To the Graduate Council:

I am submitting herewith a dissertation written by David Hatler Webb entitled "A Biosystematic Study of Hypericum Section Spachium in Eastern North America." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Botany.

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A BIOSYSTEMATIC STUDY OF *HYPERICUM* SECTION *SPACHIUM* IN EASTERN NORTH AMERICA

A Dissertation

Presented for the

Doctor of Philosophy

Degree

The University of Tennessee, Knoxville

David Hatler Webb

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B Botanischer Garten and Botaniches Museum Berlin-Dahlem, Berlin, Federal Republic of Germany.

BISH Bernice P. Bishop Museum, Honolulu

BM British Museum (Natural History), London, Great Britain

C Botanical Museum and Herbarium, Copenhagen, Denmark

CHARL The Elliot Herbarium of the Charleston Museum, Charleston

G Conservatoire et Jardin Botaniques, Geneva, Switzerland

GA University of Georgia, Athens

GH Gray Herbarium of Harvard University, Cambridge

ILL University of Illinois, Urbana

K	Royal Botanic Gardens, Kew, Great Britain
MICH	University of Michigan, Ann Arbor
MO	Missouri Botanical Gardens, St. Louis
NCU	University of North Carolina, Chapel Hill
NY	New York Botanical Gardens, New York
SMU	Southern Methodist University, Dallas
TENN	University of Tennessee, Knoxville
US	United States National Museum, Smithsonian Institute, Washington, D.C.
WIS	University of Wisconsin, Madison

ABSTRACT

A biosystematic study was conducted on the eastern North American taxa of Hypericum sect. Spachium. Morphological, biochemical, cytological, ecological, and distributional data resulted in the recognition of the following twelve taxa: H. boreale, H. canadense, H. cumulicola, H. denticulatum var. denticulatum, H. denticulatum var. acutifolium, H. drummondii, H. incertum, H. gentianoides, H. gymnanthum, H. mutilum, H. majus, and H. setosum.

Scanning electron microscope studies of the pollen of these species showed the pollen to be trizonocolporate with a reticulate to finely reticulate-foveate exine. Three groups were distinguished on the basis of pollen size and exine ornamentation. Three basic patterns of the seed coat were recognizable, but did not correspond with the groups based on pollen morphology. Seed coat morphology provided a reliable means for the distinction of such closely related taxa as H. incertum and H. denticulatum var. acutifolium as well as some of the less closely related taxa.

Biochemical analysis of flavonoids found in the eastern North American species of sect. Spachium revealed the presence of three major types in two different classes of flavonoid compounds: flavonols, C-glycosyl flavones, and flavones. The C-glycosyl flavones and flavones were only found in H. incertum. All taxa investigated were found to contain quercetin based compounds with sugar substitutions occurring at the 3 position. One species, H. boreale, was found to contain a kaempferol based compound.

Chromosome counts for the taxa showed n = 6 in H. setosum and H. cumulicola, n = 8 in H. majus, H. mutilum, H. canadense, H. boreale, and H. gymnanthum, n = 12 in H. gentianoides, H. drummondii, H. incertum, H. denticulatum var. acutifolium, and some populations of H. denticulatum var. denticulatum, and n = 24 in most populations of H. denticulatum var. denticulatum. The counts of n = 6 are the first reports of this number in the genus Hypericum and possibly represent the base number for the genus. The counts for H. setosum, H. cumulicola, H. gymnanthum, and H. drummondii are the first reports for these species.

Hypericum dissimulatum is recognized as a recurrent hybrid of H. canadense and H. boreale or H. mutilum. The hybrid nature of this taxon is indicated by its intermediate morphology and its reduced pollen stainability. Field observations and a study of herbarium specimens of the taxa of the H. canadense complex support the reports of hybridization by previous workers.

The present taxonomic treatment differs from some relatively recent treatments of the eastern North American taxa of sect. Spachium in the following respects: (1) no subspecific taxa are recognized within H. mutilum and H. canadense, (2) H. dissimulatum is treated as a recurrent hybrid, (3) H. gentianoides and H. cumulicola are viewed as distinct species rather than being conspecific, and (4) the H. denticulatum complex is recognized as being comprised of two species, H. denticulatum and H. incertum, the former with two varieties.

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CHAPTER I

INTRODUCTION

The genus Hypericum L. traditionally has been included in the family Guttiferae. The Guttiferae as conceived by Engler (1925) consists of five subfamilies, Hypericum being a member of the Hypericoideae. Several authorities (Lawrence, 1951; Hutchinson, 1959, 1973; Taktajan, 1969) have elevated the Hypericoideae to familial rank, while other systematists (Cronquist, 1968; Thorne, 1968) have maintained the Hypericoideae as a subfamily within the Guttiferae. Although the name Guttiferae is a nomen conservandum (Stafleu, 1978), the alternative name Clusiaceae is sometimes used in referring to this family.

In an anatomical study of the Guttiferae and allied families, Vestal (1937) viewed the Hypericaceae as derived from the Guttiferae, yet noted that it is ". . . a matter personal opinion whether the group should remain as a part of the Guttiferae or be considered as a separate family." According to Schofield (1968), the anatomical differences between the genera of the Hypericaceae and those of the Guttiferae warrant separation of the two families. Furthermore, Lebreton and Bouchez (1967) found Hypericum to contain leucoanthocyanins and flavonols. Since these compounds were poorly represented in taxa belonging to other subfamilies (e.g., Clusioideae and Calophylloideae) of the Guttiferae, these workers favor the separation of the Hypericoideae from the Guttiferae.

In contrast to the view expressed above, Adams (1962b) and Robson (1977) consider the elevation of the Hypericoideae to familial rank to be undesirable because such treatment would require the other subfamilies

of the Guttiferae to be given familial rank. This latter treatment will be adopted for the sake of consistency, and Hypericum will be treated as belonging to the Hypericoideae at a subfamily rank under the Guttiferae (Clusiaceae).

The genus Hypericum consists of some 300 to 400 species distributed in the subtropics, montane regions of the tropics, and temperate zones (Robson, 1972a; Wood and Adams, 1976). Although members of the genus vary in habit from small annuals to trees, almost all have numerous stamens, yellow flowers, and entire opposite leaves. Due to the showy nature of the corolla, several species of Hypericum are cultivated as ornamentals (Bailey, 1949). The only other major economic importance attributed to the genus in North America involves H. perforatum L., which has been implicated in cases of livestock poisoning (Kingsbury, 1964).

About forty-six species of Hypericum, representing sections Roscyna (Spach) R. Keller, Myriandra (Spach) R. Keller, Hypericum, and Spachium (R. Keller) Robson, occur in eastern North America. This study involves eastern North American taxa formerly treated by Keller (1925) as belonging to sect. Brathys (Mutis ex L.f.) Choisy subsect. Spachium R. Keller. Recently, Robson (1977) has given subsect. Spachium sectional rank. Thus, all the species in eastern North America that were formerly included under sect. Brathys are now included under sect. Spachium (R. Keller) Robson. Several other sections recognized by Keller (1925) have been emended and/or have undergone changes in rank. For a discussion of the sectional changes relating to North American taxa, the reader is referred to Adams (1962a) and Robson (1977).

Section Spachium occurs naturally on all continents except Europe and Antarctica and exhibits a predominantly southern distribution being

restricted primarily to the tropical, subtropical, and temperate zones (Jiménez, 1973b; Robson, 1977). However, five species (H. gymnanthum, H. mutilum, H. majus, H. canadense, H. gentianoides) have been reported from various localities in Europe (Webb, 1958; Vivant, 1960; Robson, 1968; Banfi, 1977) and several workers have commented on these species as to whether they represent introductions or native taxa.

Species belonging to sect. Spachium are characterized by divergent styles with capitate stigmas, translucent glands on leaves and perianth parts, and three to five obscure groups of stamens that are generally less than twenty in number (Wood and Adams, 1976). While these characters are shared by the closely related sect. Brathys, the two sections differ in flower number, characteristics of the leaf margin, general habit, and internode length (Robson, 1977). According to Robson (1956, 1958) the genus Hypericum can be divided into four main groups, with the sections Humifusoideum R. Keller, Brathys, and Spachium comprising the Austral Group.

The taxonomic confusion associated with the species of Hypericum in eastern North America is evidenced by studies of the species comprising sect. Myriandra (Adams, 1959, 1962a), sect. Hypericum (Culwell, 1970), and sect. Spachium (Jiménez, 1973a). The need for taxonomic study and a brief discussion of the problems involving the eastern United States taxa belonging to sect. Spachium have been presented by Adams (1962b, 1973, pers. comm.) and Wood and Adams (1976). The major taxonomic problems within this section center around the taxa belonging to the H. canadense complex, the H. denticulatum complex, and the status of the varieties of H. mutilum and H. canadense recognized by Fernald (1950). Preliminary studies of the eastern North American taxa belonging to sect.

Spachium indicated that the treatment of Jiménez (1973a) inadequately defines the H. denticulatum complex while it unnecessarily lumps other taxa (e.g., H. gentianoides and H. cumulicola). Since that study was primarily classical in scope and inadequate in several respects, a biosystematic study of the eastern North American taxa of sect. Spachium has been undertaken here to clarify some of the remaining taxonomic problems within the group.

In order to study the morphological variation and determine the distributions of the taxa belonging to sect. Spachium in eastern North America, some 7600 specimens including types were borrowed from eighteen herbaria. Although most of the experimental aspects of this study involved populations from eastern North America, herbarium specimens of the various taxa were examined from throughout their North American ranges. In addition to the study of herbarium specimens, field studies over much of the eastern United States permitted field observation of the taxa recognized in this study. Cytological, biochemical, ecological, and taxometric studies were also conducted.

The following names will be used to designate the taxa recognized in this study: H. boreale (Britt.) Bickn., H. canadense L., H. cumulicola (Small) Adams, H. denticulatum Walt. var. denticulatum, H. denticulatum var. acutifolium (Ell.) Blake, H. drummondii (Grev. and Hook.) Torr. and Gray, H. gentianoides (L.) BSP., H. gymnanthum Englem. and Gray, H. incertum Steud., H. majus (Gray) Rusby in Britt., H. mutilum L., and H. setosum L. Full synonomy for these taxa is contained in Chapter IX.

CHAPTER II

HISTORY OF THE GENUS

The most recent infrageneric classification of Hypericum is that of Robson (1977), whose view of the genus is somewhat broader than that of past workers. In the following discussion Robson's generic concept is adopted and Hypericum is recognized as including several genera (Ascyrum L., Sarothra L., Crookea Small, and Sanidophyllum Small) familiar to North American botanists. Excluded from Hypericum are those species with interstaminal glands (hypogynous glands) and flesh colored petals that are imbricate in bud. These species are included in the genus Triadenum Raf., which according to Robson (1972a, 1977) is a herbaceous derivative of Cratoxylon Blume. In many past treatments of the Guttiferae or Hypericaceae, the species presently referred to Triadenum have been included in the genus Elodea (an orthographic variant of Elodes Adans.) or treated as a section (sect. Elodea) of Hypericum. While all the American species having hypogynous glands have been removed from the genus Hypericum, a few Old World species with interstaminal glands have been retained in Hypericum. For a more detailed account of the "Elodes group" (i.e. those with hypogynous glands) the reader is referred to Robson (1977).

The general outline of the following discussion follows an abbreviated history of the genus presented by Robson (1977). The name Hypericum originated with the Greeks and was used as early as the 2nd century B.C.E. The name, which literally means "above image," was derived from the Greek practice of hanging these plants above their religious icons to ward off evil spirits. Pliny, Galen, Dioscorides, and others used

the name in early scientific works as did various authors of the sixteenth and seventeenth centuries (Robson, 1977).

The first generic description of Hypericum is that of Tournefort (1700), who also recognized the genera Ascyrum and Androsaemum. Hypericum and Ascyrum were separated on the basis of the number of carpels comprising the gynoecium (three in Hypericum and five in Ascyrum). Both Hypericum and Ascyrum were recognized by Linnaeus (1737) in the first edition of Genera Plantarum. However, the separation of the two genera was not based on the number of carpels comprising the gynoecium, but on the number of petals. Ascyrum was characterized by four petals in contrast to the five petals of Hypericum. The Linnaean concept of Ascyrum was based on Hypericoides of Plumier (1703), while his Hypericum included Hypericum, Ascyrum, and Androsaemum of Tournefort. In addition to Hypericum and Ascyrum, Linnaeus, in the first edition of Species Plantarum (1753) and in the fifth edition of Genera Plantarum (1754), recognized the genus Sarothra. Like Hypericum its corolla consisted of five petals, but the androecium was composed of only five stamens in contrast to the numerous stamens described for Hypericum.

Several other genera typically included in Hypericum were described in the post-Linnaean 18th century. Androsaemum was distinguished by Miller (1754), but was not validly published until 1755 by Duhamel du Monceau. In addition to recognizing Hypericum, Ascyrum, and Androsaemum, Adanson (1763) described four additional genera (Komana, Elodes, Kniffia, and Hypericoides), and Linnaeus fil. (1781) described the genus Brathys.

The first major synoptic treatment of Hypericum is that of Choisy (1821) who divided the Hypericineae into seven genera, five of which

(Haronga Thouars, Vismia Vand., Androsaemum, Hypericum, and Ascyrum) comprised the Hypericineae verae, while the remaining two (Carpodontos Labill. and Eucryphia Cav.) were classified as Hypericineae anomalae. Androsaemum, Ascyrum, and Hypericum formed the tribe Hypericeae, which represents Hypericum in its current sense if the species Choisy included in Hypericum sect. Elodea are excluded. Five species were included under the genus Ascyrum, while Androsaemum contained a single species. Some 102 species were included under the genus Hypericum, which was divided into four sections: Ascyreia Choisy, Brathys (L.f.) Choisy, Perforaria Choisy, and Elodea Choisy. Choisy's sections were delimited on the basis of axillary vs. terminal flowers, sepal characteristics, and stamen and style number.

A later treatment of the Hypericaceae by Spach (1836a, 1836b) divided the family into two tribes: (1) the Desmostemoneae with eight genera, and (2) the Hypericeae with seventeen genera. Of the seventeen genera comprising the Tribe Hypericeae, thirteen were described as new. The assemblage formed by the Tribe Hypericeae and two species (H. aegypticum L. and H. elodes L.) included in the Desmostemoneae represents the genus Hypericum in its current sense. Six years later, Jaubert and Spach (1842) added two additional genera to those comprising the Hypericeae. The generic concepts of Spach were largely rejected by later workers (Endlicher, 1840; Torrey and Gray, 1838; Bentham, 1862; Keller, 1893, 1925) whose treatments reflect a much broader generic concept.

Endlicher (1840) reduced fifteen of the seventeen genera comprising Spach's Hypericeae to infrageneric rank under the genus Hypericum L. with the remaining two being included under the genus Ascyrum L. However, Endlicher (1840) failed to clearly indicate the rank of his

generic subdivisions, and according to Brizicky (1969) they ". . .must be regarded and dealt with as taxonomic categories published without indication of rank." As a result many of the sectional names of Hypericum were not validly published until Keller's 1893 treatment of the genus.

While Endlicher (1840) placed those species with interstaminal glands under the genus Elodea Adans., Bentham (1862) included these species in Hypericum, which he recognized in addition to Ascyrum. Similarly Keller (1893, 1925) recognized Ascyrum and Hypericum with the latter being comprised of eighteen sections in the treatment of 1925. The sectional classification of Keller (1893, 1925) is largely drawn from Endlicher (1840), and is based primarily on fasciculation of the stamens and the number of carpels comprising the gynoecium. Other attempts at infrageneric classification of the genus Hypericum are those of Stefanoff (1932, 1933a, 1933b, 1934) and Gorschkova (1949). As noted by Robson (1977), the twenty-three new series names proposed by Gorschkova were not validly published because they lacked Latin descriptions. Stefanoff's treatment, which included twenty-two new sections, dealt only with those species of Hypericum from Europe, western Asia, north Africa, and Macronesia, and has largely been ignored due to a lack of typification of sectional names and the limited geographic area of the treatment (Robson, 1977).

In a revision of the North American species of the Hypericaceae, Coulter (1886) recognized the family to be composed of three genera: Hypericum, Ascyrum, and Elodea Juss. This view was followed by the southern botanist Chapman (1897), while Mohr (1901) only recognized Ascyrum and Hypericum. Small (1903) added the genus Crookea to the Hypericaceae and several years later (Small, 1924) described the genus

Sanidophyllum from the dune region northwest of Lake Okeechobee in Florida. Two other genera now included in Hypericum, Takasogoya Y. Kimura and Spachelodes Y. Kimura, were described by Kimura (1935, 1936). Some American workers of the twentieth century (Britton and Brown, 1913; Small, 1933) maintained the Linnaean genus Sarothra. According to the treatment of Britton and Brown (1913), Sarothra contained a single species, Hypericum gentianoides (L.) BSP., while Small (1933) included an additional species, H. drummondii (Grev. and Hook.) Torr. and Gray in the genus.

In a reversal of the trend of a broadened concept of Hypericum, Kimura (1951) fragmented the genus by elevating several of Keller's sections to generic rank. According to Kimura (1951) the Hypericaceae consisted of two subfamilies: the Vismioideae and the Hypericoideae, with most of the species currently included in Hypericum belonging to the nine genera comprising the Hypericoideae. For a comparison of the classifications proposed by Spach, Keller, and Kimura the reader is referred to Robson (1977).

Adams (1957), in a revision of the genus Ascyrum, maintained it as distinct from Hypericum. Four years later Adams and Robson (1961) transferred all American species of Ascyrum to Hypericum as well as reducing Crookea to synonomy under Hypericum. The following year Adams (1962b) transferred the single species of Sanidophyllum to Hypericum.

In the more recent regional floras of the eastern United States, the Guttiferae or Hypericaceae have been treated as being comprised of one to three genera. Gleason (1952) recognized three genera (Ascyrum, Hypericum, and Triadenum), while Fernald (1950) treated those species with hypogynous glands and pink flowers as a section (Sect. Elodea)

under Hypericum. A treatment of the Canadian species of the family by Scoggan (1978) is similar to that of Fernald in that the single Canadian species with hypogynous glands is treated under the genus Hypericum. Radford et al. (1968) recognize only the genus Hypericum. Adams (1973) in his treatment of the Clusiaceae (Guttiferae) of the southeastern United States recognizes two genera: (1) Hypericum (including Crookea, Sarothra, Ascyrum, and Sanidophyllum), and (2) Triadenum.

The most current infrageneric treatment of Hypericum is that of Robson (1977) who divides the genus into thirty sections. Although Robson's work lacks detailed sectional descriptions, it contains a key to the sections with full synonomy for each. As noted earlier in this discussion, Robson's generic concept is rather broad and includes several genera that have historically been considered as quite distinct.

CHAPTER III

MORPHOLOGICAL CONSPECTUS

Habit and Vegetative Characters

In eastern North America the species belonging to Hypericum sect. Spachium are annual and/or perennial herbs that range in height from 10.0 dm in H. incertum to 0.5 dm in some diminutive forms of the species belonging to the H. canadense complex. Most of the species have erect stems although in H. boreale and in some individuals of H. mutilum the lower portion of the stem may be decumbent. The root system varies from fibrous to an elongated woody taproot as exemplified by H. cumulicola. In most species branching is primarily restricted to the leaf axils of the upper portion of the stem. However, in H. cumulicola the branching occurs at or just below the ground level and produces numerous ascending branches from the upper portion of a taproot. In H. gentianoides and H. drummondii numerous branches are produced in the axils of the medial and apical portion of the stem.

The stem and branches are essentially four-angled in cross section with slightly raised wings composed primarily of collenchyma (Jiménez, 1973a). In some of the more aquatic species (e.g., H. denticulatum var. denticulatum, H. incertum, H. mutilum) the lower stem may produce spongy aerenchyma-like tissue and the four angled nature of the stem is obscured. The lower stem of robust individuals of some of the species occupying xeric habitats may also be thickened. With the exception of H. setosum in which the stem, leaves, and calyx are covered with simple multicellular hairs, the other species of sect. Spachium are glabrous Translucent,

schizogenous glands are found on the stem, leaves, and perianth parts of all species belonging to sect. Spachium.

The leaves are simple, opposite, entire, sessile, and shorter to slightly exceeding the internodes. They range in texture from coriaceous to membraneous. In H. gentianoides and H. cumulicola the leaves are reduced (0.1 to 0.3 mm) and scale-like, while the other species have larger leaves that range from linear to ovate to oblong. Leaf shape has been one of the most important characters in distinguishing the taxa belonging to the H. denticulatum complex. With the exception of H. gentianoides and H. cumulicola, all the eastern North American taxa of sect. Spachium have a well developed mid-vein with several species having lateral veins originating from the base of the leaf. The number of veins on the leaf has frequently been used as a character for separating some of the species of the H. canadense complex.

Inflorescence

As noted by Jimenez (1973a) the basic inflorescence type of sect. Spachium is a dichasium with the inflorescences of the section being the result of modification of this basic type. Hypericum gymnanthum, H. canadense, and H. majus produce a "classical" dichasium with several orders of branching. However, the terminal branches of the inflorescence may become monochasial in some instances. This pattern, in which the lower portion of the inflorescence is a compound dichasium that becomes monochasial, is more frequent and pronounced in the H. denticulatum complex, H. setosum, H. cumulicola, and some individuals of H. mutilum. The floriferous branches produced on the apical and medial portion of the stem of some of the species noted above may also follow

this pattern. In H. boreale and some individuals of H. mutilum the floriferous branches are more spreading than those previously mentioned and may form a thyrse that exhibits varying degrees of reduction. In H. gentianoides and H. drummondii the flowers are most often borne singly in the leaf axils of the upper portion of the branches, with this pattern presumably being the result of a further reduction in the branching of the inflorescence.

Floral Characters

The calyx and corolla are pentamerous with the sepals frequently being unequal and shorter than the capsule although in H. mutilum and H. denticulatum the sepals may exceed the capsule. In these latter two species the sepals in some individuals are frequently dilated apically and are foliaceous in appearance. The petals are yellow to yellow-orange, persistent, and nearly symmetrical in the taxa belonging to the H. canadense complex but inequilateral to strongly inequilateral in the other taxa. The stamens are persistent, ranging from five to eighty. Studies of the floral vasculature by Robson (1956, 1977) indicate the androecium to be comprised of five fascicles, each of which may be composed of several stamens. In H. gentianoides each fascicle is often reduced to a single stamen (Robson, 1956, 1977). In species having numerous stamens (e.g., those of the H. denticulatum complex), the stamens appear to form a continuous ring. In species having fewer stamens (e.g., those of the H. canadense complex) the individual fascicles are sometimes visible but more frequently are indistinct.

The ovary is superior, three carpellate, and varies in shape from ovoid to conical. Placentation is parietal with numerous anatropous

ovules borne on three placentae. Development of the embryo sac is presumed to be of the Polygonum type since this type of embryo sac development has been reported in other species of Hypericum (Rao, 1957). The styles are divergent and vary in length from ca. 0.5 mm in members of the H. canadense complex to 4.0 mm in the H. denticulatum complex with all species having capitate stigmas. The seeds are numerous and vary in color from yellow to brown with the testa having various sculpturing and generally appearing striate with numerous pits. Studies of the pollen of sect. Spachium (Jiménez, 1973a; Clarke, 1976; present study) have shown it to be primarily trizonocolporate with a reticulate exine.

CHAPTER IV

SCANNING ELECTRON MICROSCOPY

The resolution and depth of focus that can be achieved with the scanning electron microscope have provided the taxonomist with an additional tool for the study of microscopic characters. Recent taxonomic literature is replete with numerous examples of the application of this instrument in biosystematic studies where it frequently has been used in the analysis of pollen, seed, and spore architecture, and characteristics of the leaf surface.

In the present study, the SEM was used to examine the seed and pollen architecture. The taxonomic implications of these studies are discussed under the appropriate section.

Methods

Pollen and seeds were mounted on standard SEM stubs using double-faced Scotch Tape for pollen and Tiger Tape for seeds. This latter product proved superior for seed mounts due to its thickness and increased adhesive properties. The specimens were coated with gold using a Denton model 515 vacuum chamber with a randomly rotating head and viewed with an ETEC autoscan model U-I Scanning Electron Microscope at the EM facility of the Botany Department of The University of Tennessee. The specimens cited in Table IV-1 have been deposited in the herbarium of The University of Tennessee (TENN) unless otherwise noted.

Pollen grains are frequently subjected to acetolysis prior to study with the light microscope and the SEM. While this treatment offers

TABLE IV-1

POPULATIONS OF *HYPERICUM* EXAMINED WITH SCANNING ELECTRON MICROSCOPY

Species	Subject	Voucher
H. boreale	pollen	NJ Cumberland Co.: Webb and Webb 52120 (TENN)
		NY Fulton Co.: Webb and Webb 53347 (TENN)
	seeds	IN Jasper Co.: Deam 49880 (GH)
		ME Penobscot Co.: Fernald Plantae Exsiccatae Grayanae 236 (GH)
		NJ Cape May Co.: Long 13635 (GH)
		NY Hamilton Co.: Muenscher and Clausen 4032 (GH)
		PA Luzerne Co.: Heller and Halbach s.n., 16-17 Sep 1892 (GH).
		RI Washington Co.: Fernald and Collins s.n., 30 Aug 1919 (GH)
		WS Adams Co.: Hartley and Thorne 5873 (GH)
		CANADA, New Brunswick, Westmorland Co.: Marie-Victorin, Germain, and Jacques 44653 (GH)
		CANADA, Quebec, Wolfe Co.: Pease 28510 (GH)
		CANADA, Quebec, Rolland 15930 (GH)
H. canadense	pollen	GA McDuffie Co.: Bartlett 1012 (MICH)
		NJ Burlington Co.: Webb and Webb 52128 (TENN)
		SC Colleton Co.: Webb, Rader, and Bierner 52485 (TENN)

TABLE IV-1 (continued)

Species	Subject	Voucher
	seeds	MA Hampden Co.: Bliss and Seymour 724 (SMU)
		PA Chester Co.: Pennell 8905 (NY)
		SC Bamberg Co.: Ahles 37553 (NCU)
H. cumulicola	pollen	FL Highlands Co.: Adams 586 (GA)
		FL Highlands Co.: Webb, Rader, and Bierner 52513 (TENN)
		FL Polk Co.: Lakela 24710 (SMU)
	seeds	FL Polk Co.: Lakela 24710 (SMU)
H. denticulatum var. denticulatum	pollen	NJ Burlington Co.: Webb and Webb 52127 (TENN)
		NC Onslow Co.: Webb and Whitten 53322 (TENN)
	seeds	NC Onslow Co.: Webb and Whitten 53322 (TENN)
		NC Robeson Co.: Ahles and Leisner 32999 (NCU)
		NC Scotland Co.: Sharp 2400 (NCU)
		TN Coffee Co.: Webb, Wofford, and Rader 52542 (TENN)
H. denticulatum var. acutifolium	pollen	NC Orange Co.: Webb and Whitten 53307 (TENN)
		TN Fentress Co.: Webb, Webb, and Phillippe 52093 (TENN)
	seeds	NC Alexander Co.: Radford, Bozeman, and Ramseur 45150 (NCU)
		NC Durham Co.: Ahles and Sears 59950 (NCU)

TABLE IV-1 (continued)

Species	Subject	Voucher
		SC Laurens Co.: Bell 10224 (NCU)
		SC Pickens Co.: Freeman 57857 (NCU)
		TN Morgan Co.: Webb and Webb 53302 (TENN)
H. drummondii	pollen	GA Miller Co.: Webb, Rader, and Bierner 52531 (TENN)
		MS Clarke Co.: Webb and Ross 53274 (TENN)
	seeds	IL Washington Co.: French s.n., 20 Aug 1873 (NY)
		MO Barry Co.: MacKenzie s.n., 29 Sep 1896 (NY)
		SC Dillon Co.: Ahles and Radford 37134 (NCU)
		TX Brazoria Co.: Palmer 6706 (TENN)
H. gentianoides	pollen	AL Escambia Co.: Webb and Ross 53279 (TENN)
		SC Berkeley Co.: Webb, Rader, and Bierner 52471 (TENN)
	seeds	AR Logan Co.: Demaree 22546 (NY)
		FL Lake Co.: Nash 1972 (US)
		MA Safford 261 (US)
		SC Charleston Co.: Ahles and Haesloop 37993 (NCU)
H. gymnanthum	pollen	AL Escambia Co.: Webb and Ross 53280 (TENN)
		MS Clarke Co.: Webb and Ross 53273 (TENN)

TABLE IV-1 (continued)

Species	Subject	Voucher
	seeds	AR Dallas Co.: Demaree 52552 (SMU)
		NC Pender Co.: Ahles and Haesloop 28038 (NCU)
		SC Calhoun Co.: Ahles and Haesloop 30198A (NCU)
		TX Hardin Co.: Cory 56652 (SMU)
H. incertum	pollen	FL Gadsden Co.: Webb and Ross 53290 (TENN)
		GA Calhoun Co.: Webb, Rader, and Bierner 52537 (TENN)
		GA Cook Co.: Webb and Ross 53293 (TENN)
	seeds	GA Baker Co.: Ford and Thorne s.n., 27 Aug 1946 (TENN)
		GA Calhoun Co.: Webb, Rader, and Bierner 52537 (TENN)
		GA Seminole Co.: Godfrey 63207 (NCU)
H. majus	pollen	MI Lake Co.: Voss 5272 (MICH)
		MI Schoolcraft Co.: Ehlers 4231 (MICH)
		CANADA, Quebec, Arthabaska Co.: Webb and Webb 53782 (TENN)
	seeds	ME Piscataquis Co.: Fernald 411 (GH)
		MI Ostego Co.: McVaugh 10887 (MO)
		VT Caledonia Co.: Seymour 21998 (MO)
		CANADA, Quebec, Riviere Du Loup Co.: M.-Victorin 9719 (GH)

TABLE IV-1 (continued)

Species	Subject	Voucher
H. mutilum	pollen	FL St. Johns Co.: Webb, Rader, and Bierner 52504 (TENN)
		MS Lowndes Co.: Webb and Ross 53268 (TENN)
		NY Ostego Co.: Webb and Webb 53346 (TENN)
		TN Polk Co.: Rogers and Underwood 34558 (TENN)
	seeds	AR Garland Co.: Demaree 37661 (GH)
		FL Duval Co.: Curtiss 5951 (MO)
		FL Leon Co.: Wiegand and Manning 2040 (GH)
		GA Screven Co.: Eyles 7572 (GH)
		GA Wilcox Co.: Wilbur and Webster 2708 (NY)
		KS Pottawatomie Co.: Norton 40 (GH)
		KY Bullitt Co.: Wharton 4973 (NY)
		MD Prince George Co.: Hunnewell 7096 (GH)
		MS Jackson Co.: Demaree 28295 (NY)
		MS Lincoln Co.: Webster and Wilbur 3284 (SMU)
		NY Suffolk Co.: Platt 866 (NY)
		NC Onslow Co.: Randolph and Randolph 938 (GH)
		PA Centre Co.: Wahl 377 (GH)
		TX Harrison Co.: Cory 57808 (SMU)

TABLE IV-1 (continued)

Species	Subject	Voucher
		TX Nacogdoches Co.: Cory 10670 (GH)
		VA King and Queen Co.: Fernald and Long 12741 (NY)
		VA Southampton Co.: Fernald and Long 8770 (GH)
		WV Tucker Co.: Moore 2089 (GH)
		CANADA, Quebec, Ancienne Lorette: Marie-Victorin 28371 (GH)
H. setosum	pollen	GA McIntosh Co.: Webb, Rader, and Bierner 52494 (TENN)
		NC Robeson Co.: Ahles and Leisner 33036 (NCU)
		NC Sampson Co.: Ahles and Leisner 33676 (NCU)
		SC Charleston Co.: Webb, Rader, and Bierner 52480 (TENN)
		SC Colleton Co.: Ahles and Bell 17868 (NCU)
		SC Colleton Co.: Webb, Rader, and Bierner 52486 (TENN)
	seeds	GA Cook Co.: Faircloth 4856 (GA)
		MS Jackson Co.: Demaree 33911 (US)
		NC Sampson Co.: Godfrey 6159 (US)
		NC Scotland Co.: Ahles 36955 (NCU)

certain advantages, it was not utilized in this study. Both pollen and seeds were removed from dried specimens and mounted according to the methods described above.

Pollen Grains

The pollen of several species of Hypericum has been described by a number of workers (Jiménez 1973a; Clarke 1975, 1976; Moore and Webb, 1978) and has been noted to be tricolporate or trizonocolporate in most instances. Clarke (1975) found several species of Hypericum to produce irregular grains that differed from "typical" Hypericum pollen in aperture number and configuration. These irregular grains are thought to be the result of meiotic irregularities and spatial variations among the developing grains.

As noted by Clarke (1976) and earlier workers (Erdtman et al., 1961; Khan, 1969) the pollen of the various species of Hypericum is quite similar. However, the studies of Clarke (1976) seem to indicate that it may be possible to recognize a number of distinct pollen types within the genus based on ". . . the nature of the exine sculpturing and the size and outline of the endoaperture."

In a study of the pollen of the species of Hypericum found in Europe, Clarke (1976) divided the species into four main groups based on pollen types. Three species (H. mutilum, H. majus, and H. canadense) examined in the present study (Figure IV-1 A, C, D) were included in the H. canadense pollen type by Clarke (1976). The H. canadense pollen type differs from the other pollen types primarily in exine ornamentation, a lack of sexine extensions, and the shape of the endoaperture. The other two species of the H. canadense complex, H. boreale and H.

Figure IV-1. Scanning Electron Micrographs of *Hypericum* Pollen.

A. *Hypericum mutilum* (3042 X, 18u)

B. *Hypericum boreale* (2851 X, 19u)

C. *Hypericum majus* (3042 X, 20u)

D. *Hypericum canadense* (2610 X, 21u)

E. *Hypericum gymnanthum* (2394 X, 21u)

F. *Hypericum denticulatum* var. *denticulatum* (1544 X, 29u)

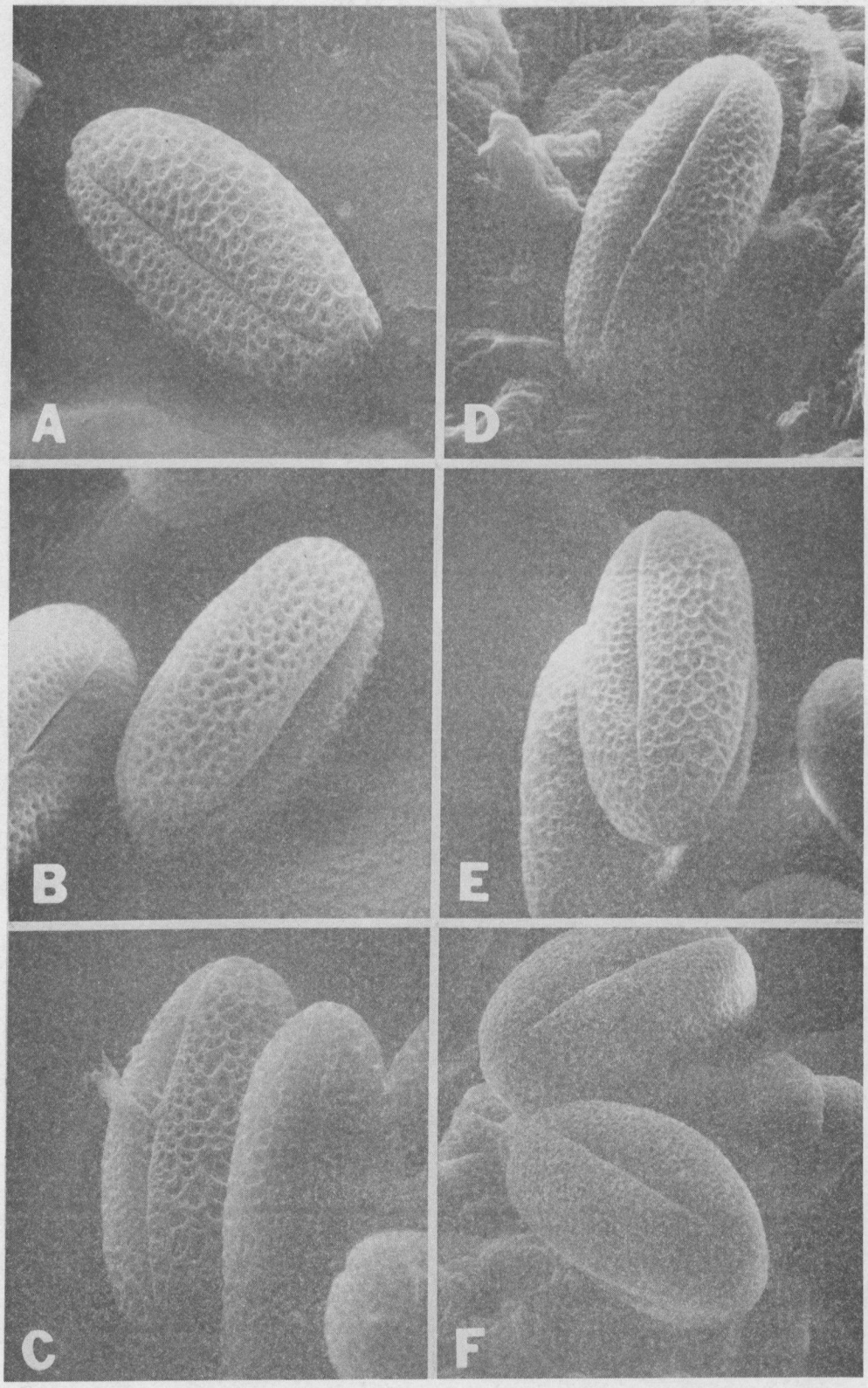


Figure IV-1

gymnanthum (Figure IV-1 B, E) are similar in size to the three species noted above and have a similar reticulate ornamentation of the exine.

The pollen of the taxa belonging to the H. denticulatum complex (Figures IV-1 F, IV-2 A, B) has a similar exine structure (e.g. reticulate), but the grains are larger in size (28u to 30u vs 18u to 24u) and more angular than the pollen from species of the H. canadense complex. The exine pattern of H. setosum (Figure IV-2 D) is similar to that observed in the two complexes mentioned above but is more similar in size (29u) to that of the H. denticulatum complex. The pollen of H. gentianoides and H. cumulicola is almost identical in size (26u) and ornamentation of the exine. The exine of these two species appears to be covered with small densely crowded pits and can be described as finely reticulate-foveate (Figures IV-2 F, IV-3 A). Though larger in size (32u) the exine ornamentation of H. drummondii is similar to that of the two species described above, but differs in having a finer reticulate-foveate exine ornamentation (Figure IV-2 C).

Two populations of H. setosum and one population of H. cumulicola were observed to have spherical pollen. Figure IV-2 E shows a typical ellipsoid pollen grain and a spherical pollen grain in the same anther of H. setosum. These spherical grains are thought to represent germinating grains or turgid grains resulting from an imbibition of water.

These studies show the pollen grains of the North American taxa of sect. Spachium to be trizonocolporate as reported by previous workers. Additionally, based on size and exine ornamentation, these species form three main groups: (1) the H. canadense complex composed of H. mutilum, H. majus, H. boreale, H. canadense, and H. gymnanthum, (2) the H. denticulatum complex composed of H. denticulatum var. denticulatum, H.

Figure IV-2. Scanning Electron Micrographs of *Hypericum* Pollen.

A. *Hypericum denticulatum* var. *acutifolium* (2115 X, 28u)

B. *Hypericum incertum* (1872 X, 30u)

C. *Hypericum drummondii* (1512 X, 32u)

D. *Hypericum setosum* (1890 X, 29u)

E. *Hypericum setosum* (1638 X)

F. *Hypericum gentianoides* (1962 X, 26u)

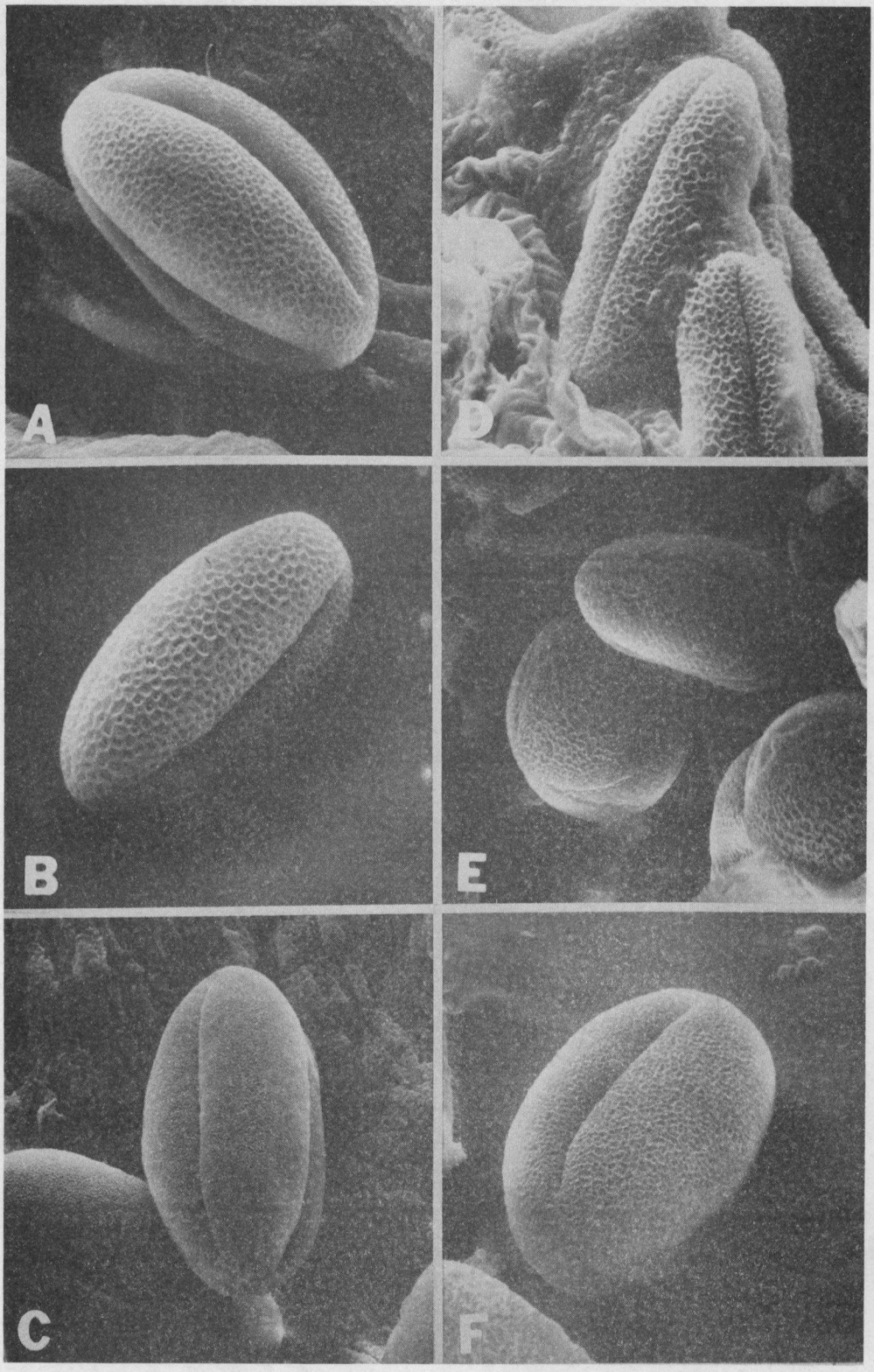


Figure IV-2

Figure IV-3. Scanning Electron Micrographs of *Hypericum* Pollen and Seeds.

A. *Hypericum cumulicola* (1962 X, 26u)

B. *Hypericum drummondii* (69 X)

C. *Hypericum drummondii* (230 X)

D. *Hypericum canadense* (151 X)

E. *Hypericum majus* (135 X)

F. *Hypericum gymnanthum* (162 X)

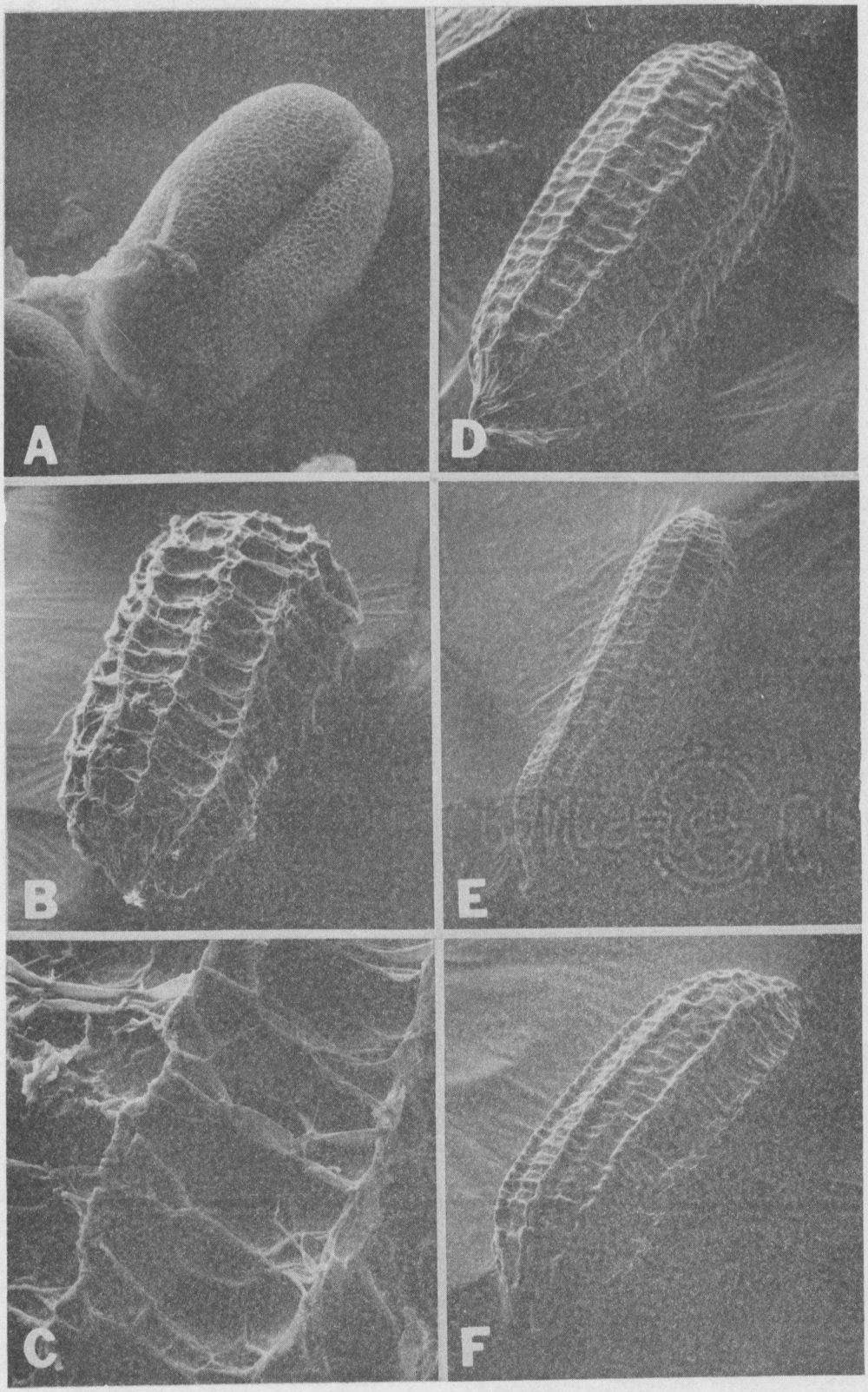


Figure IV-3

denticulatum var. acutifolium, and H. incertum in addition to H. setosum, and (3) H. gentianoides, H. cumulicola, and H. drummondii. These three main groups correspond fairly well with the presumed evolutionary lines of the eastern North American taxa belonging to sect. Spachium.

Seeds

SEM studies of the seeds of the species of sect. Spachium in eastern North America indicate three basic patterns of the seed coat. The first is illustrated by H. drummondii (Figure IV-3 B) which has pronounced longitudinal ridges or ribs and rectangular reticulations with interspaces having multi-sided and reduced secondary reticula (Figure IV-3 C). In the second type which is found in H. canadense, H. majus, H. gymnanthum, and a few populations of H. mutilum, the seeds have rounded and thickened longitudinal ribs with somewhat rectangular reticula arranged in one to two longitudinal rows between the prominent ribs (Figures IV-3 D, E, F, IV-4 A). A similar pattern is exhibited by H. gentianoides and H. setosum (Figures IV-4 B, C), although the longitudinal ribs are not as pronounced as those of H. canadense and H. gymnanthum. In the third type the longitudinal ribs are not well developed and the reticulations of the seed coat are essentially circular or rectangular in outline and arranged in distinct to weakly defined rows. In H. boreale, H. denticulatum var. denticulatum, and H. incertum the reticulations are circular in outline and form weakly defined rows (Figures IV-4 D, E, F), while in H. denticulatum var. acutifolium, H. cumulicola and some populations of H. mutilum the reticulations are more rectangular in outline and arranged in distinct rows (Figures IV-5 A, B, C). Populations of H. mutilum were also noted in which the reticulations

Figure IV-4. Scanning Electron Micrographs of *Hypericum* Seeds.

A. *Hypericum mutilum* (135 X)

B. *Hypericum gentianoides* (86 X)

C. *Hypericum setosum* (149 X)

D. *Hypericum boreale* (135 X)

E. *Hypericum incertum* (121 X)

F. *Hypericum denticulatum* var. *denticulatum* (130 X)

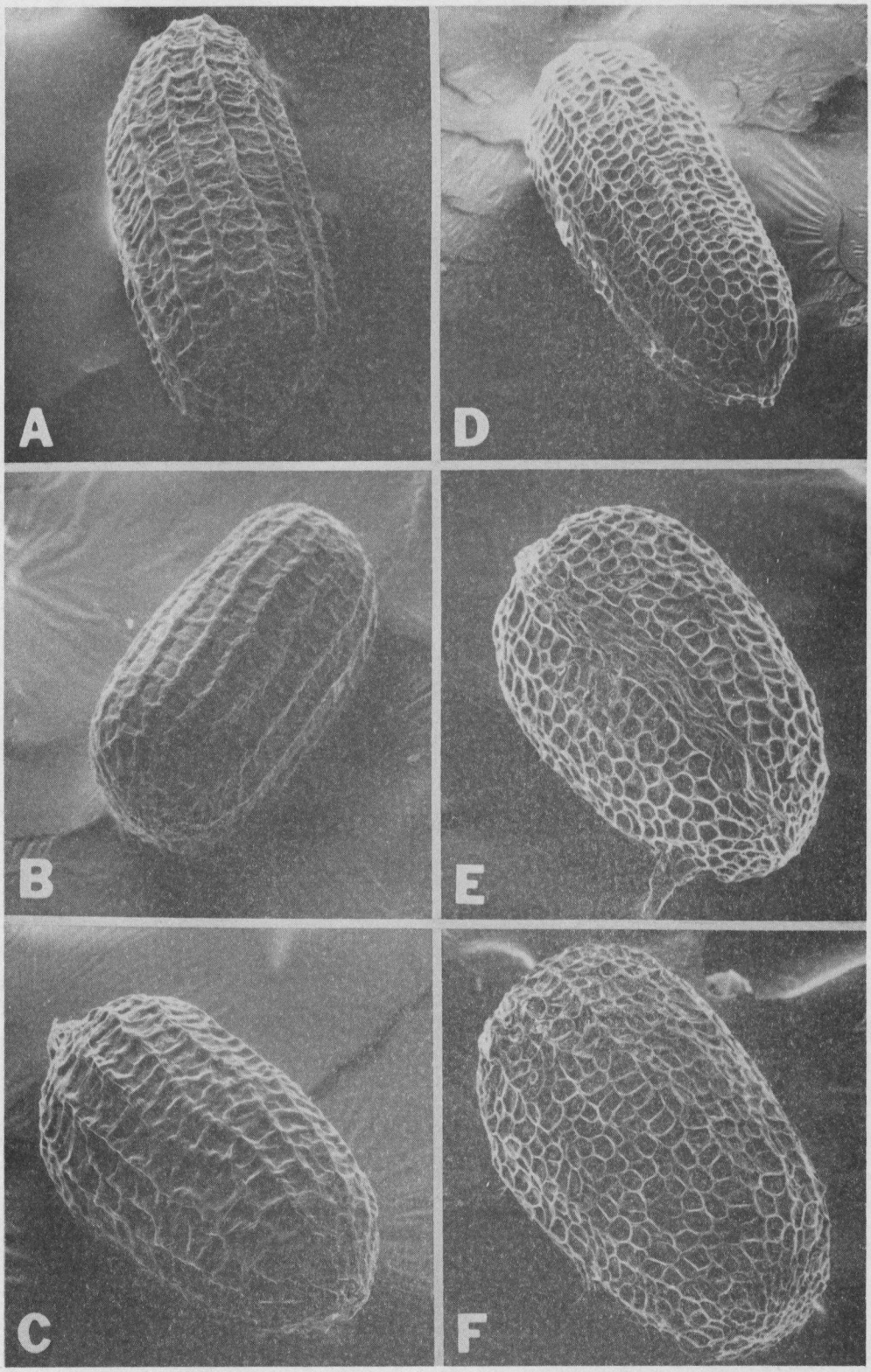


Figure IV-4

Figure IV-5. Scanning Electron Micrographs of *Hypericum* Seeds.

A. *Hypericum denticulatum* var. *acutifolium* (103 X)

B. *Hypericum cumulicola* (119 X)

C. *Hypericum mutilum* (159 X)

D. *Hypericum aphyllum* (133 X)

E. *Hypericum gentianoides* (163 X)- *Nash 1972*

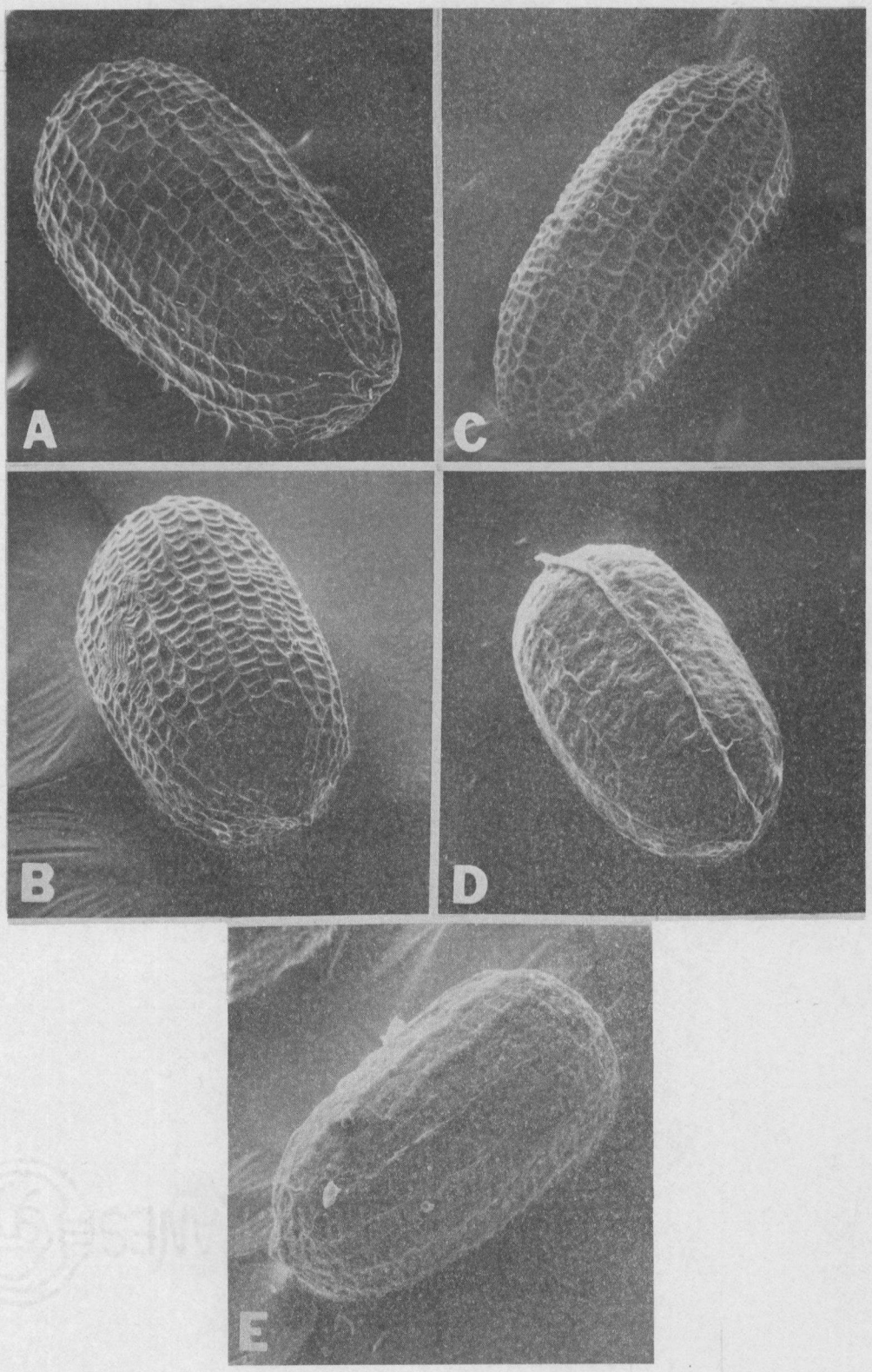


Figure IV-5

were circular but in well defined rows. In H. boreale every third row is somewhat elevated, creating a series of longitudinal furrows (Figure IV-4 D). The height of the transverse reticulations was noted to be quite variable in some taxa (e.g., H. denticulatum var. acutifolium) and in some cases greatly reduced and barely visible.

Hypericum aphyllum was described by Lundell (1943) from British Honduras and was noted to be closely related to H. gentianoides from which it differed primarily in characteristics of the seed coat. Figure IV-5 D is a seed from the isotype of H. aphyllum and Figure IV-5 E is from a population from Florida that Lundell (1943) referred to H. aphyllum. The ridges and reticulations on the seed coat of H. aphyllum are greatly reduced yet still visible. The Florida population referred to H. aphyllum by Lundell (1943) has reduced ribs and reticulations and is intermediate between H. aphyllum and H. gentianoides in the pattern of its seed coat. The SEM micrographs show a distinct difference in the seeds of H. aphyllum and H. gentianoides, but these differences are not regarded as a diagnostic character in distinguishing these two species, especially in view of the intermediate nature of the seeds of the Florida population referred to H. aphyllum. This latter population has been treated as H. gentianoides in the present study and is further discussed in Chapter IX.

SEM studies show the ornamentation of the seed coat of two of the taxa (H. denticulatum var. denticulatum and H. incertum) within the H. denticulatum complex to differ from the third taxon (H. denticulatum var. acutifolium) within the complex. This character in conjunction with differences in seed size provides a reliable means for distinguishing H. incertum from H. denticulatum var. acutifolium. As is further

discussed in Chapter IX, the gross morphological appearance of these latter two taxa is often quite similar.

With the exception of H. boreale and most populations of H. mutilum, all the other members of the H. canadense complex had similar patterns of the seed coat. The seeds of H. boreale are the most distinctive of the complex, while populations of H. mutilum were quite variable in regard to their seed ornamentation. No correlation was found to exist between the ornamentation of the seed coat and the three varieties of H. mutilum that are recognized by Fernald (1950).

CHAPTER V

FLAVONOID STUDIES

Rapid advancements in technology and instrumentation over the past two decades have simplified the identification and characterization of naturally occurring organic compounds. This has provided the systematist with an additional set of characters for the construction and refinement of classification schemes. While several groups of compounds (e.g. terpenes, alkaloids, and others) have been utilized in the systematics of higher plants, flavonoids are frequently employed because of their ubiquitous distribution, structural diversity, stability, and relative ease of identification (Harborne, 1975).

The presence of flavonoid compounds in several species of Hypericum is well documented by past workers (Bate-Smith, 1962; Hargreaves, 1966; Lebreton and Bouchez, 1967; Lebreton, 1968; Palamarchuk, 1975). A survey of the polyphenolic compounds reported for the Parietales shows flavonols to be common in the genus Hypericum while flavones are known from only a single species (Lebreton and Bouchez, 1967). According to Lebreton and Bouchez (1967) Sect. Roscyna is characterized by the presence of large quantities of kaempferol based compounds. As previously discussed in Chapter I, there is some disagreement as to whether the Hypericoideae should be given familial rank or retained as a subfamily of the Guttiferae. Lebreton and Bouchez (1967) note that the absence of flavonols and the paucity of leucoanthocyanins in the other subfamilies of the Guttiferae support the recognition of the Hypericoideae at a familial rank.

The primary emphasis of this study involved the identification and characterization of flavonoids and other phenolic compounds isolated by methods described in the following section. Preliminary checks showed intrapopulational variation to be primarily quantitative. In the absence of qualitative differences at the populational level, the major considerations of this study focused on the interpopulational differences of each taxon. All populations examined were based on personal collections (Table V-1) with voucher specimens deposited in The University of Tennessee Herbarium (TENN).

Methods

Isolation and identification of flavonoid compounds follow the techniques and procedures outlined in Mabry, Markham, and Thomas (1970). Flavonoid compounds were extracted by placing ground leaf material in 85% methanol for twenty-four hours. The extract was then spotted on Whatman 3MM chromatography paper and developed in two dimensions via descending chromatography. The chromatograms were developed in the first dimension in a solvent system (TBA) consisting of tertiary butanol, acetic acid, and water (3:1:1 v/v/v) for a period of twenty-two to forty hours, the time varying with temperature. The chromatograms were dried and developed in a second solvent system of 15% acetic acid (HOAc) for four to six hours. After drying, the color characteristics of the various spots were recorded under UV light before and after being fumed with ammonia vapor. R_f values for each compound were calculated and are recorded in Table V-2 along with color characteristics of the various compounds.

TABLE V-1

POPULATIONS OF *HYPERICUM* EXAMINED FOR FLAVONOIDS

Species	Voucher
H. boreale	ME Somerset Co.: Webb and Webb 53773
	NJ Cape May Co.: Webb and Webb 52125
	NJ Cumberland Co.: Webb and Webb 52120
	NY Fulton Co.: Webb and Webb 53347
	NY Hamilton Co.: Webb and Webb 53751
	NY Warren Co.: Webb and Webb 53753
	VT Rutland Co.: Webb and Webb 53758
H. canadense	ME Oxford Co.: Webb and Webb 53767
	MA Berkshire Co.: Webb and Webb 53787
	MA Hampshire Co.: Webb and Webb 53788
	NH Coos Co.: Webb and Webb 53761
	NJ Burlington Co.: Webb and Webb 52128
	NJ Cumberland Co.: Webb and Webb 52118
	NY Clinton Co.: Webb and Webb 53785
	NY Hamilton Co.: Webb and Webb 53350
	NC Gates Co.: Webb and Whitten 53316
	NC Onslow Co.: Webb and Whitten 53326
	SC Colleton Co.: Webb, Rader, and Bierner 52485
	VA Ammamack Co.: Webb and Webb 52112
	VA Prince George Co.: Webb and Webb 52101
H. cumulicola	FL Highlands Co.: Webb, Rader, and Bierner 52513

TABLE V-1 (continued)

Species	Voucher
H. denticulatum var. denticulatum	NJ Burlington Co.: Webb and Webb 52127
	NC Lenoir Co.: Webb and Whitten 53332
	NC Onslow Co.: Webb and Whitten 53322
	NC Onslow Co.: Webb and Whitten 53328
	SC Berkeley Co.: Webb, Rader, and Bierner 52469
	SC Lee Co.: Webb, Rader, and Bierner 52458
	SC Williamsburg Co.: Webb, Rader, and Bierner 52467
	TN Coffee Co.: Webb and Webb 52081
H. denticulatum var. acutifolium	AL Blount Co.: Webb 53267
	NC Alexander Co.: Webb and Whitten 53305
	NC Orange Co.: Webb and Whitten 53307
	NC Person Co.: Webb and Whitten 53308
	TN Bledsoe Co.: Webb and Webb 52080
	TN Carroll Co.: Webb 52072
	TN Fentress Co.: Webb, Webb, and Phillippe 52093
	TN Morgan Co.: Webb and Webb 53302
H. drummondii	AL Choctaw Co.: Webb and Ross 53271
	AL Escambia Co.: Webb and Ross 53282
	GA Miller Co.: Webb, Rader, and Bierner 52531
	MS Clarke Co.: Webb and Ross 53274
	SC Berkeley Co.: Webb, Rader, and Bierner 52472
	SC Williamsburg Co.: Webb, Rader, and Bierner 52464

TABLE V-1 (continued)

Species	Voucher
	TN Dickson Co.: Webb 52074
	TN Henry Co.: Webb 1073
	TN Henry Co.: Webb and Webb 53263
H. gentianoides	AL Escambia Co.: Webb and Ross 53279
	FL Alachua Co.: Webb, Rader, and Bierner 52518
	GA Baker Co.: Webb, Rader, and Bierner 52530
	MD Worchester Co.: Webb and Webb 52117
	MS Clarke Co.: Webb and Ross 53277
	NJ Atlantic Co.: Webb and Webb 52130
	NC Onslow Co.: Webb and Whitten 53329
	SC Colleton Co.: Webb, Rader, and Bierner 52487
	VA Prince George Co.: Webb and Webb 52100
	TN Henry Co.: Webb 1074
H. gymnanthum	AL Cherokee Co.: Webb 53264
	AL Escambia Co.: Webb and Ross 53280
	GA Early Co.: Webb and Ross 53285
	MS Clarke Co.: Webb and Ross 53273
	NC Gates Co.: Webb and Whitten 53315
	TN Franklin Co.: Webb and Webb 52084
	VA Sussex Co.: Webb and Webb 52105
H. incertum	FL Gadsden Co.: Webb and Ross 53289
	FL Gadsden Co.: Webb and Ross 53290

TABLE V-1 (continued)

Species	Voucher
	GA Calhoun Co.: Webb and Ross 53299
	GA Calhoun Co.: Webb, Rader, and Bierner 52537
	GA Cook Co.: Webb and Ross 53293
	GA Dougherty Co.: Webb and Ross 53298
	GA Early Co.: Webb and Ross 53284
	GA Thomas Co.: Webb and Ross 53295
H. majus	CANADA, Quebec, Arthabaska Co.: Webb and Webb 53782
	CANADA, Quebec, Beauce Co.: Webb and Webb 53778
	CANADA, Quebec, Frontenac Co.: Webb and Webb 53777
	ME Franklin Co.: Webb and Webb 53768
	ME Somerset Co.: Webb and Webb 53772
	NH Coos Co.: Webb and Webb 53764
	VT Caledonia Co.: Webb and Webb 53762
	VT Washington Co.: Webb and Webb 53760
H. mutilum	AL Escambia Co.: Webb and Ross 53281
	FL Hernando Co.: Webb, Bierner, and Rader 52515
	FL Jefferson Co.: Webb, Bierner, and Rader 52523
	FL St. John's Co.: Webb, Bierner, and Rader 52504
	GA Early Co.: Webb and Ross 53286
	ME Franklin Co.: Webb and Webb 53771
	MD Washington Co.: Webb and Webb 53340
	MS Lowndes Co.: Webb and Ross 53268

TABLE V-1 (continued)

Species	Voucher
	NY Fulton Co.: Webb and Webb 53348
	NY Ostego Co.: Webb and Webb 53346
	NY Washington Co.: Webb and Webb 53757
	NC Alamance Co.: Webb and Whitten 53306
	NC Onslow Co.: Webb and Whitten 53325
	PA York Co.: Webb and Webb 53342
	TN Henry Co.: Webb and Webb 52051
	SC Jasper Co.: Webb, Rader, and Bierner 52489
	VT Rutland Co.: Webb and Webb 53759
	VA Bath Co.: Webb and Webb 53338
	VA King and Queen Co.: Webb and Webb 52099
	WV Monroe Co.: Webb and Webb 53337
	CANADA, Quebec, Arthabaska Co.: Webb and Webb 53783
	CANADA, Quebec, Wolf Co.: Webb and Webb 53781
H. setosum	AL Escambia Co.: Webb and Ross 53283
	FL Duval Co.: Webb, Rader, and Bierner 52502
	GA Brooks Co.: Webb and Ross 53294
	GA McIntosh Co.: Webb, Bierner, and Rader 52494
	NC Duplin Co.: Webb and Whitten 53331
	NC Lenoir Co.: Webb and Whitten 53334
	SC Berkeley Co.: Webb, Bierner, and Rader 52473
	SC Charleston Co.: Webb, Bierner, and Rader 52475

TABLE V-1 (continued)

Species	Voucher
	SC Charleston Co.: Webb, Bierner, and Rader 52480
Putative Hybrids	
H. canadense x H. majus	
	NY Clinton Co.: Webb and Webb 53786
H. mutilum x H. majus	
	NY Washington Co.: Webb and Webb 53755
H. mutilum x H. canadense	
	NC Onslow Co.: Webb and Whitten 53327

TABLE V-2

IDENTITY AND CHROMATOGRAPHIC PROPERTIES OF THE FLAVONOIDS OF HYPERICUM

	Identity	Color[a] U.V.	Color[a] NH_3	Rf Values TBA	Rf Values HOAC
1A.	Luteolin 7-O-glucoside	P	Y	.29	.13
1B.	Orientin	P	YGr	.23	.14
2.	Vitexin	P	YGr	.40	.25
3.	Isovitexin	P	YGr	.50	.54
4.	Kaempferol 3-O-glucoside	P	Y	.66	.47
6.	Unknown	Pk	YOr	.51	.24
7.	Quercetin 3-O-glucuronide	P	YGr	.35	.42
9.	Quercetin 3-O-arabinoside	P	YGr	.64	.35
11.	Quercetin 3-O-rhamnoside	P	YGr	.67	.50
12.	Quercetin 3-O-rhamnoglucoside	P	Y	.34	.56
13.	Quercetin 3-O-galactoglucoside*	P	YGr	.48	.54
15A.	Quercetin 3-O-glucoside	P	YGr	.52	.39
15B.	Quercetin 3-O-galactoside	P	YGr	.46	.39
16.	Iso-orientin	P	YGr	.34	.38

TABLE V-2 (continued)

	Identity	Color[a] U.V.	Color[a] NH_3	Rf Values TBA	Rf Values HOAC
18.	Unknown	P	Y	.30	.31
20.	Unknown	P	Br	.56	.76
31.	Quercetin	Y	Y	.56	.02
33.	Unknown (Kaempferol?)	Y	Y	.76	.01
41.	Unknown	fBl	fBlGr	.48	.73
42.	Unknown	fBl	fBlGr	.58	.76
43.	Unknown	fBl	fBlGr	.73	.71
45.	Unknown	I	Bl	.72	.85
46.	Unknown	P	dkP	.91	.74

[a]P = purple Y = yellow Gr = green Pk = pink

Or = orange Br = brown Bl = blue

dk = dark f = flourescent I = invisible

* Order of sugars undetermined

For spectral analysis, compounds were eluted from the chromatographic paper by cutting individual spots into small pieces and washing them in 100% methanol. After being washed for two to three minutes the solution was filtered into a round bottom flask and the procedure repeated two additional times. A rotary vacuum evaporator was then used to remove the solvent. The compound was then dissolved in spectral grade methanol and examined using a Coleman 124 scanning spectrophotometer. After obtaining a reference spectrum of the unknown compound in spectral methanol (MeOH), five additional spectra were obtained utilizing the following diagnostic reagents: MeOH/NaOMe, MeOH/$AlCl_3$, MeOH/$AlCl_3$/HCl, MeOH/NaOAc, and MeOH/NaOAc/H_3BO_3 (Table V-3). With the exception of using fused sodium acetate in the sodium acetate spectral curve, the procedures employed for spectral analysis are those of Mabry, Markham, and Thomas (1970).

The six resulting spectra for each compound were analyzed for shifts in absorption maxima of the various peaks and/or shoulders and changes in the shape of the spectral curves. From these data the base compounds (e.g. quercetin, kaempferol, luteolin, apigenin) and the position(s) of the attached sugar(s) were determined (Figure V-1).

Following spectral analysis, compounds were refluxed in 6% HCl for one hour at 70°C in order to remove O-glycosyls from their flavonoid skeleton. This procedure also proved useful in verifying the presence of C-glycosides because C_6 or C_8 C-glycosyl flavonoids interconvert to form a mixture of the C_6 and C_8 C-glycosyl isomers. After refluxing, the aglycone and sugar moiety were separated in a two phase system consisting of water and ethyl acetate with the sugar dissolving in the water and the aglycone in the ethyl acetate. Following separation,

TABLE V-3

ABSORPTION MAXIMA (nm) OF THE FLAVONOIDS OF HYPERICUM

	MeOH	NaOMe	$AlCl_3$	$AlCl_3$/HCl	NaOAc	NaOAc/H_3BO_3
1A.	253, 267sh, 349	266, 302sh, 399	273, 298sh, 326, 426	272, 296sh, 360, 388	258, 265sh, 403	258, 372
1B.	256, 266, 291sh, 349	271, 331sh, 408	274, 304sh, 329, 423	266sh, 275, 296sh, 358, 384	272, 326sh, 396	265, 375, 429sh
2.	269, 299sh, 331	280, 325, 394	276, 304, 347, 384	276, 303, 343, 383	277, 310sh, 388	270, 325sh, 341
3.	272, 333	278, 327, 397	261sh, 278, 302, 350, 383	261sh, 279, 300, 344, 379	278, 312sh, 333, 394	273, 307sh, 341, 408sh
4.	265, 291, 351	274, 325, 400	273, 302, 346, 400	274, 301sh, 345, 396	273, 305sh, 378	265, 294sh, 353
6.	269sh, 309, 357	300sh, 340sh, 381	279sh, 338, 398	278sh, 333, 398	265, 300, 376	252sh, 311, 359, 410
7.	256, 265sh, 300sh, 360	272, 329, 406	271, 304sh, 418	269, 298, 364, 402	272, 324, 391	261, 297sh, 377
9.	256, 265sh, 299sh, 357	271, 328, 405	274, 304sh, 328, 434	268, 298sh, 360, 400	272, 323, 386	261, 302sh, 374

TABLE V-3 (continued)

	MeOH	NaOMe	$AlCl_3$	$AlCl_3$/HCl	NaOAc	NaOAc/H_3BO_3
11.	256, 265sh, 300sh, 351	270, 327, 394	274, 304sh, 329, 431	271, 298sh, 357, 400	271, 324 388	260, 300sh, 369
12.	256, 266sh, 297sh, 360	271, 325sh, 413	274, 304sh, 327sh, 434	268, 299sh, 363sh, 402	272, 321 398	261, 294sh, 381
13.	256, 267sh, 297sh, 360	272, 326, 411	274, 308sh, 329sh, 432	267, 297, 365sh, 401	273, 323, 390	262, 300sh, 380
15A.	256, 267sh, 299sh, 359	273, 327 410	273, 304sh, 328sh, 433	268, 298sh, 364sh, 401	272, 323, 392	261, 300sh, 379
15B.	257, 265sh, 302sh, 362	272, 326, 409	275, 302sh, 326sh, 435	269, 299sh, 364sh, 403	268, 328, 384	260, 296sh, 376
16.	242sh, 258, 271, 349	270, 276sh, 337sh, 408	276, 303sh, 330, 423	266sh, 278, 297sh, 363, 385	270, 330sh, 394	266, 379, 430sh
18.	252, 262sh, 299sh, 364	272, 324, 431	270, 312, 348sh, 425	272, 306sh, 357sh, 406	270, 321, 390	259, 300sh, 384
20.	285, 329sh	241, 288, 363	311, 387	290sh, 309, 383	287, 333sh	287, 336sh
31.	255, 268sh, 296sh, 371	248sh, 296sh, 331	272, 303sh, 327sh, 455	265, 301sh, 360, 429	257sh, 273, 327, 392	259, 300sh, 388

TABLE V-3 (continued)

	MeOH	NaOMe	$AlCl_3$	$AlCl_3$/HCl	NaOAc	NaOAc/H_3BO_3
33.	319sh, 362	306sh, 345, 422	340sh, 420			
41.	244sh, 298sh, 327	259, 308, 374	224sh, 258, 310sh, 360	243sh, 300sh, 328	251, 302sh, 346	252, 302sh, 350
42.	249sh, 299sh, 316	259sh, 309sh, 365	269, 314, 371	250sh, 319	252sh, 300sh, 319	254sh, 309sh 345
43.	251sh, 293, 327	274sh, 308, 376	260sh, 313sh, 362	252sh, 299sh, 329	273, 332	255sh, 299, 350
45.	298sh, 310	244sh, 310sh, 359	300sh, 311	300sh, 311	300sh, 311, 365sh	298sh, 310
46.	304	270sh, 347	253sh, 283 334	250, 319	348sh, 346	307

Figure V-1. Structures of the Elucidated Flavonoids of *Hypericum* Sect. *Spachium* in Eastern North America.

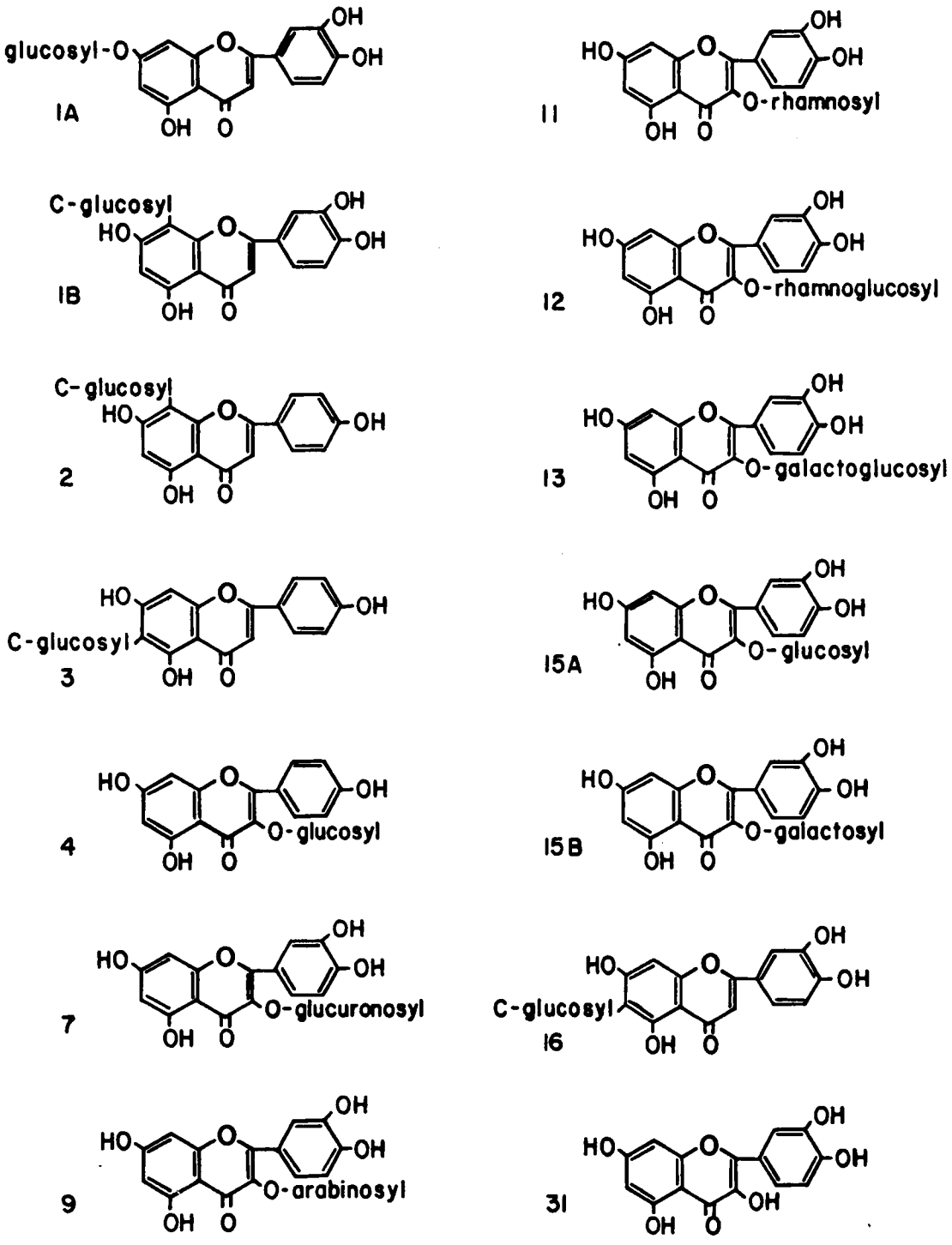

glucosyl-O
OH
OH
O
OH
O
1A
C-glucosyl
HO
OH
OH
O
OH
1B
C-glucosyl
HO
OH
O
OH
2
HO
O
OH
C-glucosyl
OH
O
3
HO
O
OH
O-glucosyl
OH
O
4
HO
OH
OH
O-glucuronosyl
OH
O
7
HO
OH
OH
O-arabinosyl
OH
O
9
HO
OH
OH
O-rhamnosyl
OH
O
11
HO
OH
OH
O-rhamnoglucosyl
OH
O
12
HO
OH
OH
O-galactoglucosyl
OH
O
13
HO
OH
OH
O-glucosyl
OH
O
15A
HO
OH
OH
O-galactosyl
OH
O
15B
HO
OH
OH
C-glucosyl
OH
O
16
HO
OH
OH
OH
OH
O
31

Figure V-1

both fractions were dried using a rotary vacuum evaporator. The agylcone was spotted on 3MM chromatography paper and developed in two dimensions as previously described. R_f values, color characteristics, and spectral properties of the aglycone were noted to substantiate identification based on spectral properties of the intact flavonoid compound.

A volatile trimethysilyl (TMS) derivative of the sugar was made by adding 0.5 ml. of TRISIL (Pierce Chemical Company) to the sugar moiety. The sugar was then identified with a Bendix 2600 gas-liquid chromatograph by comparing retention time(s) of the unknown sugar(s) with that (those) of known sugar(s).

Discussion

A composite chromatographic profile of the species of Hypericum examined during this study is shown in Figure V-2. Fourteen compounds were identified and spectral data were obtained for an additional nine compounds (Table V-3). The identified compounds were found to be based on quercetin, kaempferol, luteolin, and apigenin. Both O-linked and C-linked sugars occurred in the taxa investigated. Three of the nine unidentified compounds (e.g. 41, 42, 43) were fluorescent blue under UV light and are suspected to be phenolic acids. The unknown compounds were included in the profiles of the various taxa only if their distinctness could be verified by spectral data. It is felt that by following this procedure, comparisons on a taxon to taxon and populational basis would have more validity.

The profile of each taxon is presented accompanied by a discussion of the compounds present, interpopulational variation, and the taxonomic significance of selected compounds. Problems associated with the elucidation of specific compounds are also discussed.

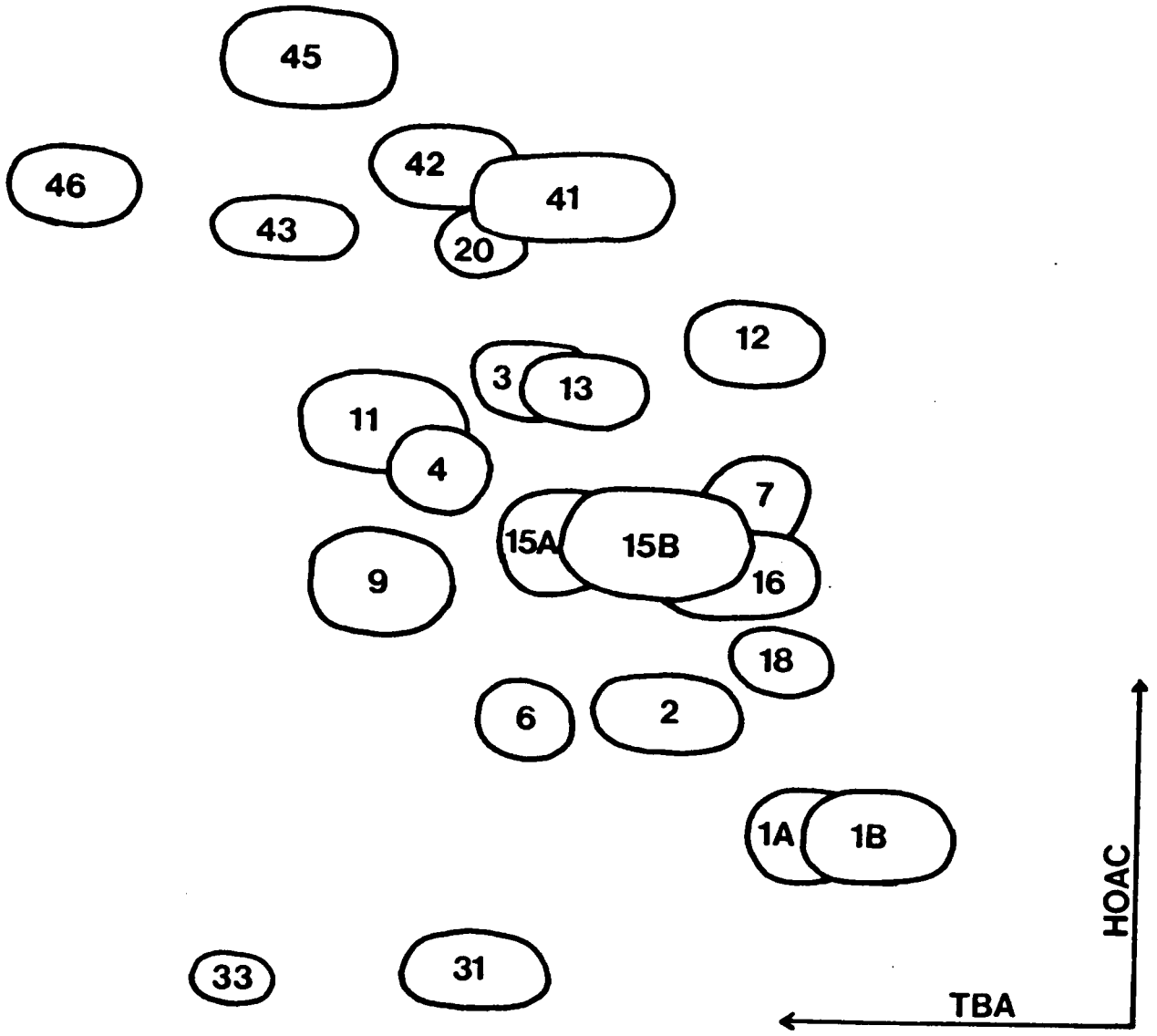


Figure V-2. A Composite Chromatogram of the Eastern North American Species of Hypericum Sect. Spachium.

H. boreale. The seven populations examined during this study had constant profiles and contained compounds 4, 7, 15A, 15B, 31, 41, and 45 (Figure V-3 A). The presence of compound 4, kaempferol 3-O glucoside, distinguishes H. boreale from all other taxa within the H. canadense complex. All other members of the complex lack compound 4 but contain compound 11 (quercetin 3-O-rhamnoside), which has a similar R_f to that of compound 4. However, the two compounds are readily distinguishable on the basis of spectral data.

Compounds 15A and 15B have similar R_f values and spectral properties; therefore, some difficulties were encountered in determining the presence of one or both of these compounds. Spectral analysis indicated them to be quercetin compounds with a substitution at the 3 position. Furthermore, their chromatographic positions indicated them to be monoglycosides. Sugar analysis led to their identification as quercetin 3-O-glucoside (15A) and quercetin 3-O-galactoside (15B). The presence of one or both of these compounds could be verified only by acid hydrolysis of the spots followed by sugar analysis. Compound 7 (quercetin 3-O-glucuronide) also frequently overlapped with compounds 15A and 15B, but its presence also could be documented by sugar analysis.

H. canadense. Thirteen populations of H. canadense ranging from Maine to South Carolina were sampled. Compounds 7, 11, 15A, 41, and 45 were present in all thirteen populations examined, with compound 31 occurring in twelve of these populations (Figure V-3 B). The latter compound is extremely weak in most populations of H. canadense. Depauperate individuals of the species, which have been designated H. canadense var. minimum, had profiles identical to the more typical individuals of the species.

Figure V-3. Chromatographic Profiles of *Hypericum* Species.

A. *Hypericum boreale*

B. *Hypericum canadense*

C. *Hypericum gymnanthum*

D. *Hypericum majus*

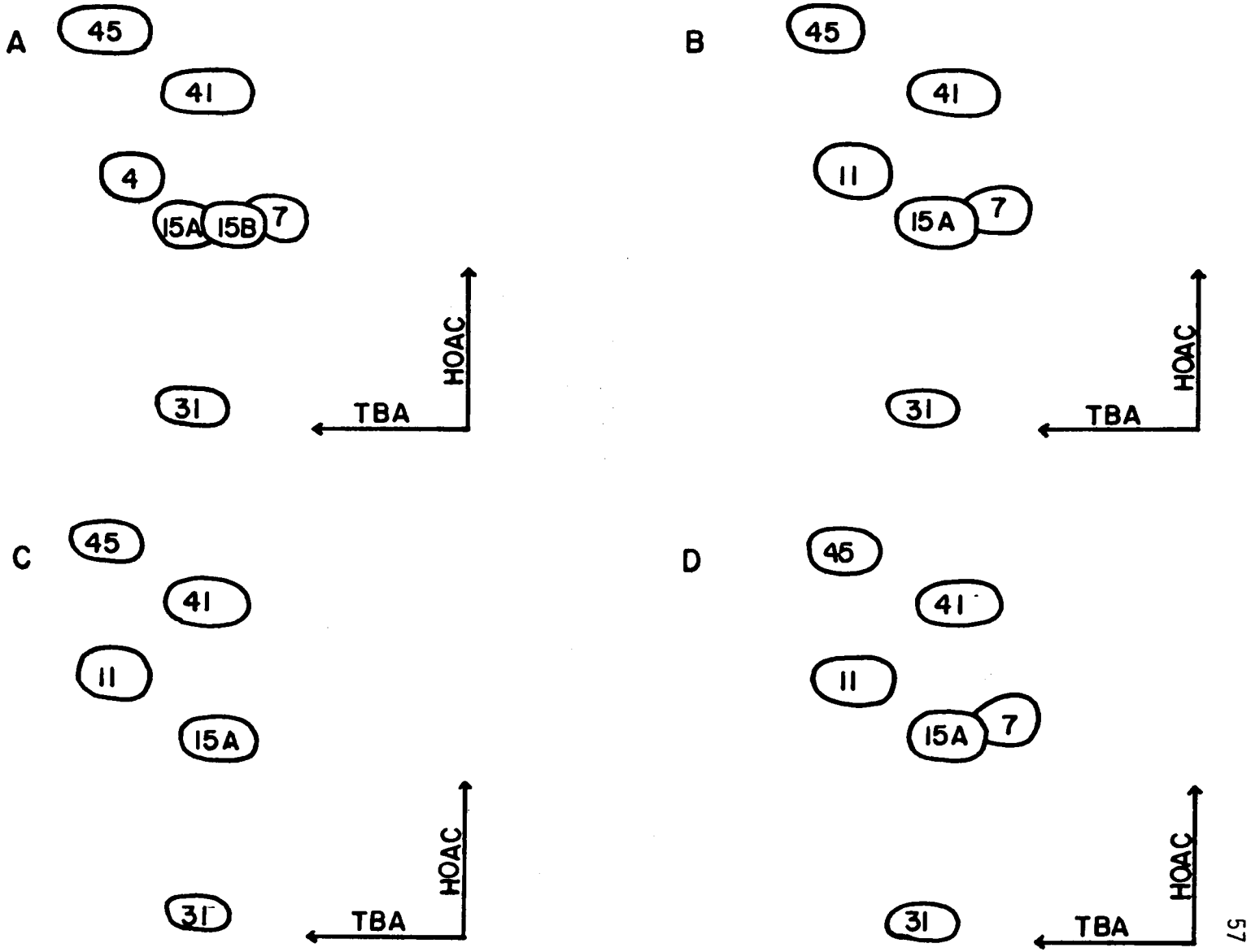

A
45
41
4
15A
15B
7
31
TBA
HOAC
B
45
41
11
15A
7
31
TBA
HOAC
C
45
41
11
15A
31
TBA
HOAC
D
45
41
11
15A
7
31
TBA
HOAC

Figure V-3

H. gymnanthum. Seven populations of H. gymnanthum were sampled. All populations were found to contain compounds 11, 31, 41, and 45 (Figure V-3 C). Compound 15A was lacking in a single population with its intensity being quite variable in the six populations in which it was found to occur.

H. majus. A comparison of the composite profile of the nine populations of H. majus (Figure V-3 D) with that of H. canadense (Figure V-3 B) shows them to be identical. All populations of H. majus examined contained compounds 7, 11, 31, 41, and 45 with compound 15A being represented in only 56% of the populations examined. This species and H. canadense are closely related; a fact reflected by the identical nature of their composite profiles.

H. mutilum. This is the most common and widespread of the species investigated during this study. In an effort to determine whether there is any chemical basis for recognizing the three varieties treated by Fernald (1950), twenty-two populations were sampled from throughout much of the range of the species in eastern North America.

Compounds 11, 31, 41, and 45 were found to be present in all populations examined (Figure V-4 A). Four populations (three from Florida and one from South Carolina) were found to lack compounds 15A and 15B. Two of these populations also had a very faint spot that had similar R_f values to compound 7. However, the spot was too weak to allow spectral analysis and its identity is unknown. The four populations lacking compounds 15A and 15B are referable to H. mutilum var. latisepalum. However, one population from southern Georgia, which is also referable to this variety, was found to contain compounds 15A and 15B. A number of populations from the Coastal Plain as well as some populations from

Figure V-4. Chromatographic Profiles of *Hypericum* Species.

A. *Hypericum mutilum*

B. *Hypericum incertum*

C. *Hypericum denticulatum* var. *denticulatum*

D. *Hypericum denticulatum* var. *acutifolium*

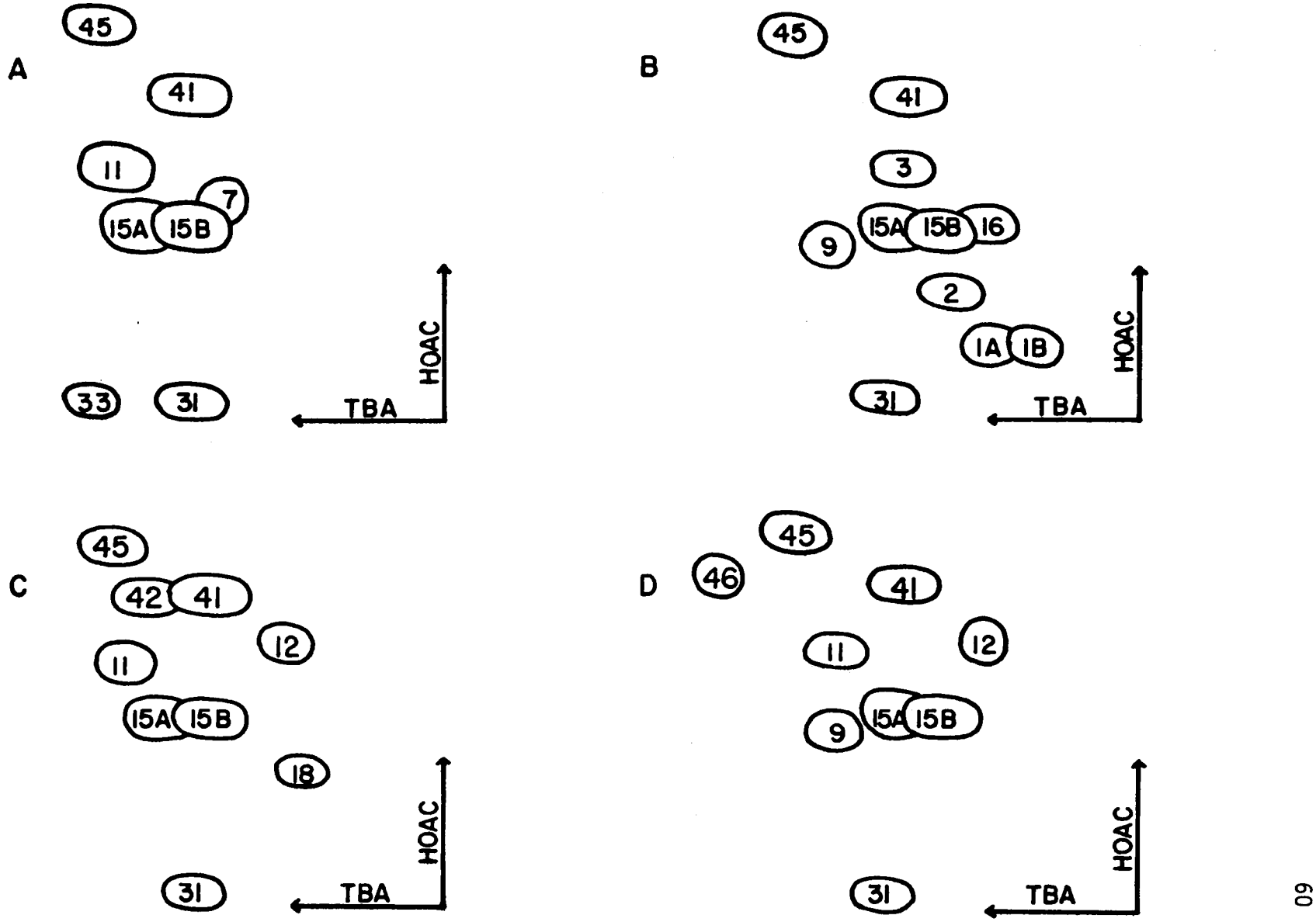

A
45
41
11
7
15A
15B
33
31
HOAC
TBA
B
45
41
3
15A
15B
16
9
2
1A
1B
31
HOAC
TBA
C
45
42
41
12
11
15A
15B
18
31
HOAC
TBA
D
45
46
41
11
12
9
15A
15B
31
HOAC
TBA

Figure V-4

the interior provinces of the eastern United States were noted to contain compounds 15A and 15B in very small quantities. Three populations of H. mutilum from the northeastern United States were found to contain compound 7. A possible explanation for the occurrence of this compound is discussed in the portion of this chapter dealing with hybridization. Compound 33, which may possibly be kaempferol, occurred in eleven populations. The identification of this compound was based on its R_f values and limited spectral data. Therefore, its identification should be considered as tentative. Although some chemical differences were noted between H. mutilum var. latisepalum and the two other varieties recognized by Fernald (1950), it was concluded that the differences do not support recognition of three taxa at the varietal level.

Hybrids can frequently be documented by flavonoid studies because the F_1 plants often exhibit a profile that is additive of that of the two parent species. Several earlier workers (Fernald, 1950; Utech and Iltis, 1970) have noted that hybridization occurs between members of the H. canadense complex (e.g. H. boreale, H. canadense, H. gymnanthum, H. majus, and H. mutilum). Although the species comprising the complex are relatively similar in their flavonoid composition (Table V-4), a few populations were examined in which the profiles of the putative hybrids seemed to indicate hybridization between recognized species.

One population from Washington County, New York, consisted of H. majus, H. mutilum, an occasional H. boreale, and a large number of individuals that morphologically appeared to be hybrids between H. mutilum and H. majus. The putative hybrids contained compounds 7, 11, 15A, 15B, 41, and 45. As noted in Table V-4, H. majus lacks compound

TABLE V-4

FLAVONOIDS OF THE H. CANADENSE COMPLEX

Taxon	Compound								
	Kaempferol-3-O-glucoside #4	Quercetin-3-O-glucuronide #7	Quercetin 3-O-rhamnoside #11	Quercetin 3-O-glucoside #15A	Quercetin-3-O-galactoside #15B	Quercetin #31	Unknown (Kaempferol?) #33	Unknown #41	Unknown #45
H. boreale	X	X		X	X	X		X	X
H. canadense		X	X	X		X^a		X	X
H. gymnanthum			X	X^a		X		X	X
H. majus		X	X	X^b		X		X	X
H. mutilum		+	X	X^a	X^a	X	X^b	X	X

X - present in 100% of populations examined
X^a - present in greater than 60% of populations examined
X^b - present in less than 60% of populations examined
\+ - the three populations of H. mutilum having this compound were growing sympatrically with either H. boreale or H. majus

15B, while H. mutilum commonly contains this compound. The hybrid nature of the intermediate plants is supported by the presence of compound 15B in these individuals.

Plants referable to H. mutilum collected from the same population were found to contain compound 7. This possibly suggests gene flow from H. majus. Compound 7 was also noted in populations of H. mutilum from Rutland County, Vermont, and Fulton County, New York. In both instances H. mutilum and H. boreale were found to be growing sympatrically, and the presence of compound 7 in these plants of H. mutilum possibly represents gene flow between the two species.

Another population from Onslow County, North Carolina, contained H. mutilum, H. canadense, and individuals thought to represent hybrids between the two species. Hypericum mutilum from this locality lacked compound 7, while H. canadense and the putative hybrids contained this compound.

H. incertum. Eight populations of this taxon were studied from northern Florida and southern Georgia. Compounds 1A, 1B, 2, 3, 9, 15A, 15B, and 41 were found to be present in 100% of the populations examined, while compound 16 occurred in three populations, compound 31 in five populations, and compound 45 in six populations (Figure V-4 B).

This taxon was found to have the greatest number of identifiable flavonoid compounds in addition to having compounds with the greatest structural diversity. Hypericum incertum contained both flavonols and flavones. Of particular interest is the presence of C-glycosyl linkages associated with the two flavones (luteolin and apigenin). Identification of the C-glycosyl is somewhat complicated by the failure of acid hydrolysis to remove C-linked sugars. Acid hydrolysis of a

compound with a C-linked sugar at either the 6 or 8 position results in a mixture of the C_6 and C_8 isomers. This isomerization was observed following acid hydrolysis of compounds 1A, 16, 2, and 3. Spectral data and R_f values indicated that glucose was most likely the substituted sugar in the four compounds mentioned above. Thus, compounds 1A, 16, 2, and 3 are thought to be orientin, iso-orientin, vitexin, and isovitexin respectively.

Most of the other compounds identified in this taxon were quercetin 3-O-monoglycosides. An exception was compound 1B, which was identified as luteolin 7-O-glucoside. This latter compound overlapped extensively with compound 1A and may partially explain why compound 1B had a lower R_f in TBA than that reported by Mabry, Markham, and Thomas (1970) and Averett (1977).

H. denticulatum var. denticulatum. A total of eight populations from Tennessee, South Carolina, North Carolina, and New Jersey were sampled. Compounds 11, 15A, 15B, 18, 41, and 42 were found in all populations examined while compound 12 and 45 occurred in seven populations and compound 31 in five populations (Figure V-4 C). One purple compound was found to have a R_f similar to that reported for luteolin 7-O-glucoside but is not included in the composite profile of H. denticulatum var. denticulatum because it was too weak for spectral analysis.

H. denticulatum var. acutifolium. All eight populations sampled were found to contain compounds 9, 15A, 15B, 31, 41, and 45 with seven populations containing compound 46 (Figure V-4 D). Two spots, thought to represent compounds 11 and 12, were found in more than half of the populations examined. Due to the weak nature of the latter two compounds, only limited spectral data were obtained for either spot. A

sugar analysis showed the spot suspected of being compound 12 to have both rhamnose and glucose. The spot was concluded to be quercetin 3-O-rhamnoglucoside (compound 12) based on sugar analysis and an R_f value similar to that obtained for compound 12 in H. denticulatum var. denticulatum. The sugar analysis of the spot suspected of being compound 11 was inconclusive and is inferred to be compound 11 primarily on the basis of its R_f value.

The flavonoid chemistry in conjunction with other data supports the recognition of three taxa within the H. denticulatum complex. Chemically, H. incertum is the most distinctive taxon and was found to contain flavones with C-linked sugars (orientin, iso-orientin, vitexin, and isovitexin) in addition to compound 1A, all of which were absent from the other two taxa (H. denticulatum var. denticulatum and H. denticulatum var. acutifolium) within the complex (Table V-5).

As is further discussed in Chapter IX, plants with lanceolate leaves from western North Carolina have previously been included in the same taxon (i.e. H. denticulatum var. acutifolium) as plants from southern Georgia and the Florida panhandle. These latter populations have in the present study been included in H. incertum. One population from western North Carolina (Alexander County) that morphologically resembled the Georgia and Florida populations of H. incertum lacked compounds (1A, 1B, 2, 3, and 16) characteristic of H. incertum. This supports the present treatment in which populations from the interior physiographic provinces with lanceolate leaves are separated from those of the coastal plain of South Carolina, southern Georgia, and northern Florida.

A paired affinity index calculated according to the formula presented by Radford et al. (1974) shows H. denticulatum var. denticulatum

TABLE V-5

FLAVONOIDS OF SOME SPECIES OF HYPERICUM SECT. SPACHIUM

Taxon	Compound																				
	Luteolin 7-O-glucoside #1A	Orientin #1B	Vitexin #2	Isovitexin #3	Unknown #6	Quercetin 3-O-glucuronide #7	Quercetin 3-O-arabinoside	Quercetin 3-O-rhamnoside #11	Quercetin 3-O-rhamnogluc-oside #12	Quercetin 3-O-galactogluc-oside #13	Quercetin 3-O-galactogluc-oside #15A	Quercetin-3-O-glucoside #15B	Quercetin 3-O-galacto-side #16	Iso-orientin	Unknown #18	Unknown #20	Quercetin #31	Unknown #41	Unknown #42	Unknown #43	Unknown #45	Unknown #46
H. incertum	X	X	X	X			X					X	X	X^b			X^a	X			X	
H. denticulatum var. denticulatum								X	X^a			X	X		X		X^a	X	X		X^a	
H. denticulatum var. acutifolium							X	X^c	X^b			X	X				X	X			X	X^a
H. setosum							X^b	X^a	X^a	X^b		X	X			X	X	X			X	
H. drummondii					X^a	X		X				X	X				X	X			X	
H. gentianoides						X		X^a				X	X^b				X	X		X	X	
H. cumulicola						X						X	X				X	X				

X - present in 100% of populations examined
X^a - present in more than 60% of populations examined
X^b - present in less than 60% of populations examined
X^c - ID based on R_f value

and H. denticulatum var. acutifolium to have a similarity of 64%, H. denticulatum var. acutifolium and H. incertum a similarity of 43%, and H. incertum and H. denticulatum var. denticulatum to have a similarity of 33%. Hypericum denticulatum var. acutifolium and var. denticulatum are more similar to each other than either is to H. incertum, yet have distinctive profiles (Figures V-4 C and D) and differ by the presence or absence of compounds 9, 18, 42, and 46 (Table V-5).

H. setosum. Considerable chemical variability was found to exist in this taxon, which morphologically is one of the more distinctive species in the section. Nine populations were sampled from Alabama, Georgia, Florida, South Carolina, and North Carolina. All populations examined contained compounds 15A, 15B, 31, 41, and 45 (Figure V-5 A). Three populations, all from South Carolina, were found to lack compound 11. Compound 9 was present in six populations, but was lacking from three populations (two from Georgia and one from Alabama). Another compound (20) was restricted to two populations from North Carolina and one from South Carolina. Other compounds occurring in fewer than 100% of the populations examined were compounds 12 and 13. Compound 12 was present in seven of the populations sampled while compound 13 was found in only two populations. Spectral data in conjunction with the R_f values indicated compound 13 to be a quercetin 3-O-diglycoside. The order of the sugars was not determined, but sugar analysis showed glucose and galactose to be the substituted sugars.

H. drummondii. Nine populations of this common old field denizen were sampled during this study. Four compounds (7, 31, 41, 45) were found in all populations analyzed, with each of the remaining four compounds (6, 11, 15A, 15B) being absent from a single population (Figure V-5 B).

Figure V-5. Chromatographic Profile of *Hypericum* Species.

A. *Hypericum setosum*

B. *Hypericum drummondii*

C. *Hypericum cumulicola*

D. *Hypericum gentianoides*

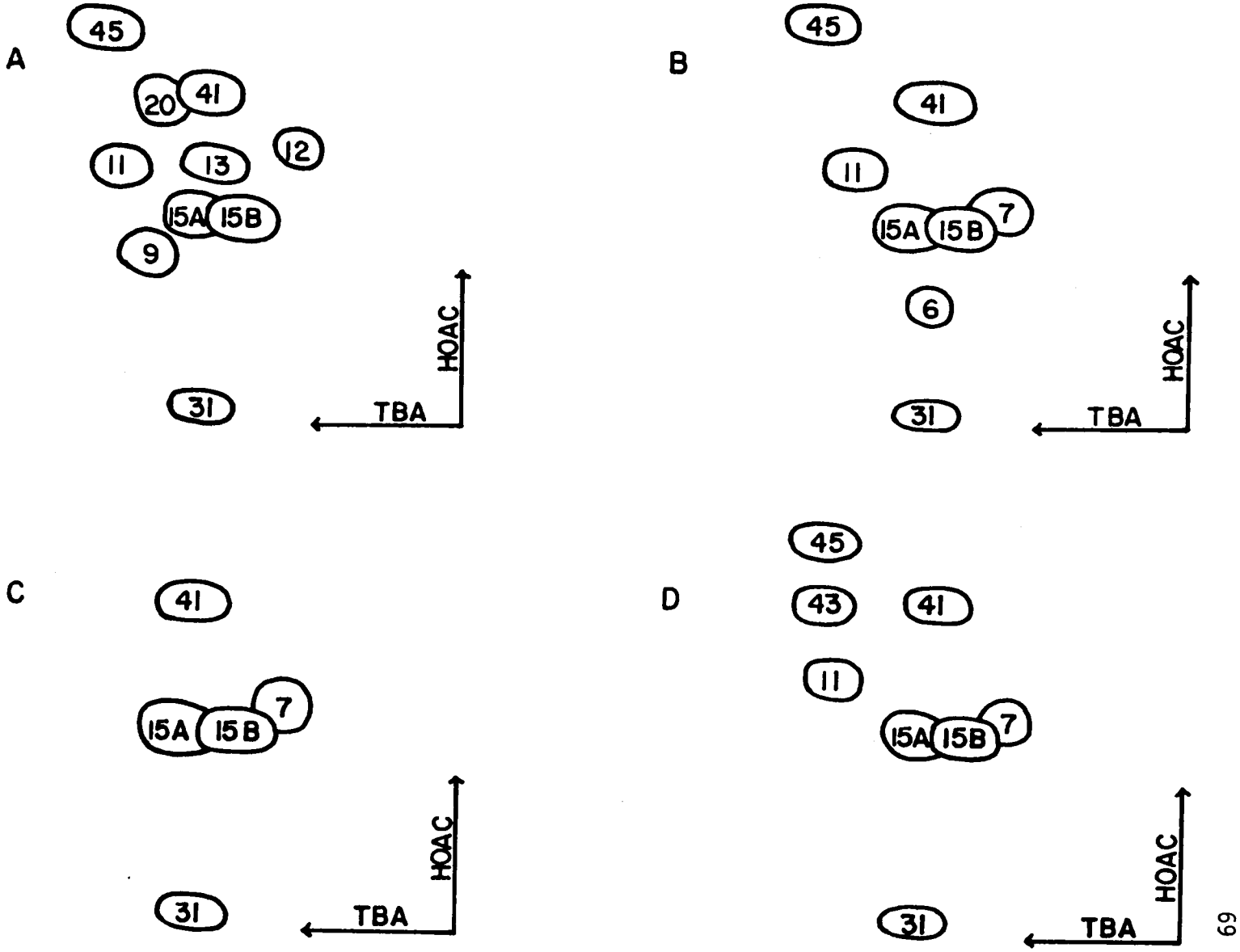

A
45
20
41
12
11
13
15A
15B
9
31
HOAC
TBA
B
45
41
11
15A
15B
7
6
31
HOAC
TBA
C
41
15A
15B
7
31
HOAC
TBA
D
45
43
41
11
15A
15B
7
31
HOAC
TBA

Figure V-5

H. cumulicola. This narrow endemic is restricted to a two county area in the dune region of central Florida. A single population from Highlands County, Florida, was found to contain compounds 7, 15A, 15B, 31, and 41 (Figure V-5 C). Three additional very faint spots were noted, but were too weak to allow spectral analysis and are not included in the composite profile.

H. gentianoides. Ten populations of this widespread and often weedy species were sampled. All populations were found to contain compounds 7, 15A, 31, 41, 43, and 45 (Figure V-5 D). Compound 11 was absent in only one of the populations studied, and compound 15B was documented as occurring in only three of the populations analyzed. An additional three spots were noted that were too weak for spectral analysis. These spots had similar R_f's and color characteristics as the three unknown mentioned in H. cumulicola. However, in the absence of spectral data it is unknown whether or not they represent the same compounds.

Jiménez (1973a) treats H. cumulicola as a synonym of H. gentianoides. While there is little doubt that the two species are closely related, chemical differences (the absence of compounds 11, 43, and 45 in H. cumulicola) in addition to morphological and cytological differences (Chapters VI and IX) lend support to the recognition of two species. Several workers of the twentieth century (Britton and Brown, 1913; Small, 1933) have maintained the genus Sarothra as distinct from Hypericum. A comparison of the compounds present in the two species (H. gentianoides, H. drummondii) often included in Sarothra with those of related taxa (Table V-5) does not seem to warrant generic separation based on flavonoid chemistry.

Conclusions

The eastern North American taxa of sect. Spachium were found to contain both flavonols and flavones. Of the two base flavonols found in this study, quercetin was present in all taxa examined, while kaempferol was only documented to occur in H. boreale. In the case of the flavonol based compounds, all substitutions were at the 3 position as O-linked monoglycosides or less frequently as diglycosides. Derivatives of luteolin and apigenin, the two base flavones elucidated during this study, were present in only a single taxon (H. incertum). The only O-glycosylflavone elucidated was luteolin 7-O-glucoside while four C-glycosylflavones were identified.

According to Harborne (1977) the presence of flavonols in leaf tissue represents a primitive condition with their replacement by flavones representing an advanced character state. C-glycosylflavones are postulated to occupy an intermediate position between flavonols and flavone O-glycosides. Thus the presence of "advanced" flavonoids in H. incertum is somewhat surprising as it is morphologically one of the more primitive taxa within the section. Regardless of the phylogenetic significance of these compounds, their presence in H. incertum provides a sound basis for distinguishing it from the other two taxa within the H. denticulatum complex.

The chemical differences between H. incertum and the other two taxa (H. denticulatum var. denticulatum and H. denticulatum var. acutifolium) of the H. denticulatum complex are much greater than those found to exist between the species comprising the H. canadense complex in which two of the recognized species (H. canadense and H. majus) were found to have identical composite profiles. Perhaps the similarity of

the compounds in the various species comprising the H. canadense complex reflects gene flow resulting from hybridization between the species within the complex. Chemical data also failed to support the recognition of the three varieties of H. mutilum treated by Fernald (1950).

Except for the example noted in the previous paragraph, each taxon recognized during this study had a distinctive profile and a characteristic set of compounds. However, the chemical differences between the species that have traditionally been included in Hypericum and those that during the past half century have been placed in Sanidophyllum and Sarothra do not appear large enough to warrant recognition of these two generic segregates.

As noted at the beginning of this chapter, several workers have reported flavonoids and other polyphenolic compounds to be present in several species belonging to the genus Hypericum. Lebreton (1968) has noted the absence of flavones in the Hypericaceae although an earlier work by the same author (Lebreton and Bouchez, 1967) reports luteolin (a flavone) to be present in H. hirsutum L. The presence of luteolin and apigenin based compounds in H. incertum provides an additional example of the occurrence of flavones in the genus Hypericum and illustrates the need for further study before flavonoid data are used to support or reject classifications above the specific level.

CHAPTER VI

CYTOLOGICAL INVESTIGATIONS

A comparison of the chromosome numbers of sect. Spachium with those of other sections of Hypericum shows it to be one of the most heterogenous sections within the genus. Hoar and Haertl (1932) report a haploid number of 8 for H. mutilum, H. majus, H. canadense, and H. boreale. A subsequent count by Bell (1965) for H. mutilum is in agreement with the earlier count of n = 8 by Hoar and Haertl (1932). However, a count by Kapoor (1972) of 2n = 18 for H. boreale conflicts with Hoar and Haertl's earlier count of n = 8. Two other species within sect. Spachium, H. japonicum and H. gramineum, are known to have a haploid number of 8 (Hair and Beunzenberg, 1959).

A count of n = 12 for H. gentianoides led Hoar and Haertl (1932) to question whether this species should be included in the genus Sarothra instead of Hypericum. While certain morphological differences exist between H. gentianoides and most other members of sect. Spachium, a count of n = 12 by Robson and Adams (1968) for H. denticulatum and H. irazuense negates the argument that H. gentianoides should be included in the genus Sarothra solely on the basis that it is the only member of sect. Spachium with a haploid number of 12. Polyploidy within the section is evidenced by Rogers' (1965) report of n = 24 for a North Carolina population of H. denticulatum var. denticulatum. Borgman (1964) reports a count of 2n = 14 for an undescribed species of Hypericum that Robson and Adams (1968) list as belonging to sect. Spachium. In summary, chromosome counts of n = 8, 12, 24 and 2n = 14 and 18 are reported for taxa belonging

to sect. Spachium with no reports existing for the following eastern North American taxa: H. gymnanthum, H. setosum, H. cumulicola, and H. drummondii. The present author has been unable to locate a voucher for the count of n = 12 reported by Robson and Adams (1968) for H. denticulatum. Preston Adams (pers. comm.) has indicated that the voucher is deposited in the herbarium at the University of Georgia. However, the cited specimen is not among the collections borrowed from this institution. While the count was most likely obtained from H. denticulatum var. acutifolium or H. incertum, an examination of the voucher is required for a positive determination of the taxon from which the count was made.

Methods

Buds were collected from plants growing in natural populations and were fixed in modified Carnoy's solution (chloroform, absolute ethanol, acetic acid in a ratio of 4:3:1 v/v) or Newcomer's solution (isopropyl alcohol, propionic acid, petroleum ether, acetone, dioxane in a ratio of 6:3:1:1:1 v/v). While meiotic chromosome counts were obtained from anthers fixed in both solutions, most counts were made from material fixed in modified Carnoy's solution. After fixation the buds were stored at 4°C until squashes were made. The anthers were squashed in aceto-orcein after being placed in 1N HCl for several minutes prior to squashing. This latter treatment, which breaks down the middle lamella, was found to be necessary in order to consistently obtain squashes a single cell layer in thickness. Voucher specimens (Table VI-1) have been deposited in the Herbarium of The University of Tennessee (TENN).

TABLE VI-1

POPULATIONS OF *HYPERICUM* EXAMINED FOR CHROMOSOME NUMBERS

Taxon	n number		Voucher
H. boreale	8	NY	Hamilton Co.: Webb and Webb 53751
	8	NY	Warren Co.: Webb and Webb 53754
H. canadense	8	NH	Coos Co.: Webb and Webb 53761
	8	ME	Franklin Co.: Webb and Webb 53769
H. cumulicola	6	FL	Highlands Co.: Webb, Rader, and Bierner 52513
H. denticulatum var. *denticulatum*	ca. 12	NJ	Burlington Co.: Webb and Webb 52127
	12, 24	NC	Onslow Co.: Webb and Whitten 53328
	24	NC	Onslow Co.: Webb and Whitten 53322
	24	NC	Craven Co.: Webb and Whitten 53319
	24	TN	Coffee Co.: Webb and Webb 53259
H. denticulatum var. *acutifolium*	12	AL	Blount Co.: Webb 53267
	12	NC	Alexander Co.: Webb and Whitten 53305
	12	NC	Person Co.: Webb and Whitten 53308
	12	TN	Bledsoe Co.: Webb and Webb 53260
	12	TN	Morgan Co.: Webb and Webb 53302

TABLE VI-1 (continued)

Taxon	n number	Voucher
H. drummondii	12	AL Lauderdale Co.: Webb and Webb 1231
	12	MS Clarke Co.: Webb and Ross 53274
	12	TN Weakley Co.: Webb 1280
H. gentianoides	12	AL Escambia Co.: Webb and Ross 53279
	12	NC Gates Co.: Webb and Whitten 53311
H. gymnanthum	8	AL Escambia Co.: Webb and Ross 53280
	8	MS Clarke Co.: Webb and Ross 53273
	8	NC Gates Co.: Webb and Whitten 53315
H. incertum	12	FL Gadsden Co.: Webb and Ross 53289
	12	GA Dougherty Co.: Webb and Ross 53295
	12	GA Thomas Co.: Webb and Ross 53298
H. majus	8	VT Caledonia Co.: Webb and Webb 53762
	8	VT Coos Co.: Webb and Webb 53764
	8	VT Washington Co.: Webb and Webb 53760
	8	CANADA, Quebec, Frontenac Co.: Webb and Webb 53777
H. mutilum	8	AL Cherokee Co.: Webb 53265

TABLE VI-1 (continued)

Taxon	n number		Voucher
	8	PA	Lackawana Co.: Webb and Webb 53343
	8	NY	Fulton Co.: Webb and Webb 53348
	8	SC	Charleston Co.: Webb and Webb 53794
H. setosum	6	NC	Duplin Co.: Webb and Whitten 53331
	6	NC	Lenoir Co.: Webb and Whitten 53334
	6	SC	Charleston Co.: Webb and Webb 53795

Results and Discussion

Chromosome counts obtained during this study (Table VI-1) verify previous reports of $n = 8$ for H. canadense, H. majus, H. boreale, and H. mutilum (Figures VI-1 A, B, C, D). Hypericum gymnanthum was found to have a haploid number of 8 (Figure VI-1 E) which is not surprising since this species is closely related to the species listed above, probably most closely to H. mutilum. According to Fernald (1950) the species listed above frequently hybridize and plants that appear to be intermediate between the recognized species are not uncommon. No meiotic irregularities were observed during the course of this study although some individuals thought to be hybrids exhibited high percentages of aborted pollen. The small size of the chromosomes (ca. 0.5u) makes recognition of meiotic irregularities difficult.

Three populations of H. denticulatum var. denticulatum were found to have a haploid number of 24 (Figure VI-1 F) and are in agreement with an earlier report of $n = 24$ by Rogers (1965). However, counts of $n = 12$ and $n = 24$ were obtained from a population in Onslow County, North Carolina. An additional population from the pine barrens of New Jersey was found to be $n =$ ca. 12. Thus it appears that while the tetraploid populations are more common and possibly more widespread, diploid populations and individuals do exist. Counts for all populations of H. denticulatum var. acutifolium (Figure VI-2 A) and H. incertum (Figure VI-2 B) were $n = 12$, as were counts for H. gentianoides (Figure VI-2 C) and H. drummondii (Figure VI-2 D). Historically, these latter two species have been included in the genus Sarothra.

Two species, H. setosum and H. cumulicola, were found to have a haploid number of 6 (Figures VI-2 E, F). Hypericum cumulicola was

Figure VI-1. Meiotic Chromosomes of *Hypericum*.

A. *H. canadense*

B. *H. majus*

C. *H. boreale*

D. *H. mutilum*

E. *H. gymnanthum*

F. *H. denticulatum* var. *denticulatum*

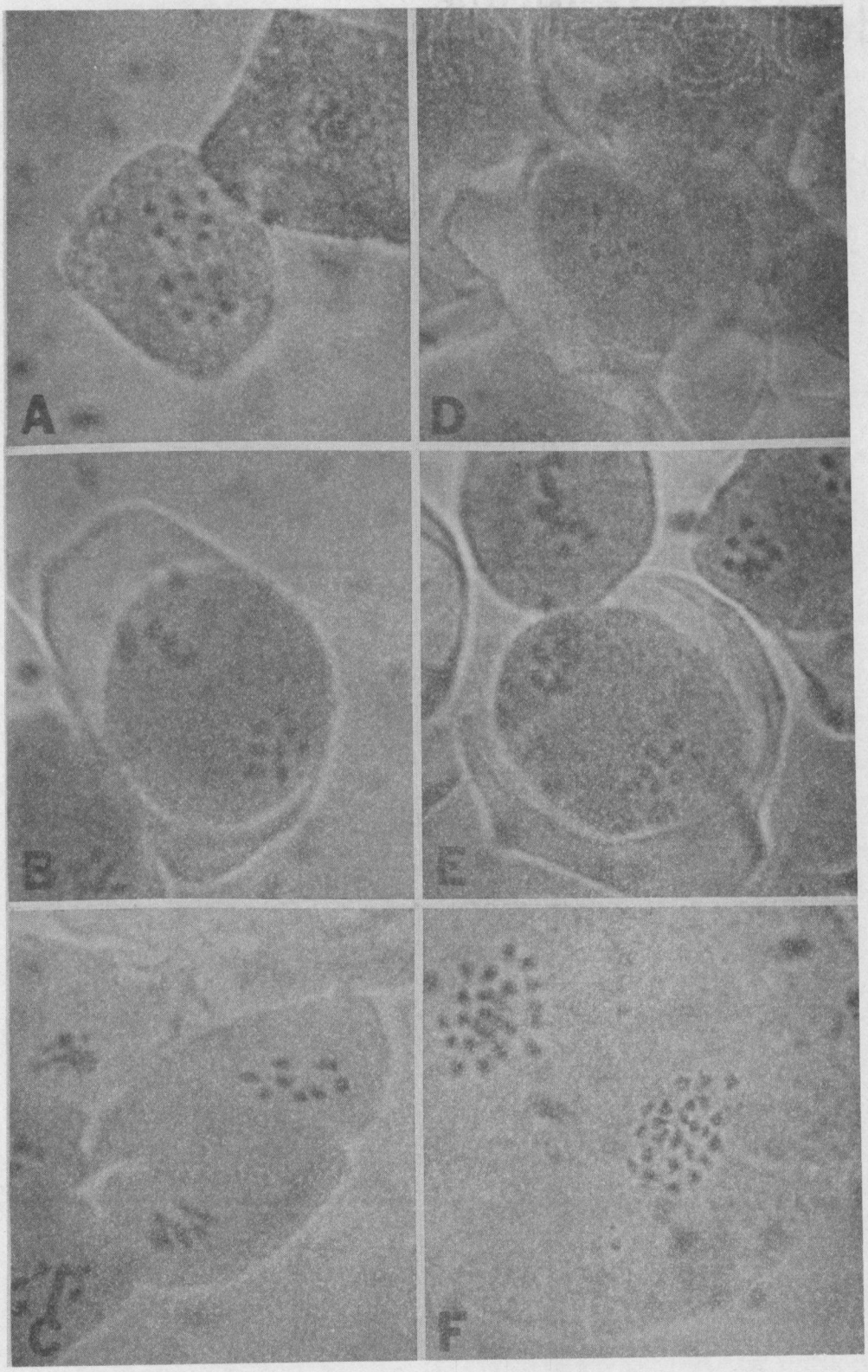


Figure VI-1

Figure VI-2. Meiotic Chromosome of *Hypericum*.

A. *H. denticulatum* var. *acutifolium*

B. *H. incertum*

C. *H. gentianoides*

D. *H. drummondii*

E. *H. setosum*

F. *H. cumulicola*

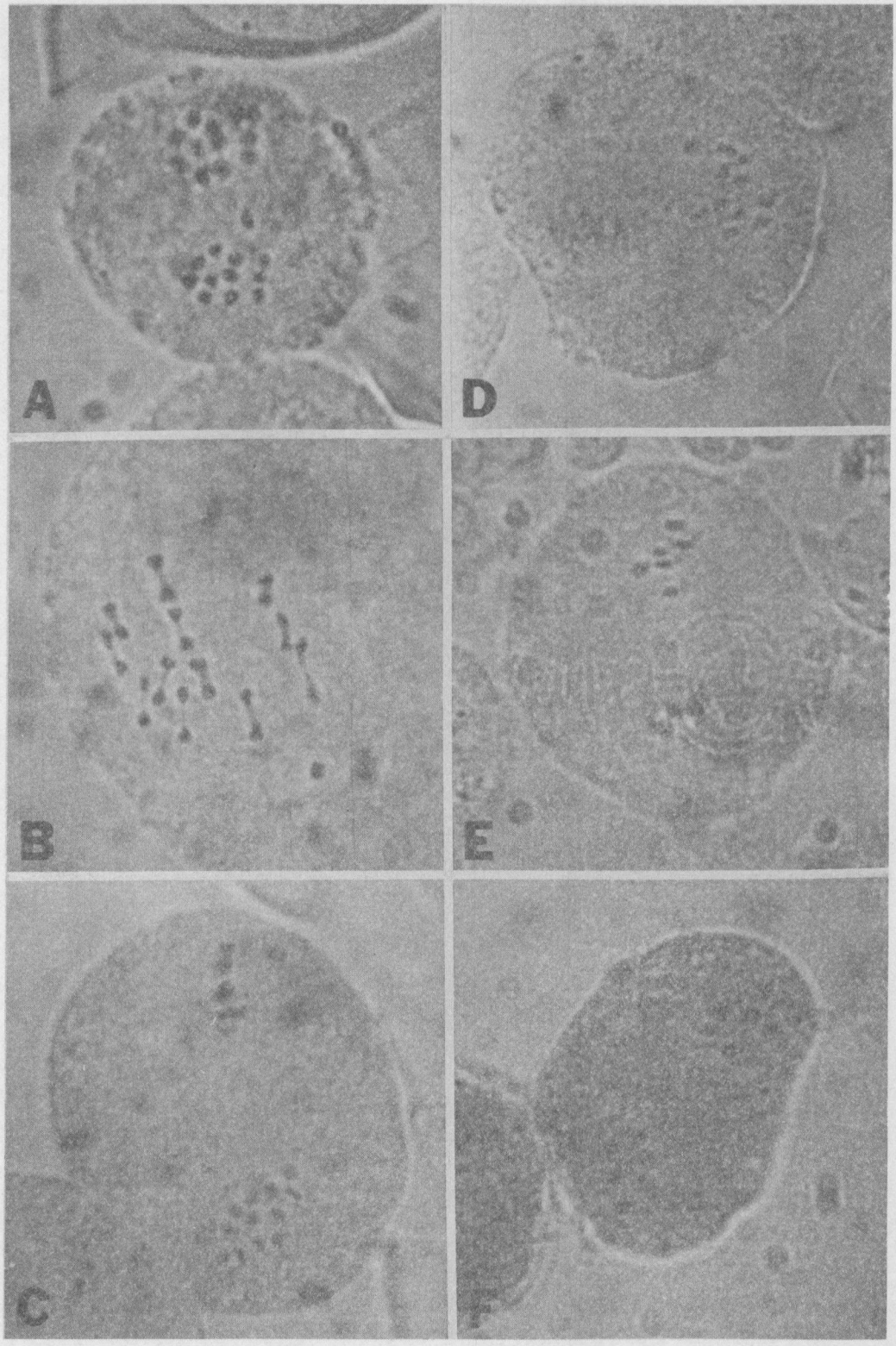


Figure VI-2

originally included in the monotypic genus Sanidophyllum (Small, 1924) with Adams (1962b) transferring it to the genus Hypericum. While the count of n = 6 provides some basis for maintaining the species in a separate genus (i.e. Sanidophyllum), this argument is diminished in view of a similar count for H. setosum. Due to certain morphological similarities between H. cumulicola and H. gentianoides, Jiménez (1973a) considers the two species to be conspecific. However, the different chromosome numbers, n = 6 in H. cumulicola and n = 12 in H. gentianoides, as well as morphological and ecological differences provide a sound basis for the recognition of two species (Chapter IX).

The counts of n = 6 in H. setosum and H. cumulicola are the first reports of this number in the genus Hypericum. The significance of this number in relation to the base number for the genus and section is discussed in the following paragraphs.

After obtaining counts of n = 7, 8, 9, 16, and 20, Neilson (1924) concluded that there was no single fundamental number on which to base this series. Winge (1925) suggested the series to have a base number of 4, with the numbers 7 and 9 having "arisen through aberation." Chattaway (1926) noted the similarity of this series to that found in Crepis in which several numbers formed the basis for polyploid series. In the opinion of Sugiura (1944), the series of chromosome numbers in Hypericum are derived from base numbers of 3 and 4.

A compilation of all known chromosome numbers for the genus Hypericum is presented by Robson and Adams (1968) who essentially agree with Chattaway's earlier views. As noted by Robson and Adams (1968), the genus Hypericum has several basic numbers (x = 12, 10, 9, 8, 7), all of which, excepting the last, occur in polyploid as well as diploid

form. The base numbers for the shrubby sections are typically 12, 10, or 9, while 8 and 7 are found to be primarily confined to the more advanced herbaceous sections. According to Robson and Adams (1968) the series listed above represents a descending series from 12 to 7. Robson (1977) in outlining the general evolutionary trends in Hypericum, notes that the series might extend to 6 even though there were no reports of this number. While Robson and Adams (1968) suggest that the 12 series in subsection Spachium may be based on $x = 6$ (cf. Fig. 14), the regularity of chromosome pairing in H. irazuensis led them to suggest that ". . . its 24 chromosomes represent 2 X 12 rather than 3 X 8, and so it is likely that the 12 series in subsect. Spachium is primary not derived from $x = 8$ or 6."

There are no chromosome counts for sect. Campylosporus, which Robson (1977) suggests to be the most primitive section within the genus Hypericum. Section Spachium as well as some nine or ten other sections are considered by Robson (1977) to be directly derived from sect. Campylosporus. Five of these sections (sects. Ascyreia, Brathys, Humifusoideum, Psorophytum, and Spachium) have base chromosome numbers of 12. In addition to the base number of 12 in sect. Spachium and Ascyreia, sect. Spachium has base numbers of 9, 8, and 7 with sect. Ascyreia having base numbers of 11, 10, and 9. Base numbers of 10, 9, and 8 are also found in other sections thought to have evolved directly from sect. Campylosporus. The sequential series from 12 to 8 in sect. Ascyreia as well as the presence of the base numbers 10 and 9 in sections thought to have evolved directly from sect. Ascyreia seem to support Robson and Adams (1968) and Robson (1977) who propose that

within the genus Hypericum there has been a decrease in the base chromosome number.

However, the acceptance of this overall trend needs to be viewed in light of counts of n = 6 for H. setosum and H. cumulicola. While this number (i.e. 6) could represent the end point in a descending aneuploid series from 12 to 6, a more reasonable alternative would be to consider 6 as the base number for the genus. In such a case, n = 12 represents the gametic count for a tetraploid and not a diploid. If n = 12 is accepted as being the gametic number for a tetraploid, then the general decrease in chromosome number in Hypericum would not require a series of structural rearrangements (i.e. unequal reciprocal translocations) necessary to retain vital genetic information.

Though counts are unavailable for species belonging to sect. Campylosporus, a review of the base numbers of closely related sections would seem to suggest that counts of n = 12 are the most probable. However, this does not preclude the possibility that some species of sect. Campylosporus may have retained a more primitive number (i.e. n = 6). At this point, the presence of n = 6 in sect. Spachium may most easily be explained by postulating a divergence of the two sections at some point in the early evolutionary history of the genus. Since chromosome counts are available for approximately one-third of the species in sect. Spachium, additional counts of n = 6 may be expected.

Available counts of sect. Spachium seem to indicate a polyploid series from 6 (H. setosum, H. cumulicola), to 12 (H. drummondii, H. gentianoides, H. irazuense, H. incertum, H. denticulatum var. acutifolium) to 24 (H. denticulatum var. denticulatum). An alternative to viewing the counts of 9, 8, and 7 as products of a descending series

would be to consider them instead to represent an ascending aneuploid series from 6. The absence of numbers between 12 and 9 lends some support to this view. The count of 2n = 18 for H. boreale (Kapoor, 1972) should be considered in conjunction with the counts of n = 8 for H. boreale (Hoar and Haertl, 1932; present study) and the counts of n = 8 for the other species (H. canadense, H. majus, H. gymnanthum, H. mutilum) which comprise the H. canadense complex. Thus within sect. Spachium there appears to have been two main evolutionary lines. One of which represents a polyploid series based on 6, and the other an ascending aneuploid series based on the same number. This view does not contradict the contention of previous workers (Robson and Adams, 1968; Robson, 1977) that within the genus Hypericum there has been a decrease in the base chromosome number from 12. It does point out that there may be exceptions to this general trend, and the descending series should be examined from the perspective that n = 12 probably represents the gametic number of a tetraploid.

CHAPTER VII

HYBRIDIZATION WITHIN THE H. CANADENSE COMPLEX

Hybridization between the species belonging to the H. canadense complex is considered to be one of the major causes of the taxonomic difficulties of the group (Fernald, 1950; Adams, 1962b; Utech and Iltis, 1970). As noted by Utech and Iltis (1970) and by field observations of the present author, these species often occur in sympatric populations with intermediates often being fairly common. Hypericum majus, H. canadense, and H. mutilum have been observed to occupy similar habitats in the same roadside ditch. Hypericum dissimulation Bickn. was described by Bicknell (1913) and was noted to usually grow ". . . with H. canadense, H. majus, H. mutilum, and H. boreale. . . ." The discussion by Bicknell (1913) raises the possibility that this taxon might be a hybrid between H. canadense and H. boreale or H. mutilum. In the opinion of Fernald (1950), H. dissimulatum perhaps represents ". . . an unusually constant and recurrent hybrid. . . ."

Pollen Viability Studies

Hybrids frequently exhibit a lower percentage of pollen viability than either of the parents due to difficulties associated with meiotic pairing. Since pollen stainability is generally accepted as a good indicator of viability, pollen stainability studies were conducted on selected populations of H. mutilum, H. boreale, H. canadense, H. majus, H. dissimulatum and plants thought to have a hybrid origin.

The pollen was removed from dried herbarium specimens and treated with analine blue in lactophenol for a period of twenty-four hours.

Three hundred grains were counted from each flower. In a few instances, five plants from a population were sampled as a check for intrapopulational variability. The results of the pollen stainability studies are contained in Tables VII-1, 2, and 3.

With a few exceptions that will be discussed in the following paragraph, plants referable to H. boreale, H. canadense, H. majus, and H. mutilum showed high percentages of pollen stainability. Populations of these four species selected from a wide geographic range had an average stainability of 96.7% for H. boreale, 96.4% for H. canadense, 95.3% for H. majus, and 94.4% for H. mutilum (Table VII-1). The reduced stainability of H. dissimulatum (48.0%) would seem to further support the hybrid origin of these plants. One population of H. canadense (Webb and Webb 53785) and one population of H. mutilum (Webb and Webb 53348) had a much lower percent stainability than the other populations examined. In both instances these species were growing sympatrically with another species of the H. canadense complex. The reduced stainability may be the result of hybridization and introgression.

Table VII-2 shows the results of pollen stainability on a population comprised of H. mutilum, H. canadense, H. majus, and intermediates from Franklin County, Maine. With the exception of plant #2 of H. canadense, plants referable to the species mentioned above had high pollen stainability. Plants thought to represent hybrids between H. mutilum and H. canadense had substantially lower stainability than that of the parents as did other intermediates from this population (Table VII-2). Reduced stainability was also noted in putative hybrids from an Onslow County, North Carolina, population containing H. canadense, H. mutilum, and intermediate individuals (Table VII-3).

TABLE VII-1

POPULATIONS OF *HYPERICUM* EXAMINED FOR POLLEN STAINABILITY

Species	Voucher		Percent Stainable
H. boreale	ME Somerset Co.: Webb and Webb 53773 (TENN)		96.7
	MI Chippewaw Co.: Churchill s.n., 17 Aug 1910 (MO)		95.0
	NJ Cumberland Co.: Webb and Webb 52510 (TENN)		96.7
	NY Fulton Co.: Webb and Webb 53347 (TENN)	93.7 95.7	94.7*
	NY Hamilton Co.: Webb and Webb 53751 (TENN)	94.0 95.7 96.7 97.7 97.0	96.2*
	NY Warren Co.: Webb and Webb 53753 (TENN)		99.0
	NY Warren Co.: Webb and Webb 53754 (TENN)		97.3
	NY Washington Co.: Webb and Webb 53756 (TENN)		98.7
	VT Rutland Co.: Webb and Webb 53758 (TENN)		99.7
	CANADA, Ontario, Frontenac Co.: Dore and Gillett 47-1060 (MO)		93.0
		AVG	96.7
H. canadense	AL Mobile Co.: Lelong 5599 (NCU)		98.3
	MA Hampshire Co.: Webb and Webb 53788 (TENN)		99.0
	MI Baraga Co.: Voss 7672 (MICH)		99.7

TABLE VII-1 (continued)

Species	Voucher		Percent Stainable
	NH Coos Co.: Webb and Webb 53761 (TENN)		99.3
	NJ Burlington Co.: Webb and Webb 52128 (TENN)		99.7
	NJ Cumberland Co.: Webb and Webb 52118 (TENN)		100.0
	NY Clinton Co.: Webb and Webb 53785 (TENN)	86.0 66.0	76.0*
	NC Onslow Co.: Webb and Whitten 53326 (TENN)		99.3
	PA Chester Co.: Wahl 11978 (ILL)		93.6
	VA Ammamack Co.: Webb and Webb 52112 (TENN)	99.7 96.3 98.0 96.7 99.0	97.9*
	CANADA, New Brunswick, Charlotte Co.: Gleason 4 (NY)		97.3
		AVG	96.4
H. majus	IL Winnebago Co.: Fell f 45625 (ILL)		98.7
	IO Decatur Co.: Anderson s.n., 13 Jul 1903 (MO)		72.0
	ME Somerset Co.: Webb and Webb 53772 (TENN)		99.3
	MI Lake Co.: Voss 5272 (MICH)		98.3
	NH Coos Co.: Webb and Webb 53766 (TENN)		98.0

TABLE VII-1 (continued)

Species	Voucher		Percent Stainable
	VT Caledonia Co.: Webb and Webb 53762 (TENN)		99.3
	VT Washington Co.: Webb and Webb 53760 (TENN)		99.3
	CANADA, Quebec, Arthabaska Co.: Webb and Webb 53782 (TENN)	91.0 93.0 91.7 89.3 94.0	91.8*
	CANADA, Quebec, Beuce Co.: Webb and Webb 53778 (TENN)		98.3
	CANADA, Quebec, Frontenac Co.: Webb and Webb 53777 (TENN)		97.7
		AVG	95.3
H. mutilum	AL Escambia Co.: Webb and Ross 53821 (TENN)		96.3
	GA Early Co.: Webb and Ross 53286 (TENN)	98.7 92.7 99.0 98.3 98.3	97.4*
	IL Marion Co.: Winterringer 1377 (ILL)		99.3
	IL Rock Island Co.: Chase 16862 (ILL)		98.0
	ME Franklin Co.: Webb and Webb 53711 (TENN)		95.0
	MS Clarke Co.: Webb and Ross 53275 (TENN)		92.7
	NY Fulton Co.: Webb and Webb 53348 (TENN)		67.3

TABLE VII-1 (continued)

Species	Voucher	Percent Stainable
	NY Oswego Co.: Webb and Webb 53346 (TENN) 96.7 99.0	97.9*
	NC Alamance Co.: Webb and Whitten 53306 (TENN)	91.3
	OH Champaign Co.: Leonard 20483 (US)	99.0
	PA Sesquahanna Co.: Webb and Webb 53345 (TENN)	98.3
	PA York Co.: Webb and Webb 53342 (TENN)	98.0
	TN Morgan Co.: Webb and Webb 53303 (TENN)	98.0
	VA Bath Co.: Webb and Webb 53338 (TENN)	84.8
	WV Monroe Co.: Webb and Webb 53337 (TENN)	99.0
	CANADA, Quebec, Wolfe Co.: Webb and Webb 53781 (TENN)	97.7
	AVG	94.4
H. x dissimulatum	MA Barnstable Co.: Fernald 636 (US)	43.0
	MA Duke Co.: Seymour 1526 (GH)	50.3
	NJ Cumberland Co.: Long 29686 (GH)	52.7
	NY Suffolk Co.: Ferguson 4340 (NY)	44.0
	NY Suffolk Co.: Svenson 11651 (MICH)	54.7
	RI Newport Co.: Fernald and Long 9921 (GH)	51.3

TABLE VII-1 (continued)

Species	Voucher	Percent Stainable
	VA Isle of Wright Co.: Fernald, Griscom, and Long 6639 (GH)	30.0
	VA Southampton Co.: Fernald and Long 8775 (GH)	48.6
	CANADA, Nova Scotia, Halifax Co.: Fernald and Long 21869 (GH)	56.3
	CANADA, Nova Scotia, Yarmouth Co.: Fernald and Long 24153 (GH)	49.3
	AVG	48.0

* This is the average stainability of more than one plant per population. The number of plants sampled per population and their stainabilities is indicated in the left column.

TABLE VII-2

POLLEN STAINABILITY OF *H. CANADENSE*, *H. MAJUS*, *H. MUTILUM*, AND INTERMEDIATES FROM FRANKLIN CO., MAINE

Species		Voucher	Plant #		Percent Stainable
H. canadense	ME	Franklin Co.: *Webb* and *Webb 53769* (TENN)	1		99.0
			2		64.0
			3		98.7
			4		99.0
			5		97.7
			6		98.7
				AVG	92.9
H. majus	ME	Franklin Co.: *Webb* and *Webb 53768* (TENN)	1		94.0
			2		95.3
			3		94.3
			4		96.7
			5		98.0
				AVG	95.7
H. mutilum	ME	Franklin Co.: *Webb* and *Webb 53771* (TENN)	1		100.0
			2		99.7
			3		99.0
			4		98.3
			5		99.7
				AVG	99.3
H. mutilum x *canadense*	ME	Franklin Co.: *Webb* and *Webb 53770* (TENN)	1		36.0
			2		0.7
			3		3.7
			4		41.7
			5		40.3
				AVG	24.5
H. majus? x *mutilum*	ME	Franklin Co.: *Webb* and *Webb 53770* (TENN)	1		46.0
			2		54.0
			3		45.3
				AVG	48.4

TABLE VII-3

POLLEN STAINABILITY OF H. MUTILUM, H. CANADENSE AND H. MUTILUM X CANADENSE FROM ONSLOW CO., NORTH CAROLINA

Species	Voucher	Plant #	Percent Stainable
H. mutilum	NC Onslow Co.: Webb and Whitten 53325 (TENN)	1	99.7
		2	98.3
		3	97.0
		4	99.0
		5	98.3
		AVG	98.5
H. mutilum x canadense	NC Onslow Co.: Webb and Whitten 53327 (TENN)	1	47.3
		2	40.7
		3	27.0
		4	32.3
		5	32.0
		AVG	35.9
H. canadense	NC Onslow Co.: Webb and Whitten 53326 (TENN)	1	97.0
		2	97.3
		3	97.7
		4	98.3
		5	99.3
		AVG	97.9

These studies indicate that putative hybrids selected on the basis of their intermediate morphological characteristics have reduced pollen stainability and presumably lower pollen fertility. The reduced pollen stainability of specimens identified as H. dissimulatum supports the interpretation of hybrid origin of these plants. Even though plants referable to H. dissimulatum have large numbers of aborted pollen grains, the capsules of plants labeled H. dissimulatum frequently contain well formed seeds. This would seem to indicate that reproductive isolation between members of the H. canadense complex discussed in this chapter is not complete although no tests have been conducted on the viability of the seeds of H. dissimulatum.

Hypericum dissimulatum and Other Hybrids

Hypericum dissimulatum, described by Bicknell (1913) and accepted by Fernald (1950), is viewed in the present treatment as a recurrent hybrid. While Bicknell (1913) thought this taxon to be a "good" species, his discussion hints of its probable hybrid origin. Regarding H. dissimulatum, Bicknell (1913) states:

> It is found in damp sandy places, usually growing with H. canadense, H. majus, H. mutilum, and H. boreale, one or all, and is not less distinct in appearance from each of them than they are among themselves.

A further comment by Bicknell (1913) hints as to the parentage of H. dissimulatum:

> Certain specimens approach H. canadense in the form and color of the pods, other examples seem nearer to H. mutilum, and it may well be questioned whether it be not a hybrid of these species or, indeed, partly of H. canadense and H. boreale as some specimens might seem to suggest.

Despite these comments, Bicknell thought H. dissimulatum to be worthy of specific rank with the principal argument being presented in the following statement:

> But all of our small St. John's-worts of this group are nearly related and, considering the extended coastwise range of H. dissimulatum, as good reasons appear for viewing it as one of a chain of close species as for surmising that it may be a cross.

Utech and Iltis (1970) report H. dissimulatum as occurring in Wisconsin where it was found to be growing with H. canadense and H. boreale. The intermediate nature of the plants referable to H. dissimulatum is illustrated in their scatter diagram. Herbarium labels have indicated H. dissimulatum to grow with H. boreale and H. canadense. Other specimens labeled H. dissimulatum have been noted growing with H. canadense and H. mutilum which would suggest that H. dissimulatum is a cross between H. canadense and H. mutilum. One of the representative specimens cited by Bicknell in the original description of H. dissimulatum is from North Carolina which is beyond the range of H. boreale. Also, a number of specimens labeled H. dissimulatum have been examined from southeastern Virginia and Maryland where H. boreale is extremely rare.

Based on field observations and a study of herbarium specimens, it is felt that the name H. dissimulatum has been applied to recurrent hybrids of both H. canadense x mutilum and H. boreale x canadense. The reduced pollen stainability of specimens labeled H. dissimulatum would seem to support the hybrid nature of this taxon.

Hybridization between the other taxa within the H. canadense complex also was indicated by field studies. As previously noted, a population containing H. mutilum, H. majus, H. canadense, and individuals

with intermediate morphological characters was observed in Franklin County, Maine. The putative hybrid origin of the intermediate plants is indicated by the reduced pollen stainability noted in these plants. Plants with intermediate morphological characters were observed to occur in sympatric populations of H. mutilum and H. gymnanthum and populations of H. canadense and H. majus. Thus, the study of herbarium specimens supplemented by field studies supports the earlier reports (e.g., Fernald, 1950; Utech and Iltis, 1970) of hybridization between taxa within the H. canadense complex. Hybridization, in addition to the morphological variability of the recognized species within the complex, has been the primary source of the taxonomic confusion associated with the complex. Specimens thought to represent putative hybrids are listed at the end of Chapter IX.

CHAPTER VIII

CLASSIFICATION

A major aim of systematic studies is the discernment of the phylogenetic relationships of the taxa under study. As discussed by Funk and Stuessy (1978) a number of methods and approaches have been developed over the past two decades that provide the systematist with an objective and repeatable means of estimating ". . . the evolutionary branching patterns. . . ." of organisms. These attempts to determine the phylogenetic relationships or evolutionary branching patterns are generally referred to as cladistics.

The various cladistic methods available to the practicing plant taxonomist and an evaluation of these methods are contained in Funk and Stuessy (1978). According to these authors the method of Nelson and van Horn (1975) is recommended as one of the most useful methods for constructing Wagner networks by manual means. The Nelson and van Horn method makes no a priori assumptions as to whether a character state is primitive or advanced and does not limit the number of character states. The resultant network is based on the most parsimonius route for branching patterns. This method is a modification of an earlier approach outlined by Farris (1970) but has the advantage of not requiring the difficult computations of the Farris method.

The Nelson and van Horn method was used to generate a Wagner network for the eastern North American taxa belonging to sect. Spachium. Thirty characters, some of which had more than two character states, were selected and are contained in Table VIII-1. Cytological, chemical,

TABLE VIII-1

CHARACTER STATES USED FOR CLASSIFICATION

Character	State	
Cytological		
1. $\underline{n}$ = 6		0
$\underline{n}$ = 8		1
$\underline{n}$ = 12 or multiple of 12		2
Chemical		
2. Compound 1A luteolin 7-O-glucoside	0*	1*
3. Compound 1B orientin	0	1
4. Compound 2 vitexin	0	1
5. Compound 3 isovitexin	0	1
6. Compound 4 kaempferol 3-O-glucoside	0	1
7. Compound 6 unknown	0	1
8. Compound 7 quercetin 3-O-glucuronide	0	1
9. Compound 9 quercetin 3-O-arabinoside	0	1
10. Compound 11 quercetin 3-O-rhamnoside	0	1
11. Compound 12 quercetin 3-O-rhamnoglucoside	0	1
12. Compound 13 quercetin 3-O-galactoglucoside	0	1

TABLE VIII-1 (continued)

Character		State
13. Compound 15B quercetin 3-O-galactoside	0	1
14. Compound 16 iso-orientin	0	1
15. Compound 18 unknown	0	1
16. Compound 20 unknown	0	1
17. Compound 42 unknown	0	1
18. Compound 43 unknown	0	1
19. Compound 45 unknown	0	1
20. Compound 46 unknown	0	1
Ecological		
21. Aquatic or semi-aquatic		0
Terrestrial		1
Morphological		
22. Plants glabrous		0
Plants pubescent		1
23. Stamens > 25		0
Stamens < 25		1
24. Styles > 2.0 mm long		0
Styles < 2.0 mm long		1
25. Capsule ovoid		0
Capsule ellipsoid		1
Capsule ellipsoid-conic		2
Capsule conic		3

TABLE VIII-1 (continued)

Character	State
26. Seeds > 0.9 mm, areolate	0
Seeds < 0.9 mm, striate	1
27. Bracts of inflorescence foliaceous	0
Bracts of inflorescence setaceous	1
28. Leaves scale-like to linear subulate	0
Leaves linear to linear-oblanceolate	1
Leaves wider (ovate, lanceolate, oblong, elliptic)	2
29. Pollen exine reticulate	0
Pollen exine reticulate-foveate	1
30. Petals > 4.0 mm	0
Petals < 4.0 mm	1

* In character states 2-20, 0 denotes absent, 1 denotes present.

ecological, and morphological characters were utilized with each character being given equal weighting. However, the large number of chemical characters (nineteen) selected somewhat biases the resulting Wagner network.

The eastern North American taxa in sect. Spachium and the selected characters were arranged in a data matrix (Table VIII-2) and their Manhattan Distances calculated according to the formula presented by Nelson and van Horn (1975). After calculating the Manhattan Distances for the operational taxonomic units or OTU's (Table VIII-3), the Wagner network was constructed as outlined by Nelson and van Horn (1975). In constructing the network it becomes necessary to create HTU's (hypothetical taxonomic units) from existing OTU's and/or from previously generated HTU's. The HTU's generated during network construction were added to the data matrix (Table VIII-2) and the Manhattan Distance matrix (Table VIII-3). For a discussion of the procedures employed in the construction of the network and the generation of HTU's the reader is referred to Nelson and van Horn (1975).

Employment of the Nelson and van Horn method resulted in the generation of sixteen networks. The most parsimonious network having the fewest number of character state changes is shown in Figure VIII-1. The number in parenthesis along each branch represents the number of character state changes between each pair of taxonomic units. Also listed along each branch are the characters that have undergone a change in state.

The network can be converted into a tree by estimating which branch represents the most likely point for the placement of the group's hypothetical ancestor. Nelson and van Horn (1975) utilize a method

TABLE VIII-2

DATA MATRIX FOR THE TWELVE OTUs[a] OF THE EASTERN NORTH AMERICAN TAXA OF SECTION SPACHIUM, INCLUDING HTUs[b] GENERATED DURING THE CONSTRUCTION OF THE NETWORK AND INFERRED ANCESTOR

Taxon	Character																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
H. boreale	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	1	1	0	2	0	1
H. canadense	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	1	3	1	1	1	0	1
H. cumulicola	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	3	1	1	0	1	0
H. drummondii	2	0	0	0	0	0	1	1	0	1	0	0	1	0	0	0	0	0	1	0	1	0	1	1	0	0	1	0	1	0
H. denticulatum var. denticulatum	2	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	1	0	1	0	0	0	0	0	0	1	1	2	0	0
H. denticulatum var. acutifolium	2	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0	0	0	1	1	1	0	0	0	0	1	1	2	0	0
H. gentianoides	2	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	1	1	0	1	0	1	1	3	1	1	0	1	1
H. gymnanthum	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	1	2	1	1	2	0	1
H. incertum	2	1	1	1	1	0	0	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	1	2	0	0
H. majus	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	1	2	1	1	2	0	1
H. mutilum	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	1	1	1	1	2	0	1
H. setosum	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	1	0	0	1	0	0	1	1	1	0	1	1	2	0	0
HTU A	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	1	2	1	1	2	0	1
HTU B	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	1	2	1	1	2	0	1
HTU C	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	1	2	1	1	2	0	1
HTU D	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	1	3	1	1	1	0	1
HTU E	1	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	1	0	1	0	1	1	3	1	1	0	1	1
HTU F	2	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	1	0	1	0	1	1	3	1	1	0	1	1
HTU G	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	1	1	1	1	2	0	1
HTU H	1	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	1	1	0	1	1	2	0	0
HTU I	2	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	2	0	0
HTU J	2	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	2	0	0
Inferred ancestor	2/1	0	0	0	0	0	0	1/0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	1	0	1	1	2	0	0/1

[a]Operational taxonomic unit.

[b]Hypothetical taxonomic unit.

TABLE VIII-3

MANHATTAN DISTANCE MATRIX FOR THE OTUs AND THE HTUs GENERATED DURING CONSTRUCTION OF THE NETWORK

	bor	can	cum	dru	den den	den acu	gen	gym	inc	maj	mut	set	HTU A	HTU B	HTU C	HTU D	HTU E	HTU F	HTU G	HTU H	HTU I	HTU J
H. boreale	0	6	9	11	12	13	9	6	14	5	4	12	6	5	5	6	7	8	4	7	10	11
H. canadense		0	8	9	11	12	6	3	15	2	4	11	3	2	2	0	4	5	4	6	9	10
H. cumulicola			0	6	13	12	5	10	15	9	9	12	10	9	9	8	4	4	9	9	11	12
H. drummondii				0	11	10	5	10	15	9	9	12	10	9	9	9	5	4	9	8	9	10
H. denticulatum var. denticulatum					0	5	12	9	10	10	8	9	9	10	10	11	12	11	8	5	2	3
H. denticulatum var. acutifolium						0	11	10	9	11	9	8	10	11	11	12	11	10	9	6	3	2
H. gentianoides							0	8	16	7	7	13	8	7	7	5	2	1	7	9	10	11
H. gymnanthum								0	13	1	2	9	0	1	1	3	6	7	2	4	7	8
H. incertum									0	14	12	13	13	14	14	15	16	15	12	11	8	7
H. majus										0	3	10	1	0	0	2	5	6	3	5	8	9
H. mutilum											0	8	2	3	3	4	5	6	0	3	6	7
H. setosum												0	9	10	10	11	12	12	8	5	7	6
HTU A													0	1	1	3	6	7	2	4	7	8
HTU B														0	0	2	5	6	3	5	8	9
HTU C															0	2	5	6	3	4	8	9
HTU D																0	4	5	4	6	9	10
HTU E																	0	1	5	7	10	11
HTU F																		0	6	8	9	10
HTU G																			0	3	6	7
HTU H																				0	3	4
HTU I																					0	1
HTU J																						0

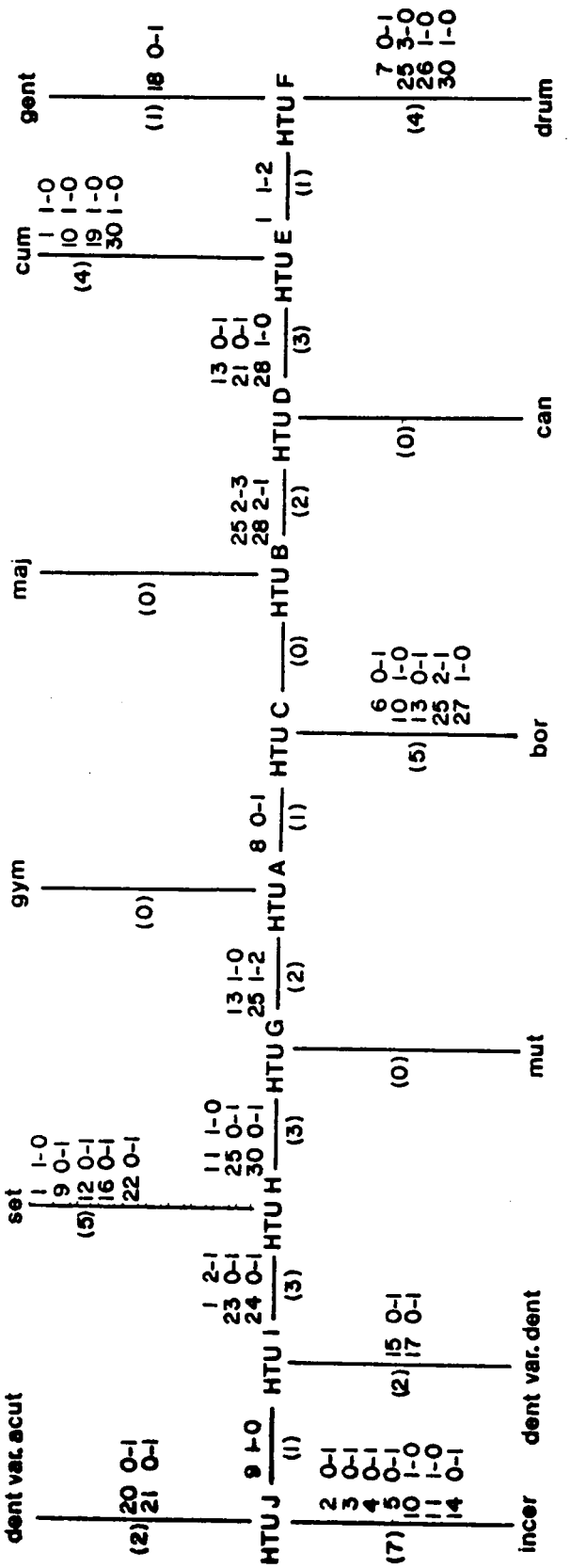


Figure VIII-1. Wagner Network Based on the Method of Nelson and van Horn (1975).

developed by Lundberg (1972) which removes much of the subjectivity from the branch selection. This method generates a hypothetical ancestor having the primitive state for each character. The primitive character state is selected by choosing the state that is the most widely distributed among the OTU's. The character states of the hypothetical ancestor are than compared to the character states of the two HTU's or OTU connected by a branch. The branch having the least number of differences from the inferred ancestor is thought to represent the branch having the maximum likelihood for the placement of the inferred ancestor. The Wagner tree generated by this method is shown in Figure VIII-2 with the character states of the inferred ancestor being presented in Table VIII-2.

Considerable caution should be employed in considering the phylogenetic implications of the Wagner tree of Figure VIII-2. The extant taxa treated in this analysis represent only a portion of a "natural" grouping within the genus. According to Robson (1977) sect. Spachium is comprised of fifty-four species. Thus, the eastern North American taxa belonging to sect. Spachium represent only about one-fifth of the total number of species within the section. However, the tree does substantiate to some extent impressions concerning phylogenetic groupings derived by more subjective means. By examining the tree from the standpoint of the relative positions of the OTU's, three main groupings can be identified: (1) the taxa of the H. denticulatum complex (H. denticulatum var. denticulatum, H. denticulatum var. acutifolium, H. incertum) and H. setosum, (2) the H. canadense complex (H. canadense, H. majus, H. mutilum, H. boreale, H. gymnanthum), and (3) H. gentianoides, H. cumulicola, and H. drummondii. The close relationship of the members of the H. canadense complex is reflected by the

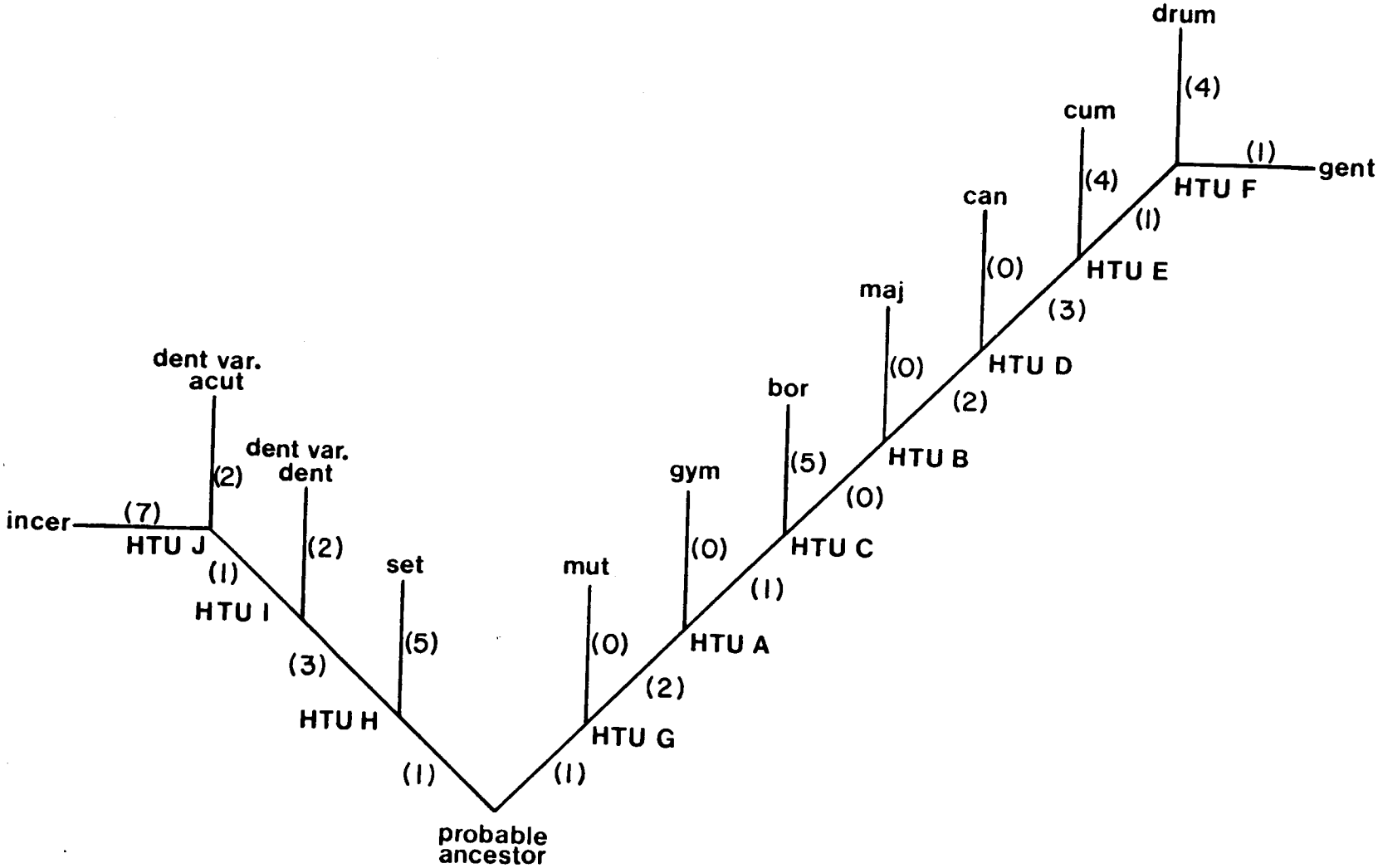


Figure VIII-2. Wagner Tree Depicting the Cladistic Relationships in the Eastern North American Taxa Belonging to Sect. Spachium.

The numbers in parentheses indicate the number of evolutionary steps.

fact that the HTU's giving rise to the species of this group are only separated by a total of five character state changes. The evolutionary line containing the H. canadense complex is terminated by species (H. gentianoides, H. cumulicola, H. drummondii) that traditionally have been considered closely related. Adams (1962b) has indicated these taxa to have their affinities with the H. denticulatum complex and the H. pauciflorum complex of Mexico.

The other evolutionary line of the tree seems to represent a natural grouping of the members of the H. denticulatum complex and H. setosum. This line is terminated by H. denticulatum var. acutifolium and H. incertum which are morphologically quite similar. The large number of character state changes (e.g., seven) that separates H. incertum from its common ancestor with H. denticulatum var. acutifolium is primarily a reflection of chemical and not morphological differences.

As discussed in Chapter VI the chromosome numbers for the taxa belonging to sect. Spachium seem to suggest two main evolutionary trends: (1) a polyploid series based on $n = 6$, and (2) an ascending aneuploid series from $n = 6$ to $n = 8$. However, according to the cladistic relationships of Figure VIII-1, OTU's having chromosome numbers of $n = 6$ and $n = 12$ arise from HTU's having a chromosome number of $n = 8$ with $n = 6$ and $n = 12$ originating from a common ancestor along both of the main evolutionary lines. Thus, the Wagner tree for the eastern North American taxa of sect. Spachium would seem to partially support Robson and Adams (1968) and Robson (1977) who propose a descending aneuploid series for the genus Hypericum. While the decrease from $n = 8$ to $n = 6$ supports the views of these workers, the increase in chromosome number

from n = 8 to n = 12 would seem to contradict the proposed trend. However, it is the opinion of the present author that the base chromosome number of sect. Spachium and of the genus Hypericum is x = 6 (Chapter VI) and the apparent descending aneuploid series within the genus Hypericum is more readily explainable if n = 12 is viewed as the gametic count for a tetraploid. Any discussion of the cladistic relationships of the eastern North American taxa of sect. Spachium is handicapped by the lack of detailed information concerning the chemistry and cytology of the other species in the section.

Figure VIII-3 represents a general impression of the evolutionary relationships of the eastern North American taxa of sect. Spachium based on cytological, morphological, and distributional data from the present and previous studies. The eastern North American taxa of sect. Spachium are thought to represent two main evolutionary lines, one composed of the species typically included in the H. canadense complex with a haploid chromosome number of 8, and the second of those species with a chromosome number of n = 6 or a multiple of that number. Morphologically, the most primitive members of the second evolutionary line appear to be the closely related taxa of the H. denticulatum complex that includes H. denticulatum var. denticulatum, H. denticulatum var. acutifolium, and H. incertum. Closely allied to the complex is H. setosum, a species that has retained what is believed to be the primitive chromosome number for the section (n = 6). Hypericum drummondii also has its affinities with the H. denticulatum complex, but is considered to be more advanced than the species in the H. denticulatum complex.

The position afforded H. drummondii contrasts with some earlier workers who have placed this species in the genus Sarothra along with

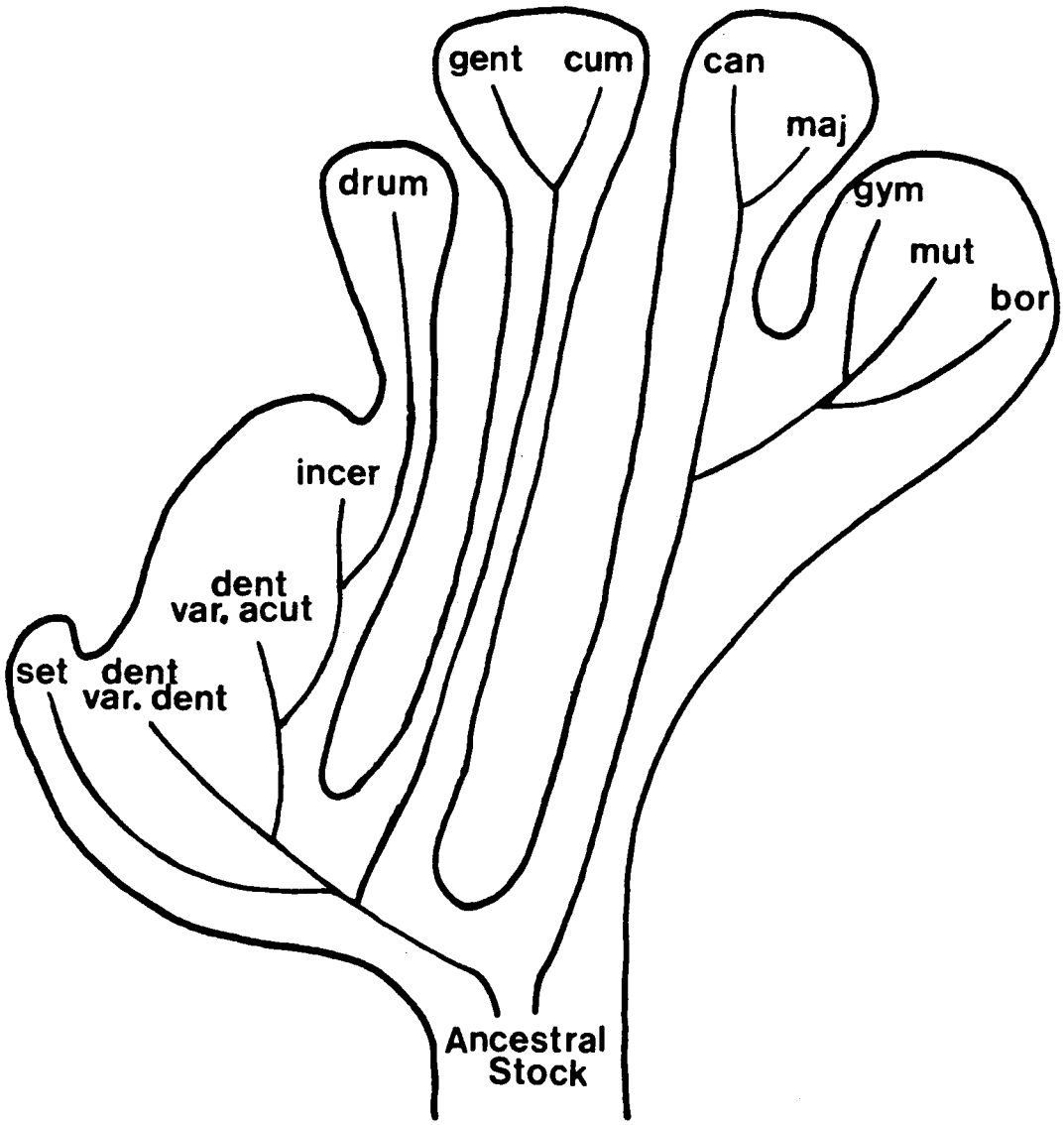


Figure VIII-3. Postulated Evolutionary Relationships of the Eastern North American Taxa Belonging to Hypericum Section Spachium.

H. gentianoides on the basis of the reduced nature of the leaf. The affinities of H. gentianoides are thought to be more closely aligned with H. cumulicola with which it shares many morphological similarities. These latter two species are postulated to represent a branch evolutionary line that diverged from the main evolutionary line leading to the taxa of the H. denticulatum complex, H. setosum, and H. drummondii. Like H. setosum, H. cumulicola has the primitive chromosome number ($n = 6$) of the section.

The second evolutionary line (Figure VIII-3) is represented by H. mutilum, H. boreale, H. gymnanthum, H. canadense, and H. majus, each with a chromosome number of $n = 8$. Hypericum canadense and H. majus are viewed as the most advanced species of this group. Utech and Iltis (1970) suggested that the ancestral population of these two species was split by the Pleistocene glaciers with H. majus evolving in the western United States, while H. canadense evolved in the region south of the glaciers. Although Robson (1972a) has noted the closest relative of H. gymnanthum to be an Asian species, H. gymnanthum appears to be closely related to H. mutilum and possibly evolved from this species or from common ancestral stock. The affinities of H. boreale also seem to lie with H. mutilum, although its present distribution which is primarily confined to glaciated regions of the northern United States and southern Canada seems to suggest a post-glacial origin. Utech and Iltis (1970) suggested that H. boreale may be a stabilized hybrid between H. mutilum and H. majus. However, there appears to be little evidence to support this proposal.

The major difference between the Wagner tree generated by the Nelson and van Horn method (Figure VIII-2) and Figure VIII-3 is the

position of H. drummondii, H. gentianoides, and H. cumulicola. According to the cladistic tree produced by the first method, these three species terminate the evolutionary line containing the species of the H. canadense complex. A much more realistic view based on chromosome numbers would be to consider them as a part of the evolutionary line comprised of the taxa of the H. denticulatum complex and H. setosum, with H. drummondii, H. gentianoides, and H. cumulicola representing morphologically advanced taxa.

CHAPTER IX

TAXONOMIC TREATMENT

Hypericum sect. Spachium (R. Keller) N. Robson. Bull. Br. Mus. Nat. Hist. (Bot.) 5(6): 338. 1977.

Hypericum sect. Perforaria Choisy. Prodr. Monogr. Hypér. 37, 44. 1821. Pro parte.

Hypericum C. Brathydineae n. Brathys (Mutis ex L.f.) Endl. Gen. Pl. 1033. 1840. Status ignot. Pro parte.

Hypericum sect. Brathys subsect. Spachium R. Keller in Engler and Prantl. Natürl. PflFam. 3(6): 214. 1893.

Hypericum sect. Brathys subsect. Connatum R. Keller in Engler and Prantl. Natürl. PflFam. 3(6): 214. 1893.

Hypericum sect. Brathys subsect. Multistamineum R. Keller in Engler and Prantl. Natürl. PflFam. 3(6): 214. 1893.

Hypericum sect. Brathys subsect. Spachium R. Keller in Engler and Prantl. Natürl. PflFam., ed. 2, 21: 181. 1925.

Sarothra sect. Trigynobrathys Y. Kimura in Nakai and Hondo. Nova Fl. Jap. 10: 233. 1951.

Sarothra sect. Spachium (R. Keller) Y. Kimura in Nakai and Hondo. Nova Fl. Jap. 10: 233. 1951.

Sarothra sect. Spachium series Eusarothra Y. Kimura in Nakai and Hondo Nova Fl. Jap. 10: 233. 1951. Nom. invalid.

Sarothra sect. Spachium series Knifa (Adans.) Y. Kimura in Nakai and Hondo. Nova Fl. Jap. 10: 233. 1951.

Sarothra sect. Spachium series Japonica Y. Kimura in Nakai and Hondo. Nova Fl. Jap. 10: 233. 1951.

Plants annual or perennial, herbaceous or suffruticose. Stems with elongated internodes, 4-lined or 4-winged and quadrangular in cross section at least when young. Leaves simple, not thickened, sessile, connate, amplexicaul to attenuate usually glabrous or rarely with simple multicellular hairs (in H. setosum). Leaves and stems with translucent glands, black glands absent. Flowers few to several, in dichasial or monochasial cymes, or occasionally solitary. Sepals 5, coriaceous to membraneous. Petals 5, yellow to yellow-orange, nearly symmetrical to strongly inequilateral. Stamens 5 to 80, persistent, often fused at their bases forming a continuous ring or in 3 to 5 generally obscure fascicles. Ovary of 3 to 5 carpels, 1 locular with parietal placentation. Styles 3 to 5 (rarely more), divergent with capitate to peltate stigmas. Fruit a capsule, longitudinally dehiscent. Seeds numerous, 0.25-1.2 mm long, generally striate with transverse reticulations. n = 6, 7, 8, 9, 12 or 24.

Type species: Hypericum gentianoides (L.) BSP.

Range: North and South America, southern Africa and Madagascar, Hawaii, New Zealand, Australia to southeast Asia and India, and Europe (probably as an adventive).

Artificial Key to Taxa Belonging to Section Spachium in Eastern North America

A. Plants glabrous, sepal margins entire . . . . . B

B. Stamens fewer than 25, styles 0.4 to 2.0 mm in length . . C

C. Leaves scale-like to linear-subulate, 1 nerved; flowers axillary and appearing racemose (except in H. cumulicola) . . . . . D

D. Leaves linear to linear-subulate, 0.5 to 2.2 cm long; capsule ovoid about equaling the sepals in length; seeds 0.8 to 1.1 mm long, rugose and areolate . . . . . 1. H. drummondii -- p. 119

D. Leaves scale-like, 1.0 to 4.0 mm long; capsule conical, two or more times the length of the sepals; seeds less than 0.8 mm long, pitted to smooth and obscurely striate . . . . . E

E. Annual with numerous opposite branches from the medial and upper portion of the stem; geographically widespread . . . 2. H. gentianoides --p. 137

E. Perennial with branches arising at or near ground level from an elongated taproot; narrow endemic known only from Polk and Highlands Co., Florida. . . . . 3. H. cumulicola -- p. 169

C. Leaves linear to elliptic to ovate, generally 3 to 7 nerved (often 1 nerved in H. canadense); inflorescence basically a compound dichasium . . . . . F

F. Capsule ellipsoid with a rounded to obtuse summit; branches of inflorescence and floriferous branches spreading; plants typically with floriferous branches from the medial and upper portion of the stem. . . G

G. Bracts of inflorescence foliaceous; lowest flower of compound dichasium subtended by a "whorl" of four leaves; capsule purple, 3.0 to 5.0 mm long . . . . . 4. H. boreale -- p. 174

G. Bracts of inflorescence subulate; lowest flower of inflorescence not subtended by a "whorl" of four leaves; capsule green, occasionally purple, 2.0 to 3.5 mm long . . . . 5. H. mutilum -- p. 189

F. Capsule conic to conic-ellipsoid; branches of inflorescence and floriferous branches (when present) ascending; floriferous branches primarily confined to the upper portion of the stem or absent . . . . . H

H. Leaves deltoid-ovate, leaf bases subcordate clasping; stems usually simple . . . . . 6. H. gymnanthum -- p. 234

H. Leaves linear to narrowly elliptic to lanceolate, leaf bases attenuate to weakly clasping; stems simple or often with floriferous branches from the upper portion of the stem I

I. Leaves linear to linear-oblanceolate, leaf bases attenuate; leaves 1 to 3 nerved; inflorescence somewhat diffuse; capsule generally conic . . . . . 7. H. canadense -- p. 242

I. Leaves narrowly elliptic to lanceolate, leaf bases weakly clasping; leaves 5 to 7 nerved (occasionally 3 nerved in depauperate individuals); inflorescence more compacted than the preceeding species; capsule ellipsoid-conic . . . . . 8. H. majus -- p. 258

B. Stamens numerous (50 to 80), styles 2.0 to 4.0 mm in length . . . . . J

J. Leaves ovate to obovate to narrowly elliptic, rarely more than 2.0 cm in length, typically appressed and shorter than the internodes . . . . 9. H. denticulatum -- p. 272 var. denticulatum

J. Leaves obovate to oblong-elliptic to linear lanceolate, up to 3.5 (4.0) cm long, typically ascending to spreading and often equalling the internodes . . . . . K

K. Leaves obovate to oblong elliptic to lanceolate; upper portion of stem often with a few axillary branches; lower stem not thickened; seeds (0.5) 0.6 to 0.8 mm long; plant terrestrial . . . . . 10. H. denticulatum -- p. 283 var. acutifolium

K. Leaves lanceolate to linear-lanceolate; upper portion of stem with numerous axillary branches; lower stem generally thickened; seeds 0.5 to 0.6 mm long; plant aquatic or semi-aquatic . . . . . 11. H. incertum -- p. 296

A. Plants pubescent; sepal margins ciliate . . . . . 12. H. setosum -- p. 303

1. Hypericum drummondii (Grev. and Hook.) Torr. and Gray. Fl. N. Am. 1: 165. 1838.

Sarothra drummondii Grev. and Hook. Bot. Misc. 3: 236, t. 107. 1833. TYPE: UNITED STATES: St. Louis, Drummond s.n. (LECTOTYPE: P, ISOLECTOTYPE: GH!, Probable ISOLECTOTYPE: K!).

Brathys drummondii (Grev. and Hook.) Spach. Ann. Sci. Nat. Sér. 2, 5: 367. 1836.

Erect annual, 1.0-8.0 dm tall, with mostly alternate or occasionally opposite, erect, ascending branches. Leaves numerous, nearly erect, linear to linear-subulate, 1-nerved, 5.0-22.0 mm long, 0.5-1.5 mm wide, shorter than or exceeding the internodes. Inflorescence appearing racemose, flowers mostly solitary in leaf axils of the upper portion of the branches and on short pedicels 1.0-4.0 mm in length. Sepals 3.0-6.0 mm long, linear-lanceolate, acute, about equaling to slightly shorter than the mature capsule. Petals yellow-orange, asymmetrical, 4.5-5.5 mm long, 2.0-2.25 mm wide. Stamens 10 to 22. Capsule ovoid, 4.0-6.0 mm long, reddish-brown. Styles 0.8-1.0 mm long. Mature seeds light to dark brown, 0.9-1.1 mm long, conspicuously rugose and areolate.

Chromosome number: $n = 12$.

Flowering time: July to September.

Distribution and habitat: Dry woods, roadsides, fallow fields, and cutover woodlands from Maryland south to Florida, west to Texas, north to Iowa, Illinois, Indiana, and Ohio (Figure IX-1); also reported from West Virginia by Bartholomew (1950).

Discussion: This species is quite common in old fields of the southeastern United States and is frequently found in habitats

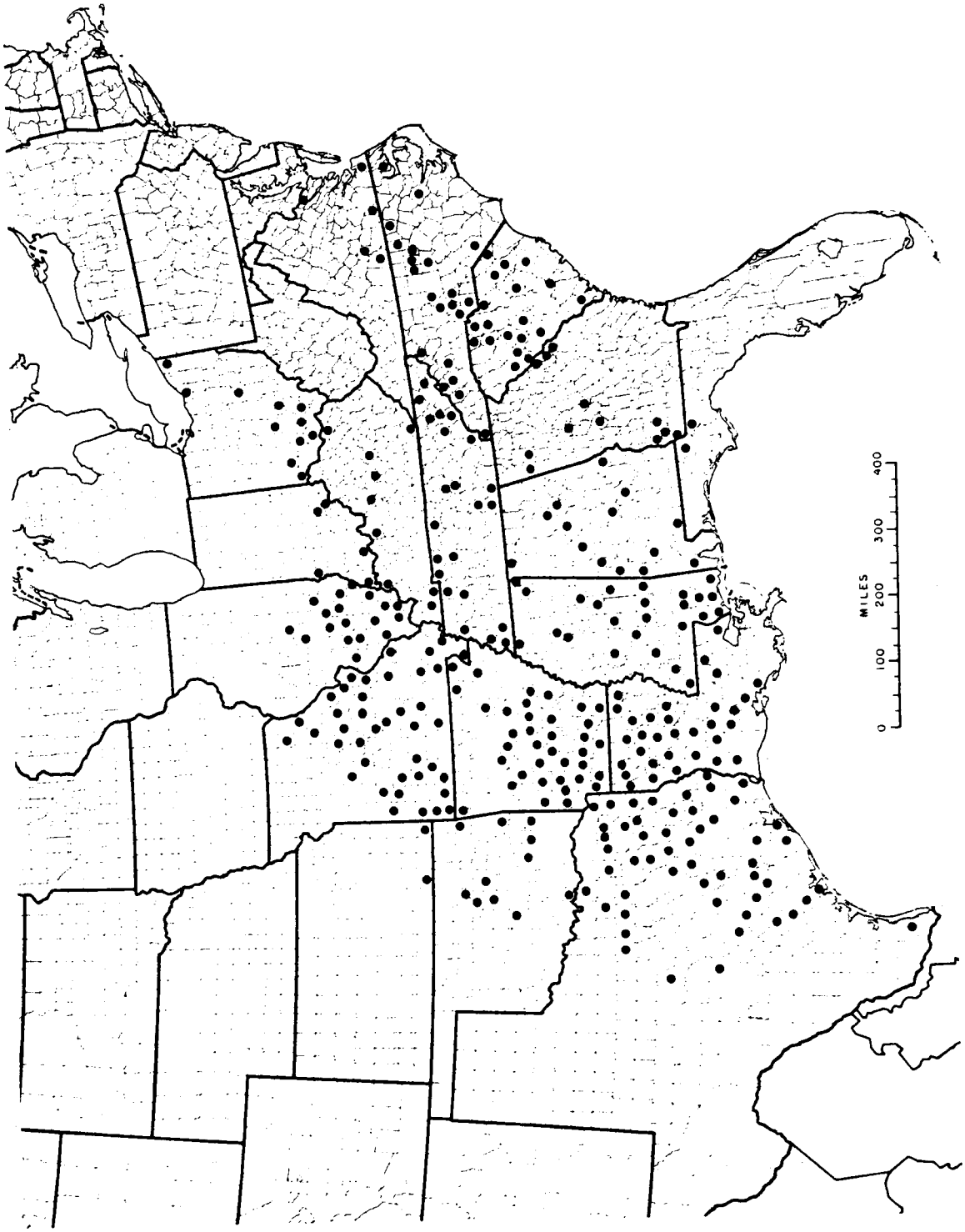


Figure IX-1. Distribution of Hypericum drummondii.

similar to those occupied by H. gentianoides. The reduced leaf of H. drummondii is undoubtedly an adaptation to the xeric conditions under which it grows. Morphologically, H. drummondii is somewhat intermediate between the taxa belonging to the H. denticulatum complex and H. gentianoides. However, H. drummondii is readily distinguishable from the latter species by its longer leaves, larger petals, and shape of its capsule. The seeds of H. drummondii, which are ca. 1.0 mm in length, are the largest seed of the eastern North American taxa belonging to sect. Spachium. The length of the styles, reduced leaves, and the raceme-like inflorescence distinguishes H. drummondii from the H. denticulatum complex.

Representative specimens:* UNITED STATES. ALABAMA. Autauga Co.: 5.3 mi W of Autaugaville, 19 Aug 1958, Shinners 27513 (SMU). Blount Co.: along US 231, 11.5 mi N of Blountville, 15 Aug 1968, Kral 32373 (SMU). Choctaw Co.: along Ala. 17, 10 mi N of Butler, 14 Jul 1977, Webb and Ross 53271 (TENN). Clarke Co.: 11.3 mi SW of Grove Hill, 29 Jul 1950, Shinners 12732 (GA, SMU). Escambia Co.: ca. 10 mi E of Brewton along Co. 9, 0.4 mi S of its jct. with US 29, 16 Jul 1977, Webb and Ross 53282 (TENN). Greene Co.: 14 mi S of Eutaw along Hwy 43, 28 Sep 1962, Thomas 698 (NCU). Jefferson Co.: Red Mountain, 5 Oct 1898, Canby 13 (MO, NY, US). Lee Co.: Auburn, 10 Sep 1899, Earle and Earle 40 (GH, MO, NY). Mobile Co.: Mobile, Oct 1879, Mohr s.n. (MICH). Montgomery Co.: near Catoma Creek, 5 mi S of Montgomery, 24 Oct 1943, Justice and Isely 88 (US). St.

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*One specimen per county is cited as a distribution voucher. Additional specimen data is available from the author.

Clair Co.: summit of Chandler Mountain, 5 Oct 1962, Bostick 244-4 (NCU). Sumter Co.: 3 mi NE of Livingston, 27 Jul 1950, Shinners 12631 (SMU). Tuscaloosa Co.: E of University campus, 9 Sep 1933, Harper 3108 (GH, MICH, MO, NCU, NY).

ARKANSAS. Arkansas Co.: P.O. De Witt, 30 Sep 1966, Demaree 54719 (ILL, SMU). Ashley Co.: Lone Pine Prairie, P.O. Mist, 15 Sep 1940, Demaree 21591 (GH, NY). Benton Co.: 1889, Plank s.n. (NY). Bradley Co.: P.O. Banks, 4 Jul 1939, Demaree 19541 (NY, SMU). Calhoun Co.: P.O. Gurdon, 3 Sep 1958, Demaree 16615 (MO, NY). Clark Co.: P.O. Gurdon, 3 Sep 1958, Demaree 40506 (GH). Clay Co.: Lurchman, 19 Aug 1913, Emig 62 (MO). Conway Co.: Petit Jean Mountain, P.O. Morrilton, 17 Aug 1955, Moore 1219 (TENN). Craighead Co.: Crowley's Ridge and lowlands near Lake City on the St. Francis River, 16 mi E of Jonesboro, 30 Jul 1929, Demaree 7065 (SMU). Drew Co.: 9 mi N of Monticello, 28 Aug 1936, Demaree 13532 (NY, SMU). Falkner Co.: Guy, 4 Sep 1934, Demaree 10964 (GH, MO, NY). Garland Co.: Cedar Mountain, Hot Springs National Park, 24 Aug 1955, Demaree 38177 (GH, SMU). Grant Co.: P.O. Sheridan, 24 Oct 1937, Demaree 16573 (ILL, MO, NY). Hempstead Co.: Tokio, 22 Oct 1932, Demaree 9935 (GH, MO, NY). Hot Springs Co.: Magnet Cove, 17 Jul 1938, Demaree 17984 (MO, NY, SMU). Howard Co.: near Mineral Springs, 12 Oct 1937, Palmer 44131 (MO). Independence Co.: P.O. Batesville, 14 Aug 1942, Demaree 23829 (GH, MO, NY, SMU). Jefferson Co.: P.O. Pine Bluff, Watson State Park, 1 Oct 1942, Demaree 24087 (MO, NY). Johnson Co.: P.O. Knoxville, 12 Aug 1949, Demaree 19974 (MO, NY, SMU). Lafayette Co.: P.O. Lewisville, 19 Oct 1959, Demaree 41946 (GH, SMU). Logan Co.: Ouachita National Forest, Jack Creek Camp, P.O.

Strickland, 25 Aug 1937, Demaree 16051 (MO, NY). Lonoke Co.: P.O. Carlisle, 17 Aug 1955, Demaree 38008 (GA, NCU, SMU). Miller Co.: P.O. Doddridge, 19 Sep 1961, Demaree 44897 (SMU). Monroe Co.: Brinkley, 28 Aug 1934, Demaree 10852 (GH, MICH, MO, NY, SMU). Montgomery Co.: Forest Seed Orchard, P.O. Mount Ida, 18 Jul 1969, Demaree 60603 (SMU). Nevada Co.: jct. of Hwy. 24 with Hwy. 30, P.O. Prescott, 25 Jul 1970, Demaree 62480 (NCU). Ouachita Co.: Smackover, 31 Oct 1937, Demaree 16613 (MO, SMU). Perry Co.: ridges above Nimrod Dam, P.O. Nimrod, 9 Jul 1954, Demaree 35627 (SMU). Pike Co.: 3 mi NW of Murfreesboro, 30 Sep 1932, Demaree 9400 (GH, MO, NY). Polk Co.: Bard Camp, P.O. Nunley, 19 Aug 1937, Demaree 15893 (MO, NY, SMU). Pope Co.: P.O. Nogo, 27 Aug 1955, Demaree 38256 (GH, SMU). Prairie Co.: P.O. Hazen, 13 Aug 1955, Demaree 37887 (GA, GH, NCU, SMU). Pulaski Co.: Fort Roots, P.O. North Little Rock, 31 Jul 1955, Demaree 37705 (GA, NCU, SMU). Randolph Co.: P.O. Pocahontas, 12 Aug 1942, Demaree 23703 (GH, SMU). Saline Co.: P.O. Bento, 29 Jun 1955, Demaree 37053 (SMU). Sevier Co.: Lockesburg, 20 Oct 1932, Demaree 9898 (MO, NY, US). Union Co.: along Ark. 275, 0.8 mi N of Ark.-La. state line, 23 Sep 1971, Rickerson 398 (MO). White Co.: P.O. Bradford, 6 Aug 1957, Demaree 39671 (SMU). Yell Co.: ridges on Tones Mountain, P.O. Dardanelle, 16 Aug 1939, Demaree 20023 (GH, MO, NY).

FLORIDA. Gadsden Co.: 2.5 mi W of Gretna, 7 Nov 1964, Godfrey 64941 (NCU). Jackson Co.: Lake Seminole, N of Sneads, 9 Sep 1958, Godfrey 57779 (GH).

GEORGIA. Baker Co.: along Ga. Rt. 91, 6.8 mi NE of jct. 91 and 253, 28 Aug 1976, Webb et al. 52529 (TENN). Bartow Co.: near

Missy Pond, ca. 4.5 mi SE of Adairsville on Cassville Mountain, 20 Oct 1963, Greear 63442 (GA, NCU). Bibb Co.: Rivoli campus, Wesleyan College, Macon, 5 Oct 1951, Flanders 146 (GA). Columbia Co.: 8 mi E of Appling, 11 Oct 1936, Pyron and McVaugh 1044 (GA). Early Co.: W of Saffold, 9 Aug 1947, Thorne 5982 (GA). Floyd Co.: collector unknown s.n. (US). Lincoln Co.: 1.2 mi E of Lincolnton, 2 Sep 1949, Duncan 10176 (GA, GH, TENN, SMU, US). Miller Co.: along Rt. 91, 4.5 mi W of jct. Hwy. 91 and Hwy. 45 in Colquitt, 28 Aug 1976, Webb et al. 52531 (TENN). Oglethorpe Co.: 5 mi W of Philomath, 21 Aug 1947, Cronquist 4590 (GA, GH, MO, NY, SMU, US). Richmond Co.: 8 mi W of Augusta, 17 Oct 1937, Pyron and McVaugh 1919 (GA, US). Seminole Co.: 9 mi W of Bainbridge, 5 Aug 1970, Godfrey 69876 (GA). Spaulding Co.: Experiment, 26 Aug 1932, Hadden s.n. (GA). Taylor Co.: streets of Butler, 14 Sep 1908, Harper 2239 (GH, MO, NY, US).

ILLINOIS. Christian Co.: Taylorville, 12 Jul 1958, Jones 22167 (ILL). Clay Co.: NE of Clay City, near Salt Pond, 6 Oct 1951, Ahles 5199 (ILL). Clinton Co.: between Carlyle and Shattue, 14 Oct 1951, Ahles 5747 (ILL). Cumberland Co.: near Neoga, 1 Oct 1948, Winterringer 1656 (ILL). Effingham Co.: RR between Edgewood and Mason, 12 Aug 1950, Ahles 2898 (ILL). Fayette Co.: 1.5 mi S of Ramsey, 16 Jul 1949, Franklin s.n. (ILL). Franklin Co.: 5 mi S of Frisco, 22 Aug 1973, Seigler and Evers DS-8067 (ILL). Jackson Co.: 2 mi NE of Carbondale, 21 Aug 1941, McCree and Wilson 1151 (ILL). Johnson Co.: Cedar Grove, 4 mi SW of Goreville, 4 Jul 1948, Winterringer 1257 (ILL). Macon Co.: E of Spitler Woods State Park, 3 Aug 1973, Shildneck C-5300 (ILL). Macoupin Co.: Carlinville,

16 Sep 1890, collector unknown s.n. (ILL). Marion Co.: along RR NE of Kinmundy, 12 Oct 1951, Ahles 5331 (ILL). Pope Co.: top of bluff, 0.25 mi E of Brownfield, 20 Jul 1948, Winterringer 1393 (ILL). Richland Co.: 3.5 mi N of Olney, 16 Aug 1947, Scherer 503 (ILL). St. Clair Co.: prairie at Hilgard's, E of Belleville, Aug 1845, Englemann s.n. (MO). Saline Co.: N of Mitchellsville, 10 Aug 1950, Ahles 2712 (ILL). Wabash Co.: Cap. Brown's farm, 21 Jul 1879, Schneck s.n. (ILL). Washington Co.: 20 Aug 1873, French s.n. (NY). White Co.: S of Norris City, 28 Jul 1951, Ahles 4680 (ILL).

INDIANA. Delaware Co.: near N. Albany, 1836, Ridell s.n. (US). Jefferson Co.: along Rd. 3, ca. 1.5 mi N of Rd. 256, 27 Oct 1945, Friesner 20247 (MICH, NY, SMU). Jennings Co.: 1.5 mi SE of Brewersville, 20 Sep 1919, Deam 30100 (GH). Posey Co.: along the Wabash River, 9 mi SW of Mt. Vernon, 16 Aug 1919, Deam 29130 (GH, US). Spencer Co.: 2 mi SE of Chisney, 13 Aug 1919, Deam 28961 (GH). Sullivan Co.: 23 Aug 1935, McCoy s.n. (SMU). Warrick Co.: Boonville, collector unknown 17 (NY).

KANSAS. Chautauqua Co.: 1896, Hitchcock 635 (MO, NY, US). Cherokee Co.: 1.5 mi S of Galena, 12 Oct 1968, Magrath and Johnson 3570 (NY). Montgomery Co.: Independence, 1882, Plank s.n. (GH).

KENTUCKY. Bell Co.: near Wasiota, Sep 1893, Kearney 397 (NY). Boyle Co.: near Mitchellsburg, 22 Jul 1937, Wharton 1014 (MICH). Breckenridge Co.: along Hwy. 60, 1.5 mi W of its jct. with 992, just W of Hardensburg, 13 Aug 1968, Fuller and Fuller 187 (NCU). Calloway Co.: 2 mi N of Murray, 19 Jul 1965, Austin 955 (NCU). Graves Co.: W of Lynnville, 21 Jul 1937, Smith and Hodgdon 4121 (GH). Lewis Co.: Kinniconick, 4 Aug 1931, Braun 227 (US).

Madison Co.: 2 mi NE of Big Hill, 6 Aug 1940, Wharton 5671 (MICH). Nelson Co.: Nazareth, 25 Aug 1934, Agnes 1641 (GH). Union Co.: 8 Aug 1936, Shacklette 441a (GH).

LOUISIANA. Acadia Par.: W side of Crowley, 9 Oct 1955, Shinners 22170 (SMU). Allen Par.: 7.6 mi WNW of Kinder, 8 Sep 1955, Shinners 21537 (SMU). Beauregard Par.: 7.7 mi ESE of De Ridder, 11 Nov 1957, Shinners 26815 (SMU). Bienville Par.: 4.1 mi W of Gibbsland, 6 Sep 1955, Shinners 21227 (SMU). Bossier Par.: 10 mi S of Plain Dealing, 18 Sep 1956, Shinners 24511 (SMU). Caddo Par.: 2.8 mi NW of Greenwood, 6 Sep 1955, Shinners 21185 (SMU). Calcasieu Par.: 2.5 mi SW of Starks, Washout Slough, 6 Oct 1956, Shinners 25086 (SMU). Caldwell Par.: 3 mi SW of Grayson, 7 Oct 1955, Shinners 21885 (GH, SMU). Catahoula Par.: 1.7 mi N of Sicily Island, 19 Sep 1956, Shinners 24678 (GH, SMU). De Soto Par.: ca. 4 mi SW of Logansport, 10 Aug 1938, Correll and Correll 10168 (MO, NY). East Baton Rouge Par.: Cypress Bayou, ca. 2 mi SE of Baker, 10 Oct 1958, Richardson 808 (US). Evangeline Par.: 7.3 mi N of Turkey Creek, 5 Oct 1956, Shinners 24967 (SMU). Grant Par.: 9.4 mi N of Dry Prong, 7 Sep 1955, Shinners 21330 (SMU). Iberia Co.: near "Little Woods," N side of Bayou Teche, N of New Iberia, 6 Oct 1962, Thieret 9579 (SMU). Jackson Par.: Chatham Lake at Chatham, La. 34, 13 Aug 1968, Thomas et al. 12035 (TENN). Lafayette Par.: vicinity of airport, near Vermillion River, 28 Sep 1961, Reese 5960 (GH, NCU). La Salle Par.: 7 mi NW of Trout, 30 Jul 1950, Shinners 12801 (SMU). Lincoln Par.: 3.6 mi WNW of Simsboro, 6 Oct 1955, Shinners 21808 (SMU). Morehouse Par.: 8.7 mi E of Mer Rouge, 19 Sep 1956, Shinners 24623 (GH, SMU). Natchitoches Par.: 3.3 mi N of

Natchitoches, 8 Oct 1955, Shinners 21990 (SMU). Ouachita Par.: RR tracks behind Windsor Marine, Monroe, 14 Nov 1969, Thomas 17438 (GA, GH, MO, NY). Rapides Par.: 5 mi NE of Forest Hill, 7 Sep 1955, Shinners 21382 (GA, SMU). Red River Par.: 8.4 mi NW of Coushatta, 23 Oct 1960, Shinners 28748 (SMU). Sabine Par.: 4.6 mi S of Many, 9 Sep 1955, Shinners 21621 (GH, ILL, SMU). St. Helena Par.: 3.5 mi E of Greensburg, 17 Jul 1962, Shinners 29875 (SMU). St. Landry Par.: 5.5 mi W of Lawtell, 5 Oct 1956, Shinners 25028 (SMU). St. Mary Par.: roadside in clearing, Cote Blanche Island, 13 Jul 1963, Thieret 16136 (SMU, US). St. Tarmany Par.: 1 mi N of Abita Springs, 14 Aug 1912, Pennell 4183 (MICH, NY). Vernon Par.: 1.3 mi N of Rosepine, 8 Sep 1955, Shinners 21587 (SMU). Webster Par.: 3.4 mi SW of Minden, 6 Sep 1955, Shinners 21217 (SMU). West Carroll Par.: 1 mi SW of Chickasaw, 29 Oct 1956, Shinners 25603 (SMU). Winn Par.: 8.4 mi WSW of Winnfield, 7 Sep 1955, Shinners 21299 (SMU).

MISSISSIPPI. Clark Co.: 3.8 mi N of Shubuta, along US 45, 15 Jul 1977, Webb and Ross 53274 (TENN). Copiah Co.: P.O. Barlow, 21 Sep 1954, Demaree 36198A (GH, SMU). De Soto Co.: 1 mi N of Coldwater River, 25 Oct 1959, McDaniel 1541 (NY). Forrest Co.: Lake Shelby State Park, 13 mi S of Hattiesburg, 15 Jul 1950, Webster and Wilbur 3385 (MICH, SMU). Franklin Co.: 4.6 mi WNW of Roxie, 24 Oct 1960, Shinners 28784 (SMU). Grenada Co.: Grenada, 6 Aug 1894, Tracy s.n. (US). Hancock Co.: N of Hwy. 90 in S central portion of county, 24 Aug 1952, Diener 550 (ILL). Harrison Co.: Cat Island, 26 Aug 1900, Lloyd and Tracy s.n. (NY). Jackson Co.: Biloxi, 10 Jul 1897, Tracy 3577 (GH, MO, NY, US). Jasper Co.: 1.7

mi N of Jones-Jasper Co. line, 10 Jul 1967, Jones 14230 (GA). Kemper Co.: along US 45, 4.4 mi N of Porterville, 13 Sep 1968, Shinners 32474 (SMU). Leake Co.: Yockanookany River between Ofahoma and Wiggins, 10 Sep 1969, Jones et al. 18061 (GA). Marion Co.: along RR at Kokomo and Hwy. 98, 24 Aug 1966, Jones 9165 (GA, NCU). Okitibbeha Co.: 7 mi W of Starkville, 10 Jul 1956, Ray 6765 (GH, NCU). Pearl River Co.: 13.7 mi SW of Poplarville, along Ga. 26, 20 Jul 1964, Pullen 641178 (GA). Perry Co.: Maxie, De Soto National Forest, P.O. Beaumont, 22 Oct 1954, Demaree 32257 (GH, SMU). Prentiss Co.: 2 mi E of Baldwyn at jct. of Ga. 366 with Ga. 370, 13 Aug 1964, Pullen 641356 (GA). Rankin Co.: 3.3 mi ENE of Pelahatchie, 27 Oct 1960, Shinners 29093 (SMU). Smith Co.: roadside between Marathon Lake and Otho, 25 Aug 1964, Jones 2396 (GA, NCU). Stone Co.: ca. 0.25 mi S of McHenry, 6 Aug 1952, Diener 385 (ILL). Tishomingo Co.: Bay Springs, 26 Sep 1974, Coleman 48519 (TENN). Wilkinson Co.: 2 mi SW of Centerville, 30 Oct 1956, Shinners 25642 (SMU). Winston Co.: N of Louisville, T15N, R12E, Sec. 8, along road leading to Tombigbee National Forest (Choctaw Unit), 31 Aug 1967, Lelong 3674 (NCU). Yalobusha Co.: 2.6 mi SE of Coffeeville on Ga. 330, 7 Jul 1964, Pullen 64822 (GA, NCU). Yazoo Co.: 1 mi W of Yazoo City near Yazoo River, 31 Aug 1959, McDaniel 1302 (NY).

MISSOURI. Barry Co.: Exeter, 29 Sep 1896, Bush 32 (MO). Boone Co.: W of Sturgeon, 3 Sep 1933, Steyermark 9390 (MO). Butler Co.: 15 Oct 1905, Bush 3697 (GH, MO, NY, US). Calloway Co.: W of Aux Vasse Creek, St. Peter sandstone glade bordering ravine tributary to Hall's Creek, T46N, R8W, Sec. 18, 11 Sep 1937,

Steyermark 26153 (MO). Cedar Co.: NW of Fairplay, 30 Jul 1897, Trelease 119 (MO). Christian Co.: near Saunders, 10 Jul 1937, Steyermark 23176 (MO). Cole Co.: above bluffs along Moreau River, Sec. 32, 2 mi N of Wardsville, 18 Aug 1937, Steyermark 24916 (MO). Dent Co.: Rhyse, 4 Jul 1927, Kellogg 1046 (MO). Dunklin Co.: Crowley's Ridge, 7 Aug 1932, Kellogg 26028 (MO). Franklin Co.: Pacific, Letterman s.n. (MO). Gasconade Co.: Perruginous sandstone glade between Swiss and Hermann, 1 Oct 1934, Steyermark 15641 (MO). Greene Co.: near Strafford, 27 Aug 1912, Standley 9449 (US). Howell Co.: Burnham Pond, T26N, R10W, 6.5 mi SW of Willow Springs, 21 Jul 1937, Steyermark 23513 (MO). Jasper Co.: Webb City, 27 Jul 1902, Palmer 262 (MO). Jefferson Co.: Silica, 21 Oct 1886, Eggert s.n. (NY, US). Knox Co.: between Edina and Knox City, 15 Oct 1934, Steyermark 16201 (MO). Lincoln Co.: 2 mi W of Foley, 15 Feb 1931, Steyermark 215 (MO). Maries Co.: vicinity of Lanes Prairie, 16 Sep 1934, Steyermark 15332 (MO). Marion Co.: near Ely, near Marion-Ralls Co. line, 16 Oct 1934, Steyermark 16271 (MO). McDonald Co.: 24 Jul 1893, Bush 23 (NY). Monroe Co.: Lakenan Floodplain, T56N, R9W, NW 1/4 Sec. 10, 5 Sep 1973, Hinterhuer 932 (MO). Montgomery Co.: E of Mineola, 1 Aug 1932, Drouet 99 (MO). Morgan Co.: 30 Aug 1935, Bush 15145 (MO). New Madrid Co.: Malden, 12 Sep 1893, Bush s.n. (MO). Newton Co.: Riding's Mill, 15 Jul 1906, Palmer s.n. (MO). Perry Co.: Silver Lake near Saline Creek, W of Perryville, 29 Jul 1934, Steyermark 13951 (MO). Pettis Co.: Sec. 25, near Morgan Co. line, 3 mi E of Bahner, 3 Oct 1938, Steyermark 21355 (MO). Phelps Co.: Jerome, 5 Oct 1913, Kellogg 160 (MO). Polk Co.: ravine tributary to Pomme de Terre River, 0.5 mi N of Burns, 17 Jul 1934, Steyermark 13644 (MO). St. Charles Co.: near

Klondike, 12 Aug 1935, Steyermark 19497 (MO). St. Clair Co.: N side bluffs of Osage River, S of Monegaw Springs, 2 mi N of Oyer, 3 Oct 1936, Steyermark 20238 (MO). St. Francois Co.: Bismark, 10 Sep 1893, Bush s.n. (MO). St. Louis Co.: St. Louis, 1838, Riehl 211 (MO). Shannon Co.: 12 Sep 1888, Bush s.n. (MO). Stoddard Co.: draw by Ardeda School, near Ardeola, 8 Nov 1936, Steyermark 20764 (MO). Stone Co.: Marble Cove, 11 Sep 1898, Trelease 964 (MO). Texas Co.: 3.5 mi S of Licking, 15 Jul 1937, Steyermark Steyermark 42152 (NY). Wayne Co.: Sep 1897, Russell s.n. (MO). Webster Co.: between Duncan and High Prairie, 28 Jul 1937, Steyermark 23798 (MO, NY, TENN).

NORTH CAROLINA. Alamance Co.: 5.5 mi SW of Swepsonville and 3.5 mi SE of Bellemont, 29 Sep 1956, Ramseur and Hammond 2227 (NCU). Buncombe Co.: Biltmore, 17 Aug 1897, collector unknown, 526[b] (GH, MICH, MO, NY, NCU, US). Cabarrus Co.: 6.3 mi SSE of Harrisburg, 3 mi SW of town of Rocky River, 23 Sep 1956, Ahles and Leisner 19743 (GA, GH, NCU, NY). Chatham Co.: 0.17 mi SE of Gulf, off Hwy. 421, 8 Sep 1955, Kessler 548 (NCU). Cherokee Co.: Andrews, Sep 1900, Heyer s.n. (NY). Davidson Co.: 3 mi N of Thomasville, along N.C. 109, 14 Sep 1956, Ahles and Leisner 18595 (NCU, SMU). Durham Co.: NE of Durham on Neuse River at Co. line, SW of Cozart, 21 Aug 1965, Ahles and Sears 59825 (NCU). Granville Co.: 1.25 mi E of N.C. 96 along dirt road 2 mi N of Tar River, 10 Sep 1964, Dayton 1946 (NCU). Haywood Co.: 1 mi S of Crabtree on N.C. 209, 7 Oct 1958, Ahles and Duke 50331 (NCU). Madison Co.: Hot Springs, 9 Aug 1924, Wehmeyer 526 (MICH). McDowell Co.: Marion, Jul 1878, Hyams s.n. (GH, NY). Mecklenburg Co.: 4 mi NE of Derita, 2 Oct

1958, Ahles and Duke 49997 (NCU). Orange Co.: 2.3 mi WNW of Chapel Hill, 25 Sep 1957, Duke 0313 (NCU). Perquimans Co.: 2.2 mi W of New Hope, 26 Sep 1967, Bozeman 11542 (ILL, NCU). Pitt Co.: 1.5 mi SSE of Stokes, 9 Oct 1958, Radford 41755 (NCU). Robeson Co.: 0.5 mi E of Rayham along US 301, 1 Aug 1957, Ahles and Leisner 32905 (NCU). Rowan Co.: roadside where N.C. 601 crosses the South Yadkin River, 6 Oct 1956, Horton 435 (NCU). Stanly Co.: 0.4 mi E of Oakboro, 24 Sep 1956, Ahles and Leisner 19901 (NCU). Union Co.: 4.5 mi SW of Sturduvants, 14 Jul 1957, Ahles and Haesloop 31447 (NCU, TENN). Warren Co.: 0.2 mi S of Bethlehem, 24 Oct 1956, Bell 5453 (NCU). Watauga Co.: 2.5 mi W of jct. N.C. 603 and US 421 on N.C. 603, W of Sugar Grove, 23 Sep 1958, Ahles and Duke s.n. (NCU).

OHIO. Adams Co.: Lake Adams, 10 Oct 1956, Braun s.n. (US). Ashtabula Co.: Oct 1899, Louth s.n. (GH). Coshocton Co.: near Coshocton, North Appalachian Experimental Watershed, 2 Aug 1942, Moldenke 13486 (SMU). Cuyahoga Co.: Brecksville to Richfield, 29 Sep 1923, Krebs 1579 (GH). Hamilton Co.: near California, 24 Aug 1917, Braun s.n. (US). Hocking Co.: cliff top, Queer Creek, 9 Sep 1910, Griggs s.n. (GH). Jackson Co.: Liberty Twp., 20 Aug 1934, Pontius and Bartley s.n. (US). Pickaway Co.: Pickaway Twp., 20 Aug 1937, Bartley and Pontius 622 (NY). Pike Co.: 16 Oct 1966, Bartley 3056 (NY). Warren Co.: Fort Ancient, 1925, Roads s.n. (US).

OKLAHOMA. Cleveland Co.: Norman, 18 Sep 1914, Emig 560 (MO). Creek Co.: Sapula, 30 Jul 1894, Bush 38 (MO). Delaware Co.: 4 mi N of Little Kansas along Okla. 10, 29 Jul 1957, Wallis 5342 (SMU). Latimer Co.: 1.75 mi W of Fanshawe, 13 Jul 1950, Cory 57492 (SMU).

Le Flore Co.: near Page, 9 Sep 1913, Stevens 2717 (GH, ILL, NY). Lincoln Co.: Fouts, 27 Aug 1895, Blankinship s.n. (MO). Marshall Co.: near Buncombe Creek, 0.5 mi N of University of Oklahoma Biological Station, 27 Jul 1959, Goodman 6944 (SMU). Pawnee Co.: Cleveland, 1 Sep 1914, Palmer 6382 (MO). Payne Co.: Stillwater, 17 Jul 1897, Myers s.n. (ILL). Pittsburg Co.: 11.2 mi NW of McAlester, 3 Jul 1948, Gardenhire and Stratton 114 (SMU). Sequoya Co.: Brushy Mountains, 12 mi NE of Sallisaw on US 59, 17 Sep 1957, Wallis 5583 (SMU).

SOUTH CAROLINA. Abbeville Co.: near S.C. 81, 3.5 mi SSE of Calhoun Falls, 13 Oct 1957, Radford 30771 (NCU). Aiken Co.: streets of Aiken, 10 Sep 1866, Ravenel s.n. (GH). Berkeley Co.: along S.C. 45, Santee Wool Combing Mill, Jamestown, 5 Jul 1957, Ahles and Haesloop 30826 (NCU, SMU). Cherokee Co.: 3.3 mi SE of jct. S.C. 11 and Co. 54 along Co. 54, SSE of Gaffney, 18 Sep 1957, Ahles 34398 (NCU). Chester Co.: on S.C. 72, 1.1 mi E of Broad River, SW of Chester, 18 Sep 1957, Bell 10032 (NCU). Darlington Co.: Witherspoon Island, 15 Sep 1941, Smith 1807 (NCU). Dillon Co.: 1.7 mi NE of Bingham on S.C. 34, 17 Oct 1957, Ahles 37134 (NCU). Dorchester Co.: 1.5 mi S of Ridgeville on S.C. 27, 25 Oct 1957, Ahles and Haesloop 37915 (NCU). Florence Co.: along RR at Florence radio tower, 18 Oct 1957, Bell 10711 (NCU). Greenwood Co.: near S.C. 246, 3.5 mi E of Hodges, 3 Sep 1957, Radford 29067 (NCU). Jasper Co.: ca. 1.5 mi from Savannah River at RR crossing, 10.5 mi NW of Tillman, 9 Sep 1956, Bell 4972 (NCU). Lancaster Co.: 2 mi SW of Lancaster on S.C. 200, 20 Sep 1957, Ahles 34693 (NCU). Lexington Co.: 1 mi S of Chapin, 5 Oct 1957, Radford 29873 (NCU). McCormick Co.: 5.25 mi

SW of McCormick along dirt road, 18 Sep 1949, Duncan 10378 (GA). Newberry Co.: 4.5 mi SE of Whitmire on US 176, 16 Sep 1957, Bell 9729 (NCU). Saluda Co.: 4 mi W of Batesburg, 12 Oct 1957, Radford 30492 (NCU). Sumter Co.: US 76 at the Wateree River, 9 Oct 1956, Freeman 56807 (NCU). Union Co.: 2 mi E of Carlisle, 25 Aug 1956, Freeman 56678 (NCU). Williamsburg Co.: 3.1 mi N of jct. Hwy. 375 and Hwy. 52 along 52, ca. 4 mi NW of Gourdin, 24 Aug 1976, Webb et al. 52464 (TENN). York Co.: 0.9 mi NE of Smyrna on Co. 11, 19 Sep 1957, Ahles 34557 (NCU).

TENNESSEE. Carroll Co.: NE of Huntingdon, 11 Aug 1947, Shanks et al. 6020 (TENN, NY). Coffee Co.: Tullahoma, 20 Aug 1897, collector unknown, 526[c] (GH, MO, NY). Dickson Co.: 4 mi W of Dickson, 15 Aug 1957, DeSelm 1710 (TENN). Dyer Co.: N of Roellin, 16 Aug 1947, Sharp et al. 6299 (TENN). Fayette Co.: Ames Plantation, 19 Oct 1972, DeSelm and Pope s.n. (TENN). Franklin Co.: Cumberland Mt. at Sewanee, 10 Sep 1898, Eggert s.n. (MO). Grainger Co.: Buffalo Springs Game Farm, 6 mi SW of Rutledge, 1 Aug 1938, Morrison s.n. (TENN, MO). Hawkins Co.: near Kincaid's Creek, 6 mi NE of Rogersville, 8 Aug 1954, Wolfe 18401 (TENN). Henry Co.: along RR tracks ca. 2.8 mi N of Puryear, along US 641 near intersection with paved road leading to Crossland, 30 Aug 1977, Webb and Webb 53790 (TENN). Jefferson Co.: 2 mi SW of Jefferson City, 1 Sep 1949, Shanks et al. 8705 (TENN). Knox Co.: Knoxville, Jul 1898, Ruth 398 (MO). Marion Co.: ca. 0.6 mi W of Anderson Point, 11 Oct 1965, Clark and Radford 2192 (NCU). Montgomery Co.: Sango community ca. 6 mi SE of Clarksville, just N of jct. US 41-A and Sango, 13 Sep 1967, Chester 1898 (NCU, SMU). Monroe Co.: near N border of

Cherokee National Forest, along Tenn. 68, 17 Sep 1946, Ford and Russell 2012 (TENN). Morgan Co.: near Coalfield, 29 Sep 1961, Sharp and Pringle 28396 (TENN). Putnam Co.: N of Double Springs, 21 Aug 1947, Norris and Shanks 7312 (NCU, TENN). Sevier Co.: Chilhowee Mountain above Cusick, 4 Oct 1958, Shanks 26003 (TENN). Shelby Co.: jct. of Hwy. 72 and Johnson Rd., 28 Aug 1965, Rogers 34438 (TENN). Stewart Co.: Gaither farm, Indian Mound, 18 Sep 1954, Clebsch and Clebsch 18797 (TENN). Sumner Co.: 11 Nov 1942, Denning 4 (TENN). Tipton Co.: 1 mi NW of Mason, off Hwy. 59, 1965, Rogers 34456 (TENN). Washington Co.: Johnson City, 29 Aug 1928, J. M. R. s.n. (GA). White Co.: W of Bon Air, edge of Plateau, 30 Jul 1947, Shanks et al. 3450 (TENN).

TEXAS. Anderson Co.: 10.25 mi SW of Palestine, 2 Nov 1947, Shinners 9624 (SMU). Angelina Co.: Lufkin, 15 Sep 1923, Tharp 187 (MICH). Austin Co.: Industry, 1893, Wuzlow s.n. (ILL). Bastrop Co.: Lake Thunderbird, NW of Smithville, 27 Aug 1971, Seigler 5467 (SMU). Bexar Co.: 20 mi S of San Antonio, 18 May 1932, Metz 677 (TENN). Bowie Co.: near Texarkana, 14 Sep 1898, Heller and Heller 4239 (GH, MO, NY). Brazoria Co.: West Columbia, 3 Oct 1914, Palmer 6706 (MICH, MO, TENN). Brazos Co.: College Station, 18 Aug 1946, Parks 819 (SMU). Brown Co.: Hwy. 279, 4 mi S of Cross Cut, 21 Oct 1966, McCart and Clark 23 (SMU). Calhoun Co.: Port Alto, 11 Aug 1920, Drushell 2926 (MO). Cass Co.: 4 mi WSW of Avinger, 21 Sep 1956, Shinners 24827 (SMU). Cherokee Co.: 3 mi SW of Reklaw, 10 Oct 1955, Shinners 22368 (SMU). Colorado Co.: W of Sheridan, 21 Sep 1913, Pennell 5532 (NY). Dallas Co.: Dallas, Jul 1880, Reverchon 89 (MO). Denton Co.: W of Cheatum Oaks, 4.5 mi N of

Grapevine near Tarrant Co. line, 12 Sep 1947, Shinners 9361 (SMU). DeWitt Co.: 3 Jul 1941, Riedel s.n. (GH). Fayette Co.: 1892, Crawford 5 (MO). Franklin Co.: 9.8 mi N of Mt. Vernon, 26 Jul 1958, Shinners 15470 (SMU). Freestone Co.: 12.5 mi ESE of Fairfield on Hwy 84, 2 Nov 1947, Shinners 9635 (SMU). Galveston Co.: Kemah, 6 Sep 1926, Fisher s.n. (SMU). Gonzales Co.: just W of Leesville, 27 Sep 1958, Correll 20444 (GH, SMU). Grayson Co.: Post Oak Belt on Lake Texoma at Cedar Bayou, N of Gordonville, 20 Oct 1946, Whitehouse 17466 (SMU). Gregg Co.: 5.5 N of Longview, 18 Sep 1953, Shinners 16237 (SMU). Hardin Co.: along Hwy. 69, N of Silsbee, 13 Aug 1971, Amerson 609 (SMU). Harris Co.: Houston, Jul 1842, Lindheimer s.n. (GH, MO). Harrison Co.: 4 mi E of Longview on Hwy. 80, 7 Sep 1946, Whitehouse 16503 (MICH, SMU). Henderson Co.: 7 mi SW of Athens, 26 Sep 1948, Shinners 10452 (SMU). Hopkins Co.: 7.8 mi S of Sulphur Springs, 11 Sep 1949, Shinners 11675 (SMU). Houston Co.: 4 mi E of Radcliff, 19 Sep 1952, Gould and Leinweber 6504 (SMU). Hunt Co.: 8 mi E of Greenville, 11 Sep 1949, Shinners 11659 (SMU). Jasper Co.: 1 mi N of turn-off to Rayburn Dam, Rt. 63, 14 Sep 1968, Correll 36557 (GH, MICH). Leon Co.: 5 mi SW of Buffalo, 2 Oct 1949, Shinners 11849 (SMU). Llano Co.: 17 Aug 1940, Tharp s.n. (GH). Milam Co.: E of Cameron, 23 Sep 1932, Wolff 3670 (SMU). Montgomery Co.: 3 mi NW of Conroe, 13 Oct 1953, Shinners 16601 (SMU). Nacogdoches Co.: Cushing, 8-9 Oct 1949, Tharp and Brown 53-101 (GA). Newton Co.: 23 Jul 1939, Tharp 187 (MO). Orange Co.: 12 mi E of Beaumont, 14 Sep 1952, Corbin 95 (SMU). Palo Pinto Co.: 16.6 mi S of Mineral Wells, 31 Aug 1953, Shinners 15922 (SMU). Panola Co.: 2 mi S and 0.5 mi W of Bethany, 2 Sep 1971, Seigler 5602a (ILL). Polk Co.: Indian Reservation, 2 Nov 1940, Innes 238

(GH). Parker Co.: 1.5 mi SE of Springtown, 9 Oct 1949, Shinners 11948 (SMU). Robertson Co.: 8 Aug 1943, Barkley 13654 (MO, NY, US). San Augustine Co.: San Augustine, 5 Sep 1923, Tharp 2468 (MO). San Jacinto Co.: 5 mi SW of Shepherd, 14 Oct 1956, Shinners 25315 (SMU). Smith Co.: Amigo, 5-12 Aug 1945, Moore 994 (GA, GH, ILL, MICH, MO, NY, SMU, TENN). Tarrant Co.: 6 mi NW of Grapevine, 23 Oct 1955, Shinners 22374 (SMU). Titus Co.: farm road SW of I-30, Macon community, 12 Sep 1971, Anderson 700 (SMU). Travis Co.: Austin, Jun-Jul 1926, Tharp 187 (MICH). Trinity Co.: 5 mi SW of Trinity, 29 Sep 1934, Cory 10423 (GH). Upshur Co.: 4.2 mi SE of Gilmer, 9 Aug 1950, Cory 57699 (SMU). Van Zandt Co.: 5.5 mi SE of Wills Point, across the road from New Hope Cemetary, 7 Sep 1945, Cory 49708 (SMU). Victoria Co.: Telferner, 12 Aug 1956, Shinners 24372 (SMU). Walker Co.: 3.3 mi E of Huntsville, 9 Nov 1945, Cory 50643 (GH, MICH, NY, SMU). Waller Co.: Waller, Aug 1928, Tidestrom s.n. (NY). Willacy Co.: 0.25 mi from shore at Port Mansfield, 27 Jun 1950, Webster and Wilbur 3071 (MICH).

VIRGINIA. Charlotte Co.: 0.5 mi S of Keysville on Va. 49, 5 Sep 1965, Ahles and James s.n. (NCU). Greenville Co.: near Three Creek, N of Emporia, 18 Sep 1938, Fernald and Long 9378 (GH, NY, US). Halifax Co.: 3 mi S of Hyco River on US 501, S of Chester Springs, 29 Aug 1965, Ahles and James 60488 (NCU). Norfolk Co.: along RR, 0.5 mi W of Bowers Hill, 6 Aug 1944, Hubricht B2571 (MO). Westmoreland Co.: 1941, Iltis 708 (SMU).

2. Hypericum gentianoides (L.) BSP. Prelim Cat. N. Y. Pl. 9.

Sarothra gentianoides L. Sp. Pl. 272. 1753. TYPE: UNITED STATES: Kalm s.n. (LECTOTYPE: LINN 391/1, as IDC microfiche!).

Hypericum nudicaule Walt. Fl. Carol. 190. 1788. TYPE: UNITED STATES: CAROLINA?: no collector cited, 649. (LECTOTYPE: BM, as photo BM!).

Hypericum Sarothra Michx. Fl. Bor. Am. 2: 79. 1803. Nom. superfl., illigit. Based on Sarothra gentianoides L.

Sarothra hypericoides Nutt. Gen. Am. 1: 204. 1818. Nom. superfl., illigit. Based on Sarothra gentianoides L.

Brathys gentianoides (L.) Spach. Ann. Sci. Nat. sér. 2, 5: 367. 1836; Hist. Nat. Veg. 5: 452. 1836.

Hypericum aphyllum Lundell. Am. Midl. Nat. 29: 477. 1943. TYPE: BRITISH HONDURAS: Toledo District, in open pine ridge, Monkey River, near Jenkins Creek, 26 Sep 1942, Gentle 4175. (HOLOTYPE: MICH, ISOTYPE: GH!).

Sarothra aphyllum (Lundell) Lundell. Wrightia 1: 58. 1945.

Plant annual, erect, (0.7) 1.0-5.0 (6.0) dm tall, with mostly opposite, ascending, wiry, filiform branches mostly from medial and upper portion of stem. Leaves appressed, scale-like, 1.0-3.0 mm long. Inflorescence appearing racemose, flowers borne singly in the axils of the leaves of the upper portion of the branches on short pedicels 0.75-1.5 mm in length. Sepals lanceolate, 1.5-2.5 mm long, 0.4-0.8 mm wide. Petals yellow, asymmetrical, 2.5-4.0 mm long, 0.8-1.0 mm wide. Stamens 5 to 10 (11). Styles 0.8-1.2 mm long. Mature capsule reddish-brown to brown,

lance-subulate, 4.0-6.0 mm long, twice to more than twice the length of the sepals. Seeds yellow, (0.25) 0.4-0.8 mm long, obscurely striate and pitted to almost smooth.

Chromosome number: n = 12.

Flowering period: May to October.

Distribution and habitat: Dry sandy fields, roadsides, rock outcrops, and dry open woodlands from Ontario, south to Florida, west to Texas and north to Wisconsin, Michigan, and Illinois (Figure IX-2).

Discussion: In the original description of Sarothra gentianoides Linnaeus (1753) cites two works in the protologue. The first is that of Gronovius (1739) and the second that of Plukenet (1700). In Flora Virginica, Gronovius (1739) cites a specimen collected by Clayton (no. 110) in addition to an illustration contained in Plukenet's Alamagesti Botanici Mantissa (1700), which is also included in the protologue of Linnaeus (1753). The specimen collected by Clayton (no. 110) is deposited at the British Museum and would logically be the element that should typify Sarothra gentianoides. However, in the Linnaean herbarium there is a specimen (LINN 391/1), which according to Jackson (1912) was in the possession of Linnaeus at the time of publication of the first edition of Species Plantarum. Jiménez (1973a) has designated the specimen in the Linnaean Herbarium as the type of S. gentianoides. This specimen might also be viewed as original material since it was apparently utilized by Linnaeus in formulating his concept of S. gentianoides.

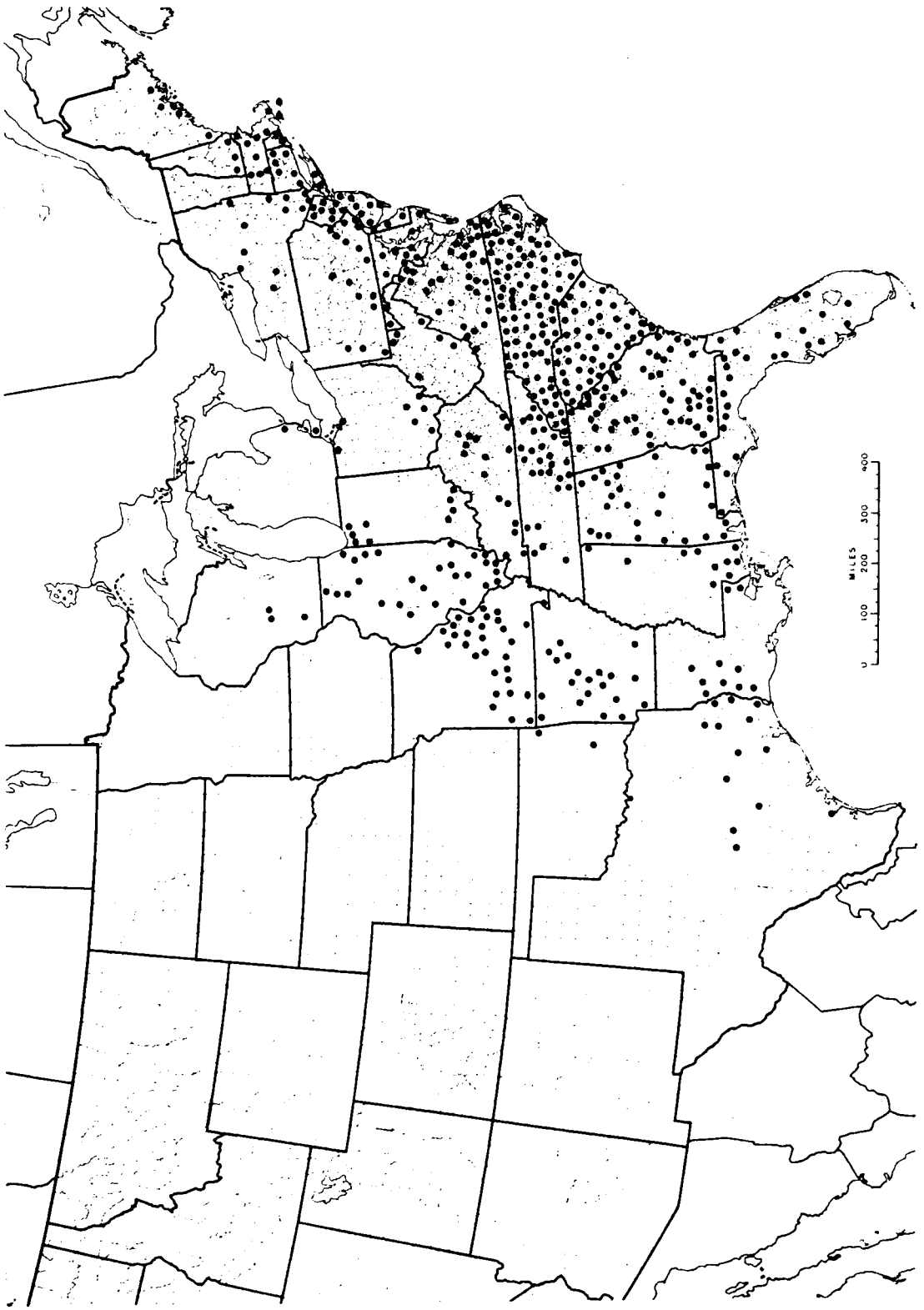


Figure IX-2. Distribution of Hypericum gentianoides.

Linnaeus assisted Gronovius in classifying and naming many of the plants described in Flora Virginica, but as noted by Stearn (1957), Linnaeus did not see all the specimens described by Gronovius. Since the specimen in the Linnaean Herbarium was in the possession of Linnaeus in 1753 (Jackson, 1912), the selection of this specimen by Jiménez (1973a) as the type of Sarothra gentianoides has been followed. However, a strong argument can be made for the selection of Clayton 110 as the lectotype of S. gentianoides. The complexity often associated with choosing a Linnaean type is illustrated by Robson (1979) in his discussion of the typification of Ascyrum crux-andreae. A detailed study of the history of Clayton 110 may eventually require this specimen to be chosen as the lectotype of S. gentianoides.

Hypericum aphyllum was described by Lundell (1943) from British Honduras. This species was noted to be closely related to H. gentianoides but differed primarily from the latter species in its seed characteristics. According to Lundell (1943) the seeds of H. gentianoides are 0.75 mm long and conspicuously striate and pitted, while those of H. aphyllum are 0.25 mm in length and are almost smooth. Hypericum aphyllum was also noted to have twice as many seeds per capsule as those of H. gentianoides.

Lundell (1943) refers two collections from Florida to H. aphyllum. An examination of one of these collections (i.e. Nash 1972) shows the seeds to average about 0.40 mm in length and have a reduced ornamentation of the seed coat. A SEM comparison of the seeds of H. gentianoides, the isotype of H. aphyllum, and Nash 1972, shows the seeds from the Nash collection to be intermediate to

those of typical H. gentianoides and those of the isotype of H. aphyllum in regard to surface ornamentation (Figures IV-4 B, p.32 IV-5 D, E, p.34). The 0.75 mm length cited by Lundell (1943) for H. gentianoides approaches the upper range of seed length for this taxon. Measurements on selected populations of H. gentianoides from the southeastern United States and Florida show the seeds of H. gentianoides to exhibit a continuous range from 0.70 mm to 0.40 mm with the smaller seeds being more common in populations from Florida. Adams (1962b) also has noted a reduction in seed size and a smoother testa in H. gentianoides from the southern portion of its range. Thus, in the opinion of the present author, the specimens represented by the Nash collection should be included under H. gentianoides.

The isotype of H. aphyllum shows an extreme reduction in branching and consists of only a basal stem with a few ascending branches. This pattern is frequently encountered in depauperate individuals of H. gentianoides and has been observed in a number of specimens from peninsular Florida. Both Adams (1962b) and Jiménez (1973a) have placed H. aphyllum in synonmy under H. gentianoides. Until a series of populations of H. aphyllum from Central America can be critically examined and compared to H. gentianoides, H. aphyllum is treated as a taxonomic synonym of H. gentianoides.

Hypericum gentianoides is one of the more distinctive species of Hypericum in the eastern United States. The extreme reduction in leaf size and its wiry stems are adaptations to the xeric conditions of its habitat. This species in addition to the closely related H. cumulicola represents a highly specialized evolutionary line.

Representative specimens: UNITED STATES. ALABAMA. Autauga Co.: sandhills by US 31, ca. 4 mi N Pratville, 4 Oct 1968, Kral 33568 (SMU). Baldwin Co.: 5 mi SE of Loxley, 28 Aug 1952, Corbin 166 (SMU). Blount Co.: 11.5 mi N Blountville on US 231, 15 Aug 1968, Kral 32372 (SMU). Calhoun Co.: just S of Boozer Lake, ca. 6 mi N of Jacksonville, 14 Aug 1966, Clark and Landers 7030 (NCU). Cherokee Co.: S side of Hwy. 68, 2.0 mi W of jct. of Main Street and Hwy. 411 in downtown Centre, 13 Jul 1977, Webb 53266 (TENN). Choctaw Co.: along Hwy. 17, 10 mi N of Butler, 14 Jul 1977, Webb and Ross 53272 (TENN). Clarke Co.: 11.3 mi SW of Grove Hill, 29 Jul 1950, Shinners 12731 (SMU). Cleburne Co.: 0.1 mi W of jct. Rabbittown Road and Skyway Motorway in Talladega National Forest, 17 Jun 1966, Clarke and Heard 2645 (NCU). Covington Co.: 7.4 mi S of Opps, 18 Aug 1958, Shinners 27455 (GA, NCU, SMU). Cullman Co.: near Cullman, Aug 1891, Mohr 883 (MICH). DeKalb Co.: 1 mi S of Ala. 35 along rim of Little River Gulf, 15 Oct 1966, Clark and Ramseur 9418 (NCU). Escambia Co.: 4.5 mi WNW of Flomaton, 19 Jul 1962, Shinners 29940 (SMU). Etowah Co.: Gadsden, 1878, Vasey s.n. (NY). Franklin Co.: exposed rock near Russellville, 7 Aug 1948, Schallert 866 (SMU). Geneva Co.: about 5 to 7 mi S of Samson on Rt. 87, 17 Sep 1972, Somers 178 (TENN). Henry Co.: Ala. Hwy. 27, at East Choctawhatchee River bridge, 28 Jul 1966, Clark 6187 (NCU). Houston Co.: ca. 0.5 mi E of Dothan bypass on US 84, 24 Aug 1966, Clark 7133 (NCU). Jackson Co.: Hickory Grove, McGee place, Sand Mountain, 15 Jun 1937, Porter s.n. (GH). Jefferson Co.: East Lake, Birmingham, 9 Oct 1896, Schuchert s.n. (NY, US). Lauderdale Co.: ca. 2 mi S Ala. line on US 43, 5 Oct 1967, Kral 29362 (GA). Lee

Co.: Auburn, 10 Sep 1899, Earle and Earle 41 (GH, NY, US). Marion Co.: outcrop by North Fork Creek, S of Hackleburg on US 43, 7 Sep 1968, Kral and Blum 32879 (GA, SMU, TENN). Mobile Co.: 2.5 mi N of Citronelle, 25 Aug 1949, Shinners 11617 (GA, SMU). Perry Co.: 10 mi W of Marion, 5 Oct 1958, McDaniel 1032 (MO). Pickens Co.: 12.8 mi E of Alabama-Mississippi state line on US 82, 14 Jul 1977, Webb and Ross 53269 (TENN). Randolph Co.: Bald Rock, Almond Community, 3.5 mi W of Wadley, 2 Aug 1966, Clark 6515 (NCU). St. Clair Co.: outcrop at Horse Pens 40, Chandler Mountain, 28 Aug 1962, Bostick 209-1 (NCU). Sumter Co.: 7 mi NW of York at old negro church, 7 Sep 1963, Jones 1734 (NCU). Tuscaloosa Co.: 6 mi E of University, 28 Jul 1950, Shinners 12655 (GA, SMU). Washington Co.: 1.3 mi W of Wagarville, 26 Oct 1960, Shinners 29049 (SMU).

ARKANSAS. Benton Co.: 1899, Plank s.n. (NY). Carroll Co.: Eureka Springs, 3 Oct 1913, Palmer 4560 (MO). Cleburne Co.: top of Sugarloaf Mountain, Heber Springs, 31 Oct 1914, Palmer 6983 (MO). Conway Co.: Petit Jean State Park, P.O. Borrilton, 13 Aug 1944, Demaree 25212 (GH, SMU). Drew Co.: P.O. Monticello, 21 Sep 1937, Demaree 16339A (GH, MO, NY, SMU). Garland Co.: Hot Springs National Park, West Mountain, P.O. Hot Springs National Park, 24 Aug 1955, Demaree 38169 (SMU). Hot Springs Co.: near Butterfield, 15 Oct 1924, Palmer 26546 (MO). Izard Co.: Calico Rock, 1 mi W of water tower, 14 Oct 1967, Tucker 6828 (NCU). Logan Co.: rim of Magazine Mountain, P.O. Blue Mountain, 22 Sep 1968, Demaree 59521 (GA, NCU, SMU). Miller Co.: near Texarkana, 8 Sep 1898, Heller and Heller s.n. (US). Ouachita Co.: P.O. Camden, 25 Jul 1955, Demaree 37611 (GH, SMU). Perry Co.: Ouachita National Forest,

Lake Sylvia, P.O. Thornburg, 25 Aug 1937, Demaree 16005 (GA, ILL, MO, NY, SMU). Pike Co.: 3 mi NW of Murfreesboro, P.O. Murfreesboro, 30 Sep 1932, Demaree 9400 (SMU). Polk Co.: 3 mi NW of Mend, 8 Nov 1947, Glassman 1240 (ILL). Pope Co.: P.O. Nogo, 28 Aug 1955, Demaree 38292 (SMU). Pulaski Co.: halfway up Maumel Mountain, 16 Oct 1931, Demaree 8587 (GH, NY, SMU). Saline Co.: bauxite glade, 9 Sep 1967, Tucker 6466 (NCU). Sevier Co.: P.O. Ben Lomond, 17 May 1961, Demaree 44971 (SMU). Stone Co.: 5 mi SW of Calico Rock, 14 Oct 1967, Tucker 6837 (NCU). Yell Co.: Fourche La Fave above Nimrod Dam, P.O. Ola, 4 Oct 1941, Demaree 22645 (SMU).

CONNECTICUT. Fairfield Co.: Fairfield, 3 Sep 1895, Eames s.n. (NCU, US). Hartford Co.: Kensington, 20 Aug 1891, Cowles s.n. (MICH). New Haven Co.: New Haven, 1858, Eaton s.n. (MO). Norwich Co.: Norwich, 11 Sep 1885, Setchell s.n. (NY). Tolland Co.: Ellington, 21 Aug 1875, Hawes s.n. (NY). Windham Co.: Woodstock, 1 Aug 1965, Seymour et al. 22973 (MO).

DELAWARE. Kent Co.: 0.25 mi S of Bakeoven Point, 7 Sep 1935, Larsen 1050 (GA). New Castle Co.: Reybold, 14 Oct 1939, Benner 9164 (GH). Sussex Co.: Reboboth, 16 Oct 1933, Larsen 440 (GH, MO).

DISTRICT OF COLUMBIA. Mount Hamilton tract, 20 Aug 1923, Leonard and Kellip 1573 (US).

FLORIDA. Alachua Co.: 10 mi NW of Gainesville, along Worthington Springs Road, 17 Jul 1948, Ford 2278 (NCU). Baker Co.: ca. 1 mi E of Glen St. Mary along US 90, S31, T2S, R22E, 1 Aug 1961, Smith et al. 533 (GH). Bay Co.: 10.5 mi N of Southport, 3 Nov 1961, Godfrey 61632 (TENN). Bradford Co.: along abandoned

road at Fla. 225, 2 mi SE of Lawtey, 25 Sep 1966, D'Arcy 992 (GA). Brantly Co.: 3 mi E of Nahunta, 23 Aug 1950, Wilbur and Webster 2742 (MICH). Brevard Co.: Okeechobee region, 8 Jun 1903, Fredholm 5850 (GH, MO). Citrus Co.: 0.4 mi N of Citrus-Hernando Co. line along Hwy. 19, 31 May 1961, Osborne 59 (SMU). Columbia Co.: along RR track, Lake City, 22 Oct 1893, Ralfs 23 (ILL, MO). Duval Co.: Baldwin, 6 Aug 1895, Nash 2319 (GH, MICH, MO, NCU, NY). Escambia Co.: 1.2 mi W of Millview, 25 Oct 1960, Shinners 28921 (SMU). Gadsden Co.: 1 mi S of River Junction, 23 Jul 1954, Ford and Arnold 3609 (GH). Hendry Co.: ca. 11 mi SW of Clewiston, 19 Feb 1947, Brass 18052 (US). Hernando Co.: 4 mi S of Brooksville, 23 Jul 1958, Kral 7431 (GH). Highlands Co.: along Hwy. 731 to Venus, 0.5 mi W of Rt. 27, 26 Aug 1976, Webb et al. 52514 (TENN). Hillsborough Co.: N of Tampa at NE border of USF campus, 9 Sep 1960, Ray and Lakela 10217 (NCU). Holmes Co.: 0.5 mi E of Westville, 29 Jul 1956, Kral and Redfearn 2841 (GH, NCU). Indian River Co.: 3 mi SW of Fellsmere city limits along Fla. 512, T31S, R37E, 12 Aug 1961, Smith and Myint 703 (NCU). Lake Co.: Eustis, 16-30 Jun 1895, Nash 1972 (GH, MO, NCU, NY, US). Lee Co.: near Fort Meyers, 4 May 1916, Standley 161 (GH, ILL, MO, NY, US). Leon Co.: along Hwy. 263 ca. 1 mi E of Airport, 12 Sep 1970, Bowers and Bowers 45605-a (NCU, TENN). Madison Co.: 3.1 mi E of jct. I-10 and Rt. 14 along I-10, 27 Aug 1976, Webb et al. 52519 (TENN). St. Johns Co.: prope St. Augustine, Sep 1848, Rugal s.n. (GH). Suwannee Co.: 11.2 mi E of Branford, 5 Sep 1954, Duncan and Hardin 18271 (GA). Walton Co.: 5 mi W of De Funiak Springs, 4 Sep 1958, Godfrey 57639 (GH).

GEORGIA. Baker Co.: edge of Mossy Pond in SW corner of county, 29 Aug 1941, Duncan 4070 (GA). Bartow Co.: 0.5 mi W of Rowland Springs Church, 3.8 mi N 14° W of Allatoona Dam, at headwaters of first W tributary of Carter Branch (a tributary of McKaskey Creek), 15 Aug 1948, Duncan 8703 (GA, GH, MO, US). Berrien Co.: 4.9 mi S of Nashville, 12 Jul 1965, Faircloth 2166 (GA, MO, NCU). Brantley Co.: 3 mi E of Nahunta, 23 Aug 1950, Wilbur and Webster 2742 (SMU, US). Brooks Co.: jct. of Old Quitman Hwy. and US 94, 0.7 mi W of Little River, 15 Sep 1969, Fairfield 6170 (GA). Bullock Co.: 3.75 mi SE of Statesboro, 19 Aug 1961, Boole 1170 (GH, NCU, SMU). Butts Co.: S slope of Tussahaw Creek, 2 mi N of Ga. 36 on county road, 11 Aug 1966, Bozeman 7508 (NCU). Chatham Co.: 3.6 mi NW of Old Ogeechee Canal, along Bamboo Farm and Pembroke Hwys, 13 Jul 1958, Duncan 21277 (NCU). Clarke Co.: granite outcrop along Oconee River, behind university campus, Athens, 20 Sep 1946, Cronquist 4149 (GA, GH, MO, NY, SMU, US). Coffee Co.: near Downing, 24 Jul 1902, Harper 1441 (GH, MO, NY, US). Columbia Co.: 8 mi E of Appling, 11 Oct 1936, McVaugh and Pyron 1047 (GA). Cook Co.: between swampland and fallow fields at Morrison Mill Creek, 15.6 mi SW of Adel, 19 Jul 1965, Faircloth 2430 (GA, NCU). Colquitt Co.: Doe Run, 14 Aug 1930, Kilpatrick s.n. (GA). DeKalb Co.: barren slope of Mt. Arabia, 19 Sep 1956, Burbanck 1531 (GA, GH, MO, NCU, NY, SMU). Dodge Co.: 3 mi W of Milan, Plantation No. 46, 29 Jul 1937, McKellar s.n. (GA). Dooly Co.: ca. 6 mi W of Vienna, Plantation No. 4, 23 Jul 1937, McKellar s.n. (GA). Dougherty Co.: area just SE of Albany, 27 Jul 1946, Duncan 6672

(GA). Echols Co.: 6 mi S of Stockton, along Alapaha River, 21 May 1963, Norsworthy 108 (MO). Elbert Co.: 6 mi W of Elberton, 13 Oct 1936, Pyron and McVaugh 1072 (GA). Emanuel Co.: ca. 14 mi S of Swainsboro, ca. 0.25 mi N of Ohoopee River, 29 Aug 1929, McKay s.n. (GA). Evans Co.: 6 mi E of Claxton, 21 Aug 1940, Duncan 2749 (GA). Forsyth Co.: E side of Two Mill Creek, 8.3 mi E4N of Cumming, 18 Aug 1955, Duncan and Adams 19517 (GA). Franklin Co.: 2 mi SW of Bowersville, Plantation No. 52, 3 Sep 1937, McKellar s.n. (GA). Glynn Co.: Sea Island, 3 Sep 1940, Ford and Thorne s.n. (TENN). Grady Co.: 6.5 mi S of Whigham, 27 Aug 1963, Faircloth 514 (GA, MO, NCU). Greene Co.: 5-6 mi SSE of Greensboro, 26 Sep 1971, Jones et al. 21531 (GA, NCU). Hall Co.: 3.6 mi W 22 S of Flowery Branch, 10 Aug 1955, Duncan and Adams 19353 (GA). Hancock Co.: along Ga. 15, ca. 5 mi S of Sparta, 9 Aug 1966, Bozeman 7341 (NCU). Harris Co.: along Ga. Hwy. 190 at Dowdell's Knob on Pine Mountain, 25 Aug 1971, Jones 21352 (GH). Hart Co.: 5 mi N of Hartwell, Plantation No. 51, 3 Sep 1937, McKellar s.n. (GA). Jackson Co.: outcrops, 2 mi SW of Pendergrass, 14 Jun 1936, Pyron and McVaugh 520 (GA). Jones Co.: Cedar Creek uplands in the vicinity of Union Hill Church, 8 Jul 1970, Campell 16 (GA). Lanier Co.: 1 mi N of Lakeland, Plantation No. 29, 9 Jul 1937, McKellar s.n. (GA). Lee Co.: just NE of Starksville bridge, 19 Sep 1948, Duncan 3080 (GA, MO). Long Co.: 0.4 mi NW of Beards' Bluff, 13 Jul 1962, Bozeman 1160 (NCU). Lowndes Co.: W side of US 41 at Twin Lakes, 10.3 mi S of Valdosta, 15 Oct 1963, Faircloth 670 (GA, MO, NCU). McDuffie Co.: sand-hills, vicinity of Thomson, 16 Aug 1907, Bartlett 1010

(ILL, MICH). McIntosh Co.: beach on Sapelo Island, 26 Jul 1956, Duncan 20364 (GH, MICH, NCU, SMU, US). Miller Co.: 4.5 mi W of jct. 91 and 45 (in Colquitt) along Rt. 91, 28 Aug 1976, Webb et al. 52532 (TENN). Montgomery Co.: county road near Oconee River bridge, S end of county, 5 Aug 1963, Fitzgerald 95 (GA). Murray Co.: S end of town, Chatsworth, 19 Aug 1968, Rogers 41957 (TENN). Oglethorpe Co.: Echols Mill, 13 mi NE of Lexington, 28 Aug 1940, McVaugh 5383 (GA). Paulding Co.: 0.2 mi W of Willow Springs Church, 1.7 mi N of Ga. 6, 23 Sep 1966, Bozeman 8496 (NCU). Pike Co.: Flat Shoals, Concord, 30 Jul 1932, Stuckey s.n. (GA). Rabun Co.: bluff on Glade Mountain in NE part of county, 16 Jul 1949, Duncan 9945 (GA). Richmond Co.: 2.9 mi E of jct. of US 1 and 78, 19 Jul 1958, Duke 1617 (NCU). Rockdale Co.: 7 mi N of Conyers, 18 Oct 1936, Pyron and McVaugh 1105 (GA). Stephens Co.: Curahee Mtn. off US Rt. 123-Ga. 13 SW of Taccoa, 21 Jul 1975, Boufford and Wood 17509 (NCU). Sumter Co.: Americus, 20 Aug 1897, Tracy s.n. (MO). Talbot Co.: sand near Junction City, 17 Oct 1964, Koelling 2081 (NCU). Tattnall Co.: along Ga. 169, 1.1 mi S of Evans Co. line, 12 Jul 1966, Bozeman 5773 (NCU). Thomas Co.: about 5 mi S of Thomasville, Plantation No. 25, 7 Jul 1937, McKellar s.n. (GA). Tift Co.: Tifton, Aug 1926, Haltern s.n. (GA). Treutlen Co.: 1 mi S of Soperton, Plantation No. 44, 28 Jul 1937, McKellar s.n. (GA). Wilcox Co.: 12 mi NW of Abbeville, 21 Aug 1950, Wilbur and Webster 2711 (MICH, SMU, US). Wilkes Co.: edge of vacant lot, 0.75 mi S of Washington, 18 Jul 1950, Duncan 11375 (GA, GH, MO, SMU, TENN). Worth Co.: 0.7 mi W of the Turner-Worth Co. line along side Ga. 33, 17 Aug 1966, Faircloth 3805 (GA, NCU).

ILLINOIS. Cass Co.: Beardstown, Aug 1843, Geyer s.n. (GH, NY). Clay Co.: S of Flora, 9 Aug 1950, Ahles 2682 (ILL). Cook Co.: ditch bank, West Pullman, 17 Sep 1900, Chase 1485 (GH, MO). Effingham Co.: along Rd. 128, S of Beecher City, 21 Sep 1974, Jones 3051 (ILL). Gallatin Co.: rocky bluff 3 mi NE of Karbers Ridge, 17 Aug 1948, Winterringer 1507 (ILL). Iroquois Co.: along US Rt. 24 E of Watselsa, 25 Jul 1964, Koelling 2040 (TENN). Jackson Co.: sandstone cliffs, Makanda, 1 Jul 1940, Gleason 9062 (NY). Jefferson Co.: N of Olddyke, 13 Aug 1898, Eggert s.n. (MO). Johnson Co.: Cedar Grove, 4 mi SW of Goreville, 13 Jun 1948, Winterringer 1217 (ILL). Kankakee Co.: 7 mi W of Kankakee, 3 Aug 1912, Sherff 1648 (ILL, MO). La Salle Co.: Ottawa, Huett s.n. (GH). Lawrence Co.: 6 mi SE of Sumner, 25 Jul 1952, Sivert s.n. (ILL). Lee Co.: 4.5 mi NW of Franklin Grove, 25 Aug 1946, Keithly s.n. (ILL). Macoupin Co.: SE right-of-way of RR tracks on NE 1/4 Sect. 36, R6W, T7N, ca. 2 mi NE of Mt. Olive, 3 Sep 1976, Shildneck C-8067 (ILL). Marion Co.: prairie strip, Salem, 12 Aug 1950, Ahles 2873 (ILL). Mason Co.: W of San Jose, 12 Jul 1951, Ahles 4075 (ILL). Ogle Co.: Oregon, 20 Aug 1884, Waits s.n. (US). Peoria Co.: Mrs. Bradley's meadow, Peoria, Jun 1889, McDonald s.n. (ILL). Piatt Co.: N of Monticello, 25 Aug 1952, Ahles 6572 (ILL). Pope Co.: top of a bluff, 4.5 mi E of Dixon Springs, 21 Jul 1948, Winterringer 1319 (ILL). Saline Co.: top of Womble Mt., 2 mi NW of Herod, 26 Sep 1948, Winterringer 1631 (ILL). St. Clair Co.: near St. Clair-Washington Avenue, 9 Aug 1948, Neill 2495 (MO). Union Co.: Cobden, 28 Jul 1886, Earle 1569 (MICH). White Co.: along the road near Carmi, Aug 1900, Schneck s.n. (ILL). Well

Co.: 2 mi S of Wilmington, 6 Sep 1931, Chase 4235 (ILL). Winnebago Co.: 2.5 mi W of S. Beloit, 11 Aug 1946, Fell and Fell f-46754 (ILL).

INDIANA. Clarke Co.: 16 Oct 1903, Smith 116 (MICH). Lake Co.: N of Penn RR and about 0.4 mi E of Liverpool Junction, 15 Sep 1946, Friesner 21048 (MICH, MO, SMU). Laporte Co.: 2 mi S of Wanatah, 15 Sep 1933, Friesner 6857 (SMU). Martin Co.: Cedar Cliffs along White River, ca. 3 mi above Shoals, 31 Aug 1915, Deam 18416 (GH). Newton Co.: roadside, Sec. 13, Jackson Township, 1 mi N, 1 mi E of Mt. Ayre, 22 Sep 1941, Loughridge 3542 (GH). Orange Co.: N of Danner's Chapel, 5 mi S of Chambersburg, 25 Sep 1937, Friesner 11572 (NY, SMU). Porter Co.: dunes at Mineral Springs, Little Lake, 26 Jul 1925, Lyon s.n. (MICH). Pulaski Co.: along Rd. 43, 1 mi S Starke-Pulaski Co. line, 21 Sep 1940, Friesner 14927 (GA, GH, SMU).

KENTUCKY. Bath Co.: near Olympian Springs, 11 Sep 1939, Gleason and Griffitts G 548 (MICH). Bell Co.: Clear Creek Spring, Pine Mountain, 12 Jul 1937, Braun 1549 (US). Calloway Co.: along Hwy. 94, 2.4 mi E of jct. Hwy. 94 and Hwy. 475, 29 Jul 1969, Hickok 345 (NCU). Clark Co.: 1 mi SE of Indiana Fields, 30 Aug 1939, Gleason and Griffitts G 13 (MO). Edmondson Co.: Piney Hollow, a tributary to Honey Creek, ca. 2.2 mi E of Brownsville Bridge, 8 Aug 1968, Elmore 402 (NCU). Estill Co.: 1 mi W of Harg, 20 Jul 1938, Wharton 3129 (MICH, MO). Fayette Co.: Lexington, Short s.n. (GH). Harlan Co.: Pine Mountain, Aug 1893, Kearney 256 (GH, MO, NY, US). Lewis Co.: Kinniconick, 4 Aug 1931, Braun 226 (US). Lincoln Co.: 0.75 mi NE of Hall's Gap, 7 Oct 1937, Wharton 13946 (MICH).

Livingston Co.: stream bed 2 mi S of Ohio River near Joy, 14 Sep 1945, Duncan 6120 (GA). Marion Co.: 2 mi W of Newmarket, 11 Aug 1939, Wharton 5156 (MICH). McCreary Co.: along Hwy. 90 E of Parkers Lake, 11 Sep 1951, McInteer 1357 (NCU). Powell Co.: 1.5 mi S of West Bend, 28 Jun 1938, Wharton 2878 (MICH). Todd Co.: near L & N RR, Guthrie, 10 Sep 1949, Brown and Clebsch 530 (NCU). Warren Co.: 4 km SW of Shanty Hollow Lake, 4 Aug 1970, Conrad 1536 (MO). Whitley Co.: Corbin, 11 Sep 1940, McFarland 52 (GA, MICH, MO, NY).

LOUISIANA. Allen Par.: 7.2 mi W of Kinder, 8 Sep 1955, Shinners 21513 (SMU). Beauregard Par.: 3 mi S of Longville, 9 Oct 1955, Shinners 22230 (SMU). Calcasieu Par.: 2.5 mi SW of Starks, Washout Slough, 6 Oct 1956, Shinners 25087 (SMU). Natchitoches Par.: 3.5 mi NW of Galbraith, 8 Oct 1955, Shinners 22041 (SMU). Rapides Par.: N of Pineville, 29 Jul 1938, Correll and Correll 9895 (GH, NY). Sabine Co.: 4.6 mi S of Many, 9 Sep 1955, Shinners 21620 (GH, SMU). St. Tammany Par.: Covington, Sep 1919, Arsene 11058 (US). Vernon Par.: 2.5 mi SE of Anacoco, 9 Sep 1955, Shinners 21603 (SMU). Winn Par.: 8.4 mi WSW of Winnfield, 7 Sep 1955, Shinners 21692 (SMU).

MAINE. Hancock Co.: S ridge of Cadillac Mt., 23 Aug 1952, Rossbach 2436 (NCU). Knox Co.: Isle au Haut Mt., SW of Vinalhaven, 2 Sep 1957, Rossbach 4251 (NCU). Lincoln Co.: SW end of Monhegan Island, 12 Aug 1954, Rossbach 3533 (NCU). Waldo Co.: RR bed along Dead Brook, 1 mi NW of Waldo Station, Brooks, 31 Jul 1957, Rossbach 4104 (NCU). York Co.: Seabury, 5 Aug 1901, Hubbard s.n. (NCU, SMU).

MARYLAND. Allegany Co.: Cumberland, 7 Aug 1953, Lane 1640 (ILL). Baltimore Co.: Soldiers Delight Area near Deer Park Road, W of Owings Mill, 17 Aug 1970, Windler et al. 3223 (MICH, NCU). Calvert Co.: Broome Island, District No. 1, 25 Jul 1956, Seymour 16734 (MO, SMU). Charles Co.: 1.5 mi E of Chapel Point, 21 Aug 1938, Hermann 9706 (MICH, NY, US). Dorchester Co.: Cambridge, 21 Aug 1873, Morong s.n. (NY). Frederick Co.: Catoctin Mountain, 19 Aug 1948, Randall 25 (GA). Garrett Co.: Mt. Lake Park, 28 Jul 1906, Braun s.n. (US). Prince Georges Co.: near Priest's Bridge, Rt. 50, 3 mi NE of Collington, 20 Oct 1935, True 1728 (MO). Worcester Co.: 2.4 mi S of jct. Hwy. 113 and Hwy. 394, along S side of US 113, 2 Aug 1976, Webb and Webb 52117 (TENN).

MASSACHUSETTS. Barnstable Co.: along Mary Dunn Road, Barnstable, 4 Sep 1918, Fernald and Long 17108 (ILL, NY). Bristol Co.: Dighton, 23 Sep 1953, Seymour 15578 (SMU). Dukes Co.: plains W of Great Tisbury Pond, Chilmark, 21 Aug 1916, Brown et al. 1471 (GH). Essex Co.: Gloucester, 1866, Bumstead s.n. (NY). Franklin Co.: Deerfield, 7 Sept 1954, Polland s.n. (GA). Hampden Co.: along Mass. 57 near jct. of US 5A and Mass. 57, 27 Oct 1966, Ahles 65589 (SMU). Hampshire Co.: E of Amherst College, Amherst, 28 Sep 1966, Ahles 64798A (GA, US). Middlesex Co.: ca. 3 mi NW of East Pepperell, 22 Oct 1966, Ahles 65198 (NCU). Nantucket Co.: Nantucket, 8 Aug 1873, Harrington s.n. (MICH). Norfolk Co.: Hoosie Whisick Pond, Milton, 14 Aug 1894, Kennedy s.n. (GH). Suffolk Co.: Boston, 1816, Boot s.n. (US). Worcester Co.: Breezy Point, Webster Lake, 14 Sep 1959, Gates et al. 18418 (MO, SMU).

MICHIGAN. St. Clair Co.: S.L.R. freight yards above Tunnel Station, near city of Port Huron, 15 Sep 1906, Dodge s.n. (MICH).

MISSISSIPPI. Clarke Co.: 8.2 mi N of Shubuta along US 45, 15 Jul 1977, Webb and Ross 53277 (TENN). Forrest Co.: N end of Geiger Lake, along roadside in Johnson State Park, 1 Jul 1965, Carter 658 (NCU). Harrison Co.: Cat Island, P.O. Pass Christian, 9 Aug 1949, Demaree 28009 (GA, SMU). Jackson Co.: Petit Bois Island, 8 May 1898, Tracy 4966 (MICH, MO, NCU, NY). Jackson Co.: P.O. Ocean Springs, 7 Aug 1952, Demaree 32639 (MICH, SMU). Marion Co.: along RR at Kokomo and Hwy. 98, 24 Aug 1966, Jones 9164 (GA). Pearl River Co.: P.O. Poplarville, 26 Oct 1962, Demaree 46906 (SMU). Stone Co.: DeSoto National Forest, Beatrice, P.O. McHenry, 24 Aug 1953, Demaree 34057 (GH, SMU). Tishomingo Co.: along roadside E of jct. of Tishomingo State Park Road and Miss. 25, 11 Aug 1966, Temple 3919 (NCU). Wayne Co.: 5 mi SE of Waynesboro, 26 Oct 1960, Shinners 29068 (SMU).

MISSOURI. Cedar Co.: NE of Fairplay, 30 Jul 1897, Trelease 118 (MO). Crawford Co.: Steelville to St. James, 25 Sep 1898, Trelease 962 (MO). Dunklin Co.: Campbell, 15 Aug 1895, Bush 90 (MO, NY, US). Franklin Co.: near Pacific, 7 Aug 1910, Sherff 992 (GH). Gasconade Co.: upland woods between Swiss and Hermann, 1 Oct 1934, Steyermark 15642 (MO). Greene Co.: near Pearle, 22 Aug 1912, Standley 9257 (US). Iron Co.: along roadside, Clark National Forest N of Minimum, 14 Sep 1969, D'Arcy 3807 (MO). Jasper Co.: 4 mi W of Jasper, 10 Sep 1925, Palmer 28942 (GH, NY). Jefferson Co.: N of Silera, 15 Sep 1891, Eggert s.n. (MO). Laclade Co.: along Pine Creek tributary to Gasconade River, 1.5 mi SW of Nebo,

Sec. 22, T33N, R13W, 23 Aug 1937, Steyermark 25152 (MO, NY). Lincoln Co.: St. Peter sandstone glade, 2 mi W of Foley, 22 Sep 1932, Steyermark 8617 (MO). Madison Co.: top of Black Mountain, SW of Fredricktown, 4 Oct 1969, D'Arcy 3859 (MO). Maries Co.: near Lane's Prairie, 16 Sep 1934, Steyermark 15331 (MO). Marion Co.: River Heights, Hannibal, 23 Jul 1919, Davis s.n. (MO). McDonald Co.: 2 Aug 1872, Bush s.n. (MO). Montgomery Co.: slopes along tributary to Sallee Branch of Loutre River, T48N, R6W, S part of Sec. 25 and N of Sec. 36, 1 mi S of Danville, 16 Sep 1954, Steyermark 77502 (SMU). Phelps Co.: Raubidoux sandstone glade between St. James and Meramec Spring, 13 Oct 1935, Steyermark 19925 (MO). Polk Co.: Graydon sandstone glade at Graydon Springs, 31 Jul 1937, Steyermark 23957 (MO). Reynolds Co.: outcrops along East Fork of Black River, "Johnson shut-in" S of Munger, 19 Oct 1935, Steyermark 19929 (MO). Ripley Co.: Current River bluffs, 24 Jul 1897, Mackenzie 322 (MO). St. Charles Co.: St. Peter sandstone glade near Klondike, 12 Aug 1935, Steyermark 19485 (MO). St. Francois Co.: along roadside of Rt. 5, 13 Aug 1962, Shacklette 6822 (MICH). St. Genevieve Co.: Pickles Springs, 27 Oct 1929, Mathias s.n. (MO). St. Louis Co.: Buissons, Aug 1838, Riehl s.n. (MO). Shannon Co.: 12 Sep 1888, Bush s.n. (MO). Stone Co.: Aug 1882, Eggert s.n. (MO). Texas Co.: along roadside, Lickling, Sep 1931, Poehlman 35 (MO). Washington Co.: Bismark, 10 Sep 1893, Bush s.n. (MO). Wayne Co.: outcrops at Granite Bend, T27N, R4E, Sec. 10, between Mill Spring and Williamsville along Black River, 14 Jul 1936, Steyermark 11763 (MO). Warren Co.: along Charrette

Creek, ca. 9 mi SE of Warrenton, 4 Oct 1934, Steyermark 15883 (MO). Webster Co.: roadside between Duncan and High Prairie, 28 Jul 1937, Steyermark 23799 (MO). Wright Co.: Roubidoux sandstone glade along S side of Hwy. 38 and N side of Tom Branch near confluence with Beaver Creek, T30N, R12W, Sec. 18, 1.5 mi SW of Graff, 7 May 1957, Steyermark 84168 (GA).

NEW HAMPSHIRE. Cheshire Co.: roadside near Spot Meadow, Winchester, 14 Aug 1972, Boufford 7692 (MO, NCU, SMU). Hillsborough Co.: Hollis, 28 Jul 1892, Grout 1 (GH). Rockingham Co.: Coffin's Mill, Hampton, 24 Aug 1938, Chandler 3113 (MO).

NEW JERSEY. Atlantic Co.: 0.2 mi N of where Hwy. 559 crosses Atlantic City Expressway, 3 Aug 1976, Webb and Webb 52130 (TENN). Burlington Co.: E of Brown's Mills, 13 Sep 1932, Gleason et al. 197 (ILL, NY). Camden Co.: Parkdale, 18 Sep 1916, Pennell 9162 (NY). Cape May Co.: shores of Lily Lake, Cape May Point, 30 Sep 1917, Stone s.n. (GH, US). Essex Co.: E side of Scotch Plains Notch, 29 Aug 1915, Miller 1369 (NY). Hudson Co.: 26 Aug 1890, Timmermann s.n. (NY). Hunterdon Co.: near branch of Stony Brook, E of Snydertown, 1 Sep 1936, Benner 7439 (GH). Mercer Co.: near Trenton, Jul 1833, Folwell 434 (GH, US). Middlesex Co.: near Milltown, 29 Jul 1890, Murray s.n. (NY). Monmouth Co.: Belmer, 26 Aug 1910, Alsburg s.n. (MICH). Morris Co.: Horton, 6 Sep 1909, Mackenzie 4375 (MO, NY). Ocean Co.: Chadwick, 8 Sep 1906, Mackenzie 2395 (MO, NY). Passaic Co.: near Clifton, 31 Aug 1892, Nash s.n. (US). Salem Co.: island in brackish marsh, ca. 3 mi S of Hancock's Bridge, 3 Oct 1935, Adams and Adams 2495 (MO).

Somerset Co.: Watchung, 27 Jul 1931, Moldenke 6061 (NY). Sussex Co.: Franklin, 2 Aug 1873, Rusby s.n. (MICH). Union Co.: Westfield, 6 Aug 1927, Drushel 5415 (MO).

NEW YORK. Bronx Co.: Gunther Park bog, 20 Aug 1900, Bicknell 5831 (NY). Columbia Co.: SE corner of Gallatin township, 22 Sep 1933, House 21059 (NY). Dutchess Co.: East Hyde Park, 24 Aug 1949, Ahles 1591 (ILL). Fulton Co.: Northville, 1872, collector unknown, s.n. (NY). Nassau Co.: Kings Park, Long Island, 26 Aug 1925, Ferguson 4435 (NY). Oneida Co.: along RR track S of Sylvan Beach, 14 Sep 1922, Muenscher 14838 (GH, MICH, MO). Orange Co.: SE of Sutherland Pond, Black Rock Forest, 7 Aug 1936, Raup 7809 (GH, NY). Oswego Co.: near Cleveland, 3 Oct 1939, House 22171 (GA, GH, ILL, MO, NY). Richmond Co.: Erastina, 21 Aug 1894, Pollard s.n. (US). Rockland Co.: E side of Franklin Turnpike, S of RR bridge, Ramapo Township, 6 Sep 1954, Lehr 608 (NY). Suffolk Co.: Long Pond, Sag Harbor, 26 Aug 1938, Muenscher and Curtis 6272 (GH, US). Tompkins Co.: S of bog on top of South Hill, Ithaca, 11 Aug 1921, Muenscher 14019 (GH, MO). Ulster Co.: near Lake Katrine, 19 Sep 1946, House 30779 (GA, MO). Washington Co.: N of Cambridge, 17 Sep 1910, Dobbin and Burnham s.n. (GH). Westchester Co.: between Bryn Mawr Reservoir and Bronxville Road, 17 Sep 1898, Bicknell 5830 (NY). Yates Co.: Penn Yan, Sartwell s.n. (US).

NORTH CAROLINA. Alamance Co.: 5.5 mi SW of Swepsonville and 3.5 mi SE of Bellemont, 29 Sep 1956, Ramseur and Hammond 2228 (NCU). Alexander Co.: Rocky Face Mountain, 9 Aug 1966, Radford 45111 (GA, GH, NCU, SMU). Alleghany Co.: Cumberland Knob, Blue Ridge Parkway, 28 Aug 1947, Moldenke 19273 (NY). Anson Co.: 1.8

mi SSW of Morven along N.C. 85, 21 Sep 1956, Ahles and Leisner 19452 (NCU). Ashe Co.: rocky ridge NE of Perkins Rock, 27 Jul 1965, Tucker 2921 (NCU). Beaufort Co.: 0.8 mi N of Pinetown, 30 Jul 1977, Webb and Whitten 53318 (TENN). Bertie Co.: about 6 mi SW of Windsor along Rt. 17, 11 Sep 1955, Wilbur 4988 (GH). Bladen Co.: Elizabethtown, 15 Jul 1926, Heller I 4075 (MICH, MO). Brunswick Co.: ca. 100 yards N of Intercoastal Waterway on N.C. Rt. 133 between Southport and Long Beach, 23 Jun 1961, Miller and Miller 787 (SMU). Buncombe Co.: Biltmore, 17 Aug 1897, collector unknown, 1318[b] (GH, MICH, NCU, NY). Cabarrus Co.: roadside, 6.3 mi SSE of Harrisburg, 3 mi SW of town of Rocky River, 23 Sep 1956, Ahles and Leisner 19742 (NCU). Caldwell Co.: 1.25 mi SW of Dudley Shoals, 4 Aug 1956, Radford 15008 (NCU). Camden Co.: 2.1 mi SSW of Camden along US 158, 15 Oct 1958, Ahles and Duke 51360 (NCU). Carteret Co.: NW of Atlantic, along Co. 1387, 13 Jul 1965, Grier and Czikowsky s.n. (GA). Caswell Co.: ca. 15 mi SE of Yanceyville along Rt. 86, 16 Aug 1955, Wilbur 4255 (GA, GH, MICH). Catawba Co.: ca. 4.5 mi SW of Catawba and 6 mi NE of Newton along Rt. 10, 18 Aug 1955, Wilbur 4413 (GH). Chatham Co.: 3 mi N of Moncure, 3 Oct 1956, Ramseur and Hammond 2313 (NCU). Cherokee Co.: roadside, near US 64 and Hiwassee River, 31 Aug 1956, Radford 17307 (NCU). Chowan Co.: 1.6 mi E of Chowan River along US 17, W of Edenton, 14 Oct 1958, Ahles and Duke 50913 (NCU). Clay Co.: bog, Chatuge Lake, 3.5 mi E of Hayesville, 21 Aug 1956, Radford 16340 (NCU). Cleveland Co.: 3.4 mi SW of Cleveland-Gaston Co. line along US 29, 18 Sep 1956, Ahles and Leisner 18987 (NCU). Columbus Co.: 2 mi SW of Fair Bluff, 7 Jul 1927, Wiegand and Manning 2032 (GH).

Craven Co.: near Trent River, S of New Bern, 19 Jul 1958, Radford 37340 (NCU). Cumberland Co.: 4.5 mi W of Hope Mills, 27 Jun 1957, Ahles and Haesloop 29739 (NCU). Dare Co.: 0.75 mi S of Oregon Inlet, 26 Aug 1953, Radford et al. 7472 (NCU). Davidson Co.: 0.7 mi W of Davidson-Randolph Co. line on US 64, 14 Sep 1956, Ahles and Leisner 18545 (NCU). Duplin Co.: bottomland, Northeast Cape Fear River, 0.6 mi NE of Sloan, 2 Aug 1957, Ahles and Leisner 33135 (NCU). Durham Co.: ca. 3 mi N of Gorman at Eno River, 21 Aug 1965, Ahles and Sears 59922 (NCU). Edgecombe Co.: 3.1 mi SW of Mercer, 12 Jul 1958, Radford 36696 (NCU). Forsyth Co.: 2.1 mi W of N.C. 150 on road paralleling South Fork Creek, 23 Oct 1958, Ahles and Haesloop 51810 (NCU). Franklinton Co.: 0.8 mi W of Mitchner's Crossroads, 10 Jul 1956, Ahles and Leisner 16372 (NCU). Gates Co.: 1.9 mi NE of Chowan River on US 158, 16 Oct 1958, Ahles and Duke 51534 (NCU). Graham Co.: 4.3 mi W of Robbinsville near Cheoah River, 19 Jul 1956, Radford 14136 (NCU). Granville Co.: edge of city water reservoir, Oxford, 24 Dec 1954, Gillespie 19002 (NCU, TENN). Greene Co.: 3.2 mi NNW of Jason, 13 Sep 1958, Radford 40350 (NCU). Guilford Co.: below spillway of Lake Brandt, north of Greensboro, 30 Sep 1958, Bell 15479 (NCU). Halifax Co.: 3.3 mi W of Roanoke Rapids, 19 Jun 1956, Ahles and Leisner 14750 (NCU). Harnett Co.: 3.4 mi SE of Spout Springs, Rt. 87, 2 Sep 1955, Rock and Channell 662 (GA, GH, SMU, TENN). Haywood Co.: 3.1 mi NW of Crabtree on road paralleling Pigeon River, 7 Oct 1958, Ahles and Duke 50422 (NCU). Henderson Co.: 5 mi NE of Hendersonville, 0.33 mi W of US 64, 20 Aug 1957, Pittillo 422 (NCU). Hertford Co.: 1.3 mi E of US 258, and less than 0.5 mi S of Virginia, 20 Oct

1958, Ahles and Haesloop 52231 (NCU). Hoke Co.: 1.7 mi ESE of Timberland on N.C. 211, 9 Aug 1957, Ahles 33735 (NCU). Hyde Co.: 2.2 mi NE of Rose Bay, 6 Aug 1958, Radford 39090 (NCU). Iredell Co.: river bottom, Catawba River on US 70-64, 24 Oct 1958, Ahles and Haesloop 51850 (NCU). Jackson Co.: top of Big Yellow Mt., 21 Aug 1936, Coker s.n. (NCU). Johnston Co.: woods near my home, 10 Sep 1932, Smith s.n. (NCU). Jones Co.: 4.3 mi WNW of Hargetts Store, 18 Jul 1958, Radford 36942 (NCU). Lee Co.: 1 mi NE of Salem Church, 27 Sep 1958, Stewart s.n. (NCU). Lenoir Co.: 1.5 mi S of LaGrange, 28 Aug 1957, Radford 28996 (NCU). Lincoln Co.: near Clark Creek, N of Lincolnton, 10 Sep 1958, Bell 15276 (NCU). Macon Co.: top of Mt. Satula, 27 Jul 1931, Coker and Holland s.n. (NCU). Madison Co.: field near Hot Springs, 9 Aug 1924, Wehmeyer 510 (MICH). Martin Co.: near US 64, 1 mi NW of Parmele, 9 Aug 1958, Radford 39309 (NCU). McDowell Co.: along N.C. 26, 2.1 mi SE of jct. with US 221, 1 Sep 1956, Bell 4507 (NCU). Mecklenburg Co.: 3 mi WSW of Cabarrus-Mecklenburg Co. line on US 29, then 1.2 mi NW, 2 Oct 1958, Ahles and Duke 49973 (NCU). Mitchell Co.: 1.2 mi NW of Spruce Pine on N.C. 26, 23 Jul 1958, Ahles and Duke 47119 (NCU). Montgomery Co.: 2.5 mi E of Norman near Naked Creek, 9 Oct 1956, Radford 19564 (NCU). Moore Co.: about 1 mi S of Carbonton, 21 Aug 1955, Kessler 466 (NCU). Nash Co.: 1.5 mi E of Bailey on US 264, 15 Oct 1956, Ahles and Leisner 21204 (NCU). New Hanover Co.: entrance to State Dock area, Wilmington, 19 Oct 1958, Bell 16020 (NCU). Northampton Co.: 0.9 mi WSW of Garysburg along US 158-301, 7 Jul 1958, Ahles and Duke 45512 (NCU). Onslow Co.: 0.8 mi from jct. US 17 and N.C. 172, along US 17, ca. 4 mi NE of Holly Ridge,

31 Jul 1977, Webb and Whitten 53329 (TENN). Orange Co.: 0.5 mi N of Co. 1005 on Co. 1951, 25 Jul 1974, Boufford 15056 (NCU). Pasquotank Co.: 0.2 mi NE of Pasquotank-Perquimans Co. line on US 17, then 0.1 mi NW, 31 Jul 1958, Ahles and Duke 48094 (NCU). Pender Co.: ca. 4 mi N of Hampstead and 9 mi S of Hollyridge along Rt. 17, 4 Aug 1955, Wilbur 4140 (GA, GH). Person Co.: near jct. of US 501 and N.C. 57, S of Timberlake, 12 Aug 1958, Bell s.n. (NCU). Pitt Co.: 1 mi E of Fountain, 11 Jul 1953, Radford et al. 7367 (NCU). Polk Co.: near Columbus, 26 Jul 1897, Townsend s.n. (US). Randolph Co.: along US 64, 1.6 mi W of Chatham Co. line, 10 Oct 1958, Bell 15515 (NCU). Richmond Co.: roadside, 5.3 mi E of Ellerbe on Ellerbe-Hoffman Road, 21 Sep 1958, Gupton 817 (NCU). Robeson Co.: 0.8 mi SW of jct. US 74 and Hwy. 301, W of Lumberton, 21 Jun 1957, Ahles and Haesloop 28848 (NCU). Rockingham Co.: Reidville, 8 Oct 1944, Jones 30 (NCU). Rowan Co.: W slope of Dunn's Mountain, 27 Sep 1956, Horton 267 (NCU, US). Sampson Co.: 1.1 mi WSW of Newton Grove along N.C. 102, 28 Jun 1957, Ahles and Haesloop 29950 (NCU). Scotland Co.: 0.75 mi W of jct. US 15-501 and Co. 1332, 30 Jul 1973, Sharp 1794 (NCU). Stanly Co.: 1 mi S of New London along US 52, 6 Jul 1956, Ahles and Leisner 16119 (NCU). Stokes Co.: near N.C. 66, 3 mi S of Mount Olive, 2 Oct 1958, Radford 41451 (NCU). Surry Co.: Geniss, 3 mi SE of Low Gap near Roaring River, 16 Sep 1956, Radford 18292 (NCU). Swain Co.: Great Smoky Mountains, Aug 1891, Beardslee and Koford s.n. (GH, MO, NY). Transylvania Co.: vicinity of Eagles Nest, near Waynesville, 10 Sep 1910, Standley 5709 (US). Union Co.: 3.7 mi NNE of Weddington near Mecklenberg Co. line, 14 Jul 1957, Ahles and Haesloop 31384 (NCU). Vance Co.: 1 mi SW of Tungsten, 21 Jul 1956, Ahles and Leisner 17245 (NCU). Wake Co.: 7 mi NW of

Raleigh, 13 Jul 1938, Godfrey 4963 (NCU, NY). Warren Co.: 0.7 mi SE of Manson on the Axtell Road, 26 Jul 1956, Bell 4173 (NCU). Washington Co.: 3.2 mi NW of Creswell, 5 Aug 1958, Radford 38895 (NCU). Wayne Co.: 4.5 mi N of Seven Springs, 28 Aug 1957, Radford 28827 (NCU). Wilkes Co.: 4 mi E of Wilkesboro, 21 Sep 1927, Wherry and Pennell 14306 (GA, MO). Wilson Co.: bog near US 264, 1 mi NW of Sims, 28 Jul 1958, Radford 37967 (NCU). Yadkin Co.: 1 mi S of Cycle near North Hunting Creek, 6 Aug 1956, Radford 15455 (NCU).

OHIO. Adams Co.: SW corner, Oliver Twp., 11 Aug 1954, Braun s.n. (US). Erie Co.: Oxford Prairie, 6 Sep 1918, Mosely s.n. (MICH). Hocking Co.: Rock House State Park, 1 Sep 1935, Demaree 11604 (SMU). Jackson Co.: Liberty Township, 9 Aug 1945, Cronquist 4029 (NY). Lucas Co.: 10 mi W of Toledo, 2 Sep 1897, Mosely s.n. (US). Meigs Co.: Salem Twp., 28 Jul 1933, Jones s.n. (NY). Ross Co.: near Londonderry, Liberty Twp., 6 Sep 1936, Bartley and Pontius 332 (NY).

OKLAHOMA. Delaware Co.: 4 mi N of Little Kansas along Okla. 10, 29 Jul 1957, Wallis 5343 (SMU). Latimer Co.: Robbers Cave State Park, 8.5 mi N of Wilburton, 13 Jul 1950, Cory 57494 (SMU).

PENNSYLVANIA. Alleghany Co.: Harrison Twp., 16 Sep 1901, Shafer 1470 (GH). Bedford Co.: 2 mi S of Hyndman, 30 Aug 1947, Berkheimer 9236 (US). Berks Co.: Scarlets Mill, 13 Sep 1916, Pennell 8745 (NY). Bucks Co.: Bristol, 4 Aug 1927, Benner s.n. (NY). Butler Co.: Seasureville, 22 Aug 1906, Webster s.n. (MO). Delaware Co.: 1 mi N of North Springfield, 29 Oct 1927, Adams et al. 1006 (MO). Fulton Co.: Johnson's Mill, 2 mi E of Warfordsburg, 25 Aug 1959, Westerfeld 20893 (NCU). Greene Co.: Franklin Twp., 27 Aug 1922, Dickey 169 (GH). Huntingdon Co.:

abandoned RR tracks, Coles Summit, ca. 2.5 mi NW of Saltill, 3 Sep 1972, Pearth s.n. (NCU). Juniata Co.: along RR, 0.5 mi SE of Denholm, 22 Sep 1951, Wahl and Westerfield 12468 (ILL). Lancaster Co.: Chikis Quartzite, between Churchtown Road and Beartown, 6 Sep 1892, Heller 511 (GH, MO, US). Lehigh Co.: N of Lehigh Furnace, 22 Sep 1907, Pretz 965 (NY). Northampton Co.: Bethlehem, Aug 1832, Moser s.n. (MO, NY). Philadelphia Co.: Germantown, 22 Jul 1922, Dreisbach 1048 (MICH). Union Co.: 2.5 mi NE of Mazeppa, 13 Sep 1954, Wahl 15233 (SMU). York Co.: 28 Sep 1892, Glatfelter s.n. (MICH).

RHODE ISLAND. Kent Co.: Warwick, 19 Aug 1916, Spalding s.n. (US). Newport Co.: roadsides near Chagum Pond, Block Island, 13 Sep 1913, Fernald et al. 9925 (GH, ILL, NY).

SOUTH CAROLINA. Abbeville Co.: Parsons Mountain, 6 mi S of Abbeville, 29 Jun 1957, Radford 25930 (NCU). Aiken Co.: 8.9 mi NE of Savannah River on US 1, 14 Aug 1958, Duke and Ahles 2064 (NCU). Allendale Co.: sandhill by Co. 41 SE of Barton and 2.1 mi N of jct. with Co. 91, 11 Sep 1956, Bell 5119 (NCU). Anderson Co.: suburbs of Anderson, 8 Oct 1917, Davis 7709 (ILL). Barnwell Co.: 0.6 mi W of jct. Co. 217 and US 78 on Co. 217, within city limits of Williston, 28 Oct 1961, Ahles and Crutchfield 55901 (NCU). Beaufort Co.: 3 mi S of Yemasse on US 17 and 21, 6 Sep 1956, Bell 4697 (NCU). Berkeley Co.: 14 mi SW of Monks Corner and about 6 mi NE of Summerville, 31 Aug 1950, Wilbur and Webster 2852 (GH, MICH, SMU, US). Calhoun Co.: 1.5 mi NE of jct. of Co. 158 and S.C. 6 on Co. 158, 27 Sep 1957, Ahles 35178 (NCU). Charleston Co.: 1.5 mi S of Rantowles on S.C. 162, 21 Jul 1957, Ahles and Leisner

32021 (NCU). Cherokee Co.: 0.5 mi WSW of jct. US 29 and Co. 52, then 0.1 mi NW on dirt road (N to Blacksburg), 18 Sep 1957, Ahles 34151 (NCU). Chester Co.: E of Broad River Bridge on S.C. 72, 27 Jun 1957, Bell 9507 (NCU). Chesterfield Co.: 2 mi N of Sugar Loaf Mountain, 2 Nov 1915, collector unknown, s.n. (NCU). Clarendon Co.: near US 301, 3.5 mi NE of Turbeville, 21 Aug 1957, Radford 28114 (NCU). Colleton Co.: 1.2 mi E of Smoaks on S.C. 217, 4 Sep 1956, Bell 4577 (NCU). Darlington Co.: Prestwood Lake N of Hartsville, 12 Jul 1920, Norton s.n. (NCU). Dillon Co.: 1.1 mi SSW of Bingham, 1.7 mi NNW of Co. line, 17 Oct 1957, Ahles 37144 (NCU). Dorchester Co.: 1.7 mi SSW of jct. Co. 16 and 54 on Co. 16, 20 Jul 1957, Ahles and Leisner 31884 (NCU). Edgefield Co.: near jct. of US 378 and S.C. 67, 6.5 mi NW of Cleora, 30 Jun 1957, Radford 26314 (NCU). Fairfield Co.: 1.6 mi W of Salem Crossroads, ca. 12 mi W of Winnsboro, 17 Sep 1957, Bell 9852 (NCU). Florence Co.: roadside ditch at crossroads, 2.4 mi SE of Lucille, 18 Oct 1957, Bell 10822 (NCU). Georgetown Co.: 6 mi S of Sampit, 23 Aug 1957, Radford 28659 (NCU). Greenville Co.: 8 mi S of North Carolina and South Carolina line on US Rd. 276, 1 Aug 1956, Daggy 3881 (ILL). Greenwood Co.: near S.C. 246, 1.5 mi E of Cokesbury, 7 Jul 1957, Radford 26703 (NCU). Hampton Co.: along RR, 1.7 mi SE of Early Branch on S.C. 28, 29 Jun 1956, Bell 3894 (NCU). Horry Co.: Ketchuptown, ca. 8 mi N of Aynor, 1 Jul 1958, Bell 13760 (NCU). Jasper Co.: Turtle Island, 13 Jul 1971, Stalter 80 (NCU). Kershaw Co.: Flat Rock, 28 Jul 1957, Radford 27711 (NCU). Lancaster Co.: 1.4 mi N of jct. US 521 and S.C. 504 on US 521, Ahles and Haesloop 31198 (NCU). Laurens Co.: by S.C. 72 near Co.

line, E of Clinton, 4 Oct 1957, Bell 10288 (NCU). Lee Co.: 0.2 mi N of Lucknow, 26 Jul 1957, Radford 27403 (NCU). Lexington Co.: 8 mi SE of Columbia, 8 Aug 1939, Godfrey and Tyron 1330 (GH, NY, US). Marlboro Co.: 5 mi NNE of Wallace, 10 Aug 1956, Radford 15573 (NCU). McCormick Co.: near S.C. 28, 0.6 mi NW of Parksville, 30 Jun 1957, Radford 26276 (NCU). Newberry Co.: along Co. 187 at jct. with Co. 71, SSE of Prosperity, 25 Jun 1957, Bell 9223 (NCU). Oconee Co.: near S.C. 107, 7.5 mi NW of Salem, 2 Sep 1956, Radford 11753 (NCU). Orangeburg Co.: 3.9 mi SSE of Eutawville on Co. 104 along Sandy Run, 26 Sep 1957, Ahles 34997 (NCU). Pickens Co.: Clemson College, 6 Oct 1906, House 3000 (NY, US). Richland Co.: between US 1 and US 21 N of Columbia, 20 Jul 1959, Bell 16445 (NCU). Saluda Co.: Little Mountain Creek, 6 mi SW of Mayson, 8 Jul 1957, Radford 26913 (NCU). Spartanburg Co.: below Rainbow Lake Dam N of Spartanburg, 4 Jun 1957, Bell 8348 (NCU). Sumter Co.: near S.C. 53 and Lynches River, 15 mi E of Mayesville, 27 Jul 1957, Radford 27548 (NCU). Union Co.: Fairforest Creek at S.C. 49, 23 Aug 1956, Freeman 56629 (NCU). Williamsburg Co.: 8 mi SE of Kingstree, 22 Aug 1939, Godfrey and Tyron 1665 (GH, MO, NY, US). York Co.: 1.6 mi S of jct. Co. 40 and S.C. 55 on Co. 40, NW of York, 19 Sep 1957, Ahles 34438 (NCU).

TENNESSEE. Benton Co.: along Hwy. 69A, 7 mi N of Camden High School, 8 Aug 1976, Webb and Webb 52138 (TENN). Bledsoe Co.: Walden's Ridge near Pikeville, 26 Jun 1935, Bain 4007 (TENN). Blount Co.: Chilhowee Mountain, Chilogate Branch, 30 Aug 1965, Thomas s.n. (TENN). Chester Co.: Henderson, Jun 1892, Bain s.n. (NY). Cocke Co.: above Newport toward Del Rio, 12 Jul 1953,

Sharp 17918 (TENN). Coffee Co.: S of Manchester on Wildlife Management Area, 16 Aug 1969, Rogers 44224 (TENN). Cumberland Co.: top of Ozone Falls, Ozone, 14 Sep 1967, Mahler and Furr 4524 (NCU, SMU, TENN). Dickson Co.: along S side of US 70, 5.9 mi W of jct. of 70 Business and 70 By-Pass in Dickson, 8 Aug 1976, Webb 52139 (TENN). Fentress Co.: E side of Hwy. 4450, ca. 0.7 mi S of North Prong of Clear Creek, 24 Jul 1976, Webb et al. 52094 (TENN). Franklin Co.: Highland Rim Forest Experiment Station, ca. 4 mi SW of jct. Hwy. 41A and Hwy. 4420, Webb et al. 52544 (TENN). Grainger Co.: Clinch Mountain, NW of Bean Station, 28 Jul 1935, Underwood and Sharp 4182 (NCU, NY, TENN). Grundy Co.: edge of Tracy City, sandstone rim of Fiery Gizzard Cove, 5 Aug 1947, Shanks et al. 5610 (NCU, TENN). Hamilton Co.: ridge back of Soddy, 14 Jul 1934, Underwood and Sharp 2368 (NCU, TENN). Henry Co.: along RR tracks ca. 2.8 mi N of Puryear along US 641 near intersection with paved road leading to Crossland, 30 Aug 1977, Webb and Webb 53789 (TENN). Jefferson Co.: Ball Camp Pike, 2.75 mi from Knoxville city limits, 5 Aug 1948, Chapman s.n. (TENN). Knox Co.: Sep 1898, Ruth 405 (MO). Marion Co.: 1.3 mi SSE of Monteagle, 11 Sep 1968, Shinners 32405 (SMU). Monroe Co.: near N edge of Cherokee National Forest on Tenn. 68, 17 Sep 1946, Ford and Russell 2006 (TENN). Montgomery Co.: W of Dotsonville, along Dover Road, 9 Oct 1949, Woods et al. 14434 (TENN). Polk Co.: below Parksville Dam (Ocoee #3), 20 Jul 1969, Rogers 44091 (SMU, TENN). Putnam Co.: along RR W of Monterey, 23 Sep 1949, Shanks et al. 13208 (TENN). Rhea Co.: University of Tennessee Geological Field Station, Walden's Ridge above Dayton, 9 Sep 1949, Shanks et al. 8991 (NCU, TENN). Roane

Co.: along Walden's Ridge above Rockwood, 29 Sep 1949, Shanks et al. 13768 (NCU, TENN). Scott Co.: near No Business Creek, 21 Jun 1947, Shanks et al. 3931 (NCU, TENN). Sevier Co.: Elkmont, CCC Camp #1212, Great Smokey Mountains National Park, 11 Jul 1935, Jennison 472 (TENN). Van Buren Co.: sandstone quarry NE of Spencer, 19 Sep 1946, Ford and Russell 1964 (TENN). White Co.: ca. 1 mi E of Bon Air on S Side of US 70, 18 Jul 1976, Webb and Webb 52087 (TENN).

TEXAS. Angelina Co.: 5.4 mi SE of Zavalla, 11 Nov 1957, Shinners 26793 (SMU). Bastrop Co.: Bastrop State Park, Aug 1938, Tharp s.n. (GH, MO, SMU). Bowie Co.: near Texarkana, 14 Sep 1898, Heller and Heller s.n. (NY). Burnet Co.: sands in granite region, 1888, Reverchon 1494 (MO). Hardin Co.: along road E of county dump grounds, S side of Hwy. 418 between Kountz and Silsbee, 30 Aug 1971, Amerson 646 (SMU). Harris Co.: Cave Island, near Houston, Jul 1843, Lindheimer 8195 (SMU). Llano Co.: Enchanted Rock, 1 Jun 1930, Tharp s.n. (MICH, NY). Nacogdoches Co.: along farm Rt. 1087, 3 mi E of Rt. 259, 3 Oct 1965, Correll and Correll 31822 (GH). Newton Co.: 1.5 mi E of Co. line along Farm Road 363 to Bon Wier, 30 Oct 1968, Correll and Correll 36693 (GH). Orange Co.: between Orange and the Sabine River, 14 Sep 1968, Correll 36519 (GH, MICH). Robertson Co.: 8 Aug 1943, Barkley 13655 (US). Sabine Co.: 9.2 mi S of Bronson, 3 Aug 1957, Shinners 26605 (SMU). San Patricio Co.: 2 mi SE of Ingleside, 26 Oct 1956, Jones 1229 (SMU). Walker Co.: 9.5 mi N of Huntsville, 29 Sep 1934, Cory 10424 (GH).

VIRGINIA. Alexandria Co.: Four Mile Run, 9 Aug 1904, Dowell 3131 (GH). Augusta Co.: roadside, along W slope near Cold

Spring, summit of Elliot Knob, 18 Jul 1937, Allard 3259 (GH). Botetourt Co.: Blue Ridge Parkway Project Station 492, 24 Jul 1947, Freer 1713 (NCU). Charlotte Co.: Co. 746, 1.5 mi S of Fears Corner, 1 Aug 1967, Ramsey et al. 9010 (NCU). Craig Co.: ca. 4 mi SE New Castle in Broad Run area, 12 Sep 1961, Kral 14126 (SMU). Dinwiddie Co.: 6 mi WNW of McKenny, 29 Aug 1960, Kral 11310 (GH). Fauquier Co.: 1 mi S of Thorofare Gap, Pond Mountain, 30 Aug 1942, Allard 10407 (MO, US). Franklin Co.: Bald Knob, town of Rocky Mount, 6 Jul 1957, Freer 2495 (GH, US). Giles Co.: 1.5 mi NNW of Newport, 30 Jul 1956, Thorne 11691 (GA). Gloucester Co.: N of James' Store, 1 Sep 1925, Wherry and Pennell 12575 (MO). Greensville Co.: 2 mi E of Radium, 7 May 1967, Harvill 15799 (NCU). Halifax Co.: 3 mi S of Hyco River along US 501, S of Cluster Springs, 29 Aug 1965, Ahles and James 60463 (NCU). Hanover Co.: Ashland, DeChalmot s.n. (US). Isle of Wright Co.: 3 mi ESE of Windsor, 16 Oct 1940, Fosberg 18035 (NCU). James City Co.: NW of Dupont Dorm, The College Woods, the College of William and Mary, 27 Aug 1968, Barans 530 (NCU). Lancaster Co.: dunes, Windmill Point, 37°37' N, 76°17' W, 15 Sep 1951, Smith 5544 (US). Loudoun Co.: along Co. 659, 1.5 mi N of jct. of Co. 659 and 643, 11 Sep 1965, Ahles and James 61519 (NCU). Louisa Co.: N side of I-64 near jct. 522 and I-64, 31 Jul 1976, Webb and Webb 52098 (TENN). Lunenburg Co.: 2 mi SSE of Rehoboth along Co. 622, 19 Sep 1965, Ahles and James 61946 (NCU). Madison Co.: Limberlost at head of White Oak Canyon, Shenandoah National Park, 24 Aug 1946, Graf 52 (US). Mecklenburg Co.: E of US 1, Roger Norwood farm, 19 Jun 1967, Seaman 6867 (NCU). Nansemond Co.: 10.3 mi SW of Whaleville,

traveling along 668, taking a right turn on Hwy. 668 and a left turn on 666, 10 Aug 1965, James 1986 (NCU). Nelson Co.: along Co. 606, 3 mi S of Buffalo Station overlooking James River, 23 Jul 1967, Ramsey et al. 9419 (NCU). New Kent Co.: along Rt. 673, 0.4 mi from its jct. with Rt. 600, 26 Jul 1974, Soltis 381 (NCU). Norfolk Co.: along RR 0.5 mi W of Bowers Hill, 6 Aug 1944, Hubricht B2570 (MO). Northampton Co.: S of Kendall Grove, 13 and 15 Oct 1935, Fernald et al. 5371 (GH). Nottaway Co.: Nottaway River on Co. 723, SW of Crewe, 11 Jun 1967, James 6804-a (NCU). Orange Co.: Gordonsville, 1 Sep 1890, Blanchard s.n. (MO, NY). Pittsylvania Co.: mill on Burch Creek on Co. 710, 2 Oct 1965, Ahles and James 62237 (NCU). Powhatan Co.: jct. of Rt. 60 and Rt. 13, 4 Aug 1970, Johnson 3525 (NCU). Prince Edward Co.: along US 15, 1.9 mi N of jct. of Co. 634 and US 15, 16 Oct 1965, Ahles and James 62680 (NCU). Prince George Co.: 6.0 mi S of jct. of Hwy. 35 and Rd. 638, 5 Aug 1976, Webb and Webb 52134 (TENN). Prince William Co.: top of ridge E of Belts, 1.0 mi N of Hopewell Gap, 28 Jul 1937, Allard 3319 (US). Roanoke Co.: S slope of McAfee Knob, ca. 3.4 mi N of Hanging Rock, 15 Aug 1946, Wood 6591 (GH, NCU). Surry Co.: S edge of Hog Island Refuge, 5 Aug 1960, Kral 11039 (NCU). Sussex Co.: roadside N of Airfield Millpond, 1 Aug 1976, Webb and Webb 52107 (TENN). Westmoreland Co.: Westmoreland State Park, 3 Sep 1941, Iltis s.n. (SMU). York Co.: near Magruder, 20 Jul 1939, Menzel 159 (GH).

WEST VIRGINIA. Greenbrier Co.: near White Sulfur Springs, 7 Sep 1903, Mackenzie 461 (NY). Monogalia Co.: "The Flats," Morgantown, 11 Aug 1890, Millspaugh 697 (NY). Pendleton Co.: Brandywine, 14 Aug 1931, Core 3674 (NY). Pocahontas Co.: Douthat

Creek, near Minnehaha Springs, 6 Aug 1931, Core 3469 (NY). Preston Co.: near Laurel Run Church, Laurel Run, 10 Jul 1942, Myers 562 (ILL). Wirt Co.: along bank of Rt. 53, 2 mi W of Wirt-Ritchie Co. line, Sep 1963, Bartholomew 6019 (GA, SMU).

WISCONSIN. Adams Co. Duck Creek, T17N, R6E, Sec. 26, Adams Twp., 19 Aug 1958, Hartley s.n. (GH). Iowa Co.: old terrace of the Wisconsin River, ca. 1 mi N of Arena, T8N, R5E, Sec. 8, Arena Twp., 13 Aug 1958, Hartley 5333 (ILL, US). Juneau Co.: roadside, T16N, R4E, Sec. 22, 18 Aug 1960, Schlising and Musolf 1797 (MO).

CANADA. QUEBEC. Essex Co.: Windsor, 23 Jul 1901, Macoun 34082 (GH, MO, NY, US).

3. Hypericum cumulicola (Small) P. Adams. Rhodora 64: 234. 1962. Sanidophyllum cumulicola Small. Bull. Torr. Bot. Club 51: 391. 1924. TYPE: UNITED STATES: FLORIDA: sand-hills, between Avon Park and Sebring, 30 and 31 Aug 1922, Small et al. s.n. (HOLOTYPE: NY!).

Plant perennial, with woody elongated taproot up to 0.8 cm thick. Numerous branches arising at or below ground level, juvenile and sterile stems with short internodes 1.0-3.0 mm long with spreading scale-like leaves, that are 1.0-2.0 mm long. Flowering stems wiry, erect, 2.0-7.0 (7.5) dm tall with subulate, appressed leaves 1.0-3.0 mm long and internodes about 1.0 cm long. Inflorescence basically a compound dichasium with ascending monochasial branches. Sepals unequal, ovate to lanceolate, 1.5-2.0 mm long. Petals yellow, inequilateral, 4.0-5.0 mm long. Stamens 20 to 25. Styles filiform, 1.5-2.0 mm long. Mature capsule reddish-brown,

narrowly conic and acuminate, (3.5) 4.0-6.0 mm long. Seeds brown, 0.5-0.6 mm long, obscurely striate and pitted.

Chromosome number: $\underline{n} = 6$.

Flowering period: March to November.

Habitat and Distribution: Restricted to a two county area of the southern lake region of peninsular Florida where it inhabits the white sand of ancient dunes (Figure IX-3).

Discussion: This narrow endemic is known only from Highlands and Polk County, Florida, where it occupies a habitat that is rapidly being converted into orange groves and living space for the retired populus. Only a single population was observed by the author on a visit to this area. Due to its narrow range and threatened habitat, the inclusion of this species on the proposed federal list of endangered plants (U.S. Dept. of Interior, 1975, 1976) is undoubtedly warranted. A more detailed description of the habitat and ecological associates of H. cumulicola is presented by Adams (1962b).

According to the original description (Small, 1924), the type of Sanidophyllum cumulicola was collected "between Avon Park and Sebring." However, the label accompanying the type of specimen does not give the county from which the collection was made. Judging from the geographic reference given above, the type collection must surely have been from Highlands County, Florida. Several sheets collected by J. K. Small in 1919 and 1920 and having similar locality data are noted to have been collected in De Soto County. According to Morris (1974), Highlands County was one of four counties created in 1921 by a division of De Soto County. Specimens

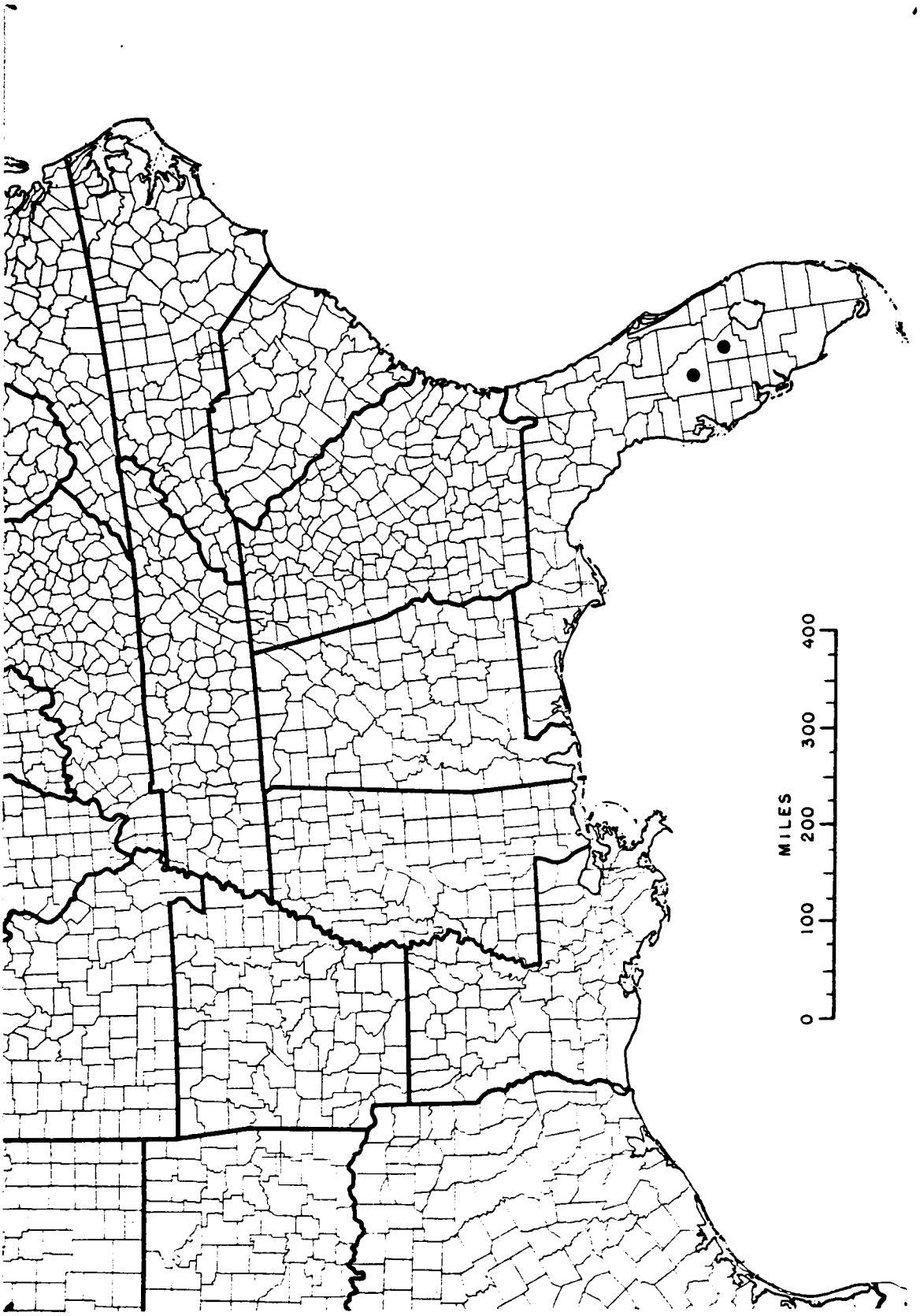


Figure IX-3. Distribution of Hypericum cumulicola.

originally indicated to have been collected in De Soto County have been referred by the author to the present day county (e.g. Highlands) from which the collections were apparently made.

Of the eastern North American taxa belonging to Sect. Spachium, H. cumulicola is mostly closely related to H. gentianoides. Jimenez (1973a) considers the two taxa to be conspecific. While the two species have numerous morphological similarities (e.g., reduced leaves, wiry stems, conical capsules), several differences exist that support the recognition of two distinct species. A list of the diagnostic characters separating the two taxa are listed below:

	H. gentianoides	H. cumulicola
1.	Plant annual	Plant perennial with an elongated taproot
2.	Main stem erect with numerous medial and upper branches	Branches arising from taproot at or just below ground level
3.	Inflorescence appearing racemose	Inflorescence a compound dichasium with ascending monochasial branches
4.	Common and widespread over much of the eastern United States	Rare and narrowly restricted endemic of the southern lake region of peninsular Florida
5.	n = 12	n = 6

Since H. cumulicola is seemingly on the verge of extinction, all the specimens examined during this study accompanied by habitat notes are listed under the heading of representative specimens.

Representative specimens: FLORIDA. Highlands Co.: sandhills, Avon Park to Sebring, 1 May 1919, Small and DeWinkeler 9040 (MICH, NY); scrub ridge, S of Frostproof, 18 Apr 1920, Small and

DeWinkeler 9592 (NY); "scrub" E of Sebring, 13 Dec 1920, Small and DeWinkeler s.n. (GH, NY); "scrub" near Kuhlman, 13 Dec 1920, Small and DeWinkeler s.n. (NY); ancient sand dunes S of Avon Park, 25 Apr 1921, Small and DeWinkeler s.n. (NY); sand dunes, S of Avon Park, 23 May 1921, Small 9972 (NY); sand hills about Lake Jackson, 31 Aug 1922, Small et al. 10639 (NY); scrub, ancient sand dunes, between Avon Park and Sebring, 24 Dec 1922, Small et al. 10749 (NY); sandy woods, Sebring, 3 Mar 1924, Hunnewell 9580 (GH); scrub between Avon Park and Sebring, 17 Jul 1924, Small et al. 11496 (NY); scrub along Lake Nancessowee near Sebring, 17 Jul 1924, Small et al. 11507 (NY); deep sands, borders of Red Beach Lake, 19 May 1925, Palmer 27402 (NY); sand, Sebring, 13 May 1927, Hunnewell s.n. (GH); sand, Avon Park, 18 May 1927, Hunnewell 10425 (GH); vicinity of Sebring, 9 Jun 1931, McFarlin 5711 (MICH); Avon Park, 4-5 Sep 1934, Small and West s.n. (NY); inland sand dune in open scrub, Sebring, 4 Jan 1936, Maxon 10838 (NY); dry scrub, S of Sebring, 15 Aug 1945, Butts s.n. (GH); scattered on white sand near Lake Placid, 12 Oct 1947, Brass 18147 (GH); abundant on white sand along Rt. 27 between Childs and Venus, Jul 1949, Brass 20595 (GH); common on white sand, 30 mi S of Sebring along Rt. 27, 25 Aug 1951, Webster 4177 (GH, MICH, SMU); white sand near Childs, 4 Sep 1954, Thorne 15267 (GH); sand scrub, S of jct. Fla. 70 and US 27, 27 Nov 1959, Adams 403 (MO, NY, SMU); ancient dunes area ca. 5 mi S of Childs, off Fla. 70, 28 Nov 1959, Ray 9655 (GH); abundant in open sand scrub, 6.6 mi S of Fla. 70 and US 27, 1 Aug 1960, Adams 586 (GA, GH, NY, SMU, TENN); sandy opening of ancient marine terrace ca. 6.7 mi S of US 27 and Fla. 70 intersection, Bairs Den, 7 Oct 1960,

Ray et al. 10356 (GH); white sand from undisturbed scrub along Josephine Creek off US 27, S of Kuhlman, 2 Sep 1962, Lakela 25320 (MICH); ancient sand dunes, 6.7 mi S of Fla. 70 on US 27, 26 Aug 1976, Webb et al. 52572 (TENN). Polk Co.: white sand, Frostproof, Hwy. 630 connecting US 27 and US 27A, 23 Aug 1961, Lakela 24561 (GH); white sand scrub, Frostproof, E of Maintenance Station, Lake Clinch, 30 Sep 1961, Lakela 24710 (NY, SMU); white sand scrub on Hwy. 630, E of Co. Maintenance Station, Frostproof, 26 May 1962, Lakela and Conrad 25089 (GH).

4. Hypericum boreale (Britt.) Bickn. Bull. Torr. Bot. Club 22: 213. 1895.

Hypericum canadense L. var. boreale Britt. Bull. Torr. Bot. Club 18: 365. 1891. TYPE: UNITED STATES: MAINE: York Harbor, Aug 1888, Bicknell s.n. (LECTOTYPE herewith designated, NY!).

Hypericum boreale (Britt) Bickn. forma callitrichoides Fassett. Rhodora 41: 376. 1939. TYPE: UNITED STATES: MAINE: Completely submerged, quiet cove, Damariscotta Lake, Jefferson, Maine, 22 Aug 1936, Fassett 18068. (HOLOTYPE: WIS!).

Sarothra borealis (Britt.) Y. Kimura in Nakai and Honda. Nov. Fl. Jap. no. 10: 232. 1951.

Plant perennial, slender, erect or decumbent and rooting from the lower nodes, (0.5) 1.0-4.0 dm tall, from slender rhizomes. Often with numerous axillary branches from medial and apical portion of the stem. Lower internodes shortened with overlapping, obovate to spatulate leaves, frequently deciduous and not present in mature plants. Leaves of medial and upper stem sessile with

rounded apices and bases, clasping, narrowly elliptic to elliptic, to widely ovate, to elliptic oblong, 5.0-20.0 mm long, 5.0-12.0 mm wide, mostly 3 to 5 nerved, shorter to about equaling the internodes. Inflorescence basically a compound dichasium, arising terminally and from axillary branches, generally subtended by a "whorl" of four leaves formed by the shortening of the two internodes immediately below the first flower of the inflorescence. Lowest flower frequently subtended by four ascending, floriferous branches. Bracts foliaceous, 2.0-2.5 mm in length and somewhat resembling the cauline leaves in shape. Sepals often unequal, narrowly elliptic to narrowly ovate, with rounded apices, 2.5-3.5 mm long and shorter than the mature capsule. Petals yellow, slightly asymmetrical, 2.5-3.0 mm long. Stamens 8 to 15. Mature capsule deep purple, ellipsoid, 3.0-5.0 mm long. Seeds tan to yellow, ca. 0.7 mm long, pitted and having longitudinal furrows.

Chromosome number: $\underline{n} = 8$.

Flowering period: July to September.

Distribution and habitat: Bogs, lake margins, sandy to peaty soils of swales and marshes from Newfoundland, Nova Scotia and Quebec, south to southeastern Virginia, and west to Wisconsin and Minnesota (Figure IX-4).

Discussion: Britton (1891) proposed the name H. canadense L. var. boreale to apply to a group of northern plants ". . . with oval or orbicular leaves. . . ." that had previously been referred to H. canadense L. var. minimum Choisy in DC. While Britton's new taxon was noted to have a northern distribution, no locality nor collector is cited in the original description. The brevity of

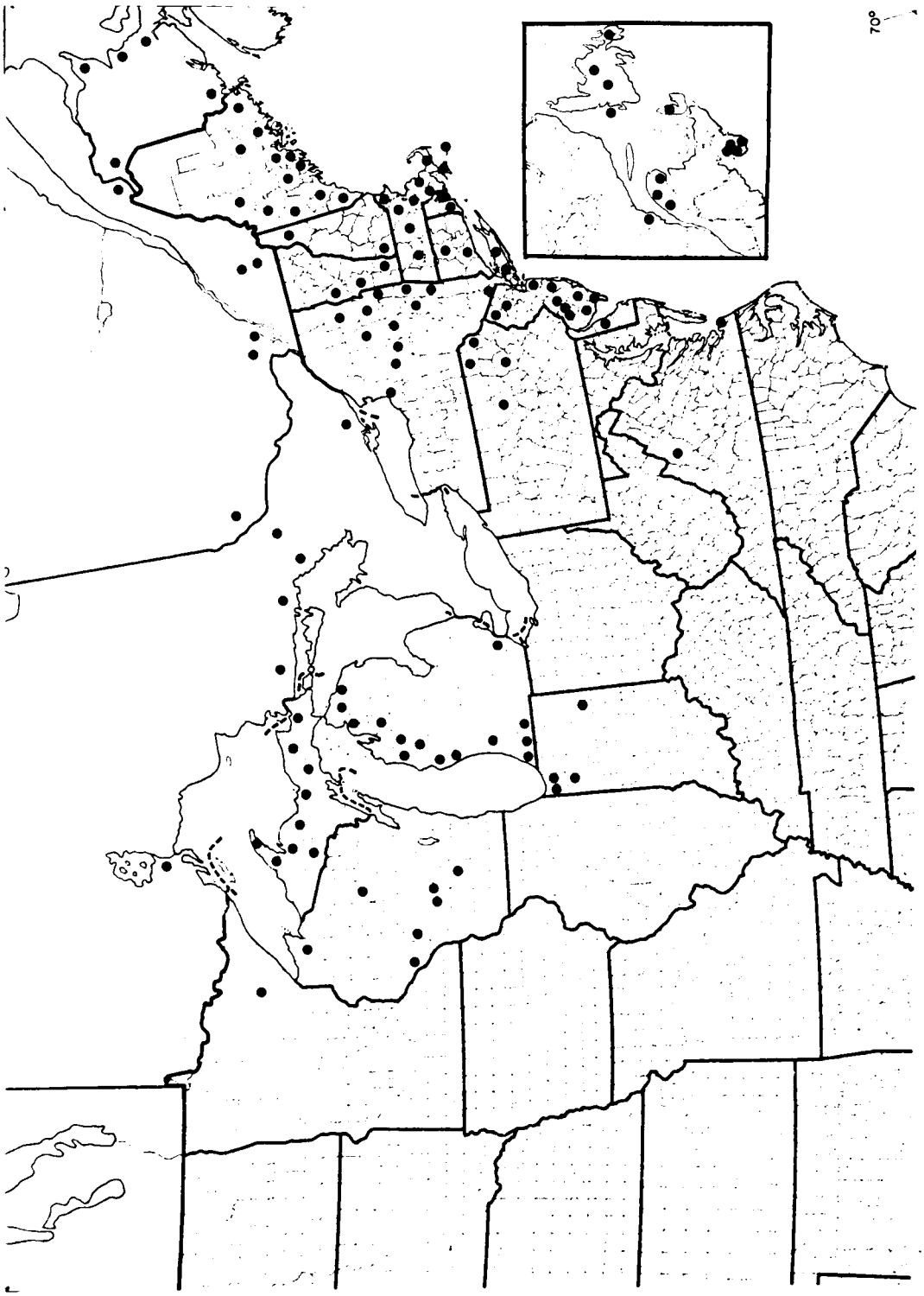


Figure IX-4. Distribution of Hypericum boreale.

Britton's "diagnosis" in addition to its failure to clearly distinguish the new taxon from certain specimens referrable to H. mutilum, might foster argument as to whether or not the name H. canadense var. boreale is validly published.

Additional information concerning the specimens examined by Britton in describing H. canadense var. boreale is provided by Bicknell (1895) who elevated var. boreale to specific rank. According to Bicknell (1895) the type material examined by Britton was collected in 1888 and based on ". . . some fragmentary specimens. . . ." This additional note by Bicknell suggests that the specimens utilized by Britton were possibly sent to him by another collector. Regardless of the origin of these specimens, the description and specimens cited by Bicknell (1895) leave no doubt as to his application of the name H. boreale (Britt.) Bickn. In his description of H. boreale, Bicknell clearly and explicitly indicated Britton to be the original author.

While the diagnosis in the brief protologue is inadequate by modern standards, the discussion presented by Bicknell (1895) seems to remove any doubt concerning the plant to which Britton intended the name H. canadense var. boreale to be applied. Thus, in the opinion of the present author, H. canadense var. boreale should be viewed as a validly published name and is in accord with long term use and nomenclatural stability. Britton's concept of H. canadense var. boreale is further substantiated by the discovery of what is believed to be original material.

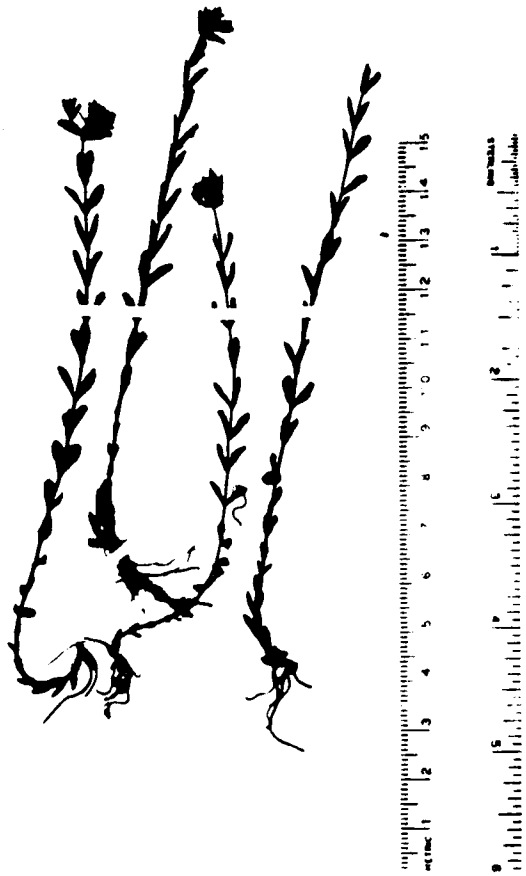
A specimen meeting the criteria described by Bicknell (1895) was found in the general collections of the New York Botanical

Garden (Figure IX-5). The specimen was originally identified as H. canadense var. minimum. However, the varietal name has been marked out and replaced by boreale. The label is hand written and based on a comparison of handwriting known to be that of N. L. Britton, the writing on the label is almost certainly that of Britton. The specimens were collected in 1888 by E. P. Bicknell from York Harbor, Maine. This explains Bicknell's interest and familiarity with the specimens upon which Britton based his new taxon. Also, as noted by Bicknell (1895), the specimens are fragmentary in the sense that they are depauperate, yet are referable to the plant that has long been known as H. boreale.

One of the specimens cited by Bicknell (1895) was collected in 1888 by John Macoun and is deposited at NY. However, there is no evidence to indicate that this specimen was examined or utilized by Britton in describing H. canadense var. boreale.

In view of the previous discussion, the 1888 collection of Bicknell is believed to represent original material and is designated as the lectotype of H. canadense var. boreale in spite of the fact that Jimenez (1973a) designated Robinson and Schrenk 186 as the lectotype of H. boreale (Britt.) Bickn. This specimen was collected in 1894, three years after Britton's original description, and therefore cannot be considered to be original material. The specimen designated by Jimenez (1973a) should be considered a neotype rather than a lectotype. According to Article 8 of the International Code of Botanical Nomenclature (Stafleu, 1978), an author's choice of a neotype is superseded if ". . . any of the original

Figure IX-5. Lectotype of *Hypericum canadense* var. *boreale*.



HERBARIUM OF COLUMBIA COLLEGE, NEW YORK.

Hypericum Canadense L. var. ~~[illegible]~~ Torr. & Gr. Battelle

Coll. E. P. Bicknell, Aug. 1888. ~~Stock~~.

Loc. York Harbor, Maine.



Figure IX-5

material is rediscovered. . . . " Thus, the Bicknell specimen collected in 1888 supersedes the specimen designated by Jimenez (1973a) and meets the criteria of a lectotype.

Morphologically, H. boreale most closely resembles H. mutilum. The two species can be distinguished readily by the presence of foliaceous bracts in the inflorescence of H. boreale, while those of H. mutilum are subulate. Additionally, in H. boreale the two internodes subtending the lowest flower of the compound dichasium are frequently shortened so the last two pairs of stem and/or rameal leaves form a "whorl." In H. mutilum the lowest flower of the compound dichasium is generally subtended by a single pair of leaves.

Hypericum boreale occasionally is found growing submersed. These plants, which are most always sterile, exhibit elongated stems and suborbicular leaves and have been described by Fassett (1939) as forma callitrichoides. Observations by Utech and Iltis (1970) on populations of H. boreale in Wisconsin lakes indicate this form grades shoreward into typical plants of H. boreale.

Hypericum boreale is attributed to Tennessee by Sharp et al. (1960) and Robinson and Shanks (1959). No specimens have been seen from Tennessee that are referable to this species. A few sheets of H. mutilum at TENN were misidentified as H. boreale and are thought to be the basis of these reports.

Representative specimens: UNITED STATES. CONNECTICUT. Hartford Co.: Southington, 5 Sep 1899, Bissell s.n. (GH). New Haven Co.: Southford Falls Park, 17 Aug 1941, Catherine 115 (NY).

DELAWARE. Kent Co.: margin of Tubmill Pond, 2 mi N of Milford, 31 Aug 1935, Tatnall 2760 (GH).

INDIANA. Jasper Co.: 2 mi SW of Tefft, 18 Sep 1930, Deam 49880 (GH). Lake Co.: Miller, 26 Jul 1895, Moffatt 366 (ILL). Porter Co.: Wilson, Dune Park, 17 Aug 1958, Bennett s.n. (ILL, NY). Wells Co.: borders of lakes in Jackson Twp., 1 Sep 1904, Deam s.n. (MO, US).

MAINE. Cumberland Co.: Baldwin, valley of the Saco River, 28 Aug 1916, Fernald and Long 14083 (US). Franklin Co.: Farmington, 18 Aug 1903, Knowlton s.n. (GH). Hancock Co.: Ripples Pond, Mt. Desert Island, 30 Aug 1895, Faxon 12 (GH, NY). Kennebec Co.: Fayette, 26 Aug 1903, Knowlton s.n. (GH). Knox Co.: N side of Forest Pond W of Friendship, 7 Aug 1957, Rossbach 4140 (NCU). Lincoln Co.: Ice Ponds Monhegan Island, 22 Aug 1921, Churchill s.n. (MO). Oxford Co.: along Saco River, Fryesburg, 18 Aug 1964, Seymour 22049 (MO, SMU). Penobscot Co.: river meadows, Orono, 12 Aug 1908, Fernald Plantae Exsiccatae Grayanae 236 (GA, GH, MICH, MO, NY, TENN, US). Somerset Co.: Dead River, 19 Aug 1896, Fernald and Strong 433 (GH, MO, US). Waldo Co.: 1.5 mi SE of Mason Pond, E of Belfast, 11 Aug 1957, Rossbach 4150 (NCU). Washington Co.: Lubec, Hunt's Pond, 18 Sep 1965, Pike (NCU). York Co.: York Harbor, Aug 1892, Bicknell 5782 (NY).

MASSACHUSETTS. Barnstable Co.: Dennis Pond, Yarmouth, 19 Sep 1913, Fernald and Long 9898 (US). Bristol Co.: Whiteville, Mansfield, 7 Oct 1961, Seymour 19612 (MO, SMU). Dukes Co.: Chappaquiddick Island, 2 Oct 1912, Bicknell 5785 (NY). Essex Co.: Manchester and vicinity, Chamberlain s.n. (NY). Hampshire Co.:

pond margin, Ware, 13 Aug 1973, Ahles 78529 (NCU, SMU). Middlesex Co.: Mt. Tabor, Lexington, 19 Sep 1897, Williams s.n. (GH). Nantucket Co.: Nantucket Island, 12 Sep 1889, Bicknell s.n. (NY). Norfolk Co.: Frog Pond, Glen Echo Park, Stoughton, 17 Aug 1912, Blade 4379 (US). Plymouth Co.: Great South Pond, Plymouth, 6 Sep 1913, Fernald et al. 9894 (GH, NY, US). Worchester Co.: S end of Pierpoint Meadow Pond, Dudley, 18 Aug 1958, Gates et al. 17948 (MO, SMU).

MICHIGAN. Alger Co.: N shore of Beaver Lake, 10 Aug 1973, Voss 14414 (MICH). Allegan Co.: ca. 5.5 mi SE of Fenneville, S shore of Ely Lake, Sec. 26, Clyde Twp., 15 Sep 1958, Voss 8177, (MICH). Baraga Co.: Little Lake, ca. 4 mi W of Alberta, 30 Jul 1966, Voss 12269 (MICH). Berrien Co.: Tamarack Swamp, 28 Jul 1946, Steyermark 63930 (ILL). Cass Co.: Dewey Lake, 4 Aug 1906, Gates 1409 (MICH). Charlevoix Co.: E side of Heart Lake, W edge of Sec. 28, T32N, R4W, ca. 5.5 mi SE of Boyne Falls, 24 Jul 1970, Voss 13504 (MICH). Cheboygan Co.: Smith's Bog, 11 airline miles SW of Cheboygan, 10 Aug 1952, Shinners 13703 (SMU). Chippewa Co.: shore of Lake George, 1.5 mi NW Homestead, 3 Sep 1935, Hermann 7144 (MICH, NY, US). Houghton Co.: Chamaedaphne bog near Laurium, 1 Aug 1926, Hermann 744 (MICH). Iron Co.: Lake 17, T43N, R36W, T16-17, 11 Aug 1938, F.P. 38-297 (MICH). Kalkaska Co.: Twenty-Eight Lakes, E side of M-66, ca. 7 mi S of Kalkaska, T26N, R8W, Sec. 29, 23 Aug 1959, Hyypio 816 (MICH). Keweenaw Co.: along Lake Upson, 17 Jul 1949, Richards 2418 (MICH). Lake Co.: Howe Lake, Luther, 25 Jun 1938, Anderson and Fassett 17194 (GH, MO). Luce Co.: NW side of Sleeper Lake, end of road E from Bailey's Sawmills, Sec. 33, R10W,

T48N, ca. 10 mi N of Newberry, 25 Jul 1948, McVaugh 9513 (MICH). Manistee Co.: W shore of Gordon Lake, Sec. 24, Onekama Twp., ca. 1.5 mi NE of Onekama, 21 Aug 1957, Voss 5365 (MICH). Marquette Co.: along road to Negaunee and Sands, 23 Aug 1906, collector illegible, s.n. (MICH). Muskegan Co.: shore of drying lake, NW 1/4 Sec. 30, Holton Twp., ca. 3.5 mi SW of Holton, 19 Aug 1957, Voss 5292 A (MICH). Oceana Co.: shore of Horner Lake, ca. 5 mi NW of Shelby, 20 Aug 1957, Voss 5323 (MICH). Ontonago Co.: along Carp Lake, Porcupine Mountains, Aug 1923, Darlington s.n. (MICH). Presque Isle Co.: swamp margin, State Forest Headquarters, Black Lake, 13 Aug 1933, Gleason and Gleason 330 (NY, SMU). St. Joseph Co.: Sec. 1, Park Twp., 27 Sep 1954, Hanes S.J. 201 (MICH). Schoolcraft Co.: SE 1/4 Sec. 32, R13W, T45N, E side of Al Pool, W of road, 13 Jul 1964, Laskowski 940 (MICH). Wayne Co.: Woodlawn Cemetary, Detroit, 5 Aug 1916, Billington s.n. (MICH). Wexford Co.: SW end of Woodward Lake, ca. 8 mi NW of Cadillac, 19 Aug 1956, Voss 3281 (MICH).

MINNESOTA. St. Louis Co.: shore of Janet Lake, along Hwy. 73, S of Hibbing, 22 Sep 1950, Lakela 12254 (ILL).

NEW HAMPSHIRE. Cheshire Co.: shores of Gilmore Pond, Jaffery, 10 Jul 1898, Robinson 502 (GH). Coos Co.: N shore of Burns Pond, Whitefield, 2 Sep 1913, Moore 5040 (GH).

NEW JERSEY. Atlantic Co.: Egg Harbor City, Sep 1917, MacKenzie 8056 (NY). Burlington Co.: Saylors Pond, Camp Dix, 28 Sep 1921, Long 24976 (GH). Camden Co.: pond edge, Winslow Jct., 3 Sep 1917, Gershoy 454 (GH). Cape May Co.: 1.0 mi S of jct. of Hwy. 557 and Hwy. 49, along E side of Hwy. 557, 3 Aug 1976, Webb and Webb 52125 (TENN). Gloucester Co.: ca. 1 mi SE on Racoon

Creek, 13 Oct 1923, Long 29717 (GH). Morris Co.: Budd's Lake, 11 Sep 1904, MacKenzie 1015 (MICH, NY). Ocean Co.: Old Sam's Pond, Pt. Pleasant, 2 Oct 1910, MacKenzie 4842 (MO, NY). Sussex Co.: S end of Lake Marcia, High Point, 12 Sep 1909, MacKenzie 4414 (MO, NY).

NEW YORK. Albany Co.: Rensselaerville, NW side of Myosotis Lake, 7 Aug 1950, Harper 3224 (NCU, TENN). Columbia Co.: shore of Kinderhook Lake, 9 Sep 1933, House 18859 (GH, NY). Essex Co.: Catlin Lake, Newcomb, 14 Aug 1939, House 26925 (MO, NY). Fulton Co.: Adirondac Park, near Pine Lake and jct. of Hwy. 10 and Hwy. 29A, 12 Aug 1977, Webb and Webb 53347 (TENN). Hamilton Co.: 15.8 mi S of jct. Hwy. 30 and Hwy. 28 (in Indian Lake) along Hwy. 30, 12 Aug 1977, Webb and Webb 53751 (TENN). Hermiker Co.: shore of fourth lake, Fulton Chain, 13 Aug 1895, Haberer 1363 (GH). Nassau Co.: Lakeville, Hempstead, Long Island, 13 Sep 1901, Churchill s.n. (MO). Oneida Co.: along stream N of West Vienna, 20 Aug 1933, House 20834 (NY). Oswego Co.: Mud Pond, Oswego, 23 Aug 1922, Fernald et al. 14390 (GH, NY, US). Rensselaer Co.: shore of Glass Lake, 25 Aug 1934, Muenscher and Clausen 4686 (MO). Rockland Co.: Green Swamp, Bear Mountains, Harriman Sec., Palisades, Interstate Park, Haverstraw Twp., 8 Aug 1954, Lehr 755 (NY). St. Lawerence Co.: Grass River Flow, 19 Aug 1930, Muenscher and Maguire 1252 (MO). Suffolk Co.: pond edge N of Babylon, 15 Sep 1941, Svenson 11655 (NY, US). Warren Co.: S end of Schroon Lake, Horicon, 16 Oct 1916, Metcalf and Wiegand 6814 (GH, MICH). Washington Co.: Hadlock Pond near West Fort Ann, ca. 1 mi N of Hwy. 149, 12 Aug 1977, Webb and Webb 53756 (TENN).

PENNSYLVANIA. Centre Co.: oak barrens, 3 mi S of Stormstown, 24 Aug 1937, Wahl s.n. (GH). Luzerne Co.: Catskill Formation along Long Pond, 16-17 Sep 1892, Heller and Halbach 512 (GH, ILL, MO). Susquehanna Co.: W shore of Ball Lake, 1.25 mi SSE of Ararat, 25 Aug 1950, Glowenke 11489 (NY). Wayne Co.: shore of Lower Woods Pond, 1.5 mi NE of Cold Spring, 25 Jul 1954, Wahl 14486 (GH, NCU).

RHODE ISLAND. Newport Co.: Crescent Beach, Block Island, 20 Aug 1913, Fernald and Long 9888 (GH, NY). Washington Co.: quagmire pond, NE of Woodville, Richmond, 30 Aug 1919, Fernald and Collins (GH).

VERMONT. Addison Co.: Bristol, 19 and 21 Aug 1903, Eggleston 3257 (MO, US). Rutland Co.: along Hwy. 100, 5.5 mi S of Pittsfield, Colton Pond in Gilford Woods State Park, 13 Aug 1977, Webb and Webb 53758 (TENN). Windham Co.: Newfane, Brookline, 4 and 5 Aug 1900, Eggleston and Grout 1948 (GH).

VIRGINIA. Augusta Co.: Lipscomb Pond, vicinity of Lipscomb, 8 Sep 1940, Killip 36071 (US). Princess Anne Co.: fresh pond back of dunes, Chesapeake Beach, 13 Sep 1946, Fernald et al. 15304 (MO, NY, US).

WISCONSIN. Adams Co.: Silver Lake, T16N, R5E, Sec. 9, Quincy Twp., 31 Aug 1958, Hartley and Thorne 5873 (GH). Bayfield Co.: Siskowitt Lake, S of Cornucopia, 10 Jul 1938, Fassett et al. 17192 (NY). Buffalo Co.: Mississippi River bottoms opposite Wabasha, Minnesota, 5 Aug 1926, Fassett 3441 (GH, NY). Columbia Co.: along the Wisconsin River road, Portage, 18 Aug 1945, Allen s.n. (ILL). Jackson Co.: shore of Little Bear Flowage, T21N, R2W,

Sec. 8, Millston Twp., 19 Jul 1958, Hartley 4746 (GH, ILL, US). Juneau Co.: along roadside 2 mi N of Sprague, 23 Aug 1940, Shinners and Catenhusen 2725 (NY). Lincoln Co.: shore of Spirit River, Rt. E, T34N, R6E, Sec. 20, Bradley Twp., 8 Sep 1950, Seymour 12373 (MO). Marinette Co.: Marinette, 19 Aug 1892, Vanette 23-2-16 (GH).

CANADA. NEW BRUNSWICK. Charlotte Co.: Chamock Lake, St. Andrews, 22 Aug 1909, Klugh 10 (GH). Gloucester Co.: Bathurst, 24 Jul 1902, Williams and Fernald s.n. (GH). Kent Co.: 16 mi N of St. Louis, 30 Aug 1947, Swallen 9842 (US). Madawaska Co.: St. Leonard and vicinity, 30 Jul 1927, Malte and Watson 712 (MICH). Westmoreland Co.: Moncton, 9 Aug 1894, Barnhart 804 (NY).

NEWFOUNDLAND. Valley of Exploits River, bank of river below Bishop Falls, 28 Jul 1911, Fernald and Wiegand 5844 (GH); valley of Exploits River, Grand Falls, 15 Aug 1911, Fernald and Wiegand 5846 (GH); drainage area of Collier's River, Brigus Jct., Avalon Peninsula, 5 Aug 1911, Fernald and Wiegand 5845 (GH, NY); region of Humber Arms, Bay of Islands, back of Birchy Cove (Curling), 11 Aug 1910, Fernald and Wiegand 3711 (GH).

NOVA SCOTIA. Annapolis Co.: beach of Grand Lake, 19 Jul 1921, Fernald et al. 24138 (GH, MICH). Digby Co.: shore of Journeay Lake, Weymouth, 8 Aug 1921, Fernald 24140 (GH). Shelburne Co.: beach of Welshtown (Birchtown) Lake, 2 Aug 1921, Fernald and Long 24139 (GH). Victoria Co.: swamp in Cape Breton Highlands National Park, South Ingonish, Aug 1939, Ferguson 1-4--69 (NY). Yarmouth Co.: margin of Trefry's Lake, Arcadia, 29 Jul 1920, Fernald and Long 21858 (GH).

ONTARIO. Algoma Co.: bog margin ca. 5 mi NW of Wawa, 20 Jul 1964, Voss 11699 (MICH). Frontenac Co.: Bolton Creek, 5 mi N of Sharbot Lake, Osa Twp., 11 Sep 1948, Dore and Gilbert 47-1060 (MO). Nipissing Co.: Island Lake, Algonquin Park, 27 Jul 1900, Macoun 21680 (US). Parry Sound Co.: Bacon Lake, Laurier, Aug 1905, Moyer 2457 (NY). Sudbury Co.: beach near Hunt Pt., near East Knob, Cloche Mts., 29 Aug 1932, Grassl 1965 (MICH, NY). Thunder Bay Co.: near Walker Lake, Schreiber, north shore of Lake Superior, 9 Aug 1937, Hosie et al. 1397 (GH).

PRINCE EDWARD ISLAND. Queens Co.: Mermaid Lake, 6 mi ENE of Charlottetown, 31 Jul 1953, Smith 288 (NY).

QUEBEC. Abitibi Co.: Taschereau, along road through Privat Twp. to Proulx Mills, 9 mi SE of Tashereau at Lois River, 29 Aug 1952, Baldwin and Breitung 4297 (GH). Argenteuil Co.: Saint-Adolphe, comté d'Argenteuil, 15 Jul 1947, Rolland-Germain 426 (GH, MICH, NY, US). Deux Montagnes Co.: Oka, rivages du lac des Deux-Montagnes, 5 Sep 1925, Marie-Victorin 21978 (GH). Est Gaspe Co.: Riviere Ouest, comté de Gaspe, 13 Aug 1931, Marie-Victorin et al. 44528 (GH). Matane Co.: river flat near the Locked Camp, Riviere Cap Chat, 27 Aug 1923, Fernald and Smith 25883 (GH). Magantic Co.: E margin of Black Lake, 27 Aug 1915, Fernald and Jackson 12123 (GH). Rimouski Co.: Rimouski, 18 Jul 1907, Fernald 1115 (GH). Saguenay Co.: flat in the river, Mingan, 18 Sep 1915, St. John 90590 (GH). Temiscouata Co.: Notre Dame du Lac, 13 Aug 1887, Northrop 192 (NY). Wolfe Co.: shore of Lake Nicolet, south of Ham, 17 Sep 1940, Pease 28510 (GH).

5. Hypericum mutilum L. Sp. Pl. 787. 1753. TYPE: UNITED STATES: VIRGINIA: Clayton 232. (LECTOTYPE: BM!, photo GH!).

Ascyrum Crux-andreae L. Sp. Pl. 788. 1753. Pro parte, quoad syn. Plukenet. TYPE: UNITED STATES: MARYLAND: Kreig s.n. (TYPE: Sloane Herbarium (HS 92.83) of BM, photo TENN!).

Hypericum quinquenervium Walt. Fl. Carol. 190. 1788. TYPE: UNITED STATES: CAROLINA: no collector cited, 692. (LECTOTYPE: BM, as photo!).

Hypericum parviflorum Willd. Sp. Pl. 3: 1456. 1802. TYPE: UNITED STATES: PENNSYLVANIA: no collector cited, Sheet No. 1. (TYPE: B, as photo!).

Hypericum stellarioides H.B.K. Nov. Gen. Sp. Pl. 5: 196. 1822. TYPE: COLOMBIA: Crescit in monte Quindiu, Humboldt and Bonpland s.n. (HOLOTYPE: P).

Hypericum euphorbioides St.-Hil. var. euphorbiodes. Fl. Bras. Merid. 1: 332, pl. 69. 1828. TYPE: BRAZIL: SÃO PAULO: crescit ad ripas fluminis Parahyba, prope Sebastionopolim, et ad rivulos prope Jondiahi, 1816-21, St. Hilaire 1076. (HOLOTYPE: P).

Hypericum euphorbioides St.-Hil. var. minor St.-Hil. Fl. Bras. Merid. 1: 332. 1828. TYPE: BRAZIL: RIO DE JANEIRO: in humidis propre praedium vulgo Fazenda da Barra Seca, 1816-21, St. Hilaire 231. (HOLOTYPE: P).

Hypericum euphorbioides St.-Hil. var. floribundum St.-Hil. Fl. Bras. Merid. 1: 332. 1828. TYPE: BRAZIL: MINAS GERAIS: ad ripas fluminis Paranahiba, 1816-21, St. Hilaire 921. (HOLOTYPE: P).

Brathys quinquenervia (Walt.) Spach. Ann. Sci. Nat. sér. 2, 5: 367. 1836.

Brathys euphorbioides (St.-Hil.) Spach. Ann. Sci. Nat. sér. 2, 5: 367. 1836.

Sarothra blentinense Savi f. Nouv. Giorn. Pisan. 39: 225. 1839. TYPE: ITALY: Bientina, 1836, Savi s.n. (LECTOTYPE herewith designated, P, ISOLECTOTYPES: FI, UPS).

Hypericum impunctatum Hochst. ex Steud. Nom., ed. 2, 1: 788. 1840. Nom. superfl., illigit. (Apparently based on H. quinquenervium Walt.).

Hypericum arenarioides Richard. Ess. Fl. Cuba 238. 1845. TYPE: CUBA: Guaniman, Ramon de la Sagra s.n. (HOLOTYPE: P).

Hypericum rutilum D. Dietr. Syn. Pl. 4: 1235. 1847. Orthographic error of H. mutilum L.

Hypericum blentinense (Savi f.) Bertoloni. Fl. Ital. 8: 340. 1852.

Hypericum mutilum L. var. minus (St.-Hil.) Reichardt in Mart. and Eichler. Fl. Bras. 12: 186. 1878.

Hypericum mutilum L. var. densiflorum Kuntze. Rev. Gen. 1: 60. 1891. TYPE: UNITED STATES: MISSISSIPPI: Cairo, collector not cited, 28?3. (LECTOTYPE: NY!).

Hypericum mutilum L. var. foliosissimum Kuntze. Rev. Gen. 1: 60. 1891. TYPE: Not located, however based on description appears to be referable to H. mutilum.

Hypericum collinum Schlecht. and Cham. var. liebmanii R. Keller. Bull. Herb. Boiss. 6: 260. 1898. TYPE: MEXICO: Mirador, X 1842, Pl. Mex. Liebm. Hypericac. Nr. 49. (LECTOTYPE: C!).

Hypericum mutilum L. var. latisepalum Fern. Rhodora 38: 372. 1936. TYPE: UNITED STATES: FLORIDA: Duval Co.: low grounds, June-August, Curtiss 264*. (HOLOTYPE: GH!, ISOTYPE: NY!).

Hypericum mutilum L. var. parviflorum (Willd.) Fern. Rhodora 41: 549. 1939.

Sarothra mutila (L.) Y. Kimura in Nakai and Hondo. Nov. Fl. Jap. no. 10: 232. 1951.

Plant annual or perennial, erect, or lower portion of the stem sometimes decumbent, (1.0) 1.5-6.0 (8.0) dm tall. Plants typically with numerous axillary, floriferous, spreading branches above the middle. Lower leaves ovate to elliptic to obovate, smaller than the upper leaves. Upper and rameal leaves sessile, elliptic to ovate to lance-deltoid, (0.3) 0.5-3.5 cm long, 4.0-15.0 mm wide, mostly 3 to 5 nerved, generally clasping with rounded to subcordate bases and rounded to obtuse to subacute apices. Inflorescence a compound dichasium, rather diffuse, typically with spreading branches although ascending monochasial branches present in some individuals. Bracts subulate, to 4.0 mm in length. Sepals linear-lanceolate to broadly lanceolate with acute apices, to oblong or foliaceous with rounded apices, 2.0-4.0 (4.5) mm long, 1.0-1.5 mm wide, about equaling to slightly exceeding the mature capsule. Petals yellow, slightly asymmetrical, 1.75-2.5 mm long, 0.8-1.25 mm wide. Stamens 5 to 16. Style 0.5-0.7 mm long. Mature capsule short ellipsoid and rounded at the summit, 2.5-3.5 (4.0) mm long, green or occasionally reddish-brown. Seeds yellow to golden-brown, 0.4-0.7 mm long, pitted and obscurely striate.

Chromosome number: $n = 8$.

Flowering period: June to October.

Distribution and habitat: Ditches, swales, marshes, and lake margins from Quebec south to Florida, west to Texas and north to

Wisconsin (Figure IX-6), also introduced into other regions of the world.

Discussion: Hypericum mutilum is a wide ranging and extremely variable species that has been introduced into various regions of the world. These two factors have resulted in a large number of specific and varietal names being proposed for the species.

Fernald (1950) recognized three varieties of H. mutilum in eastern North America. According to Fernald (1939), H. mutilum var. parviflorum differs from typical H. mutilum in having ". . . all the leaves elliptic and gradually rounded at the summit . . . .", while in var. mutilum ". . . the uppermost cauline and rameal leaves. . . . " are ". . . ovate- to lance-deltoid, or gradually tapering from base to summit." Variety parviflorum also was noted to differ from typical mutilum by its smaller size. According to Fernald (1939) only var. parviflorum occurs in ". . . southern New England, northern New York, Nova Scotia, New Brunswick, Quebec, and the region westward. . . ." A study of herbarium specimens from these areas indicates plants with ovate leaves to be quite common in these regions. The same population may also have individuals having both leaf shapes. In plants of short stature the leaves may all be elliptic, while the larger plants in the same population may have both types of leaves. However, populations exist in which all the plants have elliptic leaves. Plants having a leaf shape intermediate between var. parviflorum and var. mutilum are quite common. In view of these facts and the failure of plants of either leaf shape to exhibit distinctive geographical ranges, var. parviflorum is not recognized in the present study.

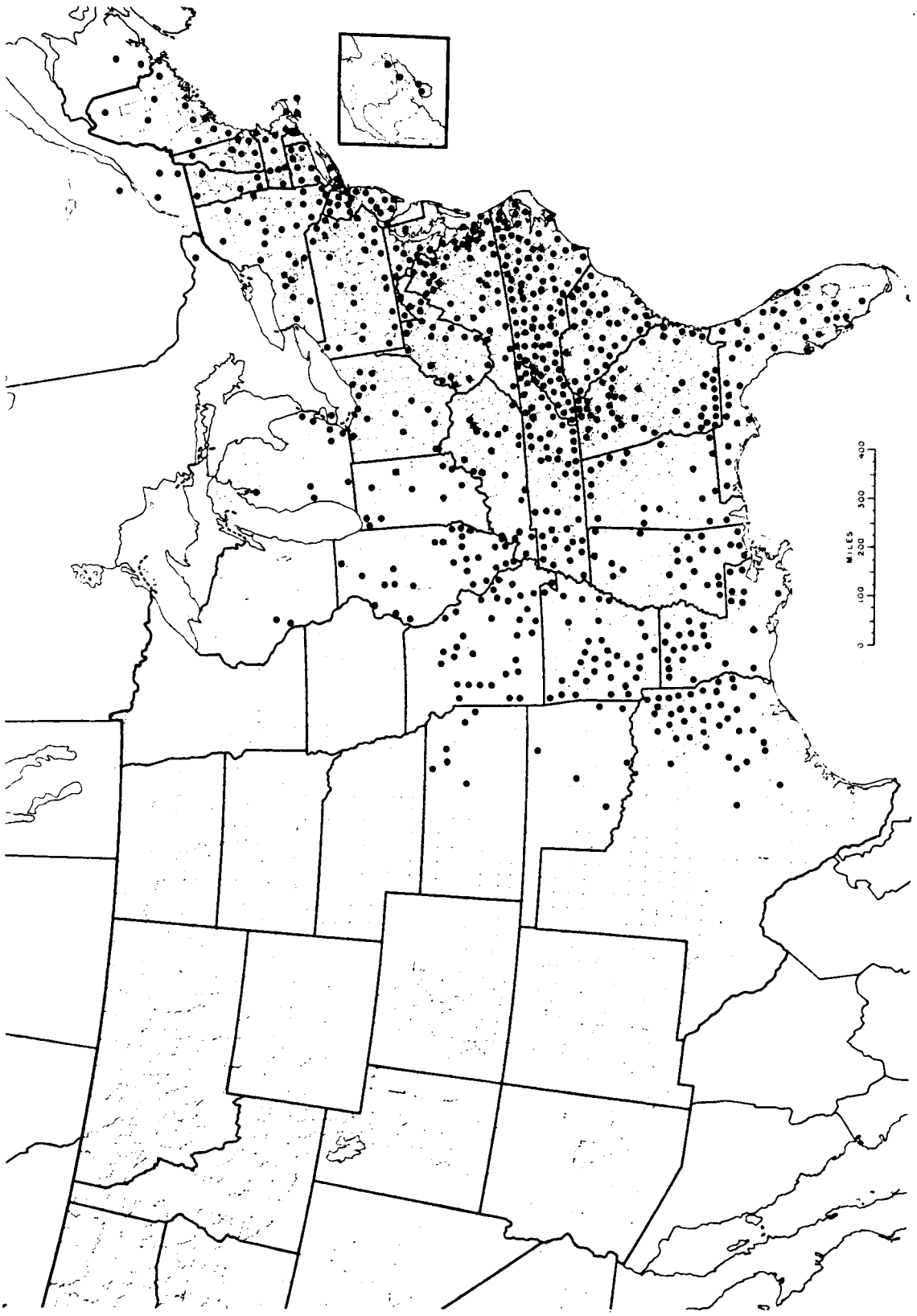


Figure IX-6. Distribution of Hypericum mutilum.

The third variety recognized by Fernald (1936a, 1950) is Hypericum mutilum var. latisepalum. This variety was distinguished from the other two varieties by having all sepals dilated. In the original description of var. latisepalum, Fernald (1936a) listed it as occurring from Florida to Texas, while the range was later (Fernald, 1950) noted to extend to the ". . . tidal mud of s. N.J." In this latter work the sepals of var. latisepalum were described as ". . . broadly lanceolate or oblong, foliaceous." A study of specimens of H. mutilum var. latisepalum from southeastern Virginia that were collected and annotated by Fernald shows only the sepals of the lowest flowers of the inflorescence to be dilated. The sepals are rarely foliaceous as is often the case with plants from the Gulf Coastal Plain. In addition to having dilated sepals, specimens of H. mutilum from Florida and Texas are often reduced in size, have small ovate leaves, and a diffusely branched inflorescence with ascending monochasial branches. However, the number of flowers of the inflorescence having dilated sepals is quite variable.

Plants with somewhat dilated sepals can be found in populations from the interior provinces of the eastern United States. Specimens from Illinois have been observed to have foliaceous sepals on several flowers of the inflorescence. Plants from central Arkansas frequently have dilated sepals, yet the leaf shape is elliptic-oblong and resembles the parviflorum-type leaf. Thus, the dilated sepals cannot in all cases be correlated with a particular leaf shape or a distinctive geographic range.

While plants with dilated sepals occur most commonly along the coastal plain from South Carolina to Florida and west to Texas,

populations of H. mutilum with dilated sepals are known from other geographic regions. The degree of dilation of the sepals and the number of flowers of the inflorescence with dilated sepals is quite variable even within the coastal plain region. The recognition of these populations at the varietal level would require quantification of the degree of sepal dilation and the number of flowers having dilated sepals. In view of the variability and intergrading nature of this character, var. latisepalum is not recognized in this treatment. Although some minor chemical differences were noted in populations of H. mutilum referable to var. latisepalum, they do not appear to be significant enough to support recognition of these populations at the varietal level.

In the protologue of Ascyrum crux-andreae, Linnaeus (1753) includes "Hypericoides ex terra mariana floribus exiguis luteis," which is from Plukenet (1700) and refers to a Kreig specimen (HS 92.83) in the Sloane Herbarium. This specimen was reported by Torrey and Gray (1838) to be H. mutilum. Dr. N. K. B. Robson (pers. comm.) of the British Museum also has verified this specimen to be H. mutilum. Thus, it would seem that A. crux-andreae should be considered as a taxonomic synonym of H. mutilum. This was noted by Fernald (1936b), who further stated that Linnaeus (1763) in the second edition of Species Plantarum altered his concept of A. crux-andreae and applied the name to a different plant.

In the opinion of Robson (1979) the various elements of the protologue of A. crux-andreae refer to both H. stans and H. mutilum. Apparently, Linnaeus never saw the Kreig specimen that is deposited in the Sloane Herbarium and according to Robson (1979) the Kreig

specimen ". . . does not come into the reckoning" in the selection of a lectotype. In the view of Robson (1979), the lectotype of Ascyrum crux-andreae is a specimen (Clayton 230) that Linnaeus saw while assisting Gronovius in preparing Flora Virginica. In such case, the name H. crux-andreae (L.) Crantz has priority over H. stans and is to be applied to the plants formerly included in this taxon. Since the protologue of A. crux-andreae does include an element referable to H. mutilum, the synonomy of this treatment follows that proposed by Robson (1979) and includes A. crux-andreae pro parte, quoad syn. Plukenet in synonomy under H. mutilum L.

Jiménez (1973a) has listed H. degeneri Fosb. in synonomy with H. mutilum. This species was noted by Fosberg (1969) to probably represent an introduction to the Hawaiian Islands where it was collected from Kalauea around 1930. The type of H. degeneri has been examined by the present author and has been excluded as a synonym of H. mutilum. Its decumbent habit, leaf shape, and branching pattern differs from any eastern North American plants referable to H. mutilum.

The types of the following species and varieties (Hypericum stellarioides H.B.K., H. euphorbioides St.-Hil. var. euphorbioides, H. euphorbioides var. minor St.-Hil., H. euphorbioides var. floribundum St.-Hil., H. arenarioides Richard, Sarothra blentinense Savi f.) were requested from Paris but at the present time have not been made available for study. These taxa have been included in synonomy on the basis of their descriptions and the treatment of Jiménez (1973a). Their inclusion under H. mutilum should be considered as tentative until the types can be studied.

Representative specimens: UNITED STATES. ALABAMA. Calhoun Co.: margin of Boozer Lake, ca. 6 mi N of Jacksonville, 14 Aug 1966, Clarke and Landers 7033 (NCU). Cherokee Co.: along Hwy. 68, 2 mi W of jct. of Main Street and Hwy. 411 (in downtown Centre), 13 Jul 1977, Webb 53265 (TENN). Cleburne Co.: 2.5 mi N jct. Skyway with Co. 55, S of Piedmont, 22 Jul 1968, Kral 31866 (SMU). Colbert Co.: ca. 12 mi SW of Leighton, 25 Aug 1965, Landers s.n. (NCU). Crenshaw Co.: Dozier, Oct and Nov 1941, Reed 2117 (MO). De Kalb Co.: on Ala. 68, 12 mi NW Centre, 21 Jul 1968, Kral 31780 (NCU, SMU). Escambia Co.: 4.7 mi NNW of Pollard, 19 Jul 1962, Shinners 29960 (SMU). Geneva Co.: along Hwy. 52, 3.6 mi W of jct. Hwy. 52 and 167, ca. 4 mi W of Hartford, 16 Jul 1977, Webb and Ross 53287 (TENN). Hale Co.: Tanglewood, 5 Aug 1966, Williams 389 (GH, NCU). Houston Co.: ca. 0.5 mi E of Dothan bypass on US 84, 24 Aug 1966, Clark 7069 (NCU). Jackson Co.: near Point Rock Creek, Guntersville Reservoir at intersection with Lee Hwy., 10 Jun 1944, Isely 3612 (US). Lee Co.: 3 mi E of API campus, Auburn Country Club Lake, 15 Jul 1959, Farmer s.n. (NCU). Limestone Co.: by US 31, 1 mi N Athens and jct. Ala. 127, 3 Oct 1968, Kral 33483 (SMU). Madison Co.: along Paint Rock River at Marshall Co. line on US 431, ca. 2.5 mi N of New Hope, 17 Aug 1967, Clark s.n. (NCU). Mobile Co.: 2.5 mi N of Citronelle, 25 Aug 1949, Shinners 11627 (GA, SMU). Monroe Co.: banks of tributary of Big Flat Creek, N of Monroeville where crossed by Ala. 41, 21 Aug 1968, Kral 32811 (SMU). Pickens Co.: near National Guard Armory on E side of Reform, 14 Jul 1977, Webb and Ross 53270 (TENN). Tuscaloosa Co.: 6 mi E of Tuscaloosa

(University), 28 Jul 1950, Shinners 12666 (GA, SMU). Washington Co.: borders of ditches and ponds, 13 Jul 1895, Mohr s.n. (US).

ARKANSAS. Benton Co.: 1899, Plank s.n. (NY). Bradley Co.: P.O. Warren, 9 Oct 1943, Demaree 24730 (GH, SMU). Clark Co.: P.O. Gurdon, 30 Sep 1963, Demaree 49080 (SMU). Clay Co.: Seven Mile Island, E of Piggott, 19 Jul 1951, Moore 510585 (SMU). Conway Co.: Petit Jean State Park, P.O. Borrilton, 31 Jul 1958, Demaree 40360 (SMU). Craighead Co.: vicinity of Lake City on the St. Francis River, 16 mi E of Jonesboro, 9 Jul 1929, Demaree 7005 (GH, NY, SMU, US). Crawford Co.: Lake Sheperd Springs, near Lake Ft. Smith, 3 Aug 1967, Tucker 6109 (NCU). Cross Co.: P.O. Levesque, 24 Jul 1939, Demaree 19590 (SMU). Drew Co.: margins of Bayou Bartholemue, near Tillar, 16 Oct 1937, Palmer 44256 (MO). Faulkner Co.: 8 mi S Conway, 5 Sep 1940, Moore 400057 (SMU). Garland Co.: Ouachita National Forest, P.O. Jessieville, 27 Jul 1955, Demaree 37661 (GA, GH, NCU, SMU). Hempstead Co.: Fulton, 18 Sep 1900, Bush 909 (MO). Hot Springs Co.: P.O. Magnet Cove, 17 Jul 1938, Demaree 17987 (GA, ILL, NY, SMU, TENN). Howard Co.: ca. 1 mi S of Mineral Springs on Ark. 355, 27 Jun 1969, Hamilton 109 (NCU). Independence Co.: P.O. Oneal, 21 Jul 1940, Demaree 21381 (GH, SMU). Johnson Co.: P.O. Knoxville, 13 Aug 1939, Demaree 19946 (SMU). Lee Co.: 7 mi W of Marianna just S of Oak Forest, 10 Jul 1959, McDaniel 1178 (NY). Logan Co.: P.O. Strictland, 25 Aug 1937, Demaree 16016 (SMU). Madison Co.: P.O. Aurora, 13 Sep 1966, Demaree 54351 (SMU). Montgomery Co.: P.O. Mount Ida, 16 Aug 1955, Demaree 37961 (SMU). Nevada Co.: 4 mi SE of Prescott, 18 Jul 1912, Hollister 52 (US). Ouachita Co.: P.O. Chidster, 22 Jul 1962,

Demaree 46047 (SMU). Perry Co.: above Nimrod Dam, P.O. Nimrod, 20 Aug 1939, Demaree 20150 (SMU). Phillips Co.: Mariana-Helena Recreational Area, P.O. West Helena, 16 Jul 1955, Demaree 37412 (GH, SMU). Polk Co.: Shady Creek Camp, P.O. Shady, 12 Aug 1937, Demaree 15690 (MO, NY, SMU). Pope Co.: P.O. Nogo, 28 Aug 1955, Demaree 38255A (GA, GH, NCU, SMU). Prairie Co.: P.O. Hazen, 26 Jul 1970, Demaree 62513 (SMU). Pulaski Co.: Pulaski Heights, Little Rock, 13 Sep 1931, Demaree 8161 (GH, MO, NY, SMU, US). Saline Co.: Bread Creek, P.O. Paron, 25 Aug 1961, Demaree 44715 (SMU). Sevier Co.: Cossatot River bottoms, P.O. Ben Lomond, 3 Oct 1967, Demaree 57387 (NCU). Union Co.: El Dorado, 31 Jul 1954, Hoiberg 526 (SMU). Washington Co.: 3 mi SE of Fayetteville on White River above dams, 17 Sep 1930, Moore s.n. (SMU). Yell Co.: Mount Nebo State Park, P.O. Dardanelle, 16 Aug 1939, Demaree 20107 (SMU).

CONNECTICUT. Fairfield Co.: strand of Poquonock River, Trumbull, 16 Aug 1962, Seymour 20254 (MO). Hartford Co.: along Old Reservoir Road, 0.5 mi S of Prospect Street, Wethersfield, 20 Jul 1973, Hill 1226 (NY). Litchfield Co.: Butternut Creek back of game technician's house, Litchfield-Morris Wildlife Sanctuary, 3 Sep 1941, Dwyer 2639 (NY). New Haven Co.: New Haven, Oct 1884, Chatterton 1276 (ILL). Tolland Co.: strand of Hop River, Andover, 30 Aug 1957, Seymour 17649 (MO). Windham Co.: Pomfret, 24 Aug 1871, Morong s.n. (NY).

DELAWARE. New Castle Co.: Townsend, 12 Aug 1911, Churchill s.n. (GH).

DISTRICT OF COLUMBIA. flats of the Potomac River at Chain Bridge, 3 mi NW of Georgetown, 13 Aug 1938, Hermann 9645 (MICH).

FLORIDA. Alachua Co.: along I-75, 10 mi S of Fla. 24, 27 Aug 1976, Webb et al. 52517 (TENN). Bradford Co.: along Fla. 16, 3.5 mi NW of Starke, 8 May 1965, Wiggins 19988 (NCU, US). Brevard Co.: Okeechobee region, 5 Jun 1903, Fredholm 5841 (GH, MO, US). Charlotte Co.: near Punta Gorda, 24 Feb 1946, Schallert 4193 (SMU). Citrus Co.: roadside ditch, Homosassa Springs, 7 Jun 1958, Kral and Kral 6679 (GA, GH). Collier Co.: 5 mi W of Sunniland, 30 Apr 1960, Atwater M-203 (NCU). Columbia Co.: Lake City, 14 Jul 1893, Rolfs s.n. (MO). De Soto Co.: 14 mi E of Arcadia, 10 Jun 1956, Adams 135 (GA). Duval Co.: moist ground near Jacksonville, 4 Aug 1897, Curtiss 5951 (GA, MO, NCU, NY, US). Franklin Co.: near St. James, 9 Jun 1955, Godfrey et al. 53422 (GH, NY). Gadsden Co.: ca. 5 mi S of Wetumpka, ca. 3 mi N of jct. Fla. 267 with Fla. 20 along Hwy. 267, 17 Jul 1977, Webb and Ross 53297 (TENN). Glades Co.: Hailpin, Fisheating Creek, 13 Mar 1945, Brass 14818 (US). Hernando Co.: 2.5 mi S of Brooksville, 25 Jun 1958, Kral and Kral 7058 (GA, NY). Highlands Co.: Josephine Creek, 20 Apr 1945, Brass 15077 (US). Hillsborough Co.: Tampa, Dale Mabry, 0.25 mi N of Waters Ave., 30 Mar 1961, Patman 1062 (GH, NCU, SMU). Indian River Co.: 8 mi S of Yehaw Jct., 10 Apr 1962, Godfrey and Reinert 61855 (MO). Jackson Co.: between Lake Seminole and Dellwood, 17 Aug 1974, Godfrey 73839 (TENN). Jefferson Co.: along Hwy. 259, 7.8 mi SW from central courthouse square in Monticello, 27 Aug 1976, Webb et al. 52523 (TENN). Lake Co.: vicinity of Eustis, 16-30 Jun 1894, Nash 1004 (GH, MICH, MO, NY, US). Lee Co.: Mullock Creek

District, about 8 mi SE of Fort Meyers, May-Jun 1917, Standley 482 (GH, ILL, MO, US). Leon Co.: 2 mi E of Tallahassee, 16 Jul 1957, Godfrey 55598 (GA, GH, NY, SMU, TENN). Liberty Co.: 5 mi W of Greensboro, 14 Oct 1955, Kral 1654 (GH). Madison Co.: 6 mi W of Greenville on Hwy. 90, 14 Jun 1961, Ramsey and Mitchell 40 (TENN, US). Manatee Co.: East Fork of the Manatee River just W of bridge on Duette Rd., ca. 3 mi S of State Rd. 62, 16 Jun 1977, Shuey s.n. (TENN). Marion Co.: Salt Springs Rd., 1 mi NE of Hwy. 40, Mather M-154 (GA). Okeechobee Co.: 9 mi N of Okeechobee, 21 Jun 1960, Atwater M-299 (NCU). Orange Co.: near Christmas, 10 Apr 1948, Schallert 113 (ILL). Osceola Co.: N of Fla. 532, ca. 1.5 mi E of I-4, 25 Jun 1977, Wunderlin and Shuey s.n. (TENN). Pasco Co.: about 5 mi N of Land O Lakes off US 41, 30 Sep 1960, Ray and Lakela 10297 (GH). Pinnellas Co.: Hwy. 19, 1 mi N of Hwy. 588, 2 Jul 1977, Genelle and Fleming s.n. (TENN). Polk Co.: ca. 4 mi N of Lake Wales on US 27, 25 Dec 1962, Burch 12 (GH, MO, US). Putnam Co.: Johnson, 28 Apr-3 May 1897, Barnhart 2144 (NY). St. John's Co.: near Sampson, 27 Nov 1929, Moldenke 175 (ILL, MO, NY). Santa Rosa Co.: RR right of way, S of Pensacola, 4 Jul 1941, Brinker 202 (MO). Seminole Co.: along E bank of Wekiva River at Fla. 46 bridge, ca. 8 mi W of Sanford, 13 May 1965, Ward and Beckner 4667 (GH, NY). Taylor Co.: 10 mi E of Perry, 13 Jun 1956, Kral and Redfern 2591 (GH, NCU). Walton Co.: under bridge at Alaqua Creek along Fla. 282, ca. 4 mi NE of Portland, 20 Jun 1967, Smith 1520 (GA, NCU). Volusia Co.: Lake Helen, 12 Apr 1910, Ex Herb. S. C. Hood s.n. (GH, MO). Washington Co.: 6 mi S of Wausau, 27 Jul 1950, Webster and Wilbur 3620 (MICH, SMU).

GEORGIA. Baker Co.: margin of Mossy Pond, 23 Jul 1946, Thorne 1615 (MO). Baldwin Co.: 0.6 mi from Wilkinson Co. line on Ga. 441, 7 Jul 1971, Cowart 13 (NCU). Barrow Co.: 4.5 mi E of Winder, 25 Jun 1941, Duncan 3561a (GA). Bartow Co.: near Quicksand Pond, about 4.5 mi SE of Adairsville on Cassville Mountain, 6 Aug 1963, Greear 63361 (GA, NCU). Ben Hill Co.: base of Red Bluff, 18 mi NE of Fitzgerald, 19 Aug 1967, Faircloth et al. 4678 (GA, NCU). Brooks Co.: 6 mi SE of Pavo, 8 Jun 1958, Adams 11 (GA, GH, NCU, NY). Bryan Co.: 2.4 mi N of Bryan-Liberty Co. line on Hwy. 17, 25 Aug 1976, Webb et al. 52490 (TENN). Camden Co.: along Ga. 40 on Camden-Charlton Co. line, E of Folkston, 8 Jun 1966, Bozeman 3904 (NCU). Chatham Co.: Whitmarsh Island, 24 Jul 1938, Eyles 4618 (GA). Clarke Co.: along Sandy Creek just N of Athens, 28 Sep 1946, Cronquist 4182 (GA, GH, NY, SMU). Cobb Co.: marshy place, 12 Jul 1900, Wilson 26 (MO, NY, US). Cook Co.: pond at the Porter Purvis Farm, 6 mi W of Adel, 19 Jul 1965, Faircloth and Dean 2380 (GA, NCU). Dawson Co.: W side of Chestatee River, 1.3 mi S of Lumpkin Co. line, 1 Jul 1955, Duncan and Adams 19030 (GA). De Kalb Co.: Mt. Arabia, 30 Sep 1938, Eyles 584 (TENN). Decatur Co.: headwaters of Willacoochee Creek, 3 mi N of Faceville, 8 Aug 1947, Thorne 5900 (GA). Early Co.: along Hwy. 273, ca. 10 mi NW of Donaldsonville, 4.1 mi W of jct. Hwy. 273 and Hwy. 39, 16 Jul 1977, Webb and Ross 53286 (TENN). Echols Co.: 1.3 mi N of the Ga.-Fla. state line, 8 mi SW of Fargo, 21 Jul 1969, Faircloth 5882 (GA, NCU). Elbert Co.: N side of Broad River, 15.5 mi SE of Elberton, 1 Oct 1949, Duncan 10542 (GA). Fulton Co.: W of North Side Dr. at Echota, Atlanta, 9 Aug 1947, Venard and McDowell V-422 (GA). Gilmer Co.: Tails

Creek area E of Hightop Mountain in western part of Co., 21 Aug 1963, Duncan 22115 (GA). Grady Co.: along Cassel's Branch, 8.7 mi SE of Cairo, 2 Aug 1965, Faircloth 2612 (GA, NCU). Glynn Co.: 0.5 mi N of Picric Acid Plant, NW of Brunswick, 24 Jul 1941, Duncan 3704 (GA). Gwinnett Co.: Yellow River, 27 Jul 1897, Eggert s.n. (MO). Habersham Co.: edge of Tugalo Lake, 16 Jul 1939, Duncan 1557 (GA). Hall Co.: 3.7 mi W, 22° S of Flowery Branch, 26 Jul 1955, Duncan and Adams 19187 (GA). Harris Co.: Roosevelt State Park water supply spring on S side of Pine Mt., 14 Jul 1971, Jones et al. 20976 (GH, SMU). Lanier Co.: 0.75 mi E of Lanier-Lowndes Co. line, 30 Jul 1964, Faircloth 1418 (GA, NCU). Long Co.: 5.6 mi W of US 301 on Ga. 261, 6 Oct 1962, Bozeman and Radford 1822 (NCU). Lowndes Co.: along One Mile Branch in Drexel Park, North Valdosta, 10 Jul 1968, Faircloth 5267 (GA, NCU). Lumpkin Co.: island in bed of Chestatee River about 0.1 mi N of Hall Co. line, 2 Oct 1955, Duncan and Adams 19783 (GA). McDuffie Co.: margin of Bowden's Pond on N side of Little Brier Creek, 11.75 mi S, 31° E of Thomson, 1.5 mi SSE of Arrington's Mill, 29 Jul 1950, Duncan 11547 (GA). McIntosh Co.: around outflow from artesian well about midway of inland side of Sapelo Island, 10 Jul 1956, Duncan 20254B (GH, NCU, SMU, US). Meriwether Co.: Mrs. Crowder's pasture, 3 mi ENE of Durand and 4 mi NW of Warm Springs, 15 Aug 1972, Jones 22286 (NCU). Miller Co.: 5 mi E of Colquitt, 18 Jul 1947, Thorne 5559 (NY). Mitchell Co.: ditch on Ga. 111, 2.4 mi W of Colquitt Co. line, 29 Jun 1966, Bozeman 5243 (NCU). Morgan Co.: edge of lake, Hard Labor Creek State Park, 30 Aug 1970, Jones 20046 (GA). Murray Co.: near spring at gap, WSW of Bald Mountain, 19 Sep 1946, Duncan 7251 (GA).

Oconee Co.: riverbank, old iron bridge W of Bishop, 1 Jul 1962, Fitzgerald s.n. (GA). Oglethorpe Co.: along Millstone Creek at Echols Mill, 4 Aug 1941, Duncan 3822 (GA). Rabun Co.: 4 mi NW of jct. of Hwy. 76 and Co. Rt. 92320 on 92320, 17 Jul 1973, Massey and Massey 3632 (NCU). Randolph Co.: slough near Greer Cave, 8 mi N of Cuthbert, 18 Aug 1948, Thorne and Muenscher 8120 (GA). Seminole Co.: bank of Chattahoochee River at Neel Landing Bridge, 25 Jul 1947, Thorne 5626 (MICH). Screven Co.: near Blue Springs in SE part of Co., 3 Oct 1940, Eyles 7572 (GH). Spaulding Co.: low lands, Experiment, 22 Aug 1899, Riegal 334 (GA). Sumter Co.: 2.2 mi S of Leslie, 5 Aug 1953, Duncan et al. 17155 (GA). Thomas Co.: 0.8 mi S of jct. Hwy. 319 with 188 along Hwy. 319, 27 Aug 1976, Webb et al. 52528 (TENN). Towns Co.: jct. of 17-75 and Corbin Creek, S of Hiwassee, 20 Jul 1973, Massey and Massey 3725 (NCU). Union Co.: flats at head of Lake Winfield Scott, 13 Sep 1940, Duncan 2918 (GA). White Co.: upper N slope, Yonah Mountain, 17 Jul 1962, Fitzgerald s.n. (GA). Wilcox Co.: bog 12 mi NW of Abbeville, 21 Aug 1950, Wilbur and Webster 2708 (GH, MICH, NY, SMU, US). Wilkes Co.: Long Creek Bottoms, 7.9 mi N 58° W of Tignal, 19 Jul 1970, Fitzgerald 321A (GA).

HAWAII. Hawaii Co.: Volcano, 2 Sep 1964, Kami s.n. (BISH).

ILLINOIS. Boone Co.: W of Belvidere, 19 Sep 1945, Fell f 45697 (ILL). Clay Co.: vicinity of Salt Pond, NE of Clay City, 6 Oct 1951, Ahles 5172 (ILL). Clinton Co.: ditch between Carlyle and Shattuc, 14 Oct 1951, Ahles 5755 (ILL). Coles Co.: near Charleston, 6 Sep 1946, Jones 17505 (ILL). Crawford Co.: along RR between Oblong and Stoy, 2 Sep 1951, Ahles 4920 (ILL).

Cumberland Co.: pasture, 7 mi W and 1 mi N of Toledo, 9 Aug 1950, Ahles 2579 (ILL). Fayette Co.: 1.5 mi S of Ramsey, 16 Jul 1949, Franklin s.n. (ILL). Hancock Co.: low places in corn field, Carthage Twp., 9 Sep 1916, Gates 10003 (ILL). Hardin Co.: pasture, 6 mi N of Eichorn, 10 Aug 1950, Ahles 2764 (ILL). Henderson Co.: Mississippi bottoms near Oquawka, Patterson s.n. (ILL). Iroquois Co.: along RR between Crescent and Wotseka, 21 Sep 1952, Ahles 6865 (ILL). Jackson Co.: Campbell Lakes, 22 Jul 1941, McCree 933 (MO). Jefferson Co.: along RR S of Mt. Vernon, 12 Oct 1951, Ahles 5489 (ILL). Kankakee Co.: low grounds, Kankakee, 31 Aug 1871, Hill 164 (ILL). Lawrence Co.: 0.5 mi E of Lawrenceville, 26 Jul 1947, Sivert 587 (ILL). Lee Co.: moist meadow, Amboy, 24 Jul 1957, Long 496 (ILL). Marion Co.: pond just N of Alma along the road near the I.C.R.R., 23 Jul 1948, Winterringer 1377 (ILL, SMU). Mason Co.: prairie, Havana, 15 Aug 1903, Gleason s.n. (GH). Peoria Co.: open rich ground, Peoria, Jul 1903, McDonald s.n. (NY). Pope Co.: base of cliff, N of Herod, 10 Aug 1950, Ahles 2728 (ILL). Pulaski Co.: between Wetaug and Ullin, 11 Aug 1950, Ahles 2829 (ILL). Richland Co.: 3.5 mi N of Olney, 3 Jul 1947, Scherer 330 (ILL). Rock Island Co.: near Silvis, 20 Oct 1961, Chase 16862 (ILL). St. Clair Co.: vic. Imbs Station, 2 Sep 1961, Neill 15780 (MO). Saline Co.: edge of river bottom woodland, N of Mitchellsville, 10 Aug 1950, Ahles 2708 (ILL). Stark Co.: ditch, Wady Petra, 30 Aug 1898, Chase 194 (ILL). Union Co.: Cobden, 25 Jul 1886, Earle 14892 (ILL). Wabash Co.: ditch, S of Keensburg, 28 Jul 1951, Ahles 4641 (ILL). Woodford Co.: 3 mi S of Spring Bay, 9 Aug 1931, Chase 4192 (ILL).

INDIANA. Blackford Co.: Sec. 31 in Washington Twp., just N of nitro-glycerine works, 3 Sep 1950, Deam 513 (MO). Hamilton Co.: along Cicero Rd., 3.3 mi N of Noblesville, 22 Aug 1942, Friesner 17321 (GH). Jasper Co.: Walker Twp. in ditches and low pastures in Gifford marsh region, 17 Aug 1924, Welch 436 (ILL). Jefferson Co.: on E side of Rd. 3, ca. 1.5 mi N of Rd. 256, 27 Oct 1945, Friesner 20246 (MICH, SMU). Kosciusko Co.: S side of Wonona Lake, 24 Aug 1905, Deam 434 (NY). Lake Co.: low sandy ground, Miller, 8 Sep 1897, Chase s.n. (MO). Monroe Co.: 3 mi NE of Bloomington, 9 Aug 1918, Deam 26067 (ILL). Porter Co.: dunes at Port Chester, 17 Aug 1924, Lyon s.n. (MICH). Ripley Co.: E side of Rd. 29, 7.4 mi S of Versailles, 21 Sep 1946, Friesner 21097 (MO). Washington Co.: E side of a large buttonbush swamp about 2.5 mi E of Livonia, 1 Sep 1935, Deam 56756 (GH).

KANSAS. Douglas Co.: 6 mi S of Lawrence, 22 Jul 1959, McGregor 14565 (GH, NY, SMU). Miami Co.: 25 Sep 1884, Oyster 953 (NY). Pottawatomie Co.: wet soil, 13 Aug 1895, Norton 40 (GH, MO, NY). Riley Co.: Manhattan, 8 Oct 1886, Kellerman s.n. (MO). Saline Co.: Sep 1898, White s.n. (NY). Washington Co.: 4.5 mi E of Clifton, 13 Sep 1952, Horr 4425 (GH).

KENTUCKY. Bath Co.: Olympian Springs, 22 Jul 1938, Wharton 3158 (MICH). Boyle Co.: 1 mi W of Junction City, 1 Jul 1938, Wharton 2944 (MICH). Bullitt Co.: 3.5 mi NE of Lebanon jct., 28 Jul 1939, Wharton 4973 (NY). Calloway Co.: Tobacco, between Murray and Hazel, 22 Jul 1965, Austin 1134 (NCU). Clark Co.: 1 mi SE of Indian Fields, 24 Jul 1939, Wharton 4884a (MICH). Carlisle Co.: Arlington, near Cane Creek, 20 Aug 1923, McFarland and Anderson 287

(MO). Harlan Co.: near Harlan Courthouse, Aug 1893, Kearney 16 (GH, MO, NY, NCU, US). Hart Co.: Bonnieville, 23 Aug 1926, Woodson 854 (MO). Henry Co.: Ky. 561, 1.2 mi SW of Gest, 0.5 mi from Hwy., S end of Hardin Bottoms, 10 Aug 1962, Gentry 666 (NCU, NY). Jefferson Co.: off 3rd St. Rd., 15 Aug 1943, Davies 438 (NCU). Laurel Co.: London, near Levi Jackson State Park, 14 Jul 1935, McFarland 4152 (MO). Livingston Co.: 1.2 mi W of jct. 453 with 93, along Hwy. 93, 24 Aug 1968, Fuller and Fuller 382 (NCU). Logan Co.: Moseley's Pond, along Ky. 102, 11 Nov 1954, Clebsch et al. 18971 (TENN). Lyon Co.: Kuttawa, 27 Sep-9 Oct 1909, Eggleston 5259 (NY). Madison Co.: bank of Silver Creek, SE of Berea, 2 Aug 1938, Wharton 3284 (TENN). McCreary Co.: 2.5 mi N of Whitley City, 30 Aug 1941, Braun 4231 (US). Montgomery Co.: 1.25 mi SE of Jeffersonville, 23 Jun 1938, Wharton 2773 (MICH). Rockcastle Co.: along US 150, 1.5 mi SE of Lincoln Co. line, 5 Aug 1938, Wharton 3361 (MICH). Simpson Co.: Robey's Swamp near Franklin, 20 Jul 1966, Hunter et al. 2803 (NCU). Wayne Co.: S of Monticello, 15 Jul 1937, Smith and Hodgdon 3957 (GH).

LOUISIANA. Bienville Par.: 11 mi SE of Minden, 26 Jul 1950, Shinners 12599 (SMU). Bossier Par.: T-Board Swamp, E side of Flag Lake, 26 Jul 1975, Balogh 571 (NCU). Calcassie Par.: vicinity of Lake Charles, 25 Aug-10 Sep 1898, Mackenzie 516 (MO). Caldwell Par.: 3 mi SW of Grayson, 7 Oct 1955, Shinners 21894 (SMU). Catahoula Par.: 1.7 mi N of Sicily Island, 19 Sep 1956, Shinners 24674 (SMU). Claiborne Par.: 5 mi SW of Summerfield, 22 Oct 1958, Shinners 27635 (SMU). De Soto Par.: 5.5 mi WSW of Mansfield, 20 Sep 1956, Shinners 24774 (SMU). East Baton Rouge Par.: near

entrance to Leland College, 19 Jun 1958, Richardson 511 (ILL). East Feliciana Par.: Mac Manus RR station, E of Jackson, 11 Jun 1956, Ewan 18778 (GH). Franklin Par.: 4.7 mi NNW of Winnsboro, 19 Sep 1956, Shinners 24664 (SMU). Grant Par.: ca. 6 mi NE of Colfax in Sec. 19, T7N, R2W, 11 Aug 1976, Allen and Vincent 7091 (NCU). Jackson Par.: 3 mi S of Indian Village, 25 Apr 1955, Moore and Harman 5921 (GH). Lafayette Par.: Claycomb farm, Lafayette, 28 Jul 1942, Claycomb s.n. (GH). La Salle Par.: Old River beside US Hwy. 84, 9 mi SE of Jena, 9 Nov 1969, Rogers and Thomas 2527-A (NCU). Lincoln Par.: 3.3 mi E of Choudrant, 28 Oct 1960, Shinners 29140 (SMU). Livingston Par.: woods at Denham Springs, 28 Jun 1938, Correll and Correll 9161 (GH, NY). Moorehouse Par.: Sec. 15, ca. 5.5 mi NW of Beekman, 1 Jul 1968, Thieret 29889 (SMU). Ouachita Par.: bridge over Long Creek, 2 mi W of La. 3033, SW of Monroe, at corners of sections 22, 23, 26, 27, T17N, R2E, 24 Jul 1974, Thomas et al. 40261 (ILL, TENN). St. Helena Par.: ca. 8 mi SSE of Greensburg in Sec. 22, T3S, R5E, 6 Jul 1971, Allen 1149 (GA, NCU, SMU). St. Tammany Par.: Covington, Aug 1919, Arsene 11087 (US). Terrebonne Par.: N of Houma, 20 Jul 1913, Wurzlow s.n. (NY). Union Par.: 6.8 mi ESE of Farmerville, 18 Sep 1956, Shinners 24592 (SMU). Vernon Par.: 5.8 mi N of Rosepine, 12 Jul 1955, Shinners 20626 (SMU). Washington Par.: Strawberry Bluffs, Bayton Chitto River, S of Isabel, 3 Jul 1937, Brown 7027 (GH). Webster Par.: 1.5 mi ESE of Minden, 6 Oct 1955, Shinners 21767 (SMU). Winn Par.: 11 mi SW of Winnfield, 7 Oct 1955, Shinners 21956 (SMU).

MAINE. Aroostook Co.: Island Falls, 26 Sep 1901, Fernald s.n. (GH). Cumberland Co.: Westbrook, Aug 1900, Ricker 705 (US).

Franklin Co.: SE of New Sharon, along Hwy. 27, 0.4 mi SE of jct. of US 2 with Hwy. 27, 15 Aug 1977, Webb and Webb 53771 (TENN). Kennebec Co.: Augusta, 25 Aug 1887, Smith s.n. (MO). Penobscot Co.: Orono, 1 Aug 1908, Fernald s.n. (GA, GH, MICH, MO, NY, TENN, US). Piscataquis Co.: Abbot, valley of Piscataquis River, 15 Aug 1916, Fernald and Long 14090 (ILL). Sagadohoc Co.: W side of Merrymeeting Bay, Bowdoinham, 23 Aug 1921, Fassett 128 (NY). Waldo Co.: NE bank of Ducktrap River, NW of Rt. 137, Lincolnville, 16 Aug 1960, Rossback 5190 (NCU). Washington Co.: Topsfield, 7 Aug 1940, Knowlton s.n. (TENN). York Co.: Kennebunkport, 23 Jul 1882, Bullard s.n. (ILL).

MARYLAND. Allegany Co.: between N branch of Potomac River and C and O Canal, within 1 mi E of Oldtown, 17 Sep 1969, Downs 8930 (NCU). Baltimore Co.: 0.6 mi W of iron bridge over Loon Raven Reservoir on Warren Rd., 22 Aug 1971, Windler and Lombardo 3743 (MICH, NCU). Charles Co.: 1.5 mi E of Chapel Point, 21 Aug 1938, Hermann 9696 (GH, US). Fredrick Co.: along Hwy. 31, just E of Libertytown, 0.1 mi W of jct. Hwy. N26 with Hwy. 31, 10 Aug 1977, Webb and Webb 53341 (TENN). Garrett Co.: near Boiling Springs, vicinity of Oakland, 3 Aug 1950, Allard 19736 (GA, US). Howard Co.: Ellicott City, 3 Aug 1916, Arsene 664 (MO). Montgomery Co.: Chevy Chase, 5 Sep 1904, Chase 2617 (ILL). Prince Georges Co.: Ammendale, 1918, Hyacinth 1521 (ILL). Queen Anne Co.: .025 mi N of jct. Hwy. 305 and 301, W of Hope, 1 Oct 1971, Massey and Massey s.n. (NCU). Washington Co.: base of Tonoloway Ridge along Potomac River, ca. 3 mi SW of Hancock, 29 Sep 1969, Downs 9851 (NCU). Worcester Co.:

2.4 mi S of jct. Hwy. 113 with Hwy. 394 along Hwy. 113, 2 Aug 1976, Webb and Webb 52115 (TENN).

MASSACHUSETTS. Barnstable Co.: No Bottom Pond, Brewster, 7 Sep 1918, Fernald and Long 17094 (ILL). Berkshire Co.: Becket, 1 Aug 1945, Jones and Jones 17208 (ILL, NY). Bristol Co.: Whiteville, Mansfield, 7 Oct 1961, Seymour 19613 (MO, SMU). Dukes Co.: West Tisbury on Martha's Vineyard, 28 Aug 1893, Blodgett s.n. (NY). Essex Co.: Ipswich, 25 Aug 1898, Nash s.n. (NY). Franklin Co.: Clapps Pond, Deerfield, 7 Sep 1950, Polland s.n. (GA). Hampden Co.: along Great Brook, Southwick, 9 Sep 1914, Seymour 254 (GH, MO, NY). Hampshire Co.: University of Massachusetts campus, Amherst, 12 Sep 1972, Ahles 76168 (GA, SMU, TENN). Nantucket Co.: shore of Miacomet Pond, Nantuckett Island, 8 Sep 1904, Bicknell 5826 (NY). Middlesex Co.: Lexington, 23 Aug 1904, Worthen s.n. (US). Norfolk Co.: Stoughton, 21 Aug 1909, Blake s.n. (ILL). Worcester Co.: along Mill River, Mendon, 24 Sep 1956, Gates et al. 17028 (MO).

MICHIGAN. Grand Traverse Co.: border of small stream, 23 Jul 1955, Dieterle 1404 (MICH). Kent Co.: Fisher Station, 5 Sep 1898, Cole 45297 (MICH). Macomb Co.: near Lake St. Clair, 27 Aug 1916, Chandler s.n. (US). Monroe Co.: Federman, ca. 5 mi E of Petersburg, 26 Aug 1922, Harvey s.n. (MICH). Ottawa Co.: near River Road, Guneton, 1 Aug 1940, Bazuin 1822 (MICH). St. Clair Co.: Port Huron, 16 Aug 1896, Dodge 113 (SMU, TENN). St. Joseph Co.: Portage Lake, 30 Jul 1953, Hanes 87 (MICH). Washtenaw Co.: Huron River, Ann Arbor, 10 Oct 1903, Thomson s.n. (MICH). Wayne Co.: Elmwood Cemetary, Detroit, Clark s.n. (MICH).

MISSISSIPPI. Amite Co.: Longleaf Farm, 10 mi S of Liberty, along E fork of Amite River, 3 Jul 1967, Jones et al. 13927 (GA). Benton Co.: near bridge, 1.5 mi E of Marshall-Benton Co. line on Hwy. 4, 4 Aug 1964, Pullen 641260 (GA). Clarke Co.: near jct. of US 45 and Ala. 18, ca. 2 mi S of Quitman, 15 Jul 1977, Webb and Ross 53275 (TENN). Forrest Co.: W side of Geiger Lake, Johnson State Park, 22 Sep 1965, Carter 988 (NCU). Hancock Co.: ca. 6 mi NW of Bay St. Louis along Jourdan River, 30 Aug 1952, Diener 575 (ILL). Harrison Co.: Biloxi, 23 Jul 1897, Baker 834 (NY). Hinds Co.: along Kickapoo Rd., 6.3 mi NE of Clinton, 1 Aug 1966, Temple 3710 (GA, NCU). Jackson Co.: Vancleave, P.O. Ocean Springs, 3 Aug 1952, Demaree 32475 (NCU, SMU). Jones Co.: 4 mi W of Laurel, 3 Jul 1963, Teer s.n. (SMU). Lafayette Co.: ponds at Minnows, Inc., 12.5 mi NE of Oxford, 30 Jul 1964, Pullen 641230 (GA). Lincoln Co.: 11 mi W of Brookhaven, 11 Jul 1950, Webster and Wilbur 3284 (GA, GH, MICH, NY, SMU, US). Lowndes Co.: ca. 1.5 mi S of New Hope, just E of Mt. Zion Baptist Church, 14 Jul 1977, Webb and Ross 53268 (TENN). Madison Co.: Ross Barnett Reservoir, 14 mi SW of Canton, at Waterfowl Refuge, 17 Jul 1970, Jones 19437 (SMU). Newton Co.: 1.3 mi W of Newton, 27 Oct 1960, Shinners 29083 (SMU). Panola Co.: 17 Sep 1896, Eggert s.n. (MO). Pike Co.: lake at Percy Quin State Park, W of McComb, 24 Aug 1966, Jones 9347 (NCU). Scott Co.: Roosevelt State Park, S of Morton, 8 Sep 1969, Jones et al. 17730 (GA). Simpson Co.: roadside near Strong River, ca. 2 mi NE of jct. Hwy. 49 with Miss. 13, Sec. 14, T2N, R4E, 17 Aug 1971, Wallus and Heard s.n. (NCU). Smith Co.: Shongelo Recreation Area, N of Raleigh, 1 Jul 1967, Jones and Jones 13864 (GA). Stone Co.: P.O.

Perkinston, 16 Aug 1952, Demaree 32864 (GH, SMU). Tishomingo Co.: Hwy. 72 at Yellow Creek, 29 Jul 1974, Coleman 48516 (TENN). Walthall Co.: Bogue Chitto River, Hwy. 48 W of Tylertown, 24 Aug 1966, Jones 9228 (NCU). Wayne Co.: Waynesboro, 8-9 Aug 1896, Pollard 1212 (GH, MO, NY, US). Yalobusha Co.: along Hwy. 32, 1 mi S of jct. Hwy. 27 with Hwy. 32, near Water Valley, 7 Jul 1964, Pullen 64854 (GA, NCU).

MISSOURI. Barton Co.: along Pettis Creek, 3.5 mi S of Lamar, 21 Sep 1956, Palmer 64110 (SMU). Bollinger Co.: Blue Pond, locally known as Buchanan Factory Pond, Sec. 7, T29N, R8E, NE $\frac{1}{4}$, 10 mi NW of Zalma, 1 mi SW of Buchanan, 18 Sep 1954, Steyermark 77664 (MO). Boone Co.: Hinkson Creek, 2 mi E of Stephens Sta., 29 Jul 1933, Schmitt and Droner 798 (MO). Butler Co.: Cane Creek, Sec. 8, T25N, R5E, 8 mi NW of Poplar Bluff, 8 Jul 1936, Steyermark 11521a (MO). Calloway Co.: Stinson Creek, Sec. 34, T47N, R9W, 3 mi SE of Pulton, 10 Sep 1937, Steyermark 26112 (MO). Carter Co.: along Big Barren Creek, Sec. 5, T25N, R1W, 6 mi NE of Wilderness, 17 Jul 1936, Steyermark 11949 (MO). Chariton Co.: near Little Chariton River, Sec. 19 and 30, T54N, R17W, NE of Keytesville, 16 Sep 1937, Steyermark 26455 (MO). Crawford Co.: pond between Viburnum and Dillard, 22 Sep 1935, Steyermark 19784 (MO). Dunklin Co.: drainage canals, Kennett, 5 Aug 1930, Kellogg s.n. (MO). Greene Co.: Frisco Shops, vicinity of Springfield, 20 Aug 1912, Standley 9067 (US). Henry Co.: Pretty Bob Creek by Peeler's Spring, Sec. 1 and 12, 1-2 mi SE of Garnes, 25 Sep 1938, Steyermark 7375 (MO). Howard Co.: Salt Spring near Viaduct Hill, 3 mi NW of Rocheport, 13 Sep 1937, Steyermark 26265 (MO). Howell Co.:

Burnham Pond, T26N, R10W, 6.5 mi SW of Willow Springs, 21 Jul 1937, Steyermark 23510 (MO). Iron Co.: Iron Mountain Lake, 28 Aug 1927, Kellogg 1042 (MO). Jackson Co.: Sibley, 21 Aug 1907, Bush 4817 (MO, NY). Jasper Co.: Webb City, 27 Jul 1902, Palmer 177 (MO). Jefferson Co.: near Meramec River about 6 mi SW of Eureka near Hunter's Pond, 31 Jul 1927, Steyermark 868 (MO). Johnson Co.: along Rt. 13, 6.5 mi S of Warrensburg, 10 Aug 1937, Steyermark 24530 (MO). Lafayette Co.: Big Sniabar Creek, Sec. 11, T49N, R29W, S of Napoleon, 14 Aug 1937, Steyermark 24725 (MO). Lincoln Co.: Sandy Creek in St. Peter sandstone ravines, 2 mi W of Poley, 22 Sep 1932, Steyermark 8625 (MO). Mississippi Co.: 4 mi W of Charleston, 11 Jul 1933, Palmer and Steyermark 41479 (MO). Moniteau Co.: Big and Little Moniteau Creeks, 3.5 mi S of Jamestown, Sec. 27 and 28, T46N, R14W, 17 Aug 1937, Steyermark 24828 (MO). Oregon Co.: Red Brush Pond, Sec. 16, T24N, R2W, 4 mi S of Wilderness, 20 Jul 1936, Steyermark 12068 (MO). Perry Co.: Silver Lake near Saline Creek, W of Perryville, 29 Jul 1934, Steyermark 13950 (MO). Pike Co.: Buffalo Creek, 4 mi SE of Louisiana, Sec. 33, T54N, R1W, 6 Sep 1937, Steyermark 25880 (MO). Polk Co.: Graydon Springs, 31 Jul 1937, Steyermark 23969 (MO). Randolph Co.: Silver Spring Creek, 2 mi S of Huntsville, 3 Sep 1933, Steyermark 9399 (MO). St. Clair Co.: Osage River, 2 mi N of Oyer, S of Monegaw Springs, 3 Oct 1936, Steyermark 20253 (MO). St. Francis Co.: Bismark, 10 Sep 1893, Bush s.n. (MO). Ste. Genevieve Co.: Pickel Spring, 21 Aug 1940, Brenner s.n. (MO). St. Louis Co.: Missouri Botanical Garden Grounds, 16 Aug 1949, Shinners 11487 (GA, SMU). Shannon Co.: Polk Pond, Sec. 31, T27N, R3W, S of Winona, 23 Jul 1936, Steyermark 12214 (MO).

Texas Co.: tributary to Spring Creek, Sec. 14, T33N, R9W, 2 mi S of Sherrill, 27 Aug 1937, Steyermark 25478 (MO). Wayne Co.: Mill Creek, Sec. 4, T26N, R7E, 1.5 mi SW of Wappapello, 29 Aug 1938, Steyermark 6246 (MO). Webster Co.: between Duncan and High Prairie, 28 Jul 1937, Steyermark 23808 (TENN).

NEW HAMPSHIRE. Belknap Co.: Gilford, 27 Jul 1900, Carter s.n. (ILL). Cheshire Co.: Jaffery, 28 Aug 1898, Robinson s.n. (GH). Coos Co.: ca. 2.5 mi S of Jefferson, along road to the west of Hwy. 115A, 14 Aug 1977, Webb and Webb 53765 (TENN). Grafton Co.: Hanover, 13 Jul 1888, Tasleton s.n. (GH). Hillsborough Co.: Peterborough, 22 Aug 1927, Batchelder s.n. (TENN). Merrimack Co.: East Andover, 13 Aug 1903, Day s.n. (GH). Rockingham Co.: Hampton, 3 Sep 1938, Chandler 718 (MO). Strafford Co.: Rochester, Aug 1846, collector unknown, s.n. (NY).

NEW JERSEY. Atlantic Co.: Great Swamp Branch, 3 mi NE of Hammonton, 16 Sep 1937, Fogg 13672 (MO). Bergen Co.: Oradell, 18 Oct 1891, Britton s.n. (NY). Burlington Co.: Kinkora, 18 Aug 1910, Taylor 2549 (NY). Camden Co.: near Great Egg Harbor River, Penbryn, 21 Sep 1924, Long 31406 (GH). Cape May Co.: Bennet, 30 Aug 1917, Gershoy 456 (GH). Cumberland Co.: just W of the Atlantic-Cumberland Co. line at Tuckahoe River on Hwy. 49, 3 Aug 1976, Webb and Webb 52122 (TENN). Essex Co.: Caldwell, 12 Aug 1916, Lighthipe s.n. (NY). Glouchester Co.: 3.6 mi E of jct. Hwy. 322 and Hwy. 47, 4 Aug 1976, Webb and Webb 52132 (TENN). Hunterdon Co.: 0.5 mi E of Oldwick, 10 Sep 1938, Benner 8527 (GH). Middlesex Co.: Spotswood, 17 Aug 1910, Taylor 2498 (NY). Morris Co.: Great Swamp toward Chatham, 21 Jul 1936, Kezer s.n. Monmouth Co.: Brielle, 4 Aug

1912, MacKenzie 5152 (NY). Passaic Co.: Oak Ridge, 9 Aug 1908, MacKenzie 3731 (MO, NY). Somerset Co.: Watchung, 17 Aug 1931, Moldenke 6181 (NY). Sussex Co.: Cranberry Lake, 16 Sep 1906, MacKenzie 2460 (MO, NY).

NEW YORK. Allegany Co.: Moss Lake near Caneadea, 22 Aug 1929, Mattews 2965 (NCU). Bronx Co.: New York Botanical Garden, Bronx Park, 8 Aug 1939, Gilly 148 (NY). Cortland Co.: W side of Chicago Bog, South Cortland, 22 Jul 1916, Eames 6820 (GH). Delaware Co.: Arkville, 17 Jul 1915, Wilson s.n. (NY). Dutchess Co.: East Hyde Park, 1 Aug 1949, Ahles 1475 (ILL). Erie Co.: Buffalo, collector unknown s.n. (NY). Essex Co.: Catlin Lake, Newcomb, 31 Jul 1940, House 26925 (MO). Fulton Co.: Adirondac Park, near jct. of Hwy. 10 and Hwy. 29 A, near Pine Lake, 12 Aug 1977, Webb and Webb 53348 (TENN). Greene Co.: Windham, 28-31 Jul 1909, Taylor 936 (NY). Hamilton Co.: along Hwy. 30, 15.8 mi S of jct. Hwy. 30 and Hwy. 28 (in Indian Lake), 12 Aug 1977, Webb and Webb 53752 (TENN). Herkimer Co.: Graefenburg, 31 Jul 1904, Haberer s.n. (GH). Livingston Co.: swamp S of Conesus Lake, 2 Sep 1926, Burkholder and Muenscher 16675 (GH). Nassau Co.: Massapequa, Long Island, 17 Aug 1929, Ferguson 7895 (NY). Ocean Co.: Bogans (Osborne) Island, 5 Aug 1913, Long 9137 (GH). Oneida Co.: Tylvan Beach, Sep 1897, Maxon s.n. (NY). Ontario Co.: Laruery's Pond, West Junius, 4 Aug 1893, von Schrenk s.n. (MO). Orange Co.: swamp W of Aleck Meadow Res., 14 Jul 1936, Raup 7611 (GH, NY). Oswego Co.: Phoenix, 1895, Williams s.n. (NY). Ostego Co.: along Hwy. 166, 5.6 mi S of jct. of Hwy. 166 and Hwy. 165 (in Roseboom), 12 Aug 1977, Webb and Webb 53346 (TENN). Queens Co.: Flushing, Long

Island, 6 Aug 1929, Ferguson 7812 (NY). Richmond Co.: near Richmond, Staten Island, W of Egbertville, 29 Aug 1907, Dowell 5145 (GH). Rockland Co.: Spring Valley, along 75 Herrick Avenue, Ramapo Twp., 14 Aug 1957, Lehr 450 (NY). St. Lawrence Co.: Gouverneur, 23 Jul 1873, Redfield 864 (MO). Seneca Co.: Ovid, 1859, Brewer and Chickering s.n. (US). Suffolk Co.: Babylon, Long Island, 8-9 Sep 1898, Clute 348 (NY, SMU). Sullivan Co.: near Lake Shandelee, 6 Aug 1918, Wilson s.n. (NY). Tioga Co.: Spencer Lake, 17 Aug 1914, Wiegand and Thomas 2818 (GH). Tompkins Co.: Dryden Lake, Dryden, 17 Sep 1916, Wiegand 6817 (GH). Ulster Co.: near Katrine, 12 Aug 1916, Wilson s.n. (NY). Washington Co.: Copeland Pond, W Fort Ann, 18 Aug 1918, Burnham s.n. (GH). Westchester Co.: White Plains, 1862, Willis s.n. (NY). Yates Co.: Penn Yan, Sartwell s.n. (US).

NORTH CAROLINA. Alamance Co.: along the Haw River, ca. 5 mi SE of Saxapahaw, 17 Jul 1956, Ahles and Bell 16849 (NCU). Alexander Co.: Catawba River, near N.C. 127, N of Hickory, 16 Jul 1956, Radford 13944 (NY). Alleghany Co.: Laurel Branch, near US 21, 0.8 mi N of Roaning Gap, 27 Sep 1958, Radford 40898 (NCU). Anson Co.: Blewett Falls on Pee Dee River, 30 Jun 1956, Radford 13355 (NCU). Ashe Co.: base of N side of abandoned gravel pit, Bluff Mountain, 3 Jul 1965, Tucker 2790 (SMU). Avery Co.: 4.2 mi SSE of Banners Elk on N.C. 184, 24 Jul 1958, Ahles and Duke 47485 (NCU). Bertie Co.: 1.2 mi E of Quitsna on road to Grabtown, 9 Jul 1958, Ahles and Duke 46176 (NCU). Brunswick Co.: 170 meters from ocean, transect 3, between Long Beach and Fort Caswell, 7 Aug 1950, Boyce 1340 (GA). Buncombe Co.: near Black Mountain, 2 Sep 1913,

Standley and Bollman 10314 (US). Burke Co.: along Laurel Creek, by N.C. 18, SE of Morganton, 9 Sep 1958, Bell 15074 (NCU). Cabarrus Co.: Irish Buffalo Creek, 1.5 mi W of jct. US 29 and N.C. 73 on N.C. 73, 5 Jul 1956, Ahles and Leisner 15920 (NCU). Caldwell Co.: 2 mi SE of Draco, 4 Aug 1956, Radford 14932 (NCU). Carteret Co.: Croton National Forest, 17 Sep 1964, Phipps et al. 3785 (NCU). Caswell Co.: 10 mi N of Yanceyville, 31 Jul 1938, Godfrey 5586 (GH). Catawba Co.: S shore of Lake Hickory, below powerhouse, 8 Sep 1958, Bell s.n. (NCU). Chatham Co.: 1.8 mi S of Orange Co. line on N.C. 15 and 501, 28 Oct 1956, Ramseur and Hammond 2897 (NCU). Cherokee Co.: W of Murphy ca. 5 to 10 mi on Hwy. 64, stream margin, 22 Sep 1968, Rogers 42317 (TENN). Chowan Co.: 1.3 mi W of jct. US 17 and N.C. 32 on US 17, along Pembroke Creek, 30 Jul 1958, Ahles and Duke 47789 (NCU). Clay Co.: al. 4000, Sep 1893, Ashe s.n. (NCU). Cleveland Co.: 3.4 mi SW of Cleveland-Gaston Co. line on US 29, 18 Sep 1956, Ahles and Leisner 18989 (NCU). Columbus Co.: swamp forest of White Marsh Creek, 5.2 mi S of Hallsboro, 17 Oct 1958, Bell 15711 (NCU). Craven Co.: near US 70, 3.3 mi S of New Bern, 19 Jul 1958, Radford 37380 (NCU). Cumberland Co.: Little River, on N.C. 87 near Manchester, 7 Aug 1957, Ahles and Leisner 33408 (NCU). Dare Co.: lowland, 10 Jul 1941, Schallert s.n. (NY). Davidson Co.: Yadkin River near High Rock, 16 Jun 1956, Radford 12947 (NCU). Duplin Co.: 0.3 mi NW of Pin Hook, 2 Aug 1957, Ahles and Leisner 33151 (NCU). Durham Co.: NE of Durham on Neuse River at Co. line, SW of Cozart, 21 Aug 1965, Ahles and Sears 59844 (NCU). Edgemont Co.: Town Creek, 1.5 mi N of St. Lewis, 12 Jul 1958, Radford 36746 (NCU). Franklin Co.: 0.8 mi W of Mitchners cross

roads, 10 Jul 1956, Ahles and Leisner 16397 (NCU). Forsyth Co.: 1.7 mi NW of Vienna on road to Dozier, 8 Aug 1958, Ahles and Duke 49069 (NCU). Gates Co.: 0.3 mi S of Sunbury on US 158, 26 Jun 1958, Ahles and Duke 44555 (NCU). Graham Co.: bog, 1 mi SW of Robbinsville, 19 Jul 1956, Radford 14179 (NCU). Granville Co.: 0.7 mi W of Hester, 24 Jul 1956, Ahles and Leisner 17420 (NCU). Greene Co.: marsh near US 264, 3 mi NW of Walstonburg, 11 Jul 1958, Radford 36385 (NCU). Guilford Co.: below spillway of Lake Brandt, N of Greensboro, 30 Sep 1958, Bell 15467 (NCU). Halifax Co.: 2 mi N of Thelma along Roanoke River, 19 Jul 1956, Ahles and Leisner 17033 (NCU). Harnett Co.: approx. 3 mi NW of Lillington along Cape Fear River, 18 Oct 1956, Laing 711 (NCU). Haywood Co.: shaded E side of Lake Junaluska, 5 Jul 1932, Beaven 400 (GA). Henderson Co.: Flat Rock, 30 Jul 1895, Memminger s.n. (NCU). Hertford Co.: 3 mi N of Winton, 18 Jul 1938, Godfrey 5204 (GH). Hoke Co.: McNeils Lake, S of Dundarrach, 26 Jun 1957, Ahles and Haesloop 29620 (NCU). Hyde Co.: 1.2 mi WSW of Scranton, 6 Aug 1958, Radford 39056 (NCU). Iredell Co.: Catawba River, 0.4 mi S of N.C. 150, 1 Jul 1958, Ahles and Duke 45115 (NCU). Jackson Co.: 2 mi W of Cashiers, 17 Jul 1954, Hardin 207 (GA, MICH). Johnston Co.: 4.5 mi E of Angier, 7 Aug 1957, Radford 27973 (NCU). Lee Co.: 1.3 mi W jct. of Deep and Haw Rivers, 11 Sep 1954, Beard 162 (NCU). Lenoir Co.: Dailey's Creek, 2 mi N of Liddell, 22 Jun 1957, Radford 25625 (NCU). Lincoln Co.: near Clark Creek, N of Lincolnton, 10 Sep 1958, Bell 15285 (NCU). Macon Co.: Horse Cove Bog, 3 mi from Highlands, 2 Aug 1939, Coker and Stewart s.n. (NCU, NY). Madison Co.: gravel pit, 1.4 mi N of Madison-Buncombe Co. line on US 19-23,

SSE of Mars Hill, 14 Jul 1958, Ahles and Duke 46295 (NCU). Martin Co.: near Cononoho Creek and N.C. 125, 2.3 mi S of Hamilton, 9 Aug 1958, Radford 39481 (NCU, US). McDowell Co.: Marion, Jul 1881, Hyams s.n. (NY). Mecklenburg Co.: 0.4 mi S of Hickory Grove, 6 Aug 1958, Ahles and Duke 48572 (NCU). Mitchell Co.: 4.2 mi NW of Spruce Pine on N.C. 26, 23 Jul 1958, Ahles and Duke 47168 (NCU). Montgomery Co.: 1.25 mi S of Candor near N.C. 731, 27 Jul 1956, Radford 14698 (NCU). Nash Co.: 1.4 mi E of Nash-Johnston Co. line on US 264, 12 Jul 1956, Ahles and Bell 16566 (NCU). New Hanover Co.: US 17 on W bank of Cape Fear River opposite Wilmington, 26 Sep 1965, McCrary and Ahles 1911 (NCU). Northampton Co.: 0.9 mi WSW of Graysburg on US 158-301, 7 Jul 1958, Ahles and Duke 45527 (NCU). Onslow Co.: 3 mi N of Silverdale on road to Belgrade, 27 Jul 1957, Ahles and Leisner 32601 (NCU). Orange Co.: near fire road from Mason Farm to Pittsboro Hwy., about 1.75 mi SE from Chapel Hill, 28 Sep 1939, Radford and Stewart 39a (NCU). Pasquotank Co.: 2 mi NE of Perquimans-Pasquotank Co. line on US 17, 31 Jul 1958, Ahles and Duke 48067 (NCU). Perquimons Co.: marshy area near Hertford, 20 Jul 1938, Godfrey 5331 (GH, US). Pender Co.: Black River, 4 mi W of Montague, 26 Jul 1953, Radford et al. 7390 (NCU). Person Co.: 6.5 mi W of Moriah on road to Timberlake, 29 Jul 1977, Webb and Whitten 53309 (TENN). Pitt Co.: 2.7 mi NNE of Grimesland, 10 Aug 1958, Radford 39703 (NCU). Polk Co.: Spring Mountain Park, near Columbus, 1 Jul 1897, Townsend s.n. (US). Randolph Co.: by US 64, 1.6 mi W of Chatham Co. line, 10 Oct 1958, Bell 15523 (NCU). Richmond Co.: 3.5 mi NE of Hoffman at Camp Hackall, 24 Jul 1956, Radford 14446 (NCU). Robeson Co.: creek border, Cumberland-Robeson

Co. line on US 301 (SW of Roslin), 27 Jun 1957, Ahles and Haesloop 29801 (NCU). Rockingham Co.: 1.25 mi E of Thompsonville, 7 Jul 1956, Radford 13572 (NCU). Rowan Co.: E of US 601 bridge across the South Yadkin River, 11 Oct 1956, Horton 626 (NCU). Rutherford Co.: Chimney Rock, 22 Jul 1897, collector unknown, 524[b] (GH, MO, NCU, NY, US). Sampson Co.: 1.1 mi WSW of Newton Grove on N.C. 102, 27 Jun 1957, Ahles and Haesloop 29942 (NCU). Scotland Co.: swamp near Gibson, 14 Jul 1938, Godfrey 5070 (GH, NCU, US). Stanly Co.: 3.5 mi S of Misenheimer on Millingport Rd., 6 Jul 1956, Ahles and Leisner 16198 (NCU). Stokes Co.: Belews Creek, 1.2 mi SE of Pine Hill, 26 Jul 1958, Radford 37743 (NCU). Surrey Co.: Yadkin River near Elkin, 16 Sep 1956, Radford 18345 (NCU). Swain Co.: Camp Forney along small streams, vic. of Bryson City, 12 Jul 1935, Barksdale s.n. (NCU). Transylvania Co.: Middle Bearcamp Creek area, 2 Aug 1962, Rogers and Shake 62149a (NCU). Tyrrell Co.: Albemarle Sound, 1 mi NE of River Neck, 6 Aug 1958, Radford 39200 (NCU). Vance Co.: 1 mi SW of Tungsten, 21 Jul 1956, Ahles and Leisner 17224 (NCU). Wake Co.: near Neuse River, 0.16 mi below old mill dam, Milburnie, 6 Aug 1948, Fox and Whitford 1805 (TENN). Warren Co.: Lees Branch, 0.8 mi W of Elberon, 26 Jul 1956, Bell 4252 (NCU). Washington Co.: near US 64 and Welch Creek, 3.3 mi SW of Plymouth, 5 Aug 1958, Radford 38727 (NCU). Watauga Co.: New River, 2.4 mi SW of Todd, 25 Jul 1958, Ahles and Duke 47710 (NCU). Wayne Co.: Neuse River, 3.5 mi SSW of Goldsboro, 28 Aug 1957, Radford 28739 (NCU). Wilkes Co.: 2.5 mi SE of Parsonville near Lewis Fork Creek, 5 Aug 1956, Radford 15179 (NCU). Wilson Co.: bog near US 264, 1 mi NW of Sims, 28 Jul 1958, Radford 37997 (NCU).

Yadkin Co.: 1 mi NE of Huntsville near Yadkin River, 6 Aug 1956, Radford 15293 (NCU). Yancey Co.: 1.1 mi NNW of Swiss, 16 Jul 1958, Ahles and Duke 46728 (NCU).

OHIO. Champaign Co.: near the maple swamp, Urbana, 28 Jul 1838, Samples s.n. (MICH). Cuyahoga Co.: Shaker Pond near Cleveland, 8 Jul 1896, Greenman 869 (MO, NY). Delaware Co.: Alum Creek, 6 Sep 1928, Crane 3173 (NY). Erie Co.: Union Corners, 25 Jul 1894, Mosely s.n. (MO). Fairfield Co.: Lancaster, 31 Jul 1878, Kellerman s.n. (MO). Hamilton Co.: near Cincinnati, 22 Jul 1890, Lloyd s.n. (MO). Highland Co.: Fort Hill, 10 Aug 1962, Braun s.n. (US). Lorain Co.: roadside, Camden, 25 Jul 1897, Dick s.n. (MICH). Lucas Co.: dry ditch, NW of Holland, 13 Oct 1923, Mosely s.n. (GH). Medina Co.: edge of slough, SE of Valley City, Liverpool Twp., 15 Aug 1973, Jones 73-8-15-1021 (TENN). Portage Co.: Garrettsville, 20 Jul 1901, Webb 465 (GH). Ross Co.: dry field near Londonderry, 6 Sep 1936, Bartley and Pontius 330 (NY). Seneca Co.: edge of small pond in open field, E side of St. Rt. 231 just N of St. Rt. 224, ca. 2 mi S of Triffin, 8 Sep 1962, Stuckey 1481 (SMU). Stark Co.: near Beach City, 15 Sep 1935, Camp 943 (NY). Wayne Co.: 26 Jul 1941, Thomas s.n. (NY).

OKLAHOMA. Comanche Co.: Wichita Mts. Wildlife Refuge, 25 Jul 1941, McMurray 1017 (MICH). Le Flore Co.: roadside N of Honobia, 3 Jul 1948, Robbins 3116 (NY). Marshall Co.: Happy Hollow, 2.5 mi SE of Enos near Lake Texoma, 28 Jul 1958, Goodman 6692 (ILL, SMU). McCurtain Co.: near Little River, N of Idabel, Goodman and Waterfall 4545 (GH). Oklahoma Co.: 2.5 mi S of Harrah, on W side of US 270, 12 Jul 1941, Waterfall 3013 (GH). Osage Co.: near

Chopan, 18 Aug 1913, Stevens 2153 (ILL, MO, NY). Sequoyah Co.: 0.5 mi SE of Blackgum on State 100, 10 Sep 1957, Wallis 5556 (SMU).

PENNSYLVANIA. Allegheny Co.: Moon Twp., near Stoops Ferry, 20 Aug 1902, Shafer 312 (GA). Armstrong Co.: Buffalo Creek, 22 Jul 1932, Bright 6863 (SMU). Berks Co.: 1.5 mi NW of Eckville, 7 Aug 1952, Schaeffer 41232 (US). Bucks Co.: along Delaware River, Andalusia, 9 Aug 1923, Dreisbach 1863 (MICH). Butler Co.: Slippery Creek, Christley's Mill, 31 Jul 1946, Russell H-3902 (TENN). Centre Co.: 1 mi SW of Julian, 15 Sep 1945, Wahl 1547 (ILL, MO). Chester Co.: Atglen, 9 Aug 1916, Pennell 7894 (NY). Clearfield Co.: Du Bois, 15 Jul 1928, Hayes and Moldenke 3929 (NY). Clinton Co.: 1 mi NNE of Rosecrans, 25 Jul 1947, Wahl 3209 (GH). Crawford Co.: Spartansburg Lake, 24 Jul 1948, Krouse s.n. (NCU). Erie Co.: West Springfield, 21 Jul 1883, Pond s.n. (US). Fayette Co.: Ohio Plye Falls, 20 Jun 1902, Shafer 312 (NCU). Franklin Co.: Mont Alto, 20 Aug 1914, Tidestrom 7341 (US). Fulton Co.: 1 mi SW of Sipes Mill, 12 Sep 1955, Westerfield 18268 (NCU). Lackawana Co.: along Hwy. 247, 1.6 mi S of jct. Hwy. 247 with Hwy. 107, near Lakeland Jr. and Sr. High School, 11 Aug 1977, Webb and Webb 53343 (TENN). Lancaster Co.: near the mouth of the Tucquan, 24 Jul 1901, Heller s.n. (GH, US). Lebanon Co.: Penryn, Sep 1893, Elby s.n. (MO). Monroe Co.: Pocono Manor, 13-24 Jul 1920, Pennell 10937 (NY). Pike Co.: Rt. 6, 4 mi N of Lords Valley, 10 Aug 1935, True 828 (MO). Somerset Co.: SE shore of the Quemahoning Reservoir, 4.9 km W of Hooversville, 5 Aug 1955, Shetler 133 (NY). Sullivan Co.: Deer Lake, 5 mi SW of Eaglesmere, 4 Aug 1944, Githens s.n. (NY). Susquehanna Co.: ca. 1.0 mi N of Lake Idlewild, 1.2 mi E of jct. Hwy. 92 and Hwy. from

S Gibson to West Clifford, 11 Aug 1977, Webb and Webb 53344 (TENN). Washington Co.: 3 Aug 1923, Dickey 121 (GH). Wayne Co.: Preston Park, 30 Aug 1975, Nyman 586 (TENN). York Co.: along Hwy. 851, 1.5 mi W of New Freedom, 10 Aug 1977, Webb and Webb 53342 (TENN).

RHODE ISLAND. Bristol Co.: Bristol, 11 Aug 1961, Seymour 19469 (MO, SMU). Newport Co.: E of Dickens Point, Block Island, 15 Sep 1913, Fernald et al. 9905 (GH).

SOUTH CAROLINA. Abbeville Co.: near Norris Creek, 1 mi ESE of Abbeville, 29 Jun 1957, Radford 25909 (NCU). Aiken Co.: Little Horse Creek on US 1-76, ESE of North Augusta, 27 Oct 1961, Ahles and Crutchfield 55398 (NCU). Anderson Co.: 7.7 mi NW of Anderson near S.C. 80, 17 Jul 1956, Radford 13968 (GA, NCU). Bamberg Co.: along US 301, 7.3 mi SW of jct. US 301 with US 601, 20 Aug 1978, Webb and Webb 53807 (TENN). Barnwell Co.: 1.2 mi W of jct. of Co. 216 and US 78 on Co. 217 near Rosemary Creek, SW of Williston, 28 Oct 1961, Ahles and Crutchfield 55793 (NCU). Beaufort Co.: Bluffton, 1873, Mellichamp s.n. (NY). Calhoun Co.: 2 mi N of Orangeburg-Calhoun Co. line on S.C. 267, S of Lone Star, 3 Jul 1957, Ahles and Haesloop 30181 (NCU). Charleston Co.: 3 mi N of McClellanville, 19 Jul 1939, Godfrey and Tyron 695 (GH). Cherokee Co.: Bowens River, 1 mi N of jct. of Co. 83 and S.C. 18 on Co. 83, 11 Jul 1957, Ahles and Haesloop 30966 (NCU). Chesterfield Co.: Pee Dee River, 4 mi SE of Cheraw, 11 Aug 1956, Radford 15703 (NCU). Clarendon Co.: 4 mi S of St. Paul, 11 Jun 1957, Radford 24350 (NCU). Colleton Co.: swamp along Ashepoo River, ca. 1 mi S of Ritter on Co. 41, 26 Jun 1956, Ahles and Bell 15496 (NCU). Darlington Co.: around Prestwood Lake, 3 Aug 1940, Smith 92 (NCU). Dillon Co.:

Sweat Swamp Creek, 4.4 mi NNW of Little Rock on S.C. 57, 12 Jun 1957, Ahles and Haesloop 27740 (SMU). Dorchester Co.: 1.5 mi ESE of Bamberg-Dorchester Co. line on Co. 11, 20 Jul 1957, Ahles and Leisner 31829 (NCU). Edgefield Co.: near S.C. 23, 3.2 mi E of Edgefield, 1 Jul 1957, Radford 26563 (NCU). Fairfield Co.: 0.8 mi NW of Monticello, 26 Jun 1957, Bell 9462 (NCU). Florence Co.: 1.6 mi NE of Cartersville along Hwy. 76, 24 Aug 1976, Webb et al. 52455 (TENN). Hampton Co.: 1.8 mi NE of Early Branch, 29 Jun 1956, Ahles and Bell 15742 (NCU). Horry Co.: Lynch Creek along N.C. 86, 27 Sep 1957, Duke 0316 (NCU). Jasper Co.: 1.5 mi NNE of jct. S.C. 170 and Co. 18 on S.C. 170, 28 Jun 1956, Ahles and Bell 15658 (NCU). Kershaw Co.: Adam's Mill Pond, 5.5 mi NE of Camden, 28 Jul 1957, Radford 27658 (NCU). Lancaster Co.: Turkey Quarter Creek, just S of Lancaster, 13 Jul 1957, Haesloop and Ahles 31231 (NCU). Laurens Co.: banks of Country Club Lake, SE of Laurens, 4 Oct 1957, Bell 10111 (NCU). Lee Co.: pond on McGirts Creek near US 15 at Mechanicsville, 26 Jul 1957, Radford 27314 (NCU). Lexington Co.: Fourteen Mile Creek, 5.5 mi NE of Lexington, 9 Jul 1957, Radford 27214 (NCU). Marion Co.: along Co. 49, ca. 15 mi S of Britton Neck, 20 Oct 1957, Bell 11029 (ILL, NCU). Marlboro Co.: Pee Dee River near US 15, 9.5 mi SW of Bennettsville, 10 Aug 1956, Radford 15515 (NCU). McCormick Co.: near Savannah River, S of Clark Hill Dam, 13 Oct 1957, Radford 30698 (NCU). Newberry Co.: S of Hwy. at Lake Greenwood Dam bridge, SW of Chappells, 25 Jun 1957, Bell 9199 (NCU). Oconee Co.: Lake Chee-o-hee, N of Tomasee, 2 Sep 1956, Radford 17777 (NCU). Orangeburg Co.: 0.5 mi W of jct. Co. 50 and 45 on Co. 50, 26 Sep 1957, Ahles 35154 (NCU). Pickens Co.: Rocky

Bottom Creek, N of Rocky Bottom, 22 Aug 1956, Radford 16522 (NCU). Saluda Co.: Little Mountain Creek, 6 mi SW of Mayson, 8 Jul 1957, Radford 26922 (NCU). Sumter Co.: near S.C. 53 and Lynches River, 15 mi E of Mayesville, 27 Jul 1957, Radford 27560 (NCU). Williamsburg Co.: 3 mi NW of Kingstree, 26 Jul 1939, Godfrey and Tryon 898 (GH, MICH, MO, NY, TENN, US).

TENNESSEE. Benton Co.: roadside, Camden, 28 Aug 1922, Svenson 486 (GH). Bledsoe Co.: marshy area at Sampson, on Tenn. 30, between Mt. Crest and the Van Buren Co. line, 18 Sep 1957, Rock 959 (NCU, SMU). Blount Co.: Chilhowee Mountain, edge of Flat Creek between Wolfpen Gap and Emerine Gap, 16 Sep 1965, Thomas and Sharp s.n. (TENN). Bradley Co.: 3 mi NE of Cleveland, 11 Jul 1952, Sharp 16762 (TENN). Campbell Co.: moist soil, Cedar Creek, 11 Jul 1934, Sharp et al. 2230 (TENN). Carroll Co.: 10 mi W of Huntingdon along sandy bank, 29 Aug 1930, Svenson 4365 (GH). Carter Co.: woods in Sinking Creek, 14 Aug 1955, Pearman s.n. (TENN). Chester Co.: bottoms of South Fork of Forked Deer River, E of Henderson, 9 Jul 1948, Sharp et al. 9419 (TENN). Claiborne Co.: swampy seep, Little Creek Valley, 30 Sep 1962, Sharp et al. 30889 (TENN). Cocke Co.: along Wolf Creek, 12 Oct 1963, Sharp and Sharp 32486 (TENN). Coffee Co.: along Springs Creek, W of Hillsboro, 15 Jul 1948, Fairchild et al. 9911 (TENN). Cumberland Co.: around Finger Lake, NE of Crossville, 15 Aug 1951, Norris and Sharp 16180 (NCU). Decatur Co.: Beech River bottoms S of Beacon, 13 Oct 1949, Cooley et al. 14904 (TENN). Dickson Co.: Woodhaven Lake, Montgomery Bell State Park, 12 Oct 1949, Cooley et al. 14866 (TENN). Dyer Co.: Middle Fork of

Forked Deer River at Dyersburg, 17 Aug 1947, Sharp et al. 6392 (NCU, TENN). Fentress Co.: 0.8 mi W of Fentress-Morgan Co. line along Rd. 4242, 24 Jul 1976, Webb et al. 52095 (TENN). Franklin Co.: below pond at baseball field, St. Andrews campus, 5 Aug 1962, Chambers 33 (NCU). Giles Co.: W of Bodenham, 6 Jul 1947, Sharp et al. 28 (NCU, TENN). Grainger Co.: Buffalo Springs Fish and Game Preserve, 13 Jul 1936, Morrison and Brown 192 (NCU, TENN). Grundy Co.: Beersheba Springs, 13 Aug 1938, Svenson 8915 (GH). Hamilton Co.: Walden's Ridge above Soddy, 14 Jul 1934, Underwood and Sharp 2350 (NCU, TENN). Hardeman Co.: Tenn. 105, NE of Bolivar, 9 Jul 1947, Sharp et al. 47-273 (TENN). Hardin Co.: E of Gillises Mill, along roadside, 11 Jul 1948, Sharp et al. 9689 (TENN). Hawkins Co.: near Holston River, 24 Aug 1955, Wolfe 476 (GA, TENN). Haywood Co.: 0.5 mi E of Dancyville, off road to Eurekaton meadow, 4 Jul 1965, Rogers 34602 (TENN). Henry Co.: Kentucky Lake margin, Sorrell's Camp, Springville, 12 Jun 1976, Webb and Webb 52051 (TENN). Hickman Co.: Beaverdam Creek, S of Centerville on Tenn. 100, 20 Sep 1968, Kral 33445 (SMU). Johnson Co.: cranberry bog on E. E. Stout farm, Valley of Doe Creek, 5 mi SW of Mountain City, 2 Sep 1949, Shanks et al. 8716 (NCU). Knox Co.: Knoxville, Jul 1898, Ruth 385 (NY). Lincoln Co.: SW of Skinem, near Washburn Branch, 5 Jul 1947, Sharp et al. 4946 (TENN). Madison Co.: U.T. Experiment Sta., Jackson, 25 Aug 1947, Underwood et al. 6951 (TENN). Marion Co.: top of Walden Ridge, by Tenn. 27, 18 Sep 1946, Ford and Russell 2242 (TENN). Monroe Co.: Tellico River Gorge, 18 Sep 1946, Laing et al. 18811 (TENN). Montgomery Co.: barrens W of Oakwood, 1.5 mi from Co. line, 9 Oct 1949, Woods et al. 14461 (TENN). Morgan Co.:

roadside swamp near Coalfield, 29 Sep 1961, Sharp and Pringle s.n. (MO, TENN). Obion Co.: brook near Walnut Log, 8 Aug 1941, Eyles and Eyles 44 (GH). Polk Co.: a few mi E of Ocoee by US 64, 18 Sep 1946, Ford and Russell 2325 (TENN). Putnam Co.: Monterey Lake, where crossed by I-40, ca. 1 mi SE of Monterey, 24 Sep 1976, Webb et al. 52548 (TENN). Roane Co.: head of White Oak Lake, 14 Sep 1950, Neese 928 (US). Rutherford Co.: cedar glades, 23 Jul 1955, Beatley and DeSelm s.n. (TENN). Scott Co.: near Winfield, 29 Sep 1961, Sharp and Pringle s.n. (TENN). Sevier Co.: CCC Camp 1212, Elkmont, 11 Jul 1935, Jennison 472 (TENN). Shelby Co.: E of Germantown, 20 Aug 1947, Sharp et al. 6613 (TENN). Sullivan Co.: Bay's Mountain, Summer 1954, Roller 128 (TENN). Unicoi Co.: 2 mi W of North Carolina line on Tenn. 107, Norris and Frodin 33056 (TENN). Union Co.: Mill-Sharp Lane, Lost Creek, 2 Aug 1933, Underwood 265 (TENN). Van Buren Co.: near Falls Creek State Park, 19 Sep 1946, Ford and Russell s.n. (SMU). Washington Co.: Johnson City, 31 Aug 1928, J.M.R. s.n. (GA). Wayne Co.: Natchez Trace Parkway, 9 Jul 1946, McDougall 1008 (US). Weakley Co.: Public Well Church, S of Ralston, 12 Aug 1947, Sharp et al. 6028 (TENN). White Co.: SW of Clifty, 29 Jul 1947, Shanks et al. 2903 (TENN).

TEXAS. Anderson Co.: 9.6 mi N of Montalba, 7 Oct 1956, Shinners 25152 (SMU). Angelina Co.: 2 mi SW of Erin, 7 Jun 1963, Correll and Wasshausen 27539 (GH). Austin Co.: Belleville, 4 May 1940, Tharp 187 (MO, SMU). Bowie Co.: below spillway of Waterworks Lake, just NE of Wamba, 13 Jul 1965, Correll 31293 (GH). Burleson Co.: Cade Lake, 5 mi from Caldwell on FM 908, 11 Aug 1964, Massey and Treadwell 703 (SMU). Burnet Co.: Granite Mountain, Marble

Falls, 4 Jun 1945, Cory 49546 (GH, SMU). Cass Co.: E of Hughes Springs on Hwy. 11, 4.5 mi from Hwy. jct., 25 Sep 1948, Whitehouse 20236 (SMU). Cherokee Co.: Jacksonville, 4 Jun 1915, Palmer 7863 (MO, NY). Dallas Co.: Buzzard Spring, Jul 1876, Reverehon s.n. (MO). Freestone Co.: 5.5 mi S of Dew, off Hwy. 75, 6 Jun 1944, Lundell and Lundell 12927 (NY). Gonzales Co.: Palmetto State Park near Ottine, 22 Jun 1950, Webster and Wilbur 2973 (GA, GH, MICH, NY, SMU). Gregg Co.: 24 Jul 1939, York s.n. (GH). Hardin Co.: 7.5 mi W of Silsbee, Village Creek, 6 Oct 1934, Cory 11265 (GH). Harrison Co.: 5 mi S of Marshall, 7 Sep 1946, Whitehouse 16505 (SMU). Henderson Co.: 9.5 mi S of Athens, 22 Aug 1954, Shinners 19110 (SMU). Hopkins Co.: 7.8 mi S of Sulphur Springs, 11 Sep 1949, Shinners 11674 (SMU). Houston Co.: 4.75 mi N of Grapeland, 12 May 1937, Cory 21932 (GH). Jasper Co.: between Woodville and Jasper, just E of the Neches River, 24 Oct 1956, Gould 7320 (SMU). Marion Co.: 9.6 mi NW of Jefferson, 30 Jun 1964, Shinners 30256 (SMU). Milam Co.: moor near Grange, 1 Jun 1943, Barkley and Tharp 6022 (GH, MO). Montgomery Co.: 3 mi NW of Conroe, 13 Oct 1953, Shinners 16602 (SMU). Morris Co.: 8 mi S of Daingerfield, 8 Oct 1937, Cory 25730 (GH). Nacogdoches Co.: 10.5 mi SW of Nacogdoches, 1 Oct 1934, Cory 10670 (GH). Newton Co.: 23 Jul 1939, Tharp 187 (NY). Panola Co.: 10 mi S of Carthage on Hwy. 59, 7 Sep 1946, Whitehouse 16556 (SMU). Polk Co.: 8.7 mi N of Corrigan, 14 Oct 1956, Shinners 25337 (SMU). Robertson Co.: near Newbaden, 16 Jun 1943, Barkley 13036 (MO, NY). Rusk Co.: 5.5 mi SW of Henderson, 17 Sep 1953, Shinners 16159 (SMU). Sabine Co.: ca. 5 mi S of Patroon on Hwy. 87, Sabine National Forest, 7 Sep 1946, Whitehouse

16603 a (SMU). San Augustine Co.: 4.7 mi S of San Augustine, 9 Apr 1954, Shinners 18445 (SMU). Shelby Co.: Boles Field, Sabine National Forest, E of Shelbyville, 8 Sep 1946, Whitehouse 16678 (SMU). Smith Co.: Camp Fannin, 8 mi NE of Tyler, 21 Oct 1943, Moore 573 (GH). Titus Co.: 3 mi N of Mt. Pleasant, 16 Sep 1953, Shinners 16098 (SMU). Trinity Co.: Trinity, 10 Jun 1920, Tharp 832 (ILL). Upshur Co.: 3.4 mi S of Ore City, 18 Sep 1953, Shinners 16251 (SMU). Van Zandt Co.: 1.3 mi SE of Ben Wheeler, 4 Jul 1951, Van Vleet 1613 (SMU). Walker Co.: vic. of Huntsville, 9-12 Jul 1909, Dixon 359 (GH). Wood Co.: 8 mi SW of Winnsboro, 8 Aug 1950, Cory 57652 (SMU).

VERMONT. Bennington Co.: Manchester, 23 Jul 1898, Day 386 (GH). Caledonia Co.: Kirby Mt., Kirby, 9 Jul 1963, Seymour 21489 (MO). Franklin Co.: near bridge over Lamoille River, 20 Sep 1964, Seymour and Charette 22402 (MO). Rutland Co.: Colton Pond in Gilford Woods State Park, 5.5 mi S of Pittsfield along Hwy. 100, 13 Aug 1977, Webb and Webb 53759 (TENN). Windham Co.: Jamaica, 1 Sep 1935, Moldenke 8835a (ILL, MO, NY).

VIRGINIA. Accomack Co.: S end of Assateague Island, 7 Sep 1966, Harvill 15068 (NCU). Augusta Co.: roadside, leading N from Maple Flat Ponds, Twin Ponds on left, Big Levels Game Management Area, 19 Aug 1971, Freer 17248 (NCU). Bath Co.: along Hwy. 629, ca. 12.2 mi S of Williamsville, 1.5 mi S of jct. 678 and Hwy. 629, 9 Aug 1977, Webb and Webb 5338 (TENN). Bedford Co.: between peaks of Otter, now covered by lake, 5 Aug 1964, Freer 2752 (GH). Botetourt Co.: along James River at Gala Station, 2 Aug 1940, Massey 3947 (GH). Campbell Co.: along RR tracks on James River at

Tyree, 8 Jul 1966, Ramsey et al. 4552 (NCU). Caroline Co.: E of Penola, 6 Sep 1937, Fernald and Long 7534 (GH, MO, NY, US). Charles City Co.: During Point along the James River, ca. 2.5 mi SE of jct. of Co. 617 and Co. 613, on an extension of 617, 14 Oct 1969, Ware 2676 (NCU). Charlotte Co.: near bridge over Staunton River on Co. 746, 1 Aug 1967, Ramsey et al. 9162 (NCU). Chesterfield Co.: Group Camp 3 in Pocahontas State Park, 30 Jul 1970, Grenoble 53 (NCU). Culpepper Co.: N of Rixeyville, jct. of Co. 624 with Va. 229, 12 Sep 1965, Ahles and James 61785 (NCU). Fairfax Co.: Kirby Rd. and Primmit Run, 9 Sep 1974, Kelley and Bradley 6852 (NCU). Fauquier Co.: along RR ditch W of Beverly Mill, western slope of Bull Run Mountains, 18 Aug 1940, Allard 7964 (MO, US). Giles Co.: Moonshine Dell, 0.5 mi SE of Mt. Lake Biological Station, Salt Pond Mt., 19 Aug 1943, Iltis 2222 (SMU, TENN). Grayson Co.: 3.8 mi SW of Elk Creek on US 58-221, E of Independence, 28 Aug 1965, Ahles and Tucker 60318 (NCU). Greensville Co.: Fontaine Creek, SW of Haley's Bridge, 19 Aug 1936, Fernald et al. 6642 (GH). Halifax Co.: Staunton River on US 501, N of North Halifax, 29 Aug 1965, Ahles and James 60684 (NCU). Isle of Wright Co.: 2 mi SE of Zuni, 16 Oct 1940, Fosberg 18056 (NCU). James City Co.: Chisels Run, ca. 3 mi W of Williamsburg, 16 Jun 1921, Grimes 3759 (NY). King and Queen Co.: fresh tidal marsh of Mattaponi River, Walkerton, 1 Sep 1940, Fernald and Long 12741 (MO, NY, US). King William Co.: fresh tidal marsh of Mattaponi River at Horse Landing near King William Courthouse, 14 and 16 Oct 1939, Fernald and Long 11590 (GH, MO, US). Lancaster Co.: Kate's Creek, vic. of Lively, 20 Sep 1953, Allard 21786 (US). Loudoun Co.: Purcellville, 5 Sep 1960, Hambleton 207 (ILL, US).

Lunenburg Co.: Meherrin River at Whittles Mill on Co. 636, SE of Red Level, 19 Sep 1965, Ahles and James 62061 (NCU). Madison Co.: trail between Big Meadows Swamp and Sky Line Drive, Shenandoah National Park, 20 Aug 1945, Chase 8194 (ILL). Mathews Co.: Soles, 1 Sep 1925, Wherry and Pennell 12792 (MO, NY). Mecklenburg Co.: Roanoke River Valley behind John H. Kerr Dam, 8 Jul 1966, Seaman 3643 (NCU). Montgomery Co.: along N and W RR tracks, Merrimac Mines, 24 Aug 1973, Uttal 10239 (SMU). New Kent Co.: along Chickahominy River, 1 mi SW of Providence Forge, 23 Aug 1966, Seymour and Svenson 24781 (MO, SMU). Norfolk Co.: vic. of Norfolk, Virginia Beach, 4 Jul 1892, Britton et al. s.n. (NY). Northampton Co.: region about Cape Charles, 27 Aug 1923, Tidestrom 11607 (GH). Page Co.: region between Luray and the base of Stony Man Mountain, 31 Aug 1913, Tidestrom 6711 (MICH). Patrick Co.: vic. of Cedarmont near Stuart, 22 Aug 1965, Ahles and Clark 60062 (NCU). Pittsylvania Co.: ENE of Ringgold, Sandy Creek on Co. 730, 2 Oct 1965, Ahles and James (NCU). Prince Edward Co.: 1.9 mi N of jct. Co. 634 and US 15 on US 15, S of Worsham, 16 Oct 1965, Ahles and James 62697 (NCU). Prince George Co.: ca. 1.1 mi S of jct. Hwy. 156 and Hwy. 46, 1 Aug 1976, Webb and Webb 52102 (TENN). Prince William Co.: Broad Run flood plain, 1.5 mi below Beverly Mill, eastern slope of Bull Run Mountains, Thoroughfare Gap, 8 Sep 1940, Allard 8145 (US). Princess Anne Co.: Little Neck, 6 Sep 1935, Fernald and Long 4945 (GH). Rappahannock Co.: near Applesauce House, Shenandoah National Park, 20 Jul 1930, Walker 1119 (US). Scott Co.: Springhead, Glades Wildlife Management Area, Edith Gap Rd., off Rt. 706, Uttal 10269 (SMU). Smyth Co.: Hogtrough Creek, base of Iron Mountains, 8 Aug 1892, Small s.n. (MO, US). Southampton Co.: Johnson's Millpond, 1.5 mi N of

Sedley, 15 Sep 1946, Fernald et al. 15305 (GH, NY, US). Spotsylvania Co.: Rappahannock River, under bridge of Hwy. 1, Fredericksburg, 5 Aug 1976, Webb and Webb 52133 (TENN). Stafford Co.: below Falmouth Bridge, Fredericksburg, 20 Oct 1941, Iltis 1060 (SMU). Surry Co.: S edge of Hog Island Refuge, 5 Aug 1960, Kral 11030 (NCU). Sussex Co.: along Hwy. 460, ca. 2.3 mi NW of jct. 460 and Hwy. 40, NW of Waverly, 1 Aug 1976, Webb and Webb 52106 (TENN). Warwick Co.: N of Lee Hall, 22 Jul 1938, Fernald and Long 8771 (GH). Westmoreland Co.: near Potomac Mills, 38° 10'N, 76°56'W, 16 Sep 1951, Smith 5633 (US). York Co.: W of Williamsburg, 13 Jul 1921, Grimes 4005 (GH).

WEST VIRGINIA. Cabell Co.: Rickett's Place near Huntington, 21 Sep 1940, Gilbert 912 (GA, ILL, MO, NY, TENN). Grant Co.: source of N branch of Potomac River, NE-facing slope near Fairfax Stone, 10 Aug 1967, Downs 2123 (NCU). Greenbrier Co.: White Sulphur Springs, 19 Aug 1890, Britton s.n. (NY). Hardy Co.: along Hwy. 55, 8.5 mi SW of Wardensville from jct. of Hwy. 259 with Hwy. 55, 9 Aug 1977, Webb and Webb 53339 (TENN). Mason Co.: margin of McCullough Pond, 11 Oct 1941, Gilbert 1005 (GH). McDowell Co.: along Dry Fork above Perryville, 4 Aug 1900, Morris 1144 (US). Mineral Co.: Sulphur, Oct 1953, Brown s.n. (NCU). Monongalia Co.: along Monogahela RR tracks, 0.5 mi W of Core, 16 Aug 1945, Core et al. 524 (GH, MO, NY, NCU, TENN, US). Monroe Co.: 3.4 mi SW of Virginia-West Virginia state line, along Co. 316, ca. 9 mi SW of Paint Bank, 8 Aug 1977, Webb and Webb 53337 (TENN). Pocahontas Co.: valley of the East Fork of Greenbrier River, 19 Sep 1904, Greenman 418 (GH). Preston Co.: Aurora, 13 Aug 1898, Steele and Steele

s.n. (NY, US). Putnam Co.: Buffalo, 10 Aug 1891, Millspaugh 1089 (NY). Randolph Co.: Upper Trout Run, 2+ mi S of Helvetia, 9 Sep 1972, Rossbach 8750 (GA). Tucker Co.: along Blackwater River toward falls, 0.5 mi below Davis, Canaan Valley, 31 Jul 1950, Allard 19702 (US). Upshur Co.: near Our Mills, 5 Aug 1953, Grose s.n. (GA, MO, NCU, NY, SMU, TENN, US). Webster Co.: Camp Caesar near Cowen, 18 Jul 1936, Williams 491 (GH, MO, SMU, TENN). Wetzel Co.: RR grade, 1 mi E of Littleton, 28 Jul 1931, Haught 675 (NY). Wirt Co.: Palestine Bass Hatchery, across Little Kanawha River from Owensport, 1 Aug 1965, Wilson and Bartholomew W-6019 (GA, GH, SMU, TENN).

WISCONSIN. Jackson Co.: Black River Falls, 1861, Hale s.n. (GH, MO, NY). La Crosse Co.: Farmington Twp., T18N, R5W, Sec. 9, 5 Sep 1958, Hartley and Thorne 6173 (GH).

CANADA. NEW BRUNSWICK. Charlotte Co.: bogs of Gibson, Snowshoe, and Welsh Lake vic., 8 mi NW of St. Andrews, 24 Jul 1929, Malte 552/29 (GH). Sunbury Co.: 10 mi W of N.F.P. camp, Acadian F.E. Station, Fredericton, 25 Aug 1939, McKenney, 5, 6-79 (NY).

NOVA SCOTIA. Digby Co.: Weymouth, 8 Aug 1921, Fernald and Long 24143 (GH). Halifax Co.: wet border, Prince and Atwood 1118 (MICH). Lunenburg Co.: outlet of Hebb's Lake, Bridgewater, 16 Aug 1921, Fernald and Long 24141 (GH). Pictou Co.: near Pictou, 12-18 Jul 1901, Howe and Lang 491 (NY). Cape Breton Island, 15 Aug 1898, Macoun 19020 (GH).

ONTARIO. Bruce Co.: Garden Island, Stokes Bay, 23 Jul 1934, Krotkov 9218 (NY). Essex Co.: 0.5 mi S of Thames River Lighthouse,

Tilbury N Twp., 26 Jul 1948, Soper and Dale 4076 (GH, US). Russell Co.: Casselman, 20 Aug 1884, Macoun 348 (GH).

QUEBEC. Arthabaska Co.: 6.2 mi NE of Catholic Church in Notre Dame Du-Bon-Conseil along Hwy. 22, 16 Aug 1977, Webb and Webb 53783 (TENN). Quebec Co.: Ancienne Lorette: Ruisseau a l'eau Claire, 17 Aug 1928, Marie-Victorin 28371 (GH). Stanstead Co.: Hatley, 2 Aug 1919, collector unknown, 9384 (GH). Wolfe Co.: along Hwy. 216, 1.2 mi S of St. Julian, 16 Aug 1977, Webb and Webb 53781 (TENN).

6. Hypericum gymnanthum Engelm. and Gray. Bost. Journ. Nat. Hist. 5: 212. 1847. TYPE: UNITED STATES: TEXAS: 1843, Lindheimer, Flora Texana exsiccata 17. (LECTOTYPE: GH!, ISOLECTOTYPES: MO!, FI).

Hypericum mutilum L. var. gymnanthum (Engelm. and Gray) Gray. Manual, ed. 5: 86. 1867.

Hypericum canadense L. var. cardiophyllum Rob. Keller. Bull. Herb. Boiss. ser. 2, 8: 189. 1908. TYPE: UNITED STATES: ILLINOIS: Menard Co.: Athens, 1861, Hall s.n. (LECTOTYPE: G!, ISOLECTOTYPE: GH!, P).

Sarothra gymnantha (Engelm. and Gray) Y. Kimura in Nakai and Hondo. Nov. Fl. Jap. no. 10: 232. 1951.

Plant annual, with strict, almost simple stems (1.0) 1.5-7.0 (9.0) dm tall, rarely with 1 to 3 pair of axillary branches from the upper portion of the stem. Leaves firm, sessile, deltoid-ovate, 5 to 7 nerved, 1.0-2.5 cm long, 0.6-1.2 cm wide, clasping with broadly rounded to subcordate bases and acute (rarely rounded)

apices. Inflorescence a compound dichasium, open, with elongated internodes, elevated above the uppermost cauline leaves on an elongated peduncle. Bracts subulate, 1.0-3.5 mm long. Sepals lanceolate to narrowly ovate, acute to acuminate, (3.0) 3.5-4.8 mm long, 0.8-1.2 mm wide. Petals yellow, nearly symmetrical, narrowly elliptic, 3.0-3.5 mm long, 0.9-1.2 mm wide. Stamens 10-14. Mature capsule brown to maroon, ellipsoid-conic, (3.0) 3.5-5.0 mm long, slightly exceeding the sepals. Styles 0.5-0.7 mm long. Seeds yellow, 0.5-0.6 mm long, pitted and obscurely striate.

Chromosome number: $\underline{n} = 8$.

Flowering period: June to September.

Distribution and habitat: Wet ditches, bogs, savannahs, and cutover woods from Pennsylvania south to Florida and west to Texas and widely scattered northward to Missouri, Illinois, Indiana, and Ohio (Figure IX-7).

Discussion: Of the eastern North American taxa belonging to sect. Spachium, H. gymnanthum seems to be most closely related to H. mutilum and is often found in sympatric populations with the latter species. Individuals having intermediate characters are not infrequently observed and presumably represent hybrids and/or the products of introgression. The strict stem, the deltoid-ovate leaves with cordate clasping bases, and the erect compound dichasium of H. gymnanthum distinguishes this species from H. mutilum, which generally has spreading floriferous branches from the upper and medial portion of the stem and leaves of varying shape with rounded to attenuate bases.

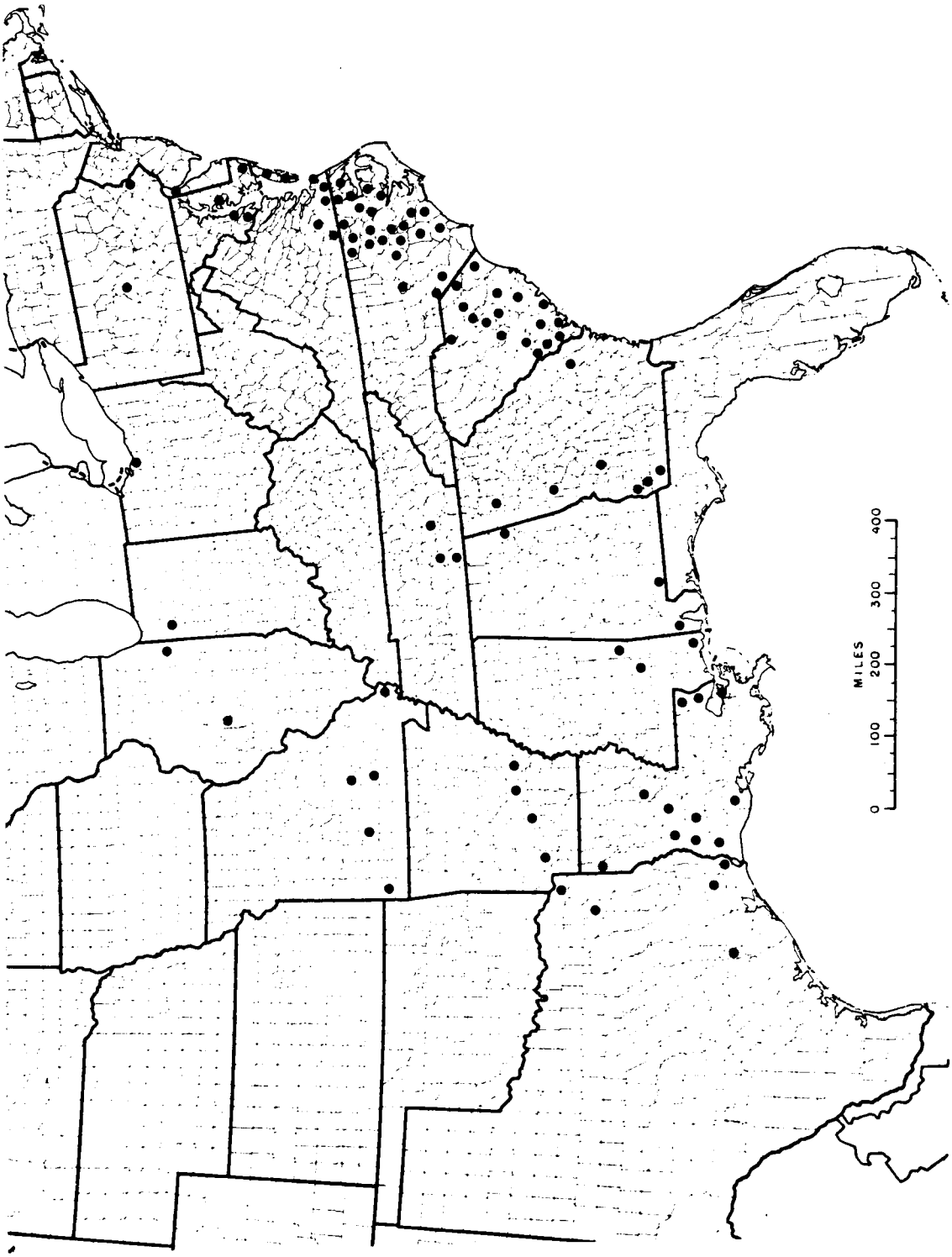


Figure IX-7. Distribution of Hypericum gymnanthum.

According to Robson (1972b) H. gymnanthum is most closely related to H. japonicum Thunb. ex Murr. This latter species inhabits Japan, Southeast Asia, Australia, and New Zealand. Robson (1972b) has suggested that the trans-Pacific link between H. japonicum and H. gymnanthum is perhaps the result of long-distance dispersal.

Representative specimens: UNITED STATES. ALABAMA. Mobile Co.: Mobile, Aug 1890, Mohr s.n. (US). Cherokee Co.: along Hwy. 68, 2 mi W of jct. of Main Street and Hwy. 411 (S side of Hwy. 68) just outside of Centre city limits, 13 Jul 1977, Webb 53264 (TENN). Escambia Co.: 0.4 mi S of jct. US 29 and Co. 9 along Co. 9, ca. 10 mi E of Brewton, 16 Jul 1977, Webb and Ross 53280 (TENN).

ARKANSAS. Arkansas Co.: in yard, Stuttgart, 28 Jun 1907, Chamberlain 349 (ILL). Dallas Co.: P.O. Fordyce, 5 Jun 1965, Demaree 52552 (SMU). Hempstead Co.: Hope, 6 Jun 1974, Seigler et al. DS-8207 (ILL). Jefferson Co.: N of Pine Bluff, 8 Jun 1898, Eggert s.n. (MO, NY).

DELAWARE. New Castle Co.: Townsend, Jul 1863, Canby s.n. (MO, NY).

GEORGIA. Bartow Co.: near Big Pelfrey Pond, about 4.5 mi SE of Adairsville on Cassville Mountain, 14 Jul 1963, Greear 63210 (GA). Bullock Co.: pine barrens, 27 Jun 1901, Harper 957 (GH, MO, NY, US). Decatur Co.: between Forest Falls and Bainbridge, 12 Aug 1901, Harper 1200 (MO, NY, US). Early Co.: 4.1 mi W of jct. Hwy. 273 and Hwy. 39 along Hwy. 273, ca. 10 mi NW of Donaldsonville, 16 Jul 1977, Webb and Ross 53285 (TENN). Meriwether Co.: Pleasant Pasture Farms off Warm Springs Airport Road near Durand, 13 Jul 1971, Jones et al. 20898 (GA). Miller Co.: along Rt. 91, 4.5 mi

W of jct. of Hwy. 91 and Hwy. 45, 28 Aug 1976, Webb et al. 52533 (TENN). Sumter Co.: Leslie, 17 Aug 1900, Harper 402 (NY, US).

ILLINOIS. Kankakee Co.: near St. Anne, 14 Aug 1943, Jones 16029 (MO). Menard Co.: Athens, 1861, Hall s.n. (GH).

INDIANA. Jasper Co.: Gifford Marsh region, Walker Twp., 17 Aug 1924, Welch 436 (ILL).

LOUISIANA. Allen Par.: 3.2 mi NW of Oakdale, 4 May 1956, Shinners 23049 (SMU). Beauregard Par.: 1.6 mi E of Ragley, 13 Jul 1955, Shinners 20680 (SMU). Calcasieu Par.: vic. of Lake Charles, 1904, Allison s.n. (NY, US). Caddo Par.: 0.25 mi NE of Trees City, 15 Jun 1969, Thieret 31241 (SMU). Orleans Par.: New Orleans, 1832, Drummond 49 (GH). La Salle Par.: 6.3 mi NE of Tullos, 16 Jun 1956, Shinners 23973 (SMU). Rapides Par.: Camp Beauregard, Alexandria, 30 Jun 1918, Leonard 1549 (US). St. Tammy Par.: ca. 4.5 mi NW of Slidell, 12 Jun 1968, Thieret 29198 (SMU). Vermilion Par.: 3.5 mi E of Gueydan along road to Kaplan, 27 May 1967, Thieret 26329 (GA). Vernon Par.: 5 mi E of Pickering, S of Camp Polk boundry, 4 May 1956, Shinners 23005 (SMU). Washington Par.: just N of Washington-St. Tammy Parish line, ca. 4 mi SSW of Enon on road to Blond, 13 Jun 1968, Thieret 29255 (GA, SMU).

MARYLAND. Calvert Co.: Broome Island, District No. 1, 25 Jul 1956, Seymour 16736 (MO, SMU). St. Mary's Co.: Tall Timbers, N of Pine Knot, 7 Oct 1928, Leonard and Leonard 6708 (US). Talbot Co.: 2.25 mi SSW of Unionville, 30 Jul 1942, Earle 3661 (GH). Worchester Co.: Ocean City, 12 Aug 1909, Carter 628 (SMU).

MISSISSIPPI. Clarke Co.: 3.8 mi N of Shubuta along US 45, 15 Jul 1977, Webb and Ross 53273 (TENN). Jackson Co.: Biloxi,

21 Jun 1898, Tracy 4492 (GH, MO, MICH, NY, US). Jones Co.: Sandersville, 13 Jun 1897, Tracy 3331 (NY).

MISSOURI. Dent Co.: Big Scotia Pond, T33N, R4W, Sec. 25, 4 mi E of Turtle, 26 Jun 1936, Steyermark 11154 (MO). Mississippi Co.: 4 mi W of Charlestown, Palmer and Steyermark 41457 (MO, NY). Newton Co.: Burkhart Prairie, 2.5 mi N of Racine, 27 Jul 1956, Palmer 63339 (SMU). Shannon Co.: 16 Jul 1891, Bush s.n. Webster Co.: between Duncan and High Prairie, 28 Jul 1937, Steyermark 23808 (NY).

NORTH CAROLINA. Beaufort Co.: near US 264, 1 mi W of Everett Crossroads, 6 Jul 1958, Radford 36256 (NCU). Bertie Co.: 1 mi N of Lewiston on road to Aulander, 9 Jul 1958, Ahles and Duke 46109 (NCU). Chowan Co.: 0.5 mi N of Rocky Hock, 30 Jul 1958, Ahles and Duke 47919 (NCU). Duplin Co.: 0.3 mi NW of Pin Hook, 2 Aug 1957, Ahles and Leisner 33164 (NCU). Edgecombe Co.: 3.1 mi SW of Mercer, 12 Jul 1958, Radford 36719 (NCU). Gates Co.: 1 mi E of Trotville, then 2.2 mi NW on dirt road, 26 Jun 1958, Ahles and Duke 44581 (NCU). Greene Co.: 3.2 mi NNW of Jason, 13 Sep 1958, Radford 40364 (NCU). Halifax Co.: 1 mi NW of Halifax along US 301, 19 Jun 1956, Ahles and Leisner 14837 (NCU). Hertford Co.: entrance to Camp P-D, Camp Company Forest, E of Como, 23 Jul 1949, Fox and Godfrey 2798 (GH, NY). Johnston Co.: 3 mi SSE of Blackman, 19 Jun 1957, Radford 25363 (NCU). Jones Co.: 2.8 mi W of Hargetts Store, 18 Jul 1958, Radford 37063 (NCU). Lee Co.: 1 mi SW of Moncure, 1 Jul 1958, Beard 1504 (NCU). Lenoir Co.: 1.5 mi N of Pink Hill, 22 Jun 1957, Radford 25767 (NCU). Martin Co.: 4 mi E of Southwick, 16 Jun 1958, Radford 35442 (NCU). Nash Co.: 1.1 mi E of Middlesex

along US 264, 12 Jul 1956, Ahles and Bell s.n. (NCU). Onslow Co.: 1.9 mi N of Verona along US 17, 31 Jul 1977, Webb and Whitten 53324 (TENN). Pasquotank Co.: 1.8 mi NE of Perquimans-Pasquotank Co. line on US 17, then 1.5 mi S, 25 Jun 1958, Ahles and Duke 44307 (NCU). Pender Co.: 3.7 mi W of Hampstead along N.C. 210, 13 Jun 1957, Ahles and Haesloop 28038 (NCU). Pitt Co.: near US 254, 2.7 mi SE of Grimesland, 10 Aug 1958, Radford 39585 (NCU). Robeson Co.: 3.1 mi N of Rowland along N.C. 130, 1 Aug 1957, Ahles and Leisner 32926 (NCU). Scotland Co.: 0.5 mi SW of Co. 1407, towards Co. 1323, 4 Aug 1973, Sharp 1850 (NCU). Warren Co.: 0.7 mi SW of Eaton Ferry, 26 Jul 1956, Bell 4374 (NCU). Washington Co.: near N.C. 32, 3.5 mi ESE of Hoke, 15 Jun 1958, Radford 35150 (NCU). Wayne Co.: 6.4 mi NNW of Seven Springs, 21 Jun 1957, Radford 25576 (NCU). Wilson Co.: near 264, 1 mi NW of Sims, 28 Jul 1958, Radford 37925 (NCU).

OHIO. Erie Co.: Perkins, 8 Sep 1895, Moseley s.n. (GH, MO).

PENNSYLVANIA. Bucks Co.: Bristol, Aug 1865, Diffenbaugh s.n. (GH). Centre Co.: 2 mi NW of State College. 17 Aug 1938, Wahl 113 (GH).

SOUTH CAROLINA. Allendale Co.: 1.2 mi SSW of Barton along Co. 68, 30 Jun 1956, Ahles and Bell 15852 (NCU). Bamberg Co.: 0.9 mi W of jct. Co. 54 and US 321, S of Denmark along Co. 54, 4 Jul 1957, Ahles and Haesloop 30498 (NCU). Beaufort Co.: 3.5 mi NW of old Hilton Head Ferry Landing, 28 Jun 1956, Bell 3810 (NCU). Berkeley Co.: 1.1 mi N of jct. Co. 132 and S.C. 6 on Co. 132 (S of Eady Town), 28 May 1957, Ahles and Haesloop 26648 (NCU). Calhoun Co.: 2 mi N of Orangeburg-Calhoun Co. line along S.C. 267, S of

Lone Star, Ahles and Haesloop 30198A (NCU). Charleston Co.: 1.3 mi S of jct. US 17 and S.C. 174, 25 Aug 1976, Webb et al. 52482 (TENN). Clarendon Co.: 4 mi SSW of St. Paul, Dingle Pond, 11 Jun 1957, Radford 24422 (NCU). Colleton Co.: 1.2 mi SW of jct. Co. 34 and 45 along Co. 34, 25 Jun 1956, Ahles and Bell 15444 (GA, GH, NCU). Darlington Co.: Segars Mill Pond, 23 Jul 1939, Smith 1120 (NCU). Dillon Co.: 0.9 mi N of jct. Co. 23 and S.C. 34, along Co. 23 SSW of Little Rock, 25 Jul 1957, Ahles and Leisner 32242 (NCU). Florence Co.: Florence, 3 Jul 1878, collector unknown s.n. (NCU). Hampton Co.: 1.7 mi SE of Early Branch along S.C. 28, 29 Jun 1956, Ahles and Bell 15718 (NY, NCU). Horry Co.: along Co. 31, 1.3 mi N of jct. with S.C. 90, 19 Oct 1957, Duke 0096 (NCU). Lancaster Co.: ca. 8 mi NE of Kershaw, between the bridges on US 601 and Co. 37, 22 Aug 1961, Williamson 1975 (NCU). Sumter Co.: 7.5 mi SW of Sumter, 4 Jun 1957, Radford 23843 (NCU). Jasper Co.: Bluffton, 1873, Mellichaup s.n. (NY). Lee Co.: along Hwy. 76, 3 mi SW of jct. of Hwy. 76 and Hwy. 341, 24 Aug 1976, Webb et al. 52457 (TENN). Williamsburg Co.: along Hwy. 52, 3.1 mi N of jct. 375 and 52, ca. 4 mi NW of Gourdin, 24 Aug 1976, Webb et al. 52466 (TENN).

TENNESSEE. Bledsoe Co.: W of Mt. Crest, near Van Buren Co. line, 19 Jul 1935, Underwood and Sharp 4038 (TENN). Coffee Co.: ca. 3 mi SSE of Manchester by I-24, 14 Aug 1968, Kral 32234 (SMU). Franklin Co.: ca. 0.5 mi SW of ranger's house near RR track at Eastern Highland Rim Forest Experiment Station, 18 Jul 1976, Webb and Webb 52084 (TENN).

TEXAS. Bowie Co.: near Texarkana, 13 Jun 1898, Eggert s.n. (MO). Hardin Co.: about 7 mi S of Kountze, 20 May 1950, Whitehouse

23256 (SMU). Orange Co.: ca. 1.5 mi E of Vidor, along Rt. 12, 26 Jun 1967, Correll 34244 (GH). Upshur Co.: 8.5 mi N of Ore City at Morris Co. line, 24 Jun 1954, Shinners 18935 (SMU). Waller Co.: Hempstead, 1872, Hall 33 (MO, NY).

VIRGINIA. Accomack Co.: along E side of Hwy. 13, 0.8 mi S of Virginia-Maryland state line, 2 Aug 1976, Webb and Webb 52113 (TENN). Greensville Co.: E of Slagle's Pond, N of Emporia, 20 Sep 1938, Fernald and Long 9376 (GH). Nansemond Co.: near camp of Camp Lumber Co., Great Dismal Swamp, SE of Whitemarsh School, 19 Jul 1939, Fernald and Long 10731 (GH, MO, NY, US). Norfolk Co.: vic. of Norfolk, 29 Jul 1892, Britton et al. s.n. (NY). Northampton Co.: back of dunes, Savage Neck, 15 Oct 1935, Fernald et al. 5366 (GH). Princess Anne Co.: Rifle Range, S of Rudy Inlet, 30 and 31 Jul and 4 Aug 1934, Fernald and Long 4037 (GH, NY).

7. Hypericum canadense L. Sp. Pl. 785. 1753. TYPE: CANADA: Kalm s.n. (HOLOTYPE: LINN 943/26, as IDC microfiche!).

Hypericum hedyotifolium Poir. in Lam. Encyc. Supp. 3: 700. 1813. TYPE: Locality uncertain, probably from the northern portion of America, possibly Nova Scotia. (LECTOTYPE: P, in Tournefort Herbarium, sheet 2187, as IDC microfiche!).

Hypericum canadense L. var minimum Choisy in DC. Prod. 1: 550. 1824. TYPE: North America, without definite locality. (HOLOTYPE: G-DC, as IDC microfiche!).

Brathys canadense (L.) Spach. Ann. Sci. Nat. sér. 2, 5: 367. 1836.

Hypericum canadense L. var. oviforme Rob. Keller. Bull. Herb. Boiss. ser. 2, 8: 189. 1908. TYPE: UNITED STATES: PENNSYLVANIA.

No original material located, possibly destroyed at Berlin; however, based on the description it appears to be referable to H. canadense.

Hypericum canadense L. var. magninsulare Weath. Rhodora 30: 188, fig. 1. 1928. TYPE: CANADA: NEW BRUNSWICK: Charlotte County, along road in pastured clearing and in open swamp, Indian Beach Trail, Grand Manan, 6 Aug 1926, Weatherby and Weatherby 5545. (HOLOTYPE: GH!).

Hypericum canadense L. forma minimum (Choisy in DC.) Rousseau. Nat. Canad. 65: 307. 1938.

Hypericum canadense L. var. galiiforme Fern. Rhodora 49: 154, pl. 1076. 1947. TYPE: UNITED STATES: VIRGINIA: Sussex County, sandy and peaty shore of Airfield Millpond, southwest of Wakefield, 11 and 12 Sep 1945, Fernald and Long 14962. (HOLOTYPE: GH!, ISOTYPES: GA!, MO!, NY!, PH, US!).

Plant annual or perennial, slender, erect, (0.5) 1.0-6.0 (7.5) dm tall, often with ascending branches from axils of the upper leaves. Basal stem leaves obovate to oblanceolate, from shortened internodes. Medial and upper cauline leaves spreading, sessile to subsessile with attenuate bases, linear to linear-oblanceolate, (0.6) 1.0-4.0 cm long, 0.5-4.0 (5.5) mm wide, 1 to 3 nerved, with round apices. Inflorescence a compound dichasium or cymule, typically diffuse, occasionally somewhat compacted. Bracts subulate, up to 3.5 mm long. Sepals linear-lanceolate to lanceolate to narrowly ovate, (2.5) 3.0-4.5 mm long, with acute to acuminate apices. Petals yellow, slightly asymmetrical, elliptic to obovate, 2.5-3.0 mm long, 1.0-1.4 mm wide, tips mostly round (occasionally acute), infrequently with red veins. Stamens 12 to 22. Mature capsule

conic, purple, (3.2) 4.0-6.0 mm long, 1.5-3.0 mm wide, generally exceeding the sepals. Styles 0.5-0.8 mm long. Seed yellow to tan, 0.5-0.7 mm long, obscurely striate and pitted.

Chromosome number: $n = 8$.

Flowering period: June to September.

Distribution and habitat: Wet ditches, bogs, depressions, lake and pond margins from Quebec south to Georgia and north to Minnesota and Ontario, with disjunct populations in southern Mississippi, southern Alabama, and the western portion of the Florida panhandle (Figure IX-8).

Discussion: Hypericum canadense is a wide ranging species with several varieties having been described to account for the variation within the taxon. A study of this variation indicates that several of the previously described varieties are best treated as forms. Plants of the northern United States and adjacent Canada are frequently reduced in size and have an inflorescence with only a few flowers. While these plants were long included under H. canadense L. var. minimum Choisy in DC., Rousseau (1938) reduced this taxon to a form and attributed the reduced habit to the physiological stress of the acidic substrate on which the plants typically grow.

Choisy's description of H. canadense var. minimum, ". . . totâ staturâ minore, floribus pancioribus," is readily applicable to the small individuals of H. canadense most commonly found in the northeastern United States and adjacent Canada. However, Britton (1891) has questioned whether the type of var. minimum is even referable to H. canadense. As noted by Britton (1891), the specimen appears

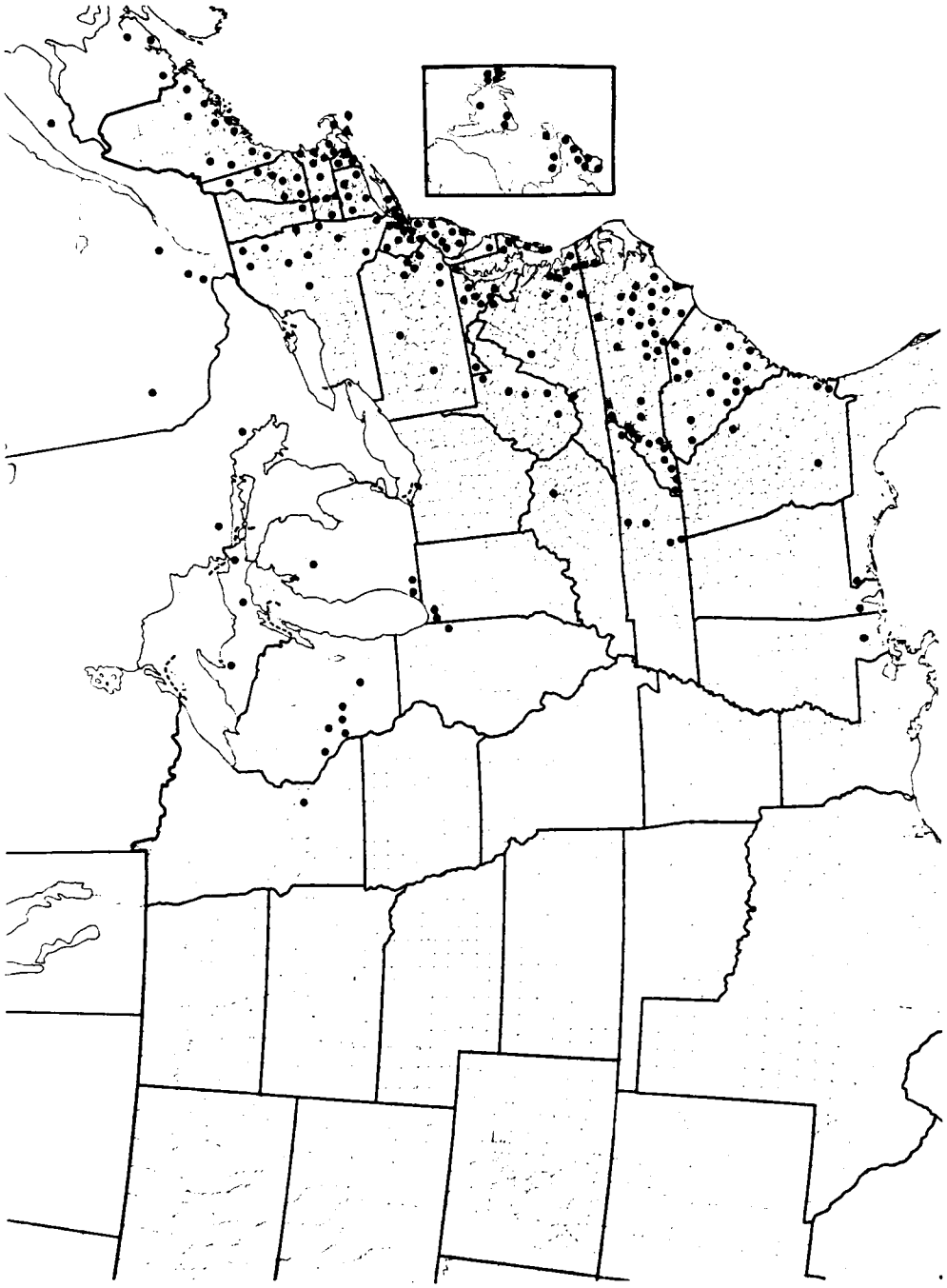


Figure IX-8. Distribution of Hypericum canadense.

to be a fragment and its place of collection is unknown. He further adds that although the type of var. minimum is ". . . not satisfactorily referable to H. canadense. . . ." it ". . . may as well be that as anything else. . . ." A study of the specimen from microfiche has led to no further resolution concerning the identity of the type of H. canadense var. minimum. Thus, based on Choisy's description and the long term application of the name, the specimen in the "Prodromous Herbarium" at Geneva is accepted as the type of H. canadense var. minimum. Whether or not the type is the North American plant to which the name has been applied, can only be resolved by a first hand examination of the specimen.

Hypericum canadense var. magninsulare was described by Weatherby (1928) from Grand Manan Island, New Brunswick. Variety magninsulare has been distinguished from typical H. canadense by its ovate to ovate-lanceolate petals, which have nerves tinged with red. As noted by Weatherby (1928) these characters are almost impossible to detect in herbarium specimens since the petals become contorted in drying and quickly lose their color. Two populations of H. canadense (Cumberland Co., New Jersey, and Onslow Co., North Carolina) from the eastern United States were observed to have reddened nerves in the petals although the petals had rounded apices. Due to the minor differences between var. magninsulare and the typical variety of H. canadense, var. magninsulare is treated as a synonym.

Fernald (1947) described H. canadense var. galiiforme from Sussex County, Virginia, where the variety was reported as growing in Sphagnum of a wooded swamp and in peat around the margin of a

millpond. Variety galiiforme has been distinguished from var. canadense by its shorter leaves, which are obovate to oblanceolate in shape, smaller flowers, a shortened rounded capsule, and a lax inflorescence. According to Fernald (1947) the variety forms definite carpets over its sphagnous and peaty substrate. The morphological differences between H. canadense var. galiiforme and typical H. canadense are thought to result from the diminutive habit induced by the unusual habitat in which var. galiiforme has been collected and is not afforded taxonomic status in the present study.

According to Jiménez (1973a), H. Brathydium Spach ex Steudel is a taxonomic synonym of H. canadense L. Steudel (1840) indicates this name to be based on Brathydium canadense Spach. Since Spach is given credit for B. canadense, Steudel was apparently aware of Spach's publication (1836a), which gives a detailed description of the species as well as the genus Brathydium. The combination of H. canadense (Spach) Steudel would have created a later homonym and thus Steudel was prompted to choose another specific epithet (i.e. Brathydium). Based on the description of genus Brathydium in Spach (1836a, 1836b), B. canadense does not belong to sect. Spachium. Therefore, the name H. Brathydium should be excluded from the synonomy of H. canadense L.

Representative specimens. UNITED STATES. ALABAMA. Mobile Co.: S of Gulf, Mobile, and Ohio RR and E of (parallel to) Gaillard Dr., NW corner of Mobile Municipal Park, 9 Sep 1970, Lelong 5599 (NCU).

CONNECTICUT. Hartford Co.: Southington, 13 Aug 1897, Bissell 45 (NY). Litchfield Co.: Washington, 12 Sep 1919, Evans

s.n. (MO). New Haven Co.: New Haven, 1875, Hawes s.n. (NY). New London Co.: Franklin, 13 Aug 1906, Woodward s.n. (GH). Tolland Co.: along Hop River, Andover, 30 Aug 1957, Seymour 17651 (MO).

DELAWARE. Sussex Co.: Silver Lake, Rehoboth Beach, 22 Jun 1942, McVaugh 6506 (NY).

DISTRICT OF COLUMBIA. Holmead Swamp, 5 Aug 1877, Ward s.n. (US).

FLORIDA. Escambia Co.: along Fla. 95, 10.8 mi N of its jct. with US 29, N of Pensacola, 3 Aug 1970, Godfrey 69646 (NCU).

GEORGIA. Camden Co.: 3 mi E of Folkston, 22 Aug 1962, Blake s.n. (GA). Glynn Co.: along Rt. 17, 1.2 mi N of Satilla River, 25 Aug 1976, Webb et al. 52497 (TENN). McDuffie Co.: near Fall line Sand-hills, Thompson, 16 Aug 1907, Bartlett 1012 (ILL, MICH). Worth Co.: 3.5 mi W of Sylvester, 25 Aug 1947, Thorne 6354a (GA).

ILLINOIS. Kankakee Co.: Kankakee, 25 Jul 1873, collector unknown, 261-1873 (ILL).

INDIANA. Lake Co.: near Tolleston, 31 Aug 1886, Hill 57-1886 (ILL). Porter Co.: Dune Park, 1 Sep 1902, Hill 185-1902 (ILL).

KENTUCKY. Montgomery Co.: 1.25 mi SE of Jeffersonville, 23 Jun 1938, Wharton 2769 (MICH).

MAINE. Cumberland Co.: South Harpswell, 6 Sep 1912, Greenman 3419 (GH, MO). Franklin Co.: 0.4 mi SE of jct. US 2 and Hwy. 27 along 27, just SE of New Sharon, 15 Aug 1977, Webb and Webb 53769 (TENN). Hancock Co.: vic. of Stonington, 2 Aug 1946, Maxon 11218 (US). Knox Co.: Eastern Head, Isle au Haut, 20 Aug 1951,

Rossbach 2211 (NCU). Lincoln Co.: Ice Pond, Monhegan Island, 22 Aug 1921, Churchill s.n. (MO). Oxford Co.: Bethal, 3 Aug 1863, Kennedy s.n. (GH). Penobscot Co.: Orono, 18 Aug 1908, Fernald 239 Plantae Exsiccate Grayanae (GH, MICH, MO, NY, TENN, US). Waldo Co.: roadside between Bald Rock Mt. and Ski Shelter, 19 Aug 1952, Friesner 25221 (NY, NCU, SMU). Washington Co.: Rogue Bluffs, 3 Aug 1936, Knowlton s.n. (TENN). York Co.: York Harbor, Aug 1892, Bicknell 5786 (NY).

MARYLAND. Baltimore Co.: Paudvia, Baltimore, 17 Sep 1908, Churchill s.n. (GH). Carroll Co.: Greenmount, 5 Sep 1902, Norton s.n. (MO). Cecil Co.: 1 mi S of Bayview, 2 Aug 1935, Wilkens 4080 (NCU). Garrett Co.: 1 Aug 1924, Dickey 44 (GH). Howard Co.: Savage Station, 4 Sep 1905, House 1516 (MO, US). Montgomery Co.: Chevy Chase, 5 Sep 1904, Chase 2618 (ILL). Prince Georges Co.: College Park, 30 Jul 1900, Stewart s.n. (MO). Worchester Co.: along US 113, 2.4 mi S of jct. Hwy. 113 and Hwy. 394, 2 Aug 1976, Webb and Webb 52114 (TENN). Wicomico Co.: Vienna, 23 Aug 1906, Shreve and Jones 1327 (US).

MASSACHUSETTS. Barnstable Co.: S of Sparrow Young's Pond, Chatham, 20 Aug 1918, Fernald and Long 17104 (GH, US). Berkshire Co.: Mt. Washington, 8 Aug 1889, Whitfield s.n. (NY). Bristol Co.: Dighton, 15 Jul 1957, Seymour 17199 (MO). Dukes Co.: Parsonage Pond, West Tisbury, 4 Sep 1916, Seymour 1274 (GH, NY). Essex Co.: Ipswich, 25 Aug 1898, Nash s.n. (NY). Franklin Co.: Deerfield, 10 Aug 1908, Day 3 (GH). Hampden Co.: Hamilton Reservoir, Holland, 24 Aug 1929, Bliss and Seymour 724 (MO, SMU). Hampshire Co.: Worthington, 13 Aug 1912, Robinson 671 (GH). Middlesex Co.:

Winchester, 13 Jul 1881, Morong s.n. (NY). Nantucket Co.: Meacomet Pond, 8 Sep 1904, Bicknell 5790 (NY). Norfolk Co.: near outlet of Hoosie Pond, Canton, 14 Jul 1899, Kennedy 1 (GH). Plymouth Co.: Marion, Jul 1888, Vail s.n. (NY). Suffolk Co.: Muddy Pond Woods, Boston, 30 Sep 1886, collector unknown, s.n. (GH). Worchester Co.: Hodes Supermarket, ca. 2 mi W of Spencer on Mass. 9, 18 Oct 1966, Ahles 65088 (NCU, SMU).

MICHIGAN. Baraga Co.: Little Lake, NE 1/4 Sec. 16, T49N, R34W, ca. 9 mi SW of L'Anse, 24 Jul 1958, Voss 7672 (MICH). Berrien Co.: Niles, 15 Aug 1867, Ames s.n. (MICH). Cass Co.: Cabel Lake, 4 Aug 1906, Gates 1361 (MICH). Chippewa Co.: W end of Walker Lake, ca. 2 mi SW of Strongs, Sec. 6-7, T45N, R5W, 10 Aug 1954, Voss 2449 (MICH, SMU). Missankee Co.: Houghton Lake Wildlife Research Area, Porter Ranch, ca. 6 km SW of Houghton Lake, 24 Aug 1973, Wentz 962 (MICH). Schoolcraft Co.: Blaney Park, 5 Oct 1943, Mills 43-121 (ILL).

MINNESOTA. Hennepin Co.: vic. of Minneapolis, Jul 1892, Aiton s.n. (TENN).

MISSISSIPPI. Stone Co.: Mississippi State Forest Lands near office at pond, 23 Aug 1953, Diener 1306 (ILL).

NEW HAMPSHIRE. Belknap Co.: 2 mi N of Meridith, 15 Aug 1935, True 1026 (US). Carroll Co.: Jackson, 8 Aug 1890, Churchill s.n. (MO, NY). Cheshire Co.: shore of Ashuelot River, near Shaw's Corner, 1 Aug 1972, Boufford 7571 (MO). Coos Co.: Boroman place, Randolph, 31 Jul 1896, Williams s.n. (GH). Hillsboro Co.: 0.7 mi NE of Hillsboro-Cheshire Co. line on US 202 (S of Peterborough), 15 Aug 1967, Ahles 69011 (NCU, SMU). Merrimack Co.: Hooksett, 6

Jul 1926, Batchelder s.n. (TENN). Sullivan Co.: Langdon, 23 Aug 1963, Seymour 21018[a] (MO).

NEW JERSEY. Atlantic Co.: by Landing Creek, NW along A.C. RR, Egg Harbor City, 29 Sep 1918, Long 19522 (GH). Bergen Co.: Haworth, 21 Sep 1906, MacKenzie 2474 (MO, NY). Burlington Co.: Kinkora, 18 Aug 1910, Taylor 2513 (NY). Camden Co.: Winslow Jct., 3 Sep 1917, Gershoy 459 (GH). Cape May Co.: N of Cape May Court House, 4 Aug 1928, Witte s.n. (NY). Cumberland Co.: Ma Long Pond, 1 mi ESE of Fairton, 29 Sep 1923, Long 29546 (GH, NY). Gloucester Co.: Atco, 6 Aug 1903, Stewart 2989 (NY). Hudson Co.: Berglu Point, 6 Aug 1894, Seal s.n. (NY). Mercer Co.: Highstown, 16 Jul 1844, Willis s.n. (MICH). Middlesex Co.: W of Monmouth Jct., 1 Sep 1916, MacKenzie 7296 (NY). Monmouth Co.: US Geol. Survey Quadrangle-Sandy Hook, Eatontown, 3 Sep 1923, Beals et al. s.n. (GH, NY). Morris Co.: Mt. Tabor, 13 Aug 1905, MacKenzie 1596 (MO, NY). Ocean Co.: along the Metedeconk River, 6 Sep 1926, McDowell 25 (GH). Somerset Co.: Watchung, 21 Aug 1947, Moldenke 19132 (NY). Sussex Co.: Franklin, Jul 1875, Rusby s.n. (MICH). Union Co.: Watching Spring Bog, Plainfield, 26 Aug 1916, Miller 1374 (NY).

NEW YORK. Bronx Co.: probably at or near the New York Botanical Garden, Bronx Park, 1940, Gilly 394 (NY). Clinton Co.: 4.2 mi N of jct. Hwy. 9N with Hwy. 73 (in Keene) along Hwy. 9N, 17 Aug 1977, Webb and Webb 53785 (TENN). Essex Co.: N end of Indian Pass, along Ausable River, 15 Jul 1923, House 9550 (GH). Franklin Co.: inlet to Upper Saranac Lake, 4 Sep 1929, Muenscher et al. 439 (MO). Fulton Co.: near jct. Hwy. 10 and Hwy. 29A near

Pine Lake, 12 Aug 1977, Webb and Webb 53349 (TENN). Greene Co.: near Tannersville, Onleora Swamps, Aug 1891, Vail s.n. (NY). Hamilton Co.: 1 mi NE of South Inlet, Raquette Lake, 27 Jul 1947, Dress 35 (SMU). Nassau Co.: Rockville Centre, Long Island, 11 Oct 1928, Ferguson 7356 (NY). Oneida Co.: White Lake, 15 Sep 1926, Wiegand 16673 (GH, MO). Queens Co.: Springfield, Sep 1886, Bisky s.n. (NY). Rensselaer Co.: depression in mountain, W of Berlin, 11 Oct 1936, House 21802 (NY). Richmond Co.: Grasmere, Staten Island, 17 Aug 1901, Magee s.n. (GH). Suffolk Co.: Long Pond, Sag Harbor, Long Island, 9 Sep 1925, Ferguson 4548 (NY). Sullivan Co.: vic. of Lake Shandelee, 26 Aug 1918, Wilson s.n. (NY). Washington Co.: near lower falls, North Beaver Creek, Vaughns, N of Hudson Falls, 1 Oct 1916, Burnham s.n. (GH). Westchester Co.: West Mt. Vernon, 9 Sep 1893, Bicknell 5787 (NY).

NORTH CAROLINA. Alamance Co.: Haw River, 11 mi W of Chapel Hill, 25 Sep 1957, Bowmer 0067 (NCU). Alleghany Co.: 1.4 mi S of Edmonds, 31 Jul 1958, Radford 38242 (GA). Ashe Co.: Bluff Mountain, 3 Oct 1961, Radford 44445 (ILL, NCU, US). Avery Co.: 2.4 mi SW of Linville on US 221, 24 Jul 1958, Ahles and Duke 47548 (NCU). Bladen Co.: 1 mi WNW of Bladenboro on N.C. 211, 3 Aug 1957, Ahles and Leisner 33316 (NCU). Buncombe Co.: slopes of Craggy Mountain, 12 Aug 1897, collector unknown, 3995 (GH, NY, US). Burke Co.: along N.C. 183, E of Linville Falls, 9 Sep 1958, Bell 15184 (NCU). Catawba Co.: Hickory, 12 Jun 1899, Churchill 1 (MO). Cherokee Co.: Aug 1893, collector unknown, s.n. (NCU). Chowan Co.: 0.5 mi N of Rocky Hock, 30 Jul 1958, Ahles and Duke 47918 (NCU). Clay Co.: Chatuga Lake, 3.5 mi E of Hayesville, 21 Aug 1956, Radford 16373

(NCU). Columbus Co.: near Bolton, 17 Jul 1926, Heller 14120 (MO). Cumberland Co.: Little River on N.C. 87 near Manchester, 7 Aug 1957, Ahles and Leisner 33409 (NCU). Duplin Co.: along N.C.24, 2.2 mi E of Sampson Co. line, 13 Sep 1949, Radford 5057 (NCU). Gates Co.: 1 mi SE of Gatesville on N.C. 37, then 3.1 mi ESE on paved road, 16 Oct 1958, Ahles and Duke 51518 (NCU, SMU). Harnett Co.: 2.8 mi S of Harnett-Lee Co. line on N.C. 87, ca. 1.6 mi S of Olivia, 4 Oct 1956, Laing 441 (NCU). Henderson Co.: Flat Rock, 31 Aug 1885, collector unknown, s.n. (NCU). Hoke Co.: 1.8 mi W of Montrose on Mountain Creek, 9 Aug 1957, Ahles and Leisner 33765 (NCU). Jackson Co.: 0.9 mi NW US 64 on N.C. 281, 5.5 mi W on Co. 1301 to Cold Mt. Gap, ca. 2 mi W to Panthertown Creek, 26 Jul 1970, Pittillo et al. 3417 (NCU). Johnston Co.: near jct. of N.C. 96 and N.C. 42, E of Clayton, 9 Sep 1961, Radford 44384 (NCU). Lenoir Co.: 1.6 mi SE of Strabane, 28 Aug 1957, Radford 28903 (NCU). Macon Co.: Harbison's Lake, 26 Aug 1951, Godfrey 52106 (ILL, MICH, NY, SMU, US). Mitchell Co.: Roan Mountain, 30 Aug 1892, Merriam s.n. (US). Montgomery Co.: 5.5 mi SE of Candor near Naked Creek, 9 Oct 1956, Radford 19500 (NCU). Moore Co.: Weymouth Woods State Park, 23 Oct 1965, Ahles 63082 (NCU). New Hanover Co.: N.C. 74, 1 mi W of Wrightville Sound, 15 Sep 1963, McCrary 1072 (NCU). Onslow Co.: 3.3 mi NE of Haw, 14 Jun 1957, Ahles and Haesloop 28140 (NCU). Pender Co.: along RR, 2.3 mi NE of New Hanover-Pender Co. line on US 17 (between Scotts Hill and Hampstead), 26 Jul 1957, Ahles and Leisner 32313 (NCU). Richmond Co.: 3.5 mi NE of Hoffman at Camp Mackall, 24 Jul 1956, Radford 14445 (NCU). Sampson Co.: 1 mi SE of Hayne on dirt road, 8 Aug 1957, Ahles and Leisner 33689

(NCU). Scotland Co.: 1.3 mi NE of Silver Hill, 31 Jul 1957, Ahles and Leisner 32273 (NCU). Transylvania Co.: Falls of Little River, 15 Aug 1881, Smith s.n. (US). Vance Co.: 2 mi S of Henderson on US 1, 1 Oct 1956, Ahles and Leisner 20446 (NCU). Wake Co.: Method, 13 Jul 1938, Godfrey 4976 (NCU). Wayne Co.: 1.4 mi N of Dudley, 24 Oct 1957, Radford 31540 (NCU). Wilson Co.: near US 264, 0.3 mi W of Sims, 25 Sep 1958, Radford 40685 (NCU). Yancey Co.: along N.C. 80 between Busick and Celo, 28 Aug 1958, Freeman 58349 (NCU).

PENNSYLVANIA. Bucks Co.: 1 mi above Tullytown, 7 Aug 1925, Dreisbach 3657 (MICH). Carbon Co.: Broad Mt. W of Nesquehoning, 8 Oct 1910, Pretz 3042 (NY). Chester Co.: Nottingham, 14 Sep 1916, Pennell 8905 (NY). Clinton Co.: along West Branch, Susquehanna River opposite Ferney, 12 Aug 1952, Westerfeld et al. 5679 (NCU). Indiana Co.: Salzburg Twp., Sep 1832, Moser s.n. (MO, NY). Lancaster Co.: near Smithville, 3 Sep 1892, Heller and Halbach s.n. (GH, NCU). Lehigh Co.: vic. of Allentown, 22 Aug 1898, Dowell 591 (GH). Northampton Co.: 1 mi W of Wind Gap, 7 Jul 1953, Shaeffer 43691 (US).

RHODE ISLAND. Newport Co.: back of Crescent Beach, Block Island, 20 Aug 1913, Fernald and Long 9913 (GH). Providence Co.: Morris Swamp, Providence, 30 Jul 1893, Collins 1 (GH). Washington Co.: South Kingston, West Kingston, 21 Aug 1906, Reynolds 0636 (GH, ILL).

SOUTH CAROLINA. Aiken Co.: Graniteville, 5 Aug 1898, Eggert s.n. (MO, US). Allendale Co.: 1.2 mi S of jct. US 301 and 321 in Ulmers, 10 Oct 1956, Ahles and Bell 20855 (NCU). Anderson Co.: Brown's Park, Anderson, 22 Aug 1917, Davis 8333 (US). Bamberg Co.:

1.5 mi SE of jct. 49 and 17 on Co. 49, along Co. 49 NE of Denmark, 24 Oct 1957, Ahles 37553 (GH, NCU). Barnwell Co.: near Windy Hill Creek on S.C. 3, N of Blackville, 28 Oct 1961, Ahles and Crutchfield 55826 (NCU). Berkeley Co.: 4 mi S of Bonneau, 13 Jul 1927, Wiegand and Manning 2012 (GH). Charleston Co.: Plaulroad, Charleston, 31 Aug 1859, Gibbes and Hume s.n. (NY). Chesterfield Co.: Montrose, near US 52 S of Cheraw, 11 Aug 1956, Radford 15771 (NCU). Colleton Co.: along Hwy. 17, 3.1 mi NE of jct. 303 and 17, 25 Aug 1976, Webb et al. 52485 (TENN). Darlington Co.: Prestwood Lake, 3 Aug 1940, Smith 46 (NCU). Georgetown Co.: Maryville, 23 Aug 1957, Radford 28564 (NCU). Kershaw Co.: Camden, 27-28 Jul 1906, House 2654 (US). Lancaster Co.: 0.4 mi NNE of Little Lynches Creek on US 601 and 2.8 mi E on dirt road, 6 Jun 1957, Ahles and Haesloop 27432 (NCU). Laurens Co.: Baldwin, 28 Jul 1921, Davis s.n. (MO). Lexington Co.: 8 mi SE of Columbia, 8 Aug 1939, Godfrey and Tryon 1333 (GH, NY, US). Marlboro Co.: 3 mi E of Wallace near S.C. 9, 30 Sep 1956, Radford 19107 (NCU). Orangeburg Co.: 0.3 mi S of jct. Co. 260 and 65 on Co. 260, E of Orangeburg, 19 Jul 1957, Ahles and Haesloop 31638 (NCU).

TENNESSEE. Carter Co.: Round Ball Mt., 7 Aug 1956, Ramseur 1395 (NCU). Cumberland Co.: along I-40, near 313.8 mile, 3.1 mi E of Exit 311, 24 Sep 1976, Webb et al. 52264 (TENN). Fentress Co.: near Clarkrange, 28 Jul 1950, Sharp 15325 (TENN). Grundy Co.: Beersheba Springs, 13 Aug 1938, Svenson 8917 (MO, TENN). Marion Co.: between Foster Falls and Tracy City, 15 Jul 1934, Underwood et al. 1097 (TENN).

VERMONT. Windham Co.: Jamaica, 18 Jul 1937, Moldenke and Moldenke 9948 (NY).

VIRGINIA. Accomack Co.: along Hwy. 13, 0.8 mi S of Va.-Md. state line, 2 Aug 1976, Webb and Webb 52112 (TENN). Augusta Co.: Magnolia swamp, 10 Aug 1938, Carr s.n. (GH). Dinwiddie Co.: S of Petersburg, 14 Jul 1938, Fernald and Long 8773 (GH). Fairfax Co.: near Falls Church, 12 Aug 1945, Chase 8038 (ILL). Giles Co.: between jct. of Meredith and Little Stony Creeks, between Big and Salt Pond Mountains, 14 Aug 1956, Thorne 18069 (GA). Greensville Co.: about 1 mi NW of Dahlia, 18 Sep 1938, Fernald and Long 9377 (GH). Henrico Co.: along RR, W of Elko, 3 Sep 1967, Harville 17617 (NCU). Isle of Wright Co.: 2 mi SE of Franklin, 8 Aug 1967, Harvill 17538 (NCU). James City Co.: 5 mi W of Williamsburg, 23 Jul 1921, Grimes 4110 (NY). Nansemond Co.: near Cox Landing, 28 Aug 1967, Harvill 17503 (NCU). Norfolk Co.: SE shore of Lake Drummond, Great Dismal Swamp, W of Wallaceton, 15 Sep 1941, Fernald and Long 13696 (GH). Northampton Co.: S of Kendall Grove, 13, 15 Oct 1935, Fernald et al. 5370 (NY, US). Prince Georges Co.: ca. 3 mi SW of New Bohemia, 22 Aug 1936, Fernald 6641 (GH, MO, NY). Surry Co.: 4.3 mi ESE of Surry on Va. 10, 7 Jul 1963, Ahles and Baird 58606 (NCU). Sussex Co.: Airfield Millpond, SE of Wakefield, 11-12 Sep 1945, Fernald and Long 14961 (GH, MO, NY, US).

WEST VIRGINIA. Greenbrier Co.: Short Mountain, 12 Jul 1941, Frye and Barry s.n. (NCU). Preston Co.: near Amboy, 31 Aug 1950, Davis and Davis 9231 (GA, MO, NY, NCU, TENN, US). Raleigh Co.: Flat Top Mountain, 17 Jul 1931, Core s.n. (GH). Upshur Co.: 10

Jul 1897, Pollock s.n. (US). Webster Co.: Welsh Glade, 16 Jul 1890, Millspaugh 571 (NY).

WISCONSIN. Buffalo Co.: Alma, 1861, Hale s.n. (GH). Columbia Co.: Camp McCoy, 28 Jul 1932, Fassett 14504 (GH). Jackson Co.: Glacial Lake, City Point Twp., T21N, R1E, Sec. 13, 2 Sep 1958, Hartley and Thorne 6025 (ILL, US). Juneau Co.: near Lyndon Station, T14N, R5E, Sec. 24 and 13, 25 Jul 1959, Hartley 7750 (ILL). La Crosse Co.: Farmington Twp., T18N, R5W, Sec. 9, 5 Sep 1958, Hartley and Thorne 6174 (ILL). Monroe Co.: Camp McCoy, 28 Jul 1932, Fassett 14504 (MO).

CANADA. NEW BRUNSWICK. Charlotte Co.: Grand Manan, 14 Aug 1927, Weatherby and Weatherby 568 Plantae Exiccatae Grayanae (GA, ILL, MICH, MO, NY, SMU, TENN, US). St. John Co.: St. John, 8 Sep 1887, Fowler s.n. (MO). Westmoreland Co.: Moncton Road, Shediac Cafe, 2 Aug 1916, Hubbard s.n. (GH).

NEWFOUNDLAND. near Carbonear, 6 Aug 1911, Fernald and Wiegand 5850 (GH, MO, US); Bay St. George, 5-7 Aug 1901, Howe and Lang 1017 (GH, NY); Trepassey, Avalon Peninsula, 16 Aug 1924, Fernald et al. 26632 (US); Bishops Falls, Valley of Exploits River, 28 Jul 1911, Fernald et al. 5849 (NY); St. John's, 4 Aug 1894, Robinson and Schrenk 185 (MO, NY, US); Ferryland District, Peters River Road and Half-Way Tucks, 16 Aug 1961, Rouleau 7093 (NY); near Sand Bank, W of Burgeo, 9 Sep 1926, Fernald et al. 323 (GH).

NOVA SCOTIA. Annapolis Co.: Middleton, 20 Jul 1920, Bean and White 21863 (GH). Guysborough Co.: Canso, 2 Aug 1901, Fowler s.n. (MO, US). Halifax Co.: Purcell's Cove, Halifax Harbor, 2-6 Sep 1901, Howe and Lang 1528 (NY). Iverness Co.: near Pembroke

Lake, Cheticaup, 13 Aug 1906, Robinson 390 (NY). Luenburg Co.: near Big Mushamush Lake, 17 Aug 1921, Fernald and Long 24147 (GH). Yarmouth Co.: Butler's Lake, Gavelton, 4 Sep 1920, Fernald et al. 21866 (GH).

ONTARIO. Algoma Co.: Batchawana Bay, Lat. 47°00'N, Long. 84°45'W, 22 Jul 1935, Taylor et al. 1478 (US). Parry Sound Co.: Port Sydney District, 9 Aug 1917, Tripp 480 (NY).

PRINCE EDWARD ISLAND. Prince Co.: Tignish, 6 Aug 1912, Fernald et al. 7762 (GH). Queens Co.: Woods Islands, 20 Jul 1952, Erskine 1315 (NY).

QUEBEC. Abitibi Co.: Taschereau, 16 mi NE at Lake Berry, 31 Aug 1952, Baldwin and Breitung 4330 (GH). Argenteuil Co.: St. Adolphe, comté d'Argenteuil, 29 Jul 1955, Rolland-Germain 6246 (NY, SMU). Berthier Co.: Lanoraire, comté de Berthier, 4 Sep 1937, Boivin 1629 (GH). Deux Montagnes Co.: St. Colomban, vic. of St. Jerome, 8 Aug 1920, M.-Victorin 11392 (GH, US). Rimouski Co.: St. Simeon, Cte Charlevoix, bords du lac Elzear, 10 Aug 1966, Cinq-Mars et al. 66-312 (GH). Terrebonne Co.: shores of Riviere du Nord, vic. of St. Jerome, 25 Aug 1918, M.-Victorin 8401 (GH, MO).

8. Hypericum majus (Gray) Rusby in Britt. Mem. Torr. Bot. Club 5: 225. 1894.

Hypericum canadense L. var. major Gray. Manual, ed. 5: 86. 1867. TYPE: UNITED STATES: Lake Superior, Robbins 31c. (HOLOTYPE: GH!)

Hypericum mutilum L. var. longifolium Rob. Keller. Bull. Herb. Boiss. ser. 2, 8: 184. 1908. TYPE: UNITED STATES: WISCONSIN: Dane Co.: Albion, Kumlien 113. (LECTOTYPE herewith designated, G!, ISOLECTOTYPE: P).

Sarothra major (Gray) Y. Kimura in Nakai and Hondo. Nov. Fl. Jap. no. 10: 232. 1951.

Plant perennial, erect, often rather stout, 1.0-6.0 (7.0) dm tall. Stems solitary or in clumps originating from a slender rhizome. Upper portion of stem occasionally with ascending branches. Base of stem with shortened internodes, leaves obovate, densely crowded, and overlapping. Medial and upper stem leaves narrowly elliptic to lanceolate, 1.0-4.4 cm long, 0.6-1.0 cm wide with rounded to subcordate, clasping leaf bases, and acute to rounded apices. Leaves about equaling to slightly exceeding the internodes. Upper leaves generally 5 to 7 nerved, often 3 nerved in smaller plants. Inflorescence a compact compound dichasium. Bracts subulate, to 5 mm long. Sepals lanceolate, (3.5) 4.5-6.5 mm long, acute to acuminate. Petals slightly inequilateral, yellow, 3.5-4.0 mm long, 1.25-1.75 mm wide, occasionally with reddened nerves. Stamens 14 to 21. Capsule conic-ellipsoid, maroon, (4.0) 5.0-6.5 (7.0) mm long, 2.5-4.0 mm wide, slightly exceeding the sepals. Style 0.6-1.0 mm long. Seeds tan, 0.5-0.7 mm long, obscurely striate and pitted.

Chromosome number: $n = 8$.

Flowering time: Late June to September.

Distribution and habitat: Bogs, ditches, lake margins, and wet marshes from New Brunswick, south to New Jersey and Pennsylvania, west to the Great Lakes region, south to Iowa, Nebraska, and Kansas, and west to Washington and British Columbia (Figure IX-9).

Discussion: This taxon was originally described by Gray (1867) as H. canadense var. major and was distinguished from the

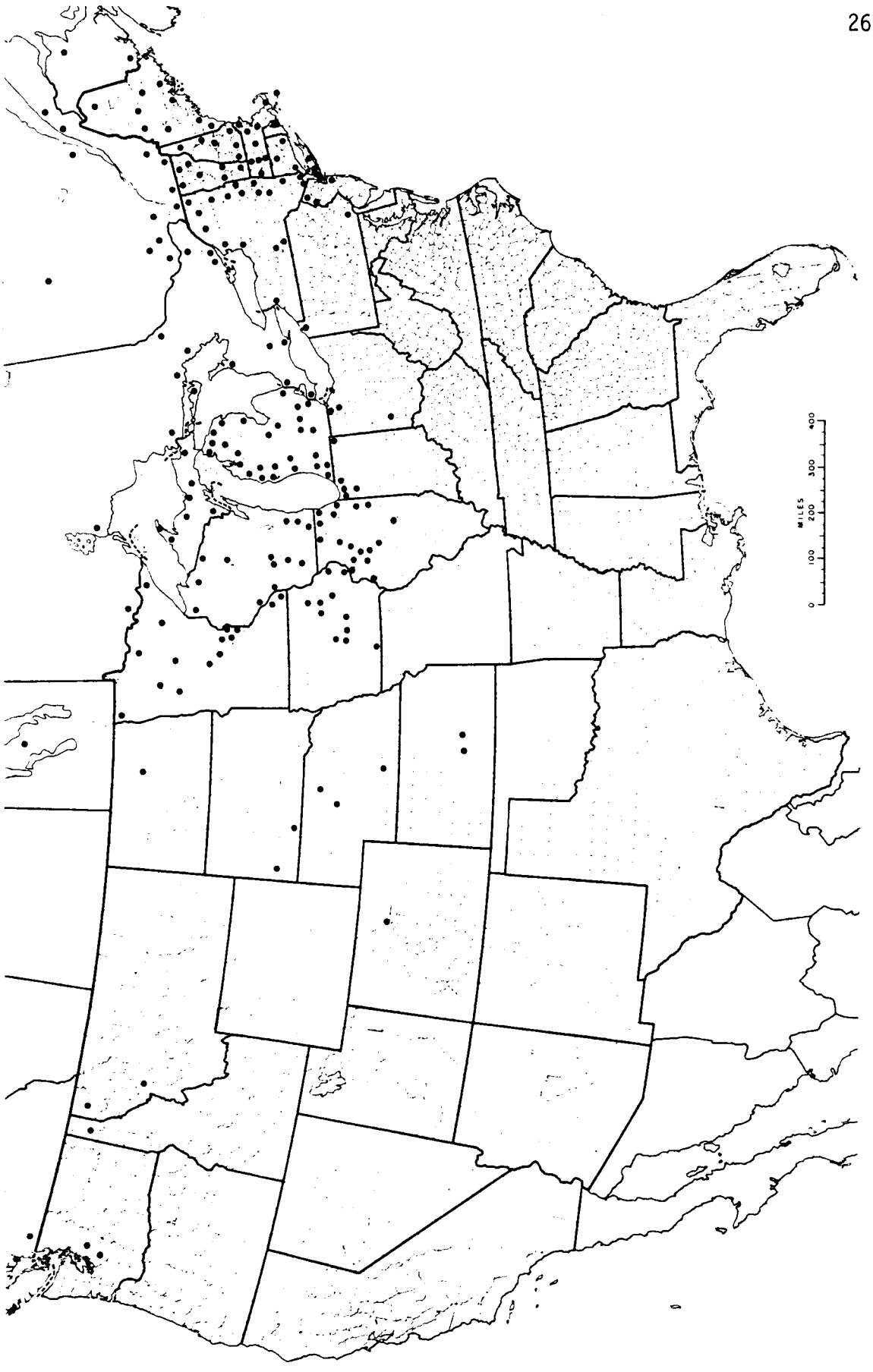


Figure IX-9. Distribution of Hypericum majus.

typical variety of H. canadense by its larger size and leaf shape. Britton (1890) noted that this taxon had ". . . a good claim to specific rank," but indicated a need for more intensive field observation before recognizing the taxon as a distinct species. Variety major was elevated to specific rank in Britton (1894). Although Britton is given credit for the change in rank in the above publication, a footnote indicates Prof. H. H. Rusby to be the contributor for the Hypericaceae. Thus, the correct citation of the authorities for H. majus is H. majus (Gray) Rusby in Britt. and not H. majus (Gray) Britt.

While H. majus and H. canadense are deemed to be distinct species, some difficulty is encountered in distinguishing depauperate individuals of H. majus from certain individuals referable to the closely related H. canadense. Several keys (Fernald, 1950; Gleason, 1952; Gillespie, 1959) have used the number of veins at the base of the leaf (1 to 3 in H. canadense and 5 to 7 in H. majus) as one of the distinguishing characters separating the two species. However, depauperate individuals of H. majus frequently have only three leaf veins and the leaf shape often approaches that of typical H. canadense. Individuals of H. majus are usually distinguishable from H. canadense by a more compacted inflorescence, longer sepals, longer inflorescence bracts, and the shape of the capsule. Additional problems associated with the delimitation of these two species as well as other members of the H. canadense complex arise due to hybridization.

As noted by Utech and Iltis (1970), H. majus and H. canadense represent ". . . a vicarious pair (W. and E. North America) which

post-glacially became sympatric in glaciated North America. . . ." It is plausable that the Pleistocene glaciers split an ancestral species into a western and southeastern population with H. majus evolving from the western population and H. canadense originating from the southeastern population. This hypothesis is supported by the present distributions of H. majus and H. canadense. The range of H. majus extends into the northwestern United States, while H. canadense inhabits various physiographic provinces of the central and southeastern portion of the eastern United States.

Several workers (Gillespie, 1959; Sharp et al. 1960; Adams, 1973) have attributed H. majus to Tennessee based on a specimen collected in Morgan County (Shanks 3053, TENN). This specimen is not believed to be H. majus, but is more likely a hybrid between H. canadense and H. mutilum.

Representative specimens: UNITED STATES. COLORADO. Boulder Co.: near Boulder, Jul 1902, Tweedy 4977 (NY).

CONNECTICUT. Fairfield Co.: Stratford, 28 Aug 1894, Eames s.n. (ILL). Hartford Co.: near jct. of US 44 and Conn. 167, on US 44, W of Avon, 23 Oct 1966, Ahles 65404 (NCU). New London Co.: Groton, 28 Aug 1895, Graves s.n. (GH).

IDAHO. Bonner Co.: sandpoint Substation, Sandpoint, 30 Jul 1930, Christ 839 (NY).

ILLINOIS. Bureau Co.: N of Buda, 17 Jul 1951, Ahles 4168 (ILL). Cook Co.: Skokie Marsh, W of Glencoe, 10 Sep 1911, Sherff s.n. (GH, US). Du Page Co.: Wayne, 14 Aug 1897, Moffatt 368 (ILL). Henderson Co.: near Oquawka, 187, Patterson s.n. (MO, NY). Henry Co.: ca. 6.5 mi N of Genesco, 14 Aug 1947, Dobbs 4 (GH).

Iroquois Co.: near Iroquois Hunting Grounds, E of Beaverville, 10 Oct 1954, Ahles 8506 (ILL). Kankakee Co.: 3 mi SE of Custer Park, 24 Aug 1947, Steyermark 64902 (ILL). Knox Co.: 6 mi S of Galesburg, 15 Jul 1965, Brown s.n. (ILL). Lake Co.: Sun Lake, Lake Villa, 9 Aug 1906, Gleason and Shore 215 (GH, ILL). Lee Co.: Amboy, 30 Jul 1957, Long 508 (ILL). Peoria Co.: Peoria, "West Bluff," Sep 1902, McDonald s.n. (ILL). Piatt Co.: N of Monticello, 25 Aug 1952, Ahles 6573 (ILL). Rock Island Co.: near Silvis, 23 Sep 1962, Chase 17116 (ILL). Stark Co.: near Wady Petra, 30 Aug 1898, Chase 193 (GH, ILL). Tazewell Co.: Meyers Lake, Pekin, 19 Aug 1950, Chase 11423 (ILL). Winnebago Co.: 3 mi N of Shirland, 18 Jul 1946, Fell and Fell 46555 (ILL).

INDIANA. Jasper Co.: Carpenter Twp., 2 mi E and 1 mi N of Goodland, 15 Jul 1925, Welch 190 (ILL). Lake Co.: near Tolleston, 31 Aug 1886, Hill 58-1886 (ILL). La Porte Co.: La Porte, 20 Jul 1878, Barnes 4 (MICH). Porter Co.: Dune Park, 30 Aug 1897, Chase s.n. (ILL). Steuben Co.: S side of W half of Crooked Lake, 28 Jul 1933, Deam 54214 (TENN).

IOWA. Black Hawk Co.: Waterloo, 21 Aug 1929, Burk 900 (ILL, MO). Buchanan Co.: Winthrop, 29 Aug 1942, Murley 1652 (SMU). Decatur Co.: moist grounds, 13 Jul 1903, Anderson s.n. (MO). Fayette Co.: Fayette, 1893, Fink s.n. (GH). Jackson Co.: Sec. 7, Union Twp., 13 Aug 1956, Cooperrider 2658 (ILL, SMU). Jasper Co.: wild rice pond, 24 Jul 1928, Conrad 329 (TENN). Linn Co.: Cedar Rapids, Jul 1898, Shimek s.n. (SMU). Polk Co.: pond adjacent to Skunk River Bed, S 1/2 of Sec. 12, Elkhart Twp., T81, R23, 29 Jul 1957, Bruggen 3320 (SMU). Poweshiek Co.: Grinnell, 30 Aug 1877,

Jones s.n. (NY). Scott Co.: Davenport, 18, Hitchcock s.n. (MO). Story Co.: Ames, Hitchcock s.n. (MO, NY).

KANSAS. Harvey Co.: 3.5 mi N of Burton, 10 Aug 1970, Mcgrath and Weeden 5796 (NY). Reno Co.: 5 mi N of Hutchinson, 30 Jul 1960, McGregor 15857 (SMU).

MAINE. Aroostook Co.: St. Francis, 5 Aug 1893, Fernald s.n. (NY). Cumberland Co.: Gray, 17 Aug 1963, Seymour 20827 (MO). Franklin Co.: along Hwy. 27, 0.4 mi SE of jct. US 2 and Hwy. 27, just SE of New Sharon, 15 Aug 1977, Webb and Webb 53768 (TENN). Hancock Co.: shore of Ripple's Pond, Mt. Desert, 30 Aug 1895, Faxon s.n. (GH, US). Penobscot Co.: Oldtown, 14 Aug 1908, Fernald 238 Plantae Exsiccate Grayanae (GA, GH, MICH, MO, NY, TENN, US). Piscataquis Co.: valley of Piscataquis River, Sangerville, 9 Aug 1895, Fernald 411 (GH, MO, NY, US). Somerset Co.: Dead River, 13 Aug 1896, Fernald and Strong 432 (GH, MO, US). Waldo Co.: Megunticook Lake, 10 Aug 1936, Halfert s.n. (MICH). York Co.: North Berwick, 19 Aug 1900, Parlin 1296 (NCU).

MASSACHUSETTS. Barnstable Co.: S end of Crooked Pond, Falmouth, 23 Aug 1919, Fernald and Long 18762 (GH). Berkshire Co.: vic. of Tyringham, 17 Jul 1897, Vail s.n. (NY). Essex Co.: Plum Island, 4 Aug 1899, Williams 1 (GH). Franklin Co.: SE of Stone Quarry near Cheapside, near Deerfield, 28 Jul 1963, Pollard s.n. (GA). Hampden Co.: Monson, Aug 1897, Morris s.n. (TENN). Hampshire Co.: Cole's land, Horse Mt., Hatfield, 15 Sep 1972, Ahles 76171 (NCU, SMU). Middlesex Co.: Winter Pond, Winchester, 5 Aug 1881, Morong s.n. (NY). Nantucket Co.: Nantucket Island,

8 Sep 1904, Bicknell 5811 (NY). Norfolk Co.: Stoughton, Ames Pond, 29 Aug 1929, Blake 10942 (GH). Worcester Co.: N of Grandview House, Princeton, 7 Aug 1894, Collins s.n. (US).

MICHIGAN. Alger Co.: Sand Point, Sec. 19, T47N, R18W, 15 Aug 1973, Read 415 (MICH). Alpena Co.: 5 mi N of Alpena, 11 Jul 1895, Wheeler s.n. (GH). Berrien Co.: Niles, Sep 1867, Ames s.n. (MICH). Cass Co.: Dewey Lake, 4 Aug 1906, Gates 1315 (MICH). Cheboygan Co.: 2 mi E of Riggsville, 7 Jul 1933, Gleason and Gleason 106 (GH, NY). Chippewa Co.: near Sault Sainte Marie, 14 Aug 1910, Churchill s.n. (MO). Emmet Co.: along Maple River, W of Pellston, 21 Aug 1921, Ehlers 1808 (MICH). Grand Traverse Co.: Chamaedaphne swamp, ca. 9 to 10 mi SE of Traverse City, 21 Aug 1954, Dieterle 1274 (MICH). Houghton Co.: near Houghton, 9 Sep 1916, Dodge s.n. (MICH, NY). Inghaw Co.: Lansing, 27 Sep 1890, Hicks s.n. (MICH). Iosco Co.: Tawas Lake, East Tawas, 14 Jul 1935, Driesbach 8500 (MICH). Jackson Co.: Clear Lake, 24 Jul 1937, Hermann 9083 (MICH). Kalamazoo Co.: Eagle Lake, near Schoolcraft, 6 Aug 1941, Hanes and Wadmond s.n. (ILL). Kalkaska Co.: near NW corner of Sec. 33, Orange Twp., ca. 5.5 mi SE of South Boardman, 18 Jul 1958, Voss 7612 (MICH). Kent Co.: Vergemmes, 28 Jul 1873, Cole 631 (MICH). Keweenaw Co.: Rock Harbor, Isle Royal, 22 Aug 1930, McFarlin 2433 (MICH). Lake Co.: NE end of Minch Lake, ca. 2 mi NW of Baldwin, 18 Aug 1957, Voss 5272 (MICH). Livingston Co.: Edwin S. George Reserve, 3 mi W of Pinckney, 29 Jul 1941, Hammerstrom 304 (MICH). Manistee Co.: Onekama, 9 Aug 1916, Umbach 8525 (MICH). Marquette Co.: Marquette, 4 Sep 1892, Wheeler s.n. (GH). Mason Co.: E shore of Hopkins Lake, ca. 5 mi SE of Ludington, 18 Aug

1956, Voss 3257 (MICH). Menominee Co.: mouth of Birch Creek on Bay Shore Drive, 8 Aug 1933, Grassl 2950 (MICH, NY). Midland Co.: 0.5 mi N and 0.5 mi W of Olson, 12 Aug 1932, Dreisbach 7772 (MICH). Muskegon Co.: Lake Harbor, Aug 1896, Moffatt 360 (ILL). Newaygo Co.: NW shore of Diamond Lake, ca. 5 mi NW of White Cloud, 11 Sep 1964, Voss 11791 (MICH). Oakland Co.: Royal Oak Lake, 29 Jul 1916, Billington s.n. (MICH). Oceana Co.: Honor Lake, ca. 1 mi NW of Shelby, 20 Aug 1957, Voss 5324 (MICH). Ostego Co.: Hardwood Lake, Sec. 11, R1W, T32N, 3 Aug 1948, McVaugh 9680 (MICH). Presque Isle Co.: Lake Sixteen, 12 Aug 1937, Ehlers 6243 (MICH). St. Claire Co.: open ground, 23 Aug 1894, Dodge s.n. (MICH). Saginaw Co.: 5 mi W of Chesaning, 17 Jul 1927, Driesbach 5122 (MICH). Schoolcraft Co.: between Gulliver Lake and Lake Michigan, 27 Aug 1929, Ehlers 4231 (MICH). Van Buren Co.: shore of Bankson Lake, 12 Sep 1952, Hanes 352 (MICH). Wayne Co.: Redford, 20 Jul 1932, Farwell 9195 (MICH).

MINNESOTA. Anoka Co.: N of Ham Lake, 1 mi E of Hwy. 5, 8 Oct 1927, Rosendahl 5496 (GH). Becker Co.: Itasca Park, Sec. NW-NE3, T142, R36, 13 Aug 1929, Grant 3072 (GH, MO, NY, US). Benton Co.: 1 mi N of Sartell, 5 Aug 1944, Moore and Hall 16881 (SMU). Cass Co.: 26 Jun 1938, Eners and Chandler 728 (MO). Chisago Co.: 5 mi E of Sunrise, 18 Sep 1940, Butters and Moore 13613 (GH). Clearwater Co.: Mink Lake, Sec. SE-SE7, T143, R36, 21 Jul 1933, Moyle 946 (GH, NY). Cook Co.: trail to Lima Mt. Twp., 64N, R1W, 2 Aug 1944, Butters and Abbe 890 (GH). Houston Co.: Jefferson, 29 Jul 1899, Wheeler 427 (TENN). Isanti Co.: lake shore, Isanti Twp., E of Hwy. 65, NE 1/4, Sec. 8, 1 Oct 1940, Moore and Moore 13708 (TENN). Kittson Co.: N section line of Sec. 15, Poppeeton

Twp., 3.9 mi E of Lancaster, 10 Aug 1939, Moore and Moore 11618 (ILL). Koochiching Co.: NE shore of Krause Bay, SE of the Island View Hotel, Rainey Lake, 14 Aug 1939, Moore and Moore 11710 (ILL). Morrison Co.: 1.5 mi NW of Little Falls, 24 Jul 1945, Moore and Huff 17828 (ILL). St. Louis Co.: Duluth, 2 Aug 1913, Johnson s.n. (NY). Washington Co.: SE 1/4, Sec. 9., May Twp., 10 Sep 1942, Moore 15672 (ILL). Winona Co.: Home Hills, Jul-Oct 1897, Holzinger s.n. (NY).

MONTANA. Lincoln Co.: Noxon, Bull River, 15 mi up, 16 Sep 1927, Kirkwood 2482 (GH). Missoula Co.: Seeley Lake, 9 Aug 1924, Kirkwood 1838 (NY).

NEBRASKA. Brown Co.: Aug-Sep 1891, Bates s.n. (NY). Kearney Co.: prairies and sandhills, 13 Jul 1900, Rydberg 6631 (NY). Thomas Co.: Thedford, 7 Jul 1887, Webber s.n. (MO).

NEW HAMPSHIRE. Belknap Co.: Three Mile Island, Lake Winnepesaukee, near Center Harbor, 6 Aug 1941, Hartman 200 (NY). Carroll Co.: Jackson, 3 Aug 1890, Churchill s.n. (MO). Cheshire Co.: Wapole, River Rd., S at RR crossing, 10 Aug 1972, Boufford 7592 (GA, NCU, SMU, TENN). Coos Co.: Whitefield, 20 Aug 1897, Deane s.n. (GH). Hillsborough Co.: Mason, 12 Aug 1918, Batchelder s.n. (NY). Rockingham Co.: Greenland, 1875-8, Chickering s.n. (MO, US).

NEW JERSEY. Sussex Co.: White Pond, 4 Sep 1910, MacKenzie 4796 (MO, NY). Monmouth Co.: Asbury Park, 12 Jul 1894, collector unknown, s.n. (US). Warren Co.: marl beach, White Pond, 23 Aug 1924, Griscom 12127 (GH).

NEW YORK. Albany Co.: Wateroliet reservoir, Guildsland, 12 Aug 1922, House 9122 (NY). Clinton Co.: Lyon Mountain, 12 Sep 1930, Muenscher and Maguire 1256 (MO). Dutchess Co.: Little Whaley Pond, Pawling, 3 Sep 1916, Pennell 8455 (NY). Erie Co.: Buffalo, Aug 1878, Edwards s.n. (NY). Essex Co.: Elizebethtown, 25 Jul 1870, Redfield s.n. (GH, NY). Franklin Co.: Malone, 27 Aug 1892, Britton s.n. (NY). Greene Co.: vic. of Tannersville, Aug 1891, Vail s.n. (NY). Jefferson Co.: Lake Ontario, Woodville, 9-11 Sep 1921, House 8642 (GH). Nassau Co.: Lynbrook, Long Island, 26 Aug 1929, Ferguson 7959 (NY). Oswego Co.: South Pond, Sandy Creek, 20 Aug 1920, Wiegand 13710 (GH). Queens Co.: Kissener, Flushing, Long Island, 27 Aug 1921, Ferguson 766 (NY). Rensselaer Co.: Valley Falls, 19 Jul 1921, House 8405 (NY). Rockland Co.: S side Rt. 59, E of Rt. 306, Ramape Twp., 29 Jul 1956, Lehr 900 (NY). St. Lawrence Co.: Narrows Island, Black Lake, 30 Aug 1922, Fernald and Wiegand 14392 (US). Saratoga Co.: near Flagler Corners, Clifton Park, 1 Aug 1935, House 22800 (NY). Suffolk Co.: Wading River, 5 Oct 1878, Miller s.n. (NY, US). Tioga Co.: Summit Marsh, Spencer, Aug 1881 and 1885, collector unknown, s.n. (GH). Tompkins Co.: Taughannock Point, 16 Oct 1918, Eames 10301 (GH, MICH). Warren Co.: Schroon River, 10 mi N of Warrensburg, 15 Aug 1940, House 27584 (MO). Washington Co.: S bank of Pond Brook, W of W Fort Ann, 18 Aug 1918, Burnham s.n. (GH). Westchester Co.: near Bronxville Rd., 24 Sep 1893, Bicknell 5804 (NY).

NORTH DAKOTA. Benson Co.: Leeds, 13 Aug 1910, Lunnell 7095 (GH, NY).

OHIO. Lucas Co.: Neapolis, 7 Jul 1925, Mosely s.n. (GH, US). Montgomery Co.: Dayton, Oct 1882, Foesshe s.n. (GH). Wood Co.: Liberty Twp., Sec. 13, 12 Aug 1937, Shanks 938 (NY).

PENNSYLVANIA. Chester Co.: Gillman s.n. (NY). Erie Co.: Erie, Presque Isle, 28 Jul 1868, Porter s.n. (GH).

RHODE ISLAND. Newport Co.: Crescent Beach, Block Island, 20 Aug 1913, Fernald and Long 9909 (GH).

SOUTH DAKOTA. Bennett Co.: near La Creek P.O., 12 Aug 1911, Visher 2246 (NY). Custer Co.: Custer, 20 Aug 1892, Rydberg 572 (NY).

VERMONT. Caledonia Co.: Peacham, 3 Aug 1883, Blauchard s.n. (NY). Franklin Co.: Swanton, 25 Aug 1911, Blake 3132 (ILL). Orleans Co.: road to Roaring Brook, Westmore, 16 Aug 1915, Edmondson 5451 (NY). Rutland Co.: North Rutland on US 7, 8 Aug 1967, Ahles 68689 (NCU). Washington Co.: along Hwy. 2, 2.5 mi E of jct. Hwy. 2 and Cabot Rd. in Marshfield, 13 Aug 1977, Webb and Webb 53760 (TENN). Windham Co.: Jamaica, 1 Sep 1935, Moldenke 8836 (ILL, NY). Windsor Co.: Hartland, 27-31 Jul 1900, Eggleston 1946 (GH).

WASHINGTON. King Co.: Seattle, 1891, Pifier 1115 (GH, NY). Pierce Co.: Camp Lewis, 14 Aug 1918, Muenscher 5106 (GH).

WISCONSIN. Adams Co.: Silver Lake, Quincy Twp., T16N, R5E, Sec. 9, 31 Aug 1958, Hartley and Thorne 5870 (ILL, US). Ashland Co.: Bass Island, 5 Aug 1896, Cheney 5780 (GH). Buffalo Co.: Alma, 1861, Hale s.n. (NY). Douglas Co.: Gordon, Thompson s.n. (ILL). Iowa Co.: Barneveld, 5 Oct 1926, Fassett 3427 (NY). Juneau Co.: Camp Douglas, 12 Jul 1890, Mearns 556 (NY). La Crosse

Co.: Lake Onalaska, Onalaska Twp., T16N, R7, Sec. 6, 10 Jul 1956, Hartley 1339 (SMU). Lincoln Co.: Pine River Dells, T31N, R7E, Sec. 28, Pine River, 18 Aug 1952, Seymour and Schlising 14697 (MO). Sauk Co.: Devil's Lake, 15 Aug 1895, Moffatt s.n. (ILL). Vilas Co.: St. Germain Creek, Sayner P.O., 27 Jul 1902, Wadmond 3117 (GH). Walworth Co.: Delavan Lake, 20 Jul 1900, Wadmond 3117 (GH). Washington Co.: ca. 5 mi N of Monches, 4 Sep 1939, Pohl and Shinners 1350 (SMU). Waukesha Co.: Silver Lake, Southern Unit, Kettle Moraine State Forest, 19 Sep 1951, Barlett and Richards 1109 (MICH).

CANADA. BRITISH COLUMBIA. Harrison Lake, 17 Aug 1916, Carter 247 (GH).

MANITOBA. Muskeg Island, Lake Winnipeg, 4 Aug 1884, MacCoun 349 (GH).

NEW BRUNSWICK. Charlotte Co.: Grand Manan along Whistle Rd., 14 Aug 1927, Weatherby and Weatherby 6534 (GH). Northumerland Co.: Chatham, 5 Sep 1913, Blake 5606 (NY, US).

ONTARIO. Algoma Co.: beach at Thessalon, 21 Aug 1932, Grassl 5481 (MICH). Bruce Co.: Stokes Bay, 15 Aug 1934, Krotkov 9221 (US). Essex Co.: 0.5 mi S of Thames River Light House, Tilbury N. Twp., 26 Jul 1948, Soper and Dale 4075 (GH). Frontenac Co.: Bedford Twp., Frontenac Park, Little Salmon Lake, 2 Sep 1968, Hainault and MacDonald 4738 (GA). Hallimand-Norfolk Co.: Long Point, Lake Erie, 24 Aug 1938, Senn and Safer 634 (GH, NY). Lambton Co.: Pt. Edward, Lake Huron, 12 Aug 1901, Macoun 34078 (GH, NY). Leeds Co.: Long Point, 8 Aug 1932, Marie-Victorin et al. 45832 (GH). Manitoulin Co.: near Helen Bay, Manitoulin Island,

10 Aug 1932, Grassl 5564 (MICH, NY). Nipissing Co.: Temagami Forest Reserve, 16 and 22 Aug 1934, Watson 6885 (GH, US). Ottowa Co.: Ottawa, 21 Aug 1894, Macoun s.n. (GH). Parry Sound Co.: N side of French River Harbor, 9 Sep 1932, Grassl 1963 (NY). Rainy River Co.: Sable Island, S end of Lake of the Woods, 1 Aug 1961, Garton 9123 (SMU). Sudbury Co.: near White Fish Lake, E of White Fish, 4-11 Aug 1935, Yuncker and Yuncker 5491 (NY). Thunder Bay Co.: Talus Lake, Sibley Twp., Lat. 48°20'N, Long. 88°50'W, 17 Aug 1936, Taylor et al. 732 (GH). Waterloo Co.: 3 mi W of Kitchener, 7 Sep 1940, Montgomery 659 (GH).

QUEBEC. Abitibi Co.: Taschereau, 16 mi NE at Lake Berry, 31 Aug 1952, Baldwin and Breitung 4329 (GH). Arthabaska Co.: along Hwy. 122, 6.2 mi NE of Catholic Church in Notre Dame Du-Bon-Conseil, 16 Aug 1977, Webb and Webb 53782 (TENN). Beuce Co.: 1.9 mi SE of St. Severin along Hwy. between St. Severin and Ting Jct., 16 Aug 1977, Webb and Webb 53778 (TENN). Charlevoix Est Co.: vic. of Cap a L'Aigle, 16 Aug 1905, Macoun 66791 (GH). Chateauguay Co.: St. Chrysostome, comté de Chateauguay, 20 Oct 1954, Rolland-Germain 6162 (SMU). Frontenac Co.: 1.5 mi N of US-Canada border along Hwy. 173, 15 Aug 1977, Webb and Webb 53777 (TENN). Gatineau Co.: comte de Gatineau, 7 Aug 1944, Louis-Marie and Lamarre 398 (GH). Labelle Co.: 25 mi au N de Mont-Laurier, 23-25 Aug 1941, Marie-Victorin et al. 128 (MO, NY). Megantic Co.: along Hwy. 269, 2.9 mi E of Pontbriand, 16 Aug 1977, Webb and Webb 53780 (TENN). Missisquois Co.: Farnham, comte de Missisquoi, 3 Sep 1932, Marie-Victorin and Rolland-Germain 46705 (GH). Papineau Co.: Mulgrave Parish, W side of Lac la Blanche at outlet, 23 Sep 1947, Calder et al. 1782 (MO).

Quebec Co.: Valcartier, 18 Aug 1925, Marie-Victorin 21984 (MO, US). Riviere Du Loup Co.: St. Hubert, vic. of Longueuil, 8 Sep 1918, M.-Victorin 8545 (GH, MO, NY, US).

SASKATCHEWAN. Vic. of camp, about 2 mi W of Ennuyeuse Creek, Lake Athabaska, about 59°3'N, 109°34'W, 25 Aug 1935, Raup 6980 (GH, NY).

9. Hypericum denticulatum Walt. var. denticulatum. Fl. Carol. 190. 1788. TYPE: UNITED STATES: CAROLINA: 1798-1800, Bosc s.n. (NEOTYPE: P, ISONEOTYPE: FI, G, P, US!).

Hypericum laevigatum Dryander in Ait. Hort. Kew., ed. 1, 3: 106. 1789. (TYPE: Not located, however based on description appears to be referable to H. denticulatum.)

Hypericum angulosum Michx. ex Willd. Sp. Pl. 3: 1454. 1802. (TYPE: UNITED STATES: CAROLINA: in paludosis Carolina, no collector cited. (HOLOTYPE: B, as photo TENN!).

Hypericum linoides Spach. Hist. Nat. Veg. 5: 452. 1836. Nom. superfl., illigit. Based on Hypericum angulosum Michx.

Hypericum virgatum Lam. var. ovalifolium Britt. Trans. N. Y. Acad. Sci. 9: 10. 1889. TYPE: UNITED STATES: NEW JERSEY: wet barrens, Spring Lake, 31 Aug 1887, Lighthipe s.n. (LECTOTYPE: NY!).

Hypericum denticulatum Walt. var. ovalifolium (Britt.) Blake. Rhodora 17: 135. 1915.

Hypericum denticulatum Walt. var. typicum Fern. and Schub. Rhodora 50: 207. 1948.

Plant perennial with slender, erect stems, 2.0-7.0 dm tall. Stem usually simple, often with lateral branches from the leaf axils

of the upper portion of the stem. Leaves broadly to narrowly ovate, to elliptic, to narrowly obovate, 5.0-20.0 (24.0) mm long, 5.0-15.0 mm broad with acute to somewhat rounded apices and subclasping bases. Leaves typically appressed, sessile, generally shorter though occasionally exceeding the internodes. Inflorescence initially a compound dichasium, often becoming monochasial with ascending branches. Flowers on short pedicels 2.0-3.0 mm long. Bracts subulate to lanceolate, up to 6.0 mm in length. Sepals acute, 4.0-8.0 mm long, 2.0-4.0 mm wide, obovate, to elliptic, to ovate, to lanceolate. Lower flowers of inflorescence frequently with obovate to ovate sepals, terminal flowers frequently with elliptic to lanceolate sepals. Petals yellow-orange, strongly inequilateral, 5.0-10.0 mm long, 4.0-6.0 mm wide. Stamens numerous (50 to 80), loosely fused at base. Styles 2.0-4.0 mm long. Mature capsule ovoid, brown, 3.0-4.5 mm long. Seeds golden-brown (0.45) 0.5-0.65 mm long, pitted.

Chromosome number: $\underline{n}$ = 12, 24.

Flowering time: July to September.

Habitat and distribution: Moist ditches, pine barrens, and savannahs along the Atlantic Coastal Plain from New Jersey south to Georgia, with disjunct populations in western North Carolina, middle Tennessee, and southern Alabama (Figure IX-10).

Discussion: The taxa included in the H. denticulatum complex are closely related and well defined from the other eastern North American taxa of sect. Spachium by elongated styles that are 2 to 4 mm in length, numerous stamens (50 to 80), and strongly inequilateral petals that are yellow-orange in color with denticulate margins. Delineation of the taxa within the complex has primarily been based

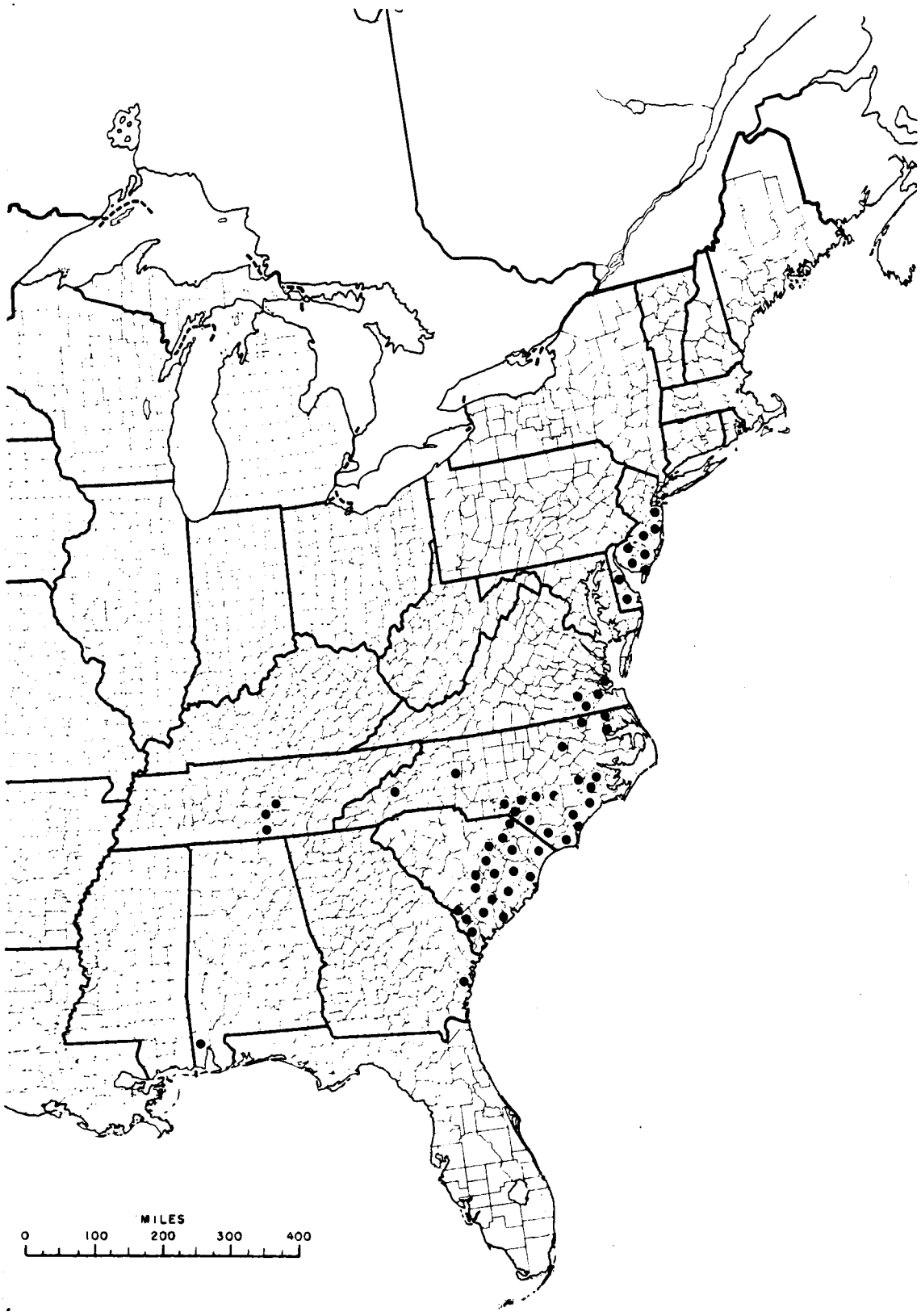


Figure IX-10. Distribution of Hypericum denticulatum var. denticulatum.

on leaf shape, and the complex has received a variety of treatments within the past half century. A more detailed discussion of some of the earlier treatments of the complex is contained in Fernald and Schubert (1948).

Small (1933) recognized two species, H. denticulatum Walt. and H. acutifolium Ell., with plants of H. denticulatum having oval leaves and oval to ovate sepals being referred to var. ovalifolium (Britt.) Blake. Fernald and Schubert (1948), Fernald (1950), and Radford et al. (1968) interpreted the complex to consist of a single species, H. denticulatum, which was divided into three varieties, var. denticulatum, var. acutifolium (Ell.) Blake, and var. recognitum Fern. and Schub. Gleason (1952) and Gleason and Cronquist (1963) recognized H. denticulatum to be comprised of varieties denticulatum and acutifolium. More recently, Adams (1973) recognized var. denticulatum, but questioned whether var. recognitum and var. acutifolium should not be viewed as a single variety. These latter two varieties have been included by Jiménez (1973a) under H. denticulatum var. virgatum (Lam.) Jiménez. In the present treatment, two species are recognized, H. incertum Steudel and H. denticulatum, with the latter species being divided into var. denticulatum and var. acutifolium. A comparison of the past treatments presented above with the present treatment is contained in Table IX-1.

Although H. denticulatum var. denticulatum is primarily restricted to the coastal plain from the pine barrens of New Jersey south to Georgia, disjunct populations exist in the more interior regions of the eastern United States (e.g. western North Carolina and middle Tennessee). These populations may possibly represent relic populations, while a disjunct population of var. denticulatum

TABLE IX-1

SOME TWENTIETH CENTURY TREATMENTS OF THE HYPERICUM DENTICULATUM COMPLEX AS COMPARED TO THE PRESENT TREATMENT

Webb (1979)		
H. denticulatum var. denticulatum	H. denticulatum var. acutifolium	H. incertum H. acutifolium pro parte
Small (1933)		
H. denticulatum (including var. ovalifolium)	H. acutifolium pro parte	
Fernald & Schubert (1948), Fernald (1950), Radford et al., (1968)		
H. denticulatum var. denticulatum	H. denticulatum var. recognitum H. denticulatum var. acutifolium pro parte	H. denticulatum var. acutifolium pro parte
Gleason (1952), Gleason & Cronquist (1963), Adams (1973)		
H. denticulatum var. denticulatum	H. denticulatum var. acutifolium pro parte	H. denticulatum var. acutifolium pro parte
Jimenez (1973a)		
H. denticulatum var. denticulatum	H. denticulatum var. virgatum pro parte	H. denticulatum var. virgatum pro parte

from Mobile County, Alabama, is thought to probably represent a recent introduction.

As previously noted by Blake (1915) and Fernald and Schubert (1948), there is no specimen of H. denticulatum in Walter's herbarium but the description leaves little doubt as to the application of the name. The name has been neotypified by Jiménez (1973a). One name, Brathys denticulata (Walt.) Spach which has been placed in synonomy with H. denticulatum Walt. by Fernald and Schubert (1948) and Jiménez (1973a), has been excluded in the present treatment. Spach (1836a) included Brathys denticulata under his "Sectio IV," which had 5 to 15 stamens, or rarely 20 to 25 stamens. The plant that is currently referred to H. denticulatum Walt. is characterized by having from 50 to 80 stamens. Spach's 1836 citation is as follows "B. denticulata Kunth. (sub Hyperico)." It would appear from the citation that Spach intended to create a new combination based on Hypericum denticulatum H.B.K. which was described in Nova Genera et Species (Humbolt, Bonpland, and Kunth, 1822) as having 10 stamens and growing in Mexico. The 1836 names of Spach (i.e. Brathys linoides, B. Erythreae, and B. lanceolata), which apply to the H. denticulatum complex, are contained in "Sectio III" for which the androecium is described as having "stamina numerosa." The source of the error apparently originated with Fernald and Schubert (1948) who note the name Brathys denticulata to be "wrongly ascribed to Kunth" and give Walter as the original author of the name in spite of Spach's citation.

Radford et al. (1968) give Humbolt, Bonpland, and Kunth as the authorities for H. denticulatum. This is also an error since

H. denticulatum H.B.K. is a Mexican plant and is a later homonym of H. denticulatum Walt., which is confined to eastern North America.

Another nomenclatural problem involves the typification and the date of publication of H. angulosum. Historically, the name H. angulosum has been attributed to Michaux (1803). The same name appeared in Volume 3, Part 2, of Willdenow's Species Plantarum. According to Schubert (1942) and Stafleu (1967), Volume 3, Part 2, of Species Plantarum was published Nov. 10, 1802. Thus, the publication of Willdenow has priority over Michaux (1803). This has been noted by Jiménez (1973a) who gives the date of publication of Volume 3 of Willdenow's Species Plantarum as 1797. Both Schubert (1942) and Stafleu (1967) give 1797 as the date of publication of Volume 1 of Species Plantarum. Thus, the citation of Jiménez (1973a) is thought to be incorrect as to the date of the volume and part of Willdenow's Species Plantarum that contains the name H. angulosum.

In describing H. angulosum, Willdenow (1802) lists "H. angulosum Michx." in the protologue and apparently intended that Michaux be given credit for the name. From the notation, "v.s.," which follows Willdenow's note on the habitat of the species, Willdenow had apparently examined a dried specimen. Jiménez (1973a) has indicated the specimen of H. angulosum in the Michaux Herbarium at Paris to be the type of H. angulosum Michx. ex Willd. This specimen has been seen as microfiche and there are no annotations to indicate that it was ever examined by Willdenow. According to Gray (1882) Louis Claude Richard, who assisted in Michaux's Flora Boreali-Americana, sent some of Michaux's specimens to Willdenow's herbarium at Berlin. The Willdenow Herbarium at Berlin contains a

specimen labeled H. angulosum with "Richard" on the original label. Since this is the specimen that Willdenow probably examined, it has been selected as the type of H. angulosum Michx. ex Willd. and replaces the specimen selected by Jimenez (1973a), which is in the Michaux Herbarium at Paris.

Another problem involving typification is that of H. virgatum var. ovalifolium which was described by Britton (1889). Although no specimens were explicitly cited in the original description, the distribution of the variety was given as the "Pine-barrens of New Jersey." Variety ovalifolium was transferred to H. denticulatum, an earlier name than H. virgatum, by Blake (1915) who noted that although this broadleaf form was ". . . chiefly known from New Jersey. . . .," it had also been collected by Rugel (number 370) in wet swamps of the Swanano Valley, North Carolina. Jimenez (1973a) has indicated the type of H. virgatum var. ovalifolium Britton to be Rugel 370.

While examining the specimens in the general collections of the New York Botanical Garden, the author discovered a specimen annotated as H. virgatum var. ovalifolium that also had "Type" penciled on the label. Personal communication with Dr. Eileen Schofield of the New York Botanical Garden has verified the annotation and the word "type" to be the handwriting of N. L. Britton. This specimen which had originally been labeled H. angulosum was collected in "wet barrens" from a locality on the edge of the New Jersey pine barrens. This specimen is thought to represent original material and was apparently intended to be the type of Britton's new variety. Therefore, this specimen has been designated as the lectotype of H. virgatum Lam. var. ovalifolium Britt. The specimen

selected by Jimenez (1973a) does not represent original material and is thus superseded according to Article 8 of the International Code of Botanical Nomenclature (Stafleu, 1978).

In H. denticulatum var. denticulatum the sepals are frequently ovate to obovate. This character contrasts with the other two taxa (H. incertum and H. denticulatum var. acutifolium) within the H. denticulatum complex, which have sepals that are narrowly ovate to lanceolate. However, in some populations of var. denticulatum, especially those from the Carolinas, the sepals of var. denticulatum may also be lanceolate. Variety denticulatum is separated from the other two taxa in the denticulatum complex primarily on the basis of leaf characters. In H. denticulatum var. denticulatum the leaves are typically appressed, ovate to narrowly elliptic, and generally shorter than the internodes. The leaves of var. denticulatum are typically shorter than those of H. incertum or H. denticulatum var. acutifolium and seldom exceed 2 cm. in length. For a more detailed comparison of H. denticulatum with the other taxa in the H. denticulatum complex, the reader is referred to the discussion under H. denticulatum var. acutifolium and H. incertum.

Representative specimens: UNITED STATES. ALABAMA. Mobile Co.: Dauphin Island, near Houston Pl., 15 Jul 1965, Deramus D 568 (NCU).

DELAWARE. Kent Co.: Felton, Aug 1867, Canby s.n. (NY). Sussex Co.: E of Ellendale, 5 Sep 1925, Pennell 12870 (MO).

GEORGIA. McIntosh Co.: 1.3 mi N of Fort Berrington Rd., 8 Jul 1972, Bozeman 758 (NCU).

NEW JERSEY. Atlantic Co.: Egg Harbor City, Sep 1917, MacKenzie 8048 (NY). Burlington Co.: Atsion, 21 Jul 1895, Heritage s.n. (ILL). Camden Co.: Winslow, 30 Sep 1908, Pennell 1777 (NY). Cape May Co.: 1 mi W of Bennett, 28 Aug 1913, Stone s.n. (NY). Cumberland Co.: 1.75 mi W of Bennets Mill, 2 Oct 1932, Fogg 5279 (TENN). Gloucester Co.: near Hardingville village, 8 Aug 1935, Long 47120 (GH). Monmouth Co.: Spring Lake, 31 Aug 1887, Lighthipe s.n. (NY). Ocean Co.: Toms River, 11 Jul 1908, Edmondson 4359 (NY).

NORTH CAROLINA. Brunswick Co.: near Inland Waterway on Caswell Beach, 20 Aug 1948, Godfrey 48412 (GH, TENN, NY). Buncombe Co.: near Biltmore, 3 Aug 1898, collector unknown, 523[d] (MO, NY, US). Carteret Co.: near Hunter Creek forest Rd., ca. 8 mi NW on N.C. 24, 23 Aug 1961, Bell 17167 (ILL, NCU, US). Chowan Co.: 0.5 mi S of Valhalla on N.C. 32, then 0.1 mi W on road to Macedonia, 30 Jul 1958, Ahles and Duke 47915 (NCU). Columbus Co.: 1 mi E of Delco, 5 Jul 1927, Wiegand and Manning 2015 (GH). Craven Co.: Newbern, 1 Aug 1898, Kearney 1982 (US). Cumberland Co.: Little River on N.C. 87 near Manchester, 7 Aug 1957, Ahles and Leisner 33401 (NCU, SMU). Gates Co.: 1.9 mi N of Sandycross, 1 Aug 1958, Ahles and Duke 48292 (NCU, TENN). Hoke Co.: 0.6 mi SE of McNeills Lake (S of Dundarrach), 26 Jun 1957, Ahles and Haesloop 29604 (NCU). Iredall Co.: Statesville, Jun 1879, Hyams s.n. (NY). Jones Co.: near US 17, 2.8 mi N of Maysville, 18 Jul 1958, Radford 37218 (NCU). Lenoir Co.: ca. 2 mi N of Pink Hill on N.C. 11, then W on Co. 1110 to jct. with Co. 1111, then N 0.1 mi, 31 Jul 1977, Webb and Whitten 53332 (TENN). Nash Co.: Middlesex, 21 Jul 1938, Godfrey 5424

(GH, US). New Hanover Co.: Wilmington, 4 Jul 1904, collector unknown, 523 (NY, US). Northampton Co.: near Margaretsville, 28 Jul 1893, Heller 1154 (GH, MO, NY). Onslow Co.: 3.9 mi N of jct. US 17 and N.C. 24 (in Jacksonville) along US 17, 31 Jul 1977, Webb and Whitten 53322 (TENN). Pender Co.: the Big Savannah, 3 mi N of Burgaw, 9 Jul 1963, Wilbur 6928 (SMU). Richmond Co.: 4 mi N of Hoffman, 1 Jul 1927, Wiegand and Manning 2014 (GH). Robeson Co.: 3.2 mi SE of Red Springs on N.C. 211, 1 Aug 1957, Ahles and Leisner 32999 (NCU). Sampson Co.: 3.5 mi E of Sampson-Cumberland Co. line on N.C. 102 and 2.5 mi S on dirt road, 28 Jun 1957, Ahles and Haesloop 30042 (NCU). Scotland Co.: 1.4 mi E of Johns, then 1.5 mi ENE on road to Maxton, 16 Oct 1957, Ahles 36996 (NCU).

SOUTH CAROLINA. Allendale Co.: 1.2 mi SSW of Barton on Co. 68, 30 Jun 1956, Bell 3997 (NCU). Berkeley Co.: 3 mi S of Bonneau, 13 Jul 1927, Wiegand and Manning 2018 (GH). Calhoun Co.: 0.1 mi W of Orangeburg-Calhoun Co. line (WSW of Elloree), 3 Jul 1957, Ahles and Haesloop 30380 (NCU). Charleston Co.: 3.8 mi N of Osborn, 21 Jul 1957, Ahles and Leisner 32130 (NCU). Clarendon Co.: 4 mi SSW of St. Paul, Radford 24465 (NCU). Colleton Co.: 0.6 mi SW of jct. Co. 48 and US 21 along Co. 48, 25 Jun 1956, Ahles and Bell 15385 (NCU). Darlington Co.: E of Kilgore's Pond, 21 Aug 1908, Coker s.n. (NY). Dorchester Co.: 0.8 mi NNE of jct. US 178 and Co. 20 along Co. 20, 20 Jul 1957, Ahles and Leisner 31849 (NCU). Florence Co.: 1.8 mi WSW of Hyman, 24 May 1957, Bell 7562 (NCU). Georgetown Co.: 7 mi E of Andrews, 27 Jun 1939, Godfrey and Tryon 156 (MO, NY, TENN, US). Hampton Co.: 1.7 mi SE of Early Branch on S.C. 28, 29 Jun 1956, Ahles and Bell 15723 (NCU). Horry Co.:

S of Co. 24 at end of Co. 135, W of Conway, 1 Jul 1958, Bell s.n. (NCU). Jasper Co.: 4.6 mi NE of Hardeeville on US 17, 8 Sep 1956, Bell and Ahles 18165 (NCU). Lee Co.: 3 mi SW of Lynchburg, 6 Jun 1957, Radford 24113 (NCU). Marlboro Co.: 3 mi S of Blenheim, 10 Jun 1956, Radford 12526 (NCU). Orangeburg Co.: Eutawville, 6-11 Sep 1909, Eggleston 5015 (NY, US). Sumter Co.: Privateer, 7.5 mi SW of Sumter, 4 Jun 1957, Radford 23844 (NCU). Williamsburg Co.: near S.C. 41, 3.6 mi SW of Andrews, 19 Oct 1957, Radford 31200 (NCU).

TENNESSEE. Coffee Co.: 3 mi SSE of Manchester by I-24, 14 Aug 1968, Kral 32233 (NCU, SMU). Franklin Co.: near Tullahoma, 7 Jul 1948, Fairchild et al. 9946 (GH, SMU, TENN). Warren Co.: NE of Morrison, 18 Jun 1948, Fairchild et al. 7565 (TENN).

VIRGINIA. Isle of Wright Co.: Cat Pond, S of Benn's Church, 18 Sep 1937, Fernald and Long 7530 (GH). Southampton Co.: Whitefield's Millpond, SW of Corinth, 7 Jul 1942, Fernald and Long 14366 (GH, NY, US). Sussex Co.: about 4 mi NW of Homeville, 19-20 Jul 1936, Fernald and Long 6837 (GH, NY, US). York Co.: NW of Grafton, 18 Sep 1937, Fernald and Long 7531 (GH, MO, NY, US).

10. Hypericum denticulatum Walt. var. acutifolium (Ell.) Blake. Rhodora 17: 134. 1915.

Hypericum virgatum Lam. Encyc. 4: 158. 1796. TYPE: UNITED STATES: no locality given. (HOLOTYPE: JUSS-P, photo GH!).

Hypericum acutifolium Ell. Sketch 2: 26. 1821. TYPE: UNITED STATES: GEORGIA: Milledgeville, no collector given, 19. (HOLOTYPE: CHARL!, photo GH!).

Brathys Erythreae Spach. Hist. Nat. Veg. 5: 452. 1836. TYPE: UNITED STATES: CAROLINA: Leconte s.n. (HOLOTYPE: P). The type of Brathys Erythreae was not available for study; however, based on the description it appears to be referable to Hypericum denticulatum var. acutifolium.

Hypericum Erythreae (Spach) Steud. Nom., ed. 2, 1: 787. 1840.

Hypericum virgatum Lam. var. acutifolium (Ell.) Coult. Bot. Gaz. 11: 106. 1886.

Hypericum denticulatum Walt. var. recognitum Fern. and Schub. Rhodora 50: 208, pl. 1110. 1948. TYPE: UNITED STATES: TENNESSEE: moist ground, Knoxville, Jul 1895, Ruth s.n. (HOLOTYPE: GH!, ISOTYPES: ILL!, US!).

Hypericum denticulatum Walt. var. virgatum (Lam.) Jimenez. Mem. Soc. Cienc. Nat. La Salle 33: 100. 1973. Nom. superfl., illigit.

Plant perennial, erect, 4.0-7.5 dm tall, generally with a few axillary branches arising from the apical portion of the stem. Leaves of the basal and medial portion of the stem typically exceeding the internodes. Leaves ascending to divergent, often becoming revolute on drying, somewhat coriaceous, obovate to oblong-elliptic to lanceolate, 1.0-3.5 (4.0) mm long, 0.3-0.8 (1.2) mm wide with acute to obtuse apices. Inflorescence a compound dichasium, sometimes producing ascending monochasial branches. Bracts lanceolate to subulate, to 6.0 mm long. Flowers on short pedicels, 2.0-4.0 mm long. Sepals narrowly ovate to lanceolate, 3.0-3.5 mm long, 1.5-2.5 mm wide, acute to acuminate. Petals yellow to yellow-orange, strongly inequilateral, persistent, 6.0-10.0 mm long, 5.0-6.0 mm wide. Stamens numerous, 50 to 80, loosely fused at base. Mature

capsule ovoid, brown, 3.0-4.5 mm long. Styles 2.0-4.0 mm long. Seeds brown, (0.5) 0.6-0.8 (0.9) mm long, striate to obscurely striate and pitted.

Chromosome number: n = 12.

Flowering period: late June to September.

Distribution and habitat: Dry roadsides, fields, and open woods from Maryland south to Georgia and Florida?, west to Louisiana, north to southern Illinois, Indiana, and Ohio (Figure IX-11).

Discussion: As previously discussed on page 275, several treatments (e.g. Fernald and Schubert, 1948; Fernald, 1950; Radford et al. 1968) have viewed H. denticulatum as being comprised of three varieties, while others (Gleason, 1952; Gleason and Cronquist, 1963; Adams, 1973; Jimenez, 1973a) have only recognized two varieties. With the exception of Jimenez (1973a), who lists H. denticulatum var. acutifolium in synonomy with H. denticulatum var. virgatum, all the treatments listed above recognize H. denticulatum var. acutifolium. Any discussion of H. denticulatum var. acutifolium is complicated by the fact that the circumscription of this variety differs among those recognizing two varieties of H. denticulatum and those recognizing three varieties. A further complication is introduced in the present treatment since certain elements formerly included in H. denticulatum var. acutifolium have been segregated and treated as a distinct species (e.g. H. incertum). This confusion is perhaps best clarified by reference to Table IX-1, page 276, which is a comparison of past treatments with that of the present, and an additional referral to the discussion under H.

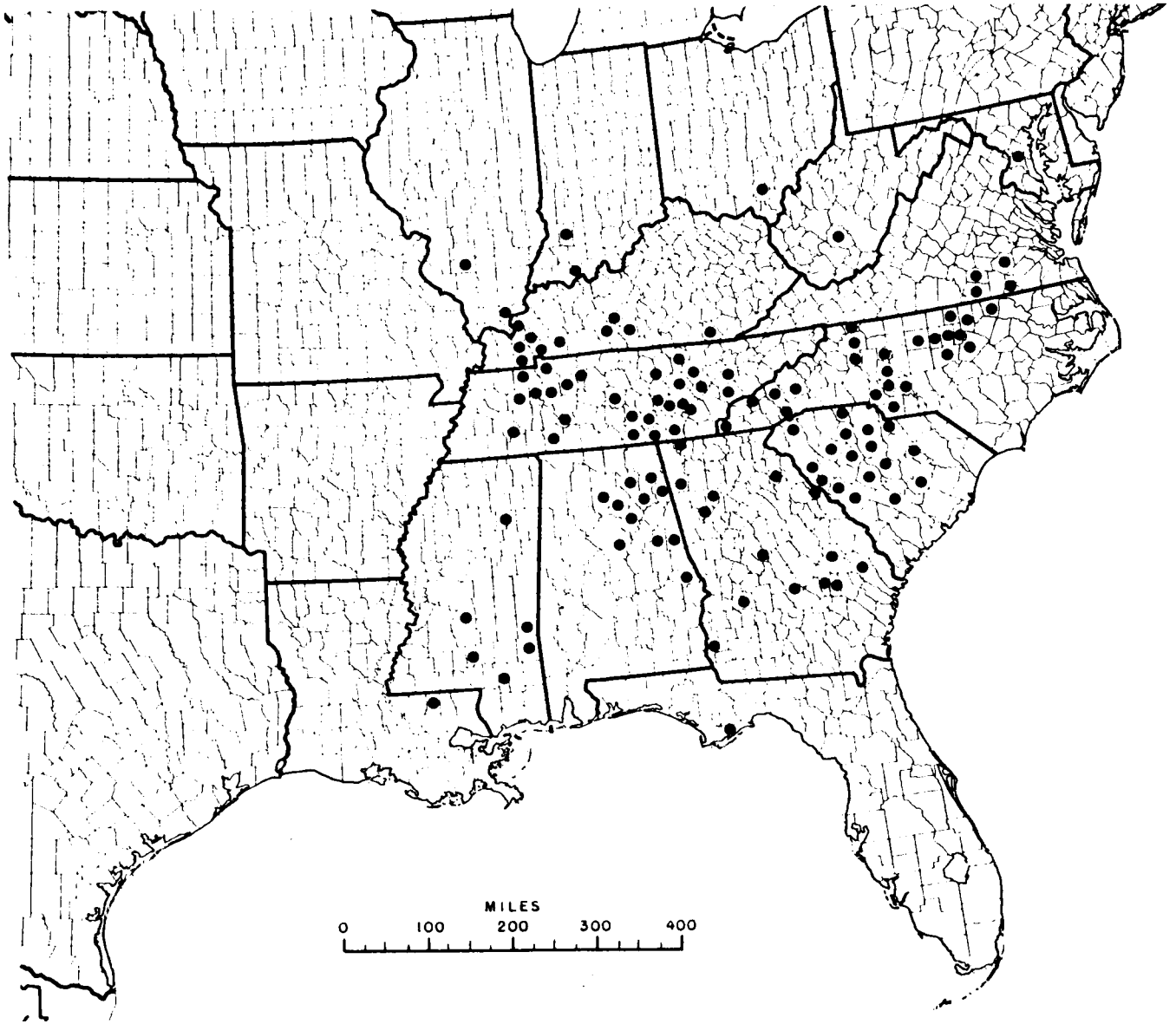


Figure IX-11. Distribution of Hypericum denticulatum var. acutifolium.

incertum (page 297), which outlines the reasons for separating and recognizing H. incertum as distinct from H. denticulatum.

Hypericum denticulatum var. acutifolium may be distinguished from var. denticulatum by its longer leaves that frequently exceed the internodes and by leaf shape that varies from lanceolate to oblong-elliptic to obovate. The seeds of var. acutifolium are typically longer than those of var. denticulatum and also differ in the ornamentation of the seed coat (Chapter IV). Hypericum denticulatum var. acutifolium has a haploid chromosome number of 12, while the most common count for var. denticulatum is n = 24. This could be used as an argument for the recognition of two taxa at the specific level; however, counts of n = 12 in var. denticulatum would seem to indicate that n = 24 represents an autopolyploid condition. While both varieties of H. denticulatum have distinctive chromatographic profiles, they are more similar to each other than either is to H. incertum. Neither of the two varieties of H. denticulatum have the C-glycosyl flavones or luteolin 7-O-glucoside that are found in H. incertum.

Radford et al. (1968) give the distribution of H. denticulatum var. acutifolium in North Carolina as the western portion of the state where it occurs in both the mountains and the western edge of the piedmont. Flavonoid studies of a population from western North Carolina (Alexander County) with lanceolate leaves showed the population to lack the C-glycosyl flavones and luteolin 7-O-glucoside. These compounds are present in populations from southern Georgia and the Florida panhandle that have formerly been included in var. acutifolium, but in the present treatment have been segregated as

H. incertum. Chemically, the population from Alexander County, North Carolina, more closely resembles the populations from the piedmont region of North Carolina that Radford et al. (1968) refer to H. denticulatum var. recognitum. Thus, the chemical evidence supports the discussion presented on page 301, which contends that H. denticulatum var. acutifolium as formerly conceived is an artificial taxon based on two distinct biological entities that were grouped primarily on the basis of lanceolate leaf shape.

The population examined from Alexander County, North Carolina, is somewhat atypical of most populations that are herein referred to H. denticulatum var. acutifolium. A study of herbarium specimens shows some populations of H. denticulatum var. acutifolium from Alexander County and adjacent Wilkes County to have lanceolate leaves with widely acuminate apices and numerous axillary branches from the medial and upper portion of the stem. These populations seem to be restricted to granite outcrops, a habitat known for its high endemism. These plants resemble H. incertum from which they can be separated by seed size and ornamentation, lack of aerenchyma tissue at the stem base, and habitat and geographical differences. Given the variation presently accepted in H. denticulatum var. acutifolium, the granite outcrop populations are not afforded taxonomic status at this time.

According to Jiménez (1973a) the H. denticulatum complex consists of two varieties, H. denticulatum var. denticulatum and H. denticulatum var. virgatum (Lam.) Jiménez. Variety virgatum is equivalent to H. denticulatum var. acutifolium of the present treatment, if those plants herein referred to H. incertum are

excluded from var. virgatum. The name H. denticulatum var. virgatum is superfluous and illegtimate since H. denticulatum var. acutifolium (Ell.) Blake was available at the time of publication of H. denticulatum var. virgatum. While H. virgatum Lam. was published in 1796, it does not have priority outside of its own rank (Stafleu, 1978).

An examination of the type of H. acutifolium in Elliot's Herbarium at the Charleston Museum (CHARL), shows it to have lanceolate leaves with acute apices and to have axillary branches from the upper portion of the stem. In these characters it is similar to H. incertum. However, on the basis of its overall habit and the geographic locality from which it was collected, it is interpreted to represent a narrow leaf plant referable to H. denticulatum var. acutifolium that inhabits the interior provinces of the eastern United States. The specimen was sent to Elliot by Dr. Boykin and was collected from near Milledgeville, Georgia (Elliot, 1824). This locality is beyond the present known range of the taxon herein referred to as H. incertum.

Hypericum denticulatum var. acutifolium is attributed to Florida based on specimens purportedly collected by Rugel from near Mount Vernon (Franklin County) and also on the basis of a specimen collected by Chapman, which only indicates the collection locality to be Florida. Another specimen referable to var. acutifolium gives Wilmington, North Carolina, as the collection locality. This specimen was collected in 1855, and as is the case with the specimens mentioned above, the collection locality is somewhat out of the range of var. acutifolium and possibly represents an error.

Although this latter collection has been deleted from Figure IX-11, page 286, the Rugel collection has been plotted since it would seem more likely based on the fact that other populations of var. acutifolium are known from southern Georgia, southern Mississippi, and Louisiana.

Representative specimens: UNITED STATES. ALABAMA. Blount Co.: 11.5 mi N of Blountsville on US 231, 15 Aug 1968, Kral 32396 (NCU, SMU). Cherokee Co.: along Ala. 9, 5 mi S Centre, 21 Jul 1968, Kral 31733 (GA, MICH, NCU, SMU). Clay Co.: 28 Aug 1897, Earle 995 (NY). Cullman Co.: Cullman, 18 Aug 1886, Mohr s.n. (US). De Kalb Co.: near former Lawson Ford on Town Creek, Sand Mt., 14 Aug 1945, Harper 3991 (US). Etowah Co. near Bale Pley, Jul 1880, Mohr s.n. (US). Lee Co.: Auburn, 1 Sep 1899, Earle s.n. (NY). Marshall Co.: 6 Jul 1899, collector unknown, 523g (US). Randolph Co.: near Blake Ferry, 5 mi W of Wedowee, 20 Aug 1940, McVaugh 5198 (GH). St. Clair Co.: ca. 2 mi S of Ashville on US 231, 15 Aug 1968, Kral 32347 (NCU, SMU). Shelby Co.: Calera, Everts s.n. (US).

FLORIDA. Franklin Co.: Apalachicola prope Mount Vernon, Aug 1843, Rugel s.n. (GH, NY, SMU, US).

GEORGIA. Bibb Co.: Macon, 25 Aug 1946, Sargent 99 (US). Bullock Co.: ca. 7 mi NW of Statesboro, 2 Sep 1961, Harper 4491 (GH). Catoosa Co.: Chickamauga Creek, near Ringgold, 6-12 Aug 1895, Small s.n. (NY). Cobb Co.: Kennesaw Mt. near Marietta, 23 Jun 1899, collector unknown, 523e (US). Dade Co.: slope of Lookout Mt., 28 Aug 1883, Smith s.n. (GH, US). Dodge Co.: Eastman, 2 Oct 1893, Mohr s.n. (NY). Douglas Co.: 2 mi E of Villa Rica, 28 Jul

1948, Cronquist 5423 (GA, NY, US). Early Co.: Big Cypress area near Baker Co. line, 11 Aug 1947, Thorne 6007 (MO). Emanuel Co.: 1.5 mi S Oak Park, 1 Aug 1962, Plummer and Pullen 826 (GA). Floyd Co.: Rome, 1889, Chapman s.n. (US). Lincoln Co.: N side of Little River ca. 1.5 mi above Savannah River, 28 Jun 1949, Duncan 9775A (GA, NCU, SMU, TENN). Montgomery Co.: near Oconee River bridge, S end of county, 5 Aug 1963, Fitzgerald 93 (GA). Oglethorpe Co.: Echol's Mill, SE of Point Peter, 4 Aug 1941, Duncan 3841 (GA). Richmond Co.: Augusta, 16 Jul 1909, Cuthbert s.n. (NY). Sumter Co.: Leslie, 15 Sep 1900, Harper 657 (NY, US). Toombs Co.: 2 mi E of Lyons, 30 Aug 1964, Kral 22317 (SMU). Worth Co.: SE corner of Dougherty Co., 14 Aug 1947, Thorne 6093 (MICH).

ILLINOIS. Pope Co.: S of Rock, 21 Jul 1948, Winterringer 4026 (ILL). Washington Co.: 30 Jun 1873, collector unknown, s.n. (NY).

INDIANA. Daviess Co.: ca. 5 mi N of Washington, 18 Sep 1934, Deam 55650 (GH). Spencer Co.: ca. 3 mi NW of Chrisney, near Little Pigeon Creek, 4 Sep 1939, Deam 59465 (GH, NY).

KENTUCKY. Barren Co.: near Diamond Cavern, 11 Sep 1940, Braun s.n. (US). Calloway Co.: between Murray and New Concord, 20 Jul 1937, Smith and Hodgdon 4084 (GH, NY, US). Christian Co.: Pennyrile State Park, 21 Sep 1954, Clebsch and Clebsch 18782 (NCU, TENN). Edmonson Co.: near Ollie, 4 Jul 1938, Braun s.n. (GH). Livingston Co.: 2 mi S of Ohio River near Joy, 15 Sep 1945, Duncan 6134 (GA). Lyon Co.: between Birmingham and Eddyville, 25 Jul 1937, Smith and Hodgdon 4224 (GH, US). Marshall Co.: Murray State University Biological Station, 27 Jun 1966, Hunter and Austin 1782

(NCU). Trigg Co.: Kentucky Lake, S of Fenton, 26 Jul 1954, Ahles 8123 (ILL, NCU). Warren Co.: near Green River, 6 Jun 1896, Price s.n. (MO). Whitley Co.: Cumberland Falls, 25 Jul 1937, Braun s.n. (GH).

LOUISIANA. St. Helena Par.: ca. 4 mi NE of Greensburg in Sec. 21, T2S, R6E, 4 Aug 1971, Allen 1319 (GA, SMU).

MARYLAND. Prince Georges Co.: ca. 1 mi SE of Laurel along Bear Branch, 12 Aug 1922, Wherry s.n. (US).

MISSISSIPPI. Chickasaw Co.: 3.7 mi SE of Pontotoc-Chickasaw Co. line on Miss. 41, 23 Jun 1964, Pullen 64527 (GA, NCU). Clarke Co.: ca. 1 mi SW of Pachuta, 20 Jul 1934, Harper 3238 (GH, MO, NY, US). Forrest Co.: 11 mi S of Hattiesburg, 17 Jul 1950, Webster and Wilbur 3431 (GA, GH, MICH, NY, SMU). Jefferson Davis Co.: 2.9 mi S of Carson, 11 Jul 1967, Jones 14275 (GA). Rankin Co.: Star, 18 Aug 1903, Tracy 8647 (GH, NY, US). Wayne Co.: T9N, R9W, Sec. 29, 14 Jul 1960, Teer 206 (SMU).

NORTH CAROLINA. Alamance Co.: 7 mi SSW of jct. N.C. 49 and 62 in Bellmont on N.C. 49 and 1 mi NNW on dirt road, 12 Jul 1956, Ahles and Bell 16904 (GA, NCU, SMU). Alleghany Co.: near N.C. 18, 1 mi SW of Edmond, 17 Jul 1959, Radford 42784 (NCU). Alexander Co.: 2.5 mi W of Vashti, 16 Jul 1956, Radford 13850 (GA, GH, NCU, NY). Buncombe Co.: Biltmore, collector unknown, 21 Jul 1897, 523[b] (GH, ILL, MO, NY, US). *Brunswick Co.: Wilmington, 22 Jun 1855, collector unknown, s.n. (GH). Cabarrus Co.: 1 mi W of Cabarrus-Stanly Co. line on N.C. 49 and 3.1 mi N on Gold Hill Rd., 23 Sep

*Deleted from Fig. IX-11, see page 289 for discussion.

1956, Ahles and Leisner 19606 (GH, NY, NCU). Chatham Co.: 1.1 mi S of Bonlee on US 421, 17 Oct 1956, Ramseur and Hammond 2735 (NCU). Cherokee Co.: Andrews, Sep 1900, Huger s.n. (NY). Davie Co.: Yadkin River, 2.5 mi S of Fork, 3 Aug 1956, Radford 14853 (NCU). Durham Co.: jct. of old Oxford Rd. and RR, ca. 5 mi NE of Durham, 29 Aug 1955, Blomquist 16764 (GA, GH, SMU, TENN). Granville Co.: 2.2 mi S of Lewis on US 15, 21 Jul 1956, Ahles and Leisner 17401 (NCU). Guilford Co.: Arden Place, Greensboro, 29 Jun 1927, Wiegand and Manning 2002 (GH). Haywood Co.: margin of Lake Junaluska, 12 Jul 1935, Oosting s.n. (GA). Henderson Co.: pasture near Edneyville, 27 Jul 1935, Correll 3303 (MICH). Mecklenburg Co.: 1.4 mi W of Cabarrus-Mecklenburg Co. line on N.C. 49, 6 Aug 1958, Ahles and Duke 48494 (NCU). Orange Co.: 8 mi N of Chapel Hill, 28 Jun 1927, Wiegand and Manning 2001 (GH). Person Co.: 6.5 mi W of Moriah on road to Timberlake, 29 Jul 1977, Webb and Whitten 53308 (TENN). Rowan Co.: vic. of Faith Post Office, 14 Aug 1891, Small and Heller s.n. (GH, NY, US). Stanly Co.: 3.5 mi S of Misenheimer on Millingport Rd., 6 Jul 1956, Ahles and Leisner 16206 (NCU, TENN). Swain Co.: Great Smoky Mountains, 9 Aug 1891, Beardslee and Kofoid (GH, MO, NY). Union Co.: 2 mi WSW of Marshville, 7 Jun 1957, Ahles and Haesloop 27599 (GH, NCU). Wake Co.: near Morrisville, 13 Jul 1949, Godfrey 49528 (NY). Warren Co.: 1 mi NW of Inez, 26 Jul 1956, Bell 4403 (NCU). Wilkes Co.: W face of Pores Knob, 21 Jul 1940, Stewart 1804 (NCU).

OHIO. Jackson Co.: near Jackson, 20 Aug 1937, Drushel 10759 (MO, NY, US).

SOUTH CAROLINA. Abbeville Co.: 3.5 mi S of Calhoun Falls, 29 Jun 1957, Radford 26031 (NCU). Aiken Co.: Vancluse, 6 Aug 1898, Eggert s.n. (MO, NY, US). Cherokee Co.: 2.8 mi SW of Blacksburg on US 29A, 18 Sep 1957, Ahles 34433 (NCU). Chester Co.: near Armenia Church, ca. 10 mi SSW of Chester, 18 Sep 1957, Bell 10084 (NCU). Clarendon Co.: 4 mi S of St. Paul, 11 Jun 1957, Radford 24364 (NCU). Edgefield Co.: 4 mi NE of Pleasant Lane, 1 Jul 1957, Radford 26367 (NCU). Fairfield Co.: near Dawkins, 25 Jul 1956, Freeman 56512 (NCU). Lancaster Co.: 3.3 mi N of Kershaw-Lancaster Co. line on Co. 21 ca. 6.5 mi W of Heath Springs, 13 Jul 1957, Ahles and Haesloop 31271 (NCU). Laurens Co.: 50 yds S of S.C. 72, 1.4 W of Co. line E of Clinton, 4 Oct 1957, Bell 10224 (NCU). Lee Co.: 3.4 mi N of Lucknow, 26 Jul 1957, Radford 27348 (NCU). Lexington Co.: near US 178 on Little Hollow Creek, 6 mi N of Gilbert, 9 Jul 1957, Radford 27133 (NCU). McCormick Co.: near S.C. 81, 2.5 mi NW of Mount Carmel, 30 Jun 1957, Radford 26097 (GA, NCU). Newberry Co.: 3.5 mi NNE of Chappells, 25 Jun 1957, Bell 9167 (NCU). Orangeburg Co.: Orangeburg, 17 Aug 1905, Hitchcock s.n. (ILL). Pickens Co.: Glassy Mt., 3 mi NE of Pickens, 8 Oct 1957, Freeman 57857 (NCU). Richland Co.: near Columbia, L.R.E. s.n. (GH). Union Co.: US 176, 1.5 mi E of the Tyger River, 19 Jun 1956, Freeman 56354 (NCU).

TENNESSEE. Benton Co.: Camp Mack Morris, 30 Jun 1950, Walker 16015 (TENN). Bledsoe Co.: between Shoemate Gap and Mt. Crest, 1 Jul 1947, Shanks et al. 3460 (TENN). Carroll Co.: 2 mi N of Hollow Rock School on road to Vale, 9 Jul 1976, Webb 52072 (TENN). Carter Co.: along Storey Creek E of Elizabethton, 22 Jul

1948, Sharp et al. 11766 (TENN). Chester Co.: Henderson, Jul 1893, Bain 395 (GH, NY). Coffee Co.: 3 mi SE of Manchester, N side of Hwy. 41, 12 Aug 1954, Shanks 18495 (TENN). Cumberland Co.: between Crossville and Crab Orchard, 8 Jun 1934, Rossbach and Hodgdon 5168 (GH). Dickson Co.: 1.5 mi E of Tennessee City, 12 Oct 1949, Woods et al. 14893 (TENN). Fentress Co.: 2.4 mi E of jct. 62 and 127 in Clarkrange on S side of Hwy. 62, 24 Jul 1976, Webb et al. 52093 (TENN). Franklin Co.: near Tullahoma, 7 Jul 1948, Fairfield et al. 9946 (NY). Grundy Co.: along S rim at W end of Savage Gulf, 11 Jul 1977, Webb and Wofford 53301 (TENN). Hamilton Co.: above Soddy, Willow Ridge, 14 Jul 1934, Sharp and Underwood 2367 (NY, TENN). Henry Co.: 1.9 mi W of jct. US 641 and Hwy. 8172 (in Puryear) along Hwy. 8172, 3 Jul 1977, Webb and Webb 53262 (TENN). Humphreys Co.: 3 mi E of McEwen on US 70, 7 Jul 1965, Rogers 33966 (TENN). Knox Co.: near Knoxville, Aug 1891, Ruth s.n. (MO). Lewis Co.: SE of Hohenwald, 8 Aug 1947, Sharp et al. 5767 (NY, TENN). Marion Co.: top of Walden Ridge by Tenn. 27, 18 Sep 1946, Ford and Russell 2250 (TENN). Meigs Co.: near Decatur, 13 Jul 1934, Sharp and Underwood 2316 (TENN). Morgan Co.: along Fork River near Rugby, 8 Jul 1951, Sharp 15124 (NCU, TENN). Putnam Co.: Double Springs Prairie, Rt. 56, 1 mi N of Baxter, 11 Jul 1958, DeSelm 1864 (TENN). Rhea Co.: NE of Morgan Springs, 27 Jun 1947, Shanks 4366 (NCU, TENN). Roane Co.: Walden's Ridge above Rockwood, 29 Sep 1949, Shanks et al. 13812 (TENN). Rutherford Co.: Gladeview Prairie, 6 mi SE of Murfreesboro, 30 Jun 1957, DeSelm 1579 (TENN). Stewart Co.: near marker 9M4, oak hickory forest, 7 Jul 1966, Ellis 01783 (NCU). Van Buren Co.: Fall Creek Falls State Park,

29 Jul 1947, Shanks et al. 2991 (SMU, TENN). Wayne Co.: between Collinwood and Waynesboro, 7 Jul 1947, Sharp et al. 47-101 (TENN).

VIRGINIA. Dinwiddie Co.: E of McKenny, 13 Oct 1941, Fernald and Long 13976 (GH, NY, US). Greensville Co.: near Readjuster Bridge over Nottoway River, NE of Orion, 13 Jun 1940, Fernald and Long 12132 (GH). Lunenburg Co.: 1.2 mi NW of South Meherrin River on Co. 633 (S of Rehoboth), 19 Sep 1965, Ahles and James 61855 (NCU). Mecklenburg Co.: near John H. Kerr Dam, 25 Aug 1967, Seaman 7268 (NCU).

WEST VIRGINIA. Fayette Co.: edge of New River, Cotton Hill, 26 Jun 1941, Sharp s.n. (TENN).

11. Hypericum incertum Steud. Nom., ed. 2, 1: 788. 1840. Nomen novum. Based on Brathys lanceolata Spach, Hist. Nat. Veg. 5: 453. 1836. Brathys lanceolata Spach. Hist. Nat. Veg. 5: 453. 1836. TYPE: UNITED STATES: midi des Etats Unis. (TYPE: P). Hypericum harperi R. Keller. Bot. Jahrb. 58: 198. 1923. TYPE: UNITED STATES: GEORGIA: Sumter Co.: wet pine barrens, 9 Jul 1901, Harper 1028. (LECTOTYPE: BM, ISOLECTOTYPES: GH!, MO!, NY!, US!)

Plants perennial, erect, 3.0-10.0 dm tall, typically with numerous axillary branches from along the medial and upper portion of the stem. Basal portion of the stem typically spongy, up to 8.0 mm in thickness, often with numerous suckers arising from a spongy horizontal rhizome. Leaves ascending, sessile, partially encircling the stem. Lower leaves narrowly elliptic to lanceolate, about equaling the internodes, medial and upper leaves lanceolate to linear-lanceolate, acuminate, 1.0-3.0 cm long, 3.0-5.0 (8.0) mm

wide, generally exceeding the internodes. Terminal inflorescence initially a compound dichasium, becoming monochasial and producing ascending branches. Inflorescence of axillary branches appearing racemose. Bracts lanceolate to subulate, up to 6.0 mm long. Sepals acute to acuminate, lanceolate, frequently unequal, 3.0-5.0 mm long, 0.8-1.0 mm wide. Petals yellow-orange, persistent, strongly inequilateral, 6.0-10.0 mm long, 5.0-7.0 mm wide. Stamens numerous (50 to 80), attached at base. Mature capsule ovoid, brown, 3.0-4.5 mm long. Styles 2.0-4.0 mm long. Seeds light to dark brown, 0.5-0.6 (0.65) mm long, pitted.

Chromosome number: n = 12.

Flowering period: July to September.

Habitat and distribution: Taxodium swamps and wet pine barrens of the Florida panhandle and coastal plain of Georgia and South Carolina (Figure IX-12).

Discussion: Field studies indicate H. incertum to grow in open swamps dominated by Taxodium ascendens Brongn. or around the margins of open depressions where it is commonly associated with such taxa as Pluchea foetida (L.) DC., Eriocaulon decangulare L., Ludwigia pilosa Walt., Sabatia dodecandra (L.) BSP., Rhexia virginica L., Bacopa caroliniana (Walt.) Robins., and various species of grasses and sedges. The habitat of H. incertum is inundated during the early portion of the growing season but becomes drier in late summer and early fall. As a result of the aquatic habitat occupied by this species, the lower stems of H. incertum are thickened with aerenchymous tissue, which provides a good

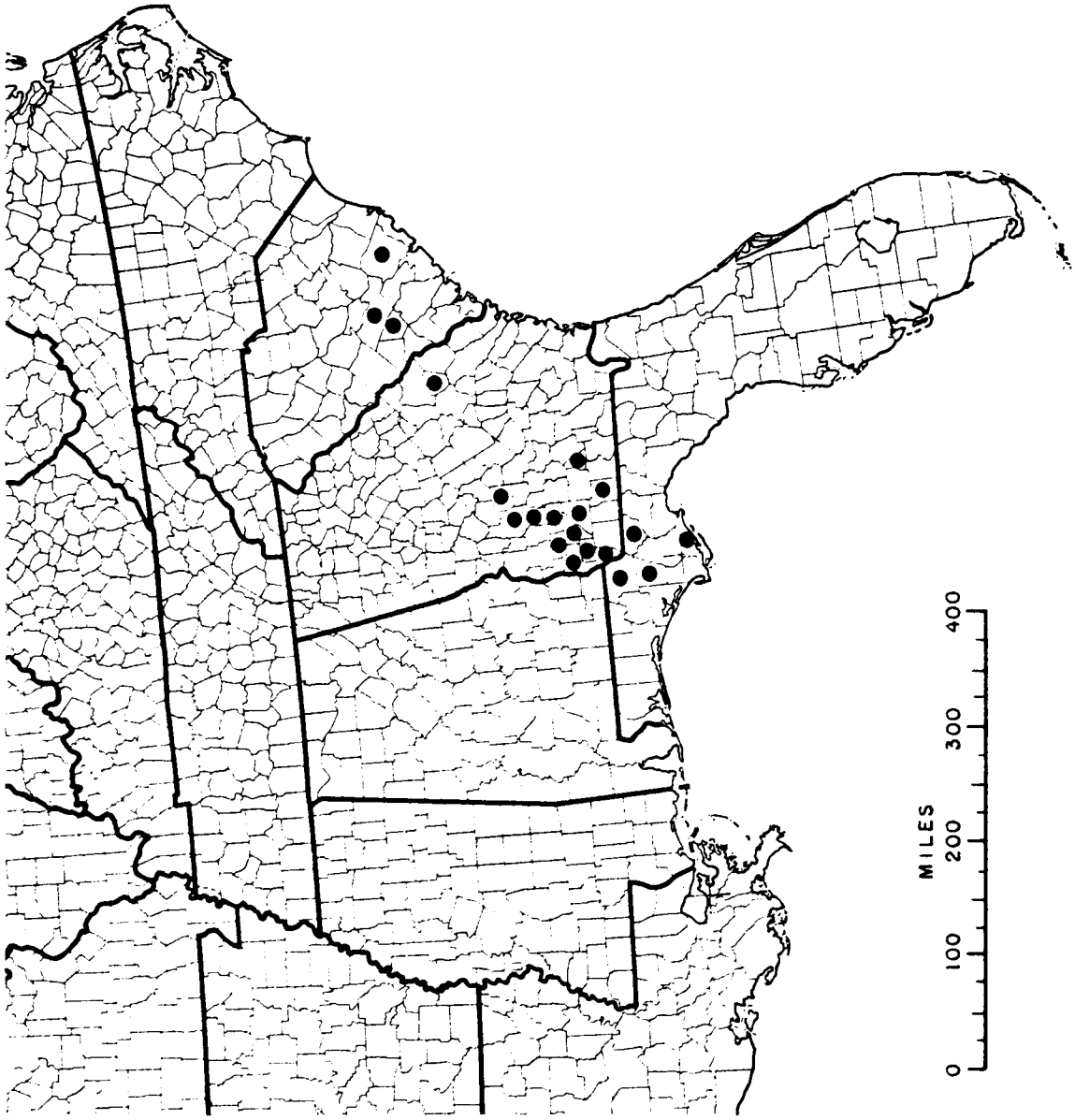


Figure IX-12. Distribution of Hypericum incertum.

character for distinguishing it from individuals of H. denticulatum var. acutifolium, which may also have lanceolate leaves.

Other characters that distinguish H. incertum from H. denticulatum var. acutifolium include smaller seeds, numerous axillary branches from the medial and upper portion of the stem, and its distinctive ecological niche. Hypericum denticulatum var. acutifolium typically inhabits more xeric sites such as old fields, roadsides, and dry open woods of the more interior physiographic provinces of the eastern United States (Figure IX-11, page 286). Studies with the SEM (Chapter IV) have also shown the ornamentation of the seed coat of H. incertum to differ from that of H. denticulatum var. acutifolium. Chemically the two taxa are readily distinguishable by the presence of C-gylcosyl flavones in H. incertum. Chromosome counts of H. incertum and H. denticulatum var. acutifolium show both to be n = 12 (Chapter VI).

The C-gylcosyl flavones found in H. incertum also distinguish it from H. denticulatum var. denticulatum, which lacks this class of compounds (Chapter V). The ornamentation of the seed coat of both of these taxa is similar as has been noted in Chapter IV, and both have seeds of similar size. The ovate to narrowly elliptic leaves, which are typically appressed and shorter than the internodes, and the strict stem of H. denticulatum var. denticulatum distinguish this taxon from H. incertum.

Additional evidence for distinguishing H. incertum at the specific level relates to the observation of a sympatric population of H. incertum and H. denticulatum var. denticulatum in Berkeley

County, South Carolina. Ecologically, the two taxa may occupy a similar ecological niche. However, their ranges only overlap in the coastal plain of South Carolina and Northeastern Georgia (Figures IX-12, page 298, and IX-10, page 274). In the Berkeley County population mentioned above, H. incertum and H. denticulatum were observed to inhabit the same cypress depression. Hypericum incertum occupied the more inner portion of the depression, while H. denticulatum var. denticulatum grew around the margins of the depression. No intermediates were observed although the two taxa grew within approximately fifty feet of each other. This situation would seem to indicate the two taxa to be distinct biological species. Additional field observations and/or breeding experiments are needed to strengthen this assessment.

As previously noted in this discussion, n = 12 has been found in H. incertum while both n = 12 and n = 24 have been reported for H. denticulatum var. denticulatum (Chapter VI). Since n = 24 appears to be the most common number in populations of H. denticulatum var. denticulatum, hybrids between H. incertum and var. denticulatum would be sterile or have reduced fertility.

In view of the chemical differences, the morphological differences, its distinctive ecological niche (as compared to H. denticulatum var. acutifolium), and field observations, it is felt that H. incertum is best treated as a species rather than as a variety of H. denticulatum.

In the past treatments of Fernald and Schubert (1948), Fernald (1950), Gleason (1952), Radford et al. (1968), and Adams (1973), plants herein referred to H. incertum have been included

under H. denticulatum var. acutifolium, while Jimenez (1973a) included them under H. denticulatum var. virgatum. Small (1933) recognized H. acutifolium as a distinct species which like the varieties listed above includes H. incertum in part. In the opinion of the present author, plants formerly included under these names (i.e. H. denticulatum var. acutifolium, H. denticulatum var. virgatum, and H. acutifolium) represent two distinct biological entities that have been artifically grouped on the basis of a lanceolate leaf shape. Thus, on the basis of leaf shape, H. incertum was included with the more interior populations of H. denticulatum having lanceolate leaves. These latter populations have in the present study been included under H. denticulatum var. acutifolium. A comparison of past treatments of the H. denticulatum complex with the present treatment is contained in Table IX-1, page 276.

Jiménez (1973a) apparently not realizing that Fernald and Schubert (1948) had indicated Harper 1028 to be the type of H. harperi, designated another of Harper's collections (i.e. 1006) as the type of this species. The designation of Jiménez (1973a) is contrary to Article 8 of the International Code of Botanical Nomenclature (Stafleu, 1978) and Harper 1028 should be retained as the type of H. harperi.

The type of Brathys lanceolata Spach was requested from Paris but at the time of this study was unavailable for examination. Based on the description and its collection locality, it is thought to be the plant that in the present study has been referred to as H. incertum. This latter name is a nomen novum created by Steudel (1840) when he transferred the species in the genus Brathys to

Hypericum. The use of the name H. incertum should be considered as tentative until the type of B. lanceolata can be studied. In the event that B. lanceolata is a narrow leaved plant referable to H. denticulatum var. acutifolium, the correct name of the taxon is H. harperi.

Representative Specimens. UNITED STATES. FLORIDA. Calhoun Co.: 19.6 mi N of Wewahitchka, 21 Jul 1967, McDaniel 9481 (GA). Gadsden Co.: 3 mi NW of Gretna, 10 Oct 1959, Godfrey 58994 (GH, NCU, SMU). Jackson Co.: Sneads, 20 Oct 1900, Curtiss 6731 (GH, ILL, MO, NY, US).

GEORGIA. Baker Co.: 4 mi S of Newton on Hwy. 91, 25 Aug 1946, Ford and Thorne s.n. (TENN). Calhoun Co.: 1 mi N of Leary, 28 Jul 1947, Thorne 5666 (GA, GH). Cook Co.: 4 mi S of jct. Ga. 76 with Ga. 37 (in Adel) along Ga. 76, 17 Jul 1977, Webb and Ross 53293 (TENN). Dooly Co.: 2.7 mi SSE of Unadilla along RR, 31 Jul 1953, Duncan et al. 16818 (GA). Dougherty Co.: 11 mi S of Albany near Newton Rd., 28 Jun 1947, Thorne 5017 (MICH). Early Co.: 6 mi SE of Blakely, 29 Jul 1946, Duncan 6793 (GA). Jenkins Co.: 2.5 mi N of Millen, 9 Aug 1936, McVaugh and Pyron 920 (GA). Lee Co.: 6 mi NE of Leesburg, 22 Aug 1948, Thorne and Muenscher 8344 (US). Miller Co.: 7 mi ESE of Colquitt, 8 Jul 1947, Thorne 5209 (MO, NY, US). Mitchell Co.: 5 mi N of Camilla, 31 Jul 1947, Thorne 5794 (GA). Seminole Co.: 1.5 mi E of Donaldsonville, 26 Oct 1963, Godfrey 63207 (NCU, SMU, US). Sumter Co.: wet pine barrens, 9 Jul 1901, Harper 1028 (GH, MO, NY, US). Thomas Co.: along Ga. 133, 9.8 mi S of jct. US 84 and Ga. 133, ca. 15 mi SE of Thomasville, 17 Jul 1977, Webb and Ross 53295 (TENN).

SOUTH CAROLINA. Bamberg Co.: along US 301, 0.3 mi N of jct. with S.C. 64, 8 Sep 1967, Radford et al. 11399 (GA, ILL, NCU). Berkeley Co.: 6 mi SW of Moncks Corners, 7 Aug 1939, Godfrey and Tryon 1454 (TENN, NY, US). Orangeburg Co.: Eutawville, 6-11 Sep 1909, Eggleston 5017 (GH, MO, NY). Sumter Co.: 5 Aug 1884, Smith s.n. (GH, NY, US).

12. Hypericum setosum L. Sp. Pl. 787. 1753. TYPE: UNITED STATES: VIRGINIA: Clayton 153 (not 135). (LECTOTYPE: BM!)
Ascyrum villosum L. Sp. Pl. 788. 1753. TYPE: Hypericum virginianum frutescens pilosissimum, Plukenet, Phytogr.: t. 245, f. 6. 1691. (LECTOTYPE: original description and illustration.)
Hypericum villosum (L.) Crantz. Inst. rei Herb. 2 : 520. 1766.
Hypericum pilosum Walt. Fl. Carol. 190. 1788. TYPE: UNITED STATES: SOUTH CAROLINA: Berkeley Co.: grass-sedge bog or savannah, 14 miles south of Moncks Corners, 11 Aug 1939, Godfrey and Tyron 1424. (NEOTYPE herewith designated, NY!, ISONEOTYPE: GH!, US!).
Hypericum simplex Michx. Fl. Bor. Am. 2: 80. 1803. Nom. superfl., illigit. Based on Ascyrum villosum L.
Hypericum Nuttallii G. Don. Gen. Syst. 1: 607. 1831. Nom. superfl., illigit. Apparently based on Hypericum pilosum Walt.
Brathys tomentosa Spach. Hist. Nat. Veg. 5: 453. 1836. Nom. superfl., illigit. Based on Hypericum pilosum Walt.

Plant annual or perennial, erect, 2.0-7.0 (8.0) dm tall, stem simple or occasionally branched apically. Stem and leaves scabrous-tomentose to pilose. Leaves numerous, sessile, clasping, 1-nerved, ovate to elliptic to lanceolate, appressed to ascending

with acute apex, 4.0-15.0 (18.0) mm long, (1.5) 2.0-7.0 mm wide. Lower leaves about equaling to slightly exceeding the internodes with upper leaves reduced and shorter than the internodes. Inflorescence a compound dichasium, often with ascending monochasial branches. Sepals ovate to ovate-lanceolate to obovate, acute, conspicuously ciliate, 3.0-5.0 mm long, 1.5-2.5 mm wide, about equaling to shorter than the mature capsule. Petals yellow, strongly inequilateral, 5.0-7.0 mm long, 5.0-7.0 mm wide. Stamens numerous (20 to 40). Styles 3 or rarely 4, 1.5-2.0 mm long. Mature capsule ovoid, (3.5) 4.0-5.0 mm long, brown to brownish-black. Seeds numerous, 0.4-0.6 mm long, yellow to golden brown, obscurely striate and pitted.

Chromosome number: n = 6.

Flowering period: June to September.

Distribution and habitat: Wet ditches, bogs, savannahs, and wet pinelands along the Coastal Plain from southeastern Virginia, south to the Florida panhandle and west to Louisiana (Figure IX-13); also attributed to eastern Texas by Correll and Johnston (1970).

Discussion: In addition to the pubescent Hypericum setosum, Linnaeus (1753) also described Ascyrum villosum accompanied by the phrase name "Ascyrum foliis hirsutis, caule stricto." Both of these species were indicated to be inhabitants of Virginia. As noted by Adams (1957), A. villosum cannot be considered an Ascyrum as "No member of this genus has the character 'foliis hirsutis.'" Since H. setosum is the only pubescent species of the genus (sensu lato) found in the United States, it would appear that the same plant is described under different genera (i.e. Ascyrum and Hypericum).

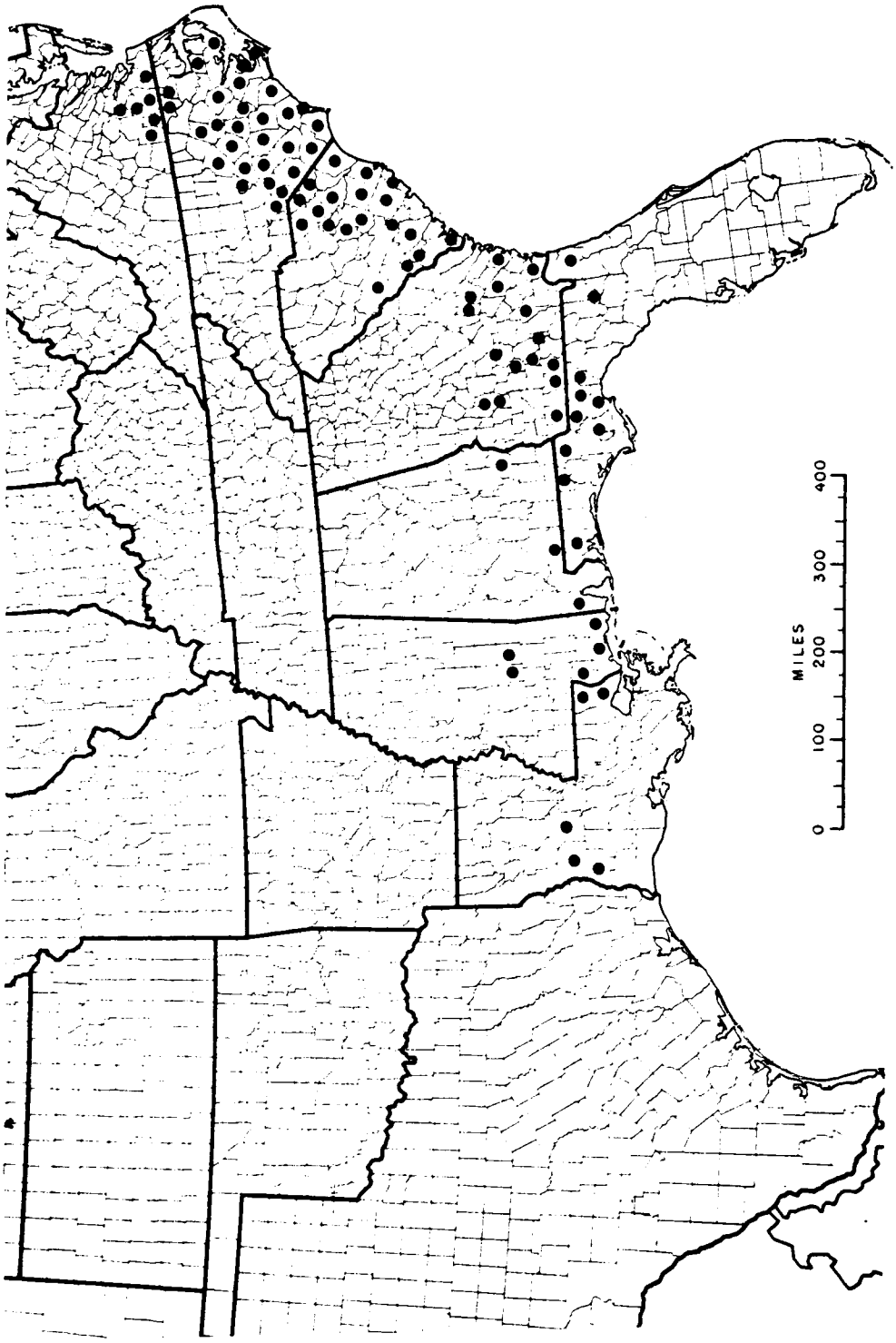


Figure IX-13. Distribution of Hypericum setosum.

In the protologue of A. villosum, Linnaeus references Plukenet (1696) (Pluk. alm. 189. t. 245. f. 6.). The illustration in Plukenet's work is an excellent line drawing readily referable to H. setosum. However, the drawing depicts a fruiting specimen lacking petals. Adams (1957) has suggested that at the time of publication of the first edition of Species Plantarum, Linnaeus had no specimens of Ascyrum, but based the species described under this genus on the works of earlier authors. Robson (1979) has noted that in the protologue of A. villosum, Linnaeus inserted a symbol (e.g., +) following "Habitat in Virginia" that apparently signified that he did not have first hand knowledge of this species. Robson (1979) has proposed that the description and illustration of Plukenet (1696) be chosen as the lectotype of A. villosum and that the species should be considered as a taxonomic synonym of H. setosum. Both Robson's selection of a type and the taxonomic position afforded A. villosum are in accord with the view of the present author and have been followed in the present treatment.

While the major portion of Thomas Walter's herbarium is now deposited at the British Museum, several of the types of species described in Flora Caroliniana are missing (Blake, 1915). This is apparently the case with Hypericum pilosum, since N. K. B. Robson (pers. comm.) of the British Museum has indicated that the type of H. pilosum is not in Walter's herbarium. Therefore, a neotype from South Carolina has been designated to serve as the type for this name.

Hypericum setosum is the only pubescent species of Hypericum in the United States and, therefore, is one of the most distinctive.

In general habit it most closely resembles H. denticulatum. The H. denticulatum complex and H. setosum represent the most primitive members of sect. Spachium in the eastern United States.

Representative specimens: UNITED STATES: ALABAMA. Barbour Co.: along Lake Eufaula, ca. 5 mi S of Eufaula, 11 Sep 1963, Kral 33197 (SMU). Escambia Co.: 6.5 mi E of East Brewton on US 29, 16 Jul 1977, Webb and Ross 53283 (TENN). Mobile Co.: 6.5 mi S of Mt. Vernon, 26 Oct 1960, Shinners 29006 (SMU).

FLORIDA. Duval Co.: near Jacksonville, Sep 188?, Curtiss 268 (GA, GH, MO, NY, US). Gadsden Co.: N side of Lake Talquin, W of Midway, 5 Nov 1956, Williams 11-5-3 (TENN). Holmes Co.: Westville, 28 Aug 1899, collector unknown, 2564[a] (US). Jackson Co.: 6 mi W of Sneads, 8 Aug 1927, Wiegand and Manning 2058 (GH). Jefferson Co.: 8 mi SSW of Monticello, 13 Sep 1957, Kral 5765 (GH, SMU). Leon Co.: 2 mi N of Chaires at jct. of Hwy. 154 and Hwy. 158, 27 Sep 1955, Gillespie and Godfrey G9-55-39 (GH). Liberty Co.: along the Ochlockonee River, W of Tallahassee, 8 Sep 1960, Godfrey 60256 (SMU). Santa Rosa Co.: near the Yellow River, NW of Maxton, 7 Oct 1962, Godfrey 625 (SMU). Union Co.: N side of road next to plots N of Lake Butler, S19, T4S, R20E, 7 Aug 1961, Gray 10 (GH, US). Wakulla Co.: St. Marks Wildlife Refuge, near the Lighthouse road, 2 Oct 1961, Godfrey 61497 (SMU).

GEORGIA. Ben Hill Co.: 7 mi E of Ben Hill-Turner Co. line on Ga. 90, ENE of Rebecca, 26 Oct 1968, Faircloth 5696 (GA). Brooks Co.: along US 84, 6 mi W of jct. of US 84 and Ga. 33 (in Quitman), 17 Jul 1977, Webb and Ross 53294 (TENN). Camden Co.: SE of Folkston, 22 Aug 1962, Blake s.n. (GA). Cook Co.: 4.3 mi NE

of Adel, 23 Sep 1967, Faircloth 4856 (GA). Decatur Co.: 1.3 mi SSW of Faceville, 6 Sep 1955, Thorne and Davidson 17124 (GA). Lanier Co.: along US 221, 2.5 mi WSW of Lakeland, 12 Oct 1967, Faircloth et al. 4962 (GA). Lee Co.: near Fox Pond, SE of Leesburg, 21 Aug 1948, Thorne and Muenscher 8313 (GA). McIntosh Co.: along US 17, 2.4 mi N of jct. of US 17 and Hwy. 251, 25 Aug 1976, Webb et al. 52494 (TENN). Sumter Co.: a mile or two NW of Leslie, 3 Aug 1958, Harper 4403 (GA, GH, MO). Tattnail Co.: ca. 2 mi S of Glenville, 11 Sep 1972, Godfrey 72101 (TENN, US). Thomas Co.: along Rt. 319, 0.8 mi S of jct. 319 and 188, 27 Aug 1976, Webb et al. 52526 (TENN). Tift Co.: Tifton, 18 Aug 1933, Stuckey s.n. (GA). Toombs Co.: 2.5 mi N of courthouse, 1 Aug 1962, Pullen and Plummer 815 (GA). Ware Co.: Waycross, 25 Aug 1900, collector unknown, 2564[C] (US). Wayne Co.: 3.6 mi N of Hortense, 16 Sep 1961, Duncan 21829 (GA).

LOUISIANA. Beauregard Par.: 0.5 mi N of Ragley, 8 Sep 1955, Shinners 21567 (SMU). Rapides Par.: Alexandria, Hale s.n. (NY). St. Tammany Par.: S of jct. US 11 and Rt. 41, along US 11, 14 Sep 1969, Rogers 1475 (MO). Vernon Par.: 2.3 mi NW of Leesville, between highway and RR, 10 Oct 1955, Shinners 22262 (GH, SMU). Washington Par.: along "Dollar Road" in Sec. 16, ca. 4 mi WSW of Varnado, 11 Oct 1970, Thieret 32535 (GA, SMU).

MISSISSIPPI. Harrison Co.: ponds near Mississippi City, 14 Sep 1885, Smith 531 (US). Jasper Co.: 1.7 mi N of Jones-Jasper line, I-59, 10 Jul 1967, Jones 14228 (GA). Jackson Co.: Scranton, 5-6 Aug 1896, Pollard 1193 (GH, MO, NY, US). Pearl River Co.: 1 mi N of Picayune, 8 Aug 1964, Sargent 8350 (GA). Smith Co.: Taylorville, 21 Aug 1903, Tracy 8646 (GH, MO, NY, SMU).

NORTH CAROLINA. Bladen Co.: 2.5 mi N of Richardson along paved road, 3 Aug 1957, Ahles and Leisner 33275 (GA, NCU). Brunswick Co.: along N.C. 133, 4 mi S of its jct. with US 17, 14 Sep 1963, McCrary and Ahles 1198 (NCU). Carteret Co.: RR ditch, ca. 0.5 mi SE of Co. 1103 off N.C. 58, S of Kuhns, 10 Sep 1966, Bradley et al. 3489 (NCU, TENN). Columbus Co.: Nakina, 31 Aug 1932, Schallert 904 (SMU). Craven Co.: near US 70, 2.4 mi NW of Cherry Point, 10 Sep 1958, Radford 40188 (NCU). Cumberland Co.: along Hwy. 87, 5 mi SE from Fayetteville, 8 Oct 1939, Radford and Stewart s.n. (NCU). Duplin Co.: 3.8 mi SE of Chinquapin, 3 Oct 1957, Ahles 35878 (NCU). Harnett Co.: Spout Springs, 26 Sep 1958, Stewart s.n. (NCU). Hertford Co.: entrance to Camp P-D, Camp Company Forest, E of Como, 23 Jul 1949, Fox and Godfrey 2793 (GH, NY). Hoke Co.: 1.8 mi W of Montrose on Mountain Creek, 9 Aug 1957, Ahles 33777 (NCU). Hyde Co.: near US 264, 3.2 mi E of Leechville, 18 Oct 1958, Radford 42644 (NCU). Johnston Co.: near jct. of N.C. 42 and N.C. 96, E of Clayton, 9 Sep 1961, Radford 44390 (NCU). Lee Co.: 2 mi S of Moncure near Lonnie Womble's Creek, 19 Jul 1955, Beard 1289 (NCU). Lenoir Co.: 1.6 mi SE of Strabane, 28 Aug 1957, Radford 28902 (NCU). Nash Co.: 1.1 mi E of Middlesex on US 264, 12 Jul 1956, Ahles and Bell 16647 (NCU). New Hanover Co.: prope Wilmington, Oct 1867, Canby s.n. (MICH, NY, US). Northampton Co.: 4 mi SE of Jackson on N.C. 305, 7 Jul 1958, Ahles and Duke 45736 (NCU). Onslow Co.: 10 mi N of jct. US 17 and N.C. 24 (in Jacksonville) along US 17, 31 Jul 1977, Webb and Whitten 53320 (TENN). Pamlico Co.: near Grantsboro, 13 Oct 1938, Godfrey and White 6790 (GH). Pender Co.: 2.9 mi SE of Pender-

Duplin Co. line on Hwy. 50, 31 Jul 1977, Webb and Whitten 53330 (TENN). Pitt Co.: 2.9 mi SE of Grimesland, 10 Aug 1958, Radford 39578 (NCU). Richmond Co.: 3.5 mi NE of Hoffman at Camp Mackall, 24 Jul 1956, Radford 14443 (NCU). Robeson Co.: ca. 1.5 mi NE of Lumberton on N.C. 41 and 3 mi N, 1 Aug 1957, Ahles and Leisner 33036 (NCU). Sampson Co.: 4.7 mi W of Salemburg on road to Autryville, 8 Aug 1957, Ahles and Leisner 33676 (NCU). Scotland Co.: 2.2 mi N of Old Hundred then 1.4 mi E on dirt road, 16 Oct 1957, Ahles 36955 (NCU). Wake Co.: 2.5 mi S of jct. of US 1 and N.C. 55 in Apex on N.C. 55, 27 Aug 1961, Ahles and Williamson 55027 (NCU). Washington Co.: 1.7 mi NNE of Hoke, 5 Aug 1958, Radford 38851 (NCU). Wayne Co.: 2 mi W of Seven Springs on N.C. 55, 16 Sep 1958, Duke 2634 (NCU). Wilson Co.: 1 mi S of Lamm, 25 Sep 1958, Radford 40775 (NCU).

SOUTH CAROLINA. Aiken Co.: wet area on A near jct. with 2, 16 Sep 1966, Gabrielson 350 (NCU). Allendale Co.: on S-3-26, 6.1 mi S of jct. with US 301, 0.3 mi N of jct. with S-3-41, 8 Sep 1967, Bozeman et al. 11422B (NCU). Beaufort Co.: savannah at jct. of S.C. 170 and 462 on S.C. 170, 7 Sep 1956, Ahles and Bell 18056 (NCU). Berkeley Co.: 14 mi S of Moncks Corners, 11 Aug 1939, Godfrey and Tyron 1424 (GH, NY, US). Charleston Co.: Adams Run, 15 Aug 1939, Godfrey and Tyron 1556 (GH, NY, US). Chesterfield Co.: savannah, Cash, 29 Sep 1956, Radford 18719 (NCU). Clarendon Co.: near US 301, 3.5 mi NE of Turbeville, 21 Aug 1957, Radford 28048 (NCU). Colleton Co.: 3.6 mi E of Smoaks on S.C. 217, 4 Sep 1956, Ahles and Bell 17868 (GH, NCU, NY). Darlington Co.: across creek from paper mill near Hartsville, 15 Aug 1908, Coker s.n. (NY).

Dillon Co.: 0.9 mi N of jct. Co. 23 and S.C. 34 on Co. 23 (SSW of Little Rock), 25 Jul 1957, Ahles and Leisner 32240 (SMU). Dorchester Co.: 0.8 mi NNE of jct. US 178 and Co. 20 on Co. 20, 20 Jul 1957, Ahles and Leisner 31873 (NCU). Florence Co.: 3 mi W of Cowards on S.C. 541, 18 Oct 1957, Bell 10863 (NCU). Georgetown Co.: 5 mi S of Andrews, 11 Aug 1939, Godfrey and Tyron 1355 (GH, MO, NY, TENN, US). Hampton Co.: savannah on S.C. 63, 2.3 mi NE of Varnville, 8 Sep 1967, Bozeman et al. 11436 (NCU). Horry Co.: SSE of Conway at jct., 4.3 mi ESE of Pee Dee Crossroads, 19 Oct 1957, Bell 10916 (NCU). Lee Co.: along RR tracks, 3.0 mi SW of jct. Hwy. 76 and 341 (in Lynchburg) on Hwy. 76, 24 Aug 1976, Webb et al. 52456 (TENN). Marlboro Co.: 4.5 mi NE of Wallace, 10 Aug 1956, Radford 15670 (NCU). Sumter Co.: 2 mi NE of Shiloh, 27 Jul 1957, Radford 27420 (NCU). Williamsburg Co.: 1.5 mi N of jct. US 52 and S.C. 375 along US 52, ca. 2.5 mi NW of Gourdin, 19 Aug 1978, Webb and Webb 53801 (TENN).

VIRGINIA. Brunswick Co.: 1.5 mi SE of Triplett, 18 Aug 1942, Lewis s.n. (GH). Greensville Co.: along Mill Creek about 1 mi N of Skipper's, 20 Aug 1938, Fernald and Long 9101 (GH). Nansemond Co.: bog by Norfolk and Western RR, about 0.5 mi W of Kilby, 8 and 12 Sep 1946, Fernald et al. 15308 (GH). Prince George Co.: SE of Petersburg at head of Poo Run, 19 Jun 1936, Fernald et al. 5844 (GH). Southampton Co.: woods W of Branchville, 20 Sep 1938, Fernald and Long 9375 (GH). Sussex Co.: about 4 mi NW of Waverly, 10 Sep 1937, Fernald and Long 7532 (GH).

Hybrids

Listed below are specimens that are thought to represent hybrids. These specimens are cited under their putative parents.

H. boreale x H. canadense

MASSACHUSETTS. Barnstable Co.: margin of Griffith's Pond, Brewster, 12 Sep 1918, Fernald Plantae Exsiccatae Grayanae 377 (GA, GH, MICH, MO, NY, US).

NEW YORK. Suffolk Co.: Long Island, pond N of Babylon, 27 Sep 1941, Svenson 11651 (GA, MICH, NY).

H. canadense x H. gymnanthum?

VIRGINIA. Sussex Co.: shore of Airfield Millpond, SW of Wakefield, 11 and 12 Sep 1945, Fernald and Long 14955 (GH).

H. canadense x H. mutilum

CONNECTICUT. Windham Co.: moist ground in old excavation, Thompson, 24 Sep 1940, Weatherby 6963 (GH, US).

MASSACHUSETTS. Dukes Co.: Parsonage Pond, West Tisbury, 4 Sep 1916, Seymour 1967 (GH).

NORTH CAROLINA. Gates Co.: low woods border, 1.9 mi N of Sandycross, 1 Aug 1958, Ahles and Duke 48291 (NCU).

RHODE ISLAND. Newport Co.: meadow NE of Fresh Pond, Block Island, 15 Sep 1913, Fernald et al. 9906 (NY, US).

SOUTH CAROLINA. Marlboro Co.: 5 mi N of Wallace near Whites Creek, 10 Aug 1956, Radford 15597 (NCU).

TENNESSEE. Morgan Co.: Boggy pond margin near Glades, 25 Aug 1946, Shanks 3053 (TENN).

VIRGINIA. Isle of Wright Co.: roadside ditch S of Zuni, 20 Aug 1936, Fernald et al. 6639 (GH, NY). Nansemond Co.: low pine woods E of Whaleyville, 17 Sep 1937, Fernald and Long 7535 (GH). Prince George Co.: swale about 3 mi SE of New Bohemia, 22 Aug 1936, Fernald et al. 6638 (GH, NY, US). Southampton Co.: swale S of Courtland, 19 Jun 1938, Fernald and Long 8775 (GH, US). Sussex Co.: shore of Airfield Millpond, SW of Wakefield, 11 and 12 Sep 1945, Fernald and Long 14955 (US).

H. canadense x H. boreale? or H. mutilum?

MAINE. York Co.: 20 Aug 1896, Bicknell s.n. (NY).

MARYLAND. Anne Arundel Co.: marsh at the head of the Severn River, 24 Oct 1951, Hotchkiss and Uhler 7334 (US).

MASSACHUSETTS. Barnstable Co.: first pond N of No Bottom Pond, Brewster, 7 Sep 1918, Fernald and Long 17101 (GH, NY). Bristol Co.: Freetown, 17 Oct 1972, Ahles 76282 (SMU). Dukes Co.: Chappaquiddick Island, 15 Sep 1913, Bicknell s.n. (GH). Nantucket Co.: shore of Miacomet Pond, Nantuckett Island, 8 Sep 1904, Bicknell 5796 (NY).

NEW JERSEY. Camden Co.: wet ground, Penbryn, 12 Oct 1920, Meredith s.n. (NY). Cumberland Co.: border of large pond, Cumberland, 18 Sep 1932, Fogg 5154 (GH, NY, US).

NEW YORK. Nassau Co.: shore of pond, Wantaugh, Long Island, 24 Sep 1929, Ferguson 8095 (NY). Richmond Co.: New Dorp, Staten Island, 31 Aug 1890, Britton s.n. (NY). Suffolk Co.: Poxaboyne Pond, Bridgehampton, Long Island, 13 Aug 1925, Ferguson 4340 (NY).

PENNSYLVANIA. Chester Co.: 2 mi N of Sadsburyville, 5 Oct 1924, Stone s.n. (GH).

RHODE ISLAND. Newport Co.: back of Crescent Beach, 20 Aug 1913, Fernald and Long 9921 (GH).

CANADA. NOVA SCOTIA. Digby Co.: wood-road near Cedar Lake, New Tusket, 4 Sep 1921, Fernald and Long 24154 (GH, NY). Halifax Co.: beach of Third Lake, Windsor Junction, 31 Aug 1920, Fernald and Long 21869 (GH, NY). Lundenburg Co.: margins of shallow ponds, outlet of Hebb's Lake, Bridgewater, 16 Aug 1921, Fernald and Long 24152 (GH). Yarmouth Co.: peaty swale of Canoe Lake, 23 Aug 1921, Fernald and Long 24153 (GH, NY).

QUEBEC. East Abitibi Co.: Amos, 18 mi SE at Lake Roy, 14 Aug 1953, Baldwin 5476 (GH).

H. gymnanthum x H. mutilum

MARYLAND. Worchester Co.: Ocean City, 12 Aug 1909, Carter s.n. (NY).

MISSOURI. Shannon Co.: Gilmore Pond, between Jacks Fork of Current River and Flat Rock Hollow, 6.5 mi NW of Montier, 8 Jul 1951, Steyermark 72134 (MO). Texas Co.: sinkhole pond, near Yukon, 9 Aug 1935, Kellogg 27024 (MO).

NORTH CAROLINA. Robeson Co.: ditch, 3.1 mi N of Rowland on N.C. 130, 1 Aug 1957, Ahles and Leisner 32926 (NCU).

TENNESSEE. Franklin Co.: wet meadow, Huntland, 6 Aug 1939, Svenson 10416 (MO).

VIRGINIA. James City Co.: wet bottomland about 5 mi W of Toano, 16 Jul 1939, Menzel 95 (GH). Sussex Co.: depressions in field, N of Littleton, 22 Jul 1936, Fernald and Long 6281 (GH).

H. canadense x H. majus

CONNECTICUT. Hartford Co.: Hartford, 16 Jul 1900, Driggs s.n. (GH).

MASSACHUSETTS. Dinwiddie Co.: Lincoln, 28 Aug 1898, Greenman 3141 (GH).

NEW HAMPSHIRE. Cheshire Co.: sandy roadside, Jaffrey, 28 Aug 1896, Robinson 23 (GH).

NEW YORK. Nassau Co.: Long Island, Lynbrook, 26 Aug 1929, Ferguson 7962 (NY).

H. majus x H. boreale?

MICHIGAN. Mason Co.: Hamlin Lake, Ludington, 8 Sep 1910, Chaney 266 (NY).

H. majus x H. mutilum

MAINE. Penobscot Co.: open clay soil, Oldtown, 14 Aug 1908, Fernald s.n. (GH).

Excluded Names

Sarothra canadensis (L.) Raf. Am. Monthly Mag. 2: 267. 1818. Invalidly published name.

Sarothra cuneifolia Raf. Atl. Journ. 1: 17. 1832. No authentic specimens located; description inadequate for taxonomic purposes.

Sarothra parviflora (Willd.) Raf. Am. Monthly Mag. 4: 192. 1819. Invalidly published name.

Sarothra pauciflora Raf. Fl. Tellur. iii. 79. 1836. Nomen nudum.

Sarothra quinquenervia (Walt.) Raf. Am. Monthly Mag. 2: 267. 1818. Invalidly published name.

Hypericum mutilum L. var. boreale Bickn. Bull. Torr. Bot. Club 22: 213. 1895. Invalidly published name.

Hypericum mutilum L. var. minimum Coleman. Kent Sci. Inst. Misc. Publ. 2: 9. 1874. No authentic specimens located; description inadequate for taxonomic purposes.

CHAPTER X

SUMMARY

Morphological, cytological, biochemical, and pollen stainability studies were carried out on taxa within Hypericum sect. Spachium in eastern North America. Twelve taxa are recognized in the present treatment and are listed as follows: H. boreale, H. canadense, H. cumulicola, H. drummondii, H. denticulatum var. denticulatum, H. denticulatum var. acutifolium, H. gentianoides, H. gymnanthum, H. incertum, H. majus, H. mutilum, and H. setosum.

The scanning electron microscope was used to study the pollen and seeds. The pollen was found to be trizonocolporate with a reticulate to finely reticulate-foveate exine. Three groups were recognizable on the basis of pollen size and exine ornamentation and include: (1) the H. canadense complex, (2) the H. denticulatum complex and H. setosum, and (3) H. gentianoides, H. drummondii, and H. cumulicola. Although three basic patterns of the seed coat were recognized in the eastern North American taxa belonging to sect. Spachium, they were not consistent with the three groups mentioned above. However, seed coat ornamentation does support some of the taxonomic decisions of this study. The seeds of H. incertum were found to differ from those of H. denticulatum var. acutifolium in the arrangement and shape of the seed coat reticulations and provide a reliable means for distinguishing the two taxa. A study of the variation of the seeds of H. mutilum failed to support the recognition of the three varieties that had formerly been distinguished for this species.

Flavonoid studies of 114 populations of eastern North American taxa belonging to sect. Spachium resulted in the identification (total or partial) of fourteen compounds with spectral data being obtained for nine additional compounds. The identified compounds were found to be based on quercetin, kaempferol, luteolin and apigenin. The two flavones, luteolin and apigenin, were found to have C-linked sugars at the 6 or 8 positions. With the exception of luteolin 7-O-glucoside, all other substitutions were O-linked sugars at the 3 position.

Interspecific differences in flavonoid profiles were found for all taxa except H. canadense and H. majus. Although the other species of the H. canadense complex had distinctive profiles, the differences between taxa within the complex were small. Flavones were only found in H. incertum, a member of the H. denticulatum complex. The presence of these compounds in this species distinguishes it from the other taxa within the complex as well as all the other eastern North American taxa belonging to sect. Spachium. Flavonoid studies failed to support the recognition of three varieties of H. mutilum and also do not seem to warrant separation of H. gentianoides and H. drummondii into the genus Sarothra.

Chromosome counts from meiotic material were obtained for thirty-four populations. The taxa of sect. Spachium in eastern North America were found to have chromosome counts of n = 6, 8, 12, and 24. Counts of n = 6 for H. setosum and H. cumulicola represent the only reports of this number in the genus Hypericum and possibly represent the base number for the genus. The chromosome count of n = 6 for H. cumulicola and n = 12 for H. gentianoides supports the separation of these two species which were considered to be conspecific in the latest revision

of sect. Spachium. Chromosome counts obtained in this study and previous counts for other taxa in sect. Spachium suggest two evolutionary lines (1) a polyploid series based on n = 6, and (2) an ascending aneuploid series based on the same number.

Pollen stainability studies showed the pollen of H. dissimulatum to have a lower percentage of stainability than that of the other members of the H. canadense complex. This supports morphological data which suggest H. dissimulatum to represent a hybrid. In this treatment the plants formerly referred to H. dissimulatum are viewed as recurrent hybrids between H. canadense and either H. boreale or H. mutilum. Field observations and a study of herbarium specimens support previous workers who have reported hybridization to occur between the taxa of the H. canadense complex.

Cladistic analysis substantiated the general impressions concerning the phylogenetic groupings derived by more subjective methods. The relative positions of the OTU's along the Wagner tree indicated the following three groups: (1) the taxa of the H. denticulatum complex and H. setosum, (2) the H. canadense complex, and (3) H. gentianoides, H. cumulicola, and H. drummondii. However, any discussion of the cladistic relationships of the eastern North American taxa belonging to sect. Spachium is handicapped by a lack of detailed information concerning the chemistry and cytology of the other species of the section.

The present taxonomic treatment of the eastern North American taxa of sect. Spachium differs from some relatively recent treatments of the group in following respects: (1) no subspecific taxa are recognized within H. mutilum and H. canadense, (2) H. dissimulatum is treated as a recurrent hybrid, (3) H. gentianoides and H. cumulicola

are viewed as distinct species rather than being conspecific, and (4) the H. denticulatum complex is recognized as being comprised of two species, H. denticulatum and H. incertum, the former with two varieties. The recognition of two species within the H. denticulatum complex has resulted in the resurrection of the name H. incertum.

An examination of the general collections from lending herbaria has resulted in the discovery of what is believed to represent original material of H. denticulatum var. ovalifolium and H. canadense var. boreale. These specimens have been designated as lectotypes for their respective names.

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VITA

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