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SOME NOTES ON TRILLIUM STAMINEUM HARBISON IN TENNESSEE

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This wake-robin is a real Trillium (*Trillium stamineum*) and as such is a perennial herb, normally with a whorl of three broad, netted-veined leaves terminating the unbranched aerial stem and subtending a single flower consisting of three green sepals, three colored petals, six stamens with long linear anthers, and one superior pistil with three linear stigmas. There is a fleshy, underground rootstock and an ovary with several ovules in each cavity.

Trillium stamineum is a sessile-leafed and sessile-flowered *Trillium* with the petals not narrowed into a claw-like base and usually with the distal region of the aerial stem pubescent. This last characteristic will serve in most cases to separate this species from *Trillium sessile L.*, from *T. Underwoodii* Small, and from *T. Hugeri* Small, which have no pubescence at all on the distal part of the stem. *Trillium viride* Beck is like *T. stamineum* in having the distal end of the stem pubescent, but it is unlike *T. stamineum* in having its petals narrowed to claw-like bases.

Species of the genus *Trillium* have long been noted for their variability and consequent taxonomic difficulty which is especially apparent in the broad-leaved, sessile-flowered group (Anderson, 1934, p. 120). So it is not surprising to find Tennessee specimens of *Trillium stamineum* often varying markedly from the description give nof the type of Cullman County, Alabama, by Harbison (1901, p. 23). Some of these differences are here summarized before the detailed study of *Trillium stamineum* is taken up: (1) The rootstock is given as "horizontal" but in our specimens it is *vertical or vertically inclined with the apex pointed upward*, or it is *vertical or vertically inclined with the apex pointed downward* (thus being upside down), or it is *horizontal*. All of these positions are well represented. (2) The stem is said to be "pubescent near the top" and this holds true for most Tennessee specimens. There are, however, a few plants with the stem entirely *glabrous.* (3) Sepals are stated to be "spreading or finally reflexed." For Tennessee plants, this would need to be corrected to read *spreading or finally becoming erect and arched over the maturing fruit.* (4) The statement "petals . . . somewhat twisted" holds true for almost all Tennessee specimens but some plants have *untwisted petals.* (5) Anthers are

Fig. 1. *Trillium stamineum* Harbison showing leaf margins, which are sometimes undulate, and narrow petals, which are often twisted. Plant slightly wilted.

given as "straight" and this applies to most of our plants but in some cases the anthers *are arched over the pistils* (for example, see no. 5400B)[1]. (6) Berry is said to be "pale purple" but this

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[1] The no. when not preceded by a name is of a specimen collected by the author. Thus, no. 54000B, should be read as if it were Shaver no. 5400B. Such specimens are in either the author's herbarium or that of the University of Tennessee. Numbers preceeded by V. U. are in the herbarium of Vanderbilt University and those preceded by U. T. are in the University of Tennessee herbarium and were collected in the spring of 1948 by a group composed of A. J. Sharp, C. J. Felix, and Bill Adams. I am greatly indebted to Dr. Elsie Quarterman of Vanderbilt University and to Dr. A. J. Sharp of the University of Tennessee for the loan of specimens.

does not apply to the mature fruit of any Tennessee specimens which I have examined. In all observed cases, *the mature fruit is green.*

Undergroupd parts. Rootstocks of *Trillium* are scanty in my herbarium and also in all herbaria examined in this study. They are short and thick, averaging 3.06 cm. in length and 1.6 cm. in thickness with a range in length from 1.8 cm. to 6.0 cm. and in thickness from 1.3 cm. to 2.3 cm. At one end is the growing apex to which is attached one or occasionally two erect stems, ensheathing scales, the remains of the previous year's stems and scales, and a bud to produce next year's aerial stem. At the other end is the older, decaying portion (Plate I, A). Occasionally, there is a side branch (rarely more than one) which may bear the remains of a former aerial stem with its scales.

Throughout the length of the rootstock, there are low encircling, flesh-colored or ashy-gray (in older parts) rings separated from each other by a small groove or in large rootstocks by an exceedingly narrow ridge bordered on each side by a very shallow groove. The groove or ridge is marked with the black remains of the base of a large sheathing scale. It has been assumed by some investigators that similar lines, grooves, or ridges, in certain other species of *Trillium* could be regarded as representing a year's growth (see Brandt, 1916, p. 43, and also presumably Rimbach, 1902), and could therefore be counted to determine the age of the rootstock.

In view of Brandt's comment (1916) that Rimbach's determinations (1902) of the age of the rootstock of *T. ovatum* probably was overestimated, and in view of my inability to locate studies dealing with the relations between these encircling lines or rings on the rootstock and its age in any *Trillium*, I have examined the scale-aerial stem relations of the current year's growth, of last year's growth, of the still older stem and scale scars, and of the buds formed this year to produce next year's aerial stem and sheathing scales, in as many rootstocks of *T. stamineum* as were available.

It was found that the bud for next year's aerial stem seems to consist of the rudiment of the stem covered above by two complete tent-like cones (Plate I, *H*). A comparison of these bud structures with the current aerial stem and its sheaths (Plate I, G) shows that the stem rudiment makes the aerial stem, the inner cone develops into the inner sheathing scale closely applied to the base of the aerial stem, and the outer cone becomes the outer enveloping sheath of the aerial stem. It is this outer sheath that encircles the rootstock and leaves behind the black line or ring across the rootstock when the sheath falls off and this ring is the particular structure that we are concerned with in counts to determine the age of the rootstock. It is in this region that great increases in the diameter and in the length of the rootstock take place. There is little growth in the region of the stem scar and the scar left by the inner sheathing scale when they fall off. The stem scar is a very small, black, lens-shaped, inconspicuous structure, studded with the small black bases of veins. It appears closely circled by a small ridge formed from the remnants of the inner sheath (inner cone derivative). This stem scar and the accompanying close inner sheathing scale scar appear later in an almost axial position to the long and prominent cross line left by the outer sheathing scale. These stem and sheathing inner scale scars are so small that they will hardly be seen unless carefully searched for with a lens and so they are not likely to confuse the student trying to count rings to determine the age of the rootstock.

There is, however, a situation that might complicate matters and that is the presence of two aerial stems at the apex of the rootstock. Such a condition actually exists in everal specimens of *T. stramineum* in my collection. A careful examination seems to indicate that in all these cases the two aerial stems arise side by side from the rootstock and are separated at their achievement by two (or perhaps sometimes one) very thin membranes which are derived from the inner cone of the bud. These are the two inner sheathing scales with one tightly wrapped around the base of each aerial stem. One sheathing scale (developed from the outer cone of the bud) surrounds both aerial stems and their inner sheathing scales. When this outer sheathing scale falls off, it leaves a single encircling line around the rootstock. Thus there are not two or more encircling lines per bud or per year, as would be the case were both the inner and outer sheaths to

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Plate I. (Opposite page.) *Trillium stamineum* Harbison. *A*. Sketch showing the three sessile leaves, the three fairly broad sessile sepals, the three narrow petals, the six stamens, and the central pistil with its three stigmas, × 0.5 (in diameters), no 10978 A, plant 1. *B*. In the center is the pistil with its three coiled, sessile stigmas surrounded by five of the six stamens (all of the sixth stamen except a small portion of the base has been removed in order to show better the pistil), ×1.5, no. 5400B. In this plant the stamens curve over the pistil and are slightly twisted near the end. Two stamens have their upper ends pushed to one side in pressing. *C*. A single stamen showing the flaring base of the filament and the slightly protruding connective at the apex of the anther, ×1.5,no. 5379, plant 2. *D*. A small portion of a wrinkled root from G, ×2.0, no. 10978C. *E*. The lower surface of the leaf cluster and of the distal end of the stem, ×0.5, no. 5400D. The stem is pubescent only near its distal end and the leaves are pubescent on the veins and more so near the leaf bases. Leaf apices are slightly twisted. *F*. Three seeds with their attachments to the placenta of a mature fruit, ×1.5, no. 11023K. *G*. Rootstock with scale sheaths, concentric encircling scale scars, and roots, ×1.0, no. 10978C, plant 2. The small circular scar is of a broken-off root. *H*. A diagramatic representation of a resting bud. The upper tent-like cone develops into the outer sheath encircling the base of the stem, the inner tent-like cone develops into the inner sheath, while the small basal cone makes the aerial stem. *I*. The three sessile terminal leaves at the distal end of a sterile stem, ×0.5, no. 5389B, plant 2.

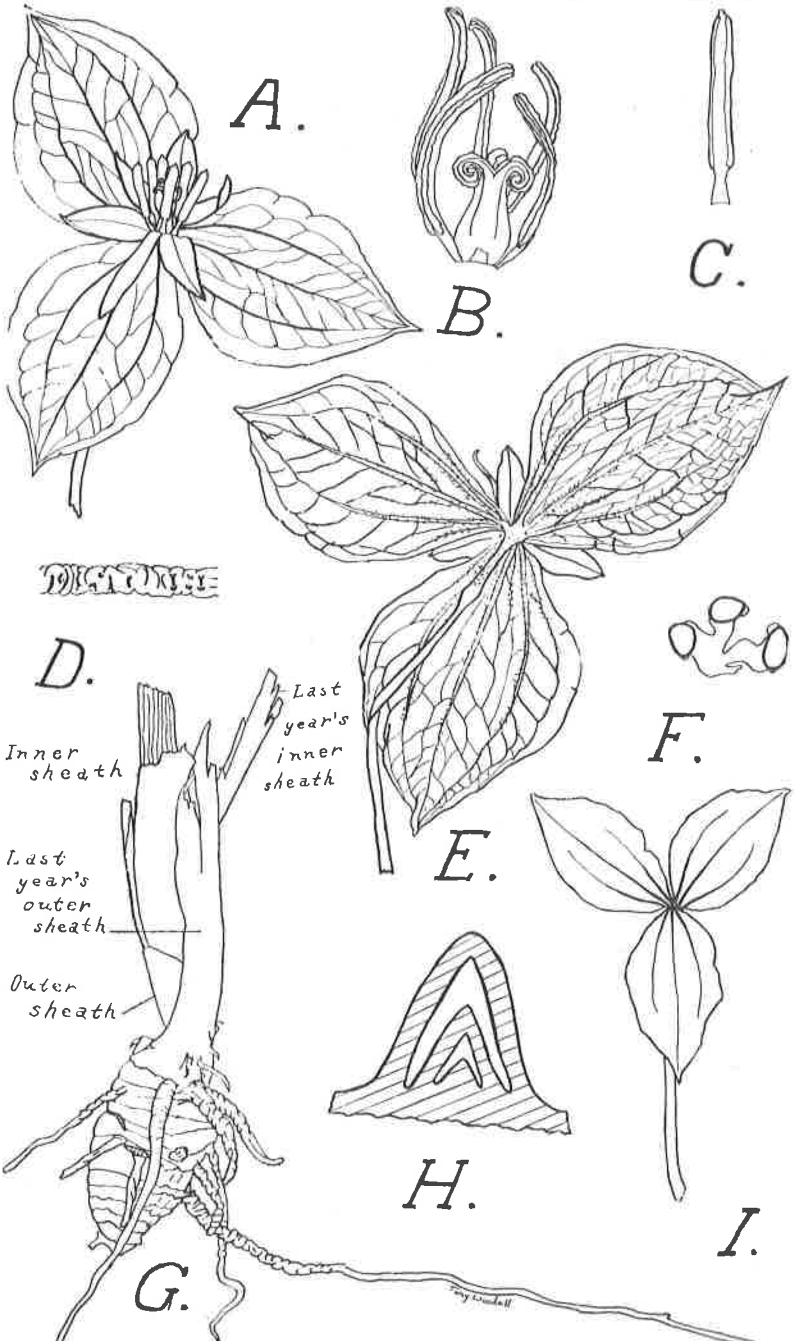
A.
B.
C.
D.
E.
F.
Last year's inner sheath
Inner sheath
Last year's outer sheath
Outer sheath
G.
H.
I.

Plate I

leave an encircling line. I have found no exceptions to this rule so far and now believe that this is the usual relation when two aerial stems arise from the apex of the rootstock.

At the place where the roots break through the epidermis and through the outer part of the rootstock there is often an encircling ridge tipped with black, or occasionally an elliptical area around the root will be seen marked off by a narrow black line. On the older parts of the larger rootstocks are many small ridges (derived in the ways previously mentioned but with age not too sharply delimited) which make counts in this region not so dependable as in the younger parts. However, it seems that age determinations of the rootstock may be made with fair accuracy if attention is paid to the complications existing around the roots and at the older end of the rootstock.

The count of these rings in plants of *Trillium stamineum* bearing flowers (to avoid very immature plants) indicates ages varying from 7 to 17 years with an average age of 12 years. It is interesting to compare these results with those secured by Rimbach (1902) probably using a similar method but using a different species. He used plants of *T. ovatum* and determined the age of their rootstocks as from 20 to 40 years (an average was not given). The width of such annual rings of growth varies in *T. stamineum* from 1.65 mm. to 3.53 mm. with an average width of 2.55 mm. Rimbach gave 1 mm. as the width of an annual growth ring in *T. ovatum*.

Sheaths. The sheaths encircling the base of the aerial stem are normally two in number (as has already been stated:) an inner sheath from 2.7 to 6.8 cm. long (with an average of 4.6 cm.), and an outer sheath from 1 to 3 cm. long (with an average of 2.3 cm.). These sheaths are attached in order to the rootstock just to the outside of the place of attachment of the aerial stem and are wrapped to make two concentric cylinders around the stem (Plate1, G). Distally each sheath ends in an acute or acuminate apex which may be much frayed and tangled and slightly open on one side like a split skirt. In color they vary from light to dark brown. Sometimes the sheaths are light brown basally and a darker brown toward their apices. They are scarious and seem to have very thing longitudinal veins. The remains of old sheathing scales and of old aerial stems are often present on the larger rootstocks.

When two aerial stems and their sheaths arise close together, as occasionally happens, there must result variations in size and arrangement of the sheaths from that just described. The inner sheath of one aerial stem often seems larger in size than normal, varying from 3.6 to 7.5 cm. in length and averaging 5.0 cm., and the inner sheath of the other aerial stem is small and fragmentary. There is only one outer sheath and it is wrapped around both aerial stems. It seems larger than usual (from 4.6 to 5.00 cm. long, with an average length of 4.8 cm.)

Scars left on the rootstock by the aerial stems when they die and fall off, as they do each year, are not arranged one behind the other. Instead, one scar is placed to one side and the next scar to the other side, then back again to the first side, and so on. I am not sure that the scars tend to be only on the upper side of the rootstock but this appears to be true.

Roots. At the apex of the rootstock with its crown of sheathing scales, an aerial stem, and a rapidly-growing corm-like ring of growth, no roots are found. The next spring, when this growth ring is close to one year old, it produces two to three long unbranched roots which have a basal region 1.5 mm. thick and a slenderer terminal part which gives rise to numerous thin branching secondary roots. The main roots remain alive for several years (I have not been able to determine how many) and persist for many years after death. They become brittle in herbarium specimens and are easily broken off. The total number of roots per rootstock varies much. In my material, the average number seems to be about eleven.

Results secured with other species of *Trillium* might prove interesting. Rimbach (1902) reports that *T. ovatum* produces two to four roots on the new growth the second year, a total of 20 or more being eventually formed and lasting for about ten years. However, Brandt (1916) thinks that the age is probably overestimated. In Brandt's own study (1916) of *T. sessile* var. *giganteum,* he found that this plant sent out three to five or more roots at the base of the terminal crown about the time aerial shoots appeared above ground, that these roots reached a length of 15 to 20 cm. their first year, and that growth in length was continued the next year and in addition numerous branches of the second order appeared. He thought that the roots lived for three or four years or longer.

The roots of several species of *Trillium* have been described as possessing a contractile region: *T. sessile* L. by Foerste (1891) and by Rimbach (1900), *T. sessile* var *giganteum* by Brandt (1916), and *T. ovatum* by Rimbach (1902). Rimbach described his method of marking transversely roots with India ink and of growing the plants in soil back of a glass window through which some roots could be studied and measured (when the dark screen was removed). He found that only young roots contract and that in their second year. The contraction, which is gradual, extends over some time, taking place in first one root and then in another. It may shorten the root as much as one centimeter. In doing this the roots become deeply and transversely wrinkled for a distance of 3 to 4 cm. from their origin but this wrinkling does not involve the inner active cortex nor the stele. Rimbach thought the contraction due to longitudinal shortening of the inner active cortical cells and the endodermis with the same cells becoming radially broadened. Arber (1925) recognized root shortening and wrinkling in various plants and attempted to check on the method of shortening in *Hypoxis setosa* Baker using sections. She concludes (p. 21) that ". . . my attempt to solve it [the contraction] for the case of *Hypoxis* has left me completely puzzled, for I can detect no such shortening [of cells] as that postulated by Rimbach."

Presumably the roots of *T. stamineum* are contractile (Plate I, *D, G.*) for the fleshy basal portions of the roots become deeply wrinkled for a distance of 1.8 to 3.4 cm. (averaging about 2.7 cm.). Since root contraction is limited to young roots located near the apical crown, it is this portion of the rootstock that tends to be pulled deeper into the soil year by year. If the rootstock is not vertical to stort with, the roots being mainly on the lower side, will make the rootstock more inclined or even inverted, with their contractions. However, if the rootstock is vertical and the contractile roots are symmetrically arranged, the rootstock may retain its vertical position. Rootstocks have been assumed to reach a depth at which contractile roots are no longer produced. Instead, very thin much branched nutritive roots appear. I have little material of this stage but such as I have suggests that the slender nutritive roots are produced by the region just back of the terminal crown and that the rootstock tends eventually to become horizontal, all of this at a depth of 6 to 10 centimeters or more. I have no idea what determines the correct depth for these events to occur.

Plate II. (Opposite page.) *Trillium stamineum*. A. Pistil with three sessile stigmas showing stigmatic surfaces above, pear-shaped ovary below, and thin wing which extends from near the base of the ovary onto each stigma, ×1.5, *V.U.* no. 4174. *B.* Seed partly covered to right by white fleshy aril which continues onto the stalk, ×4.0, no. 11023K. *C.* Cross section of mature fruit with the six ridges to the outside and the three inner projecting placentae (diagrammatic), ×1.5, no. 11023K. *D.* Small leaf showing the three main veins and the other more prominent veins. This is the leaf that I have regarded as having an obtuse base. Actually the base is slightly cuneate, ×0.5, no. 10978, plant 2. *E.* Petal to show veining, ×2.0, no 10978A, plant 1. Note almost parallel longitudinal central veins and the few smaller veins branching off of the midvein especially near its base. *F.* Shape of leaf, veining, almost obtuse base, and almost acute apex, ×0.5, *V.U.* no. 4174. *G.* Petal showing usual shape and twists, ×1.0, *U.T.* no. 10072. *H.* Rootstock with encircling scars left by outer scale sheaths when they fell off, roots, aerial stem and crumpled and mussed scale sheaths, ×1.0, *V.U.* no. 4173. *I.* Sepal to show veining and small bordering margin, ×2.0, no. 10978A, plant 1. *J.* A large-leaved form fairly common in Middle Tennessee (part of scale present at base of stalk), ×0.5, *U.T.* no. 10200, plant 1. *K.* Lower surface of base of three leaves and end of stem showing pubescence on veins and on terminal portion of stem, ×1.0, no. 5400D.

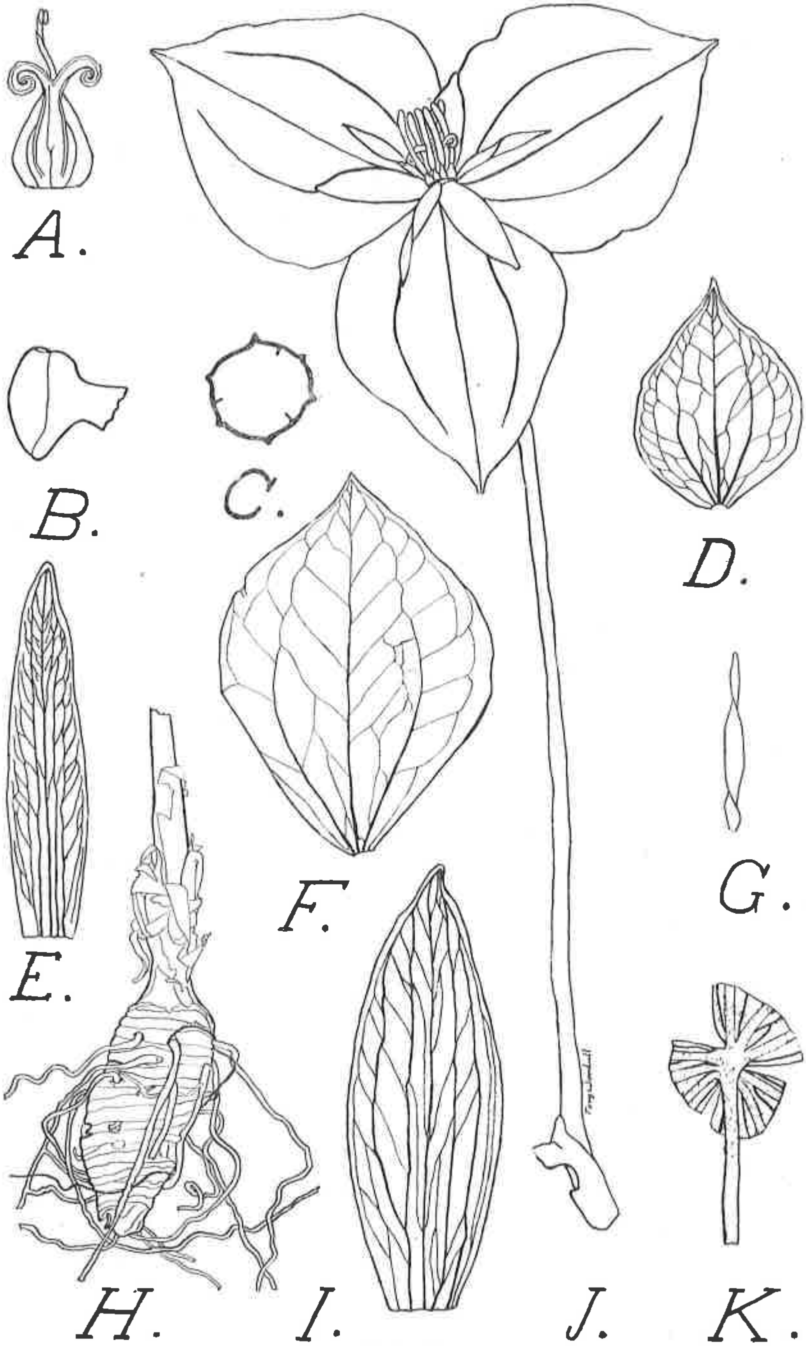

Plate II

Stem. Usually there are one or two erect, unbranched, cylindrical aerial stems growing from the apex of the rootstock. The basal portion of the aerial stem is in the ground and varies in color from white to yellowish-white, to greenish-white, to yellowish-brown, to yellowish-purple, and is about 3.5 to 5 cm. long (the average of this basal part of 27 stems being 4.67 cm. and the range from 2.5cm. [*U. T.* no. 10072, plant 3] to 10.0 cm. [*U. T.* no. 11943, plant 2]). The encircling basal membraneous sheath is composed of two or sometimes more yellow or yellowish-brown scales. In a representative plant (no 10978B), the longest of three scales is 5 cm., the next longest 3 cm., and the shortest 2.5 cm.

About ground level, the color of the stem changes from the yellowish color of the underground portion to the purplish aerial part. At first there is a very dark purple zone which fades apically into a less dark purple and often into a greenish-purple color. Distally for a short distance below the leaves the stem is usually pubescent (Plate II, *K*). The pubescence is whitish and varies in length and abundance from plant to plant and is entirely absent in a few (probably in 5 to 10 percent) cases. It is difficult to get exact data because most herbarium specimens are mounted with a leaf covering the distal end of the stem. In no plants examined did the pubescence occur beyond a few centimeters down the stem from the leaves, the rest of the stem being entirely glabrous. Dried stems, as seen in herbarium material, show many very delicate longitudinal striae. Fifty-four complete stems were available for measuring length. The average of such measurements is 23.42 cm. with a minimum length of 12.5 cm. (no. 5379A, plant 2) and a maximum length of 39.4 cm. (no 5400A).

Leaves. The leaves are normally three in number, sessile, and arranged in a whorl at the distal end of the stem just below the flower parts. The upper surface is glabrous and usually beautifully mottled with whitish-green and dark green and often even with a third intermediate shade of green present. The mottling does not seem to be related to the larger veins as appears to be the case in some violets. Leaf blades are broad and mostly oval or ovate in shape. Of 177 leaves examined with this point in mind, 139 were oval or essentially so (Plate I, *A, E*), 39 were approximately ovate, five were obovate, one was oblong, and three were broken or crumpled so that their shape could not be determined. In reality some of the above leaves were intermediate in shape; they were placed in the shape group that they most closely approached. Harbison (1901, p. 23) described the leaves as "ovate-lanceolate to broadly ovate."

Leaf bases are obtuse or very slightly cuneate. Of 164 leaf bases studied, 132 were slightly cuneate (Plates I, *E;* II, *F*). It is very rare for the leaves to overlap but occasionally they do overlap slightly near their base (*U.T.* no. 11939, plant 1). Typically the leaf apex is acuminate but in a few cases it is acute; 14 of 174 complete leaves had acute apices and 160 leaves had acuminate apices (Plates I, *A*, *E;* II, *D*, *F*, *J*). The leaf margin is almost entire but occasionally has an angle or angles, a few crenations, or it may be wavy or undulate (Fig. 1). Pressed leaves appear to be very thin but fresh leaves seem much thicker.

The leaves are netted veined with three or sometimes five main veins (156 of 164 blades had three main veins and only eight had five main veins), and are glabrous on both the upper and lower surfaces with the exception of the veins which are pubescent below. The pubescence is of white hairs and is more abundant near the base of the blade. However, the pubescence varies much in abundance and in length from plant to plant. When hairs are absent on the stem but are present and are long and numerous on the veins of the lower leaf, the contrast may be striking. There is a thin wing-like extension on each side of each main vein visible from the lower side. Between the main veins, the under surface of the blade appears to be covered with a fine, light-green meal.

One hundred fifty-six leaves were measured for length and for width and the following results secured: Average length 7.3 cm., maximum length 10.8 cm. (No. 5352, plant 2), minimum length 5.2 cm. (No. 10978, plant 2), average width 4.8 cm., maximum width 8.3 cm. (*V.U.* no. 4174), minimum width 2.8 cm. (no. 5389B). The ratio of the average width of the leaves to their average length is 1:1.5.

All the preceding discussion of leaves was based on leaves from fertile stems. Leaves from sterile stems are not very common in nature in Tennessee and are very scarce in the herbaria studied. In the specimens found and studied, the whorl of three leaves terminates the stem (Plate I, *I*) since there is no flower. Such leaves differ only slightly from those just described. The leaves seem some narrower and also some shorter than leaves from fertile stems. Their shapes, bases, and apices appear similar to those from fertile stems except for the slightly narrower blades. There are supposed to be some young plants with one leaf only atop a single stem but I have no data on such leaves.

Sepals. The three spreading and sessile sepals are arranged in a whorl just above the leaf whorl with the sepals placed alternate to the leaves (Plates I, *A*, *E;* II, *J*). These sepals are broadly attached to the receptacle and are usually oblong or oval in shape with a rounded acuminate or sometimes acute apex. Of 158 sepals studied for shape, 89 were essentially oblong, 45 essentially oval, 17 ovate, 2 obovate, and 5 too crumpled for determination. Harbison (1901, p. 23) gave the shape as "broadly lanceolate to elliptic . . ." All 158 sepals except one had complete apices, 110 being acuminate, 38 acute, and 9 obtuse or obtuse pointed. The apices are in no case very sharp pointed. Rather the margins approach the apex as though the apex were to be sharp but instead of becoming sharp the extreme tip is rounded off.

The sepals are green in color and often suffused with purple which may be especially prominent on the upper surface near the sepal base and on the narrow veinless marginal border. The margin is entire but the narrow border is often wavy up and down. There are three to five main longitudinal veins (Plate I, *I*). Usually the lower surface is green and in some plants there is a green meal on the veins.

There were available for measurements of length 161 sepals and for measurements of width 152 sepals; these all being parts of 56 different flowers. The average length was found to be 2.42 cm. and the average width 0.86 cm. This makes the ratio of average width to average length 1:2.8. The maximum length observed was 3.6 cm. (*U.T.* no. 10043) and the maximum width 1.5 cm. (*U.T.* no. 11939, plant 1). The minimum length was 1.5 cm. (*U.T.* no. 11902, plant 2) and the minimum width 0.6 cm. (*U.T.* no. 10072, plant 1).

Petals. There are three dark purple petals arranged in a whorl just above the sepal whorl with each petal alternately placed to the sepals (Plates I, *A;* II, *J*) and broadly attached to the receptacle. The petals are spreading and narrow or almost linear in shape. Some of them (23 out of 58 petals) were slightly broadest near the base, therefore being narrowly lanceolate, and some (24 out of the 58 petals examined) were widest at the middle, thus being narrowly elliptic in shape. Harbison (1901, p. 23) had the petals "lanceolate." The apex is essentially acute or acuminate (or sometimes obtuse) but it does not come to a sharp point for the point is rounded over (Plate II, *G*). The petals have an entire margin and are glabrous. The veining does not show very well, but a specimen kept in glycerine for a few days and then examined under a binocular microscope (10×) by transmitted light was fairly satisfactory. There are usually five to seven main longitudinal veins. The midvein and the next vein immediately lateral to it on each side are almost parallel to each other for most of their length and give off few veins on their basal half. The petals appear to be netted veined although I have not been able to see this for some of the lateral veins (Plate II, *E*).

As has been mentioned previously, many petals are twisted (Plate II, *G*). Of 144 petals examined on this point, 66 had one twist (1/2 to 1 complete twist), 18 had two twists (1 1/2 to 2 complete twists), and 60 had no twists at all. Thus about 58 percent of the petals are twisted and about 42 percent untwisted.

Measurements were made of the petals in 58 different flowers where they are not covered up or broken. Altogether 154 petals were measured for length and the following results secured: Average length 2.48 cm., maximum length 3.1 cm. (*U.T.* no. 11939), minimum length 1.5 cm. (*U.T.* no. 11902). This means that the petals on the average are slightly longer than the sepals (which averaged 2.42 cm. in length). Petals having the same length (35.6 percent), or being longer (23.7 percent) than the sepals, make up 59.3 percent of the total number. This leaves 40.7 percent of the petals shorter than the sepals.

For the measurement of width, only 139 petals were suitable. Their average width was 4 mm.; maximum width 8 mm. (*U.T.* no. 10043); minimum width (1.5 mm. (*U.T.* no. 10072, in one of the two plants). In these plants, the ratio of the average width to the average length of the petals is 1:6.18.

The width of 128 petals was compared with the width of the sepals from the same flowers. None of the petals were as wide as or wider than the sepals but 65.63 percent of the petals had a width exactly one-half (21.875 percent) or less (43.75 percent) the width of the sepals and only 34.375 percent had a width greater than 1/2 the width of the sepals. The average width of the petals (4 mm.) was less than 1/2 the width of the sepals which was 4.28 mm. According to Harbison (1901) the petals are "about as long and one-half to two-thirds as wide as the sepals." Eventually the petals wither and become brittle but they do not fall off, instead they persist and also retain their dark purple color.

Stamens. There are six stamens arranged in two whorls of three stamens which with the stamens of one whorl alternating with those of the other whorl. The three stamens of the basal whorl are alternately arranged with the petals. The stamens are purple in color with the exception of the anther sacs which are yellowish-white. Pollen is red, brownish (no. 5379C), or light yellow (*U.T.* no. 11865).

A total of 260 stamens from 46 flowers were measured for length and the following results secured: Average 1.74 cm., maximum 2.55 cm. (no. 5352), minimum 1.1 cm. (*U.T.* no. 10072). The ratio of the average length of the stamens to the average length of the petals is 1:1.42. Harbison (1901, p. 23) gives the stamens as "one-half to two-thirds as long as the petals." Some of the plants examined by me had some stamens slightly shorter than 1/2 that of the petals (*U.T.* no. 10072) and some were slightly longer than 2/3rds the length of the petals (no. 5352). However, almost all of my plants fall within these limits.

The anthers may be straight (as described by Harbison, 1901) or they may be arched (Plate II, *E*) over the stigmas (no. 5400B). It may be that the anthers are straight at first but with age begin to arch. Sometimes their apices are twisted (no. 5352). The anthers are very narrowly oblong in shape and average 1.46 cm. in length and about 0.19c m.. in width (Plate I, *C*). The connective is very slightly prolonged (usually less than 1/4 mm. but never more than 1/2 mm.) beyond the anther sacs in a rounded nose-like point. The filament is short having an average length of only 3.08 mm. It flares slightly at the base where it is attached. With age the stamens dry up but they do not fall off and they do not lose their purple color.

Pistil. The pistil is dark purple in color and has three linear and sessile stigmas, each recurved to expose the stigmatic surface on the outside of the coils (Plate I, *B*). The coiled stigmas are difficult to measure but seem to be mostly between five and seven millimeters long. However, the stigmas in one plant (*U.T.* no. 11939) appear to be 12 mm. long. The ovary is glabrous, ovoid in shape, and broadly attached to the receptacle by the large end (Plate II, *A*). There are six shallow and rather narrow longitudinal wings, one at least extending onto each stigma. There were 14 plants that had enough of the ovary exposed so that its length could be measured and 10 in which thickness could be measured. The average length of the ovary is 6.2 mm. (from 3.5 to 7.5 mm.) and the average thickness 3.9 mm. (from 2.0 to 6.0 mm.).

As maturity of the fruit approaches, which for Nashville, Tennessee, is about July 5-15, certain changes take place in the plants. The leaves lose their green color and turn yellow. They may even die at their margins and turn brown. The sepals begin to lose their green color and become yellow as they begin to arch over the maturing fruits. The aerial stem begins to lose its purple color, first at its distal end and then downward, changing to green and then to yellow. I believe that this continues until the entire aerial stem becomes yellow before the plant dies and falls over, which is about July 10-20. Meantime, the petals, stamens, and stigmas have withered and become brittle so that they may easily get broken off. They do not lose their purple color nor do they fall off spontaneously.

On the other hand, the purple color of the ovary gradually gives way to green as the ovary develops into a mature fruit. Harbison (1901, p. 23) calls the mature fruit a "pale purple" color but this is certainly not true of the Tennessee specimens which I have seen.

The mature fruit is ovoid in shape, glabrous, and with six low, longitudinal ridges. It varies from 1.0 to 1.5 cm. in length (averaging 1.16 cm.) with a diameter between 0.8 and 1.2 cm. (averaging 0.99 cm.). When mature it breaks away from the receptacle and falls to the ground leaving behind a white scar from 4 to 5 mm. in diameter. The fallen fruit is thin-walled and indehiscent. It is usually partly open basally where it broke away from the receptacle and may soon start to decay basally. A cross section of the fruit shows (Plate II, *C*) the partitions between the three cells now to be incomplete and somewhat fleshy with each partition bearing two rows of transversely placed seed.

Seed. The number of mature seed varies from 11 to 39 (with an average of 18.9) seed per fruit. In addition there are often abortive or underdeveloped seed present. The mature seed are light brown to golden brown in color. Each seed is more than half covered by a white aril which is sticky and fleshy and merges into the fleshy seed stalk (Plate I, *F;* II, *B*). Seeds vary greatly in size and this even holds true for the seeds in a single fruit. The largest seed studied were 4 mm. long and 3 mm. thick but

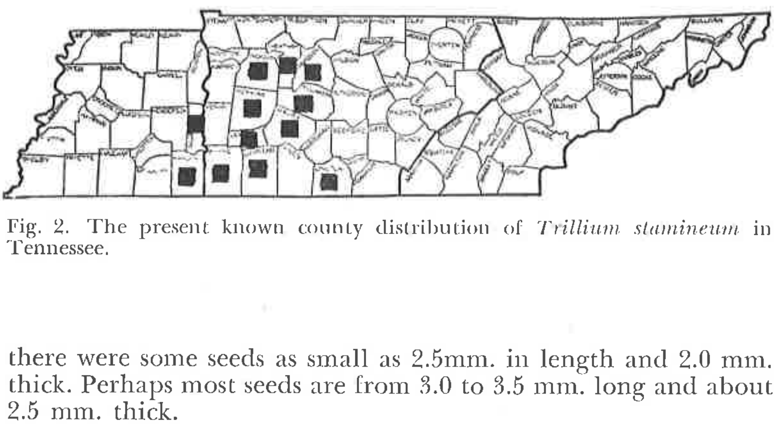

Fig. 2. The present known county distribution of *Trillium stamineum* in Tennessee.

there were some seeds as small as 2.5mm. in length and 2.0 mm. thick. Perhaps most seeds are from 3.0 to 3.5 mm. long and about 2.5 mm. thick.

Distribution in Tennessee. This trillium is not uncommon in a group of counties west and southwest of Nashville where it grows on wet, wooded slopes and in ravines. Specimens have been studied from the following counties: CHEATHAM: 1 mi. W. Kingston Sprgs. (*Shaver* 5400); DAVIDSON: (*V.U.* 4173); DECATUR; N. of Parsons (*U.T.* 12832); DICKSON: Big Barton Cr. bridge at highway (*U.T.* 10043); HARDIN: N.E. cor. of Co. (*U.T.* 10156); HICKMAN: Hickman Sprgs. (*U.T.* 11943); LAWRENCE: Buffalo river, W. of Barnesville (*U.T.* 11006); LEWIS: Meriwether Lewis Nat. Mon. (*V.U.* 2002); LINCOLN: Molina (*U.T.* 10849); MAURY: Above Rockdale (*U.T.* 11154); WAYNE: Leatherwood bluff, Beech Cr. (*U.T.* 10200); WILLIAMSON: Fernvalle (*V.U.* 3895). Additional collections were made and studied from other stations in several of the above counties.

LITERATURE CITED

Anderson, W. A., 1934. Notes on flora of Tennessee: the genus *Trillium*. *Rhodora,* 36:119-128. Apr.

Arber, Agnes. 1925. *Monocotyledons, a morphological study.* Pp. i-xv, 1-258. University Press, Cambridge, England. She lists in her bibliography 12 papers by A. Rimbach starting with 1895.

Brandt, R. P. 1916. Notes on California apecies of *Trillium* L. III. Seasonal changes in *Trillium* species with special reference to the reproductive tissues. *Univ. Calif. Publ. Bot.,* 7 (3):39-70. Pl. 7-10. Dec. 9.

Foerste, Aug. F. 1891. Abnormal phyllotactic conditions as shown by the leaves or flowers of certain plants. *Bot. Gaz.,* 16:159-166.

Harbison, T. G. 1901. New or little known species of *Trillium. Biltmore Bot. Studies,* 1 (1):19-24. (See page 23.) Aug. 8, 1901.

Rimbach, A. 1900. Physiological observations on some perennial herbs. *Bot. Gaz.,* 30:171-188. Sept.

Rimbach, A. 1902. Physiological observations on the subterranean organs of Californian Liliaceae. *Bot. Gaz.,* 33 (6):401-420. Pl. xiv.

Small, John K. 1913. *Flora of the southeastern states.* 2nd ed. Pp. i-xii, 1-1394.

NEWS OF TENNESSEE SCIENCE

Dr. Donald Caplenor of George Peabody College for Teachers and Secretary of the Tennessee Academy of Science has accepted a position as Head of the Biology Department at Millsaps College, Jackson, Mississippi. Dr. Wendell Holladay of the Department of Phlysics, Vanderbilt University, is the new Secretary of the Academy.

The following evening lectures are being presented by the Summer Institute in Radiation Biology at the University of Tennessee: *Food and People,* by Dr. Stanley A. Cain, Department of Conservation, University of Michigan; *Man and Weeds,* by Dr. Edgar Anderson, Washington University and Missouri Botanic Garden; *A New Look at the Juvenile Hormone of Insects,* by Dr. Carroll M. Williams, Harvard University; *Hormones and Development of Sex in the Oppossum,* by Dr. Robert K. Burns, Carnegie Institution of Washington and Johns Hopkins University; *The Role of Ultraviolet Radiation in Biology,* by Dr. Alexander Hollaender, Biology Division, Oak Ridge National Laboratory. These lectures are being sponsored by the National Science Foundation, The Atomic Energy Commission, and the University of Tennessee.

Department of Botany, University of Tennessee

Dr. A. J. Sharp will spend the summer teaching Bryology and Lichenology at the University of Michigan Biological Station, Cheboygan, Michigan.

Dr. R. E. Shanks will spend the first half of the summer working on an AEC project, "Vegetation Studies related to the Movement of Radioactive Wastes," at Oak Ridge. Dr. H. De Selm will spend the entire summer at Oak Ridge working on this project. Dr. Shanks will spend the second half of the summer at Point Barrow, Alaska, working on Vegetational Studies in Arctic Alaska; these studies are supported by the Arctic Institute.

Dr. F. H. Norris will spend the second half of the summer at the University of Arkansas Summer Institute in Natural Sciences; this is being supported by the National Science Foundation.

(*Continued on Page* 197)