

**NOTES ON TRILLIUM LUTEUM (MUHL.)
HARBISON IN TENNESSEE**

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Trillium luteum is a yellow or green-flowered trillium with sessile leaves and sessile flowers. In the yellow-flowered form, fresh flowers may have beautiful lemon-yellow petals, stamens with yellow connectives and yellow filaments, and a green, whitish-green, or yellowish-white ovary. Sometimes nearly all the trilliums in a small patch will be of this type. However, there are many plants with brownish or purplish petals, stamen connectives yellow with a brownish central line, and with yellow or brown filaments. Such plants appear to be intermediate forms between *T. luteum* and *T. cuneatum* Raf. Their ovaries are usually green, whitish-green, or yellowish-white. In this study, intermediate plants of these types are called *T. luteum*.

DIFFERENTIATING CHARACTERISTICS

The yellow color of the flowers of *T. luteum* seems to fade in pressing: yellow petals becoming brown (or with a central purplish spot), the yellow anther connectives developing a brown central line, and the yellow stamen filaments becoming entirely brown or developing a brown central line. The ovary usually remains green or whitish-green in color. In such plants, the single most important identification character probably is the green, whitish, or yellowish ovary in *T. luteum* and the brown or black ovary in *T. cuneatum*. The yellow and greenish flower colors characteristic of *T. luteum* tend to approach the maroon or brown colors of *T. cuneatum* Raf. Rarely, the ovary of *T. luteum* is dark brown, maroon, or black in color (*Sharp and Shanks* 453). In such cases, the petals are usually yellow, at least in part, or the stamen connectives are yellow, or both the petals and stamens are yellow. I have regarded these plants as belonging to *T. luteum*. It seems probable, however, that a more intensive study of the intermediate forms between *T. luteum* and *T. cuneatum* would show that one species should be regarded as a variety of the other.

There are other sessile-flowered and sessile-leaved trilliums that might be confused with *T. luteum* and these are considered below. *T. sessile* L. has stamens with connectives prolonged two or more millimeters beyond the anther cells while in *T. luteum* these connectives are prolonged only 0.5 - 1.0 mm. beyond the anther cells.

T. viride Beck has greenish or yellowish petals that are rather narrow and long with very long claws, pubescent leaf under surfaces, and pubescent distal end of the stem. The petals of *T. luteum* have no claws and there is no pubescence on the under leaf surfaces nor on the distal end of the stem (but these parts are sometimes scabrous).

✓ The stamens of *T. Underwoodii* Small are almost sessile, having a filament less than 2 mm. long, while the stamens of *T. luteum* have filaments about 3 mm. long.

The filaments of the stamens of *T. lanceolatum* Boykin are about the same length as the anther cells while the filaments of the stamens of *T. luteum* are about one-fourth the length of the anther cells.

T. viridescens Nutt. has purple petals with very long claws (1.5 - 2.0 cm.) but *T. luteum* has unclawed yellow or greenish petals. *T. ludovicianum* Harbison is like *T. viridescens* in having very long, clawed petals.

The petals of *T. discolor* Wray are usually yellow to greenish in color and obovate in shape with one or more petals having apiculate apices. The petals of *T. luteum* are usually oblanceolate and non-apiculate.

T. stamineum Harbison has linear, purple, and twisted petals and the undersides of the leaves and the apical end of the stem are pubescent. The petals of *T. luteum* are not twisted and the under leaf surfaces are not pubescent (although they are often somewhat scabrous) and the apical end of the stem is not pubescent.

T. decumbens Harbison plants are prostrate and lie flat on the ground. The distal end of the stem and the under leaf surfaces are pubescent and the connectives are prolonged 2 mm. or more beyond the anther cells. *T. luteum*, however, bears its leaves below the flower near the distal end of an erect stem, has the under leaf surfaces and the distal end of the stem glabrous or scabrous but not pubescent, and has very short (usually 1 mm. or less) prolongations of the connectives beyond the anther cells.

SOME CHARACTERISTICS OF TRILLIUM LUTEUM (MUHL.) HARBISON FROM TENNESSEE

Underground parts. These consist of a thick rootstock bearing one, or rarely two, erect stems with each stem surrounded basally by two or more sheaths. Each rootstock also bears roots. For this study of the underground parts, only 26 plants were available, since most of the plants borrowed were pressed plants that did not have the underground parts present.

Rootstocks. These averaged 2.8 cm. in length (with a range from 1 - 9 cm.) and an average thickness of 1.28 cm. (the range was from 0.9 - 1.8 cm.). Usually the rootstocks are unbranched

and cylindrical in shape but some are ellipsoidal, some globular, and one ovoid. The color of the rootstock is difficult to determine in pressed plants but it seems to be an ashy-slate or a dark yellowish-brown. The older end of the rootstock may be black or blackish, thus contrasting with the yellowish-brown of the growing end. The black lines encircling the rootstock are apparently formed by the basal fragments of the outer sheaths which have fallen off. The part between two successive black lines probably represents the growth in that year, as seems to be the case in *T. stamineum* (Shaver, 1957), *T. sessile* (Shaver, 1959), and *T. cuneatum* (Shaver, 1960). Thus counts of these black lines may give a fairly accurate picture of the age of the rootstock. For example, a plant (Bain, no. 3, U.T.) has a rootstock 3 cm. long with 18 encircling black lines. So, the age of this rootstock is about 18 years and its average increase in length per year is about 1.7 mm.

Many scars on the rootstock are small and not easily seen because they do not increase in length and thickness of the rootstock. The great growth increases occur at the encircling black lines and between these lines near the growing end of the rootstock. These black lines are the remnants and scars of the outer sheaths. The circular scar left when the inner sheath falls surrounds the more central scar of the aerial stem. These last scars remain small and inconspicuous.

Rootstocks are usually unbranched and all but seven were placed horizontally in the soil. These seven rootstocks had these soil positions: one was vertically placed, one was placed 60° from the horizontal with the growing end up, two were 45° from the horizontal with the growing end up, one was 30° from the horizontal with the growing end down, and two were placed 15° from the horizontal with the growing end up.

Roots. Three types of roots occur in *T. luteum*: (1) fleshy, unwrinkled, and unbranched roots, (2) fleshy unbranched and transversely wrinkled in the fleshy region, and (3) thin and wiry, unwrinkled, branched roots. The fleshy roots are fleshy near their bases for a distance of 5 cm. or less with the fleshy part about 1.8 mm. thick. Such roots at first are smooth and arise mostly from the lower side of the rootstock near its apical end. The next year, usually, the fleshy part of the smooth roots become transversely wrinkled due, apparently, to the contraction and shortening of this region. Contracting and shortening phenomena have been described somewhat for *T. stamineum* elsewhere (Shaver, 1957). The shortening occurs, apparently, only in young, fleshy roots, and tends to pull the growing end of the rootstock deeper into the soil. Since the older roots have quit contracting, the older end of the rootstock tends to keep its position in the soil. In this material, the average number of fleshy roots per rootstock was 6.7 with a range from 3 to 13.

The general effects of root contractions and shortenings near

the growing end of the rootstock and the absence of these processes in the older roots of the rootstock, are to change the position of the rootstock in the soil. Thus some rootstocks are vertical, the contracting roots being symmetrically placed on all sides, and some are inclined to the horizontal at various angles with the growing end up, or with the growing end down, depending on the position of the contracting roots and their relative pull. However, most of the rootstocks are horizontally placed in the soil. How this position is maintained is not at present understood by the author.

The third class of roots are wiry, thin (about 0.5 mm. thick), and much branched. They arise directly from the rootstock or they terminate the fleshy roots with the exception of the newly formed ones. The thin roots are mostly grayish, ashy, or slate-colored, thus contrasting with the yellowish-brown or straw-color of the fleshy roots.

Sheaths. Typically, there are two sheaths wrapped around each stem at the stem base. The outer, cylindrical sheath is about 1.8 cm. long, with a range from 0.8 to 3.0 cm., The inner cylindrical sheath is about 3.5 cm. long with a range from 2.5 to 3.7 cm. Just outside the attachment of the stem to the rootstock, is the attachment of the inner sheath in a concentric position. This attachment is followed by the concentric attachment of the outer sheath. When two stems are attached to the rootstock side by side, as occasionally occurs, there will be an inner encircling sheath for each stem, but there will be only a single outer sheath and it will encircle both stems. Both inner and outer sheaths have their free or distal ends obtuse. Their colors tend to be white or yellowish-white basally and yellowish-brown, gray, or slate distally.

Stem. Most of the stems available for study were incomplete, the rootstock and a part of the basal underground stem being absent. There were, however, thirty-one plants complete with rootstocks and one or two aerial stems. These stems averaged 20.2 cm. in length, when the underground basal portion was counted, with a range from 10.0 to 33.8 cm. in length. Thickness seems greatest a short distance above the ground, varying from 1.5 to 8.0 mm. and averaging 4 mm. The stem is slightly constricted below the leaf whorl to form a neck. Thickness here varies from 1.5 to 5 mm. and averages 2.7 mm.

Stem colors are difficult to determine from herbarium material for a leaf is usually mounted or glued over the distal end and the sheaths cover the basal end. The basal 3-5 cm. of the stem are in the soil in the plant's natural habitat and are white to yellowish-white in color, changing at the surface of the ground to maroon or purplish. Above this region, the stem is purple or black-purple for 8 cm. or more. This color becomes less intense distally where it gives way gradually to green in fresh plants.

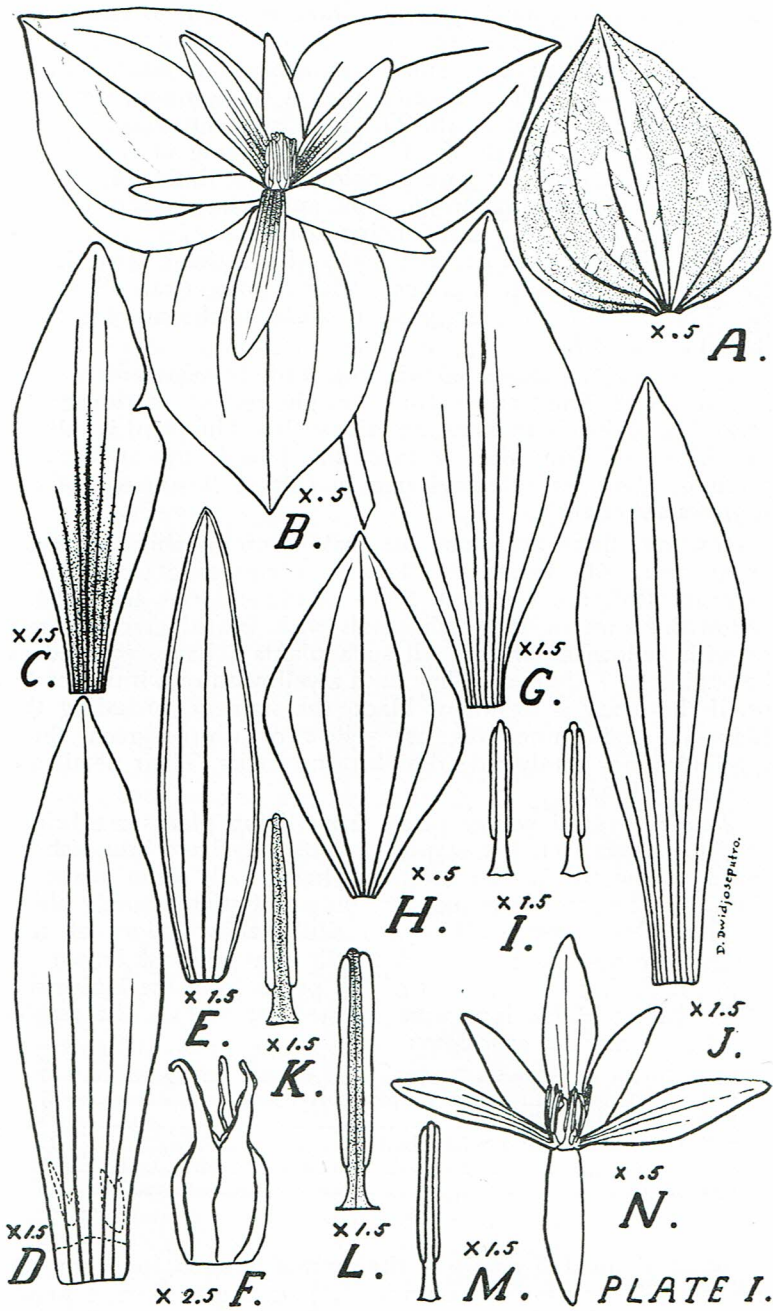
In most herbarium specimens, the green is seen to have faded to brown.

Leaves. A whorl of three sessile leaves subtends the single flower (Pl. I, *B*). Most of the 109 leaves examined for shape were oval (53) or ovate (44) but 12 were orbicular. Their bases are rounded or some are slightly and gradually narrowed. Usually the leaves overlap basally. The apices of all of the leaves were acuminate varying from abruptly short acuminate to long acuminate. Leaf margins are entire or sometimes slightly and irregularly lobed. The upper surfaces are mottled with two shades of green, the lighter shade forming patches which tend to follow the larger veins (Pl. I, *A*). The leaves seem to be glabrous and smooth. This is certainly true for the upper surfaces. Very rarely are the lower surfaces of these leaves visible for the leaves are fastened to the mounting paper by their lower surfaces. None of the visible lower surfaces were pubescent but an occasional plant from Middle Tennessee had scabrous veins.

A sample for measurement was selected from all the mounted specimens in the herbarium of the University of Tennessee at Knoxville, Tennessee. Each specimen of this species was carefully described for my notes but every other sheet only was selected for the leaf study. The group was further reduced by eliminating specimens from outside Tennessee. This left a balance of 95 specimens. These had an average length of 8.5 cm. with a range from 5.5 to 13.6 cm. The width averaged 5.6 cm. with a range from 3 to 11 cm. There are three or five prominent veins radiating from the base of the leaf.

Sepals. Three sepals make up the lowest whorl of the sessile and terminal flower. The sepals grow erect. They persist for a while even after the fruit has matured and fallen. Most sepals are green and glabrous on both the upper and lower surfaces. An occasional plant occurs with the green sepals having a large purple or black-purple spot at the base in a central position. Altogether, there are 18 sepals having yellowish-brown or

Plate I. *Trillium luteum* (Muhl.) Harbison. (See next page.) *A*. Leaf showing one of the mottling patterns, the stippled area indicating dark green and the unstippled area white-green, no. 2004. Unless otherwise indicated, the numbers used in the plate are the Vanderbilt University Herbarium numbers. *B*. The terminal whorl of three leaves subtending the sessile flower of three sepals, three petals with the more prominent veins drawn, stamens, and part of the pistil. The brown part of the petals is stippled and the yellow portion is unstippled, no. 2004. *C*, *D*, *G*, and *J*: Representative sizes and shapes of petals with the brown area in *C* stippled and the yellow part unstippled. *C*, no. 3114; *G*, no. 2007; *J*, no. 2006; *D*, no. 3115. The petals of *G* and *J* are brown as are those of *D* (with the exception of the base and the two encircled areas nearby, which are yellow). *E*. A representative sepal with its veinless border, no. 2006. *F*. Pistil, no. 2007. *H*. A leaf with an unusual shape, no. 4568. *K* and *L*, stamens with much yellow present (stippled areas are brown), *K*, no. 4573, and *L*, no. 3114. *I*, no. 2006, and *M*, no. 2007, stamens. *N*. Yellow flower with the more important veins shown, no. 4568.



dark-brown spots (one per sepal). There are three – rarely five – prominent veins at the sepal base.

A small veinless border (Pl. I, E) makes up the sepal margin. This border is translucent, often with a slightly purplish tint, and undulates up and down. The most common shape for the sepals is lanceolate with 63 of 113 sepals being of this shape. Other shapes encountered were: oblong, 18; elliptic, 15; lanceolate-oblong, 11; miscellaneous, 6. Sepal apices are remarkably uniform, 110 being obtuse and 3 being acutish.

Sepals averaged 2.96 cm in length, with a range from 2.3 to 4.8 cm. Average width is 0.8 cm., with a range from 0.5 to 1.4 cm. The ratio of the average sepal width to the average sepal length is 1 to 3.7.

A typical living flower of this trillium is beautiful when seen in full bloom. The tree petals are “bright yellow” or “buttercup yellow” and the six stamens are yellow also. The pistil is yellowish-white, greenish-white, or greenish. This is the appearance given by *Trillium luteum* living in eastern Tennessee, where it grows abundantly.

However, there are many atypical plants of this species in most parts of Tennessee. Forms intergrading toward *T. cueatum* Raf. are common. Some of these forms have faded yellowish-brown or brownish petals with whitish-green ovaries or with yellowish-stamens. All such plants I have regarded as belonging to *T. luteum*. They have a yellowish or whitish ovary or, if the ovary is brown or black, the stamens, including the filaments and connectives, are yellow or whitish-green. Such specimens may rarely have dark-brown ovaries. Their petals are green or yellow.

Petals. Typical yellow petals from living plants are bright yellow as described, but atypical plants may have brownish or faded yellow petals, the color varying greatly from plant to plant. Furthermore, pressed and mounted plants rarely show brightly-colored petals. The beautiful yellow colors of live petals have now become a faded yellow, a yellowish-brown, or a brown. Altogether, a total of 115 petals from the University of Tennessee Herbarium were selected for study. The results may be summarized as follows:

Light brown or yellowish brown	47
Yellowish brown with central purple spot at base	27
Brownish to dark brown	18
Yellowish brown with a yellow base	11
Yellow	9
Maroon	3

115

Most of the 115 petals in the sample selected for study are elliptic (62) or narrowly elliptic (20) in shape. Twelve petals are oblong, six oblanceolate, and fifteen are miscellaneous

(ovate, 3; obovate, 3; elliptic-oblong, 3; narrowly-oblong, 3; lanceolate-oblong, 3). The apices of the petals are mainly obtuse, 94 out of 109 petals being obtuse, 15 being acute or acutish, and 6 are questionable. Basally, the sides of the petals are gradually narrowed but there is hardly a definite claw present (Pl. I, C, D, J).

Altogether, 118 petals were measured for length. Average length was 4.5 cm. with a range from 3.0 to 7.3 cm. Width averaged 1.1 cm. with a range from 1.5 to 0.5 cm. The ratio of average width to average length is 1:4. The petals are much longer than the sepals; the ratio of the average length of the sepals to the average length of the petals being 1 : 1.5. Petals and sepals are like in being erect in the fully opened flower. However, they are often spread out in pressing so as to expose the stamens and the pistil.

Stamens. There are six distinct and erect stamens surrounding the pistil in each flower. Each stamen consists of a broad basal filament topped by a linear anther. The two linear anther sacs are attached to the linear connective, one on each side. The connective is prolonged for a short distance beyond the anther sacs (Pl. I, K, L, M).

The stamens are yellow in fresh, typical specimens and yellowish-brown in atypical plants and in much herbarium material. Pressed plants are sometimes mounted in such a way as to hide all or a part of the stamens. This makes it difficult to study all six stamens in a flower. The plan adopted was to select one stamen from each plant available for study. Altogether, fifty-four stamens were examined and measured. The two anther sacs from each stamen are linear in shape and adnate to the linear connective. These anther sacs average 1.2 cm. in length with a range from 0.6 to 1.5 cm. The connective is usually prolonged for a short distance (about 0.4 mm. on the average) beyond the anther sacs. This prolongation is cone-shaped, with the apex rounded off and bent toward the pistil.

The filament of the stamen is flaring at the base and tapering above to the base of the anther sacs. Each filament averages 2.7 mm. in length. Range in length is from 2 to 4 mm. Altogether (filament plus anther and including the anther sacs and the prolongation of the connective beyond the anther sacs), the average stamen measures 1.5 cm. in length with a range from 0.8 to 1.9 cm.

Pistils. In *T. luteum*, color of the pistils is useful for identification purposes. Yellow is the most common color, followed by white, and then by green. Brown or blackish-brown colors appear to be rare. Forty-four pistils suitable for this study were available. Thirty-three of these pistils had considerable yellow color and were listed in my notes as yellow or yellowish, 15; yellowish-white, 12; yellowish-brown, 4; yellowish-green, 2. The remainder

(11) were greenish, 2; whitish-green, 2; white, 2; blackish-brown, 5. These brown or blackish-brown pistils were from plants with yellow stamens (yellow filaments, yellow prolongations of connectives beyond anther sacs, *Ruth*, May 8, 1914, Knox Co., Tenn. One flower (*Sharp and Shanks* 453) had two brownish-purple petals with yellow bases. Connectives are yellow. Another plant (*A. J. Sharp and R. E. Shanks* 453A) has a flower with yellowish petals and yellowish-brown stamens. Plants like these deserve more study than I have been able to give them.

Ovary. The ovary is ovoid in shape with six blunt basal pouches which push outward between the stamen filaments. The ovary averages 6.3 mm. in length with a range from 4 to 8 mm. Thickness was 5.3 mm. with a range from 3 to 8 mm. Each ovary bears three erect stigmas whose tips are bent slightly to one side and outward. Stigmas are sessile, about 6 mm. in length, and range from 4 - 8 mm. long.

Fruit and Seed. Unfortunately, I have not had the opportunity to study mature fruit and mature seed. Harbison (1901, p. 22) describes the fruit as a "berry ovoid, greenish, 1-2 cm. in diameter." Harbison does not describe the seed. I expect them to be golden-yellow in color with seed bearing a very large white and frothy aril.

SUMMARY OF TAXONOMIC CHARACTERISTICS OF *T. LUTEUM* IN TENNESSEE

Rootstock thick, about 2.8 cm. long, and placed at various angles in the soil. It is encircled by black lines. *Roots* are of three types: (1) thin, much branched roots arising from the rootstock and terminating the fleshy roots. (2) fleshy roots arising from the rootstock and without transverse circular wrinkles, (3) fleshy roots transversely wrinkled. The unwrinkled fleshy roots are young roots; they will later become transversely wrinkled. *Stems* are smooth, erect, and glabrous. The *leaves* are sessile, oval or ovate, acuminate, with rounded and usually over-lapping bases. Mottled above, smooth and glabrous (rarely scabrous on the large veins below). Length 5.5 to 13.6, width 3 to 11 cm. *Sepals* lanceolate, obtuse, 2.3 to 4.8 cm long, 0.5 to 1.4 cm. wide, with a narrow, veinless, marginal border. Typical *petals* are a beautiful "buttercup" yellow color but there are many atypical flowers that have brown or partly brown petals. In this last case, the pistil is yellow or green. When the ovary is brown (which is very rare), the petals seem to be yellow or green. Most petals are elliptic in shape with obtuse apices. Length is 3 - 7.3 cm., about 1.5 times the length of the sepals. The six *stamens* are mostly yellow in color with two linear anther sacs adnate to a linear connective which is usually prolonged less than one millimeter beyond the anther sacs. The anther sacs are about 1.2 cm long and the stamen filament is about 2.7

mm. long. Typical pistils are yellow or green (rarely brown and that only (?) when the petals or stamens or both are yellow or green). The *ovary* is ovoid with longitudinal ridges. It is surmounted by three sessile stigmas erect except for tips slightly bent outwards.

DISTRIBUTION IN TENNESSEE

Trillium luteum is mostly a trillium of East Tennessee where it often occurs abundantly in almost pure stands in fertile, wooded ravines and hillsides. The map is based on the specimens

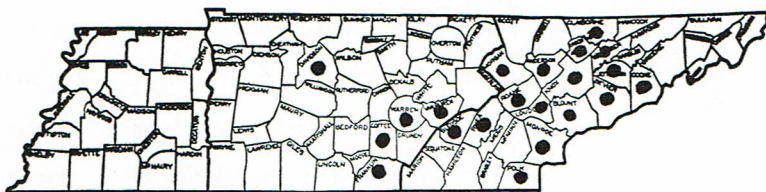


Fig. 1. County distribution of *Trillium luteum* in Tennessee.

in the University of Tennessee Herbarium at Knoxville with the exception of Davidson County which is based on specimens in the Herbarium of Vanderbilt University and the following two specimens which are cited from Anderson (1934, p. 124): "Sevierville [Sevier County], Aprl. 11, 1917, *Ainslie*; Grand View [Rhea County] 1897, *R. W. Taylor*."

RELATION OF TRILLIUM LUTEUM TO TRILLIUM CUNEATUM

Trillium luteum appears to be very similar to *Trillium cuneatum* Raf., in all taxonomic characters save color. The color of a typical flower of *T. luteum* is maroon or purple. If color differences are disregarded, it would be difficult, or perhaps impossible, in some cases to separate these species. Since the intensity and amount of yellow present varies greatly from plant to plant, it might be possible to arrange a collection to show many variations from one species to the other. Anderson (1934, p. 124) has already called attention to these intermediate forms as follows: ". . . the extreme types approach other named 'species' so closely that it becomes doubtful whether the distinction really exists or not. *T. luteum* is closely related to *T. Hugerii* [*T. cuneatum* Raf.] to which it is similar in every respect except in color; every part of the plant show the yellow pigmentation instead of purple."

The present author uses the name, *T. luteum* for all of these plants having one or more of these flowering parts yellow or green: petals, stamens, or pistils. He calls similar plants *not having any of the above flower parts yellow or green*, *T. cuneatum*.

LITERATURE CITED

- Anderson, W. A. 1934. Notes on the flora of Tennessee: the genus *Trillium*. *Rhodora*, 36:119-128. Apr.
- Fernald, M. L. 1950. *Gray's Manual of Botany*. 8th ed. Pp. i-lxiv, 1-1632. Amer. Book Co., New York City
- Gates, R. R. 1917. A systematic study of the North American genus *Trillium*, its variability, and its relation to *Paris* and *Medeola*. *Ann. Mo. Bot. Gard.*, 4:43-32. Pl. 6-8. Feb.
- Gray, A. 1880. No title given. A note given: "Trillium sessile, as we learn from Mr. Lehman, of Salem, North Carolina, and from specimens sent by him, abundantly occurs in the neighborhood of Kingston, Tenn., with bright yellow petals; and I have recently heard of this from other western sources . . ." *Bot. Gaz.*, 5:63.
- Harbison, T. G. 1901. New or little known species of *Trillium*. *Bilt. Bot. Studies*, 1:19-24.
- Harbison, T. G. 1902. New or little known species of *Trillium*. II. *Bilt Bot. Studies*, 2:158.
- Macbride, J. Francis. 1918. I. Further new or otherwise interesting Liliaceae. Contributions from the Gray Herbarium of Harvard University lvi, 19.
- Muhlenberg G. H. E. 1813. *Trillium sessile* L. var. *luteum* Muhl. Muhlenberg's Catalogue, p. 38. Also in his manuscript volume "Observationes Botanicae de Plantis Americanae Septentrionalis," in Lib. Phil. Acad. Nat. Sci.; he describes it under *T. sessile* var. Originals of these not seen but cited from Harbison 1901.
- Peattie, Donald C. 1927. *Trillium* in North and South Carolina. *Jour. Elisha Mitchell Sci. Soc.*, XLII: 193-206.
- Shaver, Jesse M. 1957. Some notes on *Trillium stamineum* Harbison in Tennessee. *Jour. Tenn. Acad. Sci.*, 32 (3):169-184. July.
- Shaver, Jesse M. 1959. *Trillium sessile* in Tennessee. *Jour. Tenn. Acad. Sci.*, 34 (1): 31-39. Jan.
- Shaver, Jesse M. 1960. *Trillium cuneatum* Raf. in Tennessee. *Jour. Tenn. Acad. Sci.*, 35 (2):81-91. Apr.
- Small, J. K. 1913. *Flora of the southeastern United States*. 2nd ed. Pp. i-xii, 1-1,394. The author, New York City.
- Small, J. K. 1933. *Manual of the southeastern flora*. Pp. 1-xxii, 1-1554. The author, New York City.