

# THE TAXONOMY OF THE GENUS *EUTHAMIA*<sup>1</sup>

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Ever since the name *Euthamia* was first proposed by Nuttall in 1818 as "a subgenus, or rather genus, reciprocally allied to *Solidago* and *Chrysocoma*..." the euthamioid goldenrods have been variously treated as a genus, or as a section or subgenus of the genus *Solidago* to which they are most closely allied. Accordingly there has developed over the years an extensive synonymy and there still exists significant confusion about specific limits in the group and the relationships between *Euthamia* and *Solidago*. Recent evidence (Sieren, 1970; Anderson and Creech, 1975) seemingly supports the contention that *Euthamia* should be considered a distinct genus. The purposes of this paper are, therefore, to present a taxonomic treatment of the genus and to give fairly complete accounts of the bibliography and synonymy as a basis for further study.

## HISTORY OF THE GENUS

The first description of a *Euthamia* species was by Linnaeus in 1753 in *Species Plantarum* from a specimen of *Euthamia graminifolia* in Pehr Kalm's collections from Canada. Apparently recognizing the habit similarities between it and species of the genus *Chrysocoma* (i.e., narrow, sessile, entire leaves), Linnaeus named the specimen *Chrysocoma graminifolia*, alluding in the specific epithet to the grass-like leaves. In his *Mantissa* of 1767, Linnaeus later named the same species *Solidago lanceolata* based on a specimen probably collected by Royen in "America septentrionali" although there was apparently some doubt since in the description there is a question mark after the phrase. The two names were brought into synonymy by Michaux (1803), who recognized both as *Solidago lanceolata*. He extended its known range down the eastern seaboard, and he also recognized two varieties,  $\alpha$  *major* with "*foliis rarioribus, latiscule linearibus*" and  $\beta$  *minor*, with "*foliis crebrioribus, anguste linearibus; axillis foliosis: subglutinosa*",  $\alpha$  *major* having a habitat "in Canada" and  $\beta$  *minor* "in pascuis circa *Charlstown*", around Charlestown, South Carolina. The distinc-

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tions between the two varieties were so obvious that Frederick Pursh in 1814 elevated *β minor* to specific rank with the name *Solidago tenuifolia*, thus recognizing two species, *S. lanceolata* and *S. tenuifolia*. Many herbarium specimens collected in the middle 1800's reflect the widespread usage of the epithet *lanceolata*.

The name *Euthamia* was first proposed in 1818. Nuttall in his *Genera of North American Plants* suggested the name for this group of goldenrods "...in allusion to the crowding of the flowers", as "a subgenus, or rather genus, reciprocally allied to *Solidago* and *Chrysocoma*...", although he maintained the two species in the genus *Solidago*. He also took up the earlier specific epithet *graminifolia* and relegated *S. lanceolata* to synonymy under *S. graminifolia*. The fact that, in his 1841 publication, he referred to the 1818 proposal of *Euthamia* as a "section" of *Solidago* indicates that he did not intend in 1818 to consider the group as a good genus, even though in discussions under the genus *Bachyris* he referred to "*Euthamia tenuifolia*". Stephen Elliott, in 1824, also used the name *Euthamia* in combination with specific epithets, but he too used it only in Nuttall's sense of the group as a subgenus and he retained the species in *Solidago*.

Sixteen years later, in 1841, Nuttall finally used the name *Euthamia* in a truly generic sense. At that time, he retained *E. tenuifolia* and *E. graminifolia*, and named a new and very distinct species from western North America, *Euthamia occidentalis*. Torrey and Gray, in the next year, transferred the three species back to *Solidago*, and added the equally distinct *Euthamia leptoccephala* from western Louisiana and Texas.

Of the four species thus recognized 100 years after *Species Plantarum*, *Euthamia graminifolia* was the most inclusive, wide-ranging, and variable, and everything not included in the other three species was placed in it. It wasn't until 50 years later, when E. L. Greene (1902) published his "A Study of *Euthamia*", that the genus was closely examined. After reinstating the genus in 1894, he proceeded to name 14 new species in 1902, one in 1906, and another in 1911. Several of his new species were based on single specimens sent to him by other collectors. In 1894, Greene also had inaugurated the debate over the status of Linnaeus' *Erigeron carolinianus* by proposing *Euthamia caroliniana* as the earlier valid name for *Solidago tenuifolia*. Following Greene's efforts, M. L. Fernald (1908) returned the previously and newly named species to

*Solidago* and between then and 1944 proposed 17 new names, although most were not new species, but rather the result of the transfer of Greene's species from *Euthamia* to *Solidago*. He also considered Greene's species concept to be too narrow.

The next important study was by R. C. Friesner in 1933. In his investigation of the northeastern American *Solidagos*, he maintained 13 of the previously described species and one variety, and added one new species of his own and 3 new binomial combinations. His species concept tended to be nearer Greene's and he recognized several of Fernald's varieties as species. In 1943, Stuart K. Harris made a study of *Solidago*, section *Euthamia*. He added 4 new names, and Fernald, in the 8th edition of Gray's Manual, followed Harris' treatment of the group, as have authors of other floras.

#### MORPHOLOGY

##### Stems

All species of *Euthamia* are fibrous-rooted, rhizomatous perennials. New shoots arise from the underground stems in successive growing seasons, and often form extensive, relatively dense colonies. In *E. gymnospermoides*, and probably *Euthamia* generally, the rhizomes between shoots tend to die off, so that in any given colony the shoots are not all interconnected. Except perhaps in *E. occidentalis*, where Harris (1943a) has reported "tuberous enlargements" on the rhizomes of some specimens, the underground portions of the stems are not diagnostically important.

The erect stems are usually nearly terete near the base with only slight vertical ridges and become strongly striate-angled toward the apex, especially in the inflorescence where the diameters are less. They often tend toward woodiness at the base, although this is variable with some of the *Euthamia* species, such as *E. pulverulenta* and *E. hirtipes*, being often very woody even in the inflorescence.

Biseriate, glandular trichomes (colleters) secrete a viscid substance which often gives the stems of *Euthamia* species a varnished appearance, especially in the inflorescence. This appears to be somewhat correlated with the habitat, species growing in more severe sites producing more varnish. In a population of *E. gymnospermoides* near Urbana, Illinois, the plants had little varnish when young, were very sticky in early August at the bud stage, and although still shiny, were relatively dry again when flowering had

been completed in September and October. This can be a useful distinguishing character for those species such as *E. gymnospermoides* and *E. tenuifolia* which are characteristically glutinous. Other useful stem characters for separating species are the presence or absence and amount of pubescence, the glaucous condition which often characterizes *E. occidentalis*, height of the plants, and the relative length of the inflorescence. Most of the species have at least a few short hairs on the stem, especially on the uppermost branchlets, but only one variety, *E. graminifolia* var. *nuttallii*, is typically pubescent on the stem below the inflorescence. The amount of pubescence in all species of *Euthamia* increases toward the plant apex. Little work has been done on the anatomy of the genus.

### Leaves

*Euthamia* leaves, except in shape and degree of pubescence, are extremely non-variable, and even those characters vary within relatively narrow limits.

The leaves of all of the species are sessile, glandular-punctate, and have entire and more or less scabrous margins. Small internal cavities which can be seen by transmitted light are present in all of the species and vary only as to size and abundance. The nature of these cavities was indicated by Anderson (1963) for *Euthamia leptcephala*, in which they are very large. The stomates are, in some species, often very conspicuous, appearing as little white shimmering dots.

Whittaker (1918) pointed out that the leaves are essentially 3-veined, but that a multiplication of nerves can occur which seems to be especially correlated with an increase in leaf size; as a result, when distinguishing taxa in *Euthamia*, the character of vein number is not a good one to use except secondarily. Because the species are so similar morphologically, the significance of this particular character has been overemphasized. Since the leaves are all essentially linear, the major veins run more or less parallel to the midrib from the base outward.

*Euthamia* leaf pubescence is very uniform, and varies only as to amount. Three kinds of trichomes are present, all of which are present in all of the species.

The most conspicuous type is a simple, uniseriate hair which is

found on the margins, and, in pubescent forms, the veins and laminar surfaces. The number of cells comprising the trichomes ranges from 2 to 4, and even glabrous species have at least a few of these hairs in the axils of the leaves or on the veins.

The second type is composed of a uniseriate pedestal of a few to several cells supporting an elongated, whip-like cell. These are most easily seen on the phyllaries, but are also present on the leaves.

The punctae which characterize *Euthamia* are caused by biseriate, glandular trichomes (colleters) which are depressed below the surface and secrete a viscid, varnish-like substance. In those species, such as *E. gymnospermoides*, in which the punctae are most easily seen, there also is an increased production of varnish. The colleters are usually 4 cells in height and, from a side view, appear to have a flattish top.

On the epidermal surfaces, the arrangement of the stomatal subsidiary cells is anomocytic (ranunculaceous) and the cuticle is usually developed into random, very narrow, parallel striations which seem to have no particular orientation with respect to the stomates.

The lower cauline leaves of *Euthamias* are early deciduous, so that by flowering time the stems below the inflorescences are often devoid of leaves.

### **Inflorescences**

The inflorescences are mostly corymbiform or somewhat paniculate (*Euthamia occidentalis*) with the heads variously stalked or sessile in terminal glomerulate clusters. Useful diagnostic characters include the pubescence or lack of it, the relative size and shape of the inflorescence, the tendency of some species to form an irregular, interrupted, or storied inflorescence, whether or not the heads are pedunculate, and the relative flatness of the top of the inflorescence.

### **Heads**

The heads are characteristically small, less than 1 cm. in length, and numerous. As mentioned previously, they are variously glomerate or pedunculate and most species have at least some heads of both conditions although there often is a tendency in one direction or the other. The receptacles in all species of *Euthamia*, in addition to being deeply alveolate, are to a greater or lesser degree also fimbriate, in some species only slightly so, but usually very

conspicuously. The phyllaries are characterized by the presence of colleters (and are thereby often glutinous) and by the *Euthamia* type of the whip-trichomes previously discussed. The colleters are generally restricted to the upper 1/3 of the phyllaries, but in *E. tenuifolia* they most often extend the entire length. Whereas on the leaves they sit in tiny depressions, the colleters on the phyllaries can often be seen as small, granular, whitish bumps. The whip-trichomes are conspicuously located on the margins at the tips of the phyllaries. Various shaped, simple, uniseriate trichomes similar to those found on the leaves are also often interspersed with the whip hairs. As pointed out by Kapoor and Beaudry (1966), the stamen filaments in *Euthamia* join the inside of the corolla at the junction of the tube and the limb.

#### SYSTEMATIC TREATMENT

##### Generic Synonymy and Description

**Euthamia** (Nuttall) Nuttall, Trans. Amer. Phil. Soc. n.s. Vol. 7. 1841.

Basionym: *Solidago*, subgenus *Euthamia*. Nuttall, 1818. TYPE SPECIES: *Euthamia tenuifolia* (Pursh) Nuttall. Nuttall (1818) 162; Elliott (1824) 391; Britton (1901) 942; Greene (1902) 72; Small (1903) 1189, (1933) 1360; Rydberg (1906) 349, (1917) 872; Britton & Brown (1913) 398; Wooton & Standley (1915) 667; Bush (1918) 158; Friesner (1933) 57; Harris (1943) 413; Shinnars (1951) 137.

*Aster* Linnaeus, Sp. Pl. 872 (1753) in part.

*Chrysocoma* Linnaeus, Sp. pl. 840 (1753) in part.

*Solidago* Linnaeus, Sp. Pl. 878 (1753) in part.

Erect perennial herbs spreading by means of fibrous-rooted rhizomes, the above-ground stems often woody at the base. Plants glandular, often viscid, aromatic when crushed, the glandular trichomes biseriate, sessile. Sap watery. Leaves very uniform, alternate, sessile, entire, glandular-punctate, mostly linear to linear-lanceolate, glabrous or pubescent. Stems and branches nearly terete, striate-angled, glabrous or pubescent. Entomophilous; the heads with both ligulate and tubular florets, borne corymbosely either sessile, subsessile, or pedunculate in small glomerules at the tips of stems and branches; phyllaries imbricate in 3 to 5 series, the inner narrower and longer than the outer, green-tipped or the pigment

absent, one-nerved, the tips obtuse, acute, or acuminate. Receptacle alveolate, variously fimbriate. Ray florets pistillate, fertile, usually more numerous than the disc florets; corolla yellow, variously lobed and veined, divided into a terminal limb and a basal tube; style branches 2, the stigmatic papillae marginal with blunt tips; pappus of nearly equal capillary bristles, nearly as long as the corolla. Disc florets perfect, fertile; corolla yellow, 5-lobed, with commissural veins, the terminal limb often constricted conspicuously into the lower tube; stamens 5, the filaments epipetalous at the junction of the tube and limb, not connate; anthers connivent, without long tails, the terminal appendage deltoid; style branches 2, linear, obtuse, spreading at maturity, the collecting hairs terminal and median on the outer surface, extending down between the marginal, blunt, stigmatic papillae; pappus of nearly equal capillary bristles, nearly as long as the corolla. Mature ovaries pubescent, variously veined, sometimes extended into a basal tubercle, nearly terete, widest at or above the middle. Pollen spheroidal, echinate, the spines short, 3-pored.

Basic chromosome number,  $x = 9$ , the majority of the species are diploids ( $n = 9$ ), although  $n = 18$  and  $n = 27$  are known.

Entirely North American, including mostly non-weedy species of dry to wet habitats.

The name *Euthamia* was derived from the Greek (*eu-*, well, and *-thamees*, crowded) by Nuttall "...in allusion to the crowding of the flowers."

#### KEY TO THE SPECIES OF *EUTHAMIA*

1. Heads 10–20 flowered, some or more often all of them pedunculate; involucre turbinate or campanulate, if campanulate then the leaves less than 4 mm wide and with numerous axillary fascicles, 3–6 mm high; leaves 1–5 nerved, firm or lax, deflexed, diverging or ascending. .... 2.
2. Leaves usually less than 3 mm wide, 1–3 nerved, lax, either deflexed or ascending, conspicuously punctate and often viscid, never pustulate; axillary fascicles numerous or absent; involucre turbinate or campanulate; coastal plain species. .... 3.
3. Axillary fascicles numerous; cauline leaves usually very lax and conspicuously deflexed; involucre 3–5 mm high;

- inflorescence often storied and dome-like, usually less than 1/3 of the height of the plant; wide distribution. . . . .  
 . . . . . *E. tenuifolia*
3. Axillary fascicles absent; cauline leaves not conspicuously deflexed; involucre 5-6 mm high; inflorescence irregular to nearly flat-topped, not uniformly dome-shaped, usually nearly 1/2 the height of the plant with several, very strict, woody branches; Texas. . . . . *E. pulverulenta*
2. Leaves usually more than 3 mm wide, 3-5 nerved, firm, diverging or ascending, either conspicuously punctate and viscid or pustulate; axillary fascicles essentially absent; involucre turbinate; species of the coastal plain and midwestern interior. . . . . 4.
4. Involucres 3-5 mm high; leaves usually conspicuously darkly glandular-punctate and occasionally pustulate, if pustulate then also pubescent in the axils and on the veins; eastern coastal plain species. . . . . *E. hirtipes*
4. Involucres 4-6 mm high; leaves either epustulate and strongly punctate or conspicuously pustulate and appearing to lack punctae, if pustulate then very glabrous; southern coastal plain and midwestern species. . . . . 5.
5. Leaves pustulate, appearing translucently punctate, not viscid, thin, very smooth, lanceolate; lower Mississippi valley and southeastern Texas. . . . . *E. leptcephala*
5. Leaves densely and darkly glandular-punctate, not pustulate or conspicuously translucent-punctate, usually viscid, thick, often pubescent in the axils or on the veins, lance-linear; midwestern prairies and plains. . . . .  
 . . . . . *E. gymnospermoides*
1. Heads 20-50 flowered, mostly sessile but occasionally pedunculate; involucre campanulate, 3-5 mm high; leaves 3-7 nerved, firm, diverging or ascending. . . . . 6.
6. Innermost phyllaries obtuse or merely acute, not conspicuously acuminate; inflorescence corymbiform, essentially flat-topped; plants glabrous or pubescent, never glaucous; northern and eastern species. . . . . 7.
7. Disc flowers usually less than 12, always less than the number of rays; heads narrowly campanulate; plants glabrous to pubescent, usually not viscid, to 15 dm in height; stem simple to near summit or well-branched;

- widely distributed. . . . . *E. graminifolia*
7. Disc flowers usually more than 12, often more than the number of rays; heads broadly campanulate; plants very glabrous, often viscid, to 8 dm in height; stem simple to near the summit with a small inflorescence; Nova Scotia. . . . . *E. galetorum*
6. Innermost phyllaries acuminate; inflorescence paniculate, interrupted; plants glabrous and often glaucous; western species. . . . . *E. occidentalis*

## TAXONOMIC TREATMENT OF SPECIES

1. ***Euthamia galetorum*** Greene. Leaflet. Bot. Obs. and Crit. 2: 152. 1911. Type: margin of Lake Pleasant, near Springfield, Nova Scotia, *E. L. Greene, August 8, 1910.* (ND-G 59!).

*Solidago tenuifolia* (Pursh) Nuttall var. *pycnocephala* Fernald, Rhodora 23: 293. 1922. Type: Wet lower peaty and cobbly beach of Salmon (Greenville) Lake, Yarmouth County, Nova Scotia, *M. I. Fernald, C. H. Bissell, C. B. Graves, R. Long, and D. H. Linden 22743, August 13, 1920.* (GH!).

*Solidago graminifolia* (L.) Salisb. var. *galetora* (Greene) House, Bull. N. Y. State Museum 243-244: 45. 1923.

*Solidago galetorum* (Greene) Friesner, Butler Univ. Bot. Studies 3, no. 1: 58. 1933.

*Euthamia graminifolia* (L.) Nutt. *galetorum* (Greene) Friesner, Butler Univ. Bot. Studies 3, no. 1: 58. 1933.

Erect perennial from branched creeping rhizomes, to 8 dm in height. Stem glabrous, terete or nearly so, striate-angled, branched near the summit. Cauline leaves alternate, sessile, entire, linear, tips obtuse to short acute, to 6 cm long and 5 mm wide, 3-5 nerved, glabrous, margins scabrous, axillary fascicles absent or if present not numerous, punctae often conspicuous. Inflorescence small, compact, terminal, usually less than 10 cm broad, branches glabrous. Heads glomerulate. Involucre campanulate, 3-4 mm high. Phyllaries wide, one-nerved, the outer broadly ovate, obtuse, green-tipped, the inner linear, obtuse to acute, with or without green tips. Flowers 20-50, the discs usually equal to or a few more than the rays. Achenes about 1 mm long, pubescent. Receptacle alveolate, only slightly fimbriate.

FLOWERING: July to October.

CHROMOSOME NUMBER: Unknown.

DISTRIBUTION: Lake shores of southern Nova Scotia.

*Euthamia galetorum* appears to be most closely allied to *E. graminifolia*, although it has frequently been treated as a variety of *E. tenuifolia* (Fernald, 1950). It is readily separated from the latter species by its large numbers of flowers, especially disc, its wider, ascending leaves, and the absence of axillary fascicles. In its gross morphology *E. galetorum* most closely approaches the wide, bluntish-leaved variety of *E. graminifolia*, variety *major*. Collections of this variety from open sites such as lake shores, which is where most of the *E. galetorum* collections have been made, bear a striking resemblance to the latter species. *Euthamia galetorum* appears to be restricted to Nova Scotia and its consistently large number of disc flowers correlated with very broad heads, often viscid leaves, and the strict habit, seems to separate *E. galetorum* from the Nova Scotian representatives of *E. graminifolia*.

This is a pretty species, often with shining leaves, the type specimens found by Greene "growing among sundews and bog violets, bordering thickets of sweet gale." It is seemingly restricted to Nova Scotia and most of the specimens have been collected along the cobbly and boggy shores and beaches of lakes in the southern half.

2. ***Euthamia graminifolia*** (L.) Nuttall, Trans. Amer. Phil. Soc. **II**, 7: 326. 1840.

Erect perennial from branched creeping rhizomes, up to 1.5 meters in height. Stem nearly glabrous to densely hirtellous, terete or nearly so, striate-angled, branched in the upper fourth. Cauline leaves alternate, to 13 cm long and 12 mm wide, 3-5 nerved depending on width, with merely scabrous to scabrous-ciliolate margins, nearly glabrous with only a few scattered hairs on the upper midrib in the axils to densely spreading hirtellous on both surfaces, axillary fascicles absent, or if present not numerous, punctae inconspicuous, the plants usually not strongly glutinous. Inflorescence short, flat-topped or slightly rounded, nearly as long as broad, the branches nearly glabrous to densely pubescent, and, except in reduced forms, not all reaching the summit thus giving the inflorescence an irregular, interrupted appearance. Heads mostly densely glomerate. Involucre campanulate, 3-5 mm high. Phyllaries yellowish, 1-nerved, the outer ovate, obtuse, usually green-tipped, the inner oblong, obtuse to broadly acute, with or without

green tips. Ray flowers 11–35, usually 17–22. Disc flowers 4–13, usually 5–7. Achenes about 1 mm long, pubescent. Receptacle alveolate, weakly to moderately fimbriate.

COMMON NAMES: Creeping Yellow Weed, Nuttall's Goldenrod, Lance-leaved Goldenrod, Bushy Goldenrod, Flat-topped Goldenrod, Fragrant Goldenrod, Lance-leaf Euthamia, Grass-leaved Goldenrod, Flat-topped Hairy Goldenrod, Narrow-leaved Goldenrod.

FLOWERING: July to October.

CHROMOSOME NUMBER:  $2n = 9$ , Beaudry and Chabot (1959), Solbrig, et al. (1964), Sieren (1971);  $2n = 18$ , Beaudry and Chabot (1959), Beaudry (1963), Kapoor and Beaudry (1966).

DISTRIBUTION: Common in moist places from Newfoundland across Canada to southern British Columbia, south in the Rocky Mountains possibly to New Mexico; south in the eastern United States to Virginia, west to Illinois and the Black Hills of South Dakota.

*Euthamia graminifolia* is the most variable species in the genus. Although many more segregates have been proposed in the past, only 3 stand out with any distinctness.

*Euthamia graminifolia* var. *graminifolia* is the acute to attenuate, narrow-leaved, nearly glabrous form which extends in a wide band through the middle of the range from the Dakotas to Nova Scotia. It intergrades on its southern side with the pubescent extreme of the species, variety *nuttallii*, and on its northern and western sides with the wider, bluntish-leaved variety *major*. The varieties are most difficult to sort out in the east where they seem to blend almost imperceptibly. In the west, they are more distinct. Variety *major* overarches variety *graminifolia* and extends into western Canada and the Dakotas and down the length of the Rocky Mountains possibly to New Mexico, although I have seen specimens only from as far south as east-central Utah. Variety *nuttallii* does not extend as far west as variety *graminifolia*, but is the only representative of the species in Illinois and Indiana, except in the far northern countries and around Lake Michigan.

As previously mentioned, the varieties, especially *graminifolia* and *nuttallii*, are nicely intergraded in the east, and often grow in the same areas with all intermediates. Because of these intermediates, it

is often difficult to apply the formal varietal names. When Greene (1902) named *Euthamia nuttallii*, he had in mind robust, hispidly-hirtellous plants like those from the District of Columbia, the type locality. This concept has since been gradually broadened to include smaller, narrower-leaved plants if they appear at all pubescent, and only the most glabrous specimens are set aside to be included in variety *graminifolia*. Pubescence, and also the presence or absence of chlorophyll at the phyllary tips, have been overemphasized in the species as useful characters for distinguishing segregates. Every specimen of *E. graminifolia* I have seen has at least a few hairs, and the amount of pubescence varies not only from plant to plant, but also from one part of the plant to another, usually increasing from the base to the apex. These characters can be useful, however, in characterizing the species in relation to other closely related taxa.

The species varies considerably in habit. Variety *nuttallii*, *sensu* Green, is usually very tall (sometimes to 5 feet), and fully branched, although the inflorescence is usually less than one-third the height of the plant. Varieties *graminifolia* and *major* vary with the habitat. Those plants growing in open sites such as lake shores and roadside ditches are usually of a stricter habit with a smaller inflorescence than are those found in more closed sites. Several specimens of variety *major* bear a striking resemblance to the blunt-leaved *E. galetorum*, a species collected most often from lake shores in Nova Scotia. The relationships between these two species warrant further study.

*Euthamia graminifolia* is characterized by 20- to 50-flowered heads, but even on one plant the number is often very erratic. In variety *nuttallii*, the number of flowers decreases slightly moving from the eastern part of the range to the western and there are indications that this is true of the other two varieties also.

The species as a whole is not conspicuously punctate, although this too is variable, and it is often difficult to see the punctae at all.

Both variety *graminifolia* and variety *nuttallii* have a haploid chromosome number of 9. It is unknown for variety *major*.

The nearly glabrous forms of *Euthamia graminifolia* bear a close resemblance to *E. gymnospermoides*, especially when they are fully branched. The two taxa are distinct, however, and the differences are discussed under the latter species.

*Euthamia graminifolia*, more so than any of the other species in the genus, is moisture-loving; so much so that it was included by

Fassett (1957) in his *Manual of Aquatic Plants* as occurring commonly on wet shores of lakes and streams and occasionally in shallow water.

2a. ***Euthamia graminifolia* var. *graminifolia***

*Chrysocoma graminifolia* Linnaeus, Sp. Pl. 841. 1753. TYPE: "Habitat in Canada. Kalm." (S; photocopy WNC!)

*Solidago lanceolata* Linnaeus, Mantissa 114. 1767. TYPE: "Habitat in America septentrionali. Royen 80." (LINN; photo GH!).

*Solidago graminifolia* (Linnaeus) Salisbury, Prodomus 109. 1796.

*Aster graminifolius* (L.) Kuntze, Revisio Generum Plantarum 1: 316. 1891.

*Solidago graminifolia* (L.) Salisb. var. *typica* Rosendahl & Cronquist, Amer. Midl. Nat. 33: 253. 1945.

*Solidago graminifolia* (L.) Salisb. var. *graminifolia* forma *bulbipara* LePage, Nat. Canad. 88:52. 1961. A form with bulbils in the axils of the leaves. TYPE: Ontario, on the Kenogami River, 14 miles above Mammamatawa, Dutilly and LePage 38343, August 3, 1960. (CAN!)

2b. ***Euthamia graminifolia* var. *major* (Michaux) Moldenke, Phytologia 12: 478. 1966.**

*Solidago lanceolata* Linnaeus  $\alpha$  *major* Michaux, Fl. Bor. Am. 2: 116. 1803. TYPE: "in Canada." Type specimen not designated.

*Euthamia camporum* Greene var. *tricostata* Lunell, Amer. Midl. Nat. 2: 59-60. 1911. TYPE: North Dakota, Leeds, Benson Co., Lunell, August 23, 1898. (MIN!).

*Solidago graminifolia* (L.) Salisb. var. *septentrionalis* Fernald, Rhodora 17: 12. 1915. TYPE: "--Newfoundland: . . . Quebec. . ." Type specimen not designated.

*Euthamia bracteata* Bush, Amer. Midl. Nat. 5: 172. 1918. TYPE: Colorado, Canon City, T. S. Brandegee B532, 3072. 1872. (Probably MO)

*Solidago bracteata* Bush, Amer. Midl. Nat. 5: 173. 1918.

*Solidago camporum* (Greene) Fedde var. *tricostata* (Lunell) Fedde, Justs. Bot. Jahresb. 41. Abt. 2: 144. 1918.

*Solidago graminifolia* (L.) Salisb. var. *Grahami* Rousseau, Nat. Canad. 69: 107. 1942. TYPE: Quebec: Ile d'Anticosti, sur la berge du ruisseau McGillvray (entre la rivière à La Loutre et la rivière Jupiter) avec *Solidago anticostensis*. 27 août 1940. Rousseau 51456A. (MTJB. not seen)

*Solidago graminifolia* (L.) Salisb. var. *tricostata* (Lunell) Harris, Rhodora 45: 413. 1943.

*Solidago graminifolia* (L.) Salisb. var. *major* (Michaux) Fernald, Rhodora 46: 330. 1944.

*Solidago graminifolia* (L.) Salisb. var. *major* (Michaux) Fernald forma *gemmans* LePage, Nat. Canad. 81: 260. 1954. A form which produces bulbils in the axils of the leaves. Suggested by LePage to be a result of less than adequate light necessary to produce mature fruits and as a means of insuring perpetuation by vegetative means. TYPE: along the Albany River, Dutilly and LePage 30387, August 12, 1952. (CAN!)

Extending across the northern portion of the range of *E. graminifolia*, this variety differs from the typical variety in having wider and blunter leaves. In the western parts of its range, where it is most distinct, in the Dakotas, western Canada, and in the Rockies, the leaves become quite short in relation to their width. The other morphological characters are not significantly different from those of variety *graminifolia*.

2c. ***Euthamia graminifolia* var. *nuttallii*** (Greene) W. Stone, Pl. So. New Jersey 752. 1912.

*Euthamia nuttallii* Greene, Pittonia, 5: 73. 1902. TYPE: District of Columbia, near Chevy Chase, *E. L. Greene, September 15, 1902*. Lectotype designated by L. H. Shinnars in 1946. (ND-G 53!).

*Euthamia floribunda* Greene, Pittonia 5:74. 1902. TYPE: "marshes of Delaware Bay at Port Norris in southern New Jersey, in 1890, by J. H. Holmes." (US!).

*Euthamia hirtella* Greene, Leafl. Bot. Obs. and Crit. 1: 180-181. 1906. Bush (1918). 160. TYPE: Indiana, Lakeville, *E. L. Greene, September 29, 1903*. Lectotype designated by L. H. Shinnars in 1946. (ND-G 50!).

*Solidago graminifolia* (L.) Salisb. var. *nuttallii* (Greene) Fernald, Rhodora 10: 92. 1908.

*Solidago polycephala* Fernald, Rhodora 10: 93. 1908. TYPE: *Euthamia floribunda* Greene, non *S. floribunda* Phil., Anal. Univ. Chile 87: 430. 1894.

*Solidago graminifolia* (L.) Salisb. var. *polycephala* (Fernald) Fernald, Rhodora 17: 12. 1915.

*Solidago hirtella* (Greene) Bush, Amer. Midl. Nat. 5: 160. 1918.

*Euthamia fastigiata* Bush, Amer. Midl. Nat. 5: 164. 1918. TYPE: Biltmore, North Carolina, sandy bottoms along the French Broad River, Biltmore Herbarium 993b, August 23rd, 1897. (NY 75054! isotypes, ILL! ND-G!; paratypes, ND! GH!).

*Solidago floribunda* (Greene) Bush, Amer. Midl. Nat. 5: 167. 1918, non *S. floribunda* Phil., Anal. Univ. Chile 87: 430. 1894.

*Solidago fastigiata* Bush, Amer. Midl. Nat. 5: 164. 1918.

*Solidago nuttallii* (Greene) Bush, Amer. Midl. Nat. 5: 168. 1918.

This variety can usually be distinguished from variety *graminifolia* by its hispidly-hirtellous leaves and branches with the most typical specimens observed from Illinois, Indiana, Ohio, and the District of Columbia. In addition, the plants of variety *nuttallii* often are more robust and have larger leaves than variety *graminifolia*.

3. ***Euthamia gymnospermoides*** Greene, Pittonia 5: 75. 1902. TYPE: Sapulpa, Indian Territory, *B. F. Bush 252, October 6, 1894*. (ND-G 48!; isotype, GH!).

- Euthamia media* Greene, *Pittonia* 5: 74. 1902. TYPE: Banks of the Mississippi at Oquawka, Illinois, *Harry N. Patterson, 1876.* (ND-G 58!)
- Euthamia camporum* Greene, *Pittonia* 5: 74. 1902. TYPE: Banks of the Platte, at Sterling, Colorado; *Edw. L. Greene, 1896.* (ND-G 57!).
- Euthamia chrysothamnoides* Greene, *Pittonia* 5: 76. 1902. TYPE: Prescott, Arkansas, 25 Aug., 1882, *G. W. Letterman.* (US!).
- Euthamia remota* Greene, *Pittonia* 5: 78. 1902. TYPE: "rolling prairie country about Lake Michigan, not rare from northern Indiana to southern Wisconsin." Type specimen not designated.
- Solidago moseleyi* Fernald, *Rhodora* 10: 93. 1908. TYPE: Ohio, Oxford Prairie, Erie Co., September 5, 1898, *E. L. Moseley.* (Location not known).
- Solidago gymnospermoides* (Greene) Fernald, *Rhodora* 10: 93. 1908.
- Solidago camporum* (Greene) A. Nelson, *Coult. & Nels. Man. Bot. Rocky Mts.* 507. 1909.
- Solidago graminifolia* (L.) Salisb. var. *camporum* (Greene) Fernald, *Rhodora* 17: 12. 1915.
- Solidago media* (Greene) Bush, *Amer. Midl. Nat.* 5: 167. 1918.
- Solidago chrysothamnoides* (Greene) Bush, *Amer. Midl. Nat.* 5: 172. 1918.
- Euthamia glutinosa* Rydberg, *Brittonia* 1: 102. 1931. TYPE: Kansas, Belvidere, September 15, 1897, *L. F. Ward* (NY!).
- Solidago perglabra* Friesner, *Butler Univ. Bot. Studies* 3, no. 1: 61. 1933. TYPE: dry bank at east end of Mink Lake, four miles north of Valparaiso, Porter Co., Indiana, *R. C. Friesner 3542.* September 5, 1931. (BUT; photo, GH!).
- Solidago graminifolia* (L.) Salisb. var. *media* (Greene) S. K. Harris, *Rhodora* 45: 413. 1943.
- Solidago graminifolia* (L.) Salisb. var. *remota* (Greene) S. K. Harris, *Rhodora* 45: 413. 1943.

Erect perennial from branched creeping rhizomes, up to 1 meter in height. Stem glabrous or with scabrous lines, terete or nearly so, striate-angled, branched one-third to one-half way down. Cauline leaves alternate, sessile, entire, narrowly linear-lanceolate, short to long-attenuate, to 12 cm long and 8 mm wide, 3–5 nerved, margins scabrous, nearly glabrous, often with scattered short hairs on the veins or in the axils, axillary fascicles absent or, if present, not numerous, punctae generally easily seen and quite often very conspicuous, plants often strongly glutinous. Inflorescence V-shaped, flat-topped to slightly rounded, branches glabrous or with scabrous lines. Heads numerous, glomerate or more often partly or wholly pedunculate. Involucre turbinate, often strongly glutinous, 4–6 mm high. Phyllaries straw-colored, one-nerved, often green-tipped, the outer ovate, obtuse to acute, the inner linear-oblong, obtuse to acute. Ray flowers 9–13. Disc flowers 3–9, 3.0–5.0 mm long. Achenes about 1 mm long, pubescent. Receptacle alveolate, moderately to very strongly fimbriate.

COMMON NAME: Viscid Euthamia.

FLOWERING: August to October.

CHROMOSOME NUMBER:  $n = 18$ , Sieren (1971).

DISTRIBUTION: Plants of high plains and moist roadside prairies from the Texas Panhandle and Oklahoma to Colorado, north and east to southern Michigan, Ohio, Indiana, Illinois, and Missouri.

*Euthamia gymnospermoides*, *E. media*, *E. camporum*, and *E. remota* were all described by E. L. Greene in 1902; *E. camporum* from northeastern Colorado, *E. media* from western Illinois, *E. gymnospermoides* from what is now Sapulpa, Oklahoma, and *E. remota* from around the southern end of Lake Michigan. Most recently, *E. camporum* has been included in *E. graminifolia* as a variety (Harrington, 1954; Fernald, 1950) as has *E. media*; in addition, *E. media* has been treated as a separate species (Deam, 1940; Jones, 1963) and *E. remota* was placed in synonymy with *E. media* (Jones, 1963). *Euthamia gymnospermoides* is the name most often recognized as the correct one for the common species of the prairies from Texas and Oklahoma to Wisconsin and South Dakota (Fernald, 1950; Gleason, 1952), although Shinnery (1951) suggested that what has been called *E. gymnospermoides* is really *E. camporum*, and *E. gymnospermoides* might be a restricted endemic of central Oklahoma.

In an attempt to clarify the situation, specimens from the 12 state area involved were sampled for 23 character states, using especially those that had been traditionally used to distinguish the species, and, in addition, searching for new ones which might show some positive correlation. Some of these, after a time, were determined to be more or less non-variable (for example, achene length) or extremely variable even in a single head (such as ray floret length) and the measuring of these was to a large extent discontinued. The examinations failed to produce any characters that could be used to separate the taxa specifically, but rather indicate that *E. camporum*, *E. media*, *E. gymnospermoides* and *E. remota* are at this time best treated as con-specific.

They did, however, point out several morphological trends which occur over the range of the species.

Moving west and southwest from Illinois and Wisconsin, the leaves tend to become somewhat thicker, a little narrower, and more

glutinous, and the punctae more distinct, possibly in response to the decreasing rainfall.

The height of the receptacle fimbriellae is more or less sporadic throughout the range, although it too tends to increase moving toward the southwest, and the most strongly fimbriate receptacles were observed on specimens from Oklahoma.

Involucre height, one of the characters often used to distinguish the taxa *media* and *gymnospermoides*, also to a certain extent was sporadic, but in general the shorter involucre were found in the east and they increased in height toward the western part of the range.

In general, the length of the flowers, both ray and disc, varied with the height of the involucre, the shorter involucre surrounding shorter flowers, although even within a single head the lengths of the ray flowers were extremely variable.

Although most of the achenes examined were immature, length and pubescence did not seem to be significantly variable.

There also is no significant trend in flower number, with most counts falling between 15 and 20 per head, this narrow range not allowing for much of a trend in any event.

It was interesting to note that as flower length increased moving west, the tubes of the disc corollas remained relatively constant, and it was the limbs that varied in length.

*Euthamia gymnospermoides* closely resembles the glabrous form of *E. graminifolia* and the two species are often difficult to distinguish in those areas where they are in contact, in particular southern Minnesota, Wisconsin, and Michigan. As part of the sampling studies involving *E. gymnospermoides* special attention was paid to specimens of *E. graminifolia* and *E. gymnospermoides* north and south of the Tension Zone in Minnesota and Wisconsin. The Tension Zone as it extends from northwest to southeast through these states is that region which contains the northernmost localities for many species which are a part of the Prairie element, and the southernmost localities for many species which are a part of the Boreal element (Curtis, 1959). The Tension Zone thus includes species from both elements.

That differences exist in the *Euthamias* north and south of the Tension Zone has long been recognized. In most instances, the glabrous plants in Illinois and Indiana have been treated as either *E. graminifolia* var. *media* (Fernald, 1950), or *E. media* (Jones, 1963),

Table 1. Comparison of *E. graminifolia* north of the Tension Zone in Wisconsin and *E. gymnospermoides*.

<i>E. graminifolia</i>	<i>E. gymnospermoides</i>
1. Haploid chromosome number 9.	1. Haploid chromosome number 18.
2. Number of flowers per head usually more than 20.	2. Number of flowers per head usually less than 20.
3. Stem branched in the upper one fourth.	3. Stem branched in the upper one half to one third.
4. Inflorescence wider and shorter, the width/height ratio averaging 0.87.	4. Inflorescence narrower and longer, the width/height ratio averaging 0.71.
5. Leaf punctae inconspicuous and the plants not obviously glutinous.	5. Leaf punctae conspicuous and the plants often obviously glutinous.
6. Receptacle moderately fimbriate.	6. Receptacle moderately to strongly fimbriate.
7. Involucre height 3.0–5.0 mm, averaging about 4.0 mm.	7. Involucre height 4.0–6.0 mm, averaging about 4.5 mm.
8. Heads densely glomerate, pedunculate only when associated heads abort.	8. Heads occasionally glomerate.
9. Disc florets 2.5–3.5 mm long, averaging about 3.0 mm.	9. Disc florets 3.0–5.0 mm long, averaging about 4.0 mm.

intermediate between the more westerly *E. gymnospermoides* and the northern *E. graminifolia* var. *graminifolia*. Rosendahl and Cronquist (1945) chose to consider *E. graminifolia* and *E. gymnospermoides* as intergrading to some extent in the area of the Tension Zone and did not recognize the plants south of that area as a separate taxon. I am in agreement with the latter interpretation.

The significant differences between *E. gymnospermoides* and *E. graminifolia* as indicated by the Wisconsin studies and including the sampling of *E. gymnospermoides* over the 12 state area are given in table 1. Where the two species come in contact in Minnesota, Wisconsin, Michigan and Ohio, the differences are subtle, and often do not hold consistently, but in most cases, the combination of the characters that do hold is enough to allow proper application of the names.

Besides the narrower heads in *E. gymnospermoides*, reflecting the reduced number of flowers, the leaves of that species are narrower, more numerous, and often more strongly ascending. The inflorescence is longer and usually viscid, and is more nearly flat-topped. The inflorescence of *E. graminifolia* is usually somewhat interrupted with not all of the branches reaching the same level at the summit.

It appears that the discernible line of contact between the two species in Wisconsin lies just slightly south—perhaps 50 miles—of the Tension Zone as indicated in the maps of Wisconsin in the paper by Salamun (1965). This may be related to a greater adaptability of *Euthamia graminifolia* which is found in a wider variety of habitats than is *E. gymnospermoides*.

4. ***Euthamia hirtipes*** (Fernald) Sieren, *Phytologia* **23**: 304. 1972.

× *Solidago hirtipes* Fernald, *Rhodora* **48**: 65. 1946. TYPE: Sussex

Co., Virginia: roadside thicket about 1½ miles north of Waverly, September 13, 1945, *Fernald & Long 15015* (GH!); isotype (PH).

Erect perennial from branched creeping rhizomes, up to 1.5 meters in height. Stem glabrous to hirtellous, terete or nearly so, striate-angled, branched at or above the middle. Cauline leaves alternate, sessile, entire, linear-lanceolate, acute to acuminate, to 8 cm long and 5 mm wide, 3–5 nerved, margins scabrous, nearly glabrous to sparsely hirtellous, especially on the veins, axillary fascicles absent or if present not numerous, punctae usually conspicuous, the surfaces sometimes slightly pustulate. Inflorescence v-shaped with few to several strongly ascending branches, essentially flat-topped, occasionally somewhat storied, usually longer than broad, branches glabrous to pubescent. Heads numerous, mostly pedunculate. Involucres turbinate, glutinous, 3–5 mm high. Phyllaries straw-colored, 1-nerved, the outer ovate, obtuse, usually green-tipped; the inner oblong, obtuse to broadly acute,

with or without green tips. Ray flowers usually 7–12. Disc flowers usually 3–5. Achenes about 1 mm long, pubescent. Receptacle alveolate, moderately to strongly fimbriate.

FLOWERING: October

CHROMOSOME NUMBER:  $2n = 54$ , Sieren and Merritt (1980).

DISTRIBUTION: On the coastal plain from southeastern Virginia to southeastern South Carolina.

*Euthamia hirtipes* was first proposed by Fernald to be the result of hybridization between *E. graminifolia* and *E. microcephala* (part of *E. tenuifolia* as here understood) inasmuch as it is morphologically intermediate between the two and the ranges of the proposed parents would allow it. Fernald suggested at that time that it might eventually be recognized as a fully established species with a greater range than that of the type population. Several specimens have been since collected from the Carolinas which bear strong resemblance to the type. Most of the specimens have been referred to either *E. tenuifolia* or *E. leptcephala* and were most probably the basis of the extension of the range of *E. leptcephala* from the lower Mississippi valley east to the Carolinas. *Euthamia tenuifolia* and *E. microcephala* were often distinguished on the basis of leaf width, *E. tenuifolia* having slightly wider leaves, which probably accounts for most of the specimens being named *E. tenuifolia*.

Specimens of *Euthamia hirtipes* from further south in the range differ from the type in that they tend to be less pubescent and to have the leaves more strongly ascending. It may be that further studies will provide evidence for segregating the type population and the more southerly individuals as distinct species; for the present, however, their similarities seem to justify maintaining them as one.

Pollen goodness tests and mature achenes indicate a high degree of fertility in the species. In addition, there seems to be no conspicuous intergradation between it and either *Euthamia graminolia* or *E. tenuifolia*; thus the species seems clearly defined.

The question of the range extension of *Euthamia leptcephala* and its relation to *E. hirtipes* is further discussed with the treatment of the former species.

5. ***Euthamia leptcephala*** (Torrey & Gray) Greene, Mem. Torrey Bot. Club 5: 321. 1894.

*Solidago leptcephala* Torrey & Gray, Fl. N. Am. 2: 226. 1842. TYPE: "Western Louisiana, Dr. Leavenworth! Dr. Hale! Texas, Drummond;" The collection from Louisiana by Leavenworth has been designated as the lectotype. (Lectotype, GH!; syntype, GH!).

Erect perennial from branched creeping rhizomes, up to 1 meter in height. Stem glabrous, terete or nearly so, striate-angled, branched near the top. Cauline leaves alternate, sessile, entire, lanceolate, short-cuspidate to acute, to 8 cm long although usually shorter, and to 7 mm wide, 3–5 nerved, with scabrous margins, very glabrous, often yellowish-green with a conspicuous midrib, punctae obscure, the surface often pustulate. Inflorescence short, compact, cuneate-rounded, branches glabrous. Heads glomerate or pedunculate in small terminal clusters. Involucres turbinate, 4–6 mm high. Phyllaries whitish-yellow, somewhat viscid, often with green tips, the outer ovate-linear, bluntish, the inner linear, obtuse to sometimes acute. Ray flowers usually 7–14. Disc flowers usually 3–5. Achenes about 1 mm long, pubescent. Receptacle alveolate, moderately to strongly fimbriate.

COMMON NAME: Western Bushy Goldenrod.

FLOWERING: September to November.

CHROMOSOME NUMBER: Counts made by Beaudry (1963) and Kapoor and Beaudry (1966) indicate that this species has a diploid chromosome number of 54. The counts were made from specimens collected in Florida and South Carolina, out of the range of the species as here understood.

DISTRIBUTION: A species of the lower Mississippi valley, ranging from southeastern Texas to Arkansas, southeastern Missouri, extreme southern Illinois, western Tennessee and Kentucky, Mississippi and Louisiana in wet flats, low wet fields, glades, edges of woods and other moist places.

*Euthamia leptcephala* is most easily recognized by its very smooth, often pustulate leaves. It most closely resembles *E. hirtipes* of the east coast which differs from *E. leptcephala* in being conspicuously punctate and more pubescent, usually having at least a row of hairs on the upper midrib. The leaves of *E. hirtipes* may be slightly pustulate, which probably accounts for some of the confusion regarding the two species. Fernald (1950) extended the range of *E. leptcephala* to the Carolinas, probably basing his decision on Gray Herbarium specimens of *E. hirtipes* which were

collected in North Carolina. As here understood, the ranges of the two are distinct. They are, however, very similar morphologically and if additional material presents a continuous range correlated with normal range variation in the distinguishing leaf differences, the two species might, with some justification, be united. The relationships between the two species and, for that matter, the entire southeast complex, warrant further study and until this can be done, it seems preferable to treat the species as separate taxa.

*E. leptcephala* is typically found growing at low elevations, and according to Palmer and Steyermark (1935), the species, at least in Missouri where it is restricted to the southeastern lowlands, has a decided preference for acid soils.

6. ***Euthamia occidentalis*** Nuttall, Trans. Am. Phil. Soc. II. 7: 326. 1841. TYPE: "Hab. Banks of the Oregon and Wahlamet, and Lewis' River, in the Rocky Mountains; chiefly on sand and gravel bars, as well as islands." No specimens were cited in Nuttall's original description, but a specimen in the Gray Herbarium collected by Nuttall along the Wahlamet and very probably a part of the original material has been designated as the lectotype. (GH!).

*Solidago occidentalis* (Nutt.) Torrey & Gray, Fl. N. Am. 2: 226. 1842.

*Aster baccharodes* Kuntze, Rev. Gen. Pl. 1: 316. 1891. TYPE: a new name, the type that of *Euthamia occidentalis* Nuttall.

*Euthamia californica* Gandoger, Bull. Soc. Bot. Fr. 65: 41. 1918. TYPE: California, Santa Clara county, Palo Alto, abundant in places on and near the marshes. 2-5 feet. *C. F. Baker 1517*, September 1, 1902. (Isotype, GH!).

*Euthamia linarifolia* Gandoger, Bull. Soc. Bot. Fr. 65: 41. 1918. TYPE: Washington, Klickitat county, auf der Niederung Bingen, *William N. Suksdorf 6108*, August 7, 1907. (Isotype, WTU; photo, GH!).

Erect stout perennial from branched creeping rhizomes, up to 2 meters in height. Stem glabrous, terete or nearly so, striate-angled, branched at or above the middle. Cauline leaves alternate, sessile, entire, linear, cuspidate to attenuate, to 10 cm long and 9 mm wide, 3-5 nerved, margins scabrous, often sparsely pubescent on the upper surface in the axils, often with axillary fascicles, punctae not conspicuous. Inflorescence ample, virgate-rounded, narrow, elongate, often interrupted, branches glabrous, leafy-bracted. Heads not densely glomerate, mostly all pedunculate in small cymose clusters. Involucres campanulate, 4 mm high. Phyllaries firm, scarious, prominently 1-nerved, straw-colored, the outer lance-linear, acute,

sometimes green-tipped, the inner linear, decidedly acute to acuminate. Ray flowers 15–28, usually 17–22, 1.5 to 2.5 mm long. Disc flowers 7–18, usually 9–11. Achenes about 1 mm long, pubescent. Receptacle alveolate, moderately fimbriate.

COMMON NAME: Western Goldenrod.

FLOWERING: July to November.

CHROMOSOME NUMBER:  $2n = 18$ , Raven (1960), Beaudry (1963), Kapoor & Beaudry (1966).

DISTRIBUTION: A widely distributed species in marshes, stream beds, river bottoms, lake shores, and other moist ground from southern California north to British Columbia and Alberta, south to Nebraska, New Mexico, and Arizona. Ranging in altitude from the shores of the Pacific to 7500 feet in the southern Rockies. Although several manuals mention Texas, Shinnars (1950, in his notes on the Texas *Euthamias* gave no indication it is found there; until some specimens are forthcoming, Texas should be excluded from its range. Harris (1943) noted that he had seen two collections from just south of the California border.

*Euthamia occidentalis* is one of the most distinctive species in the genus, and is the only representative of the group in the far west. It is quickly identified by its large size, its paniculate inflorescence, and its very acute to acuminate innermost phyllaries. Its leaves and stems are extremely glabrous and often have a whitish cast.

7. ***Euthamia pulverulenta*** Greene, *Pittonia* 5: 75. 1902. TYPE: "from the vicinity of Hockley, southeastern Texas", *F. W. Thurow in 1890*. (US).

*Solidago texensis* Friesner, *Butler Univ. Bot. Studies* 4: 196. 1940. A new name proposed by Friesner because of earlier homonym, *Solidago pulverulenta* Nutt.

*Solidago gymnospermoides* (Greene) Fernald var. *callosa* Harris, *Rhodora* 45: 413. 1943. A new name, the type that of *Euthamia pulverulenta* Greene.

Erect perennial from branched creeping rhizomes, up to 1.5 meters in height. Stem glabrous, terete or nearly so, striate-angled, branched near the middle. Cauline leaves alternate, sessile, entire, narrowly linear, acute, to 7 cm long and 3 mm wide, usually narrower, 1–3 nerved, margins scabrous, glabrous, viscid, axillary fascicles usually absent, strongly punctate. Inflorescence large, usually with several very strict woody, glabrous branches. Heads

sometimes sessile, but usually individually stalked. Involucres turbinate, 5–6 mm high. Phyllaries straw-colored, one-nerved, usually green-tipped, the outer ovate, acute or obtuse, the inner linear-oblong, acute or obtuse. Ray flowers 10–11. Disc flowers 5–7. Achenes about 1 mm long, pubescent. Receptacle moderately to strongly fimbriate.

FLOWERING: October and November

CHROMOSOME NUMBER: Unknown

DISTRIBUTION: Southeastern Texas.

L. H. Shinnars in 1951 examined the type of *Euthamia pulverulenta* and pointed out that the species had long been overlooked since its original description. Several specimens have been seen from the general area of the type, and, although they are probably closely related to *E. gymnospermoides*, their narrow leaves and strict woody branches make them distinct enough. The pulverulence after which the species is named is most likely the colleters common on the phyllaries of all of the species of the genus, but which are often obscured by the varnish. Greene (1902) mentioned the number of ray flowers was less than the number of discs in the type specimen, and, although this is apparently the exception rather than the rule, one specimen (Willacy Co., Texas, *B. C. Tharp* in 1941, GH) was seen in which this is the case.

8. ***Euthamia tenuifolia*** (Pursh) Nuttall, *Genera* 2: 162. 1818.

TYPE: A specimen (*Pursh*, pine barrens near Dismal Swamp) collected by Pursh on his southern expedition of 1806 has been designated as the lectotype. (PA!).

*Solidago lanceolata* L.  $\alpha$  *minor* Michaux, *Fl. Bor. Am.* 2: 116. 1803. TYPE: "foliis crebrioribus, anguste linearibus; axillis foliosis: subglutinosa. Hab.  $\alpha$ . in pascuis circa Charlestown."

*Solidago tenuifolia* Pursh, *Fl. Amer.* II: 540. 1814.

*Euthamia tenuifolia* (Pursh) Nuttall  $\gamma$  *glutinosa* Nuttall, *Trans. Am. Phil. Soc.* 7: 326. 1841. Said by Nuttall to be distinguished by its very glutinous heads. Type specimen not designated.

*Euthamia tenuifolia* (Pursh) Nuttall  $\beta$  *microcephala* Nuttall, *Trans. Am. Phil. Soc.* 7: 326. 1841. Described by Nuttall as having smaller than usual heads. Type specimen not designated.

*Solidago caroliniana* (L.) B. S. P., *Prelim. Cat. N. Y. Pl.* 26. 1888. TYPE: Not *Erigeron carolinianum* L., basionym.

*Euthamia caroliniana* (L.) Greene, *Mem. Torrey Bot. Club* 5: 321. 1894. TYPE: Not *Erigeron carolinianum* L., basionym.

- Euthamia microcephala* Greene, Pittonia **5**: 79. 1902. TYPE: dry field, Leslie, Sumpter Co., Georgia, Roland M. Harper 594, September 6, 1900, (US; photo, GH!).
- Euthamia microphylla* Greene, Pittonia **5**: 79. 1902. TYPE: Ocean Springs, Mississippi, S. M. Tracy 4751, October 9, 1898; Apalachicola, Florida, Dr. Chapman. Five specimens of Tracy 4751 have been seen, but none with the date given by Greene for the type. The specimen in the Notre Dame Green Herbarium, however, has "type" written on the label in what appears to be Greene's handwriting and this specimen has been designated as the lectotype. (ND-G 51!; other specimens of Tracy 4751: ND-G 52, US, OS!; Chapman GH!).
- Euthamia minor* Greene, Pittonia **5**: 78. 1902. TYPE: Based on *Solidago lanceolata* L.  $\alpha$  minor Michaux.
- Solidago minor* (Greene) Fernald, Rhodora **10**: 13. 1908.
- Solidago microphylla* (Greene) Bush, Amer. Midl. Nat. **5**: 177. 1918.
- Solidago microcephala* (Greene) Bush, Amer. Midl. Nat. **5**: 176. 1918.
- Solidago michauxii* House, Bull. N. Y. State Mus. **254**: 695. 1924. *S. minor* (Greene) Fernald, 1908, non *S. minor* Mill., 1768.

Erect perennial from branched creeping rhizomes, up to 1 meter in height. Stem glabrous, terete or nearly so, striate-angled, branched above the middle. Cauline leaves alternate, sessile, entire, often very narrow, linear, acute, up to 7 cm long and 4 mm wide, 1-3 nerved, with scabrous margins, glabrous or more often hirtellous in the axils or on the veins, axillary fascicles numerous especially in the inflorescence, strongly punctate. Inflorescence flat-topped or rounded with the heads then somewhat storied, branches nearly glabrous or the uppermost hirtellous. Heads sessile or more often pedunculate. Involucres campanulate to turbinate, 3-5 mm high. Phyllaries pale straw-colored, one-nerved, usually more or less green-tipped, the outer ovate, acute to obtuse, the inner oblong-linear, acute or obtuse. Ray flowers 7-15. Disc flowers 3-9. Achenes about 1 mm long, pubescent. Receptacle moderately to strongly fimbriate.

COMMON NAMES: Slender Goldenrod, Narrow-leaved Bushy Goldenrod, Slender Fragrant Goldenrod, Quobsque Weed, Narrow-leaf Euthamia.

FLOWERING: August to December

CHROMOSOME NUMBER:  $2n = 18$ , Beaudry and Chabot (1959), Beaudry (1963), Kapoor and Beaudry (1966), Sieren and Merritt (1980).

DISTRIBUTION: Found in moist or dry sandy soil on the coastal plain from southeastern Maine south to Florida and west to

Louisiana. The species is best developed in the Carolinas, Georgia, and Florida.

*Euthamia tenuifolia* is readily distinguished from the other species in the genus by its very narrow, usually reflexed leaves, its numerous axillary fascicles, and its small numbers of flowers. In the northern portion of its range, there is a slight increase in flower number correlated with slightly wider leaves and, at the northern extreme, a stricter habit with a smaller inflorescence. This creates an occasional problem in identification as they are then similar to some specimens of *E. graminifolia* from the same area, but the difficulty is minor, and the two species are very distinct. It was these northernmost specimens which are somewhat intermediate between typical *E. tenuifolia* and *E. galetorum* that previous authors (Harris, 1943; Fernald, 1950) used as the basis for combining the two species. *E. galetorum* has wider, firmer leaves which are never reflexed and many more flowers per head.

In addition to *E. microcephala*, Greene (1902) split off several other segregates from the southeastern portion of the range which do not seem to differ significantly enough to deserve specific rank.

The plants are very often divested of the cauline leaves below the inflorescence by flowering time, leaving only the very narrow rameal leaves with their numerous axillary fascicles subtending narrow, viscid heads. One of the more attractive species in the genus, *E. tenuifolia* has been reported on several herbarium labels to be strongly and pleasantly odoriferous.

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