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PODACHENIUM CHIMALAPANUM (ASTERACEAE), A NEW SPECIES FROM EASTERNMOST OAXACA, MEXICO

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ABSTRACT

A new species, ***Podachenium chimalapanum*** B.L. Turner, is described and illustrated from easternmost Oaxaca, México. It is closely related to *P. pachyphyllum* and *P. chiapanum*, but somewhat closer to the former, occupying a geographical position between these two taxa.

KEY WORDS: Asteraceae, Heliantheae, *Podachenium*, Oaxaca, México

Routine identification in connection with a forthcoming treatment of the tribe Heliantheae for the Comps of Mexico (*cf.* Turner 1997, *The Comps of Mexico*, [Vol. 10], Phytologia Memoirs) has occasioned the present paper.

PODACHENIUM CHIMALAPANUM B.L. Turner, *spec. nov.* Figure 1. TYPE: MEXICO. Oaxaca: Mpio. Sta. María Chimalapa, Cerro Piicotzuc, ca. 18 straight-line km SSE of La Laguna Veracruz, top of western peak, granitic ridge with very steep, in parts, almost vertical slopes (to N and S), growing among "very dense cloud scrub" 1.0-1.5 m high, very exposed to wind and fog, with *Cavendishia, Gaultheria*, etc. (17° 07′ 25″ N, 94° 27′ 15″ W), 1400 m, 5 Apr 1996, *Thomas Wendt et al. 6806* (HOLOTYPE: MEX!; Isotype: TEX!).

Simile *P. pachyphyllo* (Sch. Bip. *ex* Klatt) Jansen sed folia parviora et capitulescentias congestiores cum capitula pauciora habens.

"Shrub" to 1.5 m(?). Stems sparsely pubescent when young, but soon glabrate. Larger leaves ovate-elliptic, mostly 6-9 cm long, 3-4 cm wide; petioles 5-7 mm long; blades grading into the petioles, pinnately nervate, glabrous on both sides, the upper surfaces drying black, the margins serrulate. Heads arranged 3-13 in rather congested terminal cymose panicles, the ultimate peduncles 1.0-2.5 cm long. Involucres 3.5-4.5 mm high, ca. 7 mm across; bracts 2-seriate, subequal, the outer

Fig. 1. *Podachemium chimalapanum*. isotype TEX.

series spatulate and loose, the inner less so. Receptacle moderately convex, ca. 3 mm across, glabrous; chaff indurate, persistent, their apices acute, somewhat pungent to the touch. Ray florets ca. 11, neuter; ligules white, 6-8 mm long. Disk florets numerous; corollas yellow, 2.5-3.0 mm long, the tube ca. 0.5 mm long, the lobes ca. 0.8 mm long. Achenes flattened radially, the body ca. 2.5 mm long, 0.9 mm wide, the podocarp poorly developed; pappus of 2-5 principal scales 1.0-1.5 mm high, between these 1 or more smaller scales.

This novelty is closely related to *Podachenium pachyphyllum* (Sch. Bip. *ex* Klatt) Jansen of northcentral Oaxaca, differing from this in having somewhat smaller, ovate-elliptic leaves, fewer heads (3-13 vs. 15-30) arranged in a much more congested capitulescence, and having heads with loosely arranged outer phyllaries (vs. appressed). Turner & Panero (1992) provided a key to the four species of *Podachenium* known to them; in this treatment *P. chimalapanum* will key readily to *P. pachyphyllum*, except for its fewer, shorter ligules (ca. 11 vs. 13, 6-8 mm long vs. 15-20 mm long, this latter range inaccurately stated in the table provided by Turner & Panero). But, as indicated in the above, *P. chimalapanum* differs notably from *P. pachyphyllum* in having a very congested, relatively few-headed capitulescence, the species standing somewhere between the latter and *P. chiapanum* B.L. Turner & Panero; geographically, it also stands between these two taxa.

The species is named for the Chimalapan region of eastern Oaxaca, to which it seems confined.

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THE STATUS OF *OBOLARIA VIRGINICA* L. (GENTIANACEAE) IN TEXAS AND SURROUNDING STATES

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ABSTRACT

A recent find of *Obolaria virginica* L. from southeastern Texas led to a review of the status of this species in Texas and surrounding states.

KEY WORDS: *Obolaria virginica* L., Texas, Gentianaceae

Obolaria virginica L., Pennywort, a northeastern species, reaches its western limit in southeastern Texas (Correll & Johnston 1970; Johnston 1990; Hatch *et al.* 1990; Jones *et al.* 1997). It is not known from Oklahoma (Taylor & Taylor 1989). In Arkansas it occurs only in several east central counties (Smith 1988), and in Louisiana it is reported from fifteen parishes (Thomas & Allen 1998; MacRoberts & MacRoberts 1995).

Obolaria, a monotypic genus, and *Bartonia* are the only saprophytic genera of the Gentianaceae found in North America (Maas 1986). *Obolaria virginica* is found chiefly in deciduous forests but is also found in rich woods, river banks, mixed hardwood slopes, and bottom lands (Andreas 1970; Brown 1972; Gillet 1959; MacRoberts & MacRoberts 1995; Hammond-Soltis 1979). It is said to be common in rich mesic woods throughout the piedmont and mountainous areas in the southeastern United States (Kondo 1970). It is easily overlooked in the early stages of growth (Brown 1972).

On February 4, 1998 while searching for *Cardamine concatenata* (Michx.) Sw., *Sanguinaria canadensis* L., and *Uvularia perfoliata* L., I found *Obolaria virginica* growing in a side slope of a beech-hardwood community in the Angelina National Forest in Angelina County. It was located within four meters of a dry, shallow, undeveloped side drain of a larger system. The overstory and midstory species in this site were *Quercus alba* L., *Q. michauxii* Nutt., *Fagus grandifolia* Ehrh., *Ostrya virginiana* (P. Mill.) K. Koch, *Magnolia grandiflora* L., *Ilex opaca* Ait., *Acer barbatum* Michx., and *Pinus taeda* L. This appears to be the remnants of perhaps a once larger hardwood community that was reduced when the surrounding area was cut and replanted with loblolly pine, in some areas as close as seven meters to the drain.

The duff layer was quite thick and ground cover species found at the time were limited to *Mitchella repens* L. and *Sanicula* sp. *Corallorhiza wisteriana* Conrad, another uncommon species in east Texas, was also found near the site.

This type of community has been described in east Texas, where it reaches its southwestern limit, by McLeod (1972), Diamond *et al.* (1987), Marks & Harcombe (1981), Nixon *et al.* (1980), MacRoberts & MacRoberts (1997). Through restoration, protection, and improvement, the U.S. Forest Service hopes to achieve a target of 3500 acres of this community in the National Forests and Grasslands in Texas (NFGT). Currently NFGT claims to have about 2500 acres of beech-white oak forest in its holdings (USDA 1996a).

I surveyed numerous herbarium collections (TEX, NO, BRIT, ASTC, LTU, SFRP, LSU, NLU, DUR) for *Obolaria* from Texas. GH, MICH, and MO have no specimens of *Obolaria* from Texas (J. Pringle, pers. comm.). Only two specimens were found. One is from Jasper County and the other from Sabine County, both in southeastern Texas. It has been recently reported that a new county record has been found and a new location was found in an earlier documented county (W. Holmes, pers. comm.), but the information has not been released. Although MacRoberts & MacRoberts (1995) located *O. virginica* in a similar habitat in the Kisatchie National Forest in Louisiana, floristics of beech-hardwood sites in the Sabine National Forest in Texas did not include the species (MacRoberts & MacRoberts 1997).

While *Obolaria virginica* is not on the state rare species list, it is eligible for listing as it is only known from three sites, fewer than six occurrences being classified as S1, (*i.e.*, critically imperiled in Texas and especially vulnerable to extirpation from the state). Beech-Hardwood Forest is rare in east Texas. The Texas Organization for Endangered Species (TOES) lists it as a threatened community and the Texas Natural Heritage Program lists it as imperiled. The U.S. Forest Service lists this community as sensitive, although it has no listing for *O. virginica* (USDA 1996b).

The distribution of *Obolaria virginica* in Arkansas, Louisiana, Oklahoma, and Texas is shown in Figure 1. Documentation is given for only Louisiana and Texas.

DOCUMENTATION

LA: Bienville Parish, *Thomas 6666* [NLU]. Caldwell Parish, *Marx 474* [LTU]; *Thomas 38170* [LTU]; *Thomas 51173* [LTU]. Catahoula Parish, *Thomas 127* [NLU]; *Thomas 128* [NLU]. Claiborne Parish, *Lewis 129* [NLU]; *Lewis 2650* [NLU]. Grant Parish, *Parker 570* [NLU]. Lincoln Parish, *Pavlu 501* [LTU]. Morehouse Parish, *Pias & Thomas 49776* [LSU]; *Thomas 12936* [NLU]; *Thomas 58135* [NLU]. Natchitoches Parish, *Holmes 4424* [NLU]. Ouachita Parish, *Thomas 13906* [NLU]. Rapides Parish, *Carr, MacRoberts, & MacRoberts 2168* [VDB]; *MacRoberts & MacRoberts 2254* [SFRP]. St. Helena Parish, *Allen 15593* [LSU]. Webster Parish, *Price s.n* [NLU]. W. Feliciana Parish, *Cocks s.n* [NO]; *Penfound s.n* [NO]. Winn Parish, *Parker 588* [NLU].

Figure 1. Distribution of Obolaria virginica in Arkansas, Louisiana, Oklahoma and Texas. R = Reported.

TX: Angelina Co., *Walker 136* [TEX]. Jasper Co., *Lundell 13368* [TEX]. Sabine Co., *Correll & Correll 24883* [TEX].

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CLASSIFICATION OF THE GENUS *GILIA* (POLEMONIACEAE)

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ABSTRACT

The body of knowledge concerning taxonomic characters in *Gilia* has increased greatly since the last previous infrageneric classification in 1959. The older and the newer information is combined to construct a new infrageneric classification, in which the species are grouped into three subgenera and seven sections. Five formerly poorly known species which have traditionally been in *Gilia* are excluded from the genus. Three of these are transferred to *Tintinabulum*, one to *Allophyllum*, and one to a new genus, ***Maculigilia***. The very different approaches to classification of molecular cladistics and evolutionary systematics are currently being applied to *Gilia* and related genera; the two approaches are compared and discussed.

KEY WORDS: *Gilia, Allophyllum, Maculigilia*, Polemoniaceae, polyphyly

It was a common practice in the nineteenth century to group the temperate species of Polemoniaceae into four genera: *Polemonium, Phlox, Collomia*, and *Gilia* (Meisner 1836-1843; Bentham & Hooker 1876; Gray 1878; Peter 1897). *Polemonium* and *Phlox* have distinctive vegetative and floral characters which define them as genera, and consequently they have had a relatively stable taxonomic history. To a lesser extent this is also true of *Collomia*. *Gilia*, on the other hand, lacks distinctive vegetative and floral features, making generic definition difficult. It became a convenient catchall in the nineteenth century for species that did not fit into the other genera. Gray (1878), for example, adopted a very broad concept of *Gilia* which embraced twelve sections differing greatly from one another; and the treatment of *Gilia* by Bentham & hooker (1876) was very similar.

The trend toward all-inclusiveness in *Gilia* was reversed in the twentieth century as the plants became better known and more characters were found. The reverse trend was to segregate subgroups out of the old *Gilia* as separate genera. This process was started by Milliken (1904), a student of Jepson, and has continued to the present time. The net result is that the genus *Gilia* has been undergoing many and substantial changes in its constitution throughout its 200-year taxonomic history, unlike *Polemonium*, *Phlox*, and *Collomia*.

The genus problem in *Gilia* has two complementary aspects: delimitation of the genus as a whole, and recognition of natural sections and subgenera. The objectives are to identify the natural sections or subgenera; to group together those that belong to the same major monophyletic branch; to exclude subgroups that belong to other phylogenetic branches; and to use these inclusions and exclusions to determine the range of variation of the genus.

Three general classification systems of *Gilia* were proposed in the 1940s and 1950s: those of Mason & A. Grant (1948), Grant & Grant (1956), and Grant (1959). They all attempted to reflect the natural relationships of the subgroups as understood at the time. The 1959 system, which is still widely used, recognized five sections: *Giliastrum, Giliandra, Gilia, Saltugilia*, and *Arachnion*. It is in need of revision. The 1948 system contains some elements which were passed over in 1959, but will be taken up in the present revision.

Much research has been done on *Gilia* by many workers since 1959. The work has been carried out on several fronts. Our knowledge of morphological characters and chromosome numbers has increased. Non-traditional characters such as pollen morphology, flavonoids, chloroplast DNA, and ribosomal DNA have been introduced (Stuchlik 1967a, 1967b; Taylor & Levin 1975; Smith *et al.* 1977; Johnson *et al.* 1996; Porter 1977; Day, unpubl.). A sixth section of *Gilia*, section *Kelloggia*, has been set up (Day 1993a, 1993b). Two sections of the 1959 system, *Giliandra* and *Giliastrum* have been segregated as the genera *Aliciella* and *Giliastrum*, respectively (Porter 1998a, 1998b).

It is time to restudy and revise the system of classification of *Gilia* in the light of the new as well as the old evidence. This task is attempted here.

INTRODUCTION TO THE CLASSIFICATION

A survey of taxonomic characters was carried out in search for relatively conservative characters that identify groups of related species and distinguish such groups from one another. The diagnostically useful gross morphological characters and basic chromosome numbers are emphasized in the following descriptions of groups. The newer types of characters in pollen, flavonoids, and DNA are presented following the conventional characters.

A useful pollen character is the distribution of apertures. Two modes occur in *Gilia* and its close relatives: pantoporate (apertures scattered over grain) and zonocolporate (apertures in equatorial zone) (Stuchlik 1967a, 1967b; Taylor & Levin 1975; Chuang *et al.* 1978; Day, unpubl.).

Three main groups of flavonoids are found in *Gilia*, and these are designated as types A, B, and C (Smith *et al.* 1977). Type A consists of common flavonols (kaempferol, quercitin, myricetin); type B is 6-methoxyflavonols (patuletin, eupalitin, eupatolitin); type C is C-glycosylflavones (apigenin-based and luteolin-based) (Smith *et al.* 1977).

Variation in DNA sequences in a region of a chloroplast gene matK in *Gilia* and related genera is plotted in a cladogram (Johnson *et al.* 1996). Sequence variation in nuclear ribosomal DNA ITS is plotted on another cladogram (Porter 1997).

Variation in different types of characters is sometimes congruent and sometimes not. In the latter case, taxonomic judgment and weighting come into play. The observed distribution of characters, and my interpretation of them in cases of incongruence, are expressed in the following classification system. This system groups the species into three subgenera and seven sections. Five species are excluded from *Gilia* and transferred to other genera.

Only the essential nomenclature is given here. Additional synonyms for infrageneric taxa can be found in Grant (1959).

SYSTEM OF CLASSIFICATION

GILIA Ruíz & Pavón, *Prodr. Fl. Peruv.*, 25 and t. 4. 1794. TYPE SPECIES: *Gilia laciniata* Ruíz & Pavón.

Plants herbaceous; perennial, biennial or annual, sometimes with a woody or soft-woody base. Herbage with several types of pubescence, but not with dense coarse woolly hairs. Leaves alternate, with irregular pinnate teeth, lobes, or divisions, or entire-margined and linear in reduced forms. Usually spring blooming. Corolla mostly funnelform, sometimes campanulate, rotate, or salverform. Seeds angular, mostly sandy-colored, mostly mucilaginous when wet, but not mucilaginous in two sections. Chromosomes large, basic number x=9 in most sections, x=8 in sect. *Giliandra*.

Pollen zonocolporate, except in subg. *Kelloggia* where pantoporate. Flavonoids of type A and C widespread in genus; type B flavonoids found only in sections *Giliastrum* and *Gilmania* so far as known. (See preceding section for explanation of these terms.).

Widespread in western North America, also in temperate South America.

73 species as presently understood. These are grouped here in three subgenera and seven sections.

For the relationships of *Gilia* to the *Eriastrum-Ipomopsis-Langloisia* group and *Leptodactylon-Linanthus* group see Grant (1998). The relationships between *Gilia*, and *Tintinabulum* and *Macugilia* are considered later in the present paper.

Key to the Main Subgroups of *Gilia*

A. Perennials or biennials, with woody base or herbaceous throughout.
  B. Corolla campanulate or rotate. Pollen blue. Seeds mucilaginous when wet.... sect. *Giliastrum*, in part
  BB. Corolla funnelform, or occasionally salverform. Pollen yellow or white (except blue in 1 species of sect. *Giliandra*). Seeds not mucilaginous when wet.
    C. Plants scapose. Basal leaves pinnately lobed or divided, with strap-shaped rachis. x=8.... sect. *Giliandra*, in part
    CC. Plants not scapose. Leaves with broad blade. x=9. Rare.... sect. *Gilmania*, in part
AA. Annual herbs.
  D. Corolla campanulate.... *G. incisa* group in sect. *Giliastrum*
  DD. Corolla funnelform, or occasionally salverform.
    E. Seeds not mucilaginous when wet. Pollen yellow or white.
      F. Plants scapose. Basal leaves pinnately lobed or divided, with strap-shaped rachis. x=9 or 8.... *G. leptomeria* group in sect. *Giliandra*
      FF. Plants not scapose. Leaves with broad blade. x=9. Uncommon.... *G. latifolia* in sect. *Gilmania*
    EE. Seeds mucilaginous when wet. Pollen blue.
      G. Leaves with 1 or 2 linear finger-like lobes, or reduced and unlobed. Pollen pantoporate. Middle and high elevations in mountains.... subg. *Kelloggia*
      GG. Leaves dissected but not with lobes as in G. Pollen zonocolporate. Mainly at lower elevations, uncommon in middle elevations, and rarely at high elevations.... subg. *Gilia*
        H. Pubescence of interwoven fine cobwebby hairs. Basal leaf rosette present.... sect. *Arachnion*
        HH. Pubescence of straight multicellular hairs and stipitate glands. Basal leaf rosette present or absent.
          I. Upper leaves well developed. No basal leaf rosette. Inflorescence usually a head or cluster.... sect. *Gilia*
          II. Upper leaves much reduced. Basal leaf rosette present. Inflorescence an open cyme.... sect. *Saltugilia*

I. *GILIA* subg. *GREENEOPHILA* Brand, Pflanzenreich 250:144. 1907. TYPE SPECIES: *Gilia rigidula* Bentham.

Perennials, sometimes with woody or soft-woody base, biennials, and annuals. Leaves with once pinnate teeth, lobes, or divisions. Corolla often concolored, sometimes bicolored. Pollen yellow, white, or blue. Seeds mucilaginous when wet or not so. Basic chromosome number x=9 and x=8.

Pollen zonocolporate. Flavonoids of types A, B, and C occur in sects. *Giliastrum* and *Gilmania*; no information on flavonoids in sect. *Giliandra*. Species representing the sections of this subgenus fall close together in the cladograms for *cp*DNA and *rn*DNA. They are remote from species of subg. *Gilia* on the same cladograms.

Center of distribution of the perennial and biennial members in northern México, Rocky Mountains, and intermountain region. Annuals widespread in western deserts. One section occurs also in temperate South America.

Three sections, sects. 1-3 as follows.

1. *GILIA* section *GILIASTRUM* Brand, Pflanzenreich 250:147. 1907. TYPE SPECIES: *Gilia rigidula* Bentham.

Giliastrum Rydberg, *Fl. Rocky Mts.*, ed. 1, 699 and 1066. 1917.

Perennials with soft-woody base, and annuals. Lower leaves with a broad blade and once pinnate lobes, the lobes often sharp-tipped, or leaves linear. Corolla campanulate or rotate. Corolla concolored, violet or whitish, or bicolored, violet with a yellow center. Pollen blue in some species, no data for other species. Seeds sandy colored, mucilaginous when wet. x=9, n=6 found in one species.

Type B flavonoid is present.

Center of distribution in northern México and Texas. Secondary centers in Baja California and temperate South America.

Gilia incisa Benth., *G. insignis* (Brand) Cory & H.B. Parks, *G. foetida* Gill. *ex* Benth. (S. Amer.), *G. gypsophila* B.L. Turner, *G. ludens* Shinners, *G. purpusii* K. Brandegee, *G. rigidula*, and *G. stewartii* I.M. Johnst. This species list is based on Turner (1994).

Porter (1998b) is segregating section *Giliastrum* as a genus separate from *Gilia* to eliminate polyphyly. Grouping *Giliastrum* together with subgenus *Gilia* results in a polyphyletic genus according to Porter's phylogenetic hypothesis based on *nr*DNA. According to my phylogenetic hypothesis based on all available characters, section *Giliastrum* and subgenus *Gilia* have diverged widely, but nevertheless from a monophyletic taxon. See the last two sections of this paper. Separation of *Giliastrum* from subgenus *Gilia* is thus deemed unnecessary from a phylogenetic standpoint, and in addition, is undesirable taxonomically since it obscures the relationship between the two phyletic branches.

2. *GILIA* section *GILIANDRA* A. Gray, Proc. Amer. Acad. Arts 8:276. 1870. TYPE SPECIES: *Gilia stenothyrsa* A. Gray. *Aliciella* sect. *Giliandra* (A. Gray) J.M. Porter, Aliso 17:27. 1998.

Aliciella Brand, Pflanzenreich 250:150. 1907. TYPE SPECIES: *Gilia triodon* Eastwood.
Aliciella sect. *Aliciella* subsect. *Subnudae* J.M. Porter, Aliso 17:31. 1998. TYPE SPECIES: *Gilia subnuda* Torrey *ex* A. Gray.

Perennial herbs, sometimes woody-based, biennial herbs, and annuals. Plants with a basal leaf rosette and scapose upper parts. Lower leaves leathery, with a strap-

shaped rachis and once pinnate lobes or divisions. Corollas mostly funnelform, sometimes salverform, tubes slender or broad. Corollas showy, concolored, blue, red, or pink; or small and inconspicuous in most annual species. Pollen yellow or white, except blue in one species (*Gilia tenuis*). Seeds sandy colored, not mucilaginous when wet. x=8 throughout the section, x=9 occurs also in some annual species.

The species of this section fall into two subgroups. The perennial and biennial species with showy flowers and x=8 are basal. They occur in Utah, Colorado, and adjacent areas. The second subgroup consists of annuals, mostly with small flowers, they have both x=8 and 9 and polyploidy. They are derived and occur in the western deserts.

The center of distribution of the showy-flowered subgroup is in the Rocky Mountains and Colorado Plateau. The annuals range widely in the western deserts as noted above.

Showy-flowered perennial species: *Gilia caespitosa* A. Gray, *G. formosa* E. Greene *ex* Brand, *G. haydeni* A. Gray, *G. mcvickerae* M.E. Jones, *G. pentstemonoides* M.E. Jones, *G. pinnatifda* Moc. & Sessé, *G. sedifolia* Brandegee, *G. stenothyrsa* A. Gray, *G. subnuda*, and *G. tenuis* F.J. Sm. & Neese. Annual, mostly small-flowered species: *G. heterostyla* S.A. Cochrane & A.G. Day, *G. humillima, G. hutchinsifolia* Rydb., *G. leptomeria* A. Gray, *G. lottiae* A.G. Day, *G. micromeria* A. Gray, *G. nyensis* Reveal, *G. subacaulis* Rydb., and *G. triodon* Eastw. The list of perennial species is based on Porter (1998a), that of the annual species on Day (unpubl.).

Porter (1998a) has recently segregated *Giliandra* and *Gilmania* as a separate genus, *Aliciella*, in order to achieve monophyly. A genus containing *Giliandra, Gilmania*, and subgenus *Gilia* is polyphyletic according to Porter's phylogenetic hypothesis based on *m*DNA. However, this combination is diverse, but monophyletic according to my phylogenetic hypothesis based on all available characters. See discussion in the last two sections of this paper. Separation of *Aliciella* from *Gilia* is deemed unnecessary phylogenetically and undesirable taxonomically for the same reasons as those given above with regard to *Giliastrum*.

3. *GILIA* section *GILMANIA* (Mason & A. Grant) V. & A. Grant, Aliso 3:299. 1956. TYPE SPECIES: *Gilia latifolia* S. Watson. *Gilia* subg. *Gilmania* Mason & A. Grant, Madroño 9:205. 1948. *Aliciella* subg. *Gilmania* (Mason & A. Grant) J.M. Porter, Aliso 17:43. 1998.

One species a woody-based perennial, another species an annual. Lower leaves with a broad blade and lobed margins, the lobes sharp-tipped. Corolla funnelform, pink. Pollen yellow. Seeds reddish-brown, not mucilaginous when wet. x=9.

Type B flavonoids present.

Deserts from southern California to Utah.

Gilia latifolia and *G. ripleyi* Barneby.

Mason & A. Grant (1948) set up a subgenus, *Gilmania*, for this distinctive small group; and Grant & Grant (1956) retained it in the rank of section. I later sank *Gilmania* into section *Giliastrum* (Grant 1959); this was a step in the wrong direction. Porter (1998a) has recently grouped sect. *Gilmania* with sect. *Giliandra* in the segregate genus *Aliciella*. I regard this as a step in another wrong direction. *Gilmania* does not fit well in either section, on conventional taxonomic characters, and is best treated as a third section coordinate with the other two.

II. *GILIA* subg. *GILIA*

Annual herbs. Leaves divided once pinnately to tripinnately, or entire margined and linear in reduced forms. Corolla mostly funnelform, sometimes salverform. Corolla concolored, or bicolored or tricolored with spots or rings. Pollen blue. Seeds mucilaginous when wet. x=9.

Pollen zonocolporate. Flavonoids of type B absent so far as known. Species of the three sections in this subgenus fall close together on the cladograms for *cp*DNA and *m*DNA. They are remote from the species of subg. *Greeneophila* on the same cladograms.

Center of distribution in California, occurring in regions with summer-dry climates and in deserts. Ranging through other parts of western North America, and recurring in temperate South America.

Three sections, nos. 4-6 as follows.

4. *GILIA* section *GILIA*

Annual herbs with well-developed upper leaves. Pubescence of straight multicellular hairs and stipitate glands. Inflorescence usually a head or cluster. Corollas funnelform, concolored or tricolored.

Center of distribution in cismontane California. Ranging north to British Columbia; recurring in temperate South America.

Gilia achilleaefolia Benth., *G. angelensis* V. Grant, *G. capitata* Sims, *G. clivorum* (Jepson) V. Grant, *G. laciniata* Ruíz & Pavón (S. Amer.), *G. lomensis* V. Grant (S. Amer.), *G. millefoliata* Fischer & C. Meyer, *G. nevinii* A. Gray, *G. tricolor* Benth., and *G. valdiviensis* Griseb. (S. Amer.).

5. *GILIA* section *SALTUGILIA* V. & A. Grant, Aliso 3:84. 1954. TYPE SPECIES: *Gilia splendens* Douglas.

Annual herbs with well-developed basal leaves and reduced upper leaves. Pubescence of straight multicellular hairs and stipitate glands. Inflorescence cymose. Corollas funnelform, concolored.

Center of distribution in southern California. Ranging to central California mountains and to southwestern deserts.

Gilia australis (H. Mason & A.D. Grant) V. Grant & A.D. Grant, *G. caruifolia* Abrams, *G. scopulorum* M.E. Jones, *G. splendens* H. Mason & A.D. Grant, *G. stellata* A.A. Heller, and *G. yorkii ined. Gilia yorkii* is a new species (Shevock & Day, in press).

6. *GILIA* section *ARACHNION* A. & V. Grant, Aliso 3:214. 1956. TYPE SPECIES: *Gilia latiflora* A. Gray.

Annual herbs with a basal leaf rosette and scapose upper body. Pubescence of fine cobwebby hairs especially in leaf axils. Inflorescence cymose. Corollas mostly funnelform, sometimes salverform. Corollas usually tricolored.

Center of distribution in southern California mountains and Mojave Desert. Ranging to other areas of western North America; recurring in temperate South America.

Gilia aliquanta A.D. Grant & V. Grant, *G. austro-occidentalis* (A.D. Grant & V. Grant) A.D. Grant & V. Grant, *G. brecciarum* M.E. Jones, *G. cana* (M.E. Jones) A.A. Heller, *G. clokeyi* H. Mason, *G. crassifolia* Benth. (S. Amer.), *G. diegensis* (Munz) A.D. Grant & V. Grant, *G. flavocincta* A. Nels., *G. inconspicua* (Smith) Sweet, *G. interior* (H. Mason & A.D. Grant) A.D. Grant, *G. jacens* A.D. Grant & V. Grant, *G. latiflora* (A. Gray) A. Gray, *G. leptantha* Parish, *G. malior* A.G. Day & V. Grant, *G. mexicana* A.D. Grant & V. Grant, *G. minor* A.D. Grant & V. Grant, *G. modocensis* Eastw., *G. ochroleuca* M.E. Jones, *G. ophthalmoides* Brand, *G. sinuata* Douglas *ex* Benth., *G. salticola* Eastw., *G. tenuiflora* Benth., *G. tetrabreccia* A.D. Grant & V. Grant, *G. transmontana* (H. Mason & A.D. Grant) A.D. Grant & V. Grant, and *G. tweedyi* Rydb.

III. *GILIA* subg. *KELLOGGIA* Mason & A. Grant, Madroño 9:219. 1948. TYPE SPECIES: *Gilia capillaris* Kellogg.

Medium-sized to small annual herbs. Herbage glandular-puberulent, or glabrous. Upper and lower leaves about the same size. Leaves with 1 or 2 linear finger-like lobes, or unlobed and entire. Corolla funnelform, concolored or bicolored. Pollen blue, pantoporate, the sexine striated or with spinules. Capsule containing 1-6 seeds per locule. Seeds mucilaginous when wet. x=9.

No information on flavonoids, and only one puzzling record of DNA sequences.

Center of distribution in mountains of central California, Nevada, and Oregon. Disjunct populations in Idaho and Colorado.

7. *GILIA* section *KELLOGGIA* Day, Novon 3:332. 1993.

Characters of the subgenus.

Gilia capillaris Kellogg, *G. leptalea* (A. Gray) E. Greene, and *G. sinistra* M.E. Jones.

The species of subgenus *Kelloggia* are similar in habit, and floral and seed characters to those of subgenus *Gilia,* and occur in the same geographical area. For these reasons the species assigned here to the subgenera *Kelloggia* and *Gilia* were formerly thought to be closely related.

However, the discovery of pantoporate pollen in the species of *Kelloggia* (Day, unpubl. data) indicates that it is isolated from the subgenera *Gilia* and *Greeneophila,* which have zonocolporate pollen (Stuchlik 1967a, 1967b; Day, unpubl. data).

What are the true relationships of *Kelloggia*? Pollen characters and leaf form point to a relationship with *Allophyllum.* But more evidence is needed to determine the best taxonomic disposition of *Kelloggia.*

DNA evidence might shed light on the problem. The only DNA record of the section published so far is for *cp*DNA matK in *Gilia sinistra* (Johnson *et al.* 1966). It places *G. sinistra* in a group of five *Navarrettia* species in the cladogram. This result is out of line with the phenetic evidence concerning both *Kelloggia* and *Navarrettia.* Further molecular studies are needed.

EXCLUSION AND REASSIGNMENT OF FIVE SPECIES

Five species of annuals with reduced vegetative and floral characters, assigned to *Gilia,* have been poorly understood throughout this century. The species in question are *G. campanulata* A. Gray, *G. inyoensis* I.M. Johnst., *G. filiformis* Parry *ex* A. Gray, *G. maculata* Parish, and *G. tenerrima* A. Gray. The first four are desert annuals and the last one is montane. The relationships of these species to the main subgroups of *Gilia* have not been obvious from the usual taxonomic characters, leaving it up to successive workers to place them as best they can in the system. Much more has become known about these plants in the last ten years, however, and it is time for a reassessment.

The five species do not fit well into any of the seven sections recognized in the present treatment. If they were to remain in *Gilia,* additional sections would have to be set up for them. This is a plan that I considered and tried to implement but in the end discarded. The species are not only misfits in *Gilia,* but show signs of relationship to other genera. Therefore, it seems best to take them out of *Gilia* and place them in other genera. I am resurrecting the long dormant genus *Tintinabulum* of Rydberg (1917) for *G. campanulata, G. inyoensis,* and *G. filiformis.* A new genus *Maculigilia* is set up for *G. maculata*; and *G. tenerrima* is transferred to *Allophyllum.*

TINTINABULUM Rydberg, *Fl. Rocky Mts.*, ed. 1, 698 and 1065. 1917. TYPE SPECIES: *Gilia filiformis* Parry *ex* A. Gray. *Gilia* subg. *Tintinabulum* Mason & Grant, Madroño 9:220. 1948.

Gilia subg. *Greeneophila* sect. *Campanulastrum* Brand, Pflanzenreich 250:144. 1907. TYPE SPECIES: *Gilia campanulata* A. Gray. *Gilia* subg. *Campanulastrum* Mason & A. Grant, Madroño 9:219. 1948.

Small desert annuals with a spreading habit. Stems very slender. Leaves alternate, reduced, lanceolate to linear. Flowers solitary on slender pedicels. Corolla narrowly to broadly campanulate. Corolla yellow or bicolored yellow and white. Pollen yellow. Seeds mucilaginous when wet. x=9.

Center of distribution northern Mojave Desert, ranging through deserts to Utah and Arizona. Three species.

Tintinabulum filiforme (Parry *ex* A. Gray) Rydberg, *Fl. Rocky Mts.*, ed. 1, 698 and 1065. 1917. BASIONYM: *Gilia filiformis* Parry *ex* A. Gray, Proc. Amer. Acad. Arts 10:75. 1874.

Tintinabulum campanulatum (A. Gray) V. Grant, *comb. nov.* BASIONYM: *Gilia campanulata* A. Gray, Proc. Amer. Acad. Arts 9:279. 1870.

Tintinabulum inyoensis (I.M. Johnston) V. Grant, *comb. nov.* BASIONYM: *Gilia inyoensis* I.M. Johnston, Contrib. Gray Herb. 75:39. 1925.

These three species differ from the rest of *Gilia*, or from *Gilia* as delimited here, in spreading habit with very slender stems, and differ from most sections of *Gilia* in campanulate corollas. In my old treatment (Grant 1959) I included them in *Gilia* sect. *Giliastrum* on what now seem to be superficial resemblances. Mason & A. Grant (1948) had previously assigned them to two adjacent small subgenera of *Gilia*, subg. *Campanulastrum* and subg. *Tintinabulum*, which was on the right track. They could be retained in *Gilia* as a third subgenus.

However, in growth habit and floral characters, the plants resemble *Linanthus* sect. *Dactylophyllum* (the *L. aureus* [Nutt.] E. Greene group). Furthermore, they cluster with *Leptodactylon* and *Linanthus* in the cladograms for *nr*DNA (Porter 1997) and *cp*DNA (Johnston *et al.* 1996).

These indications of a relationship with *Linanthus*, particularly the DNA evidence, tilt the scales in favor of segregating the group at the genus level. Rydberg's (1917) small genus *Tintinabulum* is a good place for them. The genus *Tintinabulum* is assigned to the tribe Gilieae.

MACULIGILIA V. Grant, *genus novum*. TYPE SPECIES: *Gilia maculata* Parish.

Herbae annuae diminutivae, hirsutae. Folia integra, oblongata vel oblanceolata. flores in capitulis terminalibus. Corolla campanulata, maculata. Pollen flavus, pantoporatus. Semina rubicunda brunnea, sub aqua immutata. Chromosomae x=9.

Small annuals with spreading habit. Stems with dense cover of long hairs. Leaves fleshy, entire, oblong or oblanceolate. Inflorescence a dense cluster. Calyx lobes free with ciliated membranous margins. Corolla campanulate, corolla lobes notched at tip. Corolla tricolored with white lobes and throat, yellow tube, and red spots on lobes. Pollen yellow, pantoporate. Seeds dark reddish brown, not mucilaginous when wet. x=9.

Colorado Desert, California, rare. One species.

Maculigilia maculata (Parish) V. Grant, *comb. nov.* BASIONYM: *Gilia maculata* Parish, Bull. Torrey Bot. Club 19:93. 1892. *Linanthus maculatus* (Parish) Milliken, Univ. California Publ. Bot. 2:55. 1904.

This rare species was described as a *Gilia* by Parish in 1892, but transferred to *Linanthus* by Milliken (1904) and retained there by later students (*e.g.*, Jepson 1943; Grant 1959). Patterson (1989) rediscovered the species in the wild and made a thorough study of it. The above diagnosis is based on Patterson's more detailed description. Patterson concluded that the species does not belong in *Linanthus*, but can be accommodated in *Gilia* though it is unique there.

Species *maculata* differs from the present sections of *Gilia* in its calyx, pubescence, and leaf blades, and from all sections except *Kelloggia* in having pantoporate pollen.

The species does, however, share some distinctive characters in common with section *Gilmania*. Namely, seed characters, pollen color, and desert ecology. These characters suggest a relationship with section *Gilmania*.

But the molecular evidence points in a different direction. In the cladogram for *nr*DNA ITS (Porter 1997), *Maculigilia maculata* clusters with *Leptodactylon* and *Linanthus*. It is also close to the *Tintinabulum campanulatum* group which is close to *Leptodactylon* and *Linanthus* in the cladogram.

Nevertheless, *Maculigilia maculata* is well outside the range of variation of these genera. Therefore, it is segregated into a monotypic genus of its own which seems to lie somewhere between *Linanthus* and *Gilia*. *Maculigilia* is assigned tentatively to the tribe Leptodactyloneae.

Allophyllum tenerrimum (A. Gray) V. Grant, *comb. nov.* BASIONYM: *Gilia tenerrima* A. Gray, Proc. Amer. Acad. Arts 8:277. 1870. *Navarrettia tenerrima* Kuntze, *Revisio Gen. Pl.* 2:433. 1891.

Small annual herb with spreading habit. Leaves, flowers, and capsules much reduced. Pubescence stipitate-glandular with a slender stalk bearing a black gland. Leaves alternate, oblanceolate to linear with 1 or 2 lobes, or not lobed and entire. Flowers solitary, small. Corolla tube and throat white and lobes pale blue. Pollen grains approaching pantoporate, with fine spinules on the tectum. Capsule globular, containing usually 1 seed per locule, valves usually falling off at maturity. Seeds rounded, ovoid, brown; mucilaginous when wet. x=9; $2n$=36.

Mid and high elevations in mountains, eastern Oregon and Sierra Nevada of California to Wyoming and Utah.

This species has been included in *Gilia* in almost all treatments since Gray (1878). In some modern treatments it has been placed close to the *Gilia leptalea* group which is now *Gilia* sect. *Kelloggia* (Mason & A. Grant 1948, 1951; Grant 1959). It is, however, quite distinct within *Gilia*.

Stuchlik (1967a, 1967b) and Day (unpubl.) noted that species *tenerrimum* is similar to *Allophyllum* in pollen morphology. Day (unpubl.) noted other similarities to *Allophyllum* in pubescence and gross morphology. The trichomes, leaf form, capsules, and seeds of species *tenerrimum* are characteristic of *Allophyllum* but not of *Gilia*. This evidence supports the conclusion that the species belongs to *Allophyllum*, a conclusion with which Day agrees (pers. comm.). *Allophyllum tenerrimum* is amply different from the typical *Allophyllum* -- *A. gilioides* (Benth.) A.D. Grant & V. Grant, *A. glutinosum*, etc. -- but many of the differences can be attributed to the reduced nature of *A. tenerrimum*.

In the DNA cladograms (Johnson *et al.* 1996; Porter 1997), *Allophyllum tenerrimum* occurs close to both *Allophyllum* and *Gilia* subg. *Gilia*.

PHYLOGENY

The characters and character combinations used to delineate the subgenera and sections of *Gilia* can be used to infer a probable phylogeny. The two subgenera, *Greeneophila* and *Gilia*, represent two main branches in the inferred phylogenetic tree (Figure 1). Of these two, the subgenus *Greeneophila* contains the most primitive characters.

The *Gilia rigidula* group (in subg. *Greeneophila* sect. *Giliastrum*) exhibits the primitive life-form or woody-based perennials. It approaches the most primitive genus *Loeselia* in life-form and is similar to it in sequences of *cp*DNA and *rn*DNA (Johnson *et al.* 1996; Porter 1997). The *G. rigidula* group occurs with *Loeselia* in northern México and Texas, and is probably derived from a *Loeselia*-like ancestor in this area (Grant 1959, 1998).

The perennial members of the other sections of subgenus *Greeneophila* exhibit some derived features as compared with section *Giliastrum*, and appear to be side-branches derived from a *Gilia rigidula*-like ancestor. The perennial species of section *Giliandra* have colonized the Rocky Mountains and Colorado Plateau. The centers of distribution of the perennial members of subgenus *Greeneophila* thus lie in a region from northern México to the Rocky Mountains and Colorado Plateau.

All three sections of subgenus *Greeneophila* have given rise to reduced annuals which have colonized western deserts.

The subgenus *Gilia* with its three interrelated sections (*Gilia, Saltugilia,* and *Arachnion*) consists entirely of annuals. The showy-flowered species are the basal members of this subgenus. These have their center of distribution and probable center of origin in California. The derived small-flowered members are widespread in the western deserts and mountains where they intermingle with the reduced annuals of subgenus *Greeneophila.*

Subgenus *Gilia* is united with subgenus *Greeneophila* by some common characters, but is also amply different from *Greeneophila* in morphology and center of distribution. It is also far removed from the subgenus *Greeneophila* in the cladograms for *cp*DNA matK and *nr*DNA ITS (Johnson *et al.* 1996; Porter 1997).

It is suggested that the three sections of subgenus *Gilia* branched off from an ancestor in or near the *G. rigidula* group in California in response to climatic changes toward summer-dry conditions. Such climatic changes occurred in the Middle Pliocene, Late Pliocene, and Xerothermic phase of the Quaternary (Axelrod 1948, 1950; Raven & Axelrod 1978). The hypothesis presumes that the ancestor disappeared from the California area as the climate became unfavorable for it, creating the present systematic gap. Sections *Saltugilia* and *Arachnion* then went on to radiate in the deserts as desert areas expanded in the Late Pliocene and Xerothermic time.

An origin of subgenus *Gilia* from the perennial *G. rigidula* group presents no particular theoretical difficulties. The *G. rigidula* group has given rise to the annual *G. incisa* group in Texas. There is not much difference between *G. incisa* and reduced plain-flowered species of subgenus *Gilia*, such as *G. angelensis* and *G. australis.*

The third subgenus *Kelloggia* does pose a problem. On general morphological characters, it has been allied to the other far-western annual gilias. However, it has pantoporate pollen (Day, unpubl. data). This is a primitive condition in the family, and occurs in *Loeselia* among other genera, whereas the rest of *Gilia* including the *G. rigidula* group has the derived condition of zonocolporate pollen (Stuchlik 1967a, 1967b; Taylor & Levin 1975; Day, unpubl. data).

This suggests that subgenus *Kelloggia* is not as closely related to the western annual gilias as has been thought, is not derived from the *Gilia rigidula* group, and may have an independent origin with some unknown ancestor with pantoporate pollen (Figure 1). If this suggestion is confirmed, *Kelloggia* does not belong in *Gilia.*

A number of cases exist in *Gilia* and its relatives where a given group exhibits evidence of relationships in two different directions. Some characters of the group in question, group X, indicate a relationship with group A, other characters of group X relate it to group B, and A and B are too distantly related to be able to hybridize. Subgenus *Kelloggia* is one example of this. *Maculigilia* is another; one set of characters suggests a relationship with *Gilia* section *Gilmania*, while another set indicates a relationship with *Linanthus.* Other such cases are noted in the preceding sections.

What are the phylogenetic explanations of the apparently bipolar relationships? One explanation is convergence which is common and widespread. Convergent evolution has produced desert annuals with reduced vegetative characters and small flowers in four sections (*Giliastrum, Giliandra, Saltugilia, Arachnion*); the similar-

appearing species were grouped together in the same artificial section *Eugilia* of older authors. Another source of bipolar relationships may be the retention of disparate elements in the genotype from ancient hybridization events; this is a possibility that we know very little about. We should also consider horizontal gene transfer between remotely related groups, which may be more common in nature than we realize.

DISCUSSION

Until recently all systematic studies of *Gilia* and other Polemoniaceae were carried out within the framework of either traditional taxonomy or evolutionary systematics (*cf.* Grant 1998). Studies of DNA sequence variation in Polemoniaceae including *Gilia* began in the 1990s, and the DNA evidence has been analyzed and interpreted according to the procedures of cladistics (Steele & Vilgalys 1994; Johnson *et al.* 1996; Porter 1997, 1998a).

The philosophy and methods of traditional taxonomy and evolutionary systematics, on the one hand, and those of molecular cladistics on the other, are very different, and lead to different conclusions in some cases. I have discussed the differences as regards the family Polemoniaceae elsewhere (Grant 1998), and will discuss the differences with respect to *Gilia* here.

Johnson *et al.* (1996) and Porter (1997, 1998a) state emphatically that *Gilia* is polyphyletic; indeed, "extremely" polyphyletic (Johnson *et al.* 1996). Actually, the phrase "extreme polyphyly" applies better to the historical catchall genus *Gilia* of the nineteenth century than it does to the *Gilia* of recent times. Successive generations of botanists have labored throughout the twentieth century to make *Gilia* more natural or less polyphyletic, and much progress has been made.

What is the standard of reference for determining the polyphyly or monophyly of a taxonomic group? For Johnson *et al.* (1996) and Porter (1997, 1998a, 1998b) there is only one standard. It is the cladogram or gene tree of a particular DNA segment. Johnson *et al.* (1996) and Porter (1997) go directly from the clades in their DNA cladograms to informal taxonomic groups, as I have shown in my analysis of their work (Grant 1998). Porter 1998a, 1998b) takes it a step further by converting several of the informal taxa into formal ones. Porter's (1998a) subdivisions of *Aliciella* conform closely to the set of clades and subclades in his *nr*DNA cladogram (Porter 1997). *Gilia* species occur in different clades of the DNA cladograms, and it is on this basis that *Gilia* is said to be extremely polyphyletic (Johnson *et al.* 1996; Porter 1997, 1998a).

There is another standard of reference for monophyly/polyphyly, namely, the system of classification built up by the methods of traditional taxonomy and evolutionary systematics. These methods include consideration of all possible characters and weighting of characters in cases of conflict in the evidence. They are responsible for almost all of the progress that has been made toward a phylogenetically natural classification of *Gilia* and allied genera.

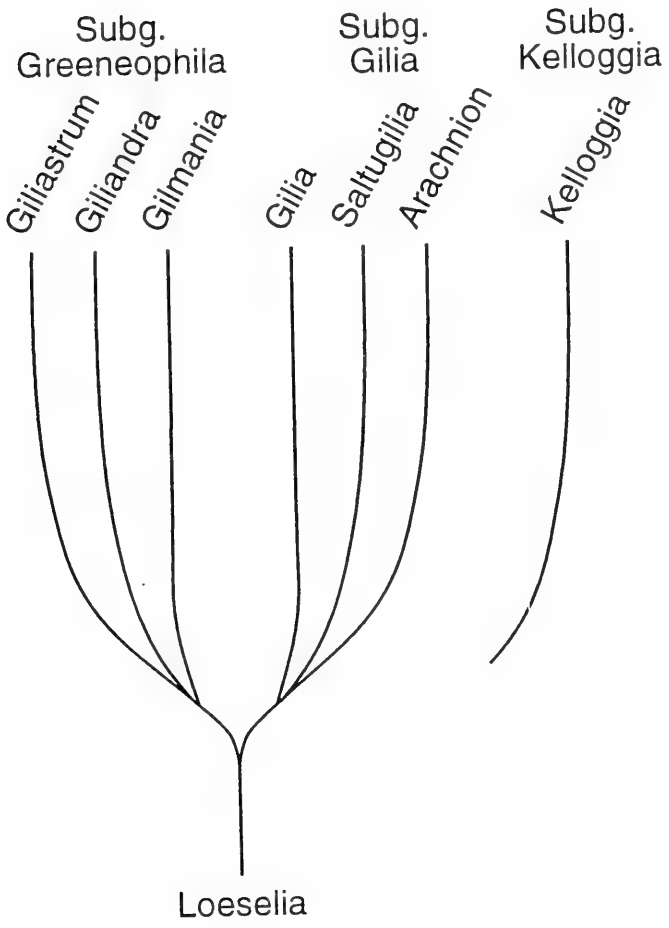

Figure 1. Proposed phylogeny of the main subgroups of the genus Gilia.

In short, all parties can agree that some polyphyly has persisted in *Gilia* and its allies into the 1990s. But disagreement exists between the molecular cladists and this evolutionary systematist as to the extent of the polyphyly, and more fundamentally, as to whether it can be detected solely from the evidence of one or two genes.

The relationship between DNA evidence and conventional characters in *Gilia* and allies falls into three patterns. There are many areas of congruence between the DNA cladograms of the 1990s and the pre-1990 classification system of *Gilia* and allied genera. Here the molecular evidence and traditional evidence are mutually supportive. There are cases where the DNA evidence calls attention to an anomaly in a sector of the preexisting system. Reexamination of the anomalous group reveals a previously unknown congruence between molecular and traditional characters, and leads to a taxonomic change. Finally, we have cases of incongruence between the DNA cladograms and preexisting classifications. These force a choice between the molecular and traditional evidence.

Let us try to place the molecular evidence in some kind of perspective. Natural relationship is measured by the degree of similarity in the genotypes of two or more individuals or groups. A single gene or region of a gene represents an infinitesimally small fraction of the genotype of a higher plant. Furthermore, the DNA of a cell organelle such as a chloroplast is less central to the genome than a major gene in a chromosome, and the latter type of genetic element is not being tested in plant molecular systematics. By contrast, the morphological characters and ecological preferences of plants represent the expression of scores or hundreds of chromosomal genes (see Clausen & Heisey 1958; Grant 1975). In any incongruence between the evidence from one or two genes and that from multifactorial phenotypic characters, the latter must be given great weight.

Molecular cladistics is designed for generating cladograms and phylogenies of genes. It is not designed for constructing classifications. For this we have the time-tested approaches of traditional taxonomy and evolutionary systematics.

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A NEW SPECIES OF *NEUROLAENA* (ASTERACEAE) FROM OAXACA, MEXICO

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ABSTRACT

A new species, ***Neurolaena jannaweissana*** B.L. Turner, is described and illustrated from western Oaxaca. Its closest relationship is with *N. balsana*, a species of northwestern Guerrero, both taxa known by only a single collection. A revised key to the Mexican species of *Neurolaena* is provided, along with a newly constructed map showing their distributions.

KEY WORDS: Asteraceae, *Neurolaena*, México, Oaxaca

In my treatment of *Neurolaena* (Turner 1982), I recognized ten species, most of these occurring in México. I added two additional Mexican species, *N. wendtii* in 1985 and *N. lamina* in 1990; these and the present addition bring to thirteen the number of taxa now recognized in *Neurolaena*, ten of these occurring in México. A key to the Mexican species follows, along with two maps showing their distributions.

KEY TO MEXICAN SPECIES

1. Heads radiate; Oaxaca..... *N. oaxacana*
1. Heads discoid..... (**2**)
   2. Pales (chaff) about 2/3 as long or longer than the subtended florets..... (**4**)
   2. Pales (chaff) of receptacle much shorter than the subtended florets; leaves 30-60 cm long..... (**3**)
3. Undersurface of blades prominently resinous-glandular; mid-ribs densely pubescent with long, dark brown, crisped, multi-cellular hairs (4-8 septate); pedicels densely brown-tomentose; achenes glabrous; Veracruz..... *N. venturana*

Fig. 1. Neurolaena jannaweissana (holotype).

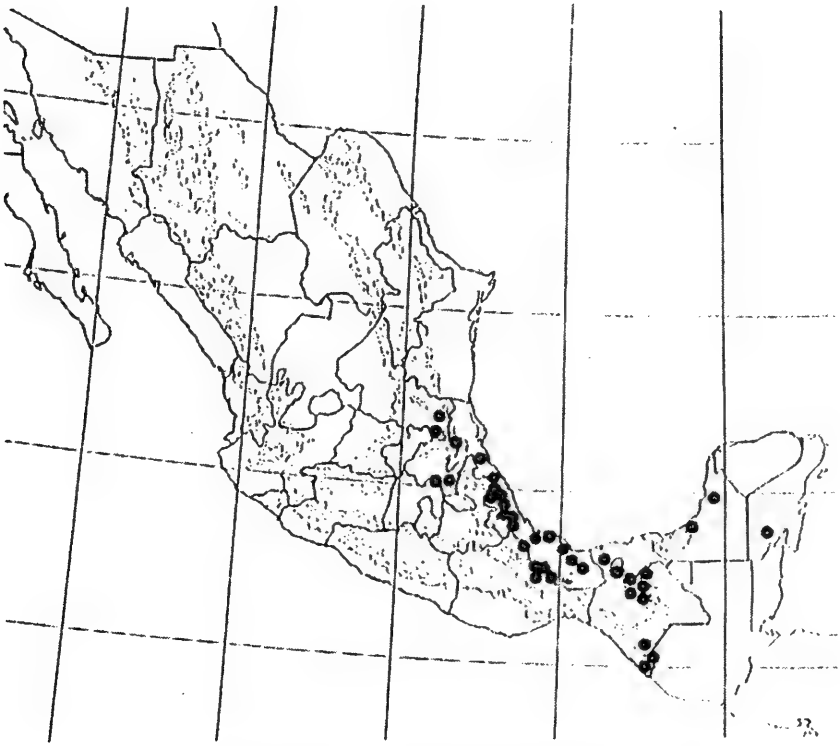

Fig. 2. Distribution of Neurolaena lobata in Mexico.

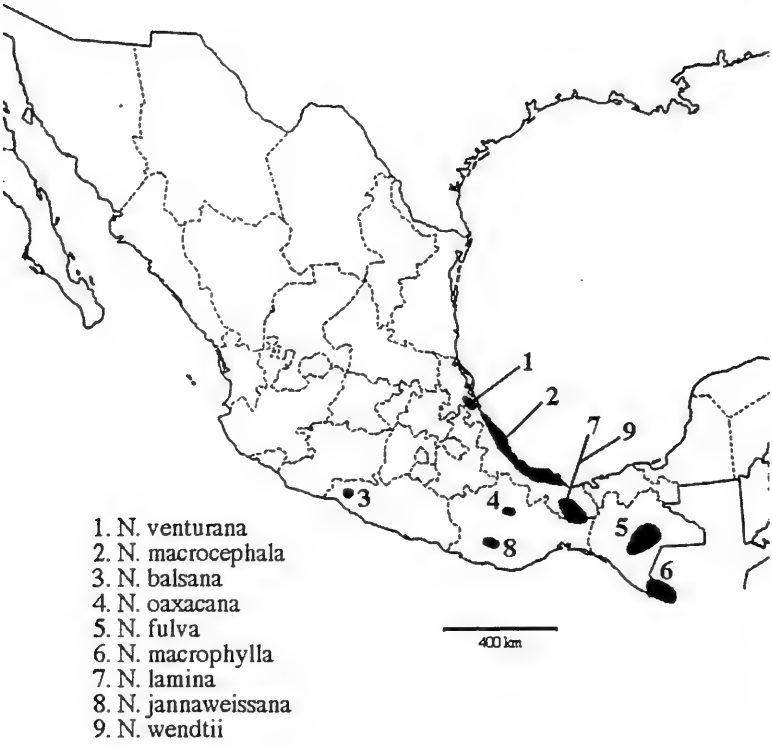

Fig. 3. Distribution of Neurolaena spp. in Mexico (other than N. lobata).

3. Undersurface of blades not, or inconspicuously, glandular beneath; mid-ribs moderately to sparsely pubescent with short, white, usually appressed hairs (2-5 septate); pedicels appressed white-hispid; achenes pubescent; SE Chiapas. ..... *N. macrophylla*
4(**2**). Heads 6-12(-14) mm across (pressed); middle series of involucral bracts linear, 1-2 mm wide..... (**5**)
4. Heads 14-16 mm across (pressed); middle series of involucral bracts narrowly ovate to ovate-orbicular, (2.0-)2.5-4.5 mm wide. ..... (**9**)
5. Undersurface of blades rather evenly soft pubescent (if hairs confined to the ribs only, the pubescence then fine and appressed). ..... (**7**)
5. Undersurface of blades coarsely hispid along the veins only, not evenly soft pubescent or densely resinous-glandular. ..... (**6**)
6. Achenes very sparsely atomiferous-glandular; pales 2-3 mm shorter than the subtended florets; Oaxaca. ..... *N. jannaweissana*
6. Achenes densely atomiferous-glandular throughout; pales about as long as the subtended florets; Guerrero. ..... *N. balsana*
7(**5**). Leaves entire to faintly crenate or rarely weakly serrate, never lobed; involucral bracts glabrous or nearly so, the middle series mostly 1 or 2-nerved; pales exceeding the subtended florets; branches of capitulescence densely fulvous(greenish-yellow) tomentose; Chiapas. ..... *N. fulva*
7. Leaves serrate to variously lobed (the uppermost ones sometimes entire or nearly so); involucral bracts mostly variously puberulent, usually 3-nerved; pales shorter than the subtended florets; branches of the capitulescence variously short-hispid, the hairs brownish, not greenish-yellow..... (**8**)
8. Leaves thin, very sparsely pubescent beneath, not at all glandular-atomiferous, the margins unlobed; southern Veracruz, eastern Oaxaca..... *N. lamina*
8. Leaves thick, densely pubescent beneath and atomiferous-glandular, the margins frequently deeply 3-lobed; widespread..... *N. lobata*
9(**4**). Outer involucral bracts appressed, broadly ovate, without terminal hirsute appendages; coastal Veracruz..... *N. macrocephala*
9. Outer involucral bracts loose, narrowly lanceolate with terminal hirsute appendages; easternmost Oaxaca and closely adjacent Veracruz..... *N. wendtii*

NEUROLAENA JANNAWEISSANA B.L. Turner, *spec. nov.* Figure 1. TYPE: MEXICO. Oaxaca: Distrito Juquila, Mpio. Tataltepec de Valdez, pine forest near Tataltepec, E of La Chinche (ca. 16° 21′ N, 97° 33′ W), along path towards Llano Verde, ca. 1000 m, 5 Jan 1994, *Janna Weiss 687* (HOLOTYPE: TEX).

Similis *N. balsanae* B.L. Turner sed foliis integris (vice foliorum dentatorum), achenis glabris aut paene glabris (vice dense glandulosorum), et paleis flosculis subtentis 2-3 mm breviorbus (vice aequalium aut longiorum).

Suffruticose herb or shrublet to 1 m high or more. Stems about 8-striate, moderately pubescent with short, somewhat down-curved hairs. Leaves alternate, 12-21 cm long, 3-4 cm wide; petioles 1-3 cm long, gradually tapering into the blades; blades pinnately veined, about equally tapered at both ends, the lower veins more pronounced than the upper, the surfaces moderately hispidulous, mostly along the major veins, margins entire or nearly so. Inflorescence composed of about 30 heads arranged in terminal clusters, the latter ca. 8 cm high, 10 cm across, the ultimate peduncles 8-14 mm long. Heads eradiate; involucres ca. 9 mm high, 14 mm wide (pressed); involucral bracts about 5-seriate, rather evenly imbricate, the outer series acute apically, the middle and inner series obtuse or rounded, the middle series linear-lanceolate, 1-nervate, ca. 1 mm wide. Receptacle ca. 2.5 mm across, ca. 0.5 mm high, the linear pales scarious, ca. 6 mm long, 2-3 mm shorter than the subtended florets. Florets numerous (40+) to a head; corollas yellow, glabrous, ca. 6 mm long, the tubes ca. 3 mm long, throat ca. 2.1 mm long, and the lobes ca. 0.9 mm long. Achenes ca. 2 mm long, black, the surfaces minutely black-warty, otherwise very sparsely atomiferous-glandular, and having a few scattered hairs; pappus of 40-50 whitish bristles ca. 6 mm long.

Because of its reduced pales, this taxon will key to, or near, *Neurolaena venturana*, in my taxonomic treatment of *Neurolaena* (Turner 1982). Its closest affinities, however, appear to be with *N. balsana* B.L. Turner, a species of northwestern Guerrero, to date known only by the type. *Neurolaena jannaweissana* differs from the latter in having shorter pales (as already noted), entire leaves, and nearly glabrous achenes (vs. densely atomiferous-glandular throughout).

It is a pleasure to name this species for Janna Weiss, newly crowned doctorate in botany at the University of Texas, Austin, Texas, her doctoral thesis (Weiss 1998) being an ethnobotanical study of the native peoples of western Oaxaca.

ACKNOWLEDGMENTS

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COMMENTS ON THE DISTRIBUTION OF *TILLANDSIA RECURVATA* L. (BROMELIACEAE) IN TEXAS

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ABSTRACT

Recent collections provide new records for the distribution of *Tillandsia recurvata* L. (Bromeliaceae) in Texas. An alternate explanation for the supposed spread of the species, attributed to local or regional environmental change, is also offered.

KEY WORDS: Bromeliaceae, *Tillandsia*, Texas, biogeography

McWilliams (1992) chronicled the apparent northeastward expansion (Figure 1) of the distribution of *Tillandsia recurvata* L. in Texas, which he attributed to local or regional environmental change. Citing the observations of professional botanists, he may have documented the spread and occurrence of the species in Brazos County, but the remainder of the supposed spread is open to a different interpretation. His expansion rests primarily upon the eastern limit of the historical distribution given by Birge (1911) that was determined in the following manner:

> "In order to determine the exact distribution of *Tillandsia recurvata* in the Southwest[,] specimens were sent to the Superintendents of Schools of the counties on the supposed border line with inquiry as to whether the plant grew in that region. The resulting information together with personal observations was used in making the map showing its distribution in Texas."

The resulting map (Figure 1) resembles an irregular triangle with the apex reaching as far north as southern McLennan County, the eastern side intersecting the Rio Grande at Brownsville (Cameron County), the western side cutting the Rio Grande at Del Rio (Val Verde County), and the base of the triangle extending along the Mexican border. As mentioned above, the occurrence of the species in a given area rested upon the observations of non-botanists near a supposed borderline. Apparently, specimens were not sent to Birge, only information as to the species' occurrence. Assuming accurate recognition of the species by the superintendents, the method would not account for the occurrence of the species outside of the supposed limits. Birge also

mentions that the apex of the distribution triangle just touches the 31° north latitude in Bell County, which is approximately four kilometers north of the present day town of Salado. Yet she includes within the mapped distribution, the southern tip of McLennan County, 54 km outside of the stated distribution. Perhaps to account for error in her method, she extended the limits of the distribution of her map in a northern direction and may have done so for the eastern and western borders as well. As a result, the Birge depiction of the distribution cannot be considered accurate. Therefore, we believe that McWilliams' (1992) reliance on Birge's distribution does not substantiate the spread of the species, but only documents its occurrence in the eastern part of its distribution.

This hypothesis is further supported by the following new county records for the species (see Figure 1).

Specimens cited: TEXAS. Atascosa Co.: rare in *Prosopis* pasture 31.5 mi S of Jourdontan on Hwy 16, ca. 50 yd E of roadside park, 6 Apr 1975, *Lewis & Joughin s.n.* (TEX-LL). Bastrop Co.: young oak-cedar-yaupon woods in & along ravine of Wilbarger Creek drainage, ca. 1.3 to 1.4 mi ENE of jct FM 969 & FM 1704, 22 Nov 1986, *Carr & Kutae 7964* (TEX-LL). Bell Co.: Moffat Cemetery off Hwy 36, 9 Jun 1998, *White 518* (BAYLU). Brown Co.: Camp Bowie Military Reserve, Dept. of Defense Site, ca. 2.4 mi E of jct US Hwy 377 & FM 45 on FM 45, in live oaks along spring fed creek, 27 Jul 1998, *Loar 001* (BAYLU). Caldwell Co.: roadside along FM 713, 3.7 mi E of jct FM 86, between McMahan and Delhi, 18 Jul 1986, *Lemke 661* (TAMU). Calhoun Co.: open grassy thickets above bay, 4 mi S of Port Lavaca, on shrubs, *Correll 28896* (TEX-LL). Colorado Co.: right side of FM 102, 1 mi S of Eagle Lake, 12 Apr 1971, *Thornton 24* (TAES). Dewitt Co.: 10 mi S of Cuervo on US Hwy 183, 5 Mar 1993, *Holmes 6334 & Yip* (BAYLU). Edwards Co.: 14 mi SW of Rockspring, Reid Ranch, 3 Apr 1983, *Johnson 137* (BAYLU). Fayette Co.: Hwy 77, Schulenburg, 27 Mar 1971, *Cary 155* (TAES). Gillespie Co.: on oaks in small park 6 mi S of Fredericksberg on road to Kerrville, 18 May 1962, *Correll & Ogden 25311* (TEX-LL). Gonzales Co.: oak trees in Palmetto State Park, camping area near Park Road 11, 6 Apr 1968, *Leonard 2023* (TEX-LL). Guadalupe Co.: 6 mi E of Seguin, *ign. leg.* (TAES). Henderson Co.: Geddie farm, 3 mi N of Athens, 17 Nov 1973, *Mathis 19* (TAES). Hidalgo Co.: Santa Anna Wildlife Refuge, 6 Apr 1957, *Correll & Schweinfurst 15663* (TEX-LL). Hill Co.: on E bank of Brazos River 0.6 km below Lake Whitney dam, 97.36468° lat. 31.86605° long., 6 Jun 1998, *Branch 302* (BAYLU). Irion Co.: 4.3 mi E of Mertzon on Hwy 67 at jct with Spring Creek, in live oaks and mesquite, 26 Jul 1998, *Singhurst 6872* (BAYLU). Jim Wells Co.: in woods of mesquite, hackberry, anacua, & live oaks near creek, 12.4 mi S of Alice, 24 Nov 1954, *Johnston 542126* (TEX-LL). Kenedy Co.: Norias Division of King Ranch, 5.5 mi N of Norias, 3 Nov 1949, *Lundell 15033* (TEX-LL). Kerr Co.: in live oaks in Kerr Wildlife Management Area, 30 Jul 1998, *Singhurst 6880* (BAYLU). Kimble Co.: in live oaks along S Llano River in S Llano River State Park, 27 Jul 1998, *Singhurst 6876* (BAYLU). Kleberg Co.: Hwy 771, ca. 1 mi W of water edge at Riviera Beach, 100 m N of road, 13 Oct 1960, *Tranverse 1799* (TEX-LL). Live Oak Co.: Atascosa River 1.5 mi E of US 281 on FM 99, Whitsett, 19 Apr 1981, *Bensmiller 199* (TAMU). Madison Co.: Navasota River Bank at Hwy 21 Bridge, 27 Aug 1996, *Neill 282* (TAMU). Mason Co.: in live oaks at Mason Mt. Wildlife Management Area, 30 Jul 1998, *Singhurst 6879* (BAYLU). McCulloch Co.: FM 1851 & San Saba River, 4.5 mi N of Fredonia, in live oak and mesquite, 24 Jul 1998,

Singhurst 6869 (BAYLU). McMullen Co.: Hwy 173, 10 mi N of Tilden, 3 Nov 1962, *Gungora, Garza, & McCart 8529* (TEX-LL). Medina Co.: SW side of Hill Country State Natural Area in live oaks along Bandera Creek, 27 Jul 1998, *Singhurst 6878* (BAYLU). Menard Co.: jct of Hwy 864 & San Saba River, 3.9 mi W of Ft. McKavett, 26 Jul 1998, *Singhurst 6973* (BAYLU). Real Co.: Hwy 83, 1 mi S of Leaky, 27 Mar 1964, *Corasco & McCart 9031* (TEX-LL). Refugio Co.: mott near Melon Creek, Red Well Pasture, Greta Ranch, ca. 8 mi NE of Refugio, 21 Jul 1981, *Hill 10589* (TAES). San Patricio Co.: 500 ft W of Big Lake, Welder Wildlife Foundation Refuge, 12 Mar 1980, *Critchfield 7* (TAMU). San Saba Co.: Colorado Bend State Park along trail to Gorman Falls, in live oaks adjacent to Colorado River, 24 Jul 1998, *Singhurst 6881* (BAYLU). Schleicher Co.: 3.8 mi N of jct FM 2084 & Hwy 190, jct FM 2084 & Poor Hollow, in live oaks and elms, 25 Jul 1998, *Singhurst 6871* (BAYLU). Sutton Co.: ENE of jct FM 3130 & IH-10 towards Roosevelt, WSW of Cedar Hill Cemetery in live oaks along N Llano River, 26 Jul 1998, *Singhurst 6875* (BAYLU). Tom Green Co.: S Concho River in live oaks, 0.4 mi NW of Christoval, 25 Jul 1998, *Singhurst 6870* (BAYLU). Williamson Co.: live oaks W of Round Rock, 17 Aug 1946, *York 46292* (TEX-LL).

Depending on location, the new records expand the known distribution of *Tillandsia recurvata* presented by Birge (1911), Smith (1944), and McWilliams (1992), from 100-240 kilometers northward. It also shows that the species is considerably more widespread in the central, western, and northern parts of the Edwards Plateau and nearby vegetational regions than previously thought.

The common feature among most of the new records is the proximity to large bodies of water or permanent creeks, falls, or springs. In Irion County, the species is fairly localized to Spring Creek in mainly *Quercus fusiformis* Small (Fagaceae) and *Prosopis* (Fabaceae). In Tom Green County, along the South Concho River, *T. recurvata* is very abundant in *Quercus fusiformis, Prosopis, Celtis* (Ulmaceae), and *Ulmus crassifolia* Nutt. (Ulmaceae). Similarly, in the southeastern corner of Kimble County, along the South Llano River, several healthy populations exist in creek drainages. Menard County's population, on the San Saba River, is a little more sparse with only a few plants per tree. In McCulloch County, the species is abundant in *Q. fusiformis, Prosopis*, and *Juniperus ashei* Buchh. (Cupressaceae) along the San Saba River in the southern two thirds of the county. The number of *T. recurvata* in *Q. fusiformis* at the Brown County site is described as "plentiful along spring-fed creek." At the Hill County location, *T. recurvata* is abundant, with one to several plants per tree for a distance of about 400 meters along the edge of a vertical limestone cliff. Numerous seeps are perched on the cliff, which is 10-15 meters high on the east side of the Brazos River. Several trees, primarily *Juniperus ashei* and *Quercus fusiformis*, were infested with a hundred or more plants. The sheer number of plants occurring in Hill County indicates a well-established and presumably old population. No specific mention of abundance or a creek is made for the Henderson County specimen, but, based on label information, the location would probably be nearby Caney Creek, three miles north of Athens.

For regions with less rainfall, Birge (1911) mentions that *Tillandsia recurvata* "is in many cases confined entirely to the river valleys." She also says ". . . its northern range is determined by the cold of the winters." It appears moisture and heat retention from large bodies of water moderate the local environment, forming a microclimate suitable for this species' growth.

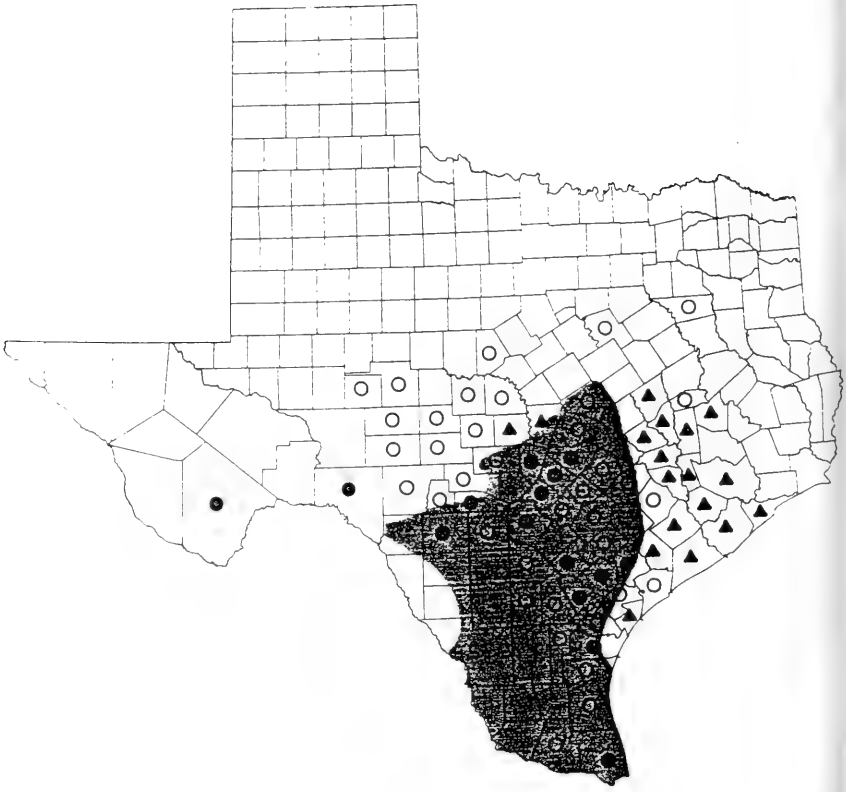

Figure 1. Shading depicts the distribution of Tillandsia recurvata in Texas reported by Birge (1911). Closed circles represent records cited by Smith (1944). McWilliams' (1992) expansion of the distribution shown as triangles. New county records illustrated as open circles (see text for explanation).

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PARAKEELYA: A NEW GENUS SEGREGATED FROM *CALANDRINIA* (PORTULACACEAE)

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ABSTRACT

Extensive analyses of Portulacaceae have demonstrated that traditional circumscriptions of the genus *Calandrinia* Kunth were artificial, and that the included species were intertwined phylogenetically with many other Portulacaceae lineages. Roger Carolin proposed that the Australian endemic species of *Calandrinia* sensu lato, which are not related closely to *Calandrinia* sensu stricto, be transferred to *Rumicastrum* Ulbr., but combinations were never made. *Rumicastrum* appears to belong to Chenopodiaceae, however, as Ulbrich suggested. Here, the genus *Parakeelya*, based on an aboriginal name, is established to accommodate the Australian endemic calandrinias. New combinations are provided for 38 names.

KEY WORDS: Australia, *Calandrinia*, *Parakeelya*, Portulacaceae, phylogenetics, *Rumicastrum*

In seminal phylogenetic studies of Portulacaceae, Carolin (1987, 1993) determined that the traditional circumscription of the genus *Calandrinia* Kunth (100-150 spp.; *e.g.*, Pax & Hoffmann 1934; *cf.* McNeill 1974; Nyanyano 1986) was unnatural, and that the species were intertwined phylogenetically with many lineages of Portulacaceae. Carolin's general conclusion was corroborated in subsequent investigations (Hershkovitz 1991a, 1991b, 1993a, 1993b; Hershkovitz & Zimmer 1997, submitted ms.). Hershkovitz (1993a, 1993b) showed that *Calandrinia* sensu stricto was a morphologically well-defined lineage comprising fourteen species native to the Americas, and that these species are not related closely to a group of 35-50 Australian native species classified in *Calandrinia* sensu lato (though one species of *Calandrinia* sensu stricto is adventive in Australia -- see below). These phylogenetic results have been corroborated by ribosomal DNA sequence data (Hershkovitz & Zimmer 1997; submitted ms.).

Carolin (1987, 1993) proposed that the Australian endemic calandrinias should be transferred to the genus *Rumicastrum* Ulbr., which had been described as a monotypic

genus of Chenopodiaceae from Western Australia (Ulbrich 1934). Presumably, Carolin believed that a specimen identified as *Rumicastrum chamaecladum* Ulbr., *George 16288* (PERTH,B; Carolin 1987) actually was an unspecified Australian calandrinia, notwithstanding that the diagnosis and illustration of *Rumicastrum* (Ulbrich 1934) impart no hint of portulacaceous affinity. Carolin's proposal was reiterated in papers coauthored by Carolin (Syeda & Carolin 1989, 1990; Kühn *et al.*, 1993). Hershkovitz (1991a, 1991b, 1993a, 1993b) accepted on faith Carolin's proposal.

Nomenclatural realignments reflecting the compelling phylogenetic evidence were formalized for several members of *Calandrinia* sensu lato and other Portulacaceae (see Hershkovitz 1993a; Hershkovitz & Zimmer 1997), but the Australian calandrinias were not renamed, even in subsequent floristic treatments (see below). Several factors probably have contributed to the delay in renaming these plants, including inertia and perhaps the name *Rumicastrum* itself, which seems perfectly appropriate for a chenopod but unpalatable for attractive members of Portulacaceae. Also, Hershkovitz' work concentrated primarily on American plants such that formal names for Australian plants were dispensable.

Hershkovitz & Zimmer (1997) included an Australian calandrinia (*Calandrinia ptychosperma* F. Muell.) in their analysis of ribosomal DNA data for the portulacaceous alliance. In the original draft of their paper, they had recombined this species under *Rumicastrum*. Werner Greuter and Brigitte Zimmer (pers. comm., 13II1997) kindly advised the authors that "*Rumicastrum chamaecladum*, as evidenced by the specimen *George 16288*, which perfectly fits the original description (and would be a good neotype) has nothing, but absolutely NOTHING to do with Australian *Calandrinia*. We are persuaded it is a perfectly good chenopod reasonably close to *Atriplex*." The holotype of *Rumicastrum chamaecladum* presumably was destroyed during World War II. Hershkovitz & Zimmer (1997) thus reverted to using *Calandrinia* for their plant, as the circumscription of *Calandrinia* was not the focus of that paper.

In a manuscript currently in review, Hershkovitz & Zimmer present ribosomal DNA evidence reinforcing the morphologically-based circumscription of *Calandrinia* sensu stricto. The data again show that the sampled Australian taxon is not related closely to this genus. In the context of the submitted manuscript, the appellation of *Calandrinia* for the Australian plant is awkward and misleading, necessitating a new generic name.

The present paper proposes the generic name *Parakeelya* for the Australian calandrinias. This name derives from the vernacular name "parakeelya" applied generically to *Calandrinia polyandra* Benth. by Black (1948), to *Calandrinia* (presumably referring to the Australian species only) by West (1986), and, with specific epithets, to other species of Australian calandrinias by Black (1948) and numerous floristicians (see below). "Parakeelya" apparently is an alternative spelling for "periculia," the aboriginal vernacular for the seed meal of *Calandrinia balonensis* Lindl. (Mueller 1876; *cf.* Poellnitz 1934).

The only purpose of the present paper is to validate names for the Australian species. A comprehensive generic description is problematic. The Australian calandrinias comprise a diverse assemblage. For some characters, the species

approach the full range of variation found in Portulacaceae as a whole (*e.g.*, growth habit, seed geometry and sculpturing, pollen morphology; Carolin 1987, 1993; Syeda 1979; Syeda & Ashton 1989; Syeda & Carolin 1989, 1990; see also floristic references cited below). There appears to be no known single character that ties the species together. Some features that occur among these species are unique or unusual among Portulacaceae, *e.g.*, capsules that split only at the apex, polyforate-operculate pollen, three-dimensional leaf venation, and anisocytic stomata (Carolin 1987, 1993; Hershkovitz 1991b). In fact, monophyly of the Australian species has not been demonstrated. Carolin's (1987) cladogram of Portulacaceae showed polyforate-operculate pollen as a synapomorphy of this group, but several species have pantocolpate pollen (Carolin 1987; Kelley 1973), which plausibly is primitive in this group (Carolin 1987; Hershkovitz 1993a). Polyphyly of the Australian species is not supported, either. Specifically, there are no features that link particular species to otherwise divergent lineages of Portulacaceae. To the contrary, and despite the lack of a clear synapomorphy, the species appear to be linked to one another by combinations of features.

Because of the variability in this group, as well as the poor representation of herbarium material of these taxa in the United States and Europe, the generic diagnosis will emphasize the traits of the one species for which ribosomal DNA evidence is available, *Calandrinia ptychosperma* F. Muell. The diagnosis basically will be that of Mueller (1876, elaborated from Mueller 1864), amended to include mention of polyforate-operculate pollen. The diagnosis obviously will omit reference to the range of variation in the species being transferred, but, at the same time, it will be much more applicable to the Australian species in general than is that of *Calandrinia*.

Calandrinia ptychosperma is designated here as the type for the generic name, even though the vernacular name "parakeelya" refers to either or both of *Calandrinia balonensis* and *C. polyandra*. *Calandrinia balonensis* and *C. polyandra* have 12-15-pantocolpate pollen (Carolin 1987; Kelley 1973), while *C. ptychosperma* has polyforate-operculate pollen. To the degree that polyphyly of the Australian plants is conceivable, these alternative pollen states represent one of the plausible distinctions. I have observed, however, that *C. balonensis* is among the Australian species that have three-dimensional leaf venation (Hershkovitz 1991b), so I suspect that additional research will show that the Australian plants indeed are monophyletic.

Specific combinations will be provided for those species that otherwise are validly published and accepted in the most recent Australian floristic and taxonomic works (Beard 1970; Blackall & Grieve 1988; Chapman 1991; Cunningham *et al.* 1992; Green 1985; Queensland Herbarium 1993; Syeda 1979, 1981, 1996; Walsh 1996; West 1986, 1987, 1990, 1992). Chapman (1991) listed 60 specific and subspecific combinations in *Calandrinia* in Australia, of which 53 pertain to *Parakeelya*. One name pertains to *Anacampseros* (Hershkovitz 1993), and six have been applied in reference to the American native *C. ciliata* (Ruíz & Pavón) DC., which has established adventively in Australia. [All current Australian floras use *C. menziesii* (Hook.) Torrey & A. Gray for this species. Discordance with current opinion in American works (*e.g.*, Kelley 1993) aside, documentation of the identity of the Australian plants with, specifically, the type of *C. menziesii* appears to be lacking.] For the group here circumscribed as *Parakeelya*, Syeda & Carolin (1990) indicated that there are 34 species, while Carolin (1993) indicated that there are 50. Review of the floristic work suggests that 33 validly published species are accepted. These plus one problematic

name are transferred here to *Parakeelya*. Two additional species described by Syeda (1979) remain unpublished (Syeda & Carolin 1988), and another two apparently are unidentified/undescribed (West 1990; Queensland Herbarium 1993). Additional names listed by Chapman (1991) that pertain to *Parakeelya* are disposed in the discussion following the taxonomic treatment below.

PARAKEELYA Hershkovitz, *gen. nov.* TYPE: *Parakeelya ptychosperma* (F. Muell.) Hershkovitz (*Calandrinia ptychosperma* F. Muell.).

Herba humilis, glabra, foliis radicalibus lineari-filiformibus confertis acutis, caulinis brevioribus, racemis paucifloris, bracteis acutis scariosis, pedicellis calyce ter aliquotiesve rarius vix longioribus aetate erectiusculis, sepalis persistentibus rotundo-ovatis acutatis, pollinis grana polyporus-operculatus, stylo nullo, capsula calycem breviter superante vel aequante apice quadrivalvi cylindrico-conica, seminibus nitentibus fusco-atris simpliciter longitudinali-sulcatis fere reniformibus.

PARAKEELYA ARENICOLA (Syeda) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia arenicola* Syeda, Proc. Linn. Soc. New South Wales 116:153. 1996.

PARAKEELYA BALONENSIS (Lindl.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia balonensis* Lindl. *in* T.L. Mitchell, *J. Exped. Trop. Australia*. 148. 1848.

PARAKEELYA BREVIPEDATA (F. Muell.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia brevipedata* F. Muell, *Fragm.* 10:69. 1876.

PARAKEELYA CALYPTRATA (Hook. *f.*) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia calyptrata* Hook. *f. in* Hook., *Icon. Pl.* 3:296. 1840.

PARAKEELYA COMPOSITA (Nees) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia polypetala* Fenzl *in* Endl. *et al.* var. *composita* Nees *in* Lehm., *Pl. Preiss.* 1:247. 1845.

PARAKEELYA CORRIGIOLOIDES (F. Muell. *ex* Benth.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia corrigioloides* F. Muell. *ex* Benth., *Fl. Austral.* 1:175. 1863.

PARAKEELYA CREETHAE (Tratman *ex* Morrison) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia creethae* Tratman *ex* Morrison, J. Bot. 50:165. 1912.

PARAKEELYA DISPERMA (J.M. Black) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia disperma* J.M. Black, Trans. & Proc. Roy. Soc. South Australia 45:11, t. III. 1921.

PARAKEELYA EREMAEA (Ewart) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia eremaea* Ewart, *Fl. Victoria* 486. 1921. SYNONYM: *Calandrinia pusilla* Lindl., *nom. illegit., in* T.L. Mitchell, *J. Exped. Trop. Australia*. 360. 1848, non *Calandrinia pusilla* Barnéoud 1846.

PARAKEELYA GRACILIS (Benth.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia gracilis* Benth., *Fl. Austral.* 1:173. 1863.

PARAKEELYA GRANULIFERA (Benth.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia granulifera* Benth., *Fl. Austral.* 1:176. 1863.

All current floristic references (see above) regard *Talinum nanum* Nees 1845 as a taxonomic synonym of *Calandrinia granulifera* Benth. Nee's epithet has priority, but it was not available for recombination in *Calandrinia* (see discussion below). *Parakeelya granulifera* becomes the valid name for *Calandrinia granulifera* if it is considered distinct from *Talinum nanum*.

PARAKEELYA LEHMANNII (Endl.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia lehmannii* Endl. *in* Lehm., *Pl. Preiss.* 2:235. 1848.

PARAKEELYA LINIFLORA (Fenzl) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia liniflora* Fenzl *in* Endl. *et al.*, *Enum. Pl.* 52. 1837.

PARAKEELYA NANA (Nees) Hershkovitz, *comb. nov.* BASIONYM: *Talinum nanum* Nees *in* Lehm., *Pl. Preiss.* 1:246. 1845. SYNONYMS: *Calandrinia pygmaea* F. Muell. *nom. illegit.*, *Fragm.* 1:175. 1859; *Calandrinia neesiana* H. Eichler, Taxon 12:295. 1963.

Calandrinia pygmaea F. Muell. was illegitimate because it was a homotypic synonym of *Talinum nanum* Nees. Nonetheless, *Calandrinia pygmaea* was adopted in taxonomic and floristic works until the middle of the 20th century (*e.g.*, Bentham 1863; Poellnitz 1934; Black 1948), by which time the proper recombination of *Talinum nanum* had been preempted by *Calandrinia nana* Philippi 1894. [Beard (1970) included the name "*Calandrinia nana* (Nees) C.A. Gardn." in his checklist, without a reference or basionym.] *Calandrinia neesiana* H. Eichler became the new name for *Talinum nanum*, but this now is widely regarded as a taxonomic synonym of *Calandrinia granulifera* Benth. *Parakeelya nana* has priority over *Calandrinia granulifera* when these are regarded as the same species.

PARAKEELYA PAPILLATA (Syeda) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia papillata* Syeda, Telopea 2:60. 1980.

PARAKEELYA PICKERINGII (A. Gray) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia pickeringii* A. Gray, U.S. Expl. Exped., Phan. 1:144. 1854.

PARAKEELYA PLEIOPETALA (F. Muell.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia pleiopetala* F. Muell., *Fragm.* 10:70. 1876.

PARAKEELYA POLYANDRA (Benth.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia polyandra* Benth., *Fl. Austral.* 1:172. 1863. SYNONYM: *Talinum polyandrum* Hook. *nom. illegit.*, Bot. Mag. 4833. 1855, non *Talinum polyandrum* Ruíz & Pavón, *Syst. Veg. Fl. Peruv. Chil.* 115. 1798.

PARAKEELYA POLYPETALA (Fenzl) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia polypetala* Fenzl *in* Endl. *et al.*, *Enum. Pl.* 51. 1837.

PARAKEELYA PORIFERA (Syeda) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia porifera* Syeda, Telopea 2:59. 1980.

PARAKEELYA PRIMULIFLORA (Diels) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia primuliflora* Diels *in* Diels & E. Pritz., Bot. Jahrb. Syst. 35:198, fig. 24 A-F. 1904.

PARAKEELYA PTYCHOSPERMA (F. Muell.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia ptychosperma* F. Muell., Fragm. 4:137. 1864.

PARAKEELYA PUMILA (Benth.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia calyptrata* Hook. *f. in* Hook. var. *pumila* Benth., *Fl. Austral.* 1:175. 1863.

PARAKEELYA QUADRIVALVIS (F. Muell.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia quadrivalvis* F. Muell., *Fragm.* 1:176. 1859.

PARAKEELYA REMOTA (J.M. Black) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia remota* J.M. Black, Trans. & Proc. Roy. Soc. South Australia 47:369. 1923.

PARAKEELYA RETICULATA (Syeda) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia reticulata* Syeda, Telopea 2:60. 1980.

PARAKEELYA SCHISTORHIZA (Morrison) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia schistorhiza* Morrison, J. Bot. 50:164. 1912.

PARAKEELYA SPERGULARINA (F. Muell.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia spergularina* F. Muell., *Fragm.* 1:175. 1859.

PARAKEELYA SPHAEROPHYLLA (J.M. Black) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia sphaerophylla* J.M. Black, Trans. & Proc. Roy. Soc. South Australia 51:378. 1927.

PARAKEELYA STAGNENSIS (J.M. Black) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia stagnensis* J.M. Black, Trans. & Proc. Roy. Soc. South Australia 51:379. 1927.

PARAKEELYA STENOGYNA (Domin) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia stenogyna* Domin, Biblioth. Bot. 22(89):971. 1926

PARAKEELYA STROPHIOLATA (F. Muell.) Hershkovitz, *comb. nov.* BASIONYM: *Claytonia strophiolata* F. Muell., *Fragm.* 11:82. 1880. SYNONYM: *Calandrinia strophiolata* (F. Muell.) Poelln., Feddes Repert. Spec. Nov. Regni Veg. 35:173. 1934.

PARAKEELYA TUMIDA (Syeda) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia tumida* Syeda, Proc. Linn. Soc. New South Wales 116:156. 1996.

PARAKEELYA UNIFLORA (F. Muell.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia uniflora* F. Muell., Trans. & Proc. Philos. Inst. Victoria 3:41. 1857.

PARAKEELYA VOLUBILIS (Benth.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia volubilis* Benth., *Fl. Austral.* 1:174. 1863.

Based on the cited taxonomic and floristic references, additional names (excluding autonyms) in *Calandrinia* listed by Chapman (1991) are disposed taxonomically as follows:

Calandrinia calyptrata Hook. *f. in* Hook. var. *pumila* Benth, homotypic synonym of *Parakeelya pumila.*
Calandrinia caulescens Kunth, synonym of *Calandrinia ciliata.*
Calandrinia caulescens Kunth var. *menziesii* (Hook.) A. Gray, synonym of *Calandrinia ciliata.*
Calandrinia ciliata (Ruíz & Pavón) DC., accepted.
Calandrinia compressa Schrad. *ex* DC., accepted, probably does not occur in Australia (Poellnitz 1934).
Calandrinia cygnorum Diels, synonym of *Parakeelya brevipedata.*
Calandrinia dipetala J.M. Black, synonym of *Parakeelya calyptrata.*
Calandrinia liniflora Fenzl *in* Endl. *et al.* var. *grandiflora* Benth., synonym of *Parakeelya liniflora.*
Calandrinia maryonii S. Moore, synonym of *Parakeelya ptychosperma.*
Calandrinia menziesii (Hook.) Torrey & A. Gray, synonym of *Calandrinia ciliata.*
Calandrinia morrisae Goy, synonym of *Parakeelya ptychosperma.*
Calandrinia pogonophora F. Muell., synonym of *Anacampseros australiana* J.M. Black.
Calandrinia polyandra Benth. var. *leptophylla* Benth., status uncertain (West 1986; *cf.* Black 1948).
Calandrinia polypetala Fenzl *in* Endl. *et al.* var. *composita* Nees, homotypic synonym of *Parakeelya composita.*
Calandrinia tepperiana W. Fitzg., synonym of *Parakeelya quadrivalvis.*
Calandrinia volubilis Benth. var. *parvula* J.M. Black, status uncertain, not mentioned in cited floras (including Black 1948).

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ANNOTATED CHECKLIST OF THE VASCULAR PLANTS OF WALKER, MONTGOMERY, AND SAN JACINTO COUNTIES, EAST TEXAS

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ABSTRACT

An annotated checklist is provided of the vascular plant species of Walker, Montgomery, and San Jacinto counties of southeast Texas, an area totaling 2450 square miles and completely including the Sam Houston National Forest. Most of the three-county area is within the "Pineywoods" Texas Natural Region; smaller portions are within three other Natural Regions: the "Blackland Prairie," "Oak Woods and Prairies," and "Gulf Coastal Prairie." A total of 1373 species in 623 genera and 160 families are recorded. Distribution records are documented individually by county, either with the herbarium repository of a voucher specimen or a literature citation. Asteraceae is the largest family in the flora with 170 species; next largest are Poaceae (155 species), Fabaceae (120 species), and Cyperaceae (105 species). The largest genera are *Carex* with (37 species), *Cyperus* (18 species), *Rhynchospora* (17 species), *Desmodium* and *Eleocharis* (15 species), *Dichanthelium* and *Juncus* (14 species), *Eupatorium, Symphyotrichum,* and *Trifolium* (11 species), *Ludwigia* (10 species), *Hypericum, Paspalum, Solidago,* and *Viola* (9 species), *Eragrostis, Helianthus, Panicum, Polygonum,* and *Ranunculus* (8 species), and *Chamaesyce, Crataegus, Euphorbia, Lespedeza, Liatris, Oenothera, Scutellaria, Sisyrinchium, Smilax,* and *Solanum* (7 species).

KEY WORDS: floristics, Texas, checklist

This checklist provides a preliminary summary of the vascular plant species known to occur in Walker, Montgomery, and San Jacinto counties, Texas. It also provides a guide to species that may be found within the Sam Houston National Forest, whose

boundary lies completely within these three counties. It seems likely that the number of species in the checklist may be expanded at least 10% as specialized habitats (especially wetland and deep sand) are studied in more detail. We believe, however, that the broad floristic outline is indicated here.

The three-county flora includes 1373 species in 160 families and 623 genera. The average number of species per genus is 2.2. Asteraceae is the largest family in the flora with 170 species; next largest are Poaceae (155 species), Fabaceae (120 species), and Cyperaceae (105 species). Other families are significantly smaller (e.g., Lamiaceae with 39 species, Euphorbiaceae with 37, Scrophulariaceae with 34, Apiaceae with 30, Rosaceae with 26, Onagraceae with 24, Fagaceae with 21, and Ranunculaceae and Rubiaceae with 18). The largest genus, by far, is *Carex* with 37 species. Other relatively large genera are as follows: *Cyperus* (18 species), *Rhynchospora* (17 species), *Desmodium* and *Eleocharis* (15 species), *Dichanthelium* and *Juncus* (14 species), *Eupatorium, Symphyotrichum,* and *Trifolium* (11 species), *Ludwigia* (10 species), *Hypericum, Paspalum, Solidago,* and *Viola* (9 species), *Eragrostis, Helianthus, Panicum, Polygonum,* and *Ranunculus* (8 species), and *Chamaesyce, Crataegus, Euphorbia, Lespedeza, Liatris, Oenothera, Scutellaria, Sisyrinchium, Smilax,* and *Solanum* (7 species).

Documentation for the occurrence of each taxon is indicated by a symbol for its county or counties of occurrence. Voucher specimens for most of the records are deposited in SHST (Sam Houston State University, Huntsville) and SBSC (Spring Branch Science Center, Houston), the identities of these verified by Nesom and Brown. Some records (as indicated) are taken from other herbaria and from literature, and detailed surveys of other Texas herbaria undoubtedly will provide additional records.

The comprehensive treatment of Correll & Johnston (1970) remains the primary basis for assessments of the Texas flora. Recent nomenclatural updates (Johnston 1989; Hatch *et al.* 1990) also have been useful. Nomenclature in the current checklist mostly follows Jones *et al.* (1996) and Kartesz (in Kartesz & Meachum 1998). Where the primary entry in the current checklist differs from the latter two references, other currently used names are provided as synonyms.

A 1978 fire destroyed most of the plant collection at SHST, which had been amassed over a number of decades by S.R. Warner (primarily for Walker County) and served as the basis of knowledge for the local flora. Fortunately, a checklist and summary of the Walker County plants (including 643 species) was prepared in 1977 by Tom Zimmerman (unpublished), based on Warner's field notes and herbarium specimens. Warner's studies of the Walker County flora included particular attention to the relationship of plant distribution to soil type, this information included in Zimmerman's compilation. Warner made careful identifications, but a small set of taxa said by Warner to occur in Walker County were probably based on misidentifications or earlier taxonomic interpretations: these are noted below. Most of the species recorded by Warner have been recollected for SHST since the 1978 herbarium fire; 61 remain to be recollected. The more recent additions to SHST have been made since 1978 primarily by Claude McLeod, Michael Warnock, Guy Nesom, and various students. James Kessler added many regional collections of Cyperaceae and other taxa in the mid 1970's. Kathy Nelson (1996) added and summarized records for Asteraceae of Walker County.

Herbarium SBSC is part of the Spring Branch Science Center of the Spring Branch Independent School District in Houston. It is the largest herbarium in southeast Texas, with over 31,000 specimens of vascular plants. The herbarium was begun by R.A. Vines, but more than half of the collections are those of Larry Brown, as it now serves as the primary repository for vouchers for Brown's floristic investigations of the Houston area and southeast Texas. Among these studies, an annotated checklist of Harris County (including Houston) and the eight counties contiguous with it (including Montgomery County) is currently in preparation.

A published florula of the Little Thicket Nature Preserve (Peterson & Brown 1983; San Jacinto County, 650 acres, 485 species, including keys) is very helpful. A number of records from San Jacinto County on the present list are documented by Little Thicket vouchers in SBSC.

A checklist of the vascular species of Huntsville State Park (2122 acres, 320 species) is maintained by the Texas Parks & Wildlife Department (Singhurst 1998). This summary is based originally on a list prepared by Claude McLeod in 1976, with additions and revisions by TP&WD personnel, including recent collections by Jason Singhurst. Specimens documenting a number of these HSP records are deposited in BAYLU (Baylor University) and SHST.

Treatments of the Texas species of legumes (Turner 1959) and ferns and fern allies (Correll 1956) also have furnished additions to the present checklist not documented by specimens in SHST, as does a treatment of Asteraceae for Texas (Turner unpublished). Carr (1994) conducted a floristic study of blackland prairie openings within the Sam Houston National Forest, these records partly documented by specimens deposited at TEX. A few records have been taken from various other published references, as specifically indicated within the list.

Description of the area

Walker County covers about 505,600 acres (790 square miles), Montgomery County about 697,000 acres (1089 square miles), and San Jacinto County about 365,250 acres (571 square miles), the whole area totaling about 1,568,000 acres (2450 square miles). Sam Houston National Forest includes about 161 thousand acres (about 1/10 the total area). Tracts that most nearly approach being "natural areas" (the least disturbed, with the highest species diversity) are Huntsville State Park (2100 acres in Walker County), Lake Houston State Park (4900 acres partly in Montgomery County), several relatively small, privately owned nature preserves in San Jacinto County, and two "Scenic Areas" and one "Wilderness Area" within SHNF that are currently somewhat exempted from the otherwise heavy economic orientation of timber management in the National Forest. Otherwise, much of the private land also is heavily managed for timber production and there is much rural "development" in the form of housing, ranching, and farming. Conroe and The Woodlands (Montgomery Co.), and Huntsville (Walker Co.) are the largest urban areas.

The Trinity River flows across the northern tip of Walker County and then forms the north and eastern boundary of San Jacinto County, where it is impounded as Lake Livingston. The East Fork and West Fork of the San Jacinto River flow southward

through the area – the latter is the primary input for Lake Conroe in Walker and Montgomery County. Several variants of bottomland hardwood communities, highly disturbed for the most part, occur along these and other rivers and creeks.

The climate of the three-county area is hot; daily high temperatures from May through October commonly are above 90 degrees Fahrenheit. The area receives an average range of about 43-48 inches of rainfall annually.

Soils in the three-county area were deposited in the Tertiary and Quaternary periods. The largest areas are Pliocene and Pleistocene sands (Willis, Bentley, and Beaumont Formations), often with a clay subsoil. Clay prairies in Walker and Montgomery counties and clay inclusions (all three counties) within the sandy areas of pine-oak forest are Fleming Formation (Miocene). Sandstone outcrops in Walker County are Catahoula Formation (Miocene) -- most of the large outcrops have been removed by quarrying. Alluvial deposits of the larger rivers are extensive in places.

General nature of the vegetation

Parts of Walker County and Montgomery counties are within the "Blackland Prairie" Natural Region (*sensu* LBJ School of Public Affairs 1978). Small, discrete patches of prairie vegetation on clay substrate extend eastward across the region as inclusions within the pine-hardwood forests. These prairie inclusions are strongly predictable in floristic composition (Carr 1993) and are most similar in vegetation to the "Fayette Prairie" (Smeins and Diamond 1983) immediately west of the area. Much of the western half of Walker County is "Oak Woods & Prairies (Oak Woodlands)" Natural Region. The southern extremity of Montgomery County lies in the "Gulf Coastal Prairie" Natural Region.

Most of the three-county area, however, is within the "Pineywoods" Natural Region. Because of the prevalence of timber management, pines usually are dominant, either as plantations or mixed with various combinations of hardwoods. A few white oak and laurel oak dominated stands can be found on mesic slopes in Sam Houston National Forest. Stands of scrubby post oak - blackjack oak, however, which typically occur on xeric ridges, have almost all been replaced by roads or managed pine stands.

Walker and Montgomery counties lie essentially at the southwestern corner of the Eastern Deciduous Forest, the relatively sharp vegetational change to prairie molded by rapidly decreasing precipitation (westward) and an abrupt transition from primarily sandy soils to the prairie clays. A conspicuous set of woody species reaches the western maximum of its distribution in Walker County (*e.g.*, sweetgum, red maple, southern magnolia, cherry laurel, nutmeg hickory, the two hornbeam species, sassafras, fringetree, silverbell, witch hazel, dwarf chinquapin, black oak, white oak, and swamp chestnut oak). Other Walker County species are near their western distributional limit (*e.g.*, shortleaf and loblolly pine, dogwood, black gum, white ash, persimmon, bitternut hickory, water hickory, river birch, southern red oak, willow oak, and overcup oak). Eastern Montgomery County and a major part of San Jacinto County lie within the "Big Thicket" region (*sensu* McLeod 1971). Walker County is significantly drier than these areas and the geographic distribution of many species does not cross westward into Walker County (*e.g.*, beech, laurel oak, longleaf pine,

sweetbay, redbay, maple-leaved viburnum, horsesugar, gallberry holly, pepperbush, titi, and sweetspire (Nesom 1998; Nesom *et al.* 1997).

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CHECKLIST

Symbols for documentation of distribution

W = Walker County: voucher SHST; W = voucher SBSC
M = Montgomery County: voucher SHST; M = voucher SBSC
J = San Jacinto County: voucher SHST; J = voucher SBSC

(astc, brch, mich, sbsc, smu, taes, tex) = acronyms for other herbaria of voucher repository
(mercer) = herbarium of Mercer Arboretum, Humble, Texas

W(reference), M(reference) , or J(reference) = literature report

*J = added from Peterson & Brown (1983)

P = added from survey of blackland prairie inclusions (Walker Co.; Carr 1994)

H = added from Huntsville State Park list (Walker Co.; Singhurst 1998)

0 = added from Warner checklist for Walker County (Zimmerman 1977): no SHST voucher

*[species] = no voucher known for any of the three counties

FERNS

ASPLENIACEAE
Asplenium platyneuron (L.) B.S.P. WMJ

AZOLLACEAE
Azolla caroliniana Willd. WM

BLECHNACEAE
Woodwardia areolata (L.) Moore WM(Correll 1956)J
SYN= *Lorinseria areolata* (L.) Presl

DENNSTAEDTIACEAE
Pteridium aquilinum (L.) Kuhn WM(Correll 1956)J

DRYOPTERIDACEAE
Athyrium filix-femina (L.) Roth WM(Correll 1956)J
Onoclea sensibilis L. WM(Correll 1956)J
Polystichum acrostichoides (Michx.) Schott WMJ
Woodsia obtusa (Spreng.) Torr. W(Correll 1956)

LYGODIACEAE
Lygodium japonicum (Thunb. *ex* Murr.) Sw. WMJ

OPHIOGLOSSACEAE
Botrychium dissectum Spreng. WM(Correll 1956)*J
Botrychium lunarioides (Michx.) Sw. W
Botrychium virginianum (L.) Sw. W
Ophioglossum crotalophoroides Walt. WJ
Ophioglossum engelmannii Prantl W

OSMUNDACEAE
Osmunda cinnamomea L. WJ
Osmunda regalis L. WMJ

POLYPODIACEAE
Pleopeltis polypodioides (L.) Andrews & Windham WMJ
SYN= *Polypodium polypodioides* (L.) Watt

PTERIDACEAE
Cheilanthes alabamensis (Buckl.) Kunze W
Cheilanthes tomentosa Link W
Pellaea atropurpurea (L.) Link W
Pteris multifida Poir. M(Correll 1956)

THELYPTERIDACEAE
Thelypteris kunthii (Desv.) Morton WM(Correll 1956)J
SYN= *Thelypteris normalis* (C. Chr.) Moxley
Thelypteris × *versicolor* St.John J(Correll 1956)
SYN= *Thelypteris quadrangularis* (Fée) Schelpe var. *versicolor* (St.John) A. Smith
SYN= *Thelypteris hispidula* (Decne.) C.F. Reed var. *versicolor* (St.John) Lellinger

FERN ALLIES

EQUISETACEAE
Equisetum laevigatum A. Br. WM

ISOETACEAE
Isoetes melanopoda Gay & Durieu *ex* Durieu W

LYCOPODIACEAE
Lycopodiella appressa (Chapm.) Cranfill J
SYN= *Lycopodium appressum* (Chapm.) Lloyd & Underwood

SELAGINELLACEAE
Selaginella apoda (L.) Spring WM(Correll 1956)J
Selaginella arenicola Underwood subsp. *riddellii* (Van Eselt) Tryon W
SYN= *Selaginella riddellii* Van Eselt

GYMNOSPERMS

PINACEAE
Pinus echinata P. Mill. WMJ
Pinus elliottii Engelm. WM[*fide* C&J 1970] J
Pinus palustris P. Mill. J
Pinus taeda L. WJ

TAXODIACEAE
Taxodium distichum (L.) Rich. W*J

CUPRESSACEAE
Juniperus virginiana L. WJ
Thuja orientalis L. W

MONOCOTS

AGAVACEAE
Manfreda virginica (L.) Salisb. WJ
SYN= *Agave virginica* L.
SYN= *Polianthes virginica* (L.) Shinners
Yucca flaccida Haw. W
Yucca louisianensis Trel. W*J
Yucca treculeana Carr. W

ALISMATACEAE
Sagittaria graminea Michx. WMJ
Sagittaria latifolia Willd. WJ
Sagittaria papillosa Buch. M

AMARYLLIDACEAE
Cooperia drummondii Herb. WJ
Cooperia pedunculata Herb. M
Crinum bulbispermum (Burm.) Milne-R. & Schw. W
Habranthus tubispathus (L'Herit.) Traub WM
SYN= *Habranthus texanus* (Herb.) Steud.
Hymenocallis liriosme (Rafin.) Shinners WJ
Leucojum aestivum L. W
Manfreda virginica (L.) Salisb.
SYN= *Polianthes virginica* (L.) Shinners WJ
Narcissus sp. W

ARACEAE
Arisaema dracontium (L.) Schott WJ
Arisaema triphyllum (L.) Schott 0J
Colocasia esculenta (L.) Schott W
Peltandra virginica (L.) Schott W
Pistia stratiotes L. M
Xanthosma sagittifolium (L.) Schott W

ARECACEAE
Sabal minor (Jacq.) Pers. WMJ

BROMELIACEAE
Tillandsia recurvata (L.) L. W
Tillandsia usneoides (L.) L. WMJ

BURMANNIACEAE
Apteria aphylla (Nutt.) Barnh. ex Small J
Burmannia biflora L. J

COMMELINACEAE
Callisia repens (Jacq.) L. W
Commelina communis L. WJ
Commelina erecta L. WM*J
Commelina virginica L. WMJ

Tinantia anomala (Torr.) C.B. Clarke W
Tradescantia hirsutiflora Bush W*J
Tradescantia ohiensis Rafin. W
Tradescantia reverchonii Bush W

CYPERACEAE
Bulbostylis capillaris L.) C.B. Clarke M(Kral 1971)
Bulbostylis ciliatifolia (Ell.) Fern. var. *coarctata* (Ell.) Kral WM(brch)*J
Carex abscondita Mack. WM(brch)J
Carex albicans Willd. *ex* Spreng. var. *australis* (Bailey) Rettig WMJ(taes)
SYN= *Carex physorhyncha* Liebm. *ex* Steud.
Carex albolutescens Schwein. WMJ
Carex corrugata Fern. W*J
SYN= *Carex amphibola* Steud. misappl.
Carex crebriflora Wieg. J
Carex basiantha Steud. WJ(smu)
SYN= *C. willdenowii* Schkuhr. *ex* Willd. misappl.
Carex blanda Dewey W*J
Carex brevior (Dew.) Mack. *ex* Lunell W(brch)MJ(taes)
Carex bushii Mack. WMJ
Carex caroliniana Schwein. W*J
Carex cephalophora Muhl. *ex* Willd. H*J
Carex cherokeensis Schwein. WMJ
Carex comosa Boott W
Carex complanata Torr. & Hook. WMJ
Carex crus-corvi Shuttlew. *ex* Kuntze WJ
Carex debilis Michx. WJ
Carex digitalis Schkuhr *ex* Willd. var. *asymmetrica* Fern. WJ
Carex emoryi Dewey W(brch)
Carex fissa Mack. var. *fissa* W(mich)
Carex flaccosperma Dewey WMJ
Carex frankii Kunth WMJ
Carex glaucescens Ell. J
Carex hyalina Boott WM(brch)
Carex intumescens Rudge WMJ
Carex joorii Bailey J(brch)
Carex leavenworthii Dewey WM(tex)J(smu)
Carex leptalea Wahl. WMJ
Carex longii Mack. M(taes)
Carex louisianica Bailey WM(mich)J
Carex lupuliformis Sartw. *ex* Dewey M
Carex lupulina Muhl. *ex* Willd. WMJ
Carex lurida Wahl. WMJ
Carex meadii Dew. W
Carex microdonta Torr. & Hook. WM(smu)
Carex microrhyncha Mack. W(taes)
Carex muhlenbergii Schkuhr. *ex* Willd. W*J
Carex oxylepis T. & H. WJ
Carex retroflexa Muhl. *ex* Willd. WM*J
Carex socialis Mohl. & Schwegm. W(brch)
Carex striatula Michx. W

Carex texensis (Torr.) Bailey W(brch)J(taes)
Carex triangularis Boeckl. WMJ(taes)
Carex tribuloides Wahlenb. var. *sangamonensis* Clokey WJ
Carex verrucosa Muhl. M(brch)J(brch)
Carex vulpinoidea Michx. M
Cyperus articulatus L. W
Cyperus croceus Vahl M(taes)J(brit)
Cyperus echinatus (L.) Wood WMJ
SYN= *Cyperus ovularis* (Michx.) Torr.
Cyperus entrerianus Bockler M(taes)
Cyperus erythrorhizos Muhl. WJ
Cyperus esculentus L. WJ
Cyperus filiculmis Vahl HM(Marcks 1972)
Cyperus haspan L. WM
Cyperus hystricinus Fern. WJ
Cyperus iria L. M(brit)
Cyperus ochraceus Vahl H
Cyperus odoratus L. var. *squarrosus* (Britt.) Jones *et al.* MJ
Cyperus plukenetii Fern. WJ
Cyperus polystachyos Rottb. WM
Cyperus pseudovegetus Steud. WMJ
Cyperus retroflexus Buckl. var. *retroflexus* W(taes)M(mich)J
Cyperus retrorsus Chapm. WMJ
Cyperus rotundus L. WMJ
Cyperus squarrosus L. M
SYN= *Cyperus aristatus* Rottb.
Cyperus strigosus L. WMJ
Cyperus surinamensis Rottb. M(smu)
Cyperus thyrsiflorus Jungh. W
Cyperus virens Michx. WMJ
Eleocharis acicularis (L.) R. & S. W
Eleocharis albida Torr. W
Eleocharis atropurpurea (Retz.) Presl M
Eleocharis equisetoides (Ell.) Torr. M
Eleocharis interstincta (Vahl) R. & S. M
Eleocharis palustris (L.) R. & S. WM
SYN= *Eleocharis macrostachya* Britt.
Eleocharis microcarpa Torr. MJ
Eleocharis montana (Kunth) R.& S. M
Eleocharis montevidensis Kunth WM(smu)J(mich)
Eleocharis obtusa (Willd.) Schultes WMJ
Eleocharis olivacea Torr. W
Eleocharis parvula (R. & S.) Link WM
Eleocharis quadrangulata (Michx.) R. & S. WM(mich)
Eleocharis radicans (Dietr.) Kunth W
Eleocharis tortilis (Link) Schultes WMJ
Eleocharis tenuis (Willd.) Schultes WM
SYN= *Eleocharis verrucosa* (Svens.) Harms
Eleocharis vivipara Link W
Fimbristylis autumnalis (L.) R. & S. WMJ
Fimbristylis decipiens Kral M(brch)

Fimbristylis miliacea (L.) Vahl WM(brch)J
Fimbristylis puberula (Michx.) Vahl var. *puberula* W
Fimbristylis vahlii (Lam.) Link WM(taes)J
Fuirena breviseta (Cov.) Cov. M
Fuirena simplex Vahl WM
Fuirena squarrosa Michx. WM
Isolepis carinata Hook. & Arn. *ex* Torr. WM
SYN= *Scirpus koilolepis* (Steud.) Gl.
Isolepis molesta (M.C. Johnston) S.G. Sm. M
SYN= *Scirpus molestus* M.C. Johnston
Kyllingia brevifolia Rottb. WM(taes)
SYN= *Cyperus brevifolius* (Rottb.) Hassk.
Kyllingia pumila Michx WMJ
SYN= *Cyperus tenuifolius* (Steud.) Dandy
Rhynchospora caduca Ell. WMJ
Rhynchospora capitellata (Michx.) Vahl J
Rhynchospora colorata (L.) H. Pfeiffer W
SYN= *Dichromena colorata* (L.) Hitchc.
Rhynchospora corniculata (Lam.) Gray WMJ
Rhynchospora divergens M.A. Curtis M(Correll & Correll 1975)
Rhynchospora filifolia Gray M(tex)
Rhynchospora globularis (Chapm.) Small WMJ
Rhynchospora glomerata (L.) Vahl WMJ
Rhynchospora grayi Kunth W
Rhynchospora harveyi Boott W
Rhynchospora inexpansa (Michx.) Vahl WMJ
Rhynchospora microcarpa Baldw. *ex* Gray W
Rhynchospora miliacea (Lam.) Gray W
Rhynchospora mixta Britt. M
Rhynchospora nivea Bock. W(us)
Rhynchospora perplexa Britt. MJ
Rhynchospora rariflora (Michx.) Ell. *J
Rhynchospora recognita (Gale) Kral W(taes)
Schoenoplectus pungens (Vahl) Palla var. *pungens* W(taes)
Scirpus cyperinus (L.) Kunth WM(taes)J
Scirpus pendulus Muhl. WJ SYN= *Scirpus lineatus* Michx. misappl.
Scleria ciliata Michx. WM
Scleria oligantha Michx. W*J
Scleria pauciflora (Torr.) A. Nelson W(taes)
Scleria triglomerata Michx. WM

DIOSCOREACEAE
Dioscorea bulbifera L. M
Dioscorea villosa L. WJ

ERIOCAULACEAE
Eriocaulon decangulare L. WM

HYDROCHARITACEAE
Hydrilla verticillata Royale WM
Limnobium spongia (Bosc.) Steud. M

HYPOXIDACEAE
Hypoxis hirsuta (L.) Cov. WMJ
Hypoxis curtisii Rose J(sbsc)
Hypoxis wrightii (Baker) Brackett W(tex)J(sbsc)

IRIDACEAE
Alophia drummondii (Grah.) R.C. Foster W
Iris hexagona Walt. MJ
Iris pseudacoris L. M
Iris virginica L. W
Nemastylis geminiflora Nutt. WM
Sisyrinchium angustifolium Mill. *J
Sisyrinchium exile Bickn. WM*J
Sisyrinchium langloisii Greene WMJ
Sisyrinchium minus Engelm. & Gray W
Sisyrinchium rosulatum Bickn. WJ
Sisyrinchium sagittiferum Bickn. WJ
Sisyrinchium texanum Bickn. WM

JUNCACEAE
**Juncus acuminatus* Lam. 0
Juncus brachycarpus Engelm. WM
Juncus bufonius L. M
Juncus capitatus Weigel WM
Juncus coriaceus Mack. WM*J
Juncus dichotomus Ell. WM
Juncus diffusissimus Buckley WMJ
Juncus effusus L. WMJ
Juncus marginatus Rostk. WM*J
Juncus nodatus Cov. J
Juncus repens Michx. WMJ
Juncus scirpoides Lam. WM*J
Juncus tenuis Willd. W*J
Juncus validus Cov. WMJ
Luzula bulbosa (Wood) Rydb. WMJ

LEMNACEAE
Lemna perpusilla Torr. W
Lemna valdiviana Phil. W
Spirodela polyrhiza (L.) Schleid. W
Spirodela punctata (Mey.) Thomps. W
SYN= *Spirodela oligorhiza* (Kurtz) Hegelm.
Wolfia brasiliensis Wedd. W
SYN= *Wolfia papulifera* Thomps.

LILIACEAE
Allium canadense L. var. *canadense* WM*J
Allium drummondii Regel W*J

Allium mobilense Regel WM
SYN= *Allium canadense* L. var. *mobilense* (Regel) M. Ownbey
Asparagus officinalis L. W
Camassia angusta (Engelm. & Gray) *Blankinsh.* W
Nothoscordum bivalve (L.) Britt. WMJ
Polygonatum biflorum (Walt.) Ell. *J
Schoenolirion wrightii Sherman W
SYN= *Schoenolirion texanum* (Scheele) A. Gray
Stenanthium gramineum (Ker-Gawl.) Morong W
Trillium gracile Freeman J

MAYACACEAE
Mayaca fluviatilis Aublet J
SYN= *Mayaca aubletii* Michx.

NAJADACEAE
Najas guadalupensis (Spreng.) Magnus W

ORCHIDACEAE
Corallorrhiza wisteriana Conrad H0M*J
Habenaria repens Nutt. J
SYN= *Platanthera repens* (Nutt.) Wood
Listera australis Lindl. W*J
Platanthera ciliaris (L.) Lindl. M
SYN= *Habenaria ciliaris* (L.) R. Br. *ex* Ait. *f.*
Platanthera clavellata (Michx.) Luer J
SYN= *Habenaria clavellata* (Michx.) Spreng.
Platanthera cristata (Michx.) Luer M(Correll 1944)
Ponthieva racemosa (Walt.) Mohr J
Spiranthes cernua (L.) Richard WJ
Spiranthes gracilis (Bigel.) Beck WJ
SYN= *Spiranthes lacera* var. *gracilis* (Bigel.) Luer
Spiranthes tuberosa Rafin. W*J
SYN= *Spiranthes grayi* Ames
Spiranthes praecox (Walt.) S. Wats. *J
Spiranthes vernalis Engelm. & Gray WM
Tipularia discolor (Pursh) Nutt. HM(sight)J
Triphora trianthophora (Sw.) Rydb. J(Hartman 1974)

POACEAE
Agrostis elliottiana Schult. *J
Agrostis hyemalis (Walt.) B.S.P WJ
Agrostis perennans (Walt.) Tuckerm. *J
Aira caryophyllea L. *J
Aira elegans Willd. *ex* Kunth WMJ
SYN= *Aira caryophyllea* var. *capillaris* A. Mute
Andropogon gyrans Ashe W
SYN= *Andropogon elliottii* Chapm.
Andropogon gerardii Vitman W
Andropogon glomeratus (Walt.) B.S.P. WJ

Andropogon ternarius Michx. W
Andropogon virginicus L. W
Aristida lanosa Ell. W
Aristida longispica Poir. var. *geniculata* (Rafin.) Fern. M*J
Aristida oligantha Michx. WMJ
Aristida purpurascens Poir. W
Aristida purpurea Nutt. var. *longiseta* (Steud.) Vasey W
SYN= *Aristida longiseta* Steud.
Arundinaria gigantea (Walt.) Muhl. WM(mercer)J
Arundo donax L. M
Avena sativa L. WM
SYN= *Avena fatua* L. var. *sativa* (L.) Hausskn.
Axonopus fissifolius (Raddi) Kuhlm. WM
SYN= *Axonopus affinis* Chase
**Axonopus furcatus* (Fluegge) Hitchc. 0
Bothriochloa ischaemum (L.) Keng W*J
Bothriochloa laguroides (DC.) Herter subsp. *torreyana* (Steud.) Allred & Gould WJ
SYN= *Bothriochloa saccharoides* (Sw.) Rydb.
Bouteloua curtipendula (Michx.) Torr. WJ
Bouteloua hirsuta Lag. WJ
Bouteloua rigidiseta (Steud.) Hitchc. WJ
Briza minor L. WMJ
Bromus japonicus Thunb. WM
Bromus pubescens Muhl. ex Willd. W
Bromus secalinus L. WM
Bromus catharticus Vahl WMJ
SYN= *Bromus unioloides* (Willd.) Kunth
**Cenchrus echinatus* L. 0
Cenchrus spiniflex Cav. WMJ
SYN= *Cenchrus incertus* Curtis
Chasmanthium latifolium (Michx.) Yates WMJ
Chasmanthium laxum (L.) Yates WMJ
Chasmanthium sessiliflorum (Poir.) Yates WMJ
Chloris cucullata Bisch. W
Chloris subdolichostachya Muller W
Coelorachis rugosa (Nutt.) Nash M
Cortaderia selloana (Schultes) Asch. & Graebn. W
SYN= *Cortaderia dioica* (Spreng.) Spreng.
Cynodon dactylon (L.) Pers. W*J
Cynosurus echinatus L. W
Dactylis glomerata L. M
**Dactyloctenium aegypticum* (L.) Willd. 0
Desmazeria rigida (L.) Tutin H
SYN= *Catapodium rigidum* (L.) Hubbard ex Dony
Dichanthelium aciculare (Desv. *ex* Poir.) G. & Cl. WJ
SYN= *Dichanthelium angustifolium* (Ell.) Gould
Dichanthelium acuminatum (Sw.) Gould & Clark WMJ
Dichanthelium boscii (Poir.) G. & Cl. WJ SYN= *Panicum boscii* Poir.
Dichanthelium commutatum (Schult.) Gould WM
SYN= *Panicum commutatum* Schult.

Dichanthelium dichotomum (L.) Gould WM*J
SYN= *Panicum dichotomum* L.
Dichanthelium lanuginosum (Ell.) Gould W*J
SYN= *Panicum lanuginosum* Ell.
SYN= *Dichanthelium acuminatum* var. *fasciculatum* (Torr.) Freckm.
Dichanthelium laxiflorum (Lam.) Gould WJ
SYN= *Panicum laxiflorum* Lam.
Dichanthelium lindheimeri (Nash) Gould WJ
SYN= *Panicum lindheimeri* Nash
SYN= *Dichanthelium acuminatum* var. *lindheimeri* (Nash) G. & Cl.
Dichanthelium linearifolium (Scribn. *ex* Nash) Gould WJ
SYN= *Panicum linearifolium* Scribn. *ex* Nash
Dichanthelium oligosanthes (Schultes) Gould var. *oligosanthes* W*J
SYN= *Panicum oligosanthes* Schultes
Dichanthelium oligosanthes (Schultes) Gould var. *scribnerianum* (Nash) Gould WM
SYN= *Panicum scribnerianum* Nash
Dichanthelium ravenelii (Scribn. & Merr.) Gould. WJ
SYN= *Panicum ravenelii* Scribn. & Merr.
Dichanthelium scoparium (Lam.) Gould WM
SYN= *Panicum scoparium* Lam.
Dichanthelium sphaerocarpon (Ell.) Gould. WMJ
SYN= *Panicum sphaerocarpon* Ell.
SYN= *Dichanthelium polyanthes* (Schultes) Mohlenbr.
Digitaria ciliaris (Retz.) Koel. W*J
Digitaria cognata (Schult.) Chase W
SYN= *Leptoloma cognatum* (Schultes) Chase
Digitaria filiformis (L.) Koel. W
Digitaria villosa (Walt.) Pers. WJ
Digitaria violascens Link *J
Echinochloa colona (L.) Link W
Echinochloa crus-gallii (L.) Beauv. WM
Echinochloa walteri (Pursh) Heller WM
Eleusine indica (L.) Gaertn. WM
Elymus canadensis L. W
Elymus virginicus L. WM*J
Eragrostis barrelieri Daveau W
Eragrostis elliottii S. Wats. W
Eragrostis hypnoides (Lam.) B.S.P. M
Eragrostis hirsuta (Michx.) Nees W*J
**Eragrostis pectinacea* (Michx.) Nees *ex* Steud. 0
Eragrostis secundiflora Presl WM*J
SYN= *Eragrostis oxylepis* (Torr.) Torr.
Eragrostis spectabilis (Pursh) Steud. W
**Eragrostis trichodes* (Nutt.) Wood 0
Eremochloa ophiuroides (Munro) Hack. W
Erianthus alopecuroides (L.) Ell. W
SYN= *Saccharum alopecuroidum* (L.) Nutt.
Erianthus giganteus (Walt.) Muhl. WMJ
SYN= *Saccharum giganteum* (Walt.) Pers.
Erianthus strictus Ell. WM SYN= *Saccharum baldwinii* Spreng.

Eustachys petraea (Sw.) Desv. W
SYN= *Chloris petraea* Sw.
Festuca arundinacea Schreb. MJ
SYN= *Lolium arundinaceum* (Schreb.) S. Darb.
**Festuca subverticillata* (Pers.) Alexeev 0
SYN= *Festuca obtusa* Bieler
Glyceria arkansana Fern. J
Gymnopogon ambiguus (Michx.) B.S.P. WJ
Hordeum pusillum Nutt. WMJ
Hordeum vulgare L. W
Leersia hexandra Sw. M(mercer)
Leersia oryzoides (L.) Sw. WM
Leersia virginica Willd. WMJ
Leptochloa mucronata (Michx.) Kunth WM
SYN= *Leptochloa filiformis* (Lam.) Beauv. var. *attenuata* (Nutt.) Steyerm.
Limnodea arkansana (Nutt.) Dewey WJ
Lolium perenne L. WM
SYN= *Lolium multiflorum* Lam.
Lolium tementulum L. W
Melica mutica Walt. WMJ
Muhlenbergia capillaris (Lam.) Trin. W*J
Oplismenus hirtellus (L.) Beauv. WJ
SYN= *Oplismenus setarius* (Lam.) R. & S.
Oryza sativa L. W
Panicum anceps Michx. WJ
Panicum brachyanthum Steud. W*J
Panicum capillare L. W
Panicum dichotomiflorum Michx. W
Panicum gymnocarpon Ell. WMJ
SYN= *Phanopyrum gymnocarpon* (Ell.) Nash
Panicum rigidulum Bosc *ex* Nees HJ
Panicum verrucosum Muhl. WJ
Panicum virgatum L. W
Paspalum dilatatum Poir. WM*J
Paspalum floridanum Michx. W
Paspalum laeve Michx. W*J
Paspalum langei (Fourn.) Nash W*J
Paspalum notatum Fluegge WMJ
Paspalum plicatulum Michx. WMJ
Paspalum pubiflorum Rupr. *ex* Fourn. WMJ
Paspalum setaceum Michx. WMJ
SYN= *Paspalum pubescens* Muhl.
Paspalum urvillei Steud. WMJ
Phalaris caroliniana Walt. W
Phyllostachys aurea Carr.*ex* Riv. W
Poa annua L. WJ
Poa autumnalis Muhl. *ex* Ell. WMJ
Rostraria cristata (L.) Tzvelev W
SYN= *Koehleria gerardii* (Vill.) Shinners
Sacciolepis striata (L.) Nash WM
Schedonnardus paniculatus (Nutt.) Trel. W

Schizachyrium scoparium (Michx.) Nash WJ
Secale cereale L. M
Setaria corrugata (Ell.) Schult. W(Gould 1975)
Setaria glauca (L.) Beauv. WM
SYN= *Pennisetum glaucum* (L.) R. Br.
Setaria parviflora (Poir.) Kerg. WJ
SYN= *Setaria geniculata* auct. non (Wild.) Beauv.
Setaria viridis (L.) Beauv. W
Sorghastrum elliottii (Mohr) Nash WJ
Sorghastrum nutans (L.) Nash W
Sorghum bicolor (L.) Moench M
Sorghum halepense (L.) Pers. WM
Sphenopholis longiflora (Vasey) Hitchc. M
Sphenopholis obtusata (Michx.) Scribn. WMJ
Sporobolus compositus (Poir.) Merr. var. *compositus* WMJ
SYN= *Sporobolus asper* (Beauv.) Kunth
Sporobolus indicus (L.) R. Br. WMJ
**Sporobolus junceus* (Beauv.) Kunth H
Sporobolus vaginiflorus (Torr.*ex* Gray) Wood W
Steinchisma hians (Ell.) Nash WM
SYN= *Panicum hians* Ell.
Stenotaphrum secundatum (Walt.) Kuntze W
Stipa avenacea L. WJ
SYN= *Piptochaetium avenaceum* (L.) Parodi
Stipa leucotricha Trin. & Rupr.
SYN= *Nassella leucotricha* (Trin. & Rupr.) Pohl WMJ
Tridens flavus (L.) Hitchc. WJ
Tridens strictus (Nutt.) Nash WM
Triplasis purpurea (Walt.) Chapm. *J
Tripsacum dactyloides (L.) L. WM
Trisetum interruptum Buckl. WJ
Urochloa ciliatissima (Buckl.) R. Webster *J
SYN= *Brachiaria ciliatissima* (Buckl.) Chase
Urochloa fasciculata (Sw.) R. Webster W
SYN= *Panicum fasciculatum* Swartz
Urochloa ramosa (L.) R. Webster M
SYN= *Panicum ramosum* L.
Urochloa texana (Buckl.) R. Webster 0*J
SYN= *Panicum texanum* Buckl.
Vulpia octoflora (Walt.) Rydb. WJ SYN= *Festuca octoflora* Walt.
Vulpia myuros (L.) Gmel. W
Vulpia sciurea (Nutt.) Henr. J
Zizaniopsis miliacea (Michx.) Doell. & Asch. WM

PONTEDERIACEAE
Eichhornia crassipes (Mart.) Solms W
Heteranthera limosa (Sw.) Willd. M

POTAMOGETONACEAE
Potamogeton diversifolius Rafin. HM(Ogden 1966)
Potamogeton nodosus Poir. WMJ

SMILACACEAE
Smilax bona-nox L. WJ
Smilax glauca Walt. WMJ
Smilax laurifolia L. WMJ
Smilax pumila Walt. WMJ
Smilax rotundifolia L. WMJ
Smilax smallii Morong WJ
Smilax tamnoides L. WJ
SYN= *Smilax hispida* Muhl.

SPARGANIACEAE
Sparganium americanum Nutt. J

TYPHACEAE
Typha angustifolia L. W
**Typha domingensis* Pers. 0
Typha latifolia L. W

XYRIDACEAE
Xyris ambigua Bey. *ex* Kunth WMJ
Xyris iridifolia Chapm. M
Xyris jupicai L.C. Rich. M
Xyris torta J.E. Sm. WJM
Xyris sp. J

DICOTS

ACANTHACEAE
Dicliptera brachiata (Pursh) Spreng. W*J
Hygrophila lacustris (S. & C.) Nees WM
Justicia lanceolata (Chapm.) Small WM
SYN= *Justicia ovata* var. *lanceolata* (Chapm.) R.W. Long
Ruellia brittoniana Leonard M
Ruellia caroliniensis (Gmel.) Steud. WM
Ruellia humilis Nutt. WM*J
Ruellia nudiflora (Engelm. *ex* Gray) Urb. var. *nudiflora* WMJ
Ruellia pedunculata Torr. *ex* Gray J(Turner 1991)
Ruellia strepens L. WM
Yeatesia viridiflora (Nees) Small *J

ACERACEAE
Acer negundo L. WMJ
Acer rubrum L. WMJ

AMARANTHACEAE
Alternanthera philoxeroides (Mart.) Griseb. W
**Amaranthus albus* L. 0
SYN= *Amaranthus graecizans* auct. non L.

Amaranthus hybridus L. WM(Reed 1969)
**Amaranthus retroflexus* L. 0
**Amaranthus spinosus* L. 0
Froelichia floridana (Nutt.) Moq. WM(Reed 1969)J
Gomphrena globosa L. M
Iresine rhizomatosa Standl. WJ

ANACARDIACEAE
Rhus aromatica Aiton WMJ
Rhus copallinum L. WMJ
Rhus glabra L. WM(Barkley 1943)*J
Toxicodendron radicans (L.) Kuntze var. *radicans* WM*J
SYN= *Rhus radicans* L.
Toxicodendron pubescens P. Mill. WM(Barkley 1943)J
SYN= *Rhus toxicodendron* L.

ANNONACEAE
Asimina parviflora (Michx.) Dun. MJ

APIACEAE
Bifora americana (DC.) Benth. & Hook. W
**Bowlesia incana* R. & P. 0
Centella erecta (L.f.) Fern. WMJ
Chaerophyllum tainturieri Hook. WM*J
Cicuta maculata L. WM
Cyclospermum leptophyllum (Pers.) Sprague WJ
SYN= *Apium leptophyllum* (Pers.) F.V. Muell. *ex* Benth.
Cynosciadium digitatum DC. W
Daucus carota L. WM
Daucus pusillus Michx. WMJ
**Eryngium hookeri* Walp. 0
Eryngium prostratum Nutt. *ex* DC. WMJ
Eryngium yuccifolium Michx. W*J
Hydrocotyle ranunculoides L. M
Hydrocotyle umbellata L. WM
Hydrocotyle verticillata Thunb. WMJ
Limnosciadium pinnatum (DC.) Math. & Const. WM
Oxypolis rigidior (L.) Rafin. W
Polytaenia nuttallii DC. W
Polytaenia texana (Coult. & Rose) Math. & Const. *J
Ptilimnium capillaceum (Michx.) Rafin. W
Ptilimnium nuttallii (DC.) Britt. W
Sanicula canadensis L. WMJ
Sanicula odorata (Rafin.) Pryer & Phillippe W SYN= *Sanicula gregaria* Bickn.
Spermolepis divaricata (Walt.) Rafin. *ex* Ser. WJ
**Spermolepis echinata* (Nutt. ex DC.) Math. & Const. 0
Tauschia texana A. Gray M
Torilis arvensis (Huds.) Link W
**Torilis nodosa* (L.) Gaertn. 0
Trepocarpus aethusae Nutt. *ex* DC. W*J
Zizia aurea (L.) Koch WJ

APOCYNACEAE
Amsonia tabernaemontana Walt. W
Apocynum cannabinum L. W
Nerium oleander L. W
Trachelospermum difforme (Walt.) Gray WMJ
Vinca major L. W

AQUIFOLIACEAE
Ilex ambigua (Michx.) Torrey WMJ
Ilex coriacea (Pursh) Chapm. MJ
Ilex decidua Walt. WM(Lundell 1943)J
Ilex longipes Chapm. *ex* Trel. WMJ
Ilex opaca Aiton WMJ
Ilex vomitoria Aiton WMJ

ARALIACEAE
Aralia spinosa L. WMJ
Hedera helix L. W

ARISTOLOCHIACEAE
Aristolochia reticulata Jacq. WMJ
Aristolochia serpentaria L. WJ
Aristolochia tomentosa Sims *J

ASCLEPIADACEAE
Asclepias amplexicaulis J.E. Smith WM
Asclepias tuberosa L. WMJ
Asclepias variegata L. WJ
Asclepias verticillata L. W
Asclepias viridiflora Rafin. WMJ
Asclepias viridis Walt. WMJ
**Cynanchum laeve* (Michx.) Pers. H
Matelea cynanchoides (Engelm.) Woods. WM
Matelea decipiens (Alex.) Woods. WM
Matelea gonocarpos (Walt.) Shinners WJ

ASTERACEAE
Achillea millefolium L. subsp. *lanulosa* (Nutt.) Piper WM
Acmella oppositifolia (Lam.) Jansen var. *repens* (Walt.) Jansen WMJ
Ageratina altissima (L.) King & Rob. WJ
SYN= *Eupatorium rugosum* Houtt.
Ambrosia artemisiifolia L. HJ
Ambrosia cumanensis Kunth WJ
SYN= *Ambrosa psilostachya* DC.
Ambrosia trifida L. W
Amphiachyris dracunculoides (DC.) Nutt. W
Antennaria fallax Greene WM
SYN= *Antennaria parlinii* var. *fallax* (Greene) Bayer & Stebbins
Anthemis cotula L. W
Aphanostephus skirrhobasis (DC.) Trel. *J

Arnoglossum ovatum (Walt.) H. Rob. MJ
SYN= *Cacalia ovata* Walt.
SYN= *Cacalia lanceolata* Nutt.
Arnoglossum plantagineum Rafin. WMJ
SYN= *Cacalia plantaginea* (Rafin.) Shinners
Artemisia ludoviciana Nutt. var. *ludoviciana* M
Baccharis halimifolia L. WJ
Berlandiera pumila (Michx.) Nutt. var. *pumila* WMJ
Bidens aristosa (Michx.) Britt. WM
Bidens bipinnata L. WJ
Bidens frondosa L. W
Bidens laevis (L.) B.S.P. W
Bigelowia nuttallii L.C. Anderson W
Boltonia diffusa Ell. MWJ
Brickellia eupatorioides (L.) Shinners var. *eupatorioides* WMJ
Calyptocarpus vialis Less. WJ
Centaurea americana Nutt. W
Centaurea cyanis L. WM
Chaetopappa asteroides Nutt. *ex* DC. var. *asteroides* WM
Chlorocantha spinosa (Benth.) Nesom M
SYN= *Aster spinosus* Benth.
Chrysopsis pilosa Nutt. WMJ
Chrysopsis texana Nesom W
SYN= *Bradburia hirtella* Torr. & Gray
Cirsium carolinianum (Walt.) Fern. & Schub. W
Cirsium horridulum Michx. W
Cirsium texanum Buckley W
Conoclinium coelestinum (L.) DC. WJ
SYN= *Eupatorium coelestinum* L.
Conyza canadensis (L.) Cronq. WJ
Conyza bonariensis (L.) Cronq. W
Coreopsis basalis (Dietrich) Blake WJ
Coreopsis lanceolata L. WM
Coreopsis tinctoria Nutt. M
Croptilon divaricatum (Nutt.) Rafin. WMJ
Dracopis amplexicaule (Vahl) Cass. W
Dyssodia tenuiloba (DC.) Small var. *tenuiloba* M
Echinacea atrorubens Nutt. W
Echinacea sanguinea Nutt. WM*J
Eclipta prostrata (L.) L. W
Elephantopus carolinianus Raeusch. WJ
Elephantopus tomentosus L. WMJ
Engelmannia peristenia (Rafin.) Goodman & Lawson WMJ
SYN= *Engelmannia pinnatifida* Gray *ex* Nutt.
Erechtites hieracifolia (L.) Rafin. *ex* DC. var. *hieracifolia* WJ
Erigeron annuus (L.) Pers. W
Erigeron philadelphicus L. W
Erigeron procumbens (Houst. *ex* P. Mill.) Nesom M
Erigeron strigosus Muhl. *ex* Willd. WMJ
Erigeron tenuis Torr. & Gray WM
Eupatorium capillifolium (Lam.) Small WJ

Eupatorium compositifolium Walt. MJ
Eupatorium fistulosum Barr. J
Eupatorium lancifolium (T. & G.) Small WMJ
Eupatorium mohrii Greene M
Eupatorium perfoliatum L. WM
Eupatorium × *pinnatifidum* Ell. W
Eupatorium rotundifolium L. var. *rotundifolium* WMJ
Eupatorium semiserratum DC. WMJ
Eupatorium serotinum Michx. W
Eurybia hemispherica (Aiton) Nesom W
SYN= *Aster paludosus* subsp. *hemisphericus* (Alexander) Cronq.
SYN= *Aster hemisphericus* Alexander
Euthamia leptocephala (Torr. & Gray) Greene WMJ
Evax candida (Torr. & Gray) Gray W*J
SYN= *Calymmandra candida* Torr. & Gray
Evax verna Rafin. W*J
SYN= *Evax multicaulis* DC.
Facelis retusa (Lam.) Sch.-Bip. WMJ
Fleischmannia incarnata (Walt.) King & Rob. J
SYN= *Eupatorium incarnatum* Walt.
Gaillardia aestivalis (Walt.) Rock var. *aestivalis* J
Gaillardia pulchella Foug. WM
Gamochaeta falcata (Lam.) Cabrera W
SYN= *Gnaphalium falcatum* Lam.
Gamochaeta pensilvanica (Willd.) Cabrera W
SYN= *Gnaphalium pensilvanica* Willd.
Gamochaeta purpurea (L.) Cabrera WMJ
SYN= *Gnaphalium purpureum* L.
Grindelia lanceolata Nutt. var. *lanceolata* WJ
Helenium amarum (Rafin.) Rock WMJ
Helianthus angustifolius L. WJ
Helianthus annuus L. W
Helianthus debilis Nutt. 0J
Helianthus grosse-serratus Martens W
Helianthus hirsutus Rafin. WJ
Helianthus maximiliani Schrad. WM
**Helianthus mollis* Lam. H
Helianthus simulans E. Wats. W
Heliopsis helianthoides (L.) Sweet J
Heterotheca subaxillaris (Lam.) Britt. & Rusby WMJ
SYN= *Heterotheca latifolia* Buckley
Hieracium gronovii L. WM
Hymenopappus artemisiifolius DC. var. *artemisiifolius* W
Hypochaeris microcephala (Sch.-Bip.) Cabrera var. *albiflora* (O. Kuntze) Cabrera WJ
Iva angustifolia DC. W
Iva annua L. WJ
Krigia cespitosa (Rafin.) Chambers WMJ
Krigia dandelion (L.) Nutt. W
Krigia occidentalis Nutt. M

Krigia virginica (L.) Willd. W*J
Krigia wrightii (A. Gray) Chambers *ex* Kim W*M (Kim & T 1992)
Lactuca canadensis L. WJ
Lactuca floridana (L.) Gaertn. WJ
Lactuca hirsuta Muhl. WJ
Lactuca ludoviciana (Nutt.) Ridd. W
Leucanthemum vulgare Lam. WM
SYN=*Chrysanthemum le*ucanthemum L.
Liatris acidota Engelm. & Gray M*J
Liatris squarrulosa Michx. WMJ
SYN= *Liatris earlei* (Walt.) K. Schum.
Liatris cymosa (Ness) K. Schum. W
Liatris elegans (Walt.) Michx. WMJ
Liatris mucronata DC. WJ
Liatris pycnostachya Michx. WMJ
Liatris squarrosa (L.) Michx. var. *squarrosa* WJ
Lindheimera texana Gray & Engelm. WM
Marshallia cespitosa Nutt. *ex* DC. var. *signata* Beadle & Boynt. W
Mikania scandens (L.) Willd. WJ
Oligoneuron nitidum (Torr. & Gray) Small W(Taylor & Taylor 1984)
Oligoneuron rigidum (L.) Small W
SYN= *Solidago rigida* L.
Palafoxia hookeriana Torr. & Gray *J
Palafoxia rosea (Bush) Cory var. *rosea* WM(Turner & Morris 1976)J
Parthenium hysterophorus L. W
Pityopsis graminifolia (Michx.) Nutt. W
SYN= *Chrysopsis graminifolia* (Michx.) Ell.
SYN= *Heterotheca graminifolia* (Michx.) Shinners
Pluchea camphorata (L.) DC. WJ
Pluchea foetida (L.) DC. WMJ
Pluchea odorata (L.) Cass. WMJ
SYN= *Pluchea purpurascens* (Sw.) DC.
Pseudognaphalium obtusifolium (L.) Hill. & Burtt
SYN= *Gnaphalium obtusifolium* L. WJ
Pterocaulon virgatum (L.) DC. WM
Pyrrhopappus carolinianus (Walt.) DC. WM
Pyrrhopappus pauciflorus (D. Don) DC. WMJ
Ratibida columnifera (Nutt.) Woot. & Standl. M*J
Rudbeckia fulgida Aiton J
Rudbeckia grandiflora (Sweet) DC. WMJ
Rudbeckia hirta L. [var.] WMJ
Rudbeckia maxima Nutt. WJ
Rudbeckia missouriensis Boynt. & Beadle WJ
SYN= *R. fulgida* var. *missouriensis* (Boynt. & Beadle) Cronq.
Rudbeckia nitida Nutt. var. *texana* Perdue *J
Senecio ampullaceus Hook. WJ
Senecio obovatus Muhl. *ex* Willd. WMJ
Senecio tampicanus DC. W
SYN= *Senecio imparipinnatus* Klatt
Silphium gracile A. Gray W*J
Silphium radula Nutt. W SYN?= *Silphium asperrimum* Hook.

Smallanthus uvedalia (L.) Mackenzie *ex* Small J
SYN= *Polymnia uvedalia* (L.) L.
Solidago altissima L. WMJ
SYN= *Solidago canadensis* var. *scabra* Torr. & Gray
Solidago delicatula Small WJ
SYN= *Solidago ulmifolia* var. *microphylla* A. Gray
Solidago ludoviciana (Gray) Small WMJ
Solidago nemoralis Ait. J
Solidago odora Aiton WJ
Solidago petiolaris Aiton W
Solidago radula Nutt. W(Taylor & Taylor 1984)
Solidago rugosa Aiton WMJ
Solidago speciosa var. *rigidiuscula* Torr. & Gray W(Taylor & Taylor 1984)
Soliva pterosperma (Juss.) Less. W*J
Sonchus asper (L.) Hill WM*J
Sonchus oleraceus L. W*J
Symphyotrichum divaricatum (Nutt.) Nesom
SYN= *Aster subulatus* var. *ligulatus* Shinners
Symphyotrichum drummondii var. *texanum* (Burg.) Nesom WJ
SYN= *Aster drummondii* var. *texanus* (Burg.) A.G. Jones
Symphyotrichum dumosum (L.) Nesom W
SYN= *Aster dumosus* L.
Symphyotrichum ericoides (L.) Nesom var. *ericoides* W*J
SYN= *Aster ericoides* L.
SYN= *Virgulus ericoides* (L.) Rev. & Keen.
Symphyotrichum lanceolatum (Willd.) Nesom W
SYN= *Aster lanceolatus* Willd.
Symphyotrichum lateriflorum (L.) Love & Love WMJ
SYN= *Aster lateriflorus* (L.) Britt.
Symphyotrichum oolentangiense var. *poaceum* (Burg.) Nesom WJ
SYN= *Aster oolentangiensis* var. *poaceus* (Burg.) A.G. Jones
Symphyotrichum patens (Aiton) Nesom var. *gracile* (Hook.) Nesom WJ
SYN= *Aster patens* var. *gracilis* Hook.
SYN= *Virgulus patens* var. *gracilis* (Hook.) Rev. & Keen.
Symphyotrichum praealtum (Poir.) Nesom W
SYN= *Aster praealtus* Poir.
Symphyotrichum pratense (Rafin.) Nesom WJ
SYN= *Aster pratensis* Rafin.
SYN= *Virgulus pratensis* (Rafin.) Rev. & Keen.
Symphyotrichum racemosum (Ell.) Nesom WJ
SYN= *Aster racemosus* Ell.
SYN= *Aster fragilis* Willd.
Taraxacum officinale Weber *ex* Wiggers W
Tetragonotheca ludoviciana (Torr. & Gray) Gray M
Tetraneuris linearifolia (Hook.) Greene var. *linearifolia* W
SYN= *Hymenoxys linearifolia* Hook.
Thelesperma filifolium (Hook.) Gray W
Verbesina encelioides (Cav.) A. Gray W
Verbesina virginica L. var. *virginica* WJ
Vernonia missurica Rafin. WM(mercer)J
Vernonia texana (A. Gray) Small WMJ

Xanthium strumarium L. W
Youngia japonica (L.) DC. W

BERBERIDACEAE
Nandina domestica Thunb. WM
Podophyllum peltatum L. WMJ

BETULACEAE
Alnus serrulata (Ait.) Willd. J
Betula nigra L. WJ
Carpinus caroliniana Walt. WMJ
Ostrya virginiana (Mill.) K. Koch WJ

BIGNONIACEAE
Bignonia capreolata L. WMJ
Campsis radicans (L.) Seem. *ex* Bureau WMJ
Catalpa bignonioides Walt. *J
Catalpa speciosa (Warder) Warder *ex* Engelm. WJ

BORAGINACEAE
Heliotropium indicum L. WMJ
Heliotropium procumbens P. Mill. W
Heliotropium tenellum (Nutt.) Torr. WMJ
Lithospermum caroliniense (Gmel.) MacM. WM
Lithospermum incisum Lehm. W*J
Myosotis macrosperma Engelm. WMJ
Myosotis verna Nutt. W
Onosmodium bejariense DC. *ex* A. DC. WM
SYN= *Onosmodium molle* Michx. var. *bejariense* (DC. *ex* A. DC.) Cronq.

BRASSICACEAE
**Arabis canadensis* L. 0
**Camelina microcarpa* Andrz. 0
Capsella bursa-pastoris (L.) Medic. W
Cardamine bulbosa (Schreb. *ex* Muhl.) B.S.P. WMJ
Cardamine hirsuta L. WJ
Cardamine parviflora L. WMJ
Cardamine pensylvanica Muhl. *ex* Willd. M
Coronopus didymus (L.) J.E. Smith W
Draba brachycarpa Nutt. *ex* Torr. & Gray *J
**Draba cuneifolia* Nutt. *ex* Torr. & Gray 0
**Lepidium densiflorum* Schrad. 0
Lepidium virginicum L. WMJ
Lesquerella gracilis (Hook.) Wats. 0M
Raphanus raphanistrum L. W
**Rorippa islandica* (Oeder) Borbas 0
Rorippa nasturtium-aquaticum (L.) Hayek. W
Sibara virginica (L.) Roll. W
**Sisymbrium officinale* (L.) Scop. 0

CABOMBACEAE
Brasenia schreberi Gmel. MJ(sight)
Cabomba caroliniana A. Gray W

CACTACEAE
**Opuntia engelmannii* Engelm. var. *lindheimeri* (Engelm.) Parf. & Pink. 0
SYN= *Opuntia lindheimeri* Engelm.
Opuntia ficus-indica (L.) P. Mill. W
SYN= *Opuntia compressa* (Salisb.) Macbr.
**Opuntia macrorhiza* Engelm. P

CALLITRICHACEAE
Calllitriche heterophylla Pursh WM

CAMPANULACEAE
Lobelia appendiculata A. DC. WM(mercer)*J
Lobelia cardinalis L. W*J
Lobelia puberula Michx. WJ
Lobelia reverchonii B.L. Turner M
Lobelia spicata Lam. WMJ
Triodanis biflora (R. & P.) Greene WJ
SYN= *Triodanis perfoliata* (L.) Nieuw. var. *biflora* (R. & P.) Bradley
Triodanis lamprosperma McVaugh W
Triodanis perfoliata (L.) Nieuw. WM*J

CANNABINACEAE
Cannabis sativa L. W

CAPPARACEAE
**Polanisia erosa* (Nutt.) Iltis 0

CAPRIFOLIACEAE
Abelia grandiflora (Andre) Rehd. W
Lonicera japonica Thunb. WMJ
Lonicera sempervirens L. WJ
Sambucus canadensis L. WMJ
SYN= *Sambucus nigra* L. subsp. *canadensis* (L.) R. Bolli
Symphoricarpos orbiculatus Moench WJ
Viburnum acerifolium L. HMJ
Viburnum cassinoides L. J
SYN= *Viburnum nudum* L. var. *cassinoides* (L.) Torr. & Gray
SYN= *Viburnum nitidum* Ait.
Viburnum dentatum L. WMJ
Viburnum nudum L. WJ
Viburnum rufidulum Rafin. WMJ

CARYOPHYLLACEAE
Agrostemma githago L. W
Arenaria serpyllifolia L. W
Cerastium glomeratum Thuill. WJ

Cerastium fontanum Baumg. var. *vulgare* (Hartman) Greuter & Burdet WM
SYN= *Cerastium vulgatum* L.
SYN= *Cerastium holosteoides* Fries
Loeflingia squarrosa Nutt. WJ
Minuartia drummondii (Shinners) McNeill W
SYN= *Arenaria drummondii* Shinners
Minuartia muscorum (Fassett) Rabeler W
SYN= *Arenaria muriculata* Maguire
SYN= *Arenaria robusta* Steyerm.
SYN= *Arenaria patula* var. *robusta* (Stey.) Maguire
Petrorhagia dubia (Rafin.) Lopez & Romo WJ (both from Rabeler 1985)
SYN= *Petrorhagia velutina* (Guss.) Ball & Heyw.
Polycarpon tetraphyllum (L.) L. W
Sagina decumbens (Ell.) Torr. & Gray W*J
Silene antirrhina L. W*J
Silene gallica L. WM*J
Spergula arvensis L. H
Stellaria media (L.) Vill. WJ

CELASTRACEAE
Euonymus americana L. WMJ

CHENOPODIACEAE
Chenopodium album L. W
Chenopodium ambrosioides L. WMJ
**Chenopodium berlandieri* Moq. 0
Chenopodium pallescens Standley W

CISTACEAE
Helianthemum carolinianum (Walt.) Michx. WMJ
Helianthemum georgianum Chapm. W
Helianthemum rosmarinifolium Pursh W
Lechea mucronata Rafin. WJ
SYN= *Lechea villosa* Ell.
Lechea tenuifolia Michx. WM*J

CLUSIACEAE
Ascyrum hypericoides L. WMJ
SYN= *Hypericum hypericoides* (L.) Crantz
Ascyrum crux-andreae L. MJ
SYN= *Ascyrum stans* Michx. *ex* Willd.
SYN= *Hypericum crux-andreae* (L.) Crantz
Hypericum drummondii (Grev. & Hook.) Torr. & Gray WJ
Hypericum fasciculatum Lam. WMJ
Hypericum galioides Lam. *J
Hypericum gentianoides (L.) B.S.P. WMJ
Hypericum gymnanthum Eng. & Gray W
Hypericum mutilum L. WJ
Hypericum prolificum L. WJ
Hypericum pseudomaculatum Bush 0*J
Hypericum punctatum Lam. W

Triadenum walteri (Gmel.) Gleason WJ
SYN= *Hypericum walteri* Gmel.
SYN= *Hypericum petiolatum* Walt.

CONVOLVULACEAE
Convolvulus equitans Benth. W
Dichondra carolinensis Michx. WMJ
Evolvulus sericeus Sw. W
Ipomoea indica (Burm. *f.*) Merr. W
SYN= *Ipomoea acuminata* (Vahl) R. & S.
Ipomoea cairica (L.) Sw. WM
Ipomoea hederacea Jacq. W
Ipomoea lacunosa L. J
Ipomoea pandurata (L.) Mey. WMJ
Ipomoea cordatotriloba Dennst. WMJ
SYN= *Ipomoea trichocarpa* Ell.
Jacquemontia tamnifolia (L.) Griseb. WM
Stylisma humistrata (Walt.) Chapm. W
Stylisma pickeringii (Torr. *ex* Curtis) Gray W

CORNACEAE
Cornus drummondii C.A. Mey. WJ
Cornus florida L. WMJ
Cornus foemina P. Mill. J

CRASSULACEAE
Penthorum sedoides L. W

CUCURBITACEAE
Melothria pendula L. WJ

CUSCUTACEAE
Cuscuta compacta Juss. ex Choisy J
Cuscuta cuspidata Engelm. W
Cuscuta glabrior (Engelm.) Yunck. W
SYN= *Cuscuta pentagona* Engelm. var. *glabrior* (Yunck.) G.,T., & H.
Cuscuta glomerata Choisy *J

DROSERACEAE
Drosera brevifolia Pursh W
SYN= *Drosera annua* Reed

EBENACEAE
Diospyros virginiana L. WMJ

ERICACEAE
Rhododendron canescens (Michx.) Sweet W
Rhododendron oblongifolium (Small) Millais W*J
Rhododendron prinophyllum (Small) Millais *J
Vaccinium arboreum Marsh. WMJ
Vaccinium corymbosum L. WJ SYN= *Vaccinium amoenum* Aiton

Vaccinium elliotii Chapm. 0J
Vaccinium stamineum L. WJ
Vaccinium virgatum Aiton WMJ

EUPHORBIACEAE
Acalypha gracilens A. Gray WMJ
**Acalypha ostryifolia* Ridd. 0
Acalypha rhomboidea Rafin. WM
SYN= *Acalypha virginica* L. var. *rhomboidea* (Rafin.) Cooperr.
**Argythamnia humilis* (Engelm. & Gray) Muell. Arg. P
Chamaesyce cordifolia (Ell.) Small W
SYN= *Euphorbia cordifolia* Ell.
Chamaesyce hypericifolia (L.) Millsp. W
SYN= *Euphorbia hypericifolia* L.
Chamaesyce maculata (L.) Small W
SYN= *Euphorbia maculata* L.
**Chamaesyce missurica* (Rafin.) Shinners 0
SYN= *Euphorbia missurica* Rafin.
Chamaesyce nutans (Lag.) Small WMJ
SYN= *Euphorbia nutans* Lag.
Chamaesyce prostrata (Ait.) Small W
SYN= *Euphorbia prostrata* Ait.
Chamaesyce serpens (Kunth) Small WJ
SYN= *Euphorbia serpens* Kunth
Cnidosculus texanus (Muell. Arg.) Small WJ
Croton argyranthemus Michx. 0M
Croton capitatus Michx. var. *lindheimeri* (Engelm. & Gray) Muell. Arg. WMJ
Croton glandulosus L. var. *septentrionalis* Muell. Arg. WMJ
Croton monanthogynus Michx. WJ
**Croton texensis* (Kl.) Muell. Arg. 0
Croton willdenowii G. Webster WMJ
SYN= *Crotonopsis elliptica* Willd.
Euphorbia cyathophora Murr. W
SYN= *Poinsettia cyathophora* (Murr.) Kl. & Gke.
Euphorbia bicolor Engelm. & Gray WMJ
Euphorbia corollata L. WMJ
Euphorbia dentata Michx. WJ
Euphorbia discoidalis Chapman J
Euphorbia spathulata Lam. W*J
Euphorbia tetrapora Engelm. WJ
Phyllanthus caroliniensis Walt. WJ
Phyllanthus polygonoides Nutt. *ex* Spreng. WM
Phyllanthus urinaria L. WJ
Sapium sebiferum (L.) Roxb. WJ
Sebastiania fruticosa (Bartr.) Fern. J
Stillingia sylvatica L. WJ
Tragia betonicifolia Nutt. J
**Tragia cordata* Michx. 0
Tragia urticifolia Michx. WJ
Vernicia fordii (Hemsl.) Airy-Shaw W
SYN= *Aleurites fordii* Hemsley

FABACEAE

Acacia angustissima (P. Mill.) Kuntze WM
SYN= *Acacia hirta* Nutt.
Acacia farnesiana (L.) Willd. WJ
Albizia julibrissin Durazz. WMJ
**Amorpha fruticosa* L. H
Amorpha paniculata Torr. & Gray 0J
Amphicarpaea bracteata (L.) Fern. WM(Turner 1959)J
Apios americana Medic J
**Astragalus crassicarpus* Nutt. 0
Astragalus distortus Torr. & Gray var. *engelmannii* (Sheld.) M.E. Jones WJ
Astragalus leptocarpus Torr. & Gray W
Astragalus nuttallianus var. *trichocarpus* Torr. & Gray 0HW(Turner 1959)
Astragalus reflexus Torr. & Gray 0W(Turner 1959)
**Astragalus soxmaniorum* Lundell 0
Baptisia bracteata Muhl. *ex* Ell. *var. *laevicaulis* (Gray *ex* Canby) Isely 0
SYN= *Baptisia laevicaulis* (Gray) Small
Baptisia bracteata Muhl. *ex* Ell. var. *leucophaea* (Nutt.) Kartesz & Gandhi WM
SYN= *Baptisia leucophaea* Nutt.
Baptisia nuttalliana Small WMJ
Baptisia sphaerocarpa Nutt. W*J
Centrosema virginianum (L.) Benth. WMJ
Cercis canadensis L. WJ
Chamaecrista fasciculata (Michx.) E. Greene WMJ
SYN= *Cassia fasciculata* Michx.
Chamaecrista nictitans (L.) Moench WM(Turner 1959)J
SYN= *Cassia nictitans* L.
Clitoria mariana L. WMJ
Coronilla varia L. W
Crotalaria sagittalis L. WMJ
Dalea compacta Spreng. var. *pubescens* (Gray) Barneby WMJ
SYN= *Dalea helleri* Shinners
SYN= *Petalostemum pulcherrimus* (Heller) Heller
Dalea multiflora (Nutt.) Shinners WMJ
SYN= *Petalostemum multiflorus* Nutt.
Dalea phleoides (Torr. & Gray) Shinners WM(mercer)J (Turner 1959)
SYN= *Petalostemum glandulosus* Coult. & Fisher
Desmanthus illinoensis (Michx.) MacM. WMJ
Desmanthus leptolobus Torr. & Gray W(Luckow 1993)
Desmanthus velutinus Scheele W
Desmodium canescens (L.) DC. MJ
Desmodium ciliare (Muhl. *ex* Willd.) DC. WM(Turner 1959)J
Desmodium glabellum (Michx.) DC. WMJ
Desmodium laevigatum (Nutt.) DC. WJ
Desmodium lineatum DC. WJ
Desmodium marilandicum (L.) DC. W
Desmodium nudiflorum (L.) DC. MJ
Desmodium nuttallii (Schindl.) Schub. W
Desmodium obtusum (Muhl. *ex* Willd.) DC. W
Desmodium paniculatum (L.) DC. WMJ

Desmodium pauciflorum (Nutt.) DC. J
Desmodium rotundifolium DC. W(tex) J
Desmodium sessilifolium (Torr.) Torr. & Gray WM
**Desmodium tortuosum* (Sw.) DC. 0
Desmodium viridiflorum (L.) DC. W
Erythrina herbacea L. WMJ
**Galactia erecta* (Walt.) Vail 0
Galactia macreei M.A. Curtis WJ
Galactia regularis (L.) B.S.P. WJ
Galactia volubilis (L.) Britt. WM
Gleditsia triacanthos L. WMJ
Indigofera miniata Ort. WMJ
Indigofera suffruticosa P. Mill. WJ
Kummerowia striata (Thunb.) Schindl. WJ
SYN= *Lespedeza striata* (Thunb.) Hook. & Arn.
Lathyrus hirsutus L. WM
Lathyrus pusillus Ell. WJ
Lespedeza bicolor Turcz. J
Lespedeza cuneata (Dumont) G. Don WJ
Lespedeza hirta (L.) Hornem. WM(Turner 1959)J
Lespedeza procumbens Michx. WJ
Lespedeza repens (L.) Bart. WMJ
Lespedeza stuevei Nutt. WM(Turner 1959)
Lespedeza virginica (L.) Britt. W
Lotus unifoliolatus (Hook.) Benth. W
SYN= *Lotus purshianus* (Benth.) Clem. & Clem.
Lupinus subcarnosus Hook. W*J
Lupinus texensis Hook. WM*J
Medicago arabica (L.) Hudson W
Medicago lupulina L. WJ
**Medicago minima* (L.) L. 0
Medicago polymorpha L. WJ
SYN= *Medicago hispida* Gaertn.
Medicago sativa L. W
Melilotus albus Medic. W
Melilotus indicus (L.) All. WJ
Melilotus officinalis (L.) Lam. J
Mimosa hystricina (Small *ex* Britt. & Rose) Turner WMJ
SYN= *Schrankia hystricina* (Small) Standl.
Mimosa latidens (Small) Turner M(Turner 1959)
Mimosa microphylla Dry. WM
SYN= *Mimosa uncinata* (Willd.) Turner
SYN= *Schrankia uncinata* Willd.
Mimosa strigillosa Torr. & Gray WJ
Neptunia lutea (Leavenw.) Benth. WMJ
Neptunia pubescens Benth. var. *microcarpa* (Rose) Windler W
Pediomelum subulatum (Bush) Rydb. 0M(Ockendon 1965)
SYN= *Pediomelum hypogaeum* (Torr. & Gray) Rydb. var. *subulatum* (Bush) Grimes
Prosopis glandulosa Torrey WJ
Psoralidium tenuiflorum (Pursh) Rydb. W(Turner 1959)

Puereria lobata (Willd.) Ohwi W
SYN= *Pueraria montana* (Lour.) Merr. var. *lobata* (Willd.) Maesen & Alm.
Rhynchosia difformis (Ell.) DC. M(Turner 1959)
Rhynchosia latifolia Nutt. *ex* Torr. & Gray WM(Turner 1959)J
Rhynchosia minima (L.) DC. W*J
Robinia hispida L. W
Robinia pseudo-acacia L. WJ
Senna corymbosa (Lam.) Irwin & Barn. W
Senna marilandica (L.) Link WJ
Senna obtusifolia (L.) Irwin & Barn. M(Turner 1959)J
Senna occidentalis (L.) Link WM*J
Sesbania drummondii (Rydb.) Cory WJ
Sesbania herbacea (P. Mill.) McVaugh WJ
SYN= *Sesbania macrocarpa* Muhl. *ex* Rafin.
Sesbania vesicaria (Jacq.) Ell. WJ
Strophostyles helvola (L.) Ell. W
Strophostyles leiosperma (Torr. & Gray) Piper WM(Turner 1959)
Strophostyles umbellata (Muhl. *ex* Willd.) Britt. WM(Turner 1959)
Stylosanthes biflora (L.) B.S.P. WMJ
Tephrosia onobrychoides Nutt. WM(Turner 1959)
Tephrosia virginiana (L.) Pers. W*J
Trifolium bejariense Moric. W
Trifolium campestre Schreb. WM
Trifolium carolinianum Michx. W*J
Trifolium dubium Sibth. WMJ
Trifolium incarnatum L. WMJ
Trifolium lappulaceum L. W
**Trifolium polymorphum* Poir. 0
SYN= *Trifolium amphianthum* Torr. & Gray
Trifolium pratense L. J
Trifolium repens L. WMJ
Trifolium resupinatum L. WJ
Trifolium vesiculosum Savi M
Vicia angustifolia L. W
SYN= *Vicia sativa* L. subsp. *nigra* (L.) Ehrh.
Vicia dasycarpa Ten. W
SYN= *Vicia villosa* Roth subsp. *varia* (Host) Corb.
Vicia leavenworthii Torr. & Gray W
SYN= *Vicia ludoviciana* Nutt. var. *leavenworthii* (Torr. & Gray) Lass. & Gunn.
Vicia ludoviciana Nutt. WM
Vicia minutiflora Dietr. WM(Turner 1959)J
Wisteria frutescens (L.) Poir. J
SYN= *Wisteria macrostachya* Torr. & Gray
Wisteria sinensis (Sims) DC. WJ

FAGACEAE

Castanea pumila (L.) P. Mill. MJ
Castanea alnifolia Nutt. WJ
Fagus grandifolia Ehrh. MJ
Quercus alba L. WM(mercer)J

Quercus falcata Michx. WM*J
Quercus incana Bartr. W
Quercus laurifolia Michx. WJ
Quercus lyrata Walt. W
Quercus margarettiae Ashe *ex* Small WJ
Quercus marilandica Muenchh. WMJ
Quercus michauxii Nutt. WJ
Quercus nigra L. W*J
Quercus pagoda Rafin. WJ
SYN= *Quercus falcata* Michx. var. *pagodifolia* Ell.
Quercus phellos L. WJ
Quercus shumardii Buckl. WJ
Quercus similis Ashe WM
Quercus sinuata Walt. J
Quercus sinuata Walt. [form 2] W
Quercus stellata Wang. W*J
Quercus velutina Lam. WJ
Quercus virginiana P. Mill. WJ

FUMARIACEAE
Corydalis micrantha (Engelm. *ex* Gray) Gray WM*J
Fumaria offinialis L. M

GENTIANACEAE
Bartonia texana Correll *J
Centaurium pulchellum (Sw.) Druce W
Eustoma exaltatum (L.) Salisb. *ex* G. Don WJ
SYN= *Eustoma grandiflorum* (Rafin.) Shinners
Sabatia campestris Nutt. WM*J
Sabatia gentianoides Ell. M

GERANIACEAE
Geranium carolinianum L. WM(mercer)J
Geranium dissectum L. W

GROSSULARIACEAE
Itea virginica L. MJ
Ribes curvatum Small W

HALORAGACEAE
Myriophyllum aquaticum (Vell.) Verdcourt WM
SYN= *Myriophyllum brasiliense* Camb.
Myriophyllum heterophyllum Michx. J
Proserpinaca palustris L. M

HAMAMELIDACEAE
Hamamelis virginiana L. WJ
Liquidambar styraciflua L. WMJ

HIPPOCASTANACEAE
Aesculus pavia L. J

HYDROPHYLLACEAE
Hydrolea ovata Nutt. *ex* Choisy WMJ
Nemophila aphylla (L.) Brumm. WMJ
SYN= *Nemophila microcalyx* (Nutt.) Fisch. & Mey.
Nemophila phacelioides Nutt. WJ
Phacelia glabra Nutt. W
Phacelia hirsuta Nutt. W
Phacelia patuliflora (Engelm. & Gray) Gray M

JUGLANDACEAE
Carya alba (L.) Nutt. ex Ell. WMJ
SYN= *Carya tomentosa* (Lam. *ex* Poir.) Nutt.
Carya aquatica (Michx. *f.*) Nutt. WMJ
Carya illinoiensis (Wang.) K. Koch W
Carya myristiciformis (Michx. *f.*) Nutt. WJ
Carya ovata (P. Mill.) K. Koch W
Carya texana Buckl. WJ
Juglans nigra L. WMJ

KRAMERIACEAE
Krameria lanceolata Torrey W

LAMIACEAE
Ajuga reptans L. W(escaping cult)
Clinopodium brownei (Sw.) Kuntze W
SYN= *Micromeria brownei* (Sw.) Benth.
Hedeoma drummondii Benth. 0M
Hedeoma hispidum Pursh WM
Hyptis alata (Rafin.) Shinners J
Lamium amplexicaule L. W
Lamium purpureum L. W
**Leonotis nepetifolia* (L.) Ait. f. 0
Lycopus rubellus Moench WJ
Lycopus virginicus L. *J
**Mentha piperita* L. 0
**Mentha spicata* L. 0
Monarda citriodora Cerv. ex Lag. WM*J
Monarda fistulosa L. W*J
Monarda lindheimeri Gray M(mercer)
Monarda punctata L. WMJ
Perilla frutescens (L.) Britt. J
Physostegia angustifolia Fern. M(tex)
Physostegia digitalis Small WMJ
Physostegia intermedia (Nutt.) Engelm. & Gray W
Physostegia pulchella Lundell WJ
Prunella vulgaris L. 0HJ
Pycnanthemum albescens Torr. & Gray WMJ
Pycnanthemum tenuifolium Schrad. 0*J

Rhododon ciliatus (Benth.) Epling M(Turner 1995)
Salvia azurea Michx. *ex* Lam. WJ
Salvia coccinea Buchoz *ex* Etlinger 0
Salvia lyrata L. WMJ
Scutellaria cardiophylla Engelm. & Gray WJ
Scutellaria drummondii Benth. var. *drummondii* MJ
**Scutellaria elliptica* Muhl. *ex* Spreng. 0
Scutellaria integrifolia L. WM*J
Scutellaria racemosa Pers. M
Scutellaria ovata Hill J
Scutellaria parvula Michx. WJ
Stachys crenata Rafin. WJ
Stachys floridana Shuttlew. W
Stachys tenuifolia Willd. WM
Teucrium canadense L. var. *canadense* W
Trichostema dichotomum L. WM*J
Warnockia scutellarioides (Engelm. & Gray) M. Turner W
SYN= *Brazoria scutellarioides* Engelm. & Gray

LAURACEAE
Cinnamomum camphora (L.) J. Presl W
Persea borbonia (L.) Spreng. WMJ
Persea palustris (Rafin.) Sarg. J
Sassafras albidum (Nutt.) Nees WMJ

LENTIBULARIACEAE
Utricularia gibba L. WM
Utricularia radiata Small M
Utricularia subulata L. W

LINACEAE
Linum berlandieri Hook. var. *berlandieri* WM
SYN= *Linum rigidum* Pursh var. *berlandieri* (Hook.) Torr. & Gray
Linum medium (Planch.) Britt. var. *texanum* (Planch.) Fern. WMJ
Linum striatum Walt. WMJ

LOGANIACEAE
Mitreola petiolata (Gmel.) Torr. & Gray WJ
SYN= *Cynoctonum mitreola* (L.) Britt.
Gelsemium sempervirens (L.) Jaume St.-Hill WMJ
Polypremum procumbens L. WM*J
Spigelia marilandica (L.) L. *J

LYTHRACEAE
Ammannia coccinea Rottb. WM
Cuphea carthagenensis (Jacq.) Macbr. MJ
Cuphea glutinosa C. & S. J
Laegerstroemia indica L. WM
Lythrum alatum Pursh var. *lanceolatum* (Ell.) Torr. & Gray *ex* Rothr. WJ
Rotala ramosior (L.) Koehne W

MAGNOLIACEAE
Liriodendron tulipifera L. M
Magnolia grandiflora L. WMJ
Magnolia pyramidata Bartr. *J
Magnolia virginiana L. 0MJ

MALVACEAE
Abutilon theophrasti Medic. W
Callirhoe involucrata (Torr.) A. Gray W
**Callirhoe leiocarpa* R.F. Martin 0
Hibiscus laevis Allioni WM
SYN= *Hibiscus militaris* Cav.
Hibiscus moscheutos L. subsp. *lasiocarpus* (Cav.) Blanch. MW
SYN= *Hibiscus lasiocarpus* Cav.
Malvaviscus arboreus Cav. var. *drummondii* (T. & G.) Schery WMJ
SYN= *Malvaviscus drummondii* T. & G.
Modiola caroliniana (L.) G. Don W
Sida ciliaris L. W
Sida rhombifolia L. WMJ
Sida spinosa L. W
Sphaeralcea angustifolia (Cav.) G. Don M

MELASTOMATACEAE
Rhexia mariana L. var. *mariana* M

MELIACEAE
Melia azederach L. W*J

MENISPERMACEAE
**Calycocarpum lyonii* (Pursh) Gray H
Cocculus carolinus (L.) DC. WJ

MOLLUGINACEAE
Mollugo verticillata L. WMJ

MONOTROPACEAE
Monotropa uniflora L. H*J

MORACEAE
Broussonetia papyrifera (L.) Vent. W
Fatoua villosa (Thunb.) Nakai J
Maclura pomifera (Rafin.) Schneid. WJ
Morus alba L. W
Morus rubra L. WJ

MYRICACEAE
Morella cerifera (L.) Small WMJ
SYN= *Myrica cerifera* L.
SYN= *Myrica pusilla* Rafin.

Morella caroliniensis (P. Mill.) Small OJ
SYN= *Myrica caroliniensis* P. Mill.
SYN= *Myrica heterophylla* Rafin.

NYMPHAEACEAE
Nuphar lutea (L.) Sm. subsp. *advena* (Ait.) Kart. & Gandhi WM
SYN= *Nuphar lutea* (L.) Sm. subsp. *macrophylla* (Small) Beal
Nymphaea elegans Hook. W
Nymphaea odorata Ait. M(mercer)

NELUMBONACEAE
Nelumbo lutea Willd. M

NYCTAGINACEAE
**Boerhaavia erecta* L. 0
Mirabilis jalapa L. W
Mirabilis gigantea (Standl.) Shinners W
Mirabilis albida (Walt.) Heimerl W(Turner 1993)

NYSSACEAE
Nyssa aquatica L. M
Nyssa biflora Walt. J
Nyssa sylvatica Marsh. WJ

OLEACEAE
Chionanthus virginicus L. WMJ
Forestiera ligustrina (Michx.) Poir. WM(Brooks 1977)*J
Fraxinus americana L. WJ
Fraxinus pennsylvanica Marsh. WMJ
Ligustrum japonicum Thunb. W
Ligustrum lucidum Aiton f. WJ
Ligustrum quihoui Carr. W
Ligustrum sinense Lour. WJ

ONAGRACEAE
Calylophus berlandieri Spach subsp. *berlandieri* MJ
SYN= *Calylophus drummondianus* Spach var. *berlandieri* (Spach) Towner & Raven
Calylophus serrulatus (Nutt.) Raven M(Towner 1977)
Gaura brachycarpa Small W
Gaura lindheimeri Engelm. & Gray J
Gaura longiflora Spach WJ
SYN= *Gaura filiformis* Small
Gaura sinuata Ser. W*J
Ludwigia alternifolia L. WMJ
Ludwigia decurrens Walt. WJ
Ludwigia glandulosa Walt. WJ
Ludwigia hirtella Rafin. WM
Ludwigia leptocarpa (Nutt.) Hara W
Ludwigia octovalvis (Jacq.) Raven WJ
Ludwigia palustris (L.) Ell. WJ

Ludwigia peploides (Jacq.) Raven WM
Ludwigia pilosa Walt. J
Ludwigia sphaerocarpa Ell. M
Oenothera heterophylla Spach J
Oenothera laciniata Hill WMJ
Oenothera linifolia Nutt. W
Oenothera rhombipetala T. & G. J
Oenothera spachiana Torr. & Gray M
Oenothera speciosa Nutt. WMJ
Oenothera triloba Nutt. W
Stenosiphon linifolius (Nutt. *ex* James) Heynh. W

OROBANCHACEAE
**Orobanche uniflora* L. H

OXALIDACEAE
Oxalis corniculata L. var. *wrightii* (Gray) Turner WMJ
SYN= *Oxalis dillenii* Jacq. (*sensu* B.L. Turner 1994)
Oxalis corymbosa DC. WJ
SYN= *Oxalis debilis* Kunth var. *corymbosa* (DC.) Lourteig
Oxalis lyonii Pursh WM*J
SYN= *Oxalis priceae* Small
Oxalis rubra St. Hil. W
Oxalis violacea L. W(tex) M(tex)

PAPAVERACEAE
Argemone albiflora Hornem. subsp. *texana* G. Ownbey WM
Sanguinaria canadensis L. *J

PASSIFLORACEAE
Passiflora incarnata L. WMJ
Passiflora lutea L. WJ
Passiflora sp. M

PHYTOLACCACEAE
Phytolacca americana L. WMJ

PLANTAGINACEAE
Plantago aristata Michx. WMJ
Plantago elongata Pursh W
**Plantago hookeriana* Fisch. & Mey. 0
Plantago major L. W
Plantago rhodosperma Dcne. W
Plantago virginica L. WJ

PLATANACEAE
Platanus occidentalis L. WMJ

POLEMONIACEAE
Ipomopsis rubra (L.) Wherry WM(Wherry 1966)J
Phlox cuspidata Scheele WM(Wherry 1966)J

Phlox drummondii Hook. WMJ
Phlox pilosa L. WMJ

POLYGALACEAE
Polygala mariana P. Mill. WM
Polygala polygama Walt. WM
Polygala verticillata L. WJ

POLYGONACEAE
Brunnichia ovata (Walt.) Shinners W
SYN= *Brunnichia cirrhosa* Gaertn.
**Eriogonum longifolium* Nutt. 0
**Polygonella americana* (Fisch. & Mey.) Small 0
**Polygonum aviculare* L. 0
Polygonum hydropiperoides Michx. WM
Polygonum lapathifolium L. W
**Polygonum pennsylvanicum* L. 0
Polygonum persicaria L. W
Polygonum punctatum Ell. WJ
**Polygonum ramosissimum* Michx. 0
**Polygonum tenue* Michx. 0
Rumex altissimus Wood M(Rechinger 1937)
Rumex crispus L. W
Rumex hastatulus Baldw. WMJ
Rumex pulcher L. WM
Tovara virginiana (L.) Rafin. W
SYN= *Polygonum virginianum* L.

PONTEDERIACEAE
**Pontederia cordata* L. H

PORTULACACEAE
Claytonia virginica L. WMJ
Portulaca oleracea L. W
Portulaca pilosa L. WJ
**Portulaca umbraticola* Kunth 0
Talinum parviflorum Nutt. W

PRIMULACEAE
Anagallis arvensis L. WMJ
Centunculus minimus L. WJ
SYN= *Anagallis minimus* (L.) Krause
Hottonia inflata Ell. W
Samolus parviflorus Rafin. WMJ
SYN= *Samolus valerandi* L. subsp. *parviflorus* (Rafin.) Hulten

RANUNCULACEAE
Anemone berlandieri Pritzel W
Anemone caroliniana Walt. WJ

Clematis crispa L. J
Clematis pitcheri Torr. & Gray *J
Clematis reticulata Walt. WMJ
Clematis ternifolia DC. W
SYN= *Clematis dioscoreifolia* Levl. & Van.
Delphinium ajacis L. W
Delphinium carolinianum Walt. subsp. *vimineum* (D. Don) M.J. Warnock W
SYN= *Delphinium vimineum* D. Don
Ranunculus hispidus Michx. var. *nitidus* (Chapm.) T. Duncan M*J
SYN= *Ranunculus carolinianus* DC.
Ranunculus fascicularis Muhl. *ex* Bigelow WMJ
Ranunculus macranthus Scheele W
Ranunculus muricatus L. WM
Ranunculus parviflorus L. W
Ranunculus pusillus Poir. W
Ranunculus sardous Crantz WM
Ranunculus sceleratus L. W
Thalictrum dasycarpum Fisch. & Ave-Lall. *J
Xanthorhiza simplicissima Marsh. *J

RHAMNACEAE
Berchemia scandens (Hill) K. Koch WMJ
**Ceanothus americanus* L. 0H
**Ceanothus herbaceus* Rafin. 0
Frangula caroliniana (Walt.) Gray WMJ
SYN= *Rhamnus caroliniana* Walt.

ROSACEAE
Agrimonia microcarpa Wallr. WJ
Agrimonia rostellata Wallr. J
Crataegus brachyacantha Sarg. & Engelm. W
Crataegus crus-galli L. WJ
Crataegus engelmannii Sarg. W*J
Crataegus marshallii Eggl. WMJ
Crataegus spathulata Michx. WMJ
Crataegus viridis L. WMJ
**Crataegus warneri* Sarg. W(Sargent 1922)
Duchesnea indica (Andrz.) Focke WJ
Geum canadense Jacq. WMJ
Photinia arbutifolia (Lam.) Robertson & Phipps JM
SYN= *Pyrus arbutifolia* (Lam.) L.*f.*
Potentilla simplex Michx. H
Prunus angustifolia Marsh. W
Prunus caroliniana (P. Mill.) Ait. WM(mercer)*J
Prunus gracilis Engelm. & Gray WM
Prunus mexicana S. Wats. WMJ
Prunus serotina Ehrh. WMJ
Prunus umbellata Ell. WMJ
Rosa bracteata Wendl. W
Rosa carolina L. WM
Rosa laevigata Michx. *J

Rosa setigera Michx. 0M
Rubus argutus Link WMJ
SYN= *Rubus louisianicus* Berger
Rubus arvensis Bailey W
SYN= *Rubus saepescandens* Bailey
Rubus trivialis Michx. WJ

RUBIACEAE
Cephalanthus occidentalis L. WMJ
Diodia teres Walt. WM*J
Diodia virginiana L. WM
Galium aparine L. W*J
Galium pilosum Aiton WMJ
Galium tinctorium (L.) Scop. WMJ
Galium uniflorum Michx. W
Galium virgatum Nutt. W*J
Hedyotis nigricans (Lam.) Fosb. WJ
Houstonia micrantha (Shinners) Terrell W*J
SYN= *Hedyotis australis* Lewis & Moore
SYN= *Hedyotis crassifolia* Raf. var. *micrantha* Shinners
Houstonia pusilla Schoepf WMJ
SYN= *Houstonia minima* Beck
SYN= *Houstonia patens* Ell.
SYN= *Hedyotis crassifolia* Rafin.
Houstonia rosea (Rafin.) Terrell *J
SYN= *Hedyotis rosea* Rafin.
SYN= *Hedyotis tayloriae* Fosb.
SYN= *Houstonia pygmaea* C.H. & M.T. Mueller
Mitchella repens L. WJ
Oldenlandia boscii (DC.) Chapm. W
Oldenlandia uniflora L. WJ
Richardia scabra L. WJ
Sherardia arvensis L. WM
Spermacoce glabra Michx. W

RUTACEAE
Poncirus trifoliata (L.) Rafin. WMJ
SYN= *Citrus trifoliata* L.
Ptelea trifoliata L. WJ
Zanthoxylum clava-herculis L. WMJ

SALICACEAE
Populus deltoides Bartr. *ex* Marsh. WJ
Salix nigra Marsh. WM

SAPINDACEAE
Cardiospermum halicacabum L. W
Koelreuteria paniculata Laxm. W
Sapindus drummondii Hook. & Arn. WJ
SYN= *Sapindus saponaria* L. var. *drummondii* (Hook. & Arn.) L. Benson
**Ungnadia speciosa* Endl. 0

SAPOTACEAE
Sideroxylon lanuginosum Michx. WMJ
SYN= *Bumelia lanuginosa* (Michx.) Pers.

SAURURACEAE
Saururus cernuus L. WMJ

SAXIFRAGACEAE
Lepuropetalon spathulatum Ell. H
Saxifraga texana Buckl. W

SCROPHULARIACEAE
Agalinis fasciculata (Ell.) Rafin. WM
Agalinis gattingeri (Small) Small W
Agalinis heterophylla (Nutt.) Small *ex* Britt. WJ
Agalinis purpurea (L.) Penn. W*J
Agalinis viridis (Small) Penn. MJ
Aureolaria virginica (L.) Pennell J
SYN= *Aureolaria dispersa* (Small) Penn.
Aureolaria grandiflora (Benth.) Penn. MJ
Bacopa caroliniana (Walt.) B. Robins. M
Bacopa monnieri (L.) Pennell WMJ
Bellardia trixago (L.) Allm. M(Do *et al.* 1996)
Castilleja indivisa Engelm. WM*J
Gratiola brevifolia Rafin. HMJ
Gratiola neglecta Torrey W
Gratiola virginiana L. WJ
Lindernia anagallidea (Michx.) Penn. W
Mecardonia acuminata (Walt.) Small *J
Mecardonia procumbens (P. Mill.) Pennell W*J
SYN= *Mecardonia vandellioides* auct. non (Kunth) Pennell.
Micranthemum umbrosum (Gmel.) Blake WJ
Mimulus alatus Ait. WJ
Nuttallanthus canadensis (L.) D.A. Sutton WJ
SYN= *Linaria canadensis* (L.) Don
Nuttallanthus texanus (Scheele) D.A. Sutton WM*J
SYN= *Linaria texana* Scheele
Pedicularis canadensis L. WJ
Penstemon cobaea Nutt. W
Penstemon digitalis Nutt. *ex* Sims W
Penstemon laxiflorus Penn. WMJ
SYN= *Penstemon australis* Small subsp. *laxiflorus* (Penn.) Bennett
Penstemon murrayanus Hook. 0J
Scoparia dulcis L. WMJ
Verbascum blattaria L. W
Verbascum thapsus L. WJ
Verbascum virgatum Stokes W
Veronica agrestis L. H
Veronica arvensis L. W*J
Veronica peregrina L. WJ
Veronica persica Poir. M

SOLANACEAE
Callibrachoa parviflora (Juss.) D'Arcy W
SYN= *Petunia parviflora* Juss.
Capsicum annuum L. W
**Datura stramonium* L. 0
**Physalis angulata* L. 0
Physalis heterophylla Nees WJ
**Physalis pubescens* L. 0
**Physalis pumila* Nutt. 0
**Physalis virginiana* Mill. 0
Physalis viscosa L. var. *cinerascens* (Dun.) Waterf. WJ
Solanum carolinense L. WMJ
Solanum dimidiatum Rafin. WJ
Solanum elaeagnifolium Cav. W
Solanum lycopersicum (L.) Karst. *ex* Farw. W
SYN= *Lycopersicon esculentum* P. Mill.
Solanum pseudocapsicum L. J
Solanum ptycanthum Dun. *ex* DC. WMJ
SYN= *Solanum nigrum* L. auct.
SYN= *Solanum americanum* Mill. auct.
Solanum rostratum Dunal 0MJ

SPHENOCLEACEAE
Sphenoclea zeylandica Gaertn. W

STERCULIACEAE
Firmiana simplex (L.) W. Wight W

STYRACACEAE
Halesia diptera Ellis WMJ
Styrax americanus Lam. WJ

SYMPLOCACEAE
Symplocos tinctoria (L.) L'Herit. MJ

TILIACEAE
Tilia americana L. WMJ
SYN= *Tilia caroliniana* P. Mill.
SYN= *Tilia americana* L. var. *caroliniana* (P. Mill.) Castigl.

ULMACEAE
Celtis laevigata Willd. WMJ
Celtis tenuifolia Nutt. W
Planera aquatica Gmel. W
Ulmus alata Michx. WJ
Ulmus americana L. WMJ
Ulmus crassifolia Nutt. WMJ
Ulmus rubra Muhl. W

URTICACEAE
Boehmeria cylindrica (L.) Sw. WJ
Parietaria pensylvanica Muhl. *ex* Willd. W
**Pilea pumila* (L.) Gray 0
**Urtica chamaedryoides* Pursh 0
**Urtica urens* L. 0

VALERIANACEAE
Valerianella amarella (Lindh. *ex* Engelm.) Krok. WJ
Valerianella radiata (L.) Dufr. WM
Valerianella stenocarpa (Engelm. *ex* Gray) Krok W*J

VERBENACEAE
Callicarpa americana L. WMJ
Glandularia bipinnatifida (Nutt.) Nutt. W
SYN= *Verbena bipinnatifida* Nutt.
Glandularia canadensis (L.) Nutt. WM
SYN= *Verbena canadensis* (L.) Britt.
Glandularia pulchella (Sweet) Tronc. MJ
SYN= *Verbena tenuisecta* Briq.
Lantana camara L. WJ
Phyla nodiflora (L.) E. Greene WM*J
Phyla lanceolata (Michx.) Greene HM
Phryma leptostachya L. WJ
Verbena bonariensis L. W
Verbena brasiliensis Vell. WMJ
Verbena halei Small WMJ
Verbena rigida Spreng. WMJ
Verbena urticifolia L. W
Verbena xutha Lehm. WMJ
Vitex agnus-castus L. W

VIOLACEAE
Viola affinis Le Conte WM*J
SYN= *Viola sororia* Willd. var. *missouriensis* (Greene) McKinney
SYN= *Viola missouriensis* Greene
SYN= *Viola langloisii* Greene
Viola bicolor Pursh W
SYN= *Viola rafinesquii* Greene
Viola lanceolata L. var. *lanceolata* *J
Viola lanceolata L. var. *vittata* (Greene) Russell M
SYN= *Viola vittata* Greene
Viola palmata L. *J
SYN= *Viola triloba* Schwein. var. *dilatata* (Ell.) Brainerd
Viola pedata L. W*J
Viola primulifolia L. J
Viola sagittata Ait. WJ
SYN= *Viola triloba* Schwein. var. *triloba*
Viola walteri House WJ

VISCACEAE

Phoradendron tomentosum (DC.) A. Gray W*J
SYN= *Phoradendron serotinum* (Raf.) M.C. Johnston var. *pubescens* (Engelm.) M.C. Johnston

VITACEAE

Ampelopsis arborea (L.) Koehne WJ
Ampelopsis cordata Michx. W
Cissus trifoliata (L.) L. W
SYN= *Cissus incisa* auct. non Des Moulins
Parthenocissus quinquefolia (L.) Planch. WMJ
Vitis aestivalis Michx. var. *aestivalis* W*J
Vitis aestivalis Michx. var. *lincecumii* (Buckl.) Munson W
SYN= *Vitis lincecumii* Buckley
Vitis cinerea (Engelm.) Millard WJ
Vitis mustangensis Buckley WJ
Vitis palmata Vahl WJ
Vitis rotundifolia Michx. WMJ
Vitis vulpina L. WJ

ZYGOPHYLLACEAE

**Tribulus terrestris* L. 0

REJECTED or DOUBTFUL

Calylophus serrulata (Nutt.) Raven 0, probably = *Calylophus drummondii*
Croton floridanus Ferguson 0, = ?
Crotonopsis linearis Michx. 0, probably = *Croton willdenowii*
Forestiera pubescens Nutt. H, probably = *Forestiera ligustrina*
Gutierrezia texana (DC.) Torr. & Gray 0, probably = *Amphiachyris dracunculoides*
Helianthus cucumerifolius T. & G. 0, = *Helianthus debilis*
Oenothera jamesii T. & G. 0, = ?
Palafoxia callosa (Nutt.) T.& G. P, probably = *Palafoxia rosea*
Parthenium hispidum Rafin. 0, probably = *Parthenium hysterophorus*
Rhynchospora mixta Britt. *ex* Small H, = ?
Rumex mexicanus Meisn. 0, = ?
Rumex obtusifolius L. 0, probably = *Rumex pulcher*
Sagittaria lancifolia L. H = perhaps *S. platyphylla* (Engelm.) J.G. Sm.
Tradescantia subacaulis Bush H, = ?
Tridens muticus (Torr.) Nash 0, probably = *Tridens strictus*
Yucca arkansana Trel. 0H, probably = *Yucca louisianensis*

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NOTES ON THE DISTRIBUTION, HOST RANGE, PLANT SIZE, PHENOLOGY, AND SEX RATIO OF TWO RARE DWARF MISTLETOES FROM CENTRAL AMERICA: *ARCEUTHOBIUM HAWKSWORTHII* AND *A. HONDURENSE*

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ABSTRACT

New information on the distribution, host range, plant size, flowering periods, and sex ratio of *Arceuthobium hawksworthii* and *A. hondurense* are provided based on plant collections, field-observations and roadside-surveys conducted in 1998 in Belize, Guatemala, and Honduras, Central America. *Arceuthobium hawksworthii* parasitizes *Pinus caribaea* var. *hondurensis* and *P. oocarpa* var. *ochoterenai* in Belize, but the latter pine is less susceptible and classified here as a secondary host. Our surveys in the *P. caribaea* var. *hondurensis* forests near Poptun, Guatemala indicate that *A. hawksworthii* does not occur there, and therefore, this mistletoe probably does not occur in Guatemala. Our surveys of the Mountain Pine Ridge Region of western Belize indicate that *A. hawksworthii* occurs there at elevations between 520-900 m and is distributed in an area of approximately 250 sq. km. Therefore, this dwarf mistletoe probably has the most restricted geographic range of any known dwarf mistletoe. No new populations of *A. hondurense* were discovered in Honduras, but our examination of previously reported populations of this dwarf mistletoe indicates that it only parasitizes *P. oocarpa* vars. *oocarpa* and *ochoterenai* and not *P. maximinoi* as previously reported. Additional plant measurements of *A. hawksworthii* and *A. hondurense* are reported, including new maximum records of plant height for both species. The sex ratio of both dwarf mistletoes is 1:1, but the sample size for *A.*

hondurense was small (64 plants) and additional sampling will be needed to confirm this finding.

KEY WORDS: Hawksworth's dwarf mistletoe, Honduran dwarf mistletoe, Caribbean pine

BACKGROUND

Dwarf mistletoes (*Arceuthobium* spp., Viscaceae) are parasitic flowering plants that parasitize members of the Pinaceae in the New World and Pinaceae and Cupressaceae in the Old World. Although the dwarf mistletoes are widespread and common parasites of the Pinaceae in the United States and México, there are only a few taxa known from Central America. Little is known regarding the distribution, host range, ecology, and phenology of the Central American taxa (Hawksworth & Wiens 1996).

Two of the rarest dwarf mistletoes known occur in Belize and Honduras: *Arceuthobium hawksworthii* Wiens & C.G. Shaw, III and *A. hondurense* Hawksw. & Wiens. *Arceuthobium hawksworthii* is known only from the Mountain Pine Ridge Region (MPR) of western Belize (Wiens & Shaw 1994) and *A. hondurense* is only known from two areas of Honduras (Hawksworth & Wiens 1972, 1996). Hawksworth & Wiens (1996) speculated that *A. hondurense* may be so rare in Honduras that it might be in danger of extinction if the extensive harvesting of pine forests in Honduras continues.

Specimens of *Arceuthobium hawksworthii* have been collected by various investigators from the MPR since 1959, but this taxon was not described until recently (Wiens & Shaw 1994). It was previously considered to represent a disjunct population of *Arceuthobium globosum* Hawksw. & Wiens (Hawksworth & Wiens 1972) and later was classified as *A. aureum* Hawksw. & Wiens subsp. *aureum* (Hawksworth & Wiens 1977). However, a detailed analysis of the Belizean populations by Wiens & Shaw (1994) indicated these populations are distinct from the *A. aureum* subsp. *aureum* populations found in the western and central highlands of Guatemala. Wiens & Shaw (1994) speculated that *A. hawksworthii* might occur in eastern Guatemala in a disjunct population of its principal host, *Pinus caribaea* Morelet var. *hondurensis* (Senecl.) Barr. & Golf., that occurs in the vicinity of Poptun (Perry 1991). They also indicated that they did not observe *A. hawksworthii* below an elevation of 700 m in the MPR although previous reports place it as low as 520 m in this Region. Specimens of *A. hawksworthii* collected by A. Carty at high elevations (above 900 m) near Cooma Cairn in 1981 were tentatively identified as hybrids of *Pinus caribaea* var. *hondurensis* and *Pinus oocarpa* Schiede var. *ochoterenai* Mart. Wiens & Shaw (1994) reported they were unable to confirm if *A. hawksworthii* was parasitizing *Pinus oocarpa* var. *ochoterenai* or hybrids of these species at this location.

Arceuthobium hondurense was described in 1970 from populations southeast of Tegucigalpa, Honduras, but only one additional population of this rare dwarf mistletoe has been discovered since then (Hawksworth & Wiens 1970, 1972, 1984, 1996). It is presently known from only two general localities in Honduras; in the Piedra Herrada

Mountains, approximately 22 km southeast of Tegucigalpa and from approximately 20 km northwest of San Pedro Sula in Cusuco National Park (Hawksworth & Wiens 1996). Thus far, this dwarf mistletoe has only been reported parasitizing *Pinus oocarpa* var. *oocarpa* and *P. maximinoi* H.E. Moore (Hawksworth & Wiens 1996). So little is known about its host range and distribution in Central America that it is considered to be the rarest dwarf mistletoe described from the New World. It may also occur in El Salvador in the vicinity of Montecristo (Santa Ana Province) near the borders of Honduras and Guatemala, but this tentative report (Hawksworth & Wiens 1996) needs to be confirmed.

SAMPLING AND FIELD OBSERVATIONS

Distribution

From March 3--4, May 29--June 1, and August 18--20, 1998 we conducted roadside-surveys in the pine forests of the MPR of western Belize. *Arceuthobium hawksworthii* is common in the MPR east of Augustine, particularly along the Baldy Beacon, Hidden Valley Falls, Brunton Trail, Orchid Hill, and Granite Cairn Roads. We observed populations of *A. hawksworthii* at an elevation of 520 m at several locations, but the mistletoe is most common above 600 m. The reasons for the lower elevational limitation are unclear, because its pine hosts are continuously distributed throughout the MPR at elevations below 500 m. In addition, as was reported by Wiens & Shaw (1994) we did not observe *A. hawksworthii* in the lower elevation *Pinus caribaea* var. *hondurensis* forests closer to the coast of Belize. Our surveys now provide adequate information to estimate the distribution of this rare dwarf mistletoe in the MPR. Because we did not find populations of *A. hawksworthii* below 520 m in the MPR, we used this lower elevational limit and our roadside-survey observations to estimate the approximate distribution of *A. hawksworthii* (Figure 1); it only occurs in an area of approximately 250 sq. km. Because the highlands of the MPR are geologically distinct and have evidently been isolated from other highland regions of Central America for several thousand years (Bateson 1972; Bateson & Hall 1977; Means 1997), *A. hawksworthii* has been separated from other dwarf mistletoe populations long enough to have evolved into a distinct taxon, endemic to the MPR.

On March 6, 1998 we surveyed the pine populations near Poptun, Guatemala. These pine populations are typical *Pinus caribaea* var. *hondurensis* as reported by Perry (1991). We estimate the overall forest area dominated by pine near Poptun to be restricted to about 300 sq. km; located adjacent to the Belizean border, extending 38 km west; and south of the Machaquila River, extending 8-12 km south of the river (Perry 1991 and personal communication with Placido Castellanos of Machiquila, Guatemala). Because of this limited area, we were able to survey the majority of the pine forest (elevation 500-700 m) in the Poptun area. We did not observe *Arceuthobium hawksworthii* in these forests and we believe it does not occur there. Therefore, we are doubtful that *A. hawksworthii* occurs in Guatemala.

In Honduras we relocated the population of *Arceuthobium hondurense* northwest of Cofradia (approximately 20 km west of San Pedro Sula) in Cusuco National Park (Figure 2) at an elevation of 1400 m (ca. 3 km northwest of the village of Buenos

Aires). This is the same population of A. hondurense sampled by J.S. Beatty in 1991 that is reported in Hawksworth & Wiens (1996). Our limited roadside surveys in this area did not reveal any other populations of this rare dwarf mistletoe in northwestern Honduras, but we suspect it occurs elsewhere within and in the vicinity of Cusuco National Park.

Host Range

We examined host material (needles and mature female cones) collected from several pines at different elevations in the MPR in an attempt to clarify the identity of the hosts parasitized by *Arceuthobium hawksworthii*. Specimens of foliage and female cones of dwarf mistletoe-infected pines were collected and forwarded to J.P. Perry, Jr. for confirmation of our tentative field identifications, including a sample taken from a putative hybrid (*Pinus caribaea* var. *hondurensis* × *Pinus oocarpa* var. *ochoterenai*). In all cases our identification of the host agreed with those of Mr. Perry, except that he felt the putative hybrid was best classified as *Pinus oocarpa* var. *ochoterenai*. Our field observations from the MPR confirm that *Pinus caribaea* var. *hondurensis* is the principal host of *A. hawksworthii* in this area. This pine is severely infected in many areas and tree mortality is common in severely infested pine stands.

We were unable to find locations with sufficient numbers of *Pinus oocarpa* var. *ochoterenai* growing near severely infected *P. caribaea* var. *hondurensis* to gather quantitative data on the comparative susceptibility of these hosts to *Arceuthobium hawksworthii*. However, based on our observations at several locations where both *P. caribaea* var. *hondurensis* and *P. oocarpa* var. *ochoterenai* were both parasitized by *A. hawksworthii*, we believe the latter pine is less susceptible to this dwarf mistletoe. In some areas where many *P. caribaea* var. *hondurensis* were severely infected and where many dead *P. caribaea* var. *hondurensis* had evidence of past mistletoe infection (witches--brooms), infection of occasional, large (> 10 m in height) *P. oocarpa* var. *ochoterenai* was much less severe. In addition, we observed infection of small *P. caribaea* var. *hondurensis* (less than 2 m in height) under larger, infected *P. caribaea* var. *hondurensis*, but small *P. oocarpa* var. *ochoterenai* growing in the same areas were not infected. We tentatively classify *P. oocarpa* var. *ochoterenai* as a secondary host of *A. hawksworthii* using the host susceptibility classification system of Hawksworth & Wiens (1972).

Wiens & Shaw (1994) reported that a species of *Psittacanthus* is common on *Pinus caribaea* var. *hondurensis* in the lowlands of Belize and in the MPR. We frequently observed this mistletoe on pines in these areas as well and identified the mistletoe as *Psittacanthus pinicola* Kuijt. This species of *Psittacanthus* is distinguished by its red to orange flowers with yellow-green tips which are about 4 cm long with a conspicuous ligule at their base (Kuijt 1987). Another distinctive feature is that it has leaves whose margins taper into the petiole. We also observed both *Psittacanthus pinicola* and *Arceuthobium hawksworthii* parasitizing the same tree, and in some cases the same branch, in the MPR as was reported by Wiens & Shaw (1994).

The taxonomic status of the *Pinus oocarpa* populations in the MPR is still in question and some investigators consider these populations to be more representative of *P. tecunumanii* (Schw.) Eguiluz & Perry (Farjon & Styles 1997). Other

investigators consider these populations to represent *P. oocarpa* var. *ochoterenai* (Hunt 1962; Perry 1991). We have chosen to follow the classification of Perry (1991).

Hawksworth & Wiens (1996) reported the host of *Arceuthobium hondurense* in northwestern Honduras is *Pinus maximinoi*, but this host classification was tentative and based on information provided to one of us (J.S. Beatty) by Honduran Forestry personnel. Our examination of the pines being parasitized in northwestern Honduras indicates that the host is *P. oocarpa* var. *ochoterenai* and not *P. maximinoi* as reported by Hawksworth & Wiens. Therefore, we conclude that *A. hondurense* has only been found parasitizing *P. oocarpa* vars. *oocarpa* and *ochoterenai* in Honduras, thus far. Because so little is currently known about the distribution and host range of *A. hondurense*, it is likely that once its distribution is better documented in Central America, it will be found parasitizing other species of *Pinus*.

Plant Measurements

Additional measurements of male and female plants were made on fresh specimens of *Arceuthobium hawksworthii* in order to add to the small amount of data available for this species. Plant height (nearest 0.1 cm), the width of the base of shoots (nearest 0.1 mm), and the length (nearest 1.0 mm), and width of the third internode (nearest 0.1 mm) were measured on the dominant shoots from 150 infections of each sex. Means, standard deviations, maximums, and minimums for these four morphological characters are presented below:

	Female				Male			
	Mean	S. Dev.	Max.	Min.	Mean	S. Dev.	Max.	Min.
Height (cm)	15.6	3.4	27.8	9.6	15.7	3.8	32.8	7.8
Base (mm)	3.8	0.8	6.9	2.1	3.5	0.9	7.8	2.3
Third Internode:								
Length (mm)	12.2	2.3	19.0	7.0	11.8	2.6	21.0	6.0
Width (mm)	2.7	0.5	4.5	1.9	2.5	0.5	4.4	1.7

The largest plants we found were males (approximately 33 cm) and slightly exceeded the maximum plant height (30 cm) reported by Wiens & Shaw (1994); otherwise, these sizes and ranges are consistent with those reported by Wiens & Shaw. It is interesting to note that based on our measurements of 300 plants, which is the largest set of plant measurements completed for a dwarf mistletoe of which we are aware (see Hawksworth & Wiens 1996), the set of morphological characters we

measured for female and male plants of *Arceuthobium hawksworthii* are the nearly the same.

Additional measurements of male and female plants were made on fresh specimens of *Arceuthobium hondurense* collected on March 10 and August 21, 1998. Measurements were the same as for *A. hawksworthii* (above), but only 25 infections of each sex were measured for *A. hondurense*. Means, standard deviations, maximums, and minimums for these four morphological characters are presented below:

	Female				Male			
	Mean	S. Dev.	Max.	Min.	Mean	S. Dev.	Max.	Min.
Height (cm)	13.6	3.0	19.4	9.1	20.2	4.5	32.2	11.5
Base (mm)	4.0	0.6	5.8	2.8	4.4	0.7	6.3	3.6
Third Internode:								
Length (mm)	10.7	2.5	16.0	7.0	14.0	2.3	18.0	8.0
Width (mm)	3.3	0.3	3.9	2.7	3.4	0.5	4.8	2.8

The sizes and ranges of these characters for female plants are nearly identical to those reported for this taxon (both sexes combined) by Hawksworth & Wiens (1972, 1996), but the sizes and ranges for male plants are larger. For instance, the largest plant(s) reported by Hawksworth & Wiens (either sex) was only 21 cm compared to the 32 cm male plant we measured from southeast of Tegucigalpa.

Phenology

Male plants of *Arceuthobium hawksworthii* were still flowering as of March 5 at elevations over 800 m in the MPR. As was reported by Wiens & Shaw (1994) male flowers had perianths that were predominantly 3-merous and rarely 4-merous, but we did not observe male flowers with the vivid red color inside the perianth lobes described by Wiens & Shaw. The male flowers we observed were the same color on the inside as on the outside--a slightly darker shade of yellowish-brown than the staminate spike shoot color. Female flowers were in an early stage of fruit development on many female plants and no mature fruits were observed on female plants in early March. Wiens & Shaw (1994) speculated that *A. hawksworthii* dispersed seed in June. However, our observations of fruit in early June indicated that they were not near maturity. Our observations of fruit on August 18--20, 1998 found that only a few fruits were nearing maturity, but no fruit were dispersing seed then and attempts to manually press seeds out of fruit were unsuccessful. Anthesis was not

occurring in either June or August. Although Wiens & Shaw (1994) speculated that *A. hawksworthii* has multiple periods of anthesis and seed dispersal, this taxon appears to only have one period of anthesis annually (mid January through early March) and one annual seed dispersal period that we estimate is from mid September through October based on our observations in August, 1998. Therefore, fruit maturation requires 6--7 months.

Male plants of *Arceuthobium hondurense* had begun anthesis and some fruits on female plants were beginning to disperse seed on August 21. Therefore, flowering and seed dispersal of *A. hondurense* starts slightly earlier than September which was reported by Hawksworth & Wiens (1972, 1996) as the period of anthesis and seed dispersal. The inside of male flower perianths of *A. hondurense* are bright red as previously reported (Hawksworth & Wiens 1972, 1996), but perianth lobes become the same color as male shoots when dried. Male and female plants of *A. hondurense* demonstrate a high degree of sexual dimorphism. Male plants are more open and spreading, and female plants are compact and more densely branched.

Sex Ratio

Dwarf mistletoes are dioecious and most species have a 1:1 sex ratio (Hawksworth & Wiens 1996), but some species are reported to have a female-biased sex ratio (Hawksworth & Wiens 1996; Wiens *et al.* 1996). On May 31 and August 19 we systematically examined separate infections of *Arceuthobium hawksworthii* and determined their sex based on flower morphology of mature plants. Twenty infected *Pinus caribaea* var. *hondurensis* were felled and infections on each branch, starting at the bottom of the tree, were examined for infections with mature plants. We sexed 1066 infections; 522 were male and 544 were female. Therefore, the sex ratio of *A. hawksworthii* is 1:1, like most species of the genus.

On August 21 we systematically examined infections on five *Pinus oocarpa* and determined the sex of 64 mature plants of *A. hondurense*. Mature plants that could be sexed from the ground on small trees (less than 6 m in height) using binoculars were included in this sample and only one larger tree (10 m in height) with several infections with mature plants was destructively sampled. The sex ratio of this small sample of mature plants was 1:1 (31 females and 33 males), but a larger sample is needed to confirm this preliminary finding.

Plant Collections

Specimens of male and female plants of *Arceuthobium hawksworthii* from the MPR were deposited at the Deaver Herbarium, Northern Arizona University, Flagstaff, AZ, the US National Herbarium, Washington, D.C. and the Forestry Herbarium, Ministry of Agriculture, Belmopan, Belize. Specimens of male and female plants of *A. hondurense* were collected from Cusuco National Park and from southeast of Tegucigalpa and deposited at the Deaver Herbarium, Northern Arizona University, Flagstaff, AZ, the US National Herbarium, Washington, D.C., the Herbario Paul C. Standley, Escuela Agricola Panamericana, Tegucigalpa, Honduras, and at Southern Illinois University, Carbondale, IL.

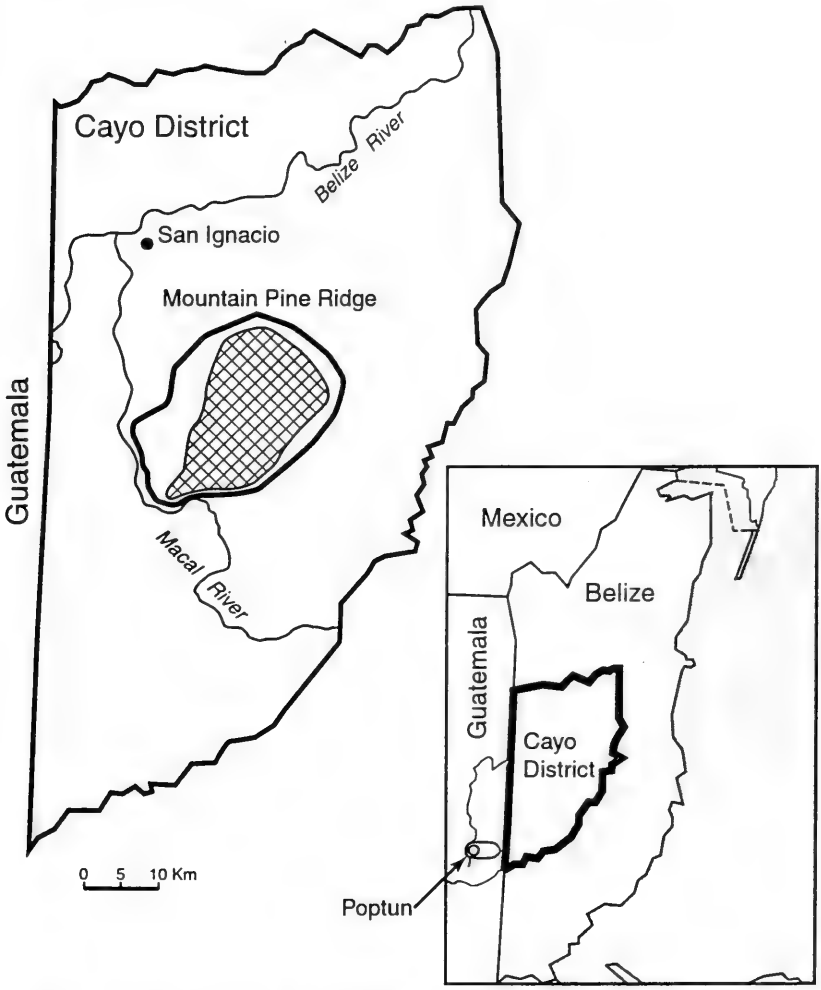

Figure 1. Location of the Mountain Pine Ridge Region (MPR) in Belize and the approximate distribution of *Arceuthobium hawksworthii* within the MPR. Thick line in blow-up represents the MPR and the cross-hatched area represents the distribution of *A. hawksworthii* (approximately 250 sq. km). Approximate area of pine forests surveyed in Guatemala is indicated by dark line around Poptun.

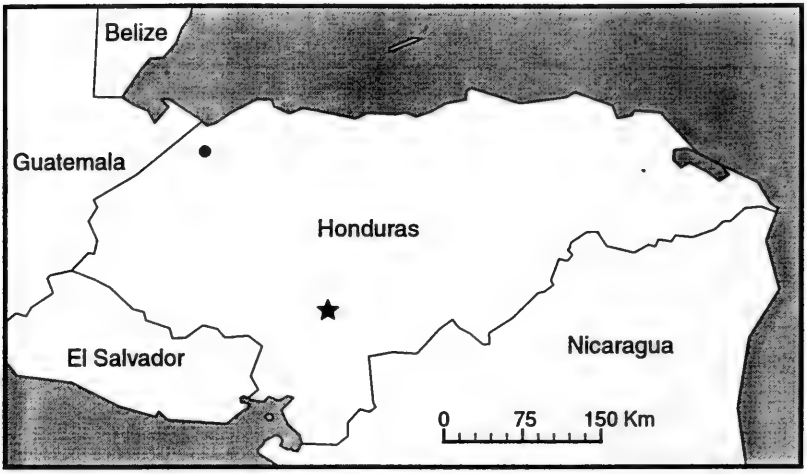

Figure 2. Location of the only known populations of *Arceuthobium hondurense* in Honduras: Cusuco National Park (circle) and in the Piedra Herrada Mountains southeast of Tegucigalpa (star).

Because the nuclear ribosomal DNA cistron has not been sequenced for *Arceuthobium hondurense* as has been done for several other species of *Arceuthobium* (Nickrent *et al.* 1994; Nickrent 1996), specimens of plant material of *A. hondurense* from both of its known locations in Honduras were sent to Dr. D.L. Nickrent, Southern Illinois University, Carbondale, IL. Dr. Nickrent will complete a molecular analysis of the internal transcribed spacer regions for *A. hondurense* and determine if this information provides insights into the phylogenetic relationships of this dwarf mistletoe with other North American species, particularly *A. bicarinatum* Urban which occurs on the island of Hispaniola and is morphologically similar to *A. hondurense*.

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NEW NAMES IN THIS ISSUE OF PHYTOLOGIA

As a result of the International Botanical Congress in Tokyo in 1993, the International Association of Plant Taxonomy has been tasked with exploring the feasibility of registration of plant and fungi names. In accordance with terms of the pilot implementation of the registration concept, new names and combinations produced in this issue of PHYTOLOGIA are listed below.

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64(1-6)	December 1987-June 1988	$3.00/issue or $17.00 for complete volume
65(1-6)	June 1988-February 1989	$3.00/issue or $17.00 for complete volume
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67(1-6)	August-December 1989	$3.00/issue or $17.00 for complete volume
68(1-6)	January-June 1990	$3.00/issue or $17.00 for complete volume
69(1-6)	July-December 1990	$3.00/issue or $17.00 for complete volume
70(1-6)	January-June 1991	$3.00/issue or $17.00 for complete volume
71(1-6)	July-December 1991	$3.00/issue or $17.00 for complete volume
72(1-6)	January-June 1992	$4.00/issue or $21.00 for complete volume
73(1-6)	July-December 1992	$4.00/issue or $21.00 for complete volume
74(1-6)	January-June 1993	$4.00/issue or $21.00 for complete volume
75(1-6)	July-December 1993	$4.00/issue or $21.00 for complete volume
76(1-6)	January-June 1994	$4.00/issue or $21.00 for complete volume
77(1-6)	July-December 1994	$4.00/issue or $21.00 for complete volume
78(1-6)	January-June 1995	$4.00/issue or $21.00 for complete volume
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