

TRILLIUM SESSILE L. IN TENNESSEE

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Trillium sessile has the characteristics of trilliums in general. This means that it is a perennial plant with a fleshy, underground rootstock bearing one or two erect, deciduous, aerial stems, each terminated by a single flower comprising three green sepals, three colored petals, six stamens with long linear anthers, and one pistil with three linear stigmas. The flower is subtended by three leaves. The superior ovary has three cells, each containing many ovules.

DIFFERENTIATING CHARACTERISTICS

Trillium sessile belongs to the group having sessile flowers. The prolongation of the connective beyond the anther sacs is thin, light brown in color with a yellowish-white border, and about 4 mm. long (rarely as short as 2 mm.). While *T. cuneatum* Raf., *T. maculatum* Raf., and *T. luteum* Harbison also have the connective prolonged beyond the anther sacs (but usually for less than 2 mm.), the prolongation is thick and purplish-brown. *T. stamineum* Harbison has a very short prolongation (0.5 mm. or less) or none at all. *T. recurvatum* Beck has leaves with petiole-like bases and strongly reflexed sepals, while *T. sessile* has leaves without petiole-like bases and its sepals are not reflexed.

T. decumbens is like *T. sessile* in having the connective much prolonged (2 mm. or more) beyond the anther cells but is unlike *T. sessile* in having the stem pubescent distally, the leaves pubescent on the veins beneath, and the stem decumbent with the leaves lying flat on the ground. The petals of *T. decumbens* are long (4 to 7 cm.) while those of *T. sessile* are short (2 to 4 cm.). *T. viride* Beck also has long petals (3.5 to 8 cm.) and these are narrowed into long claw-like bases which, however are not as long as the limb of the petal. While the petals of *T. sessile* are short and sometimes have claw-like bases, these bases are very short, usually being less than 4 mm. in length. The distal end of the stem and the basal portion of the lower surface of the larger veins are pubescent in *T. viride*, but they are glabrous in *T. sessile*.

Other trilliums having petals with claw-like bases are *T. lanceolatum* Boykin and *T. ludovicianum* Harbison. The stamens of *T. lanceolatum* have filaments almost as long as the anther, the petal limbs are linear to linear-oblong and about 1/2 as long as the claw, and the sepals are linear or linear-lanceolate.

On the other hand, the filaments of the stamens of *T. sessile* are very short, usually being from 2.5 to 4 mm. long, and therefore only 1/4 to about 1/2 the length of the anthers; the petals are narrowly elliptic and many times the length of the claw (when present), and the sepals are lanceolate.

The claw-like bases of the petals of *T. ludovicianum* are rather long as compared to the very short (usually less than 4 mm.) claw-like bases of the petals of *T. sessile*. *T. ludovicianum* also has ovate leaves and linear to linear-lanceolate long petals, while *T. sessile* has oval leaves and narrowly elliptic and shorter petals.

T. discolor Wray has obovate petals, which usually have obtuse apices with at least one petal being apiculate. Sometimes, however, the petals are acute to acuminate without the apiculate point. The petals vary in color from a pale sulphur yellow to greenish. *T. sessile* has narrowly elliptic petals, none of which is apiculate and is purple in color (or yellow-green in forma *viridiflorum* Beyer).

CHARACTERISTICS OF TRILLIUM SESSILE

Stem 1.2-2.5 dm. high, from a yellowish-white heavy rhizome about 1 cm. thick; leaves oval, 2.5-8.0 cm. long, 1-5 cm. wide, mostly mottled, rounded sessile base, apex acuminate with rounded point; flower sessile, erect; petals erect, narrowly elliptic, with or without wide claw-like bases (when present, claw usually less than 4 mm. long), 1-4 cm. long, acute, red-purple, or yellowish-green in forma *viridiflorum* Beyer; stamens about half as long as petals, the broad flat anther connective prolonged 2.0-4.5 mm. beyond anther sacs, anthers 6.5-13.0 mm. long, the filament broad, much shorter than anther; leaves mostly less than 8 cm. long, oval; no common style, ovary ovoid, 6-angled, about 4.5 mm. thick and 4.5 mm. long; the three stigmas erect or with their tips slightly curved outward, overtopped by the stamens; mature fruit ovoid in shape, and green or whitish green in color.

FURTHER NOTES ON *T. SESSILE*

Rootstock. Only 20 rootstocks were available for study. These varied from 1.0-2.5 cm. long with an average length of 1.7 cm. Thickness varied from 0.5 to 1.4 cm. with an average of 0.9 cm. Most of the rootstocks are cylindrical or ellipsoid in shape. All, except the old end of the rootstock, which is grayish or blackish, are a yellowish flesh-color.

Encircling the rootstock are black lines (Plate I, G) which seem to mark off each year's growth, as is the case in *T. stamineum* (Shaver, 1957, p. 171). The number of these rings per rootstock (considering only rootstocks bearing flowering stems) varies from 5 to 17 with an average of 8.7 rings. This seems to indicate that the age of these plants varies from 5-17 years with an average age of about 9 years. This would mean an average annual increase in length of 1.9 mm. The black encircling lines are formed from the basal fragments of the outer of the two sheaths surrounding the base of the stem. When the stem dies and falls off, it leaves on the rootstock a small lens-shaped scar encircled by the black remains of the inner of the two

sheaths. These continue small and inconspicuous, since there is little growth in thickness or length of the rootstock at this point. The great growth increases occur between the bases of the outer and inner sheaths.

The position of the rootstock in the soil varies from plant to plant. Of 19 rootstocks, 6 were horizontal, 4 erect with the stem end up, 2 erect but inverted so that the stem end was down, 5 inclined at an angle of 30-45° to the horizontal and with the stem end down, and 2 inclined at an angle of about 45° with the stem end up.

Roots. The rootstock bears (1) thick and fleshy but unwrinkled roots, (2) thick and fleshy roots which are transversely wrinkled, and (3) thin, much branched nutritive roots. The thick and fleshy, unwrinkled roots seem to appear in the spring on the last year's growth ring but in a few cases from older growth rings. In non-erect rootstocks, these roots arise from the lower side (Plate I. G). Later, the fleshy unwrinkled roots become transversely wrinkled as a result of their contraction in length. Since the con-

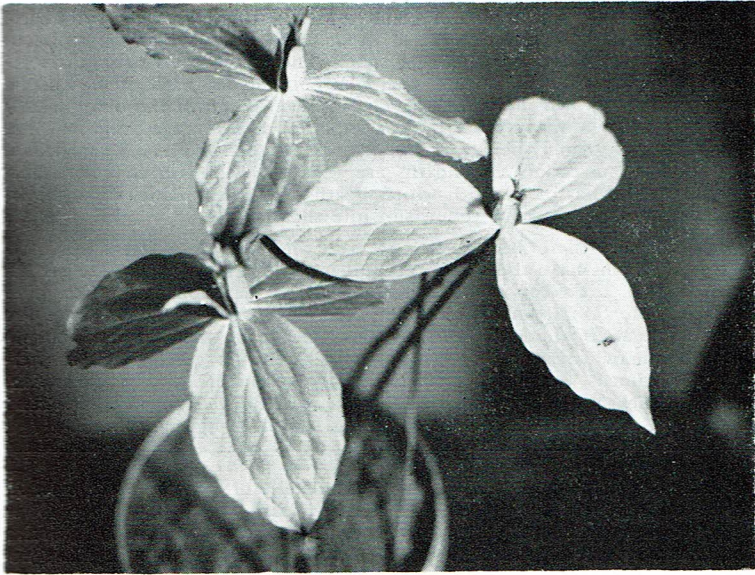


Fig. 1. Flowering *Trillium sessile* L. from Radnor Hills, Davidson County, Tennessee, transplanted into a can for photographing, April, 1958.

tracting roots occur near the growing end of the rootstock, and only contract during their first and second years of growth, the growing end of the rootstock is pulled down deeper into the soil year by year. In the case of non-erect rootstocks, their position in the soil tends to change from slightly inclined to horizontal to slightly declined or even to a completely inverted rootstock. Vertical rootstocks may remain vertical or be pulled to a new position depending on the location of the contractile roots. Root contractions have previously been described for this species by Foerste (1891) and by Rimbach (1900), for *T. sessile* var. *giganteum* by Brandt (1916), and for *T. ovatum* by Rimbach (1902). According to Rimbach (1900), the contrac-

tion may involve a length of root of 3 or 4 cm. and may shorten the root as much as 1 cm.

Each of the twenty rootstocks examined had an average of 5.4 wrinkled roots and 2.4 non-wrinkled roots. Since the rings of growth averaged 8.1 per rootstock, there was an average of about one fleshy root per ring. These fleshy roots are unbranched for a considerable distance (up to 7.3 cm.) and are about 1.0-1.3 mm. in diameter basally. Distal to the fleshy portion, the root is thin and much branched. The wrinkled portion is variable in length, in some roots being less than 1 cm. long, in others being as long as 2.5 cm. These large roots are yellowish-brown to gray-brown to a dirty-brown color. Fresh material seems to indicate that these roots remain alive as long as the rootstock is alive.

The thin, much branched, non-contractile roots arise from the rootstock and they also terminate the fleshy roots. They are 0.5 mm. or less in thickness and are assumed to be mainly nutritive. One horizontal rootstock (Shaver 10980B, plant 1), approximately 3 cm. deep in the soil, had no fleshy roots, whatever. It did have an abundance of the thin, nutritive roots. Reasons for this fact are not now apparent.

Sheaths. As in *T. stamineum* (Shaver, 1957), there are two cylindrical sheaths wrapped around each stem at its base and attached to the rootstock concentric to the attachment of the stem. When two stems arise close together so that the outer sheath encircles both stems, each stem will be surrounded by its own inner sheath. The average length of the outer sheath is 1.6 cm. (with a range from 0.7-2.7 cm.), but the average length of the inner sheath is greater, being 2.5 cm. with a range from 1.5-3.8 cm. (Plate I, G). In fresh material, the sheaths are white to yellowish in color. Herbarium material has plants with white sheaths and other plants with yellowish-brown to dark-brown to yellowish-white sheaths.

Stem. Usually there are one or two erect and deciduous stems per rootstock. Fresh stems have their underground portion white. Just at the surface of the ground, the color is red and above this a dark purple, which gives way to a zone of red and then to a green distal region. Often there are minute elongated white or greenish-white flecks in the red and purple zones and small linear, faintly reddish streaks in the green zone. In herbarium specimens, the basal part is usually yellowish-white or yellowish-brown; the next zones lack much of the red with the purple zone appearing black-purple and the green zone now being brown or light brown.

Plate I. (See the following page.) Some details of *Trillium sessile* L. *A.* Upper end of the stem, bases of the three leaves (seen from the lower side), and the veining of one complete leaf, no. 5405. *B.* Nearly globular ovary surmounted by three erect and almost linear, sessile stigmas, no. 5381C. *C.* Upper end of the stem surmounted by three large leaves, a whorl of three sepals centrally placed to the leaves and alternating with them, a whorl of three petals centrally placed to the sepals and alternating with them, and a central cluster of six stamens surrounding and hiding the single pistil, no. 5391. *D.* Stamen, narrower than usual, for the pollen has been shed and the margins of the anther and the prolongation of the connective have been rolled inward, no. 5391. *E, F, H,* and *I.* Petals selected to show relative sizes, shapes, margins, apices, bases, and veining. *E,* no. 5391B; *F,* with a claw-like base, no. 5391; *H,* no. 5381 B; *I,* no. 5381D. *G.* Ringed rootstock, roots (some transversely wrinkled), and stem base surmounted by the sheathing scales, no. 5391. *J.* Mature fruit, green in color, and tipped with the persistent, brownish-purple stigmas, no. 11199. *K.* Mature stamen showing connective prolonged beyond the two anther cells, no. 5391E. *L.* Distal end of stamen showing connective prolonged beyond the two anther cells and with slightly inrolled margins, no. 5391E. *M.* Swollen, teat-like bases of the six stamens surrounding the scar left when the fruit fell off, no. 11194. *N.* Sepal showing shape, veining, and veinless margin, no. 5381D.



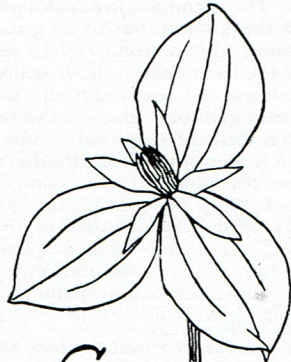
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A.



x 1.5

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C.

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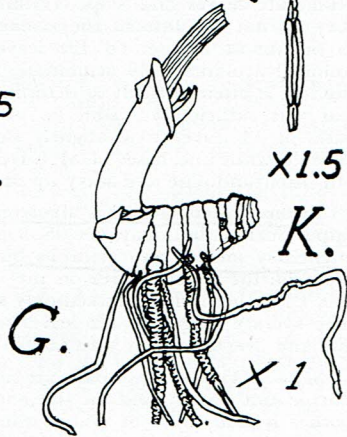
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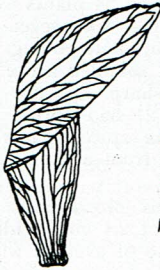
K.

x 1



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H.



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I.



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J.



x 3

L.



x 1.5

N.



x 1.5

M.

PLATE I.

The stem is cylindrical, thickest (about 3 mm.) just above the surface of the ground, narrowed greatly where attached to the rootstock, and narrowed into a neck (1.6-2.5 mm. thick) a short distance below the origin of the three leaves. Fresh stems are smooth but dried stems are longitudinally striated. All stems and the large veins seen on the underside of the leaves seems glabrous (but see the single exception given below). It is realized that it is difficult to be sure when most herbarium specimens are mounted with the lower surfaces of all the leaves glued to the mounting paper and with one leaf glued so as to cover the distal end of the stem. One plant (*Shanks and Sharp* 409, U.T. Herbarium) had very short and very heavy hairs arranged perpendicular to the stem at its distal end. These hairs are so very small and so inconspicuous that they could hardly be seen through a low power binocular microscope. There were only 31 complete stems in the materials available for study. These stems averaged 16 cm. long and varied from 12.0 to 23.5 cm.

Leaves. A whorl of three netted-veined, sessile leaves surrounds the single terminal flower. Most of the leaves have an oval shape. Of 117 leaves examined, 111 were oval in shape, 3 were ovate, 2 obovate, and 1 oblong. Apices are usually rounded acuminate, *i.e.* the sides bow in as in normal acuminate leaves and slope as though coming to a sharp point but this they do not do. Instead they come to points that are rounded over so as to be almost obtuse. Of 121 leaves studied for types of apices, 64 were rounded acuminate, 40 acuminate, and 17 acute. The shape of the base of the leaf is often difficult to determine in mounted plants but in 84 cases the leaf was sufficiently visible to allow determination of base shapes. The bases of 53 leaves were slightly sloping so as to make them very slightly cuneate while the bases of 31 leaves were rounded. Leaf margins are entire but often undulate and wavy up and down (Fig. 1 and Plate I, A and C).

Inconspicuous mottling, involving two shades of green, is the rule on the upper surface but may not show in herbarium material. Usually the leaf is entirely smooth and glabrous but occasionally very small meal-like scales occur on the lower surface on the veins and in one case (*Shanks and Sharp* 409, U. T. herbarium) exceedingly small cilia occurred on the basal margins. The average length of 122 leaves was 5.4 cm. (varying from 2.3 to 7.8 cm.) and the average width was 3.34 cm. (varying from 1.0 to 4.9 cm.).

Sepals. The three sepals are mostly green in color but often with a purple tint basally and on the narrow marginal border (Plate I, N). This border is shiny, free of visible veins, and wavy up and down. Sometimes it has a yellowish color (*Shaver* 10980 B, plant 2). Both upper and lower surfaces are glabrous. Eighty-two of the 102 sepals on 34 plants were sufficiently visible so that their shape could be determined. Sixty-seven of these were lanceolate, three lanceolate-elliptic, three lanceolate-oblong, eight oblong, and one ovate. Thirty-six out of 80 sepals had rounded acute apices, *i.e.* the apical margins slope as though to end in a sharp or acute point, but the point instead of being sharp is rounded off, 21 had obtuse apices, 16 had acute, 3 acuminate, and 4 rounded acuminate apices. Thus 73 out of 80 sepals were in the group with apices varying from acute to rounded acute to obtuse.

The sepals show three main veins in their broad base. Their length varies from 0.8 to 3.0 cm., with an average of 2.1 cm. Width varies from 3-9 mm. with an average of 5.7 mm. The ratio of average width to average length is 1:3.6 At flowering time, the sepals are erect with tips slightly incurved over the other flower parts. Later the tips may become slightly recurved. The sepals are *not* spreading and thus contrast strongly with the very widely spreading sepals of *Trillium stamineum* (*Shaver*, 1957). The sepals are persistent and keep their green color even after the fruit has ripened and fallen.

Petals. The petal whorl is composed of three erect and distinct petals so arranged that they alternate with the sepals. The petals arch together

over the stamens and pistil. Later the petal tips bend in more so that the petals cross each other. With age they shrivel up and become brittle. These brittle petals usually break off before maturity of the fruit leaving behind purple or yellowish-brown basal fragments. Usually the petals are a rich reddish-purple color, but in some cases they are brown or yellowish-brown and, in forma *viridiflorum* Beyer, green or yellowish-green. I do not know forma *viridiflorum* from Tennessee. However, plants having yellowish-brown to almost yellowish-green petals (thus approaching forma *viridiflorum*) are common.

Most of the petals examined for shape were elliptic (64 out of 107), 27 were essentially lanceolate, 8 were oblong, 6 ovate, and one obovate. Small (1933, p. 307) gives the petal shape as "narrowly elliptic" and Fernald (1950, p. 444) as "narrowly oblong to oblanceolate" (Plate I, E, F, H, I). Bases are narrowed and, in some cases, to a very short (about 2 mm. long) claw-like base. Apparently, such claw-like bases have not previously been observed in *T. sessile* for I find no mention of them in the manuals or in other trillium literature. As a matter of fact, Small (1933, p. 305) puts the group "Sessiles," which contains *T. sessile*, in his key under "Petals not narrowed into claw-like blades . . ." and Fernald (1950, p. 443) puts *T. sessile* under "d. Petals broad-based, not claw-like below . . ." These statements certainly do not hold true for all Tennessee specimens. Basal widths are about 1.5 mm.

One hundred petal apices are as follows: 80 acute or rounded acute, 14 acuminate or rounded acuminate, and 6 obtuse. Fernald (1950, p. 444) has the petals blunt which does not hold true for most Tennessee specimens. The petals are glabrous and have entire margins. The average width of 88 petals is 6.6 mm. with a range from 3-11 mm. The average length of 103 petals is 2.4 cm. with a range from 1.1-3.5 cm. This makes the ratio of average width to average length of the petals 1:3.65, and a ratio of the average length of the sepals to the average length of the petals of 1:1.16.

Stamens. There are six distinct stamens arranged in a whorl just central to the petal whorl. Each stamen (Plate I, D, K) is brown or brownish in color with two linear, yellowish-white pollen sacs adnate to a thin connective, which is less brown and is prolonged as a thin, slightly revolute, flattened, and obtuse beak 2.0-4.5 mm. beyond the anther sacs (Plate I, L). The margin of the prolongation is yellowish in color. It has an average length of 3.0 mm. (based on the measurement of 173 anthers). The anther is regarded as including the thin connective with a single pollen sac on each lateral margin and including the prolongation of the connective beyond the anther sacs. The anther ranges in length from 6.5-13.0 mm. with an average length of 9.8 mm., based on the measurements of 139 anthers. Small (1933) gives their length as from 10-12 mm. (p. 307) and uses ". . . anthers more than 1 cm. long," in his key (p. 305) to separate *T. sessile* from some of its allies. Fernald (1950, p. 443) uses ". . . anther 1-2 cm. long" in his key to help separate out *T. sessile*. Such statements should be modified to include anthers as short as 6 mm. to be of most use in Tennessee. Mature anthers are about 1 mm. wide in herbarium material but much wider in freshly opened flowers. The average length of the pollen sacs of 139 anthers is 6.8 mm. with a range from 4.0 to 10.5 mm.

The filament flares slightly at its base being about 1.2-2.0 mm. wide here and 0.5-0.7 mm. across the distal end. The average length of 131 filaments is 3.6 mm. with a range from 2.5-5.5. mm. The ratio of the average length of the filament to the average length of the stamen is 1:3.86. The stamens are erect and either straight or slightly arched over the pistil. There is a single longitudinal vein in each stamen. The average length of 122 complete stamens is 14.1 mm. with a range from 8.0-18.5 mm. The ratio of the average length of the stamens to the average length of the petals is 1:1.7, which is close to Fernald's ". . . stamens half as long as petals" (1950, p. 445).

The preceding study of the stamens of *T. sessile* was largely made on pressed plants. Almost all of the specimens were in full flower, and none showed any evidence of the interesting changes which take place later at the base of each stamen. To study these changes, fresh material was used.

With age the stamens died and dried up with the exception of a small basal portion which remained fleshy and increased in thickness and width to such an extent that the base of each stamen often merged with those of adjoining stamens (Plate I, *M*). With enlargement came a change in color from brown to pink and sometimes even to white. The fleshy condition persists until maturity of the fruit. These enlargements of the basal parts, occurring between the growing fruit and the sepals, may push against the fruit on one side and against the sepals on the other side, thus helping the fruit to fall off the plant. Similar swellings occur at the bases of the stamens of *T. stamineum*.

Pistil. The single pistil consists of an ovoid (or rarely ellipsoid) brown ovary bearing three linear, brownish-black sessile stigmas (Plate I, *B*). The inner surfaces of the stigmas are stigmatic and brownish-black or yellowish-white in color. The stigmas are about 6.5 mm. long, with a range from 5-9 mm., and erect or with their tips variously bent outward. The ovary is about 4.3 mm. (varying from 2.5-6.0 mm.) in diameter and about 4.1 mm. long (varying from 2.5-6.0 mm.) and has six low rounded wings.

Fruit. The mature fruit (Plate I, *J*) is whitish-green in color with a light pinkish tint. It is topped by the three persistent brownish-black stigmas. In shape, the fruit varies from ovoid to ellipsoid with six low and usually rounded longitudinal wings, which may or may not extend to the base of the fruit. Apically the six ridges merge together in pairs to make three ridges — one for each stigma. Mature fruits of nine plants were measured with the following results: Average height 1.2 cm. (range 0.8-2.0 cm.), average thickness 1.5 cm. (range 0.8-2.0 cm.).

Fruits mature and fall off in Tennessee from about June 20 to July 5 depending on where they are growing and on the season. Preparatory to falling off, some fruits, perhaps all, narrow and elongate basally so as to become somewhat pearshaped. The fruit then softens near its base and falls off leaving behind a large almost circular white scar (Plate I, *M*). The part played by the enlarging stamen bases in the phenonema associated with the falling off of the fruit is not clear.

Seed. There are about 15 to 25 seeds in each fruit but the number varies greatly from plant to plant. Usually there are many under developed seeds present. The mature seeds vary greatly in size even within the same berry, some being as small as 2 mm. and others as large as 3 mm. in diameter. The length of the seed is obscured by a white aril which, in fresh material is very large and fleshy but in herbarium specimens is hardly more than a white stain on the seed. The fresh seed and aril together have a length between 3.2 and 4.5 mm. with most seed being about 4 mm. long and the aril between 0.5 and 1.0 mm. long. Seed shape varies from ellipsoid to oblong. The color is mostly golden yellow but sometimes it is brownish yellow. The seeds are shiny and faintly pitted.

DISTRIBUTION

The general distribution of *T. sessile* is given by Small (1933, p. 307) as "Ga. to Miss., Minn., and N. Y." In Tennessee this species seems to be scarce and of limited distribution as represented in the herbarium material examined (herbaria of the University of Tennessee, of Vanderbilt University, and that of the author). Most of the specimens studied were from Davidson

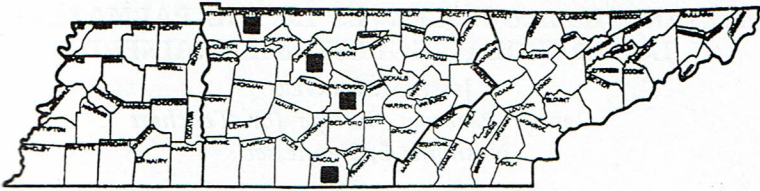


Fig. 2. The present known distribution to *T. sessile* in Tennessee.

County where this species is common. Perhaps with a more extensive searching a wider state distribution may be found.

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