

A NEW ENDEMIC HEDGENETTLE (*STACHYS*: LAMIACEAE) FROM TENNESSEE

AARON FLODEN

Department of Ecology and Evolutionary Biology
University of Tennessee Herbarium (TENN)
Knoxville, Tennessee 37996
afloden@utk.edu

ABSTRACT

Stachys glandulosissima Floden, **sp. nov.**, is described and illustrated. This species is distinct from its congeners based on a combination of characters: long petiolate leaves, sparsely distributed spreading to erect leaf indumentum, scattered pustulate-based stem-angle trichomes, the absence of eglandular pubescence on the stem faces, dense atomiferous glands on all surfaces, minimal presence of eglandular inflorescence indumentum, and elongate inflorescences. Morphologically this species is most similar to *S. eplingii* and *S. iltisii*, although it is superficially similar to *S. nuttallii*. A revised key to *Stachys* in Tennessee matches the current circumscription of species recognized in southeastern North America.

Stachys L. (Lamiaceae) is a large genus that contains an estimated 300 species (Nelson 2008; Mabberly 1997). In North America north of Mexico, there are ca. 46 species with the concentration of diversity in the mountains of the west (Mulligan & Munro 1989). The synopsis of the North American species by Mulligan and Munro (1989) is the most recent comprehensive treatment. *Stachys* in southeastern North America has received a great deal of attention in both nomenclature and taxonomy since Epling (1934) and Nelson (1981) provided overviews of the regional taxa.

Approximately 20 species of *Stachys* exist in the Southeast with a center of diversity in and around the Southern Appalachians (Nelson 2008). Despite considerable taxonomic attention there are difficulties in determination of some collections using the available floristic keys (Nelson 2008; Poindexter & Nelson 2011; Weakley 2015). Keys based on different characters can arrive at starkly different conclusions; e.g. starting with calyx lobe characters can lead to a different species than keying the same plant beginning with a key based on petiole lengths (Nelson 2008). This problem is partly due to the variation in some character states and partly because some species have been broadly circumscribed, e.g. *S. nuttallii* Shuttlew. ex Benth.

The taxonomy of *Stachys* in southeastern North America is not only taxonomically difficult because of morphological variability but also because of recent descriptions of cryptic, narrowly endemic species without clarification of the distribution or habitat of more broadly distributed species. Problems have arisen due to (1) differences of interpretation in the morphological breadth of species, (2) re-elevation or description of novel species without re-consultation of type concepts, and (3) inclusion of misidentified species in floristic works. For instance, *S. nuttallii* was argued to be the correct name with *S. cordata* Riddell, *S. subcordata* Rydb., and *S. salvioides* Small as synonyms (Nelson 1981). Conversely, Pringle (2002) argued that *S. cordata* is the name with priority for that same conglomeration of synonyms. Current treatments by Nelson (2008), Poindexter & Nelson (2011), Fleming et al. (2015), and Weakley (2015) have recognized *S. cordata*, *S. nuttallii*, and *S. subcordata* as distinct species with only *S. salvioides* treated as a synonym of *S. nuttallii*. *Stachys eplingii* J. Nels., described by Nelson and Fahey (1979), is sympatric with *S. nuttallii* but is morphologically distinct and occurs in wet to boggy places. More recently, Nelson (2008) described *S. iltisii* J. Nelson from the Interior Highlands of Arkansas and Oklahoma, which was formerly included within a broad morphologic circumscription of the Ozark-Appalachian disjunct *S. eplingii*. Though recent recognition of *S. subcordata* as distinct from *S. nuttallii* (Nelson 2008) clarifies its

distribution as endemic to high elevations in Virginia (Fleming et al. 2011), the distributions and habitat preferences for *S. cordata* and *S. nuttallii* have not been elucidated. Fleming et al. (2011) described an additional species, *S. matthewsii* Fleming, Nelson, & Townsend, which was compared to *S. hispida* Pursh, *S. latidens* Small, *S. cordata*, and *S. nuttallii*. Many of these recently described species are narrow endemics within and around the Southern Appalachian Mountains.

Despite reports of *Stachys eplingii* in Tennessee (Chester et al. 1997), the most recent account of *Stachys* in Tennessee excludes *S. eplingii* based on communications with J.B. Nelson (Chester et al. 2009). Reports of *S. eplingii* in Tennessee, including that of Mulligan and Munro (1989), have referred to a few populations from Polk County; a disjunction several hundred kilometers from its distribution in West Virginia and Virginia. Mulligan and Munro (1989) reported this species and provided a chromosome count for the species from Tennessee. Thus, the exclusion of *S. eplingii* from Tennessee leaves the placement of these unusual plants from Polk County without a sustainable assignment within a recognized species and the chromosome number of *S. eplingii* undocumented. Attempts at keying these plants in relevant literature (Nelson 2008; Poindexter & Nelson 2011; Weakley 2015) result in the placement of these plants in either *S. nuttallii* or *S. cordata* because of their long petioles. However, these Polk County populations differ from both species in their predominantly and densely distributed atomiferous glandular indument, minimal presence of eglandular indument (which is restricted to leaf surfaces, stem angles, and scattered on the calyces), and their leaf shape. Elongate inflorescences and dense glandular indument throughout the plant suggests a close relationship to *S. eplingii* and *S. iltisii*. The presence of pustulate based trichomes on the stem angles and the elliptic-oblong leaves are more similar to *S. nuttallii* than they are to *S. cordata*, which has broadly ovate leaves with pubescent stem faces and angles. Based on their distinctive combination of morphological traits, the Polk County plants are determined here to represent a distinct species confined to the Walden Creek geologic formation (see Hardeman 1966) along the Hiwassee River of Polk County.

Stachys glandulosissima A. Floden, sp. nov. (Figure 1). **TYPE: USA. Tennessee.** Polk Co.: Junction of Hwy 30 and 315, just W of stop sign on bluff slope and in ditch, abundant, 15 Jul 2011, A. Floden 1603 (holotype: TENN; isotypes: APSC, BRIT, MO, NCU, NY, SC).

Stachys glandulosissima is similar in appearance to *S. nuttallii* Shuttlw. ex Benth. with pustulate-based spreading trichomes on the stem angles but differs in its vestiture consisting of short, stipitate-glandular trichomes covering all surfaces, like those of *S. eplingii* J. Nels. The new species differs from *S. eplingii* in its long-petiolate leaves (vs. sessile or subsessile).

Perennials herbs, 5–20, or more stems per plant; rhizomes white, cylindrical tubers 1–6 mm long present at ends of new rhizomes; stems to 60–100 cm, erect, rarely branched, stem angles with uniseriate 2–4-celled retrorse to spreading pustulate-based trichomes, 1–5 mm long, sides and angles with copious short stipitate glandular trichomes, foliar internodes 4–8 cm long; leaves petiolate, petioles 1–8 cm long, midstem petioles longest, margins densely shortly stipitate glandular and with pustulate-based trichomes to 1–4 mm long; leaf blades ovate-elliptic, apex long-acuminate, base cordate on lower stem to rounded-truncate above, 7–21 x 3–8 cm, both surfaces copiously shortly stipitate glandular with interspersed longer trichomes with pustulate bases confined to veins, margins crenate to serrate; inflorescences elongate, the lower verticils well separated, the upper more dense, internodes 0.3–3 cm; cymules 1–3-flowered, verticils 4–6-flowered; inflorescence leaves greatly reduced, ovate, margins ciliate, faces densely short stipitate glandular; calyces 5–7 mm long, tube 3.5–5 mm long, lobes narrowly deltoid, 1.5–2 mm, apices cuspidate-acuminate with a reddish spinose tip ca. 0.25–0.5 mm long, calyx 2–3 mm wide at mouth, narrowly-campanulate, densely short stipitate glandular, with sparse longer non-glandular trichomes, margins with longer capitate glandular trichomes; pedicels 1–1.5 mm, corollas white to pale pink with darker reddish maculation,

6–8 mm, lower lip at 90 degree angle, 3-lobed, surface pubescent-glandular, filaments with longer trichomes proximally mixed with shorter stipitate glandular trichomes to middle and distally with dense short stipitate glandular trichomes; mericarps ovoid, 1.5–2 mm, castaneous.

Cytology. Specimens of *Stachys glandulosissima*, included within *S. eplingii* by Mulligan & Munro (1989), were reported as $2n = 34$ from near where *Floden 1604* was collected (see below).

Distribution. Tennessee. Polk Co.: Hiwassee River talus slopes with underlying seepage moisture or along smaller drainages. This species only occurs on a small portion of the south side of the river within the confines of the Walden Creek geologic formation. Fieldwork through 2009–2012 led to the discovery of populations only on the south side of the Hiwassee River on north-facing slopes.

Phenology. Flowering late May–July, fruiting July–August.

Other specimens examined. Tennessee. Polk Co.: Hwy 30, ca. 1 mi W of 315 junction on S side of road on N-facing slope, shale substrate, 35 11.964, -84 30.683, 17 May 2012, *Floden 2130* (APSC, MO, TENN) and 5 Jun 2009, *Floden 904* (APSC, MO, TENN); Hwy 30 ca. 1.25–1.5 mi W of jct with 315, along small creek on roadside, N and S sides of road, 15 Jun 2011, *Floden 1604* (APSC, MO, TENN).

The closest relationships of *Stachys glandulosissima* seems to be with *Stachys eplingii* and *S. iltisii* with which it shares numerous morphological features. *Stachys glandulosissima* has glandular vestiture throughout, elongate inflorescences, and the calyx shape of *S. eplingii* and *S. iltisii*, but it differs from both species in the long petiolate leaves, more prominently cuspidate calyx lobes, and the presence of pustulate-based, erect, stem-angle trichomes. Additional differences are seen in the abrupt shift from the lowermost, densely pubescent internodes to densely short-stipitate glandular stem faces with a sparse distribution of pustulate-based spreading trichomes on the stem angles above, and also in the minimal presence of eglandular calyx trichomes (Figure 1g). Indument type has been shown to be of value in separating species within *Stachys* species groups but not in defining relationships among groups (Salmaki et al. 2009). Further enumerations of characters that differentiate *S. glandulosissima* from its congeners are provided in the key to *Stachys* in Tennessee below.

The habitat of *Stachys glandulosissima* is at the base of shale talus slopes with underlying moisture and differs from that of *S. eplingii*, which is reportedly in boggy places (Nelson 2008). It is also disjunct from the nearest *S. eplingii* in southwestern Virginia (though a specimen collected in Burke County, N.C., by *M.A. Curtiss s.n.* [NYBG digital image] suggests it may have historically occurred in closer proximity to this new species).

The description of another novel *Stachys* species in an area that has received considerable attention to its flora, especially in the Southern Blue Ridge, shows that despite the density of collections there still are novelties in specialized ecological communities. This and other recent discoveries emphasize the continued need for floristic surveys and fieldwork even in well explored regions.

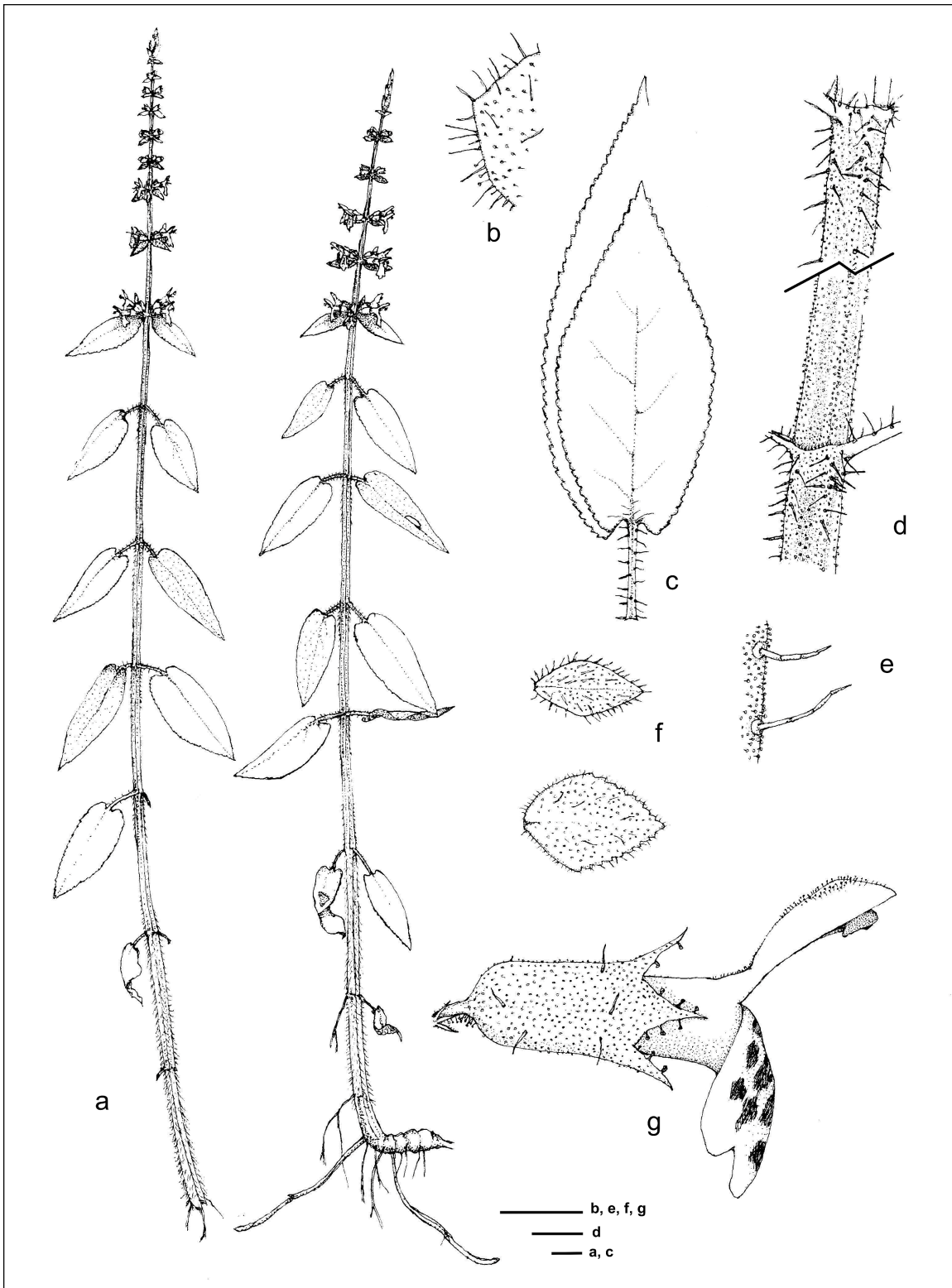


Figure 1. *Stachys glandulosissima*. A. Whole plant. B. Single serration of the leaf margin. C. Leaves showing variation in widest point of leaf and petiole D. Stem nodes and partial internodes. E. Uniseriate trichomes found on the stem angles. F. Bract leaves of the inflorescence. G. Calyx and corolla.

Measurements are as follows for their respective part of the figure: a = 2 cm; b = 0.5 mm; c = 1 cm; d = 1 cm; e = 2 mm; f = 1 cm; g = 5 mm. Drawn by the author from the type collection, *Floden 1603*.

Key to the taxa of *Stachys* in Tennessee

This key differs from the recent Flora of Tennessee (Chester et al. 2015) treatment in recognizing the synonyms of the *Stachys nuttallii*-complex as separate species following current taxonomy in the Southeast. Recent collections from northeastern-most Tennessee confirm the presence of *S. appalachiana* in the state and an additional collection of the non-native adventive *S. germanica*. *Stachys salvioides* is treated here as distinct from *S. nuttallii* and from *S. cordata*.

- 1. Leaves and stems densely hoary pubescent, adventive **Stachys germanica**
- 1. Leaves and stems variously pubescent, but not hoary.
 - 2. Rhizomes always with tubers; stem angles shortly retrorse pubescent or glabrous; leaf margins crenate; calyx lobes narrowly lanceolate; adventive **Stachys floridana**
 - 2. Rhizomes occasionally with tubers or tubers absent; stem angles variously pubescent; leaf margins various; calyx lobes deltoid to lanceolate; native.
 - 3. Stem faces glabrous below inflorescence, angles sparsely short retrorse hispid or rarely glabrous **Stachys latidens**
 - 3. Stem faces and angles variously pubescent, but not in the above combination.
 - 4. Petioles short, 5–15 mm long.
 - 5. Stem faces glabrous within inflorescence, stem angles retrorse hispid pubescent especially below inflorescence; calyces with sparse eglandular trichomes mostly on lobes; flowers 6 per verticil **Stachys hispida**
 - 5. Stem faces and angles glandular pubescent; calyces glandular pubescent throughout; flowers 8–10 per verticil **Stachys appalachiana**
 - 4. Petioles long, 15–35 mm long.
 - 6. Calyx lobes aristate, with spine-like apices 1–2 mm long.
 - 7. Stem faces eglandular; stem angles with spreading trichomes 1–3 mm long; leaves sparingly pubescent **Stachys clingmanii**
 - 7. Stem faces copiously atomiferous glandular; stem angles with pustulate based spreading trichomes 1–3 mm long; leaves atomiferous glandular mixed with sparse eglandular trichomes **Stachys glandulosissima**
 - 6. Calyx lobes not aristate, occasionally spine-like but then <1 mm long.
 - 8. Stem faces glabrous to glabrate below the first node subtending the inflorescence.
 - 9. Stem angles with pustulate based stout trichomes, faces pubescent within the inflorescence; leaves hispid pubescent **Stachys nuttallii**
 - 9. Stem angles occasionally with short retrorse hairs, faces glabrous throughout; leaves usually glabrous or glabrate **Stachys tenuifolia**
 - 8. Stem faces pubescent throughout.
 - 10. Leaves strongly cordate, lamina broadest near the base; vestiture a mix of long and short trichomes, somewhat hispid, occasionally with glandular trichomes in the inflorescence **Stachys cordata**
 - 10. Leaves cordate, lamina broadest above the middle; vestiture often densely sericeous with a mixture of longer trichomes so that the lamina is often silvery, silky even when sparse, usually stipitate glandular within the inflorescence **Stachys salvioides**

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