

have frequently found living *Anodonta* buried in damp mud where ponds have dried up. These had fairly heavy shells for *Anodonta*, however, while there were many dead thin-shelled *Anodonta* about. Thickness of shell and close alignment of the shells seem to be necessary to survival under conditions of drying. We have never found a deformed clam alive under waterless conditions. The two things that clams apparently cannot stand are extensive organic pollution of the stream, and increasing acidity. The main Trinity River was, at one time (Strecker, 1931) a good clam habitat. Strecker emphasized the fact, 21 years ago, that pollution was ruining the clam population of the Trinity around Dallas, and this pollution has greatly increased up to the present time. Several attempts at collecting in the Trinity River have been made in the course of this study, and not a live clam has been found, although ancient eroded shells attest to the former abundance of these animals.

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Synopsis of the United States Species of *Lythrum* (Lythraceae)

Lloyd H. Shinnners

Considerable difficulty was encountered in distinguishing the species of *Lythrum* found in north central Texas, and in deciding on the correct names for them. To dispose of a relatively small problem (only two species were involved), it has been necessary to undertake a study of the genus in the entire United States and Mexico. Because of lack of adequate collections, and lack of field acquaintance with any of them, those of the latter region have been omitted. Only two proved of any concern in treating those of the United States; they are noted briefly under *L. californicum* and *L. alatum*. Introgression between species where the ranges meet, the occurrence of endemic minor variants (especially in *L. californicum*), and the considerable superficial simi-

larity of the common and widespread species, have been responsible not only for frequent misidentifications, but in considerable part for misapplication of names. No new species are proposed, and only three species are involved in changes of application of earlier names (two of them unfortunately the commonest and most wide-ranging in the country). It is hoped that the artificial key given below will facilitate identification, but as in most difficult groups, it is important that complete specimens be used.

My thanks are due to Dr. Lincoln Constance, for the loan of all of the North American collections of the genus in the University of California Herbarium; to Dr. A. C. Smith, for the loan of types and selected specimens from the United States National Herbarium; to Dr. David D. Keck and Dr. Arthur Cronquist, for selected collections in the New York Botanical Garden Herbarium; and to Dr. Robert E. Woodson, Jr., for courtesies on several visits to the Missouri Botanical Garden. In addition, specimens in the Herbarium of Southern Methodist University were used in the study. I am indebted also to a number of librarians, especially at the Missouri Botanical Garden, Gray Herbarium, John Crerar Library, and Lloyd Library, for assistance in obtaining transcriptions or photostats of several references not available in Dallas. These relate mainly to the Mexican species, and will be gladly made available to anyone wishing to study the genus as represented in that country.

KEY TO THE SPECIES

- 1a. Flowers solitary (rarely in pairs) in the axils of leaves or bracts
 - 2a. Stem leaves 4-15 times as long as wide, 0.8-7 cm. long
 - 3a. Upper leaves little reduced; plant flower-bearing nearly throughout; petals 1.0-2.5 mm. long
 - 4a. Pedicels with small leaf-like bracts.....1. *L. tribracteatum*
 - 4b. Pedicels with minute scale-like bracts or none
 - 2. *L. Hyssopifolia*
 - 3b. Upper leaves gradually much reduced; plant normally flower-bearing toward summit (second shoots of injured plants sometimes with more uniform leaves and with flowers nearly to base); petals 2-6 mm. long
 - 5a. Stem leaves widest near middle or above, not clasping
 - 6a. Middle and upper stem leaves opposite
 - 7a. Stem leaves lanceolate, those in the inflorescence usually alternate
 - 8a. Petals 2 mm. long.....3. *L. Curtissii*
 - 8b. Petals 3-6 mm. long.....4. *L. lanceolatum*
 - 7b. Stem leaves linear, those in the inflorescence usually opposite.....5. *L. lineare*
 - 6b. Middle and upper stem leaves alternate

- 9a. Middle stem leaves lanceolate-oblong or oblong, the upper linear (all leaves shorter and broader on second shoots of injured plants); plants of southern and central Texas to Kansas, west to California
— 6. *L. californicum*
- 9b. Middle stem leaves lanceolate, acute, the upper similar in shape but smaller in size; plants of central Texas and Oklahoma east to Virginia and Florida, southwest along the Gulf Coast to the Rio Grande
— 4. *L. lanceolatum*
- 5b. Stem leaves widest at base, more or less clasping
— 8. *L. dactotatum*
- 2b. Stem leaves $1\frac{1}{2}$ - $3\frac{1}{2}$ times as long as wide, 0.5-3 cm. long
- 10a. Stem leaves alternate or only the lowest opposite, 1-3 cm. long; plants of Texas to Kansas and westward
- 11a. Petals 4-6 mm. long, 2-4.5 mm. wide; stem leaves firm, somewhat succulent.....6. *L. californicum*
- 11b. Petals 3-4.5 mm. long, 1.5-2 mm. wide; stem leaves thin, membranous.....7. *L. ovalifolium*
- 10b. Stem leaves opposite, 0.5-1.2 cm. long; plants of Florida and Georgia
- 12a. Leaves oblong-ovate, widest at base, clasping....9. *L. alatum*
- 12b. Leaves oblong-lanceolate or elliptic, narrowed or rounded at base, not clasping.....10. *L. flagellare*
- 1b. Flowers (at least in lower part of inflorescence) in pairs or compact clusters, the pedicels attached to very small axillary branchlets
- 13a. Flowers without bractlets, or with lanceolate bractlets scarcely longer than the pedicels; leaves lanceolate, narrowed at base; calyx glabrous.....11. *L. virgatum*
- 13b. Flowers with lance-linear bractlets reaching nearly to the tips of the calyxes; leaves oblong-lanceolate to deltoid-ovate, rounded-truncate to cordate at base; calyx usually pubescent, rarely glabrous.....12. *L. Salicaria*

1. *L. TRIBRACTEATUM* Salzm. ex Spreng., Syst. 4 (pt. 2): 190. 1827. "*Ager monsp.*" Established in Solano County, California, where first collected in 1930 (Howell, 1931). Two collections have been seen. Dried bed of rain-pool, 1 mile southwest of Elmira, *John Thomas Howell 5208*, May 30, 1930 (C). Very common in low ground along the first east-west road south of Elmira, *A. A. Heller 16159*, June 3, 1941 (C). Koehne's "varieties," with identical ranges, are no more than forms.

2. *L. HYSSOPIFOLIA* L., Sp. Pl. 1: 447. 1753. "*Habitat in Germaniae, Helvetiae, Angliae, Galliae inundatis.*" Introduced into the United States near the beginning of the 19th Century; now naturalized along the Atlantic Coast from Maine to Pennsylvania, and in the Pacific States from Washington to California at altitudes from sea level to 2100 feet; reported from Ohio by Fernald (1950), and from Michigan by Eaton (see below).

This was first found in the vicinity of Boston around 1815 or shortly before. Bigelow does not list it in the first edition

of his *Florula Bostoniensis* (1814); in the second edition (1824) it is said to be found "in low grounds and dried pools," with the added comment, "This plant was returned to me by the late Dr. Muhlenberg as *L. lineare* of Michaux. Are the two plants different?" (Muhlenberg died in 1815.) Nuttall (*Genera* 1: 303, 1818) listed it as growing "in the state of New York." Torrey's *Catalogue* (1819) does not mention it, and in the same author's *Flora of the State of New York* (1843) he quotes Nuttall and adds, "I have never found this plant in the state; nor has it ever, to my knowledge, been found in New York by any botanist other than Mr. Nuttall, who has not recorded its precise locality." The fourth edition of Eaton's *Manual* (1824) listed it from "St. Clair, Detroit." Torrey and Gray in their *Flora of North America* (1: 481, 1840) cited it from Massachusetts and New York, doubtless on the basis of Bigelow's and Nuttall's published accounts, since no collectors are named. De Candolle (*Prodromus* 3: 81, 1828) gave the distribution of the species as "in inundatis humidisque Europae totius et etiam in America bor. et austr., Nova Hollandia et cap. B.-Spei forsan introducta." Various editions of Gray's *Manual*, from the first (1848) to the sixth (1889) record the plant as appearing in New Jersey and Maine. E. L. Greene (1889) described its discovery in California as follows: "This widely disseminated, but small, homely and obscurely lurking annual was collected by the writer near Calistoga, Napa Co., as long ago as the year 1874. We neither saw nor heard anything more of it as a Californian plant until 1888, when we obtained it again at Calistoga, and also in the county of Sonoma, adjoining Napa, but whether near Santa Rosa or Petaluna the tickets do not show, and our memory does not warrant a more definite statement about this second Pacific coast locality. But the plant is here, though doubtless as elsewhere, both in Europe and America, something of a rarity." He gives no basis for his assertion that the plant was "something of a rarity" in Europe. Linnaeus and De Candolle found it widespread; Hegi (1921) speaks of it as "Zerstreut, bisweilen aber massenhaft auf nassen bis feuchten Boden" in central Europe. Judging from the collections in the University of California Herbarium, the plant soon became very widespread and common—sixteen California collections bear dates earlier than 1900; Suksdorf found it

in King County, Washington, in 1890. Abrams (1951) says merely that it has "wide geographical distribution"; Howell (1949) says that in Marin County, California, it is "common in low places in fields and meadows and in roadside hollows that are wet in spring."

Western authors have consistently accepted *L. adsurgens* Greene as a distinct species, separable solely by its perennial, stoloniferous habit. *L. Hyssopifolia* is exceedingly variable ("ausserordentliche veränderliche Pflanze", in Hegi's phrase), and judging from herbarium collections, *L. adsurgens* is an extreme variant, but not a distinct species. Close field study, and probably cytogenetic investigation, would be necessary to determine its status. Is it not possible that it represents a geographically reversed parallel of the famous De Vriesian mutations of American *Oenothera* in Europe?

3. *L. CURTISSII* Fernald, Bot. Gaz. 33: 155. 1902. "In a miry swamp, Leary's, Georgia, August 19, 1901 (no. 6876)," coll. A. H. Curtiss (isotype, C). This species and *L. alatum* (if my surmise as to the true identity of that species is correct) are both very rare southeastern endemics, each known only from duplicates of a single collection. *L. Curtissii* has larger stem leaves, more abruptly reduced branch leaves, and smaller flowers than *L. lanceolatum*, to which it is evidently rather closely related.

4. *L. LANCEOLATUM* Ell., Sk. 1: 544-545. 1821. "Grows in ditches, swamps, &c." TYPE: "Hab. in humidis. Flor. Jun. Jul." (Photo of specimen in Elliott Herbarium at Charleston; NY.) The commonest species of the southeastern states. Specimens suggesting the influence of hybridization with *L. lineare* have been seen from Florida, with *L. dacotanum* from Arkansas, and with *L. californicum* from a wide belt through central Texas and Oklahoma.

5. *L. LINEARE* L., Sp. Pl. 1: 447. 1753. "Habitat in Virginia." On or near the coast, Mississippi to Florida and north to Delaware. Said by Fernald (1950) to extend north to Long Island and west to Texas; I have seen no collections from the last-named state, those so labeled being forms of *L. californicum*.

6. *L. CALIFORNICUM* T.&G., Fl. N.A. 1: 482. 1840. "California, Douglas!" *L. alatum* var. *breviflorum* Gray, Boston Journ. Nat. Hist. 6: 187. 1850. (Said to be mixed with var. *pumilum*, from "Sister Creek," probably Kendall Co.,

Texas.)—*L. alatum* var. *linearifolium* Gray, *ibid.* "Rocks in the Cibolo River," Comal or Bexar Co., Texas.—*L. breviflorum* (Gray) Watson, *Proc. Amer. Acad.* 12: 251. 1877.—*L. album* var. *linearifolium* (Gray) Koehne, *Bot. Jahrb.* 1: 321. 1881. (Erroneously credited to "Wts. (!) (ut *L. alati* var.)")—*L. Sanfordi* Greene, *Pittonia* 2: 12-13. 1889. "Abundant in rich alluvial fields on the lower San Joaquin River, particularly about Stockton, where, on account of its deep and ineradicable underground growth, it is an unwelcome plant in fields and vineyards. I have my only specimen, and that one not yet well in flower, from a genial and very helpful correspondent, Mr. J. A. Sanford." (Other specimens named by Greene seen; C.)—*L. linearifolium* (Gray) Small, *Fl. S.E. U.S.* p. 828. 1903.—*L. parvulum* Nieuwl., *Amer. Midl. Nat.* 3: 267-268. 1914. "As type may be selected No. 442510 of the U.S. National Herbarium, i.e. S. M. Tracy's 8071 from Abilene, Texas, collected May 24, 1902." (Type not seen; other collections examined from type region, answering to description.)

A common species in coastal and central Texas, extending north in the High Plains to Kansas, west through New Mexico and Arizona to California; also in northern Mexico, in Baja California and in the states of Chihuahua, Coahuila, and Nuevo Leon. Plants of California eastward to Trans-Pecos Texas are prevailingly taller and with longer, narrower, more pointed leaves than those farther east, but considerable variation exists, especially within the state of California. In central and northern Texas, the plants are prevailingly smaller and broader-leaved. In part this is certainly due to introgression with *L. lanceolatum* (this is especially noticeable in the vicinity of Dallas, where the latter species predominates), and possibly with the localized endemic *L. ovalifolium*. The generally low-growing and small-leaved plants of the Gulf Coast and Rio Grande Plain possibly show the influence of the Mexican species called *L. gracile* by Bentham (not *L. gracile* DC.), or *L. acinifolium* Moc. & Sesse by Koehne and others. The entire assemblage appears to me to be referable to one species, within which I have been unable to distinguish satisfactorily definite geographic varieties. *Lythrum album* H.B.K., under which Koehne places all these variations, is a more shrubby white-flowered species of south central Mexico, which from

the very few specimens examined I consider distinct from the complex *L. californicum*.

7. *L. OVALIFOLIUM* Engelm. ex Koehne, Bot. Jahrb. 1: 321. 1881. (Earlier published in synonymy under *L. alatum* var. *ovalifolium* by Gray: "Springs of the Pierdenales [sic] on rocks covered by water," Blanco or Gillespie Co., Texas, *Lindheimer s.n.* (Mo); Gray adds that "this evidently runs into" var. *pumilum*.)—*L. alatum* var. *ovalifolium* (Engelm.) Gray, Boston Journ. Nat. Hist. 6: 187. 1850.—*L. alatum* var. *pumilum* Gray, *ibid.* "Sister Creek," probably Kendall Co., Texas, *Lindheimer 609*, April, "1847-48" (isotype, SMU).

Another of the numerous very localized endemics of the southeastern Edwards Plateau of Texas. The following additional collections may be cited. BEXAR Co.: Comanche Spring, *Lindheimer 799*, Aug., 1849 (C, SMU). COMAL Co.: along the Guadalupe River, *Lindheimer*, May, 1846 (SMU). KERR Co.: about Kerrville, A. A. *Heller 1885*, June 12-19, 1894 (C). TRAVIS Co.: Barton Creek, Austin, M. S. *Young*, November 1, 1915 (C-Clokey Herb.).

8. *L. DACOTANUM* Nieuwland, Amer. Midl. Nat. 3: 266-267. 1914. "Type No. 240979 of the U.S. National Museum from South Dakota, collected near Sioux Falls in August, 1892, by J. J. Thorner" (type, with isotype No. 516395, US). Regarded as *L. alatum* Pursh by Torrey & Gray and later authors, though it does not fit Pursh's description and is not known to grow in the type region. (See further remarks under the next.)

A common Midwestern low prairie species, extending south to Arkansas, west to Colorado and Wyoming, east to Ontario and Ohio, and apparently very locally to eastern Tennessee, vicinity of Washington, D.C.; northwestern Georgia, and north-central Alabama. Reported by Fernald as adventive in "N.E., N.J., etc.," and native from "Ont. and n. N.Y. to B.C., s. to Ga., La., and Tex." I have seen no specimens from the two last named states, all so labeled being *L. lanceolatum* or *L. californicum*. The Arkansas collections are from the central and northwestern parts of the state (Benton, Crawford, Lonoke, and Prairie counties); these represent the most southerly occurrence of the species west of the Mississippi, slightly farther north than the records for Alabama (near Birmingham, Jefferson Co.) and

Georgia (Chickamauga Park, Walker Co., and "Mts. of Ga.").

9. *L. ALATUM* Pursh, Fl. Am. Sept. 1: 334. 1814. "In Lower Georgia. *Enslen.*" (Type not seen.) *L. cordifolium* Nieuwl., Amer. Midl. Nat. 3: 265-266. 1914. TYPE: "N.C. to Ga. & Fla.," *S. B. Buckley*, no further data (US, sheet No. 48371; isotype, specifically marked as from Florida, NY). Not *L. cordifolium* Sesse & Mocino, 1888.

Pursh's description was as follows:

4. *L. glaberrimum*; foliis oppositis ovato-oblongis acutis basi subcordatis arcte sessilibus, ramis virgatis 4-gonoalatis, floribus axillaribus solitariis sessilibus hexandris.

In Lower Georgia. *Enslen.* June, July. *v. s. in Herb. Enslen.* From three to four feet high; flowers small, purple.

As indicated under the next species, Nuttall and apparently Elliott mistook *L. flagellare* for this one; Torrey and Gray, and all succeeding authors, have assumed that *L. dacotanum* was the plant Pursh described. The oblong-ovate, cordate, strictly sessile leaves rule out *L. flagellare*; at least three reasons can be advanced for ruling out *L. dacotanum* also. Its leaves are alternate or some subopposite; Pursh said simply "oppositis," and then characterized his next species, *L. lineare* (which has pretty strictly opposite leaves) as "foliis suboppositis." Its flowers are among the largest produced by North American species; Pursh described both *L. alatum* and *L. lineare* (the latter with petals half to three-fourths as large as in *L. dacotanum*) with the same phrase, "flowers small." The type locality is "Lower Georgia," which I take to mean the lowland or coastal area; *L. dacotanum* just enters the northwest corner of the state, in the mountains. The Buckley specimens are fragmentary, representing only the tops of plants of unknown size; a few calyxes are present, but all the petals have fallen. The identification of these as the true *L. alatum* Pursh is admittedly open to question (Pursh unfortunately gives no dimensions for the leaves). If not the same, then Buckley's plants will require a new name, since *L. cordifolium* Nieuwl. is a later homonym. It is altogether possible that there are in the southeastern states three endemics as rare and local as *L. Curtissii*. No specimens similar to Buckley's have been seen.

10. *L. FLAGELLARE* Shuttleworth ex Chapman, Fl. S. U.S.

ed. 2 Suppl. p. 620. 1883. "Ad lac. Monroe prope Simpson's Creek," Florida, *Rugel 232*, June, 1848 (an evident isotype with printed label "*Lythrum flagellare* Shuttl. n.sp.," NY). Chapman cited only a later collection by Garber, "Sarasota, South Florida." The species was republished by Nieuwland, *Amer. Midl. Nat.* 3: 268-269, 1914, on the supposition that the name had previously appeared only in synonymy; *Tracy 7594*, Braidentown, Manatee Co., Florida, July 20, 1901, was selected by him as type. All three of the collections mentioned fortunately represent the same species, so that there has been no misapplication of name. As early as 1818 Nuttall gave an unmistakable description of this species (*Genera* 1: 303), under "*4. alatum?* PH." He speaks of the leaves as subpetiolate (instead of "arcte sessilibus"), and adds "*L. Serpyllifolia* would certainly have been a much better name than the obscure one of *alatum*." Elliott (*Sk.* 1: 545, 1821) quotes both Pursh and Nuttall, without noting the contradictions, and apparently without seeing any specimens. Collections of *L. flagellare* have been seen from Lee, Manatee, Orange, and Sarasota counties, Florida. The species is perhaps nearest allied to *L. Bryanti* Brandegee, of Baja California.

11. *L. VIRGATUM* L., *Sp. Pl.* 1: 447. 1753. "*Habitat in Sibiria, Tataria.*" Reported by Fernald as introduced in New Hampshire and Massachusetts, "spread from cult.;" I have not examined any North American specimens. Three Eurasian specimens seen suggest at first glance a somewhat showier and broader-leaved *L. californicum*; they are not very similar to *L. Salicaria*, many of the flowers being solitary or merely paired.

12. *L. SALICARIA* L., *Sp. Pl.* 1: 446. 1753. "*Habitat in Europa, ad ripas aquarum.*" Like *L. Hyssopifolia*, an early introduction, listed by Pursh in 1814 as found in "wet meadows: Canada and New England." Pursh designated the American plants as a new var. *pubescens*, but this seems referable to the original species, or var. *Salicaria* as we now designate it. Though varying greatly in pubescence (very rarely almost totally glabrous), I have seen no American specimens referable to the extreme form named var. *tomentosum* DC, from garden material. Fernald recognizes three varieties, which, as far as the plants of the United States are concerned, I should regard as forms of a variable species.

An interesting floral mutation has been reported by Stout (1925). *Lythrum Salicaria* is widely naturalized in the northeastern states; it has appeared more recently in Washington (1931) and Utah (1943).

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Nomenclature of the Varieties of *Monarda punctata* L. (Labiatae)¹

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A taxonomic botanist once remarked to me (supporting the practise of another) that there were great advantages to using subspecies in place of varieties. This made it possible to disregard names one did not like, and keep those one preferred, thus circumventing the requirements of strict priority in the varietal category. I do not know that Fernald ever heard of this curious device for shirking obligations; it would have been a pleasure to hear or read his views on it. The geographic varieties of *Monarda punctata* (I subscribe heartily to the use of that category, following Fernald, Fosberg, and Weatherby) include choice examples of evasion and careless error in dealing with nomenclature. Despite a supposedly definitive revision, I found it impossible to determine the correct names of the two varieties found in northern Texas. After botanizing in the "Manual range" in 1952 for the first time in eight years, I discovered that neither of the two named varieties in the new (eighth) edition of Gray's Manual is correctly listed. Following are the legal names of the known varieties as I make them out, with explanation where it seems called for.

¹Grateful acknowledgment is due Dr. Bernice G. Schubert for notes on specimens in the Gray Herbarium annotated by Gray, and to Dr. Reed C. Rollins for the loan of the type sheet of var. *lasiodonta*.