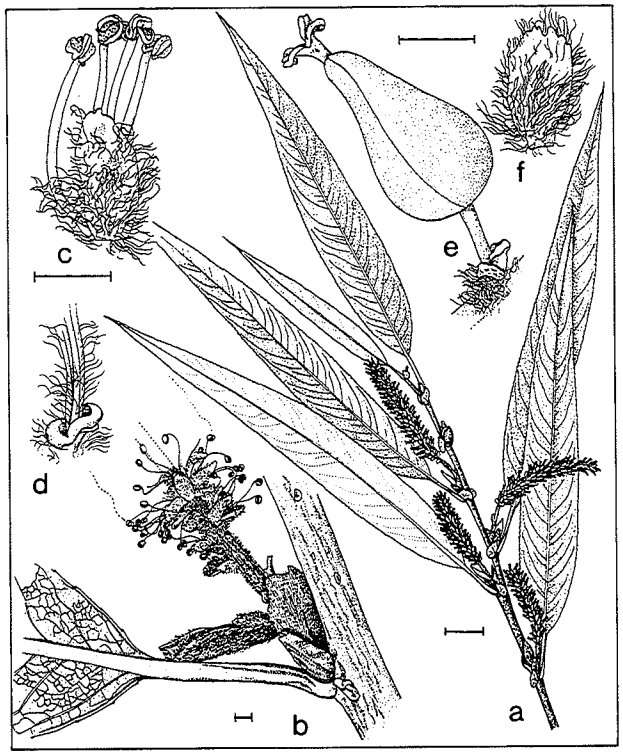


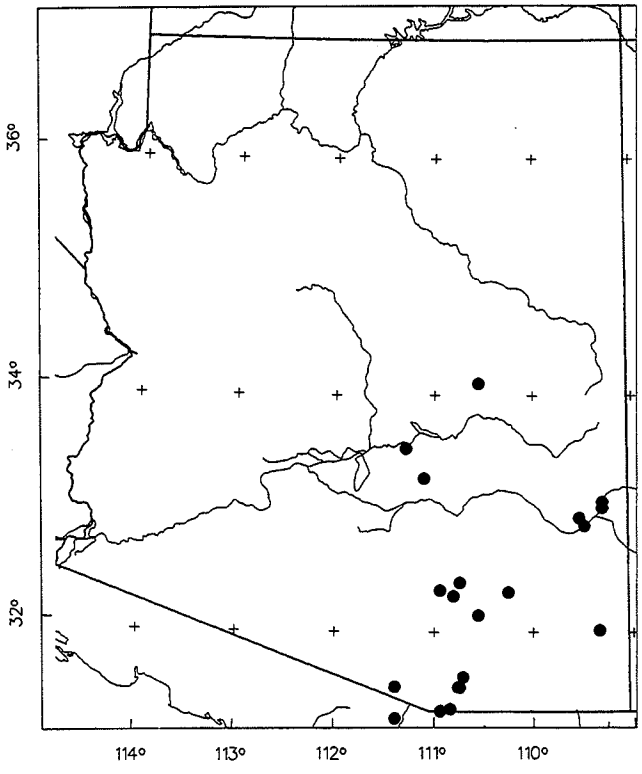
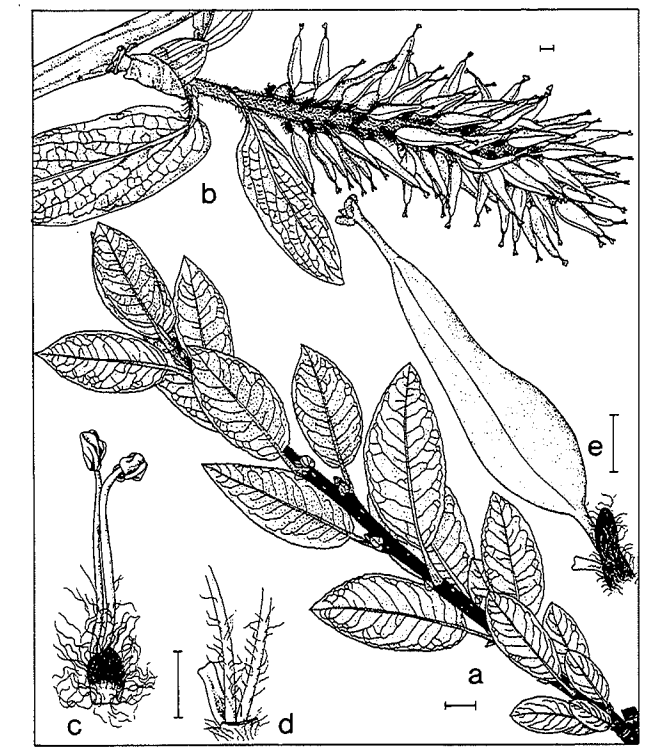


Figure 5. *Salix bebbiana*. a. Pistillate flowering branch with mature leaves (scale 1 cm), b. Detail of leaf showing stipules (scale 1 mm), c. Staminate flower, nectary adaxial (scale 1 mm), d. Pistillate flower (scale 1 mm).

Figure 6. *Salix bonplandiana*. a. Pistillate flowering branch with catkins in leaf axils of mature leaves (scale 1 cm), b. Detail showing the lower portion of a staminate catkin in a leaf axil, note persistent, scale-like prophylls and bud scale at the base of the catkin (scale 1 mm), c. Staminate flower (scale 1 mm), d. Base of stamens showing the cupulate floral nectary (scale 1 mm) e. Pistillate flower, floral bract deciduous after flowering, nectary adaxial (scale 1 mm), f. Pistillate floral bract showing irregularly toothed apex (scale 1 mm).

Figure 7.



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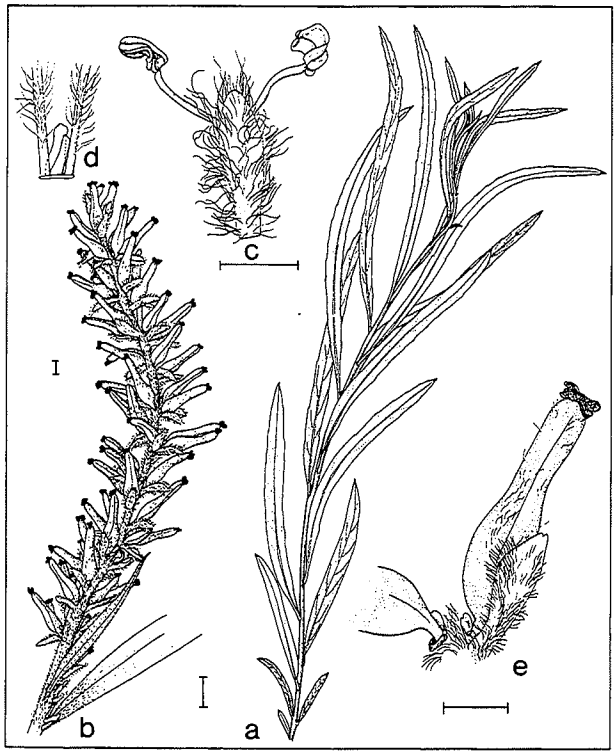
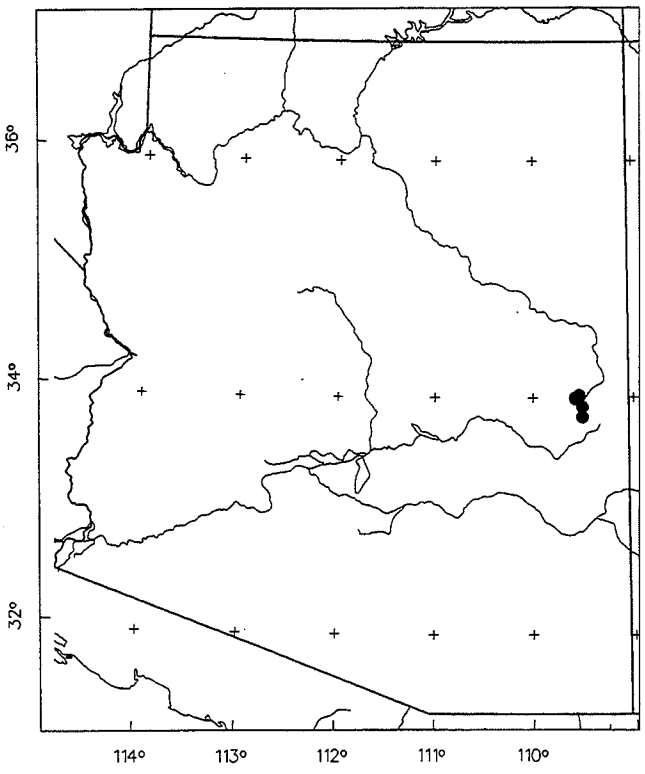




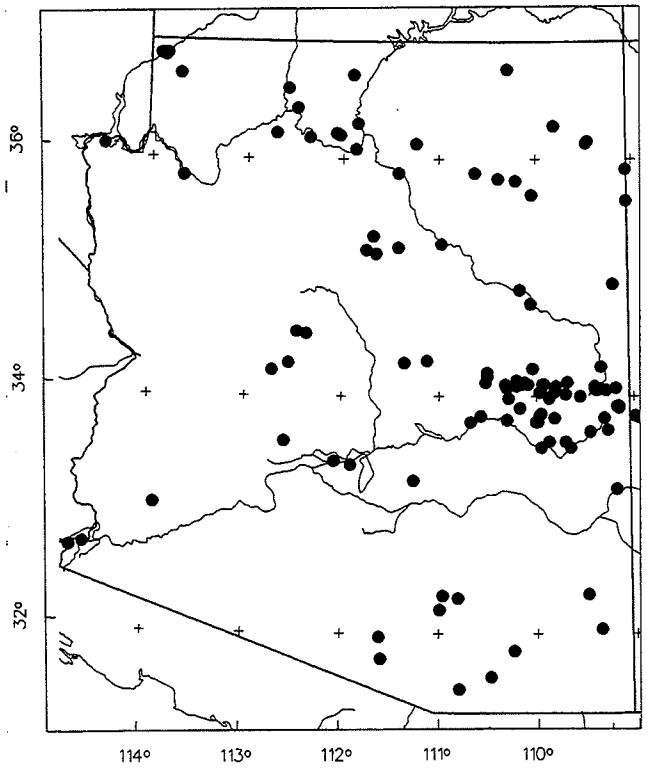
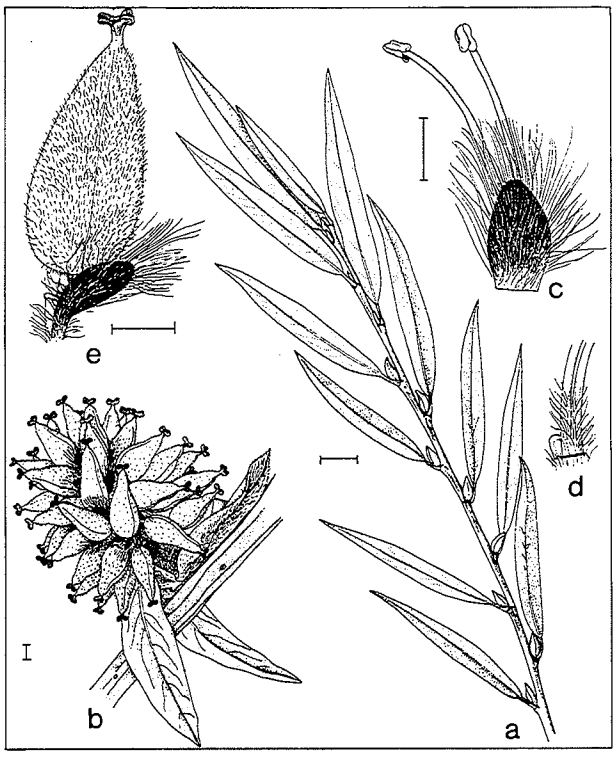


Figure 7. *Salix boothii*. a. Vegetative branch (scale 1 cm), b. Pistillate catkin on leafy flowering branchlet, note bud scale and free inner scale at base of catkin (scale 1 mm), c. Staminate flower (scale 1 mm), d. Base of staminate flower, floral bract removed to show adaxial floral nectary (scale 1 mm), e. Pistillate flower (scale 1 mm).

Figure 8. *Salix exigua* subsp. *exigua*. a. Vegetative branch (scale 1 cm), b. Pistillate catkin showing only a portion of the leafy flowering branchlet (scale 1 mm), c. Staminate flower (scale 1 mm), d. Base of staminate flower, floral bract removed to show abaxial and adaxial floral nectaries (scale 1 mm), e. Two pistillate flowers, the partial flower shows the scar left by the deciduous floral bract, the flower on the right is slightly pilose (scale 1 mm).

Figure 9.



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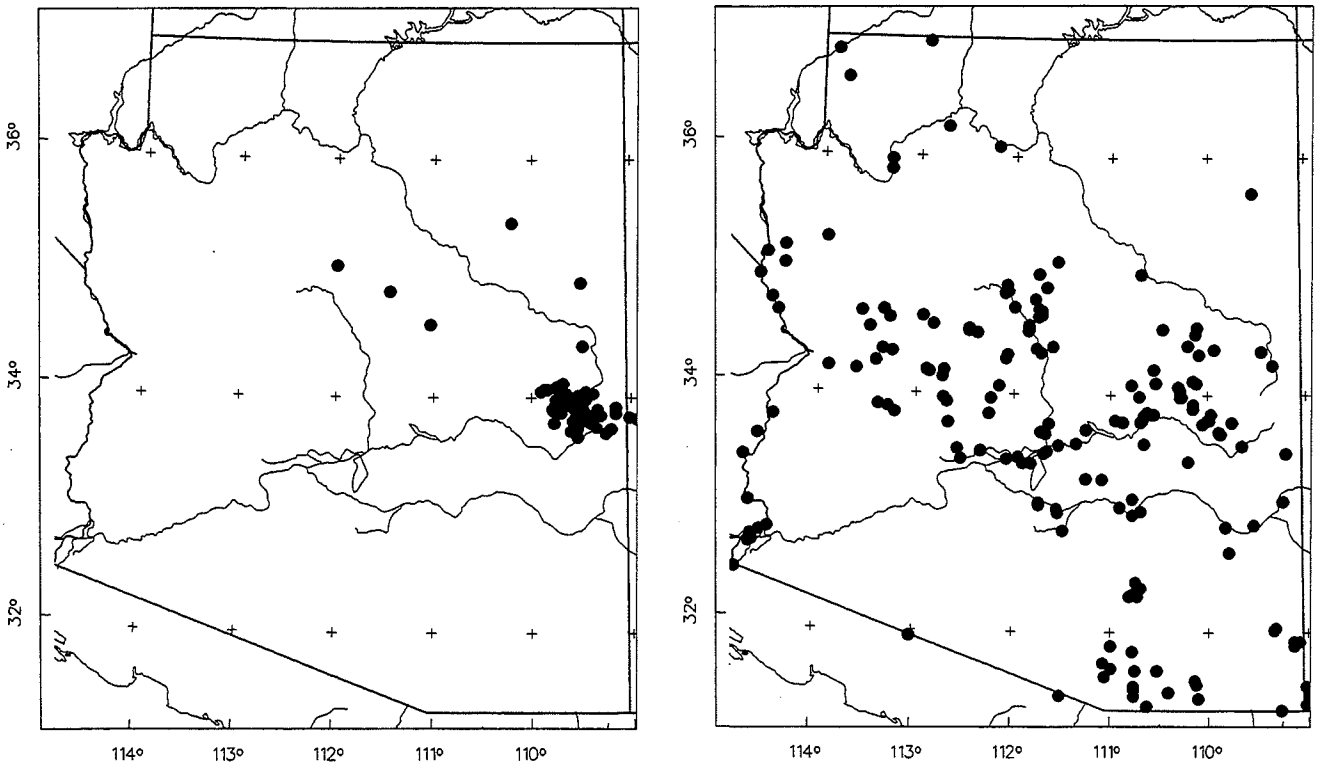
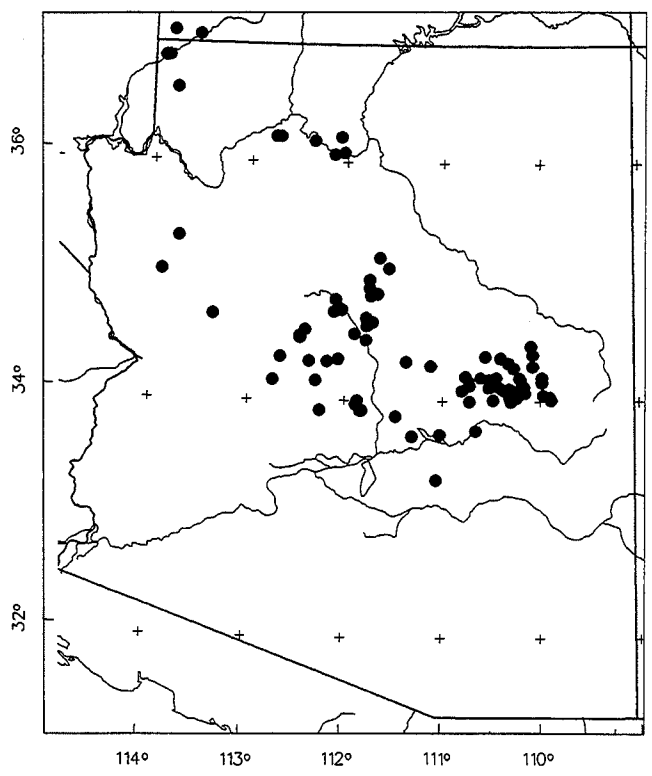


Figure 9. *Salix geyeriana*. a. Vegetative branch, note swollen floral buds (scale 1 cm), b. Pistillate catkin on very short flowering branchlet (scale 1 mm), c. Staminate flower (scale 1 mm), d. Base of staminate flower, floral bract removed to show adaxial floral nectary (scale 1 mm), e. Pistillate flower (scale 1 mm).

Figure 10. *Salix gooddingii*. a. Staminate flowering branch with catkins on leafy flowering branchlets, and vegetative branchlets (scale 1 cm), b. Mature leaf showing stipule (scale 1 mm), c. Pistillate catkin showing the pseudolateral position of catkin produced by the syleptic development of the bud in the axil of the leaf at base of catkin (scale 1 mm), d. Staminate flower, note abaxial and adaxial floral nectaries (scale 1 mm), e. Pistillate flower with a glabrous ovary (scale 1 mm), f. Pistillate flower with pilose ovary, floral bract deciduous (scale 1 mm).

Figure 11.



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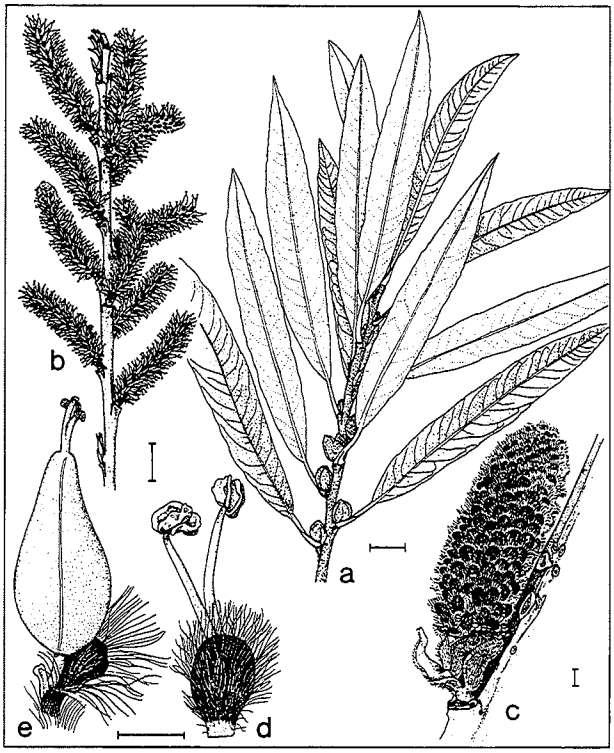


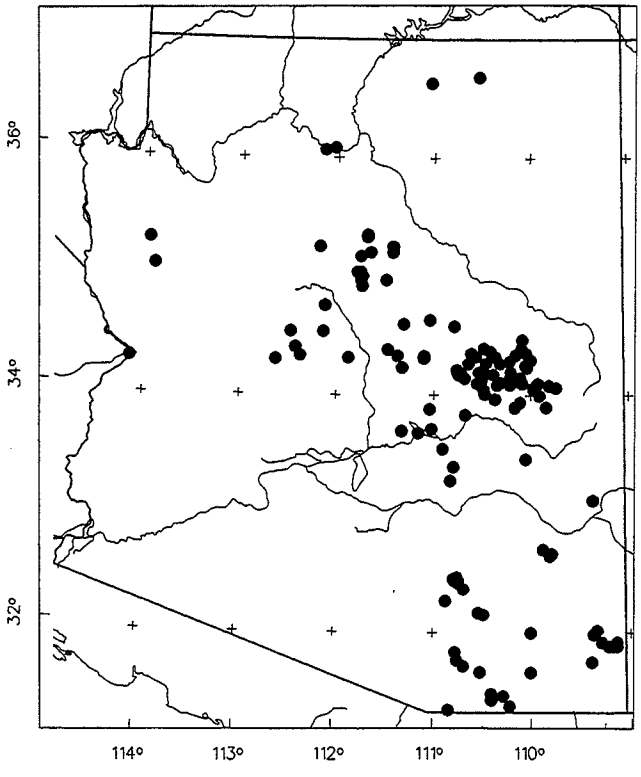


Figure 11. *Salix laevigata*. a. Vegetative branch (scale 1 cm), b. Detail of bud and base of petiole showing bud scale with a free, imbricate margin (scale 1 mm), c. Pistillate catkin on a leafy flowering branchlet (scale 1 mm), d. Staminate flower (scale 1 mm), e. Base of staminate flower showing adaxial floral nectary (scale 1 mm), f. Pistillate flower (scale 1 mm).

Figure 12. *Salix lasiolepis*. a. Vegetative branch, note swollen flower buds (scale 1 cm), b. Branch bearing pistillate catkins, the leaf buds at the distal end are just emerging (scale 1 mm), c. Immature staminate catkin showing the distinctive imbricate floral bracts (scale 1 mm), d. Staminate flower (scale 1 mm), e. Pistillate flower (scale 1 mm).

Figure 13.

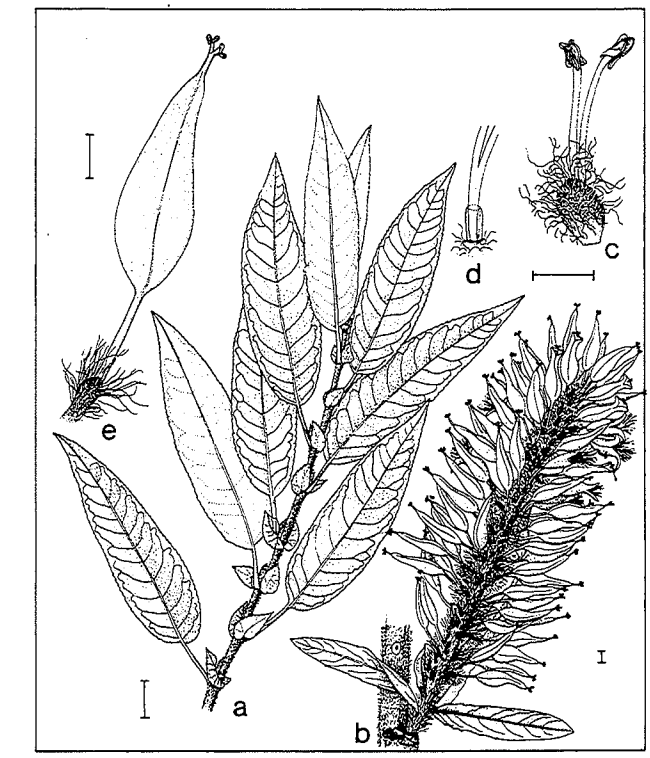
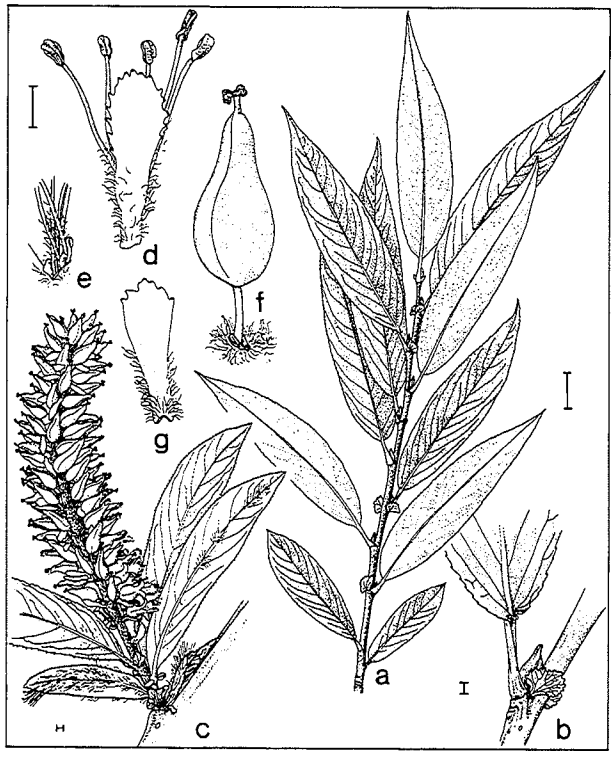
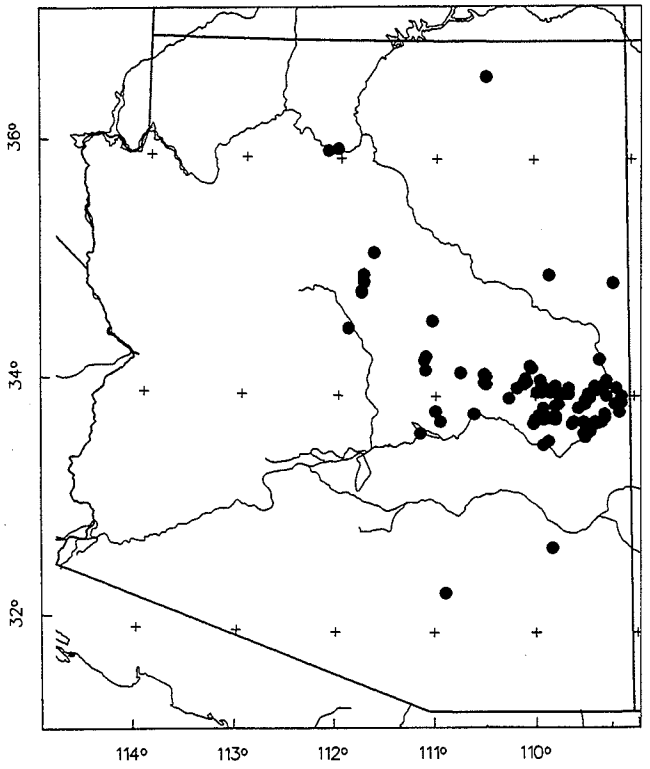


Figure 14.





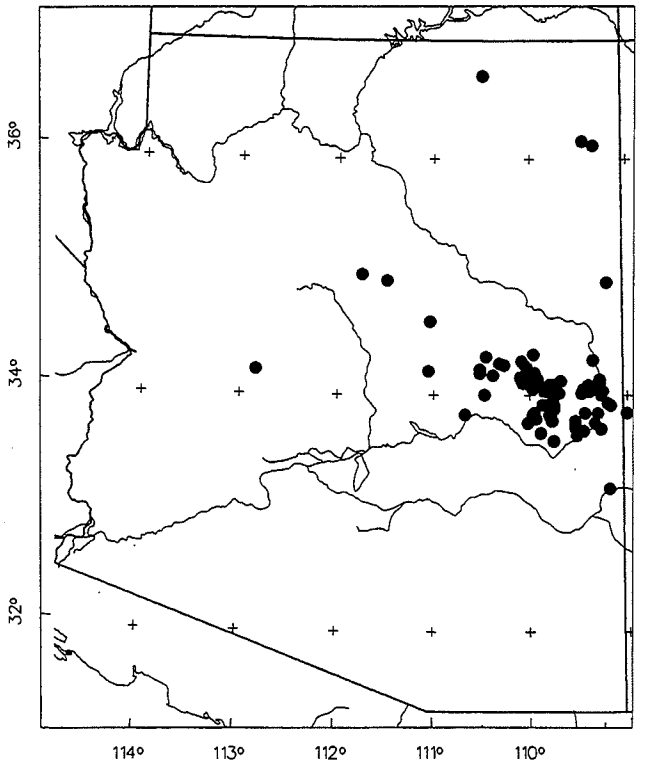
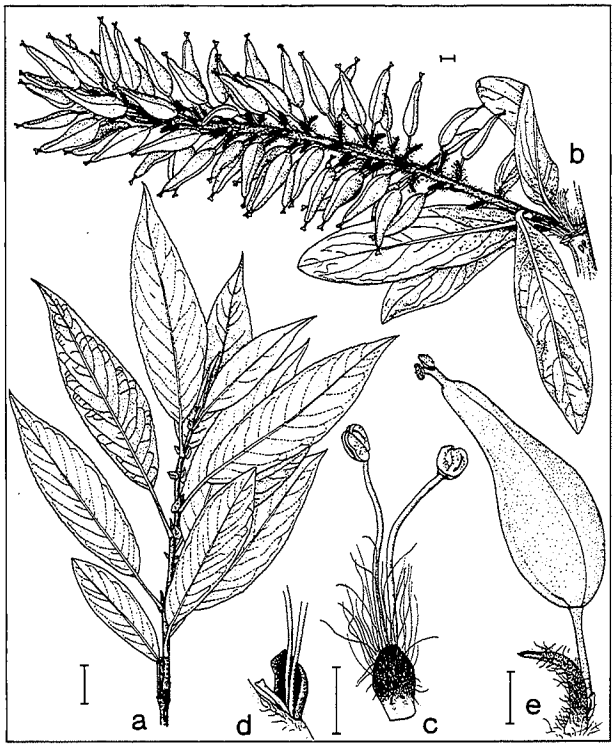


Figure 13. *Salix ligulifolia*. a. Vegetative branch (scale 1 cm), b. Pistillate catkin on short flowering branchlet (scale 1 mm), c. Staminate flower (scale 1 mm), d. Base of staminate flower, floral bract removed to show adaxial nectary (scale 1 mm), e. Pistillate flower (scale 1 mm).

Figure 14. *Salix lucida* subsp. *lasiandra*. a. Vegetative branch (scale 1 cm), b. Base of leaf, note glandular dots at base of blade and stipules (scale 1 mm), c. Pistillate catkin on a leafy flowering branchlet (scale 1 mm), d. Staminate flower, note irregularly toothed floral bract (scale 1 mm), e. Base of staminate flower, floral bract removed to show abaxial and adaxial floral nectaries (scale 1 mm), f. Pistillate flower, floral bract deciduous after flowering (scale 1 mm), g. Deciduous pistillate floral bract (scale 1 mm).

Figure 15.



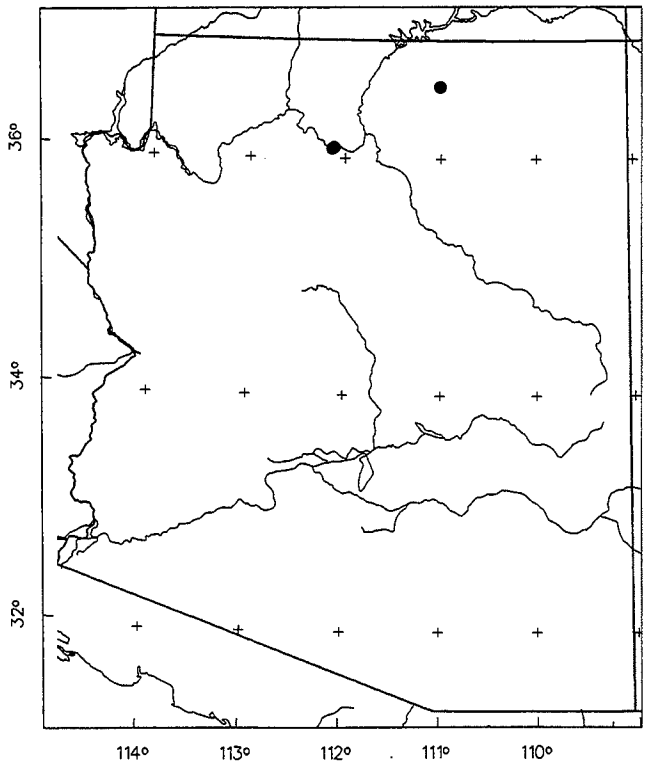
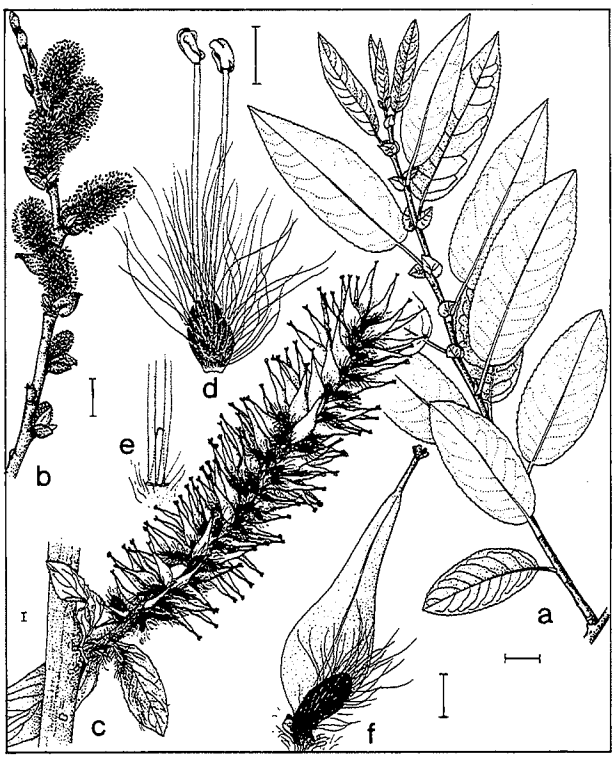


Figure 16.



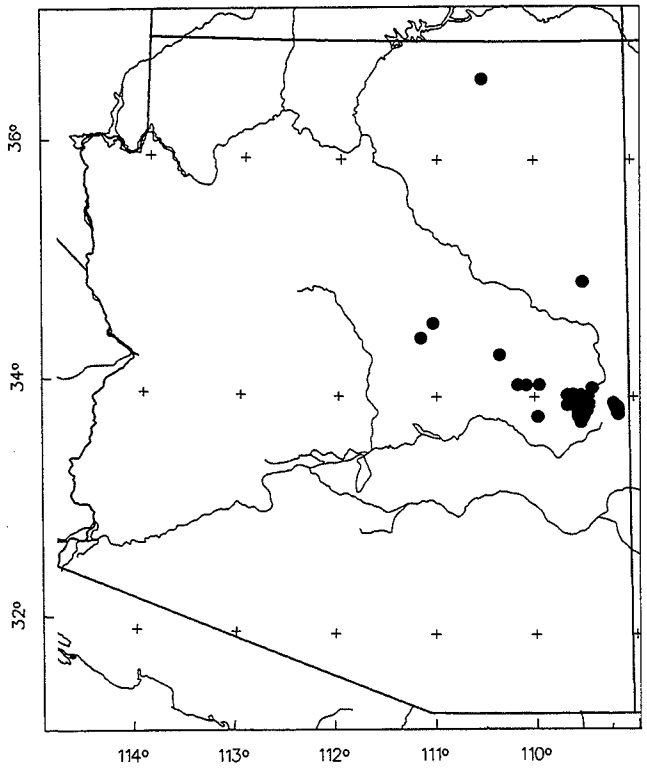


Figure 15. *Salix lutea*. a. Vegetative branch (scale 1 cm), b. Pistillate catkin on leafy flowering branchlet (scale 1 mm), c. Staminate flower (scale 1 mm), d. Base of staminate flower showing adaxial nectary (scale 1 mm), e. Pistillate flower (scale 1 mm).

Figure 16. *Salix monticola*. a. Vegetative branch (scale 1 cm), b. Branch with staminate catkins in anthesis, vegetative buds at distal end not yet emerging (scale 1 cm), c. Pistillate catkin on very short flowering branchlet (scale 1 mm), d. Staminate flower (scale 1 mm), e. Base of staminate flower, floral bract removed to show adaxial nectary (scale 1 mm), f. Pistillate flower (scale 1 mm).

Figure 17.

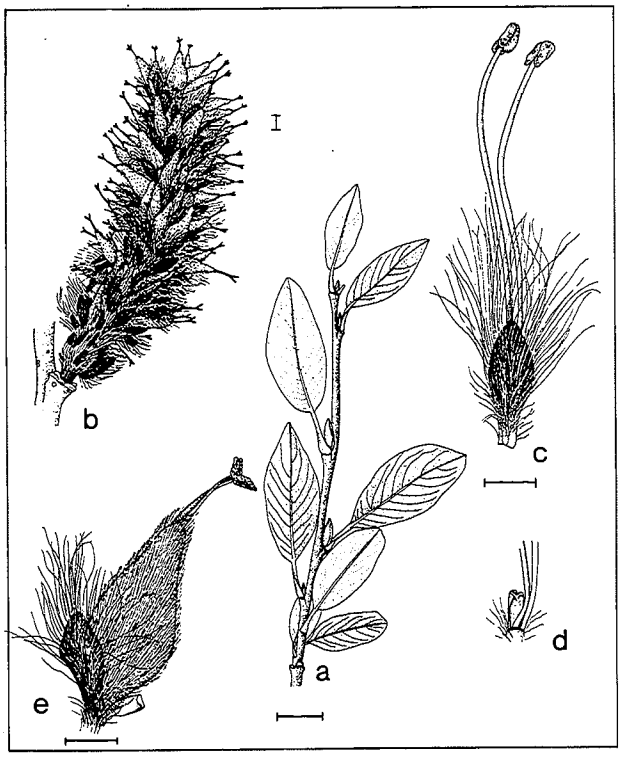
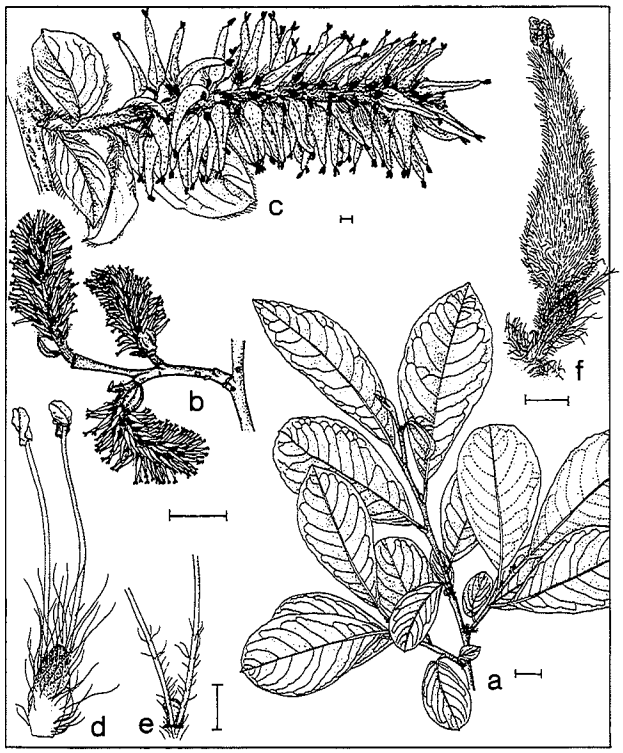
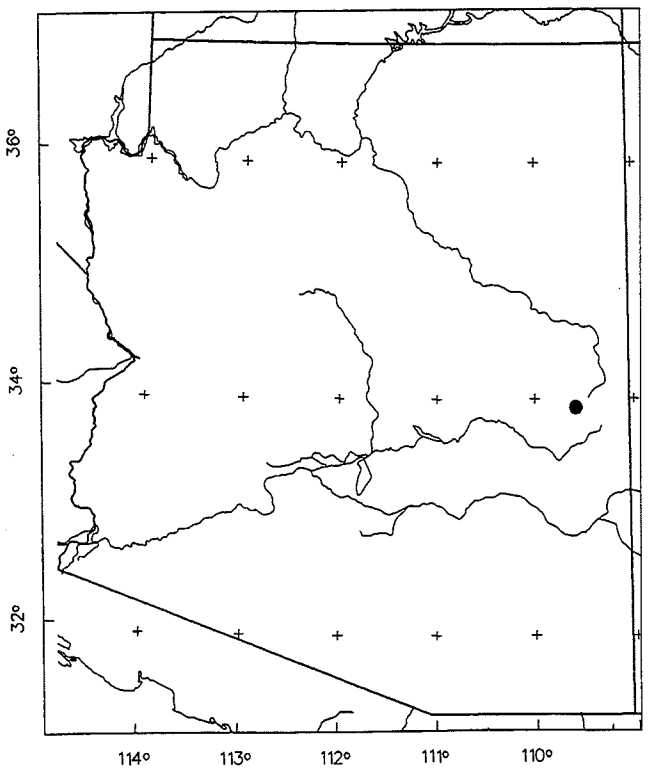


Figure 18.





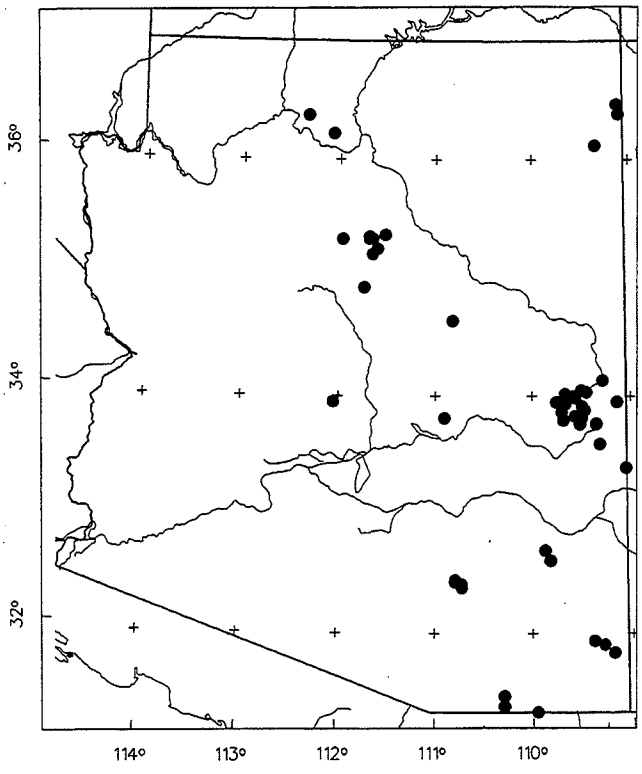


Figure 17. *Salix planifolia*. subsp. *planifolia*. a. Vegetative branch, note swollen flower buds (scale 1 cm), b. Pistillate catkin, sessile, lacking a flowering branchlet (scale 1 mm), c. Staminate flower (scale 1 mm), d. Base of staminate flower, floral bract removed to show adaxial nectary (scale 1 mm), e. Pistillate flower (scale 1 mm).

Figure 18. *Salix scouleriana*. a. Vegetative branch (scale 1 cm), b. Branch with pistillate catkins, catkins sessile, lacking a flowering branchlet (scale 1 cm), c. Pistillate catkin on a very short flowering branchlet (scale 1 mm), d. Staminate flower (scale 1 mm), e. Base of staminate flower, floral bract removed to show adaxial nectary (scale 1 mm), f. Pistillate flower (scale 1 mm).

Figure 19.

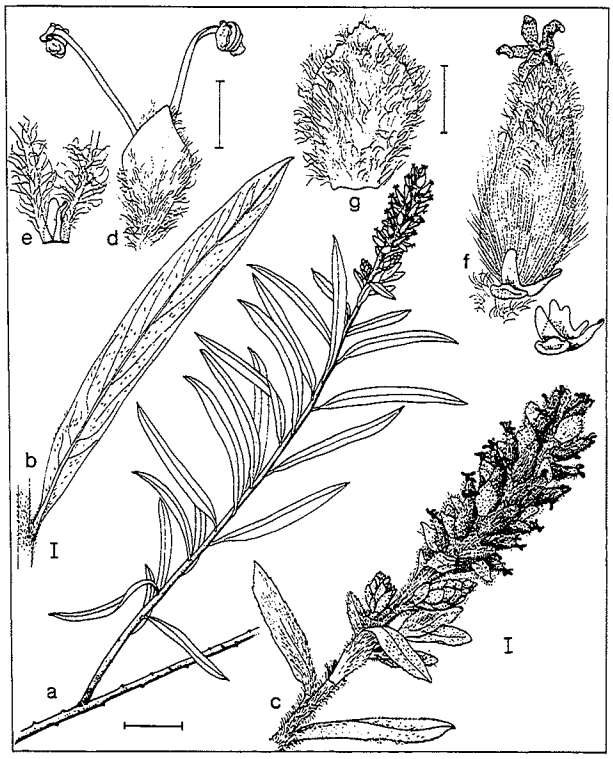


Figure 20.

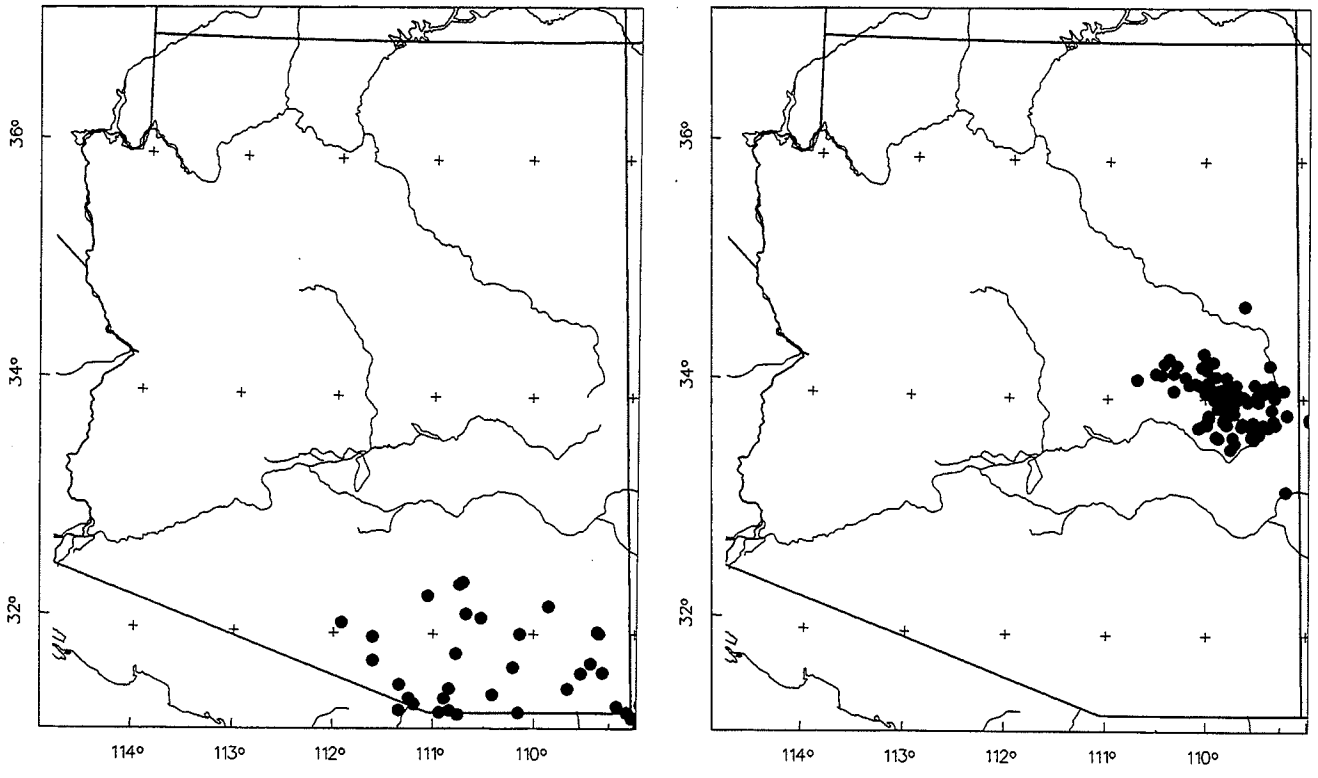


Figure 19. *Salix taxifolia*. a. Ordinary vegetative branch terminated by a pistillate catkin (scale 1 cm), b. Mature leaf, c. Branched pistillate catkin, note secondary catkins borne in the axil of floral bracts at base of catkin (scale 1 mm), d. Staminate flower (scale 1 mm), e. Base of staminate flower, floral bract removed to show abaxial (slender) and adaxial nectaries (scale 1 mm), f. Pistillate flower, floral bract deciduous after flowering, detail at lower right shows a lobed, cupulate floral nectary and floral bract scar (scale 1 mm), g. Deciduous pistillate floral bract (scale 1 mm).

Figure 20. *Salix irrorata*. Map only. A species morphologically similar to *S. lasiolepis* (Figure 11). See comment under *S. irrorata* for comparison.