

# THE PEDICELLATE SPECIES OF TRILLIUM FOUND IN THE SOUTHERN APPALACHIANS\*

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PLATES 27-35

## HISTORICAL INTRODUCTION

The Genus *Trillium*, though known throughout temperate North America as well as in Japan, China, and eastern Siberia, probably reaches its broadest development in the Southern Appalachians of eastern United States. The present work considers only the pedicellate species of *Trillium* occurring in that region of the Appalachians which embraces southern Virginia, western North and South Carolina, northern Georgia, eastern Tennessee, and northwestern Alabama.

Since the publication of *Species Plantarum* the genus *Trillium*, as we know it today, has been in a state of taxonomic entanglement. Of Linnaeus' 3 species: *T. sessile* L., *T. erectum* L., *T. cernuum*, L., the latter, *T. cernuum*, from the beginning has been misunderstood. Today, it is generally believed that Linnaeus' name, *T. cernuum* L., referred to two plants, one of which, *T. Catesbei* Elliott, occurs only from southern Virginia to Georgia and Alabama and the other, arbitrarily known as *T. cernuum* L., occurs north of these provinces. In the light of Rendle's article of 1901 it is rather evident that Pehr Kalm collected the type for what today is known as *T. cernuum* L., the type locality of which is given as "Carolina." Kalm, however, never came to Carolina. Since further evidence, set forth in the present paper, shows that *T. cernuum* L. does not occur in Carolina, it would seem that the Linnaean name correctly belongs to what is known as *T. Catesbei* Elliott. Such a nomenclatorial change would, however, serve only to complicate further the already involved synonymy of the genus. Later on Walter, in his *Flora Caroliniana* (1788), included two species, *T. cernuum* (*T. Catesbei* Elliott) and *T. sessile* L. (*T. Underwoodii* Small), both of which are common in his home area. In 1803 Michaux treated the genus as it was then known and his interpretation of *T.*

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*rhomboideum* Michaux (*T. erectum* L.) is basically in agreement with that of the present writer, though his inclusion of *T. grandiflorum* under that head was, of course, in error. Michaux interpreted Linnaeus' *T. cernuum* to be what is now known as *T. Catesbei* Elliott and in his description he characterizes *T. cernuum* L. by its style, an organ of which the present *T. cernuum* has not the slightest vestige.

Pursh in 1814 made way for a new interpretation of *T. cernuum* L. by declaring Catesby's figures of it to be erroneous. He further described *T. cernuum* somewhat as it is known today and though he gave its range as being from "Pennsylvania to Carolina," he cited it only from the "banks of the Schuykill river near Philadelphia." This is one of the few citations in early literature of the species as it is conceived today. Elliott (1821) described *T. Catesbei* and stated that it was "probably the original *T. cernuum* of Linnaeus." He further included *T. cernuum* in his list and noted that he had specimens "from mountains of Carolina in which the peduncles are scarcely an inch long and the petals rather larger than the leaves of the calyx." These specimens might have been plants of *T. Gleasoni* Fernald or *T. Vaseyi* var. *simile* (Gleason) comb. nov.; there is certainly little reason to believe them to have been *T. cernuum* L. since the criteria used for the identification of it were not set down until 1906. It becomes evident from the preceding discussion that the major problem in interpreting the pedicellate species of *Trillium* has mainly concerned *T. cernuum*.

Gray (1878) separated from *T. erectum*, *T. erectum declinatum*, a move which made insecure the status of *T. cernuum*, as it was then understood. Small (1903), however, did not include Gray's variety in his manual and his characterization of *T. cernuum* as it appeared in the manual was applicable to *T. erectum declinatum*.

Not until the publication in 1906 of Gleason's work on the pedunculate species of *Trillium* was much light thrown on the problem of *T. cernuum* and its affinities. Gleason raised Gray's *T. erectum declinatum* to specific rank and distinguished it from *T. cernuum* on the basis of anther-filament ratio, peduncle length plus degree of inclination, and distribution. In 1901 Harbison described several new sessile species and one pedicellate one, *T. Vaseyi*. Gleason in his work in 1906 described as *T. simile* a white form of *T. Vaseyi* Harbison and shortly thereafter House (1910) described as *T. Vaseyi* forma *album* plants which are to be identified with *T. erectum* var. *album* Pursh. Thus *T. Vaseyi* and its affinities were further complicated. Gates in 1917 wrote a taxonomic monograph of the genus in North America



in which he recognized 31 species and 9 varieties, of which 21 species and 5 varieties were wholly eastern in distribution. *Trillium Rugelii* Rendle (1901) was included in this work. Peattie in 1927 included 13 species, 2 varieties and several "formae" in his discussion of *Trillium* in North and South Carolina. In this list was included *T. cernuum* L. of which no specimens were cited. *Trillium Rugelii* was here placed under *T. erectum* var. *album* Pursh as a synonym and Rendle's description was completely misinterpreted. Small (1933) listed 10 sessile and 11 pedicellate species in his *Manual of the Southeastern Flora*. He adopted Peattie's treatment of *T. Rugelii*; listed *T. cernuum* as occurring in the Southeast; and placed the variants of both *T. erectum* and *T. erectum* var. *album* under the head of *T. erectum*. Anderson (1934) in a discussion of *Trillium* in Tennessee, mentions 7 pedicellate species among which is *T. cernuum*—included on the basis of Gattinger's citation (1901) from "Lookout Mountain, Ducktown," Tenn.

The present work, dealing only with the pedicellate members of the genus indigenous to the Southern Appalachians, admits 9 species and 3 varieties. The term "forma" is not included in the present account. Those populations which, to previous authors, have satisfied the requirements for the status of "forma" are here merely treated as noteworthy variants. The author respects the painstaking cataloguing and description of minor local variants, for only by the careful accumulations of data and listing of all such forms can the complete history of the genus be read and interpreted. However, no useful purpose is served by the formal naming of the great number of such minor variants, many of which are clearly isolated steps in a long transitional series.

This author reinstates *T. Rugelii* Rendle as a species; attempts a clarification of the taxonomic status of *T. erectum* var. *album* Pursh, and attempts to show its importance as a progenitor of the unstable *T. Gleasoni* Fernald. Furthermore, the presence of *T. Gleasoni* Fernald in the Southern Appalachians is demonstrated and proof of the absence of *T. cernuum* L. from the same area is made rather conclusive. A variety of *T. erectum* is proposed and illustrated.

#### GENERAL CRITERIA EMPLOYED IN SPECIES DELIMITATION AND INTRAGENERIC GROUP SEGREGATION

The pedicellate species of *Trillium* fall into three groups (see Plate 27) on the basis of leaf and ovary characters. The first group, generally referred to as the "*erectum* group," is distinguishable from the other

two groups in its possession of rhombic leaves and globose, six-angled ovaries (varying to flask-shaped in derived forms such as *T. Gleasoni*) with *recurved stigmata*. The second group is characterized by its elliptic to broadly ovate leaves and in its green six-angled ovaries, which in the cases of *T. Catesbei* and *T. pusillum* are surmounted by a short style. The other group, which might be called the *undulatum* group, has petiolate leaves and merely three-angled ovaries.

The criteria here utilized for species segregation have been mainly those of ovary contour, though to some minor degree ovary color has been employed, and petal shape and color in some cases. In the *erectum* group species delimitation has been facilitated in some cases by the use of the anther-filament ratio as a character secondary to the ovary shape. The five species of the *erectum* group are the only species of those here considered which are really difficult to identify. They fall into two sub-groups, those with globose ovaries and those with flask-shaped ones. The species in each sub-group have been delimited on the basis of anther-filament ratio plus stamen exertion and in one case (*T. Rugelii*) on anther color.

Flower odor and pedicel inclination, both of which characters have been popular in treatments of the genus in recent years, have here been omitted or merely referred to incidentally, for each is inconstant as a specific attribute. In *T. Vaseyi*, for example, the "odor of old rose petals" is not always encountered in perfectly good specimens of the species. In *T. Catesbei* and *T. Gleasoni* the pedicels may be erect, inclined, or declined and the floral pattern of the plant still be typical of the species. A complete discussion of these invalid criteria is presented in the individual treatments of the species, following.

Any student of taxonomy when dealing with the genus *Trillium* should realize that he is confronted with an externally simple expression of the liliaceous pattern, a pattern in which, because of its utter simplicity, the slightest variation is likely to be greatly exaggerated. With this reality in mind one is better equipped to speculate upon exactly what constitutes a species of the genus *Trillium*. In the present treatment a species of *Trillium* is taken to be any interfertile population which expresses in itself and in its progeny an unique floral pattern essentially distinct from the type pattern of *Trillium* which shall arbitrarily be taken as that of *Trillium erectum*.

#### GEOGRAPHICAL DISTRIBUTION

The distribution of the pedicellate species of *Trillium* in the area included in the present work is indicated under the various species



treated. Since, however, both *T. Gleasoni* and *T. cernuum* are especially important in any consideration of the *erectum* group, some mention of their continental distribution must necessarily be made here. Accepting the Appalachians as the North-South center-line of distribution for the occurrence of *T. erectum* L. one is immediately aware of the fact that all other members of the *erectum* group occur within or on the borders of this area. In the case of *T. Gleasoni* Fernald there is a westward extension all the way from the Appalachians to the Ohio-Missouri middle regions. The Philadelphia area might be accepted as the locality of greatest predominance for *T. cernuum* L. and the Ithaca region might be similarly set down with respect to *T. cernuum* var. *macranthum*. That the two species, *T. cernuum* L. and *T. Gleasoni* Fernald, interpenetrate one another's territory is evidenced by the existence of many specimens of *T. cernuum* L. for the territory of *T. Gleasoni* Fernald (*Palmer*, Mo. Bot. Gard. 27734, Shawano Co., Wis.) and of several specimens of *T. Gleasoni* from the area set aside for *T. cernuum* L. by Gleason (*Small*, NYBG Herb., Wrightsville, Penna.).

*Trillium Vaseyi* Harbison is restricted to the Southern Appalachians. Gates' citation from Connecticut was made from a specimen which should be considered to be a variant of *T. erectum* L.

*Trillium Catesbei* Elliott is more widely distributed than any other pedicellate species in the South, whereas its close relative, *T. pusillum* Michaux, is the species of most sporadic occurrence.

#### CYTOLOGICAL CONSIDERATIONS

All species of *Trillium* studied have a set of 5 pairs of chromosomes to each diploid complement. This basic genome of 10 chromosomes manifests itself in two morphologically distinct patterns each of which is peculiar to one of the two subgroups of the genus: i.e., (1) the sessile species and (2) the pedicellate species. The major difference in the ideograms of these two groups is in the configuration of the I-chromosome which is characterized (1) in the sessile species by a subterminal constriction with a knob-shaped or spherical minor element and (2) in the pedicellate species by a subterminal constriction in which the shorter arm is hooked back upon the longer arm in such a manner as to suggest a shepherd's staff.

Photomicrographs, drawings, and permanent mounts of the complements of many of the sessile and all of the pedicellate species were obtained by the present writer from smears made in the field through the use of modifications of the McClintock method. Of the pedicellate

species, the *erectum* group offers the greatest difficulty in species delimitation. The cytological considerations here set forth are concerned solely with that group.

During the course of examination of several hundred root tip smears the following scheme of designating the various member-pairs of the complement was adopted as being the most practical. This designation scheme is followed consistently in all the species. The identification of member-pairs is, in some cases, very difficult and fraught with danger. The author, as a result of extensive observations, has reason to believe that, at least in one instance, in a recent paper on this matter, misidentification of certain member-pairs has been made. It is primarily to avoid such confusion that designation-schemes of former workers in *Trillium* are rejected in favor of the present one.

The general complement of the pedicellate species is made up of five member-pairs which are conveniently designated here as pair-I, -II, -III, -IV, and -V. The two I-chromosomes of the set are characterized by a subterminal constriction so formed as to make the short arm appear crooked back upon the long arm somewhat like the crook on a shepherd's staff. The II- and III-chromosomes are possessed of median to slightly submedian constrictions which give to them the so-called V-shaped appearance. The II-chromosomes are distinguishable from the III-chromosomes by their longer and more equal arms. The IV-chromosomes are easily recognized by their L-shape which results from a submedian constriction in which the long arm is from two to two and one-half times as long as the short arm. The V-chromosomes contain more chromatic material than any other member-pair of the set. They are medianly constricted and consequently V-shaped.

The following taxonomic analyses of the species of the *erectum* group have been made from differences detected in the examination and subsequent comparison of the genomes of the respective species.

T. ERECTUM: I-chromosome typical of the pedicellate species; II- and III-chromosomes more bulky than in other members of the *erectum* group, the II-chromosome of the upper row is possessed of a distinctly enlarged long arm; IV-chromosome of the lower row has a proportionately shorter minor element than do any of the other members of the *erectum* group; V-chromosome typical of the group. (Plate 29, no. 1.)

T. ERECTUM var. SULCATUM: I-chromosome typical; II-chromosome distinctly larger than in *T. erectum*; III-chromosome arm ratios slightly



differing from those of the preceding species; IV-chromosome of the top row characterized by a longer minor element than in *T. erectum*; V-chromosome typical of the group. (Plate 29, no. 3.)

*T. ERECTUM* var. *ALBUM*: Because the ideograms of *T. erectum* and *T. erectum* var. *album* appear to be essentially the same when taken at the same stage, the ideogram of *T. erectum* var. *album* illustrated in plate 3 was taken from another stage (early anaphase figure in contrast to the late anaphase stages from which the ideograms of the other species here considered have been taken) in an effort to show the variation possible in the same complement when seen at different stages. It will be noted that there is considerable compactness to the I-chromosomes and that the short arms of the I-chromosomes appear to be possessed of more chromatin than they do in the ideogram of *T. erectum*. The II-chromosomes appear to be at a more advanced stage than do the I-ones; their arm ratios are slightly at variance with the same member-pair of *T. erectum* (Plate 29, fig. 1). The III-chromosomes, as well as the IV- and the V-ones, are alike, except for size, the corresponding member-pairs in the complement of *T. erectum*. (Plate 29, fig. 2.)

*T. GLEASONI*: I-chromosome typical of the group; II-chromosomes slightly smaller than those of *T. erectum*; III-chromosome of the upper row characterized by extremely short arms; IV- and V-chromosomes similar to those of *T. erectum*. The IV-chromosome of the lower row has a short arm which is proportionately longer than the short arm of the corresponding member of the *T. erectum* complement. (Plate 29, fig. 5.)

*T. VASEYI*: All chromosomes of the *T. Vaseyi* complement are extremely large, probably the largest in the genus. The short arm in the IV-chromosome is quite distinctive and is useful as a key chromosome for the identification of the *T. Vaseyi* complement. (Plate 29, fig. 4.)

*T. RUGELII*: I-chromosome typical of the group; II- and III-chromosomes of distinct size and arm ratios; IV-chromosomes not so singular; V-chromosomes of the lower row show a striking inequality in arm lengths. (Plate 29, fig. 6.)

In recent years there have been numerous research papers in the field of cytotaxonomy and several of them have been concerned with the cytological aspects of certain species of *Trillium*. Amongst these papers have been some which attempt to establish differences between closely related species on the basis of the distinctiveness of the ideogram

of one species as contrasted with that of another. The present writer feels that such an attitude, which seems to result from the assumption that minor floral and vegetative variations peculiar to any one species will be reflected in the morphology of one or several of the chromosomes of the species complement, is, at least in the case of the genus *Trillium*, a rather naive one. In fact it would seem that workers who know how slight are the differences in the gross morphological characters between many species of *Trillium* would have adhered to the opposing assumption, that in closely related species of *Trillium* one cannot expect to see an unique variation of one of the 18 vegetative and floral parts of a *Trillium* plant reflected in the shape or size of one of the chromosomes of the complement. While the statement of such an attitude is not in accord with the descriptions which are given above relative to the ideograms pictured in Plate 29 of this paper, it is a statement which is in keeping with the present author's feeling about the value of cytological criteria for speciation in *Trillium*. The author knows from his own experience that ideograms carefully made by camera lucida from different mitotic figures of the same species of *Trillium* show differences which to some authors would be "striking." Such differences are in some cases due to the presence of artifacts and in others due to the momentary variance in the mitotic phase in which the figure was caught. This is not to say that genome variation is not important in speciation. Between distinct species there are differences which are worthy of scientific note (such as the differences between *T. Vaseyi* and *T. Rugelii* in Plate 29); but amongst species which are closely related and in which the differences are slight, care should be taken to distinguish between uniqueness of complement and mere artifactual variation in complement appearance.

#### TAXONOMIC TREATMENT

The herbaria from which the specimens are cited in this treatment are designated by the following abbreviations: NYBG, New York Botanical Garden; Mo. Bot., Missouri Botanical Garden; D, Duke University Herbarium; UNC, University of North Carolina Herbarium; GSMNP, Great Smoky Mountains National Park; and US, United States National Herbarium.

#### A KEY TO THE SPECIES

Leaves rhombic, abruptly narrowed at the tip. Ovary six-angled, not green (save in 1b).

Anthers yellow (connectives sometimes purplish).



General ovary contour globose, not flask-shaped.

Stamen equaling or only slightly exceeding the much recurved stigma tips; flowers usually erect.

Ovary maroon or dark purple.

Petals maroon.

Petals not sulcate-tipped.....1. *T. erectum*

Petals sulcate-tipped.....1a. *T. erectum* var. *sulcatum*

Petals white.....1b. *T. erectum* var. *album*

Ovary green, red, white, or white blotched with red.

Petals white, cream, green or pinkish. See variants of 1b.

Stamen much exerted beyond the slightly recurved stigma tips; flowers usually declined.

Petals maroon and imbricate (spotted in intermediates between this and the following).....2. *T. Vaseyi*

Petals white, usually imbricate.....2a. *T. Vaseyi* var. *simile*

General ovary contour flask-shaped (not globose).

Stamen equal, sub-equal, or slightly exerted beyond the stigma tips.

Anther equaling or exceeding the filament in length; pedicel merely declined  
3. *T. Gleasoni*

Anther exceeded by (not equaling) the filament in length; pedicel vertically reflexed.....4. *T. cernuum*

Anthers purple.

General ovary contour globose to slightly elongate.

Anthers many times exceeding the filaments.....5. *T. Rugelii*

Leaves elliptic or ovate or elongate obtuse, not rhombic, not abruptly narrowed at the tip; ovary six-angled, green; or three-angled and sometimes creamy.

Petals all of one color: either all rose or all white.

Stigmas free to the base.....6. *T. grandiflorum*

Stigmas united into a short style.

Leaves acute-tipped.....7. *T. Catesbeii*

Leaves obtuse at the tip.....8. *T. pusillum*

Petals not all one color: white with a red-purple V.

Stigmas free to the base of three-angled ovary.....9. *T. undulatum*

1. *Trillium erectum* L. Species Plantarum, p. 340. 1753.

*T. rhomboideum* Michx. Fl. Bor. Amer. 1: 215. 1803.

*T. foetidum* Salisb. Parad. Lond. 1: Pl. 35. 1805.

*T. erectum* var. *atropurpureum* Pursh, Fl. Amer. Sept. 1: 245. 1814.

*T. purpureum* Kin in Ell. Sk. 1: 430. 1817.

*T. nutans* Raf. Med. Bot. 2: 99. 1830.

*T. atropurpureum* Curt. ex. Beck. Bot. N. and M. States, p. 361. 1833.

*T. erectum rubrum* Clute, Amer. Bot. 9: 76. 1905.

Plant 3 or more dm. tall; leafy bracts 8 cm. or more long, rhombic, frequently broader than long; pedicel 3 cm. or more long, erect to horizontally inclined, not declined below the horizontal leaf plane; sepals

oblong to lanceolate; petals oblong to ovate-lanceolate, frequently obtusish, maroon in color; *anthers predominantly yellow, 5 mm. or more long, rarely exceeding the ovary much in length, filaments equal or barely subequal to anthers; ovary blackish-purple, six-angled, globose with recurved stigmas.*

Type locality: Virginia.

Range: Quebec and Ontario, southward to northern Georgia.

The general feeling today amongst taxonomists interested in the genus *Trillium* that *Trillium erectum* L. is very variable is not at all unwarranted. Nevertheless to lump all these variants under one head (Small, Man. South. Fl., 1933) is a questionable move since the variants for the most part are not of the Linnean *T. erectum* but are variants of a biologically distinct unit, *T. erectum* var. *album* Pursh. For a discussion of these variations and the author's interpretation of their significance, see the following.

*Trillium erectum* in the Southern Appalachians is mostly high-mountain in distribution. It is particularly common in the Great Smoky Mountains of western North Carolina and eastern Tennessee and in the Blue Ridge of Virginia, less so in the Blue Ridge of Carolina and Georgia.

Distributional citations.—VIRGINIA. Giles Co.: *Vardell* 240. Smyth Co.: Mo. Bot. Gard. 147344. NORTH CAROLINA. Macon Co.: *Harbison* (UNC 309). Ashe Co.: *Harbison* (UNC 390). Swain Co.: *Barksdale* 515. Haywood Co.: *Barksdale* 100. Transylvania Co.: US 513262. Avery Co.: *A. Gray and party* 11782. GEORGIA. Dade Co.: US 1085037. TENNESSEE. Coffee Co.: US 959650.

1a. ***Trillium erectum* var. *sulcatum* n. var.**

Plant up to 6 dm. tall; leafy bracts rhombic, frequently broader than long; pedicel 4 to 12 cm. long; sepals green, incurved with sulcate tips; yellow anthers exceeding the maroon filaments; ovary subglobose, maroon with yellowish stigmas.

Type locality: Roaring Gap, Surry County, N. C. (*Barksdale*).

Range: Surry and Wilkes Counties, N. C., and probably northward into Virginia and West Virginia (Type: *Barksdale* 229, Surry Co., N. C.).

This new variety has been the source of some little disturbance in the assembling of the present work for many of its characters make it appear to be deserving of a specific rank. However, in dealing with the genus of plants in which the general pattern is so simple that the slightest variance in the expression of a character is outwardly empha-



sized, one cannot proceed too cautiously. *Trillium erectum* var. *sulcatum* is at once recognizable in the field by its ringent flowers with their maroon sulcate tips. It differs from *T. erectum* in its extraordinarily long pedicel, the general appearance of its flower, and its stamen.

Distributional citations.—NORTH CAROLINA. Surry County: *Barksdale* 229. Wilkes County: *Stewart* (B217).

1b. *Trillium erectum* var. *album* (Michx.) Pursh.

*T. rhomboideum* var. *album* Michx., Fl. Bor. Amer. **1**: 215. 1803.

*T. erectum* var. *album* Pursh, Fl. Amer. Sept. **1**: 245. 1814; Curt.

Bot. Mag., pl. 1027. 1807, in part.

*T. album* Small, Fl. S. U. S., 1903, in part.

*T. Vaseyi* forma *album* House, Muhlenbergia **6**: 73. 1910.

*T. erectum* forma *albiflorum* R. Hoffm., Proc. Bost. Soc. Nat. Hist. **36**: 244. 1922.

*T. erectum* forma *viridiflorum* (Curt.) Peattie, Jour. Elisha Mitch. Sci. Soc. **42**: 203. 1927.

*T. erectum* L. Small, Man. South. Fl., 1933, in part.

Plant similar to *T. erectum* L. from which it differs mainly in its white petals (rarely pinkish or green); ovary typically dark purple (in variants: green, white, pink, red, red blotched, or cream), *globose*.

Type locality: High mountains of Carolina.

Range: Quebec and Ontario southward in the mountains to northern Georgia.

This variety differs from the species only in petal color. Pursh's description of it states that the ovary is "rubro." In its present usage Pursh's name refers primarily to those plants having dark purple ovaries.

Many variations of *T. erectum* var. *album* Pursh which have got into the literature seem to be quite unworthy of a name. Such is Peattie's *T. erectum* forma *viridiflorum* which has been reputed to occur in Canada and of which Peattie says there is a "likelihood of discovering . . . this rare form . . . in mountainous Carolina." This plant does occur in the high mountains of North Carolina where the habitat is typically Canadian. The plant, however, is typical *T. erectum* var. *album* Pursh which, under climatic conditions peculiar to "late springs" and intermittent "cold snaps," sometimes has a greenish cast to its petals. Several forms of *T. erectum* var. *album* Pursh, while unworthy of designation by name, are of real evolutionary importance since they

exhibit changes in the essential organs of the flowers which suggest a development from *T. erectum* var. *album* Pursh on the one hand to *T. Gleasoni* Fernald on the other. Although in local habitat these variations are rarely associated with the unit to which their origin is attributed, their North American distribution is co-extensive with that of *T. erectum* var. *album*. They should, therefore, be regarded as sporadic offshoots of it. All of these variants which fall within the limits embraced by Pursh's variety, are characterized by *globose ovaries* (type-1 in the habitat discussions that follow). From some such offshoots, however, forms with flask-shaped ovaries (type-2) have developed. In turn from the plants with flask-shaped ovaries has arisen typical *Trillium Gleasoni* Fernald. For the sake of facilitating classification and at the same time keeping the number of species of *Trillium* within reasonable limits, it would be wise to regard all plants having the flask-shaped type of ovary coupled with an anther-filament ratio of 1:1 or more (with the higher digit always representing the anther) as falling within the limits of *T. Gleasoni* Fernald. Such a concept necessitates the placing of Small's *T. album* mainly under the heading of *T. Gleasoni*.

Botanists coming upon isolated specimens of these variants in the field might consider such a schematic interpretation as the foregoing of *erectum* var. *album* Pursh and its affinities to be the result of much theorizing over dried material. For isolated variants frequently appear to be "something entirely new." The conclusions set down here, however, have been drawn from observations of many colonies in the field as well as material deposited in herbaria. From a field notebook have been chosen the following three examples of colonies of variations of *T. erectum* var. *album* Pursh which illustrate all the forms as well as the inter-relationships of *T. erectum* var. *album* Pursh and *T. Gleasoni* Fernald.

I. On Hyatt Road in Swain County, N. C., there grow a number of variations which furnish types of almost every form of *T. erectum* var. *album* as yet described. The flowers of this series have ovaries of two distinct types: (1) the globose, six-angled ovary typical of *erectum* and (2) the elongate, flask-shaped type of ovary found in *Gleasoni*. These ovary types shall be referred to respectively as "1" and "2." In the Hyatt Road colony there are plants with flowers possessing normal white petals and type-1 ovaries, the color of which varies from purple to white blotched with purple, to pure white, to cream, to greenish. There are further to be found flowers typical of *erectum album* in every



respect save that they have pink ovaries of type-2, the *Gleasoni* type. These latter plants, when they possess pinkish petals represent good specimens of Small's *T. album*, his description of which follows:

"Similar to *T. erectum* in habit, but flowers smaller: petals white or pinkish, less inclined to be acuminate, or sometimes obtuse: filaments pink or reddish: anthers often 8-11 mm. long, with pale connectives colored like the filaments: ovary pink or red: . . . In woods, N. C., Tenn., and Georgia."

*Trillium album* therefore seems to represent a point terminating a long series of variations of *T. erectum* var. *album* wherein it and all variants beyond it are to be considered affinities of *T. Gleasoni* Fernald. Small's description of *T. album* does not state that the pedicels are declined and since the description does say that the plant is similar to *T. erectum* L. it is safe to assume that the pedicels in *T. album* are erect. New York Botanical Garden specimens of *T. album* bear out this assumption. In colonies such as the Hyatt Road colony there are plants which agree in detail with *T. album* save that the pedicels are declined. Such plants fit the description given by Gleason for his *T. declinatum* (now *T. Gleasoni* Fernald). Thus it is evident that certain variational extremes of *Trillium erectum* var. *album* Pursh are what Gray called *T. erectum* var. *declinatum*, what Gleason called *T. declinatum* and what Fernald has since called *T. Gleasoni*. In segregating *T. erectum* var. *album* Pursh from *T. Gleasoni* Fernald one must consider two types of differences: (1) those which belong to the extreme units of each species and (2) those which are peculiar to the transitional units. Considering the characters of the "extremes" it can be seen that *erectum* var. *album* has erect white flowers with globose dark purple ovaries with stigmas much recurved and anthers on straw colored filaments which are not much exerted; whereas *Gleasoni* possesses declined white-pinkish flowers with flask-shaped ovaries whose stigmas are not much recurved and whose stamens are sometimes much exerted with pinkish filaments. The major difference here seems to be the pedicel inclination and the ovary. Considering the characters of the transitional units it is seen that in *T. erectum* var. *album* ovary color varies greatly and in rare cases plants with dark-purple ovaries may have declined flowers, a character which is attributed to *T. Gleasoni* (GSMNP 4236); on the other hand plants having the floral characteristics of *Gleasoni* may have erect flowers (as in *T. album* Small). Thus there is sufficient evidence concerning pedicel variation in inclination to nullify *pedicel inclination* as a good specific character

for *Gleasoni*. There remain then two characters which will be of invaluable aid in separating *Gleasoni* from variants of *erectum album* and they are: (1) ovary contour (2) anther-filament ratio and stamen exertion. The latter is the more mutable of the two.

II. On Deep Creek in the Great Smoky Mountains National Park there is a colony in which the following types occur: (1) erect-flowered; petals pinkish; ovary green, globose, six-angled; stamens pinkish; (2) much as in (1) save flowers are horizontal; (3) much as in (1) save flowers are declined. In all these examples the common feature of importance is the globose ovary.

III. On Bryson Branch in the same county there is a colony of plants in which the following types occur: (1) erect flowers; petals pinkish; ovary reddish and flask-shaped, six-angled, stamens pinkish and much exerted; (2) same as (1) save the plants are smaller and the ovaries are dark purple and the flowers are declined. The common character in the Bryson Branch colony is the flask-shaped ovary. It is permissible then to assume that the Deep Creek plants are variants of *T. erectum* var. *album* Pursh and that the Bryson Branch plants are representative of *T. Gleasoni*.

Thus it is seen that *Trillium erectum* var. *album* as a taxonomic unit varies greatly within limits of coloration and pedicel inclination but not in ovary contour and further that when there is a variation in color accompanied by a parallel change in ovary contour from globose "1" to flask-shaped "2" the variation transcends the limits of *T. erectum* var. *album* and is to be classed as *Trillium Gleasoni* Fernald.

There are several specimens in the National Herbarium collected by T. G. Harbison at Sand Mtn., Ala., and labeled "*T. leucanthum* unpub." The plant is somewhat as follows: Plant about 3 dm.; leafy bracts broader than long (in the type), 5 x 6 cm.; sepals acutish, shorter than the petals; petals creamish, about 3.2 cm. long, ovate; stamen 1.5 cm. long, yellowish, filaments apparently colorless in dried material, 3 mm.; ovary 1.2 cm., pallid, flask-shaped. This plant also occurs in limited numbers in the Hyatt Road colony near Bryson City, N. C., where it was found by Mr. Burling Thomasson who called it to the attention of T. G. Harbison. In the present treatment this and the Alabama plant are regarded as variants of *T. erectum* var. *album* which fall barely in the limits of *T. Gleasoni*.

Distributional citations.—NORTH CAROLINA. Haywood Co.: *Barksdale* 252. Mitchell Co.: UNC 280. Macon Co.: *Harbison* (UNC 281). Jackson Co.: *Ashe* (UNC 282). Rutherford Co.: *Harbison* (UNC



289). TENNESSEE. Sevier Co.: *Barksdale* 402. Blount Co.: *Godfrey* B331. Knox Co.: *Jennison* (B261).

2. *Trillium Vaseyi* Harbison, Bilt. Bot. Studies 1: 24. 1901.

Plant 2 or more dm. tall; leafy bracts 8 cm. or more long, frequently broader than long, declined to cernuous, rarely otherwise; sepals lanceolate, 4 cm. or more long, acuminate; petals maroon or purple-brown, *broadly ovate* (rarely *ovate lanceolate*) and *imbricate*; anthers 5–20 mm. long, yellow, with purple connectives; ovary maroon, globose, much exceeded by the anthers.

Type locality: Southern Appalachians of North Carolina.

Range: Western N. C. to eastern Tenn., northern S. C., Ga., and Ala.

This *Trillium* is a very distinct species and may easily be identified by its large, declined, maroon-colored flowers with imbricated petals, as well as by its stamen which generally greatly surpasses its ovary. So far as is known *Trillium Vaseyi* does not extend northward into Virginia. It is relatively common in the Great Smoky Mountains and southwesterly in the Blue Ridge from Buncombe Co., N. C., to Fannin County, Ga., and Pickens and Oconee Counties, S. C. Though the range of *Vaseyi* is within the same political area as that of the southern limits of *erectum* it is important to note that it grows mainly in the lower altitudes, whereas *erectum* is mainly restricted to boreal regions of the high mountains.

A discussion of the variations of this species is included under the following.

Distributional citations.—NORTH CAROLINA. Haywood Co.: *Barksdale* 219. Transylvania Co.: *Barksdale* 231. Swain Co.: *Barksdale* 285. Macon Co.: *Harbison* (UNC 239). Jackson Co.: *Ashe* (UNC 241). Mitchell Co.: *Ashe* (UNC 242). Buncombe Co.: US 283925. TENNESSEE. Polk Co.: *Ruth* (Mo. Bot. Gard. 147343). SOUTH CAROLINA. Oconee Co.: *House* 2094. Pickens Co.: Bilt. 1135. GEORGIA. Stephens Co.: *Harbison* (UNC 245).

2a. *Trillium Vaseyi* var. *simile* (Gleason) comb. nov.

*T. simile* Gleason, Bull. Torr. Bot. Club 33: 391. 1906.

Plants much as in the foregoing except that the petals are white.

That *Trillium Vaseyi* var. *simile* is the same as *Trillium simile* is unquestionable. The author has seen Gleason's type and the sheets of the co-types and they agree in detail with material which the author

has collected over a wide area. In relation to the description of *Trillium simile* in Small (Man. South. Fl., 1933), it might be stated that almost any white-flowered *Trillium* would fit that description to some extent and that none would fit it completely.

*Trillium Vaseyi* var. *simile* grows in the company of the species, *T. Vaseyi*, as well as in isolated colonies. In colonies in which both the species and the variety occur there commonly are to be found intermediate plants which are especially peculiar as regards the ovary color. Whereas in the red and white forms of the species the ovary is maroon, in the intermediate forms the ovaries may be white, white flecked with maroon, or merely maroon, and the petals may vary from white blotched with pink to various shades of pink and pinkish purple.

Sometimes one encounters in the field colonies of *Trillium* in which some of the plants resemble *T. Vaseyi* var. *simile*, some resemble *T. Vaseyi*, while others appear to be an expression of the *Gleasoni* pattern. For the most part these peculiar variations appear to be hybrids—usually between one of the forms of *erectum album* and *Vaseyi* var. *simile*, or between *Gleasoni* and *Vaseyi* var. *simile*. The "Tryon region" plant which led Peattie to declare that *Trillium simile* Gleason did not have a declined flower is probably the product of such a cross. There follows here a set of notations from the author's field notes of a colony of *Trillium* in Swain Co., N. C., which appear to offer evidence of hybridization between the variety under discussion and *Gleasoni* or a variant of *T. erectum* var. *album* near *Gleasoni*.

Ice Plant Cove colony, Swain Co., N. C.:

(1) Plant 3.5 dm. tall; leafy bracts longer than wide, 14 x 13.5 cm.; fls. declined on an almost vertically deflected pedicel; sepals 1.2 x .9 cm., green, lanceolate; petals recurved and white, 3.5 x 1.9 cm.; anthers 9 mm. long with white filaments tinged with purple; ovary about 9 mm. to the stigma tips, subglobose; two scapes on its rhizome.

(2) Similar to "1" save for the colorless filaments and the horizontal flowers.

(3) Growing next to "2," plant stocky, 2.4 dm. tall; leafy bracts 14.5 x 16 cm., longer than broad, strongly nerved in keeping with the general stockiness of the plant; flower strikingly large, about 30° off being erect; pedicel about 3 cm.; sepals lanceolate; petals 4 x 2.8 cm., white; ovary mottled red and white, 6 mm. to stigma base, stigma recurved; anthers purplish, filaments colorless, stamen equaling pistil.

(4) Small plant, 2.3 dm. tall; leafy bracts 9.5 x 7.3 cm., longer than wide; flower horizontal beneath the leaves; petals 2.6 x 1.7 cm., maroon;



pistil 9 mm., reddish purple, of the *Vaseyi*-type; anthers exceeding pistil at this stage, being 11 mm. (further observations on this plant showed anthers to exceed pistil over a period of  $3\frac{1}{2}$  weeks).

(5) Similar to "1" save for a pure white ovary.

(6) Same as "4," only the ovary is white, all else, even stigmas, red.

(7) Same as "1" save flowers are horizontal beneath leaves, petals and ovary mottled red and white.

(8) Plant 4 dm. tall; leafy bracts 15-17 cm., broader than long; sepals pale green, 3.7 x 14 cm.; petals 4.7 x 3.1 cm., coriaceous, white; ovary pure white; odor similar to that of *Calycanthus*. (Odor has been mentioned in none of the preceding because according to the field notebook from which these measurements were taken there was no odor. For a discussion of the significance of odors in this genus, see the introduction.)

After observing these plants in the field for over a period of weeks during two flowering seasons the author has come to the conclusion that the entire colony of some 100 plants is the result of a cross between *T. Gleasoni* and *T. Vaseyi* or its variety, *simile*. "(1)" is nearest *T. Gleasoni* in its make-up. "(4)" represents *T. Vaseyi* in all respects save the petals which are nearer the contour of the petals of *Gleasoni*; its pistil and stamen are typical *Vaseyi*; and so on the forms may be variously interpreted in the light of the parents.

In a colony such as the above, of which there are many, a botanist is not at too great a loss for means toward solving the origin of many of the forms. However, when isolated members of such a complex are encountered there is likely to be much difficulty involved in correct identification.

#### OTHER FORMS

Near the Big Poplar in Davie County, North Carolina, there occurs a type of *Trillium* the description of which is as follows: plant 3 dm. tall; leafy bracts 10 x 11 cm., longer than broad, rhombic; pedicel 3 cm. long; sepals ovate-lanceolate, 2.5 cm.; petals white, recurved, ovate, 3 cm.; anther 6 mm., purplish, filament 5 mm., colorless; ovary globose, six-angled, white to the stigma bases which are not wholly recurved but are recurved at their tips.

Specimens of this same plant have been collected from "Forney, Cherokee Co., Ala.," by E. T. Wherry. The Davie County plant was collected by T. G. Harbison and H. R. Totten. Harbison's notes on the specimens read "*Trillium cernuum* L. . . . varies in some of its

characters from typical *T. cernuum*"; Wherry's specimen bears no extra notations but is labeled "*Trillium cernuum* L." The only character possessed by either of the sets of specimens which would suggest *Trillium cernuum* is the short pedicel, which in this author's opinion is not a good character. The present author feels that these specimens save for color much resemble his "4" in the foregoing discussion and deems it wise, until fresh material can be studied, to interpret these plants as expressions of *Trillium Vaseyi*.

Distributional citations.—NORTH CAROLINA. Graham Co.: *Barksdale* 512. Swain Co.: *Harbison* (UNC 401). Polk Co.: *Totten* (UNC 529). ALABAMA. Cherokee Co.: *Wherry* (NYBG Herb.)

3. **Trillium Gleasoni** Fernald, *Rhodora* **34**: 21. 1932.

*T. erectum* var. *declinatum* A. Gray, *Man.* ed. 5, p. 523. 1878.

*T. album* Small, *Fl. S. U. S.*, p. 278, in part. 1903.

*T. declinatum* Gleason, *Bull. Torr. Bot. Club* **33**: 389. 1906.

Plant up to 3 dm. tall; leafy bracts rhombic; pedicel erect, angled, horizontal, or declined; sepals green, acutish at the tips; petals white or pinkish-white, rarely maroon; filaments pinkish, rarely white, anthers sub-equal, equal or more commonly exceeding stigmas; ovary flask-shaped, pinkish to white.

Type locality: Ohio.

Range: Western Maryland, rarely in the Philadelphia area, and the Appalachians from Connecticut to Georgia and westerly to the middle regions of Ohio, Indiana, and Missouri.

This species is rather common in western North Carolina. It varies greatly in its flower form and is identifiable mainly by its ovary shape coupled with its petal color. The inconstancy of this species in the Southern Appalachians is no greater than in the type locality. The natural inconstancy of this species is evidenced by forms, many of which resemble *T. erectum* var. *album* Pursh and some of which resemble *T. erectum* L. The former is exemplified in specimens in the Great Smoky Mountains (*Jennison* GSMNP 4239). A full discussion of the relationships and a possible origin of this species is given under *T. erectum* var. *album* Pursh. The latter is exemplified by *T. declinatum* (Gray) Gleason forma *Walpolei* Farwell (*Friesner* UNC 300, Marion County, Indiana).

At Creve Cover Lake, Missouri, there is a large colony of *T. Gleasoni* Fernald in which there is a marked variation in the floral structure of the different plants. Some of the specimens superficially resemble



*T. Vaseyi* var. *simile* and suggest that possibly in some of its phases *T. Gleasoni* Fernald approximates an expression of a pattern closely akin to that of *T. Vaseyi* var. *simile*.

Distributional citations.—NORTH CAROLINA. Buncombe Co.: *Harrison* (UNC 279). Mitchell Co.: *Ashe* (UNC 283). Polk Co.: *Ashe* 381. Avery Co.: *Ashe* (UNC 466). Swain Co.: *Barksdale* 395.

4. *Trillium cernuum* L. *Species Plantarum*, p. 339. 1753.

?Type locality: Said to be Carolina.

Range: Probably the Atlantic seaboard from Penn. through New England.

The so-called Linnaean type of *Trillium cernuum* is reputed to have come from Carolina; yet the man who is supposed to have collected the specimen, Pehr Kalm, never came any further south than Fredericksburg, Va. Most likely Linnaeus' "Habitat in Carolina" merely referred to *T. Catesbei* which is generally conceded to have been a part of *T. cernuum* L. Many floras subsequent to the publication of *Species Plantarum* have given the southern distribution of *T. cernuum* as including Carolina. Unfortunately there are no authenticated specimens to support such an assertion. Gleason in his discussion of the territorial range of his *T. declinatum* (now *T. Gleasoni* Fernald) has arrived at the conclusion that *T. cernuum* L. is distributed over an area which "lies entirely to the north and east of that of" *T. declinatum*, but actually there is some overlapping of the territories of the two species (see under section on geographical distribution). Furthermore *T. declinatum* occurs in the Southern Appalachians, whereas *T. cernuum* does not. The author's conviction of the truth of the latter part of this statement hinges on (1) the assumption that Pehr Kalm *did* collect the specimen in the Linnean Herbarium (see Rendle) and (2) the fact that Pehr Kalm never came into either the Southern Appalachians or Carolina and (3) finally the fact that there are no good specimens from Carolina in any of the herbaria which are representative of what is known as *Trillium cernuum* L. For a discussion of some of these incorrectly labeled specimens, and even they are few, see the sections on *T. Vaseyi* var. *simile* and *T. Gleasoni* Fernald. There follows a description of the species *cernuum* gathered from observations on material which the author has had sent him from the north:

Plants 1 dm. or more tall; leafy bracts 6 cm. or more long, sometimes broader than long; sepals 1 cm. or more, not exceeding the petals; petals white, elliptic-lanceolate to ovate, 1.5 cm. or more long; anthers

equal or subequal to the filaments; ovary elongate, flask-shaped, not dark red, not maroon.

It will be noticed from this description that *T. cernuum* differs markedly from *T. erectum*, *T. erectum* var. *album*, and *T. Rugelii* in both its ovary and anther characters. From *T. Vaseyi* and *T. Vaseyi* var. *simile*, it differs primarily in its ovary character and to some extent in its stamen, though the latter is mostly a matter of relative size: the stamen being larger and more exerted in *T. Vaseyi*. From *T. Gleasoni* it differs most markedly in the anther-filament ratio: *Gleasoni* being filament 1 : anther 4 to filament 1 : anther 1, whereas in *T. cernuum* L. the ideal proportion should be filament 2 : anther 1. Other characters which seem to make it so distinct a species are for the most part intangible points which lead taxonomists to say "it's one of those things you know when you see it in the field." (A discussion of *T. cernuum* L. and illustrations of it are here included in an effort to clarify its position relative to other members of the *erectum* group.)

5. **Trillium Rugelii** Rendle, Jour. Bot. **39**: 331, Pl. 426, Fig. B. 1901.

Plant 1.5 dm. or more tall; leafy bracts 6-16 cm. long, frequently broader than long, rhombic; pedicel about 3 cm. long; sepals elliptic-lanceolate, green; petals broadly elliptic to ovate, flattening from the base to the middle, then recurving, broad at the middle, white; *anther darkish purple, 3-5 times longer than the filament, connectives maroon; ovary six-angled, maroon, with much-recurved stigmas.*

Type locality: "Mountains of the Broad River, N. C."

Range: The author made three collections of this species by the Broad River in Henderson County near Bat Cave, N. C. The species seems to be restricted to Henderson and Rutherford counties, N. C.

*Trillium Rugelii* is one of the few pedicellate Trilliums of the Southern Appalachians which has constant enough gross morphological characters to make it easily identifiable. Upon what basis Peattie merged it with *T. erectum* var. *album* (Jour. Elisha Mitch. Sci. Soc. **44**: 2, 172) and subsequently with *T. erectum* (Small, *Man. S. Fl.*, 1933) is not understood, for in no way does it remotely resemble either. Furthermore Rendle's drawing which was seen by Peattie is quite unlike either *T. erectum* or *T. erectum* var. *album*. His figure of the unique stamen of *T. Rugelii* is quite in agreement with the author's own drawing which was made from a stamen selected from an abundant supply of fresh material. The lack of latitude in Rendle's measurements is the inevitable outcome of working with dried material. Actually the plants of *T. Rugelii* vary greatly in size as do the plants of most Trilliums



and it can be added with considerable assurance that the size of a mature Trillium plant in all cases of normal development is directly proportional to the size of the root-stock, the size of which depends upon the number of years it has existed, its favorable or unfavorable location, and to a minor degree, the growing seasons of those years. In such a statement rhizomes producing more than one plant at a time are to be regarded as rhizomes producing one plant of large size.

6. *Trillium grandiflorum* (Michx.) Salisb.

*T. rhomboideum grandiflorum* Michx. Fl. Bor. Amer. **1**: 216. 1800.

*T. grandiflorum* Salisb. Parad. Lond. **1**: Pl. 1. 1805.

*T. erythrocarpum* Curt. Bot. Mag. Pl. 855. 1805.

*T. grandiflorum* f. *viride* Ann. Rep. Mich. Acad. Sci. **20**: 157. 1918.

*T. grandiflorum* f. *roseum* Farwell. Ann. Rep. Mich. Acad. Sci. **21**: 364. 1919.

Plant 2-5 dm. tall; leafy bracts 6 cm. or more long, oval or broadly oval, acuminate; peduncle 3 cm. or more long, usually erect; sepals usually imbricate, lanceolate, 2 cm. or more long; petals oblanceolate or ovate-lanceolate, white, pink, rose, rose-purple, atypically green striped or green; stamens greenish save for anthers, anthers exceeding filaments; pistil 16 mm. long with spreading stigmas.

The flowers in this species commonly open white and turn rose during the period of flowering. In the mountains of North Carolina plants of *T. grandiflorum* with flowers having green and white striped petals and with or without long-petioled leaves are sometimes encountered. These plants upon examination show themselves to be abnormal in many respects: their rootstocks frequently possess peculiar swellings and the roots do not seem to depart from the rootstock in the normal manner. Sometimes in such plants the stamen and stigma become mere curled leaflets. An examination of the somatic cells shows the chromosomes to be quite normal—at least morphologically though possibly not karyologically. Possibly some disturbance is the cause of this abnormal condition. In any event such plants should be regarded as pathological and not as representing “normal variations” or “rare forms” of the species.

The species *T. grandiflorum* in the Southern Appalachians is widespread and rather common.

Distributional citations.—VIRGINIA. Page Co.: US 400757. Bedford Co.: US 605053. Augusta Co.: *Jarmin* (Duke U51042). Giles Co.: Herb. Mtn. Lake Bio. Stn. Bluemont Co.: *House* (Mo. Bot.

147327). NORTH CAROLINA. Haywood Co.: *Barksdale* 224. Polk Co.: *Peattie* 1685 $\frac{1}{2}$ . Macon Co.: *Harbison* (UNC 342). Buncombe Co.: *Ashe* (Bilt. 1236<sup>b</sup>). Ashe Co.: *Ashe* (UNC 345). Swain Co.: *Thomasson* (UNC 348). Jackson Co.: *Henry* (UNC 319). Henderson Co.: *Ashe* (UNC 346). Stokes Co.: *Barksdale* 377. TENNESSEE. Unicoi Co.: *Price* 531. Polk Co.: US 63981. Blount Co.: *Godfrey* B 333. ALABAMA. Marshall Co.: US 1698812.

7. **Trillium Catesbei** Ell. Sk. 1:429. 1817.

*T. cernuum* L. Sp. Pl. p. 339 in part. 1753.

*T. nervosum* Ell. Sk. 1:429. 1817.

*T. stylosum* Nutt. Gen. 1:239. 1818.

*T. affine* Rendle, Jour. Bot. 39:334. 1901.

Plant 2 dm. or more tall; leafy bracts 5 cm. or more long, sometimes strongly nerved, elliptic to oval, not infrequently possessing short petiole-like bases; pedicel erect, horizontal or declined, 2 cm. or more long; sepals linear, sometimes oblong, obtusish, reflexed or recurved; petals white, pink or rose, ovate, ovate-lanceolate, to spatulate, usually recurved, especially if narrow; ovary pale green, stigmas united into a style at the base.

Type locality: Pendleton County, South Carolina.

Range: Virginia to Tenn., the Carolinas, Georgia, and Alabama.

This species is very well distributed in the Southern Appalachians as well as in the adjoining piedmont. It varies greatly in size but always within limits which make it easily identifiable. It is closely related to *T. pusillum* from which it differs mostly in leaf characters. It and *T. pusillum* are the only Eastern American species of *Trillium* which have styles.

Distributional citations.—VIRGINIA. Roanoke Co.: *Pourlette* (US 608283). NORTH CAROLINA. Wilkes Co.: *Barksdale* 146. Macon Co.: *Barksdale* 148. Stokes Co.: *Barksdale* 152. Transylvania Co.: *Barksdale* 153. Buncombe Co.: Bilt. 1028<sup>b</sup>. Henderson Co.: *Campbell* (UNC 167). Polk Co.: *Peattie* 1608. Surry Co.: *Oosting* 3546. Mitchell Co.: *Drushell* 7363. Cherokee Co.: UNC 165. TENNESSEE. Blount Co.: *Godfrey* B199. GEORGIA. Twiggs Co.: US 11150. Haralson Co.: US 370936. Marion Co.: *Harper* (US 431713). Bibb Co.: *Harbison* (UNC 177). DeKalb Co.: *Pennell* (US 1582608). ALABAMA. Lee Co.: *Earle* and *Baker* (UNC 157).

8. **Trillium pusillum** Michx. Fl. Bor. Amer. 1:215. 1803.

*T. pumilum* Pursh, Fl. Amer. Sept. 245. 1814.

*T. texanum* Buckl. Proc. Acad. Sci. Phila. for 1860:443. 1861.



Plant up to 2 dm. tall; leafy bracts elliptic, 2 cm. or more long; sepals obtusish, nerved, often broader than the petals; petals purplish, obtusish, undulate margined, often merely curled; anthers and filaments about equal; pistil with a definite style.

Type locality: Carolina.

Range: Eastern Va. to S. C., Texas, and the Ozark Plateau.

There is much visual evidence which when coupled with distributional data leads one to believe that this species is a sport of *T. Catesbei*. There is a possibility that the Texan and Ozark Plateau plant, *T. texanum* Buckley, is biologically the better species, whereas *T. pusillum* may only be a derived impotent. This is merely conjectural. The author has so far been unable to secure living material of *T. pusillum* Michaux.

The only mountain specimens are from Haywood Co., N. C. The author has collected extensively in Haywood County but has not been so fortunate as to run across *T. pusillum* there.

Distributional citations.—NORTH CAROLINA. Haywood Co.: *Harbison* (UNC 595).

9. **Trillium undulatum** Willd. Ges. Naturforsch. Freunde Berlin Neue Schr. 3:422. 1801.

*T. erythrocarpum* Michx. Fl. Bor. Amer. 1:216. 1803.

*T. pictum* Pursh, Fl. Amer. Sept. 1:244. 1814.

Plant 2 dm. or more tall (where there are two on a stock frequently they are about 1 dm.); leafy bracts 6 cm. or more long, blades elliptic or ovatis, having a purplish caste at time of flowering, longer than the petiole-like bases; pedicel erect; sepals lanceolate, 1 cm. or more long; petals white bearing a pink V at their bases, ovatis; ovary not six-angled, merely three-parted.

This species is common in the rhododendron duff and to some extent in the balsam forests of the Blue Ridge and Smokies. It is the most distinct species of the genus in our area.

Distributional citations.—VIRGINIA. Highland Co.: US 1630610. NORTH CAROLINA. Macon Co.: *Barksdale* 226. Jackson Co.: *Ashe* (UNC 385). Transylvania Co.: *Coker* (UNC 382). Mitchell Co.: UNC 388. Haywood County: *Barksdale* 560. TENNESSEE. Blount Co.: *Godfrey* B330.

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## LITERATURE LIST

- ANDERSON, W. A.  
1934 Notes on the Flora of Tennessee: The Genus *Trillium*. *Rhodora* **36**: 119-128.
- BABCOCK, E. B.  
1936 The Origin of *Crepis* and Related Genera, With Particular Reference to Distribution and Chromosome Relationships. *Essays in Geobotany*, pp. 9-50. University of California Press. Berkeley, Calif.
- CHAPMAN, A. W.  
1897 Flora of the Southern United States, pp. 504-506.  
*Curtis Botanical Magazine*  
1800 Vol. **14**: pl. 470.  
1805 Vol. **22**: pl. 855.  
1806 Vol. **24**: pl. 954.
- DARLINGTON, C. D.  
1930 Chromosome studies in *Fritillaria*. *Cytologia* **2**: 37-55.  
1937 Recent Advances in Cytology. 2nd. Ed. P. Blakiston's Sons & Co., Inc. 1012 Walnut Street, Philadelphia.
- EAMES, A. J., AND K. M. WIEGAND  
1923 Variations in *Trillium cernuum*. *Rhodora* **25**: 189-191.
- ELLIOTT, STEPHEN  
1821 Sketch of the Botany of South Carolina and Georgia **1**: 426-427.
- FERNALD, M. L.  
1932 Some Genera and Species of Rafinesque. *Rhodora* **34**: 21.
- FLORY, W. S.  
1938. The Somatic Chromosome Complement of *Habranthus robustus*. *Amer. Jour. Bot.* **25**: 386-388.
- FRIESNER, R. C.  
1929 The Genus *Trillium* in Indiana. *Butler Univ. Bot. Studies*. Paper 3.
- GATES, R. R.  
1917 A Systematic Study of the North American Genus *Trillium*, its Variability, etc. *Ann. Mo. Bot. Gard.* **4**: 43-92.
- GLEASON, H.  
1906 The Pedunculate Species of *Trillium*. *Bull. Torr. Bot. Club.* **33**: 387-396.
- HARBISON, T. G.  
1901 *Bilt. Bot. Studies* **1**: 1.
- HOUSE, H. D.  
1910 *Trillium Vaseyi* forma *album*. *Muhlenbergia* **6**: 73.
- KALM, PEHR  
1772 *Travels in N. America*. Warrington: Printed by Eyres.
- LINNAEUS, CARL  
1753 *Species Plantarum*, pp. 339-340.



## McCLINTOCK, BARBARA

- 1929 A method for making aceto-carmine smears permanent. *Stain Tech.* **4**: 53-56.

## MICHAUX, ANDREAS

- 1803 *Flora Boreali-Americana* **1**: 215-216.

## NEBEL, B. R., AND M. L. RUTTLE

- 1936 Chromosome Structure. IX. *Tradescantia reflexa* and *Trillium erectum*. *Amer. Jour. Bot.* **23**: 652-662.

## PEATTIE, D. C.

- 1927 *Trillium* in North and South Carolina. *Jour. E. M. Sci. Soc.* **42**: 193-206.

## PURSH, FREDERICK

- 1814 *Flora Americae Septentrionalis* **1**: 244-246.

## RENDLE, A. B.

- 1901 *Jour. Bot.* **39**: 228.

## ROBINSON, B. L., AND M. L. FERNALD

- 1908 *Gray's New Manual of Botany*, 7th ed. Amer. Book Co., New York.

## SHARP, L. W.

- 1929 Structure of large somatic chromosomes. *Bot. Gaz.* **88**: 349-382.  
1934 *Introduction to Cytology*. McGraw-Hill Book Co., Inc. New York and London.

## SMALL, J. K.

- 1903 *Flora of the Southeastern United States*, pp. 276-279. Pub. by the author, New York.  
1933 *Manual of the Southeastern Flora*, pp. 305-309. Pub. by the author, New York.

## SWEZY, OLIVE

- 1937 Alterations in Somatic Chromosomes in *Crepis*. *Cytologia*, Fujii Jubilee Volume, pp. 149-155.

## WARMKE, H. E.

- 1937 Cytology of the Pacific Coast *Trilliums*. *Amer. Jour. Bot.* **24**: 376-383.

## WEBER, J. M.

- 1932 Chromosome Morphology and Meiotic Behavior in Typical and Variant Forms of *Kniphofia aloides*. *Amer. Jour. Bot.* **19**: 411-422.

## WOOD, ALPHONSO.

- Class Book of Botany*, pp. 704-705.

## EXPLANATION OF PLATES

## PLATE 27

A suggested relationship scheme of the pedicellate species of *Trillium*.

## PLATE 28

Camera-lucida drawings of the ovaries and stamens of the species considered:

- I. *Trillium erectum*
- II. *T. erectum* var. *album*
- III. *T. Gleasoni*
- IV. *T. cernuum*
- V. *T. Catesbei*

- VI. *T. grandiflorum*
- VII. *T. Rugelii*
- VIII. *T. Vaseyi*
- IX. *T. undulatum*

## PLATE 29

Ideograms of the species of the *erectum* group.

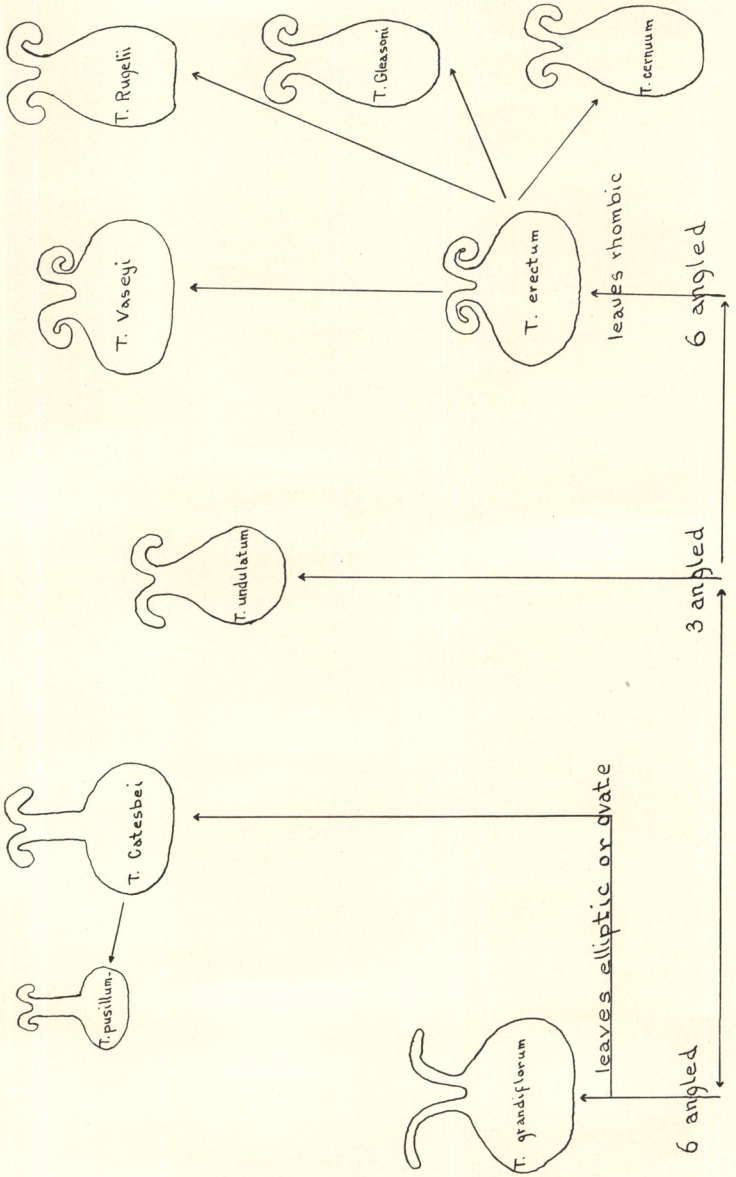
- I. *Trillium erectum*
- II. *T. erectum* var. *album*
- III. *T. erectum* var. *sulcatum*
- IV. *T. Vaseyi*
- V. *T. Gleasoni*
- VI. *T. Rugelii*

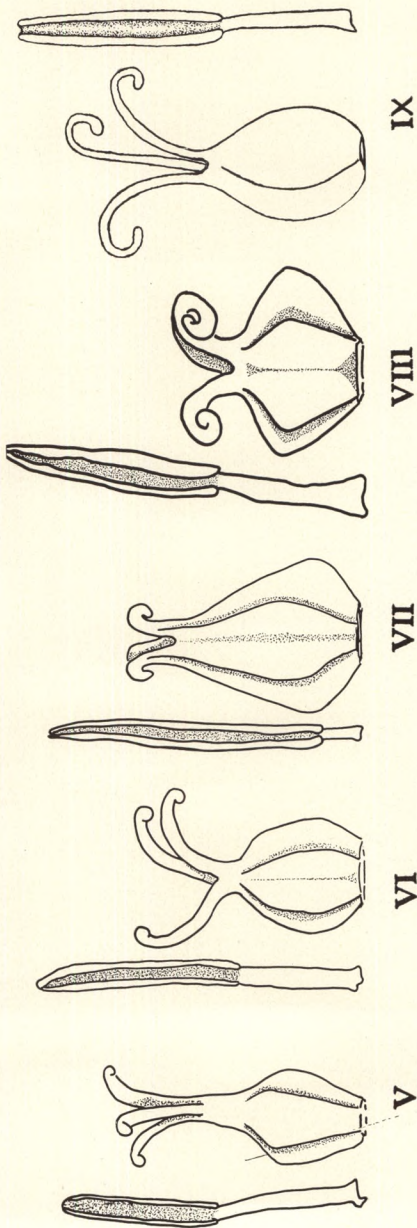
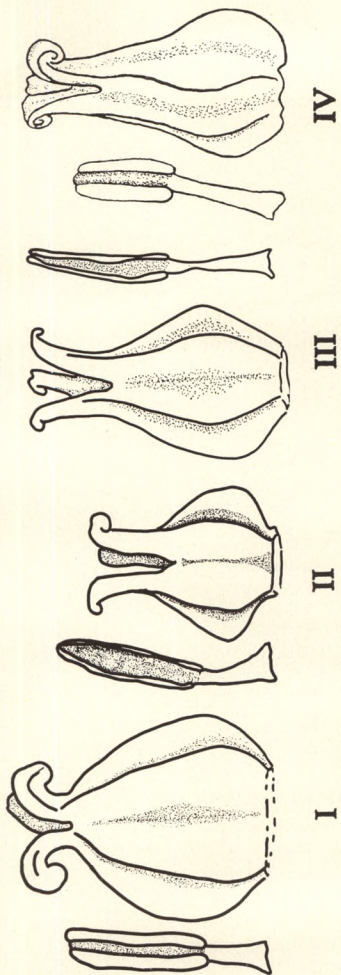
## PLATE 30

Habit photographs:

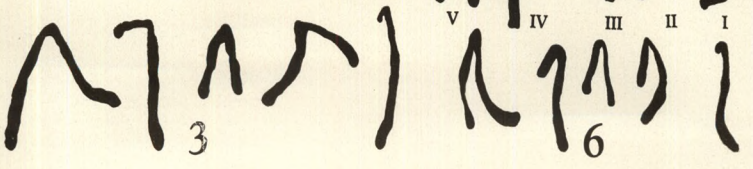
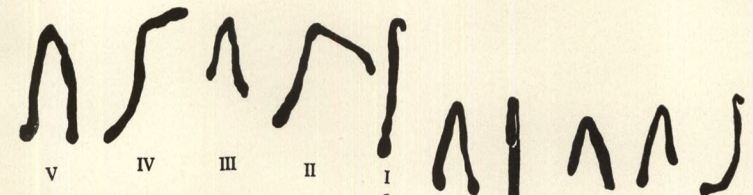
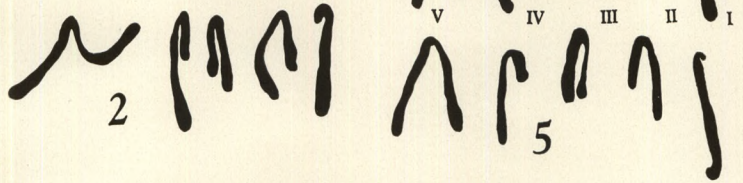
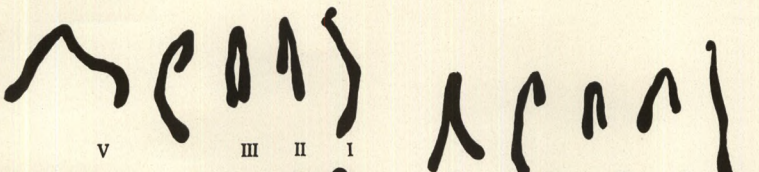
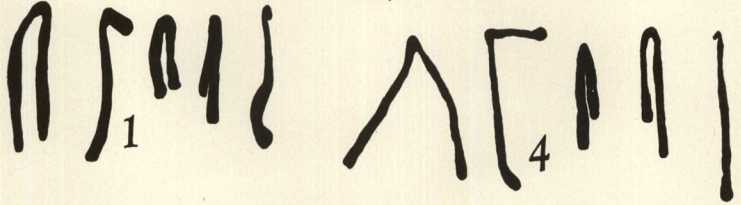
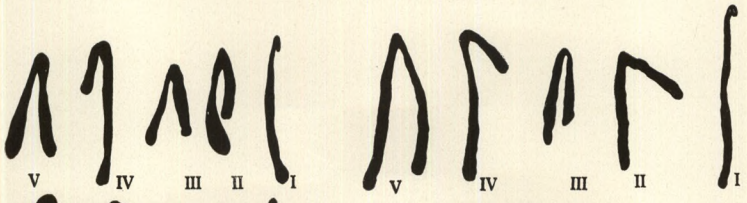
- I. *Trillium Catesbei*
- II. *T. Gleasoni*
- III. Variant of *T. erectum* v. *album* with white ovary
- IV. *T. Rugelii*
- V. *T. erectum* var. *sulcatum*

















T. Vaseyi, hybrid, Swain County, N. C.



T. Vaseyi, Transylvania County, N. C.



T. Rugelii, Rutherford County, N. C.



T. Gleasoni, Guilford County, N. C.





T. Vaseyi, habit photograph.

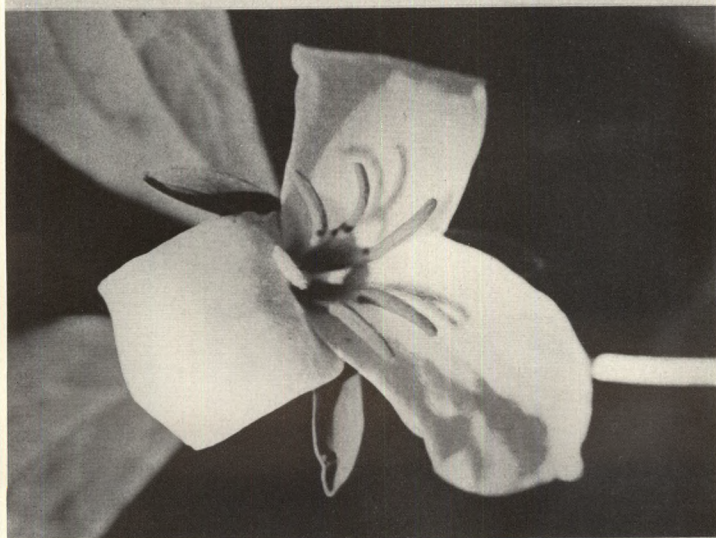


T. erectum var. sulcatum, Wilkes County, N. C.

PLATE 34



T. Catesbei, Pilot Mt., N. C., with erect flower.



T. Catesbei, Orange County, N. C., with nodding flower.





*Trillium erectum* var. *album*.