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BACCHARIS SECT. BACCHARIDASTRUM (COMPOSITAE: ASTEREAE), INCLUDING TWO MONOECIOUS AND ONE DIOECIOUS SPECIES

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With the recognition of a monoecious species in a genus of plants previously regarded as strictly dioecious (Nesom, 1988), the biological circumscription of Baccharis becomes significantly broader. This new view of the genus also solidifies the rationale for a taxonomic decision relating to another group of species. In this paper, I reinstate in Baccharis two monoecious species from South America and include a closely related but dioecious species to constitute a new section of the genus, sect. Baccharidastrum.

Cabrera (Notas Mus. La Plata, Bot. 2:175-177. 1937) segregated the genus Baccharidastrum from Baccharis and Conyza on the basis of its heterogamous heads borne on monoecious plants. Cuatrecasas (1986), Espinar (1973), and Teodoro (1958) also have recognized this genus, including it in the subtribe Baccharidinae. Cuatrecasas (1969) characterized it by the following features: monoecious; style branches of the feminine flowers short and obtuse; style branches of the masculine flowers oblong-lanceolate, without stigmatic bands, and dorsally hirsute along the whole branch; convex, naked receptacles; and 3-nerved leaves. Most significantly, since the other characteristics are found elsewhere in Baccharis, each head always has a large number of filiform, eligulate pistillate flowers with a few, central, "pseudohermaphroditic" flowers (tubular, 5-lobed, morphologically hermaphroditic but staminate with sterile ovaries). The achenial pubescence, also, is particularly distinctive, as noted by Cuatrecasas and described below.

Two additional species of Conyza (C. notobellidiastrum Griseb. and C. rivularis Gardn., minimally if at all distinct from each other) were subsequently added to Baccharidastrum (Herter. Revista Sudamer. Bot. 6:104. 1939). However, the specimens I have examined of both of these species have heterogamous heads with central, completely fertile, hermaphroditic flowers and their floral and fruit morphology is very different from that of Baccharidastrum. I see no reason to remove them from Conyza.

The two species of Baccharidastrum (as recognized by Cabrera), which occur in Argentina, Brazil, Paraguay, and Uruguay, are very similar to one another and clearly closely related. Further, they appear to differ from Baccharis pingraea DC., a true dioecious species of Baccharis widespread in the southern half of South America, in very few characteristics, which are noted in the key below. These taxa are strikingly similar among themselves in habit, vegetative, capitular, and floral morphology, and particularly in the peculiar viscid-hispidulous pubescence of their achenes. I regard B.

pingraea as the sister taxa to the other two. I believe the two monoecious species are more similar to the probable ancestral form of Baccharis with heterogamous heads. However, whether they represent truly primitive and vestigial elements in the genus or have arisen from a dioecious ancestor remains to be demonstrated, although I believe the latter is more likely.

In summary, Baccharidastrum appears to be related directly to a traditionally recognized, dioecious species of Baccharis that does not itself appear to have particularly primitive features, and in my opinion it should not be segregated as a genus, leaving Baccharis paraphyletic. The following nomenclatural combinations reflect my conclusion that these taxa should be treated as Baccharis but recognized at the sectional rank as a natural group within that genus. The only other species of Baccharis known to be monoecious, B. monoica Nesom, has monogamous heads and numerous other morphological differences (including glabrous achenes) and is not closely related to the species dealt with here.

Baccharis sect. **Baccharidastrum** (Cabrera) Nesom, comb. et stat. nov.

Baccharidastrum Cabrera, Not. Mus. La Plata Bot. 2:175. 1937. Type species: Conyza triplinervia Less.

Sect. Baccharidastrum is characterized by the following characteristics: dioecious or monoecious; glabrous, weakly to strongly glutinous subshrubs; leaves strongly 3-nerved, even in linear-leaved forms; heads sessile to short-pedicellate in tight, terminal clusters; receptacles naked, convex to nearly flat; pistillate corollas apically fimbriate; achenes (0.7-) 0.9-1.0 mm long, 4(-6)-nerved, appearing hispidulous or puberulent with minute, erect, blunt-tipped to minutely stipitate, sometimes viscid-appearing hairs, with a small but prominent, white carpopodium; pappus 1-seriate. Species of South America: Chile, Argentina, Uruguay, Paraguay, and Brazil, disjunct to Colombia.

Sect. Baccharidastrum includes three species: Baccharis pingraea DC. (a broad concept of this species, see comments below) and the two originally included by Cabrera in the genus Baccharidastrum. For the correct names in Baccharis, I rely on the essential synonymy published by Cabrera (1974, 1978).

1. **BACCHARIS VULNEARIA** Baker

Baccharis vulnearia Baker in Mart., Fl. Brasil. 6:75. 1882.

Conyza triplinervia Less., Linnaea 6:137. 1831. Not Baccharis triplinervia DC. 1836; not B. triplinervis Pers. 1807 or Baker 1881. Baccharidastrum triplinervium (Less.) Cabrera, Not. Mus. La Plata Bot. 2:177. 1937.

Baccharis serrulata DC., Prodr. 5:402. 1836. Not Pers. 1807.

Baccharis pseudoserrulata Teodoro, Contrib. Inst. Geobiol. Canoas 9:25. 1958.

2. **BACCHARIS BREVISETA** DC.

B. breviseta DC., Prodr. 5:402. 1836.

Conyza arguta Less., Linnaea 6:138. 1831. Not Baccharis arguta Pers. 1807 or Gill. ex Hook. & Arn. 1841. Baccharidastrum argutum (Less.) Cabrera, Not. Mus. La Plata Bot. 2: 177. 1937.

Cuatrecasas recognized a variety of this species, which appears to be disjunct from the main range to the south. It differs from the typical variety by narrower, frequently obtuse or subobtuse phyllaries, elevated, hemispherical receptacle, and leaf margins with subobtuse teeth. It is included in Baccharis by the following combination.

Baccharis breviseta var. **colombianum** (Cuatr.) Nesom, comb. nov.

Baccharidastrum argutum var. colombianum Cuatr., Webbia 24:232. 1969. TYPE: Colombia, Antioquia, San Jose de Cuerquia, 2 Jul 1958, M. de Garganta 2159 (Holotype: US).

3. **BACCHARIS PINGRAEA** DC.

Baccharis pingraea DC., Prodr. 5:420. 1836. B. serrulata var. pingraea (DC.) Baker in Mart., Fl. Brasil. 6:59. 1829.

Baccharis pingraea DC. var. angustissima DC., Prodr. 5:420. 1836. Referred to by Cabrera (1974) as "f. angustissima."

Pingraea angustifolia Cass., Dict. Sci. Nat. 41:58. 1826.

Baccharis angustifolia Desf., Cat. Hort. Paris, ed. 3:163. 1829. Not Michx. 1803.

Conyza montevidensis Spreng., Syst. Veg. 3:58. 1826. Not Baccharis montevidensis (Spreng.) Schultz-Bip. ex Lillo 1909.

Baccharis subpingraea Heering, Jahrb. Hamburg. Wissens. Anstalt 31:104. 1913. (including formas)

Baccharis stenophylla Espinar, Bol. Acad. Nac. Cienc., Cordoba 50: 241. 1973.

Baccharis medullosa DC., Prodr. 5:405. 1836.

Key to the species of Baccharis sect. Baccharidastrum

1. Monoecious, all heads with many eligulate pistillate flowers in outer series, with 3-7 tubular, central, morphologically hermaphroditic flowers; pistillate corollas 1.5-2.0 mm long, with a style 2.8-3.3 mm long with branches 0.1-0.2 mm long. (2)

   2. Leaves ovate-elliptic, basally attenuate to a petiole 5-10 mm long, the margins entire to obscurely serrulate ..... B. vulnearia

   2. Leaves narrowly lanceolate-elliptic, without a clear petiole, the margins prominently serrate ..... B. breviseta

1. Dioecious, the heads either pistillate or staminate; pistillate corollas 0.8-2.3 mm long, with a style 2.5-3.8 mm long with branches 0.3-0.9 mm long ..... B. pingraea

Baccharis pingraea appears to be a highly variable species, even as deCandolle recognized, as he described two varieties of it. Var. angustissima, a narrow-leaved form (leaves 1-2.5 mm wide, entire or serrulate), tends to have longer pistillate corollas ((1.4-) 1.7-2.3 mm long); I have seen collections of this from Chile and Uruguay. Var. pingraea (var. latifolia DC.), the broad-leaved form, has leaves 4-16 mm wide and pistillate corollas that mostly fall in a shorter range of length (0.8-1.9 mm long); I have seen this from Chile, Argentina, Uruguay, and Brazil. Although I have studied relatively few specimens of the species, the two putative varieties appear to be intergrading. Espinar (1973) described Baccharis stenophylla Espinar from central Argentina, based on short, very narrow-leaved plants, and cited as synonyms B. subpingraea f. nana Heering and B. subpingraea f. pseudoulicina Heering. Cabrera (1978) recognized only a single, variable species with no varieties, although slightly earlier (1974) he recognized B. pingraea f. angustissima. Clearly, a more detailed study of this complex from a wider geographical perspective is warranted.

I include Baccharis medullosa as a synonym of B. pingraea, although it was recognized as distinct by Cabrera (1974, 1978) and Espinar (1975). Cabrera contrasted them in leaf shape and width (ovate-lanceolate to ovate, 10-30 mm wide in B. medullosa vs. lanceolate to linear-lanceolate, 2-9 mm wide in B. pingraea). Espinar separated them only on the basis of leaf width, giving almost the same dimensions as Cabrera. The two taxa have essentially the same geographic range and among the specimens I have examined, I cannot find a morphological discontinuity.

The illustration of Baccharis serrulata var. pingraea from Flora Brasiliensis shows a plant somewhat intermediate in leaf width between the narrow- and broad-leaved forms of B. pingraea and clearly shows the hispidulous achenes characteristic of that species (which

B. serrulata lacks). Although collections of B. pingraea have been fairly consistently identified and match the type (fiche!) as well as can be discerned from a photograph, deCandolle originally described the achenes as glabrous.

Espinar (1973) placed Baccharis pingraea, B. medullosa, and B. stenophylla in sect. Molinae (lectotypified by B. latifolia (Ruiz & Pavon) Pers.---see Cuatrecasas, 1967). Although they are more or less similar in habit, other species placed in sect. Molinae by Cuatrecasas and Espinar have achenes that are glabrous or sparsely pubescent with long, sharp-pointed hairs directed sharply upward.

ACKNOWLEDGEMENTS

I appreciate a loan of specimens from MO, help from Paul Boldt in locating literature, and comments on the manuscript by Fred Barrie and B. L. Turner.

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ANALISIS DE CRECIMIENTO DE PLANTULAS DE **Apoplanesia paniculata** y **Celaenodendron mexicanum.**

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RESUMEN

El presente trabajo describe el crecimiento de dos especies de la Selva Baja Caducifolia de Chamela, Jalisco (**Apoplanesia paniculata** y **Celaenodendron mexicanum**) en condiciones de laboratorio; por medio del análisis clásico y funcional de crecimiento. Los resultados indican que **Apoplanesia paniculata** tiene una tasa de crecimiento mayor que **Celaenodendron mexicanum**. Ambas especies presentaron un cociente raíz/tallo < 1.

ABSTRACT

This paper describe the growth of seedlings of two species of the Tropical Deciduous Forest of Chamela, Jalisco, Mexico (**Apoplanesia paniculata** and **Celaenodendron mexicanum**) in laboratory conditions, following the classical and functional growth analysis. The results indicate that **Apoplanesia paniculata** has a higher growth rate than **Celaenodendron mexicanum**. Both species present a root/shoot ratio < 1.

INTRODUCCION

La región de Chamela, Jalisco, presenta dos tipos principales de vegetación: selva baja caducifolia y selva mediana subperennifolia a subcaducifolia (Miranda y Hernández X., 1963), siendo la primera densa, localizada en lomeríos con suelos someros. La selva mediana se desarrolla principalmente a lo largo de arroyos y en lugares protegidos con suelos profundos (Lott, 1985) Existe además, una comunidad de matorral dominado por **Celaenodendron mexicanum** en algunas zonas y por **Cordia elaeagnoides** en otras (Lott, 1985). A pesar de la marcada estacionalidad, la compleja estructura y diversidad que presenta esta selva, no se han realizado estudios de crecimiento de plántulas de las especies que ahí habitan.

El presente trabajo describe el crecimiento de **Celaenodendron mexicanum** Standl. y **Apoplanesia paniculata** Presl. en condiciones de laboratorio, por medio del análisis de crecimiento funcional (Causton y Venus, 1981; Hunt, 1982) y clásico (Evans, 1972).

A. paniculata y **C. mexicanum** pertenecen a las dos familias mejor representadas (número de especies) en la Selva Baja Caducifolia en Chamela: Leguminosae (116 especies, que representan el 15.3% de las especies) y Euphorbiaceae (66 especies, representando el 8.7% del total de especies) respectivamente (Lott, 1985).

MATERIAL Y METODOS.

Semillas de **Celaenodendron mexicanum** y **Apoplanesia paniculata** fueron colectadas en la Estación de Biología "Chamela" del Instituto de Biología, UNAM; situada en el Estado de Jalisco (19 30' N y 105 03' W). El clima de la estación presenta una marcada estacionalidad en cuanto a su regimen de lluvias se refiere con una precipitación promedio anual de 733 mm (1977-1983) ocurriendo principalmente durante los meses de Junio a Octubre (Bullock, 1986) y una temperatura media anual de 25 C. Una descripción detallada del clima en la estación ha sido publicada por Bullock (1986) y De Ita-Martínez y Barradas (1986).

Debido a la carencia de datos publicados sobre los requerimientos de germinación de las especies de la Selva Baja Caducifolia en Chamela fue necesario determinar el porcentaje y velocidad de germinación de las especies estudiadas, antes de iniciar el de crecimiento. Esto se hizo con el fin de obtener, al mismo tiempo, el número suficiente de plántulas de la misma edad.

Cinco semillas por especie fueron sembradas en arena prelavada (Hewitt, 1966) en macetas de plástico de 15 cm de diámetro en el caso de **C. mexicanum** y 8 cm para **A. paniculata.** El experimento se realizó dentro de una camara de crecimiento con una fluctuación de temperatura de 25 C durante un fotoperiodo de 14 horas y 20 C durante el periodo obscuro. La intensidad luminosa fue de 65 W/m^2 (400-700 nm) emitida por lamparas fluorescentes e incandescentes. Las plántulas fueron regadas, cada 24 horas con solución nutritiva Rorison al 100% (Hewitt, 1966), alternando dicha solución con agua destilada cada 4 días, con la finalidad de evitar toxicidad por acumulación excesiva de nutrientes. Se realizaron 8 cosechas, en cada

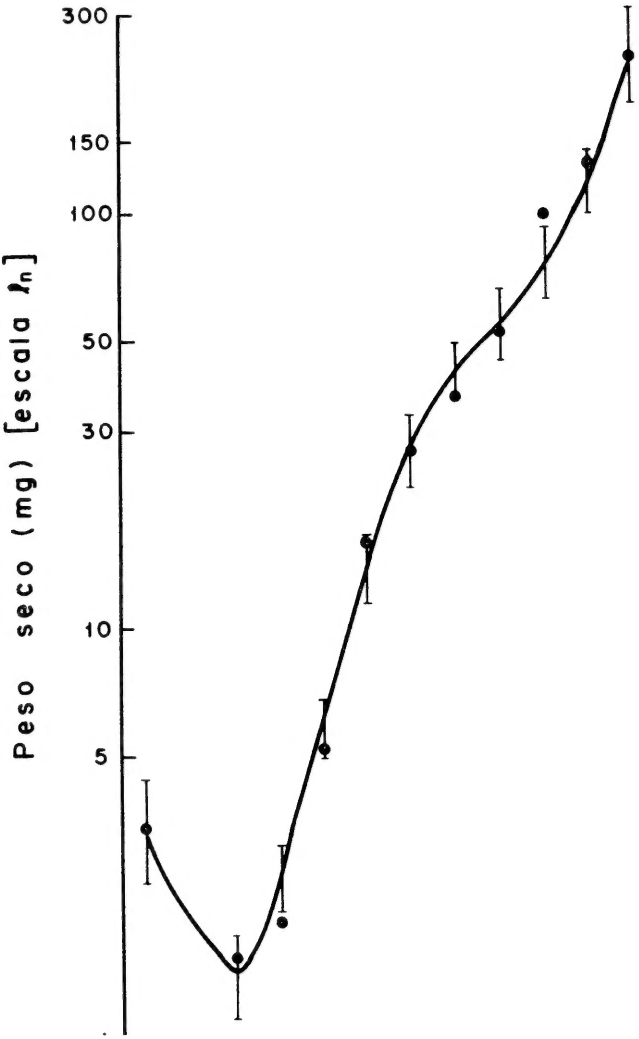

Figura 1. Valores de peso seco total observados (●) y línea de regresión con 95% C. L. (spline) de plántulas de **Apoplanesia paniculata**.

ocasion 5 plántulas de cada especie fueron selccionadas al azar; la primer cosecha fue realizada 10 días después de la germinación en el caso de **A. paniculata** y 15 días para **C mexicanum**. Al tiempo de la primer cosecha, las macetas fueron clareadas de las plántulas en exceso, dejando unicamente un individuo por maceta.

En cada cosecha se obtuvieron datos de área foliar, peso seco y longitud de tallo y raíz de cada uno de los individuos. Con estos datos se calculó la tasa de unidad foliar (E), la tasa relativa de crecimiento (R), la razón de área foliar (LAR), la tasa de peso foliar (LWR), la relación de peso de raíz-tallo (R/T) y la tasa instantánea de crecimiento (RGR) siguiendo los métodos descritos en detalle por Evans (1972) y Hunt (1978, 1982).

RESULTADOS Y DISCUSION

Los resultados de la prueba de germinación indicaron que el 80% de las semillas de **A. paniculata** germinó a los tres días y a las semillas de **C. mexicanum** les tomó ocho días alcanzar el mismo porcentaje.

Apoplanesia paniculata.

En la figura 1 se muestra la progresión del peso seco total promedio observado y la línea de regresión ajustada por un polinomio exponencial de primer orden por el método "stepwise" (Hunt and Parsons 1977, 1981). El punto inicial de la curva (t= 0) corresponde al peso seco de la semilla, por lo que, en los primeros 10 días se observa un decremento en dicho peso. En los posteriores 45 días, es notorio un acelerado incremento en biomasa.

Las figuras 2A y B muestran los valores ajustados de la tasa relativa de crecimiento (RGR) contra la tasa promedio de crecimiento entre cosechas, obtenidas por medio de un ajuste lineal ("stepwise") y por polinomios de alto orden ("spline") respectivamente (Hunt, 1982).

La curva ajustada por el método "spline" nos permite modelar com mayor detalle el crecimiento de la plantula. El ajuste polinomial de primer orden, aunque bastante preciso, tiende a eliminar variaciones en el crecimiento. Lo anterior puede observarse al comparar los ajustes de las figuras 2A y B en los intervalos de tiempo de 0 a 10 y de 35 a 45 días.

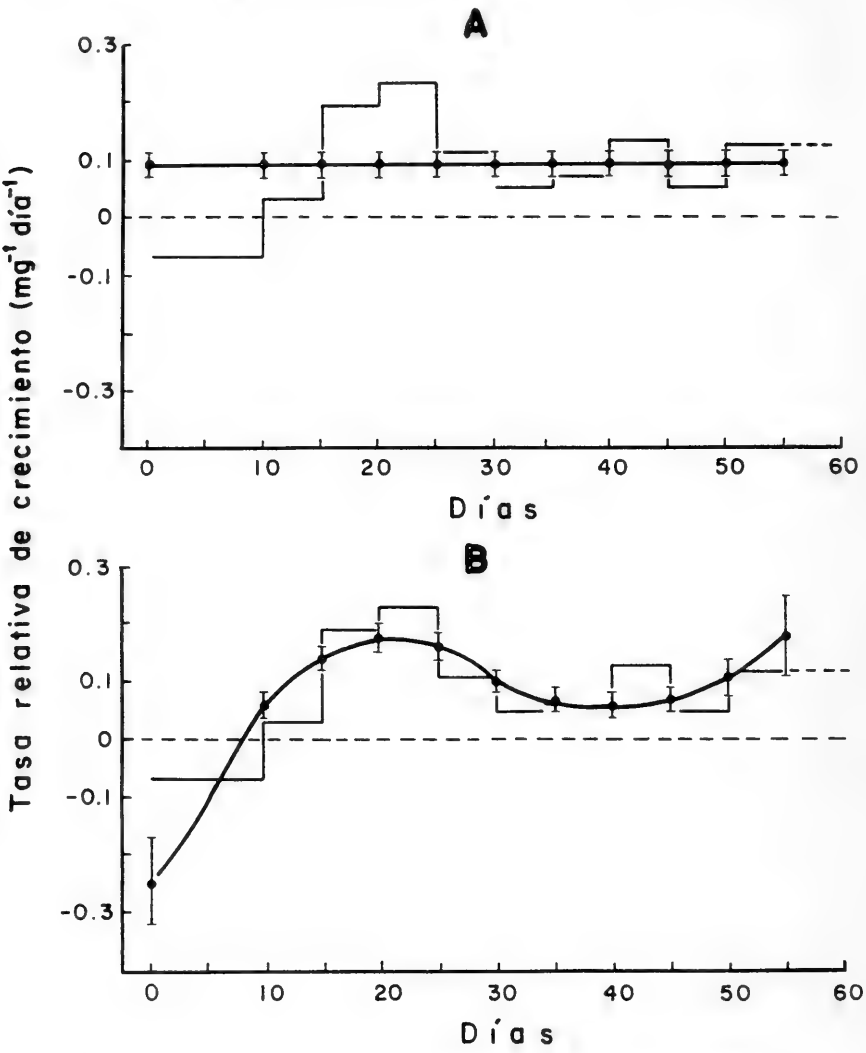

Figura 2. A) Valores ajustados (polinomial de primer orden) de la tasa de crecimiento relativa, con 95% C.L. y la tasa promedio de crecimiento entre cosechas (stepwise). (B) Progresión de la tasa relativa de crecimiento (RGR) con 95% C.L. (spline de tercer orden) y la tasa promedio de crecimiento entre cosechas para **Apoplanesia paniculata**.

Celaenodendron mexicanum.

La figura 3 muestra los valores observados del peso seco total promedio y la línea de regresión ajustada por una ecuación polinomial de primer orden. Los valores obtenidos para esta especie, no incluyen el peso de la semilla, por lo que no se observa un decremento inicial.

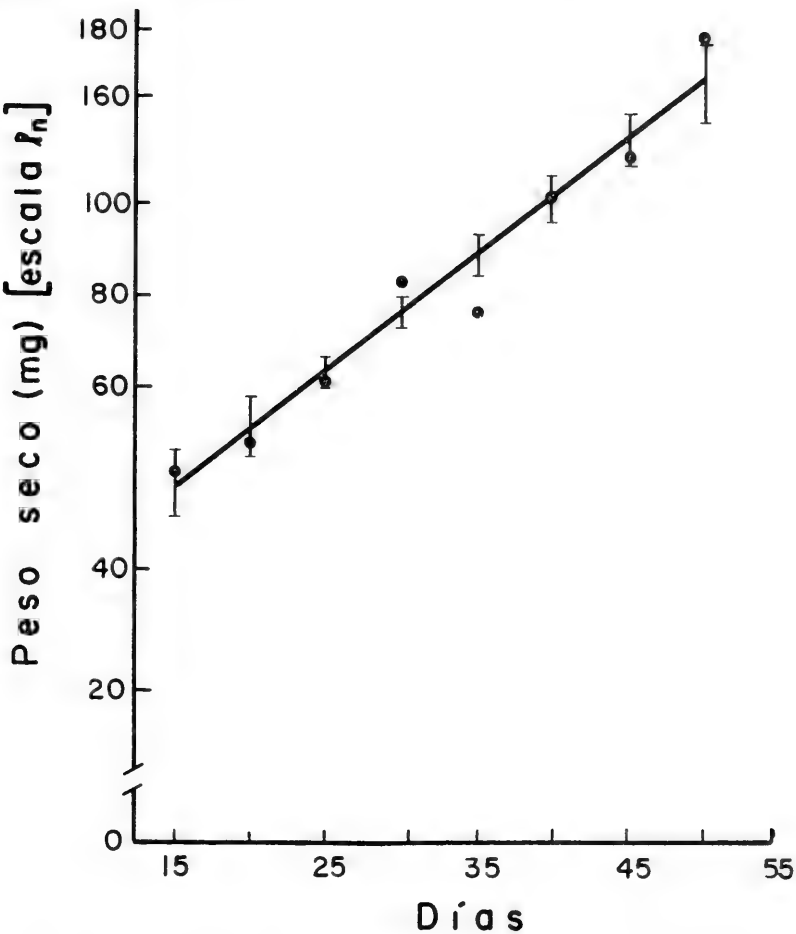

Figura 3. Valores de peso seco total observado (•) y línea de regresión con 95% C.L. (stepwise) de plántulas de **Celaenodendron mexicanum**.

En la figura 4 se observa la tasa relativa de crecimiento contra la tasa promedio de crecimiento entre cosechas, donde esta última presenta grandes variaciones. Las figuras 5A y B muestran el cociente entre el peso seco promedio de la raíz y el peso seco promedio del tallo durante las diferentes cosechas de las plántulas de **A. paniculata** y **C. mexicanum** respectivamente. En ambos casos el valor de la relación raíz/tallo es menor a 1, lo cual parece indicar que las plántulas de ambas especies asignan, durante esta fase de su crecimiento, mayor cantidad de biomasa a la formación de hojas. El estudio de la asignación de biomasa en las especies de la Selva Baja Caducifolia, durante su fase de establecimiento, es de particular importancia para entender la forma en que diferentes especies capturan y asignan recursos en un ambiente en el que la disponibilidad de agua y nutrientes parecen limitar marcadamente la distribución de las especies.

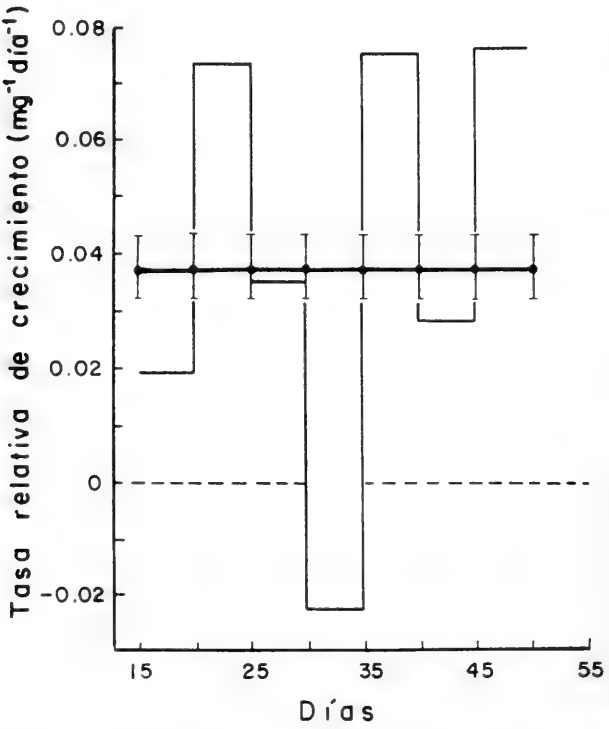

Figura 4. Valores ajustados de la tasa relativa de crecimiento con 95% C.L. y la tasa promedio de crecimiento entre cosechas de **Celaenodendron mexicanum**.

En la tabla 1 se muestra comparativamente el crecimiento de ambas especies en base a un análisis de crecimiento clásico (Evans, 1972). **C. mexicanum** obtuvo una menor tasa de crecimiento (R), menor razón de área foliar (LAR) menor y tasa de peso foliar (LWR) que **A. paniculata.**

Tabla 1. Análisis de crcimiento clásico de **Celaenodendron mexicanum** y **Apoplanesia paniculata.**

	ESPECIES	
	C. mexicanum	**A. paniculata**
E	0.402063 mg día	0.28104 mg día
R	0.0406 mg día	0.0770 mg día
LAR	0.10083 mg día	0.27397 mg día
LWR	0.1002 (10%)	0.2183 (22%)
Peso seco promedio total	84.827 mg	65.090 mg

E= Tasa foliar unitaria.
R= Tasa de crecimiento relativa.
LAR= Razón de área foliar.
LWR= Tasa de peso foliar.

La información que se obtiene al exponer diferentes especies a un ambiente controlado, como en este caso, o bien una especie a diferentes ambientes, nos ofrece un buen elemento predictivo para poder estimar comparativamente un atributo de los organismos vivos como es su potencial de producción de materia seca.

Posiblemente, los estudios de crecimiento cobran mayor interés cuando son usados en la prueba de hipótesis relacionadas con estrategias de captura de recursos y respuesta de las especies a cambios en su medio ambiente. Investigaciones del potencial plástico de las especies, ya sea morfológico o fisiológico, y estudios de sus requerimientos energéticos y del medio ambiente donde habitan, permitirán establecer con mayor precision los factores y mecanismos que operan en el control de la diversidad y estructura de las Selvas Bajas Caducifolias. Para lograr este fin, información acerca de los patrones de crecimiento de las especies es muy valiosa, ya que nos permite evaluar indirectamente la eficiencia con la cual especies coexistentes transforman recursos.

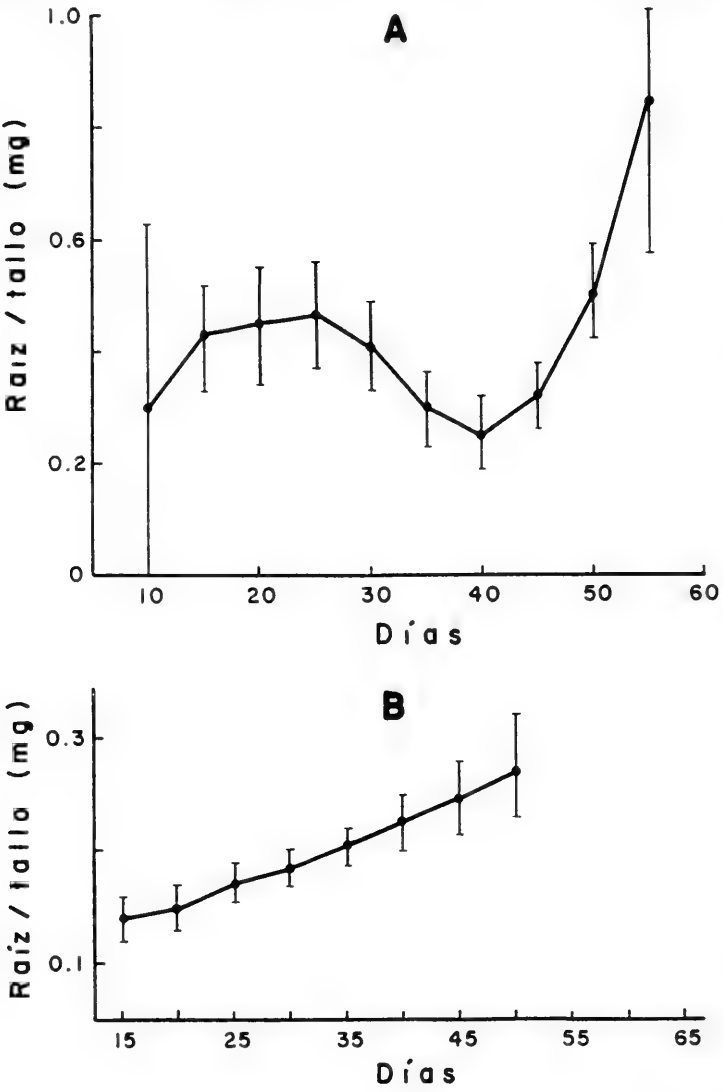

Figura 5. Relación raíz/tallo de plántulas de **Apoplanesia paniculata** (A) y **Celaenodendron mexicanum** (B), las barras indican 95% C.L.

AGRADECIMIENTOS

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FLORISTIC COMPOSITION OF TWO WEST LOUISIANA PITCHER PLANT BOGS

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Pitcher plant bogs occur in southeastern and in western Louisiana, but there is almost no information about their abundance, status, or floristics (McDaniel 1971, Barker & Williamson 1988, Allen *et al.* 1988, Murry & Urbatsch 1979). In fact, so little is known about the status of the identifying species west of the Mississippi delta that Folkerts (1977) emphasized the necessity of studying *Sarracenia alata* in this region to determine if the species is endangered. Although pitcher plant bogs in east Texas and in southern Mississippi are better known than those in Louisiana (Folkerts 1982, Nixon & Ward 1986), Nixon and Ward (1986) point out in their recent study of six Texas bogs that information about bogs in eastern Texas is scarce; in their review they were able to cite only two papers that dealt mainly with floristics.

The purpose of this paper is to describe the floristics and soils of two pitcher plant bogs in Natchitoches Parish, Louisiana.

STUDY SITES. Strange Road Bog, located in the Winn District of the Kisatchie National Forest 4 km NW of Goldonna, is situated on a gently sloping hillside about 60 m above sea level. This bog is about .4 ha and is surrounded by elements of Beech-Magnolia-Loblolly and Longleaf-Bluestem Upland habitats (Ajilvsgi 1979). It is approximately 240 km inland, making it the most northern "undisturbed" pitcher plant bog in Louisiana.

Middle Branch Bog, located in the Kisatchie District of the Kisatchie National Forest 5 km E. of Lotus, is approximately 65km SSW of Strange Road Bog. It is linear following the contour of an irregular sloping (10^{o}-20^{o}) hillside about 84 m above sea level. The bog covers approximately 3 ha and is surrounded by elements of Longleaf-Bluestem Upland (Ajilvsgi 1979). Middle Branch Bog is burnt by the Forest Service on a regular basis during the winter.

The two bogs belong to the slope community type and

are open with a few scattered trees and shrubs. Sphagnum is present in both but is not a dominant plant. Both bogs occur on fine, slow-draining loam that is kept damp through the year by seeps at their upper margins. Both are located in a humid subtropical zone in which temperatures rarely go below -6°C in winter or above 38°C in summer. Average annual precipitation is between 120 and 130 cm.

METHODS. We visited the bogs at two-week intervals from June through November 1987 and from March to July 1988. A voucher specimen for each of 116 reported species was placed in the LSU-S herbarium. We did not collect rare or unproblematic species. Because Middle Branch Bog has been collected in the past, we examined specimens in several state herbaria. We follow MacRoberts (1984, 1988) for scientific nomenclature. Two soil samples from the upper 15 cm of each bog were analyzed by A & L Agricultural Laboratories, Memphis, Tennessee.

RESULTS. Table 1 gives soil information for both bogs.

Table 1. Soil Characteristics

			Exchangeable Ions (ppm)			
Site/Sample		pH	P	K	Ca	Mg	OM%
Middle Branch	1	4.5	4	58	130	22	2.1
	2	5.2	4	82	410	176	1.9
Strange Road	1	5.1	1	35	120	15	0.6
	2	4.9	1	37	80	15	1.4

Table 2 lists the species found at the two bogs. Double asterisk indicates presence at Strange Road Bog only, single asterisk at Middle Branch Bog only, and no symbol indicates presence at both bogs.

Table 2. List of Taxa of Two Natchitoches Bogs

BLECHNACEAE - Lorinseria areolata (L.) Presl. *

DENNSTAEDTICEAE - Pteridium aquilinum (L.) Kuhn.

LYCOPODIACEAE - Lycopodium alopecuroides L. **, L. appressum (Chapm.) Lloyd & Underw., L. carolinianum L., L. cernuum L. *

OSMUNDACEAE - Osmunda cinnamomea L., O. regalis L.

PINACEAE - Pinus palustris P.Mill., P. taeda L.

AMARYLLIDACEAE - Hypoxis hirsuta (L.) Cov., H. rigida Chapm.

BURMANNIACEAE - Burmannia capitata (Walt.) Mart.

CYPERACEAE - Carex glaucescens Ell.*, Cyperus haspan L. *, C. strigosus L. *, Eleocharis tortilis (Link) Roem. & Schult. **, E. tuberculosa (Michx.) Roem. & Schult. *, Fuirena squarrosa Michx., Rhynchospora glomerata (L.) Vahl. *, R. gracilenta Gray, R. inexpansa (Michx.) Vahl, R. macra (C.B. Clark) Small *, R. microcarpa Baldw. ex Gray, R. oligantha Gray *, R. plumosa Ell., R. rariflora (Michx.) Ell. **, Scleria ciliata Michx.*, S. reticularis Michx. *, S. triglomerata Michx. **

ERIOCAULACEAE - Eriocaulon decangulare L., Lachnocaulon anceps (Walt.) Morong *, L. minus (Chapm.) Gray. **

JUNCACEAE - Juncus debilis Gray *, J. diffusissimus Buckl. *, J. marginatus Rostk. *, J. scirpoides Lam., J. tenuis Willd. *

LILIACEAE - Aletris aurea Walt., Smilax laurifolia L.

ORCHIDACEAE - Calopogon barbatus (Walt.) Ames *, C. tuberosus (L.) B.S.P., Platanthera ciliaris (L.) Lindl. **, P. cristata (Michx.) Lindl. **, P. integra (Nutt.) Gray ex Beck *, P. nivea (Nutt.) Luer *, Pogonia ophioglossoides (L.) Juss., Spiranthes vernalis Engelm. & Gray.

POACEAE - Agrostis hyemalis (Walt.) B.S.P. *, Andropogon ternarius Michx., Anthaenantia villosa (Michx.) Beauv. **, Aristida virgata Trin. **, Dichanthelium acuminatum (Sw.) Gould & Clark **, D. dichotomum (L.) Gould *, D. scabriusculum (Ell.) Gould & Clark *, D. scoparium (Lam.) Gould **, Muhlenbergia expansa (Poir.) Trin. *, Panicum rigidulum Bosc ex Nees **, P. verrucosum Muhl. **, P. virgatum L. *, Paspalum laeve Michx. **, P.notatum Flugge *, P. urvillei Steud. *, Schizachyrium scoparium (Michx.) Nash, S. tenerum Nees. *

XYRIDACEAE - Xyris ambigua Bey. ex Kunth, X. baldwiniana Schultes, X. difformis Chapm., X. drummondii Malme *, X. torta Smith. **

ACERACEAE - Acer rubrum L.

ANACARDIACEAE - Rhus copallina L. **

APIACEAE - Eryngium integrifolium Walt., Ptilimnium capillaceum (Michx.) Raf.

AQUIFOLIACEAE - Ilex opaca Ait., I. vomitoria Ait.

ASCLEPIADACEAE - Asclepias longifolia Michx. *, A. rubra L. **, A. viridiflora Raf. **

ASTERACEAE - Aster dumosus L., A. ericoides L. *, Cacalia ovata Walt. *, Chaptalia tomentosa Vent. *, Coreopsis linifolia Nutt., Eupatorium leucolepis (DC.) T. & G., E. rotundifolium L., Helianthus angustifolius L., Liatris pycnostachya Michx., Marshallia tenuifolia Raf.

BETULACEAE - Alnus serrulata (Ait.) Willd.

CAMPANULACEAE - Lobelia reverchonii B. L. Turner.

CAPRIFOLIACEAE - Viburnum nudum L. **

CLUSIACEAE - Hypericum densiflorum Pursh **, H. fasciculatum Lam. *, H.gentianoides (L.) B.S.P. *, H. hypericoides (L.) Crantz *, H. stans (Michx.) Adams & Robson. **

DROSERACEAE - Drosera brevifolia Pursh, D. capillaris Poir.

ERICACEAE - Lyonia ligustrina (L.) DC. **, Rhododendron canescens (Michx.) Sw. **, Vaccinium corymbosum L.

FABACEAE - Tephrosia onobrychoides Nutt.

GENTIANACEAE - Sabatia gentianoides Ell.

HALORAGIDACEAE - Myriophyllum aquaticum (Vell.) Verdc. *

HAMAMELIDACEAE - Liquidambar styraciflua L.

LAMIACEAE - Scutellaria integrifolia L. **

LAURACEAE - Persea borbonia (L.) Spreng.

LENTIBULARIACEAE - Pinguicula pumila Michx. *, Utricularia cornuta Michx. *, U. juncea Vahl *, U. subalata L.

LOGANACEAE - Cynoctonum sessilifolium (Walt.) St. Hil., Gelsemium sempervirens (L.) St. Hil.

MAGNOLIACEAE - Magnolia grandiflora L., M. virginiana L.

MELASTOMATACEAE - Rhexia lutea Walt. *, R. mariana L. **, R. petiolata Walt.

MYRICACEAE - Myrica cerifera L., M. heterophylla Raf.

ONAGRACEAE - Ludwigia alternifolia L., L. hirtella Raf.

POLYGALACEAE - Polygala cruciata L. **, P. incarnata L. *, P. mariana P. Mill., P. nana (Michx.) DC., P. ramosa Ell. *

ROSACEAE - Aronia arbutifolia (L.) Pers., Rubus louisianus Berger.

RUBIACEAE - Diodia teres Walt. **, D. virginiana L. **, Hedyotis boscii DC. **, Mitchella repens L. **

SARRACENIACEAE - Sarracenia alata Wood.

SCROPHULARIACEAE - Gratiola neglecta Torr. **, G. pilosa Michx. **

VIOLACEAE - Viola primulifolia L.

DISCUSSION. The soils of the two bogs are similar and are in turn similar to bogs in east Texas 120 - 150 km to the WSW (Nixon & Ward 1986). The main difference between the soils of the Natchitoches and east Texas bogs is that the organic matter of the former is less in all samples.

We recorded 138 taxa representing 77 genera and 44 families for the two bogs. Strange Road Bog had 96 taxa and Middle Branch Bog had 106 taxa. The two bogs had

46% of their taxa in common.

Some of the plants we report for Middle Branch we did not find but are collections made in previous years. These are Rhynchospora macra (Holmes 2347 NATC), Lycopodium cernuum (Holmes 3360 NATC), Scleria reticularis (Holmes 3956 NATC), Xyris drummondii (Thomas & Allen 41394 NLU), and Utricularia juncea (Holmes 3098 NATC). MacRoberts (1988) reports that he has not seen a definitive report of Rhynchospora oligantha from Louisiana. This species is ubiquitous at Middle Branch (Barbour 1321 LSUS, MacRoberts & MacRoberts 677, 701 LSUS). We saw only one Platanthera integra at Middle Branch. We did not collect it (Holmes 3863 NATC).

Strange Road and Middle Branch bog are floristically similar to the east Texas bogs described by Nixon and Ward (1986). The Texas bogs ranged from 88 to 116 taxa with an average of 103 taxa. The two Natchitoches bogs averaged 101 taxa. Although Nixon and Ward do not provide a total list of species for the six bogs they studied, they do list 48 species with presence values greater than 80%. The Natchitoches bogs had 88% of these species. The only species missing that were present in the Texas bogs were Rhus vernix , which occurs in other bogs near Middle Branch, Centella asiatica and Eriocaulon texensis , both of which occur in bogs in Vernon Parish 50 km south of Middle Branch, Heterotheca gramnifolia , which occurs peripherally at Middle Branch, Agalinus purpurea , which grows on the periphery of both bogs, and Paspalum floridanum , which is locally common.

In a future paper we will describe the status and distribution of pitcher plant bogs in western Louisiana. We find that these bogs are rare and endangered and that immediate action is needed to preserve them.

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A NOTE ON *SARRACENIA PURPUREA* L. IN LOUISIANA

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During the course of a study of pitcher plant bogs in Louisiana, which included examining herbarium specimens, talking with botanists, and surveying the literature, it became evident to us that there was considerable confusion about the occurrence of *Sarracenia purpurea* in Louisiana. We therefore looked into the matter.

Using mainly the bibliographies of Ewan (1967), Sundell (1979), and MacRoberts (1984, 1988), we surveyed the literature on Louisiana botany. The earliest reference we found to *S. purpurea* is that made by Josiah Hale (1852), who included it in his report on the medical botany of Louisiana stating that it occurred in "damp soil, Covington." In the same year, Riddell lists the species in his catalogue of Louisiana plants but without comment, except to indicate in his introductory remarks that the collections on which the catalogue is based were made by J. Hale, W. M. Carpenter, and himself. Langlois (1887), in his extensive list of Louisiana plants, does not mention *S. purpurea*. W. R. Dodson, botanist for the Louisiana Geological Survey who investigated the Florida parishes in 1894, lists *S. purpurea* in his report but gives no locality. This report is particularly interesting because W. C. Stubbs, the director of the Experimental Station, prefaces the work by saying that Dodson "made, personally, the collections" (Clendenin 1896: 248). Small (1933) lists *S. purpurea* for Louisiana in his *Manual of Southeastern Flora* but without comment. Lloyd (1942: 18), in his classic *Carnivorous Plants*, says that *S. purpurea* extends to near the Mississippi River north of New Orleans. Penn (1954), based on personal communication with Joseph Ewan, mentions a specimen collected in St. Helena Parish in 1842 that was deposited at US but gives no further details. McDaniel (1966) includes *S. purpurea* in Louisiana and is the first author to give a true citation: "St Helena Parish: 1842, Carpenter (US)." McDaniel (1972: 250) describes its range as "Florida to Mississippi (Louisiana formerly?) northward...."[1] Brown (1972) refers to a single collection from Louisiana but provides no further details.[2] Allen *et*

al. (1975) do not include S. purpurea in their checklist of St. Helena Parish. Murry and Urbatsch (1979), in a paper on Louisiana Sarracenia, state: "The only collection in Louisiana was made near Covington, St. Tammany Parish, in 1871, by Featherman (specimen in LSU)."[3] Godfrey and Wooten (1981) do not include S. purpurea in Louisiana. Thomas and Allen (1982) list it in their checklist of Louisiana plants but without comment. MacRoberts (1984: 119-120) lists it in his annotated checklist of Louisiana plants on the authority of Riddell and adds that "Featherman's collection of S. purpurea L. in St. Tammany Parish was originally identified by him as S. rubra." Taylor and Thomas (1985) list it in their checklist of St. Tammany Parish but without comment. The various Natural Heritage Program special plant lists (1986, 1987) and the report on the natural communities of coastal Louisiana (Craig et al. 1987) do not list it. MacRoberts (1988), relying mainly on bibliographic sources, lists it in his atlas and cites both the Featherman (LSU) and Carpenter (US) specimens, but he (pers. comm.) has seen neither a definitive report on S. purpurea nor these specimens.

We examined all major Louisiana herbaria, as well as US, MO, and GH collections. We found two specimens. Featherman (s.n. LSU). The original label reads: "Sarracenia rubra Walt., Red flowered trumpet leaf, Covington, A.F."[4] We examined Featherman's (1871) account of his botanical expedition to Covington in 1870 and found that he reports the species as occurring precisely as he records it on the herbarium label. Carpenter (s.n. US). The original label reads: "Sarracenia purpurea, Wet Pine Woods, St. Helena, La." This was annotated by Mohr: "Sarracenia purpurea L., St. Helena Parish, Carpenter 1842." Because in 1842 St. Helena Parish encompassed not only the present parish but also the northwestern quarter of Tangipahoa Parish, it is impossible to know from which present-day parish the specimen came.

In summary, there are two voucher specimens for S. purpurea from Louisiana, as well as the two suggestive reports of Hale and Dodson, which we were unable to trace to specimens. Clearly, S. purpurea was part of the Louisiana flora at least through the nineteenth century.

NOTES. 1. McDaniel apparently did not examine the specimens at LSU herbarium. At the time he did his research, C. A. Brown was curator and did not make loans.

2. This undoubtedly refers to the Featherman specimen since it was at LSU, and Brown had annotated it.

3. The year was 1870; 1871 was the year of publication of the report. These authors were apparently unaware of McDaniel's work as they do not mention it.

4. A.F.= Americus Featherman.

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DIAGNOSES OF NEW CYRTANDRA SPECIES (GESNERIACEAE) HAWAIIAN PLANT STUDIES 144

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Abstract

Cyrtandra is the largest genus of flowering plants native to the Hawaiian Islands. Thirty five new species, and one new variety, are here described, and two species are renamed. Their types are in the Bishop Museum in Honolulu.

Section Chaetocalyces

Cyrtandra aequalis sp. nov. Ramulae pilosae sunt, petiolis 3-5.5 cm longis pilosis, laminis 12.5-18 x 4.1-5.7 cm coriaceis elliptici-fusiformibus acuminatis cuneatis serratis supra hirsutis infra in nervis catenulate hirsutulis, cymis 4 cm longis 3-floriferis, pilosis, pedunculo 15 mm longo, pedicellis 10-15 mm longis, calycibus 17 mm longis pilosulis lobis 15.3 x 1 mm ligulatis, corollis (siccatis) 15 mm longis pilosis tubo 9 mm longo loba infera 5 mm diametro suborbiculari. Holotypus: Maui I., Honokahau, C. N. Forbes 436.M

Cyrtandra Christensenii sp. nov. Frutex 0.8-1 m altus est, petiolis 6-10.5 cm longis adpresse badie pilosulis, laminis 26-28 x 0.3-11.5 cm chartaceis acutis basi deminuenta marginibus serrati-crenatis supra aliter glabris sed midnervo adpresse badie pilosulis infra pallidioribus et in nervis principalibus adpresse badie pilosulis nervis secundariis 13-14 in dimidio quoque, cymis 3.5-4 cm longis 1-3-floriferis adpresse badie pilosulis, pedunculo 3 mm longo, bracteis 12 mm longis lanceolatis, pedicellis 7-10 mm longis, calycibus (vivis) in gemma 18 mm longis fusiformibus rostro 6 mm longo, et in flore 27 mm longo deciduis cum 3 lobis 10 mm longis, lanceo-subulatis, corollis 30 mm longis albis tubo 18 mm longo decurvato, lobis superis 7 mm diametro orbicularibus, loba infera 10 x 8 mm oblongo-elliptica, baccis 12 x 9 mm ovoideis glabris. Holotypus: Kauai I., Lumahai Stream, forest, 700 ft. elev., July 16, 1977, C. Christensen 256.

Cyrtandra elliptiapicis sp. nov. Frutex est, novellis dense adscendente pilosis, petiolis 1.7-6 cm longis sparse pilosis, laminis 4.7-15 x 2.5-6.8 cm chartaceis ellipticis acuminatis basi cuneata breve decurrenti marginibus serratis supra catenulate hirsutis infra in superficie minute puberulis sed midnervo et secondariis pilosulis nervis

secundariis 9-11 in dimidio quoque, cymis 20-25 mm longis 1-3-floriferis pilosulis, pedunculis 3-6 mm longis bracteis 4 mm longis linearibus, pedicellis 6-10 mm longis, calycibus (siccatis) 10-11 mm longis pilosis lobis 9-10 mm longis infra ligulatis et 1.5-2 mm latis sed apice 2.5-3 mm latis ellipticis, corollis (siccatis) 18-19 mm longis albis hirsutulis loba infera 6 mm longa late elliptica. Holotypus: east Maui, Honomanu, May 1911, J. F. Rock s.n.

Cyrtandra Gagnei sp. nov. Frutex est, novellis dense adpresse hirsutulis, petiolis 12-18 mm longis dense adscendente fulve hirsutulis, laminis 3.5-7.3 x 1.9-3.8 cm coriaceis obovatis (vel oblanceolatis) subacuminatis basi cuneata marginibus crenati-serratis supra adscendente hirsutulis infra pallidis et glabris nervis principalibus dense adscendente puberulis, cymis 3-3.5 cm longis 1-(2)-floriferis adscendente hirsutulis, pedunculo 6-10 mm longo, bracteis 5-6 mm longis lineari-lanceolatis, pedicellis 8-10 mm longis, calycibus 11-13 mm longis profuse adscendente hirutulis lobis 8-11.5 x 1-1.5 mm ligulatis, corollis 12 mm longis in fauce 4 mm diametro adscendente hirsutulis, lobis superis 3 x 3 mm, loba infera 5.5 x 4 mm ovata, ovario glabro. Holotypus: Maui I., Koolau Forest Reserve, 5,400 ft. alt., W. Gagné & S. Montgomery 384.

Cyrtandra Harrisonae sp. nov. Frutex est, novellis dense adpresse badie pilosulis, petiolis 2-3 cm longis item pilosulis, laminis 7.3-14 x 3.8-6.2 cm subcoriaceus ellipticis acuminatis basi cuneata complanate serrulatis supra adpresse puberulis infra pallidis et nervis adpresse puberulis, cymis 2.5-3.5 cm longis 3-floriferis dense adpresse adscendente badie pilosulis, pedunculis 6-9 mm longis, bracteis 3-6 mm longis ellipticis, pedicellis terminalibus 6-13 mm longis gemmis campanulatis, calycibus 13-14 mm longis item pilosulis, lobis 11-12 x 1.5-2.5 mm ligulatis obtusis, corollis 26 mm longis glabris in fauce 6 mm diametro, lobis superis 5 x 7 mm, loba infera 5.5 x 11 mm suborbiculari, pistilo glabro, baccis 15 x 11 mm obovoideis. Holotypus: Maui I., Kipahulu, 5,830 ft. alt., Betsy Harrison 285.

Cyrtandra honokawaiensis sp. nov. Frutex est, novellis dense fulve hirsutis, petiolis 3-3.7 cm longis hirsutis, laminis 8.5-11 x 4-5.7 cm membranaceis oblancei-ellipticis acuminatis basi anguste cuneata et decurrenti marginibus ciliatis et serrulatis supra pustulate hirsutis infra in nervis hirsutis, cymis 4 cm longis 1-floriferis profuse fulve hirsutis, pedunculis 7 mm longis, bracteis 7-9 mm longis lineari-lanceolatis, pedicellis 10-11 mm longis, calcibus 19-19.5 mm longis hirsutis lobis 15-17 x 0.8-1.5 mm ligulatis obtusis,

corollis 19 mm longis hirsutis lobis superis 2 mm longis loba infera 6.5 mm longa, ovario glabro. Holotypus: Maui I., Honokawai, J. F. Rock 8,157

Cyrtandra honomanuensis sp. nov. Frutex est, novellis pilosis, petiolis 9-9.5 cm longis pilosis, laminis 15-18.5 x 9-10.6 cm membranaceis late ellipticis subacuminatis basi gracile deminuenta infra sparse pilosulis, cymis 2.5-3.5 cm longis 3-floriferis pilosis, pedunculis 8-10 mm longis, bracteis 3-5 mm longis anguste lanceolatis, pedicellis 5-9 mm longis, calycibus 10-12 mm longis pilosis lobis anguste ligulatis sed apice ellipticis, corollis 15 mm longis pilosulis. Holotypus: Maui I., Honomanu Gulch, May 1911, J. F. Rock s.n.

Cyrtandra humiliserrulata sp. nov. Frutex est, ramulis foliosis glabris, petiolis 2-5 cm longis pilosulis, laminis 5.5-12.3 x 2.3-3.4 cm chartaceis fusiformibus acutis basi gracile cuneata et breve decurrenti supra sparse hirsutulis infra pallidis et adpresse hirsutulis, cymis 3.5 cm longis 1-floriferis pilosulis, pedunculo 15 mm longo, pedicellis 12 mm longis, calycibus 12-13 mm longis adscendente pilosulis lobis 8-9 x 2 mm ligulatis, baccis 12 mm longis subglobosis. Holotypus: Molokai I., Mapulehu mts., J. F. Rock 12,576.

Cyrtandra indiscissa sp. nov. Frutex est, novellis badie pilosis, petiolis 8-9.5 cm longis pilosis, laminis 15-19 x 9-10.5 cm membranaceis ellipticis breve acuminatis basi anguste cuneata marginibus serrulatis supra sparse pilosis infra pallidioribus et in nervis pilosis, cymis 3-4 cm longis 3-floriferis pilosis, pedunculo 6-11 mm longo, bracteis 4-7 mm longis lanceolatis, pedicellis 5-11 mm longis, calycibus 10-12 mm longis pilosis lobis 9-10.5 mm longis parte infera 1 mm lata ligulata parte apicali 3-4 mm lata elliptica, corollis 13-15 mm longis villosis. Holotypus: Maui I., Honomanu Gulch, May 1911, J. F. Rock s.n.

Cyrtandra noie sp. nov. Frutex est, novellis adpressa pilosulis, foliis inaequalibus, petiolis 1.5-4 cm longis sparse adpresse pilosulis, laminis 4.5-12.7 x 1.8-4 cm chartaceis fusiformibus acuminatis basi gracile cuneata marginibus adpresse serrulatis supra sparse adpresse pilosulis infra subalbis et in nervis adpresse pilosulis, cymis 5 cm longis 3-5-floriferis adpresse adscendente pilosulis, pedunculis 18 mm longis, bracteis 10 mm longis linearibus, pedicellis 10-13 mm longis, calycibus 13-15 mm longis lobis 11-13 x 1 mm ligulatis, corollis 17 mm longis adscendente adpresse pilosulis in fauce 4 mm diametro decurvatis loba infera 3.5 x 3 mm suborbiculari. Holotypus: Maui I., Honomanu, May 1911, J. F. Rock s.n.

Cyrtandra vespertina nom. nov.
C. occidentalis St. John, Phytologia 63: 471, 1987, non B. L. Burtt (1978).

Cyrtandra villosula sp. nov. Frutex 2 m altus est, novellis dense adpresse fulve pilosis, petiolis 1-4.6 cm longis adscendente fulve pilosis, laminis 4-14 x 1.7-5.3 cm chartaceis oblanceolatis subacuminatis basi anguste cuneata marginibus serrulatis supra glabratis infra albi-viridibus nervis principalibus dense adpresse fulve pilosulis nervulis sparse puberulis, cymis 5-7 cm longis 3-5-floriferis idem pilosulis, pedunculis 17-30 mm longis, bracteis nullis, pedicellis 12-19 mm longis, calycibus 22-24 mm longis idem pilosulis lobis 19-21 x 2.5-3.5 mm lineari-lanceolatis varie ligulatis, corollis 20-22 mm longis albis. Holotypus: Hawaii I., Koa Mill, 4,500 ft. alt., H. St. John et al. 23,479.

Cyrtandra waikamoiensis sp. nov. Frutex 2 m altus ramosus est, novellis dense fulve adscendente pilosis, petiolis 18-24 mm longis pilosis laminis 7.5-11 x 2.4-4.6 cm crasse chartaceis ellipticis (oblanceo-latisve) acuminatis basi anguste cuneata marginibus humiliter serrulatis supra catenulate hirsutulis infra subalbi-viridibus intervallis pilosulis nervis principalibus densiore pilosulis nervis secundariis 8-10 in dimidio quoque, cymis 6-12 cm longis 4-6-floriferis dense adpresse adscendente hirsutulis, pedunculis 3-7 cm longis, bracteis 12-15 mm longis lanceolatis, pedicellis 15-32 mm longis, calycibus (siccatis) 12-15 mm longis albis, tubo 1.5 mm longo, lobis -13 mm longis hirsutulis parte 2/3 basali 1-1.5 mm lata ligulata parte 1/3 apicali 2.5-3 mm late elliptica in fructu lobis 16 mm longis, corollis (siccatis) 19-20 mm longis hirsutulis. Holotypus: Maui I., Pualaia, Dec. 5, 1919, C. N. Forbes 1,748.M.

Cyrtandra wailauensis sp. nov. Frutex 2 m altus est, novellis dense subbadie catenulate hirsutis, foliis inaequalibus, petiolis ramularum principalium 4 cm longis dense catenulate hirsutis in basi connate perfoliatis, laminis 13-27 x 9-15 cm crasse chartaceis late ellipticis subacutis basi cuneata decurrenti marginibus serratis supra catenulate hirsutis infra subalbis intervallis sparse catenulate hirsutis midnervo et nervis secundariis hirsutis, cymis 2-3 cm longis 1-floriferis (vel 3-floriferis) dense catenulate hirsutis, pedunculis pedicellisque 2 mm longis, bracteis 1.5 mm longis lanceolatis, calycibus 8-9 mm longis hirsutis tubo hemisphaerico lobis 7-8 mm longis anguste ligulatis acutis corollis 25 mm longis. Holotypus: Molokai I., Wailau Valley, 220 m alt. 12-28-1936, F. R. Fosberg 13,470.

Section Cylindrocalyces

Cyrtandra laevicalycis sp. nov. Frutex est, novellis petiolis et inflorescentia dense adpresse adscendente subrubri-badie pilosulis, foliis inaequalibus, petiolis 25-55 mm longis, laminis 8-19 x 4.6-7.8 cm chartaceis ellipticis acuminatis basi breve cuneata marginibus humiliter serrulatis supra midnervo pilosulo infra subalbis sparse adscendente pilosulis et in nervis principalibus abundantiore nervis secundariis 14-17 in dimidio quoque, cymis 3 cm longis 7-floriferis, rhachidi 3-5 mm longo, bracteis 2 mm longis lanceolatis, pedicellis 7-11 mm longis, gemmis 15 mm longis fusiformibus glabris rostro 4 mm longo 5-lobato. Holotypus: Kauai I., Wahiawa mts., 1979, S. Perlman 443.

Cyrtandra paludosa Gaud., var. montana var. nov. A var. subherbacea differt in caulibus pilosis, petiolis 1-2.5 cm longis pilosulis, laminis 6-12.2 x 2.5-5.8 cm ellipticis basi cuneata marginibus crenati-dentatis supra midnervo adpresse puberulo infra nervis adpresse adscendente pilosulis, cymis 2-2.5 cm longis 1-3-floriferis, pedicellis 5-7 mm longis puberulis, calycibus 15-16 mm longis oblanceolatis. Holotypus: Kauai I., head of Kalalau Valley, wet forest, 1,230 m alt., 12/29/35, F. R. Fosberg 12,698.

Cyrtandra septentrionalis sp. nov. Frutex 1-2 m altus est, novellis dense subbadie catenulate hirsutis, foliis inaequalibus, petiolis 1-5 cm longis dense catenulate hirsutis, laminis 7-14.5 x 4-9 cm chartaceis ellipticis acuminatis basi inconcinne cuneatis et decurrentibus marginibus serrulatis ciliatis supra grosse hirsutis infra pallidioribus intervallis et nervulis puberulis nervis principalibus pilosis nervis secundariis 11-13 in dimidio quoque, cymis 2-3 cm longis 1-floriferis, pedunculo et pedicello 5 mm longo, calycibus (siccatis) 20 mm longis hirsutulis labia supera 7 mm longa cum 3 dentibus 2 mm longis lanceolatis, labia infera 8 mm longis cum 2 dentibus 6 mm longis lanceolatis, corollis hirsutis. Holotypus: Kauai I., Wainiha Valley, forest, 1000 ft. alt., Dec. 26, 1956, H. St. John 25,991.

Section Lobicalyces

Cyrtandra acriserrata sp. nov. Frutex 1.3-2.7 m altus est, novellis badie catenulate hirsutis, foliis 4 (-3) in nodo, petiolis 12-45 mm longis sparse hirsutis, laminis 4.5-13.5 x 1.2-3.1 cm subcoriaceis fusiformibus subacuminatis basi longe cuneatis marginibus grosse serratis supra glabris infra pallidioribus et in nervis principalibus sparse hirsutis nervis secundariis 7-9 in dimidio quoque,

cymis 15-35 mm longis 1-floriferis hirsutis, pedunculo 8-10 mm longo, pedicello 10-12 mm longo, bracteis 10-12 mm longis lanceolatis, calycibus (siccatis) 11-12 mm longis albis, tubo 1 mm longo dense hirsuto, lobis 10-11 mm longis lanceolatis subglabris, corollis (sicccatis) 11 mm longis albis dense hirsutulis, tubo 10 mm longo subrecto. Holotypus: Molokai I., Kukuinui Valley, Wailau, woods 2,400-2,700 ft. alt., July 4, 1933, H. St. John et al. 13,272.

Cyrtandra habenosa sp. nov. Frutex 1.5 m altus est, novellis dense adpresse adscendente pilosulis, foliis 3-verticillatis, petiolis 8-18 mm longis cum pilis simulantibus, laminis 6.5-10.6 x 2.8-4.2 cm chartaceis ellipticis acuminatis basi cuneata marginibus compresse serrulatis supra hirsutulis infra pallidioribus et in superficie glabris sed midnervo et 8 nervis secundariis adpresse adscendente puberulis, pedicellis 18 mm longis pilosulis, calycibus (siccatis) 13-15 mm longis adscendente pilosulis, tubo 1.5 mm longo lobis cum corpore 2-3 mm lato ligulato et apice 4.5-5 mm longo elliptico, corollis (siccatis) 25 mm longis tubo 16-17 mm longo extra fauce pilosulo, lobis superis 4.5 mm longis ellipticiis, loba infera 7 mm longa suborbiculari, baccis rostratis. Holotypus: east Maui, Hana Dist., Kipahulu Valley, forest, 4,750 ft alt. U.S.F.W.S. Bird Survey, Transect 17, Station 34, F. R. Warshauer & P. H. McEldowney 2,854.

Cyrtandra hemisphaerica nom. nov.

C. ustulata St. John, Phytologia 63: 483, 1987, non 63: 493, 1987.

Cyrtandra kawelaensis sp. nov. Holotypus: Frutex 4 m altus est, foliis 3-verticillatis, petiolis 10-14 mm longis pilosulis, laminis 4-7 x 1.8-2.3 cm chartaceis lanceolatis acutis basi cuneata marginibus serrulatis supra catenulate hirsutulis infra pallidioribus et in superficie puberulis sed densiorie ita in 9-11 nervis secundariis, cymis 5 cm longis 1-3-floriferis pilosulis, pedunculo et pedicelllo 2 cm longo, calycibus (siccatis) 19 mm longis pilosulis, tubo 12 mm longo labia supera 8 mm longa cum 3 lobis 3 mm longis deltoideis, labia infera 10 mm longa cum 2 lobis late lanceolatis, corollis 24 mm longis glabris lobis superis 4 x 6 mm oblate orbicularibus, labia infera 12 mm longa, loba infera 7 x 5 mm oblongo-elliptica. Holotypus: Molokai I., Kawela Gulch, 3,500 ft. alt., Dec. 30, 1938, H. St. John et al. 19,895.

Section Microcalyces

Cyrtandra semiorbicularis sp. nov. Frutex 1.3 m altus est, ramulis foliosis dense badie retrorse catenulate

hirsutis, petiolis 8-25 mm longis dense hirsutis, laminis 5-10 x 1.5-3.5 cm coriaceis oblanceolatis acutis basi cuneata marginibus humiliter serratis supra catenulate hirsutulis infra palllidioribus et profuse pilosis nervis secundariis 9 in dimidio quoque, cymis 2-2.5 cm longis 1-floriferis profuse badie pilosis, peduunculo 10 mm longo, bracteis 8 mm longis lanceolatis, pedicellis 16 mm longis, calycibus (siccatis in fructu) 8-9 mm longis 1/3 partitis, lobis 3 x 6 mm semiorbicularibus apiculatis, baccis (siccatis) 10 mm longis ovoideis acutis pilosulis. Holotypus: Kauai I., Limahuli Valley, forest, 1,790 ft. alt., July 5, 1978. S. Perlman & C. Wichman 190.

Section Schizocalyces

Cyrtandra caudiflora sp. nov. Frutex ramosus est, novellis dense adpresse subbadie pilosulis, petiolis 1.5-6 cm longis dense adpresse adscendente subbadie pilosulis, laminis 14-24 x 6-8.3 cm coriaceis ellipticis acutis basi cuneata marginibus serrulatis supra catenulate hirsutis infra dense adpresse adscendente fulve pilosis nervis secundariis 17 in dimidio quoque, cymis caulifloribus omnino ad basim 6-11 cm longis 5-27-floriferis dense adscendente fulve pilosulis, pedunculo 8-48 mm longo, bracteis 6-8 mm longis oblanceolatis, pedicellis 3-5 mm longis, calycibus (siccatis) 11-12 mm longis adpresse fulve pilosulis lobis 9-11 x 2-3 cm oblanceolatis, corollis (siccatis) 16-17 mm longis albis tubo 11-12 mm longo parte 2/5 apicali decurvata, lobis hirsutis eis superis 4 mm longis late ellipticis, loba infera 6.5 mm longa late elliptica, baccis 11 x 7 mm ellipsiodeis. Holotypus: Molokai I., Wailau Valley, woods, 2,500 ft. alt., July 4, 1932, H. St. John et al. 13,274.

Cyrtandra disgrega sp. nov. Frutex ramosus 2.7 m altus est, novellis dense badie hirsutis, foliis inaequalibus, petiolis 25-40 mm longis badie hirsutis, laminis 9.5-14 x 4.1-7 cm chartaceis late ellipticis acuminatis basi anguste cuneata marginibus grosse serratis supra remote adpresse pilosis infra adscendente puberulis nervis secundariis 5-6 in dimidio quoque, cymis 4 cm longis 1-3-floriferis dense adscendente badie hirsutis, pedunculis 1 cm longis, pedicellis 11-16 longis, bracteis 20 mm longis anguste lanceolatis, calycibus (siccatus) 15-17 mm longis tubo 4 mm longo in basi hirsuto alibi sparse ita, lobis superis 9 mm longis ligulate lanceolatis hirsute ciliatis lobis inferis 10 mm longis, corollis longioribus. Holotypus: Hawaii I., Nanawale, ohia forest, 550 ft. alt., Feb. 1987. W. Takeuchi & C. Imada 3,414.

Cyrtandra hanaensis sp. nov. Frutex est, rama foliosa adscendente puberula, petiolis 2-3.5 cm longis adscendente puberulis, laminis 11.5-13 x 5-5.7 cm coriaceis ellipticis acutis basi inaequaliter cuneata marginibus serrulatis supra adscendente puberulis et densiore in midnervo infra in superficie minute puberulis sed in nervis adscendente puberulis nervis secundariis 9-11 in dimidio quoque, cymis 4.5-6.5 cm longis 5-7-floriferis adscendente puberulis, pedunculis 15-21 mm longis, bracteis 15-17 mm longis lanceolatis, pedicellis 7-14 mm longis, calycibus (siccatis) 15-19 mm longis dense adpresse adscendente puberulis lobis 13-16.5 mm longis anguste lineari-lanceolatis, corollis (siccatis) albis 18 mm longis tubo 12 mm longo adscendente pilosulo, lobis superis 5 mm longis ovatis, loba infera 7 mm longa late ovata. Holotypus: east Maui, rim of Kipahulu, forest, 6,225 ft. alt., 29.VI.1973, Betsy Harrison 286.

Cyrtandra hylematos sp. nov. Frutex 7-10 dm altus est, novellis adscendente badie hirsutulis, petiolis 2-3 cm longis adscendente badie hirsutulis, laminis 6.5-14.5 x 3-4.7 cm chartaceis ellipticis acuminatis basic cuneata vel decurrenti marginibus minute serrulatis supra adpresse badie pilosis infra cum pilis simulantibus nervis secundariis 5-7 in dimidio quoque, cymis 3-3.5 cm longis 3-floriferis adscendente badie hirsutis, pedunculo 10-15 mm longo, bracteis 17-25 mm longis lanceolatis, gemmis campanulatis, calycibus (siccatis) 10 mm longis adscendente badie hirsutulis tubo 4 mm longo, lobis superis 4 mm longis lanceolatis, illis inferis 6 mm longis, corollis (siccatus) 14-15 mm longis albis sparse adpresse pilosulis, tubo 9 mm longo, lobis superis 3 mm longis suborbicularibus, loba infera 4.5 mm diametro suborbiculari. Holotypus: Hawaii I., Nanawale, forest, Feb. 1987, Wayne Takeuchi & C. Imada 3,412.

Cyrtandra infera sp. nov. Frutex est, rama foliosa adscendente badie pilosula, petiolis 12-52 mm longis adscendente badie pilosulis, laminis 7.5-12.5 x 2.2-5.4 cm chartaceis oblanceolatis acuminatis basi cuneata marginibus serrulatis supra catenulate subbadie hirsutulis et densiore in midnervo infra sparse subbadie pilosulis nervis secundariis 9-11 in dimidio quoque, cymis 2.5 cm longis 1-floriferis, pedicellis 12 mm longis adscendente subbadie pilosulis, calycibus (siccatis) 11-12 mm longis sparse pilosulis lobis 9-9.5 x 3.5 mm lanceolatis, corollis 13-14 mm longis albis tubo 9 x 3 mm. Holotypus: Hawaii I., Lower Nanwale Forest Reserve, forest, 300 ft. elev., 2-28-78, Lisa K. Croft 790240.

Cyrtandra kalamanthe sp. nov. Frutex 2 m altus est, novellis adpresse adscendente fulve pilosulis, petiolis 2-5.5 cm longis adpresse adscendente fulve pilosulis, laminis 7-19.5 x 2.5-5.5 cm subcoriaceis ellipticis acuminatis basi deminuenti marginibus serrulatis supra catenulate hirsutulis infra adpresse adscendente fulve pilosulis nervis secundariis 11-15 in dimidio quoque, cymis omnino ad basim 4-7 cm longis 1-3-floriferis adpresse adscendente fulve pilosulis, pedunculo 12-17 mm longo, bracteis 5-7 mm longis lanceolatis, pedicellis 12-22 mm longis, calycibus (siccatis) 12-13 mm longis dense adpresse adscendente fulve pilosulis lobis 11-12 mm longis oblancei-linearibus, corollis (siccatis) 24 mm longis tubo 18 mm longo midnervis et fauce pilosulis, lobis pilosis, lobis superis 7 mm longis suborbicularibus, loba infera 9 mm longa suborbiculari. Holotypus: Molokai I., Waikolu Valley, Hanalilolilo, 3,800 ft. alt., Dec. 21, 1932, H. St. John et al. 12,419.

Cyrtandra kauensis sp. nov. Frutex 1 m altus est, novellis badie pilosis, foliis inaequalibus, petiolis 1.5-7.5 cm longis vix pilosis, laminis 7-20 x 3.3-10 cm chartaceis late ellipticis acuminatis basi cuneata marginibus serratis supra catenulate hirsutulis infra subalbis et in nervis pilosulis nervis secundariis 9 in dimidio quoque, cymis 4 cm longis 3-floriferis badie pilosis, pedunculo 17 mm longo, bracteis 17 mm longis lanceolatis, pedicellis 11-12 mm longis, calycibus (siccatis) 12-13 mm longis in basi dense badie pilosis sed ad apicem pilis rarioribus tubo 5-6 mm longo labia supera 7 mm longa 3 lobis lineari-lanceolatis lobis inferis 8-9 mm longis, corollis (siccatis) 16 mm longis tubo 13-14 mm longo sparse pilosulo, lobis superis 2 mm longis suborbicularibus, loba infera 3 mm longa suborbiculari. Holotypus: Hawaii I., Ka'u Dist., Kiolaka'a-Kea'a Homestead Addition, Metrosideros forest, 2,300 ft. alt., May 28, 1981, J. Davis 502.

Cyrtandra kormanthike sp. nov. Frutex est, ramis puberulis, petiolis 10 mm longis puberulis, laminis 3.5-5.5 x 1.5-1.8 cm coriaceis ellipticis acutis basi cuneata marginibus serrulatis supra sparse catenulate hirsutis infra dense adpresse adscendente fulve pilosulis nervis secundariis 9 in dimidio quoque, cymis cauliforibus fere omnino ad basim 2-4.5 cm longis 1-5-floriferis dense adpresse adscendente fulve pilosulis, pedunculis 5-20 mm longis, bracteis 5 mm longis oblanceolatis, pedicellis 7-15 mm longis, calycibus (siccatis) 10-12 mm longis pilosulis lobis 8.5-10.5 x 3-4.3 mm oblanceolatis, corollis (siccatis) 24-25 mm longis pilosulis tubo 7 mm long, lobis superis 5.5 mm longis ovati-suborbicularibus,

loba infera 9 mm longa late elliptica. Holotypus: Molokai I., head of Wailau Valley, rain forest, 900 m alt., 12/29/1936, F. R. Fosberg 13,375.

Cyrtandra pentenourou sp. nov. Frutex 3.3 m altus ramosus est, novellis dense adpresse pilosis, petiolis 5-27 mm longis dense adpresse adscendente pilosulis, laminis 1.6-12 x 1-4 cm chartaceis oblanceolatis varie ellipticis acuminatis acutisve basi cuneata et decurrenti marginibus integribus vel minute serrulatis supra pilosulis infra pallidioribus minute puberulis nervis principalibus adscendente pilosulis nervis secundariis 7-12 in dimidio quoque, cymis 3-5 cm longis 1-floriferis dense adpresse adscendente pilosulis, pedunculo 7-11 mm longo, bracteis 3 mm longis linearibus, pedicellis 11-18 mm longis, calycibus (siccatis) 11-12 mm longis lobis 10-11 mm longis oblanceolatis adscendente pilosulis, corollis (siccatis) 12 mm longis dense adscendente pilosis, lobis superis 2.3 mm long ovatis acutis, loba infera 2.5 x 2.3 mm late ovata acuta, baccis rostratis. Holotypus: Kauai I., Limahuli Valley, stream bed, 600 ft. elev., July 9, 1979, S. Perlman & C. Wichman 464.

Cyrtandra prolixa sp. nov. Frutex est, novellis adpresse badie pilosis, foliis inaequalibus, petiolis 0.7-5 cm longis adscendente badie pilosis, laminis 2.8-11.7 x 1.5-4.5 cm chartaceis ellipticis subacuminatis basi cuneata breve decurrenti marginibus remote apiculate serrulatis supra adpresse adscendente pustulate hirsutulis et densiore in midnervo infra pallidioribus badie pilosis nervis secundariis 9 in dimidio quoque, cymis 22 mm longis 1-floriferis dense adscendente badie pilosulis, pedicello 14 mm longo, calycibus (siccatis) 8 mm longis adscendente badie pilosulis lobis 6-7 x 2-2.2 mm oblongis subacutis, corollis 11 mm longis tubo 7.5 x 2.5 mm pilosulis, lobis superis 3 mm longis ovatis, loba infera 4 mm longa ovata. Holotypus: Hawaii I., Kona, Lower Nanawale Forest Reserve, Transect E, 22.III.1979, L. Cuddihy 790054.

Cyrtandra vallecularis sp. nov. Frutex est, ramis foliosis puberulis, petiolis 25-55 mm longis puberulis, laminis 5.5-13 x 2.7-5.5 cm coriaceis ellipticis subacuminatis basi cuneata decurrentique marginibus serrulatis supra catenulate hirsutulis infra dense adscedente fulve pilosulis nervis secundariis 11-13 in dimidio quoque, cymis axillaribus et caulifloribus 3-6 cm longis 1-5-floriferis dense adscendente fulve pilosulis, pedunculis 18-25 mm longis, bracteis 15 mm longis lanceolatis, pedicellis 8-20 mm longis, calycibus (siccatis) 17-19 mm longis dense adpresse adscendente fulve pilosulis, lobis 14.5-16 mm longis oblanceolatis, corollis 20-23 mm longis tubo 15 mm

longo pilosulo loba infera 5 x 5.5 mm oblate suborbiculari. Holotypus: Molokai I., Olokui, Wailele Stream, 3,600 ft. alt., Feb. 4, 1948, H. St. John & R. L. Wilbur 23,249.

Section Verticillatae

Cyrtandra infraligulata sp. nov. Frutex est, caule adpresse adscendente puberulo, foliis 5-verticillatis sessilibus, laminis 28-43 x 5.3-8.3 cm chartaceis oblanceolatis sed quarto basali 1-4 mm lato ligulato apice acuto marginibus serrulatis supra midnervo et secundariis adpresse adscendente puberulis infra in nervis subpilosulis nervis secundariis 23-25 in dimidio quoque, cymis 2-3.5 cm longis 5-7-floriferis, pedunculo 1-2 mm longo, bracteis 7 mm longis ovatis, calycibus (siccatis) 10-11 mm longis ellipsoideis aliter glabris sed in labiis puberulis, labia supra 4 mm longis cum 3 lobis 1 mm longis deltoideis, lobis inferis 4 mm longis late lanceolatis, corollis puberulis. Holotypus: Molokai I., Kaluaaha Valley, Aug. 1912, C. N. Forbes 308a.Mo.

Cyrtandra manukaensis sp. nov. Frutex 1.3 m altus ramosus est, ramis foliosis adpresse adscendente pilosulis, foliis 3-verticillatis sessilibus, laminis 26-30.5 x 4-5 cm subcoriaceis oblanceolatis acuminatis tertia basali subligulata 15-17 mm lata marginibus grosse serrulatis supra remote adpresse pilosis midnervo adpresse piloso infra adpresse adscendente pilosulis et in nervis principalibus densiore, cymis 2.5-3.5 cm longis floribus compluribus condensatis, gemmis (vivis) 20-22 x 7 mm oblancei-fusiformibus adpresse puberulis rostro 3-5 mm longo, calycibus 22 mm longis adpresse puberulis deciduis 3 lobis lanceolatis, corollis 29 mm longis puberulis lobis intra glandulose puberulis labia supera 4 mm longa cum lobis 3 mm longis loba infera elliptica, ovario puberulo. Holotypus: Hawaii I., Kau, Manuka, forest, 2,400 ft. elev., May 28, 1981, H. Horiuchi ESP-318.

Cyrtandra trifoliata sp. nov. Frutex est, novellis badie adscendente pilosis, foliis 3-verticillatis, petiolis 10-20 mm longis adscendente badie pilosis, laminis 4-6 x 1-1.6 cm coriaceis anguste fusiformibus acutis basi cuneata marginibus compresse serrulatis supra glabris infra in superficie glabris sed midnervo et secundariis sparse adscendente badie pilosulis nervis secundariis 5-6 in dimidio quoque, cymis 2.5 cm longis 1-floriferis sparse adscendente badie pilosulis, pedunculo 1 cm long, bracteis 4 mm longis lanceolatis, pedicellis 7 mm longis, calycibus 12 mm longis fusiformibus remote adpresse pilosulis 2 lobis superis 4 mm longis lanceolatis, 2 lobis inferis 4 mm longis ovatis acutis, corollis

(siccatis) 21 mm longis tubo glabro lobis pilosis. Holotypus: Molokai I., U.S.F.W.S. Bird Survey, Transect 17, Station 15-16, above Halawa, 2,660 ft. elev., 21 July 1979, L. Stemmermann 3,966.

Cyrtandra tripla sp. nov. Frutex 75-100 cm ramosa est, ramulis foliosis puberulis, foliis 3-verticillis sessilibus, laminis 21-30 x 4.5-5.5 cm subcoriaceis tertia basali 2 cm lata integra parte apciali fusiformi acuminata basi rotundata marginibus minute adpresse apicule serrulatis supra microscopice puberulis midnervo puberulo infra glabris sed nervis principalibus adscendente badie pilosulis nervis secundariis 19 in dimidio quoque, cymis 25 mm longis 3-floriferis, pedicellis 4-8 mm longis pilosulis, gemmis 22 mm longis subglabris fusiformibus rostro 3 mm longo, lobis 7 mm longis lanceolatis corollis glabris exsertis, ovario pilosulo. Holotypus: Hawaii I., mauka of Manuka State Park, 1,950 ft elev., June 25, 1975, F. R. Warshauer & C. Lamoureux 322.

Cyrtandra trisse sp. nov. Frutex 1.3 m altus est, ramula foliosa dense adscendente puberula, foliis 3-verticillatis sessilibus, laminis 33.8 x 8.3 cm chartaceis parte 3/4 apicali elliptica parte basali oblonga basi rotundata subacuminata marginibus remote umbonate serrulatis supra glabris sed nervis principalibus adpresse puberulis infra glabris sed nervis principalibus adscendente puberulis nervis secundariis 19 in dimidio quoque, cymis 3-4.5 cm longis 2-5-floriferis adpresse adscendente puberulis, pedunculo 2-3 mm longo, bracteis 3-4 mm longis orbicularibus, pedicellis 8-12 mm longis, gemmis 22 x 6-7 mm corpore oblancei-ellipsoideis cum rostro 5 mm longo, calycibus(vivis) 26 mm longis deciduis fissis in 2 lobis 14 mm longis lanceolatis, corollis 30 mm longis tubo 15 mm longo glabris, labia supera cum 2 lobis 10 mm longis suborbicularibus, loba infera 12 x 8 mm ovata, baccis 19 x 12 mm ellipsoideis. Holotypus: west Maui, Iao Valley, Nakaluloa Stream, 2,800 ft. alt., Oct. 16, 1980, R. Hobdy 913.

ENLARGEMENT OF OAHU CYRTANDRA (GESNERIACEAE) HAWAIIAN PLANT STUDIES 48

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The genus Cyrtandra is the largest genus of higher plants in the Hawaiian flora. At present there are accepted 571 species, 47 varieties, and one forma. The present contribution adds 35 species and one variety, making a total of 616 species, 48 varieties, and one forma.

This contribution has been produced by H. St. John and W. N. Takeuchi; the latter during three years has done intensive field work in valleys that had been neglected. This has revised the total on Oahu to 153 species, 8 varieties, and 1 forma.

The type specimens are in the Bishop Museum, Honolulu.

Section CROTONOCALYCES

Cyrtandra acuminifolia sp. nov. Frutex est, novellis pilosis, laminis 6-18 x 4.3-10.3 cm ovalibus acutis basi cuneata infra nervis principalibus pilosulis, cymis 5.5-7 cm longis 3-9-floriferis pilosis, pedicellis 10-15 mm longis calycibus 15 mm longis pilosis lobis inferis 5-6 mm longis, corollis 24 mm longis pilosis. Typus: Oahu I., Niu, W. Takeuchi et al. Koolau 273a.

Cyrtandra basirotundata sp. nov. Frutex est, ramulis pilosis, foliis oppositis inaequalibus, petiolis 3-8.5 cm longis pilosis, laminis 11-21 x 6-13 cm ovalibus acuminatis basi rotundata et cuneata infra puberulis nervis pilosis, cymis 5-10 cm longis, 1-3 floriferis pilosis, calycibus 20-22 mm longis pilosis, lobis inferis 10-12 mm longis lanceolatis acuminatis. Typus: Oahu I., Palolo, Takeuchi & Pyle 2,655.

Cyrtandra cuspidata sp. nov. Frutex est, novellis puberulis, foliis oppositis inaequalibus, petiolis 5-7.5 cm longis puberulis, laminis 15-23 x 7.8-11 cm ovalibus acuminatis basi cuneata infra nervis puberulis, cymis 8-12.5 cm longis 3-5 floriferis puberulis, pedicellis 15-23 mm longis, calycibus vivis 17 mm longis puberulis 2/5-lobatis tubo 8 mm longo lobis inferis 6 mm longis lanceolatis, corollis 21 mm longis pilosulis decurvatis, loba infera 9 x 8 mm suborbiculari. Typus: Oahu I., Haiku, Takeuchi & Tate 2,947.

Cyrtandra kamooaliiensis sp. nov. Frutex est, novellis dense adscendente badie pilosulis, foliis oppositis, petiolis 2-7.5 cm longis, adscendente badie pilosulis, laminis 7-17 x 3.8-10 cm late ellipticis acuminatis basi cuneata et decurrenti marginibus serratis

supra sparse adpresse puberulis infra sparse minute puberulis nervis principalibus adscendente badie pilosulis, cymis 4.5-7 cm longis 3-5-floriferis axillaribus adscendente badie pilosulis, pedunculis 1-3.3 cm longis bracteis 6-10 mm longis lancelatis, pedicellis 7-22 mm longis, calycibus siccatis 10-11 mm longis pilosulis 1/2-lobatis, lobis superis 3.5 mm longis lancelatis, lobis inferis 5.5-7 mm longis, corollis vivis 25 mm longis tubo 18 mm longo pilosulo, lobis superis 5 mm diametro, loba infera 8 x 7 mm, ovario glabro, stylo glabro. Typus: Oahu I., Kaneohe, Kamooalii, W. Takeuchi 2,907.

Cyrtandra kremnes sp. nov. Frutex est, caule simplici pilosulo, foliis oppositis, inaequalibus, petiolis 5-7.5 cm longis puberulis, laminis 10-27 x 7.5-12.6 cm ovalibus acuminatis basi cuneata decurrenti infra puberulis nervis pilosulis, cymis 7-17 cm longis 6-floriferis puberulis, pedicellis 4-11 mm longis, calycibus vivis 15-16 mm longis puberulis tubo 8-9 mm longo lobis inferis 6 mm longis lanceolatis corollis 22 mm longis puberulis tubo 15 mm longo decurvato loba infera 7 x 7 mm ovati-suborbiculari. Typus: Oahu I., Kaneohe, Takeuchi 2,922.

Cyrtandra piaensis sp. nov. Frutex est, ramulis foliosis pilosis, foliis oppositis, petiolis 2.5-7 cm longis pilosis, laminis 10-14 x 4.5 7 cm ellipticis acuminatis basi cuneata infra nervis pilosulis, cymis 4-5 cm longis pilosulis, pedicellis 13-20 mm longis, calycibus vivis 18 mm longis pilosulis 2/5-lobatis lobis inferis 7-8 mm longis deltoideis et subulatis, corollis 19 mm longis pilosis tubo 15 mm longo subrecta loba infera 4.5 x 5 mm oblato-ovata. Typus: Oahu I., Niu, Takeuchi 2,720.

Cyrtandra pukeleensis sp. nov. Frutex ramosus est, novellis villosis, foliis oppositis inaequalibus, petiolis 7-10 cm longis villosis, laminis 14-17 x 10.6-12 cm ellipticis breve acuminatis basi subcordata infra nervis pilosis, cymis 5-6 cm longis 5-8-floriferis axillaribus villosis, pedicellis 12-20 mm longis calycibus vivis 9-10 mm longis 3/4-lobatis in basi villosis lobis inferis 9-10 mm longis elliptici-lanceolatis, corollis 15 mm longis tubo 12 mm long hispidulis subrectis. Typus: Oahu I., Palolo, Takeuchi 2,622.

Cyrtandra rotundata sp. nov. Frutex est, ramulis foliosis villosis, foliis oppositis, petiolis 7-13.5 cm longis villosis, laminis 15-19.5 x 15-17 cm suborbicularibus subacuminatis basi rotundata infra pilosulis sed nervis pilosis, cymis 7-8.5 cm longis 3-7-floriferis villosis, pedicellis 20-30 mm longis, calycibus vivis 17-18 mm longis pilosis lobis inferis 12 mm longis late deltoideis, corollis 17 mm longis pilosis tubo 12 mm longo recto loba infera 5 x 6 mm suborbiculari-ovata. Typus: Oahu I., Palolo, Takeuchi 2,624.

Cyrtandra subaequalis sp. nov. Frutex est, novellis villosis, petiolis 5-9 cm longis villosis, laminis 17.5-19.5 x 11.3-14 cm late ovatis subacuminatis basi rotundata cuneata infra in nervis principalibus adpresse hirsutulis, cymis 5-8.5 cm longis 7-9-floriferis villosis, pedicellis 5-15 mm longis, calycibus 14-16 mm longis 1/2-lobatis villosis lobis 7 mm longis ovatis cum apicibus subulatis, corollis 20 mm longis in medio in 45° decurvatis. Typus: Oahu I., Wailupe, J. Obata & B. Tate 1,955.

Cyrtandra subrubra sp. nov. Frutex est, ramulis foliolsis hirsutis, petiolis 3.5-6 cm longis hirsutis, laminis 11.5-18 x 6.2-10 cm ovalibus acuminatis basi, cuneata decurrentique infra adpresse puberulis nervis pilosulis, cymis 5-8 cm longis 4-7-floriferis pilosis, pedicellis 12-27 mm longis calycibus 14-17 mm longis pilosis lobis 9-14 mm longis lanceolatis corollis 25 mm longis pilosulis, in parte 2/5 ex apice in 45° decurvata loba infera 6.5 mm longa ovati-orbiculari. Typus: Oahu I., Punaluu, Takeuchi et al. 2,289.

Section CYLINDROCALYCES

Cyrtandra depressa sp. nov. Frutex ramosus est, ramulis glabris, foliis oppositis, petiolis 7-17 mm longis ciliatis, laminis 37-43 x 11.3-12.6 cm elliptici-oblanceolatis acuminatis basi longe decurrenti infra adpresse pilosulis, cymis 4-6 cm longis 3-floriferis axillaribus, pedicellis ad 7 mm longis, rostro gemmae 8 mm longo, calycibus 28 mm longis adpresse pilosulis 5 lobis 8-10 mm longis ovatis acuminatis, corollis 32-34 mm longis tubo 18-20 mm longo decurvato. Typus: Oahu I. Waianu, Takeuchi 2,536.

Cyrtandra ferrea sp. nov. Frutex est, novellis pilosulis, foliis oppositis inaequalibus, petiolis 4-7.7 cm longis pilosulis, laminis 13-23 x 8-9.5 cm ellipticis acumunatis basi cuneata et decurrenti supra et infra puberulis, cymis 5-9 cm longis 3-7-floriferis pilosulis, pedicellis 10-15 mm longis. Typus: Oahu I., Haiku, Takeuchi & Paquin 2,995, mounted on 2 sheets.

Cyrtandra fusata sp. nov. Frutex est, ramulis foliosis pilosulis, foliis oppositis inaequalibus, petiolis 2-5 cm longis pilosulis, laminis 11.5-15.3 x 0.9-6.2 cm fusiformatis subacuminatis basi decurrenti infra minute puberulis, cymis 4-5 cm longis 2-4-floriferis, pedicellis 10-14 mm longis pilosulis, calycibus vivis 22 mm longis pilosulis tubo 15 mm longo, lobis inferis 8 mm longis ovatis subulatis, corollis 24 mm longis glabris tubo 17 mm longo decurvato. Typus: Oahu I., Haiku, Takeuchi & Tate 3,004.

Cyrtandra glabriflora sp. nov. Frutex est, caulis simplex glaber est, foliis oppositis, petiolis 2-3 cm

longis glabris, laminis 24-40 x 8.5 11.5 cm fusiformi-ellipiticis acuminatis basi cuneata decurrenti supra adpresse pilosulis infra nervis pilosulis, cymis 6-10 cm longis caulifloris 7-16-floriferis puberulis, pedicellis 8-18 mm longis, calycibus vivis 19 mm longis puberulis tubo 10 mm longo lobis inferis 11 mm longis lanceolatis, corollis 24 mm longis. Typus: Oahu I., Waiahole, Takeuchi 2,529, mounted on three sheets.

Cyrtandra imparilis sp. nov. Frutex est, caule folioso pilosulo, foliis oppositis, petiolis 2-4.2 cm longis pilosulis, laminis 9-14.5 x 4-6.4 cm ellipticis vel oblanceolatis acuminatis basi cuneata infra nervis adpresse pilosulis, cymis 5-8.3 cm longis 2-5-floriferis pilosulis, pedicellis 7-19 mm longis calycibus vivis 22 mm longis in basi pilosulis 4 lobis 9 mm lanceolatis subulatis, corollis 27 mm longis glabris tubo 18 mm longo decurvato, loba infera 6 x 7 mm late ovata. Typus: Oahu I., Niu, Takeuchi 2,722.

Cyrtandra opposita sp. nov. Frutex ramosus est, novellis puberulis, laminis 12.2-19 x 7-9.4 cm ovalibus acuminatis basi cuneata, decurrenti infra midnervo adpresse pilosulo, cymis 5-7 cm longis 2-3-floriferis puberulis, pedicellis 14-25 mm longis, calycibus 9-10 mm longis 2/3-partitis lobis inferis 6 mm longis lanceolatis sed apicibus subulatis, corollis 15 mm longis puberulis. Typus: Oahu I., Palolo, Takeuchi & Pyle, s.n.

Cyrtandra ovalis sp. nov. Frutex est, ramulis foliosis pilosis, foliis oppositis inaequalibus, petiolis 6-10.5 cm longis pilosis, laminis 11.5-21.5 x 7.2-12.5 cm ovalibus acuminatis basi cuneata infra nervis pilosis, cymis 5-6 cm longis 3-4-floriferis pilosulis, pedicellis 18-20 mm longis, calycibus 21 mm longis pilosulis 3 lobis 3-4 mm longis deltoideis et subulatis, corollis vivis 25 mm longis pilosis decurvatis. Typus: Oahu I., Palolo, Takeuchi 2,704.

Cyrtandra pilosicalycis sp. nov. Frutex est, novellis subadpresse sparse badie pilosulis, foliis oppositis, petiolis 3.5-8 cm longis sparse pilosulis, laminis 8.5-20 x 3.5-9.2 cm ellipticis acumnatis basi cuneata marginibus serratis vel dentatis supra sparse adpresse pilosulis infra intervallis glabris nervis principalibus adscendente badie pilosulis, cymis 5.5-7 cm longis 3-4-floriferis axillaribus sparse adscendente badie pilosulis, pedunculis 2.5-3.5 cm longis, pedicellis 15-20 mm longis, calycibus siccatis 11-12 mm longis 1/2-lobatis lobis 6-7 mm longis lanceolatis rostro 3-4 mm long, stylo 4 mm longo glabro. Typus: Oahu I., Haiku, Takeuchi & Paquin 2,986.

Cyrtandra scapiflora sp. nov. Frutex est, novellis dense adpresse pilosulis, foliis oppositis inaequalibus, petiolis 4-5.5 cm longis adpresse pilosulis, laminis

9.5-20 x 5-8.8 cm membranaceis late ellipticis acuminatis basi cuneata breve decurrenti marginibus subintegris supra minute adpresse badiepuberulis infra nervis principalibus adpresse badie pilosulis, cymis axillaribus et cauliforibus 4-6 cm longis 3-floriferis adscendente pilosulis, pedunculis 10-25 mm longis, bracteis 8-15 mm longis lanceolatis, pedicellis 6-13 mm longis, gemmis fusiformibus et cum rostro 1.5 mm longo, calycibus siccatis 13-15 mm longis pilosulis 2/5-lobatis lobis 5.5-7 mm longis lanceolatis apice subulato, corollis vivis 28 mm longis pilosis tubo 15-17 mm longo, loba infera 4 mm longa suborbiculari. Typus: Oahu I., Haiku, W. Takeuchi & Paquin 2,994.

Cyrtandra tantalusensis sp. nov. Frutex est, novellis pilosulis, petiolis 5-8 cm longis pilosulis, laminis 18-22 x 8.4-10.7 cm ovalibus acuminatis basi cuneata et decurrenti infra nervis principalibus pilosulis, cymis 6.5-9 cm longis 4-5-floriferis pilosulis pedicellis 10-19 mm longis, calycibus 19 mm longis puberulis lobis 6-7 mm longis lanceolatis, corollis 27 mm longis. Typus: Oahu I., Tantalus, Takeuchi 1,878.

Section SCHIZOCALYCES

Cyrtandra biformalis sp. nov. Frutex est, novellis villosis, foliis oppositis, petiolis foliorum principalium 7.5-15 cm longis villosis, laminis 20.5-24 x 13.5-16 cm late ellipticis acuminatis basi cordata infra pilosulis nervis pilosis, cymis 5-18 cm longis 5-7-floriferis pilosis, pedicellis 1-4 cm longis, calycibus vivis 16-19 mm longis pilosulis lobis 9-11 mm longis lineari-lanceolatis, corollis 18 mm longis pilosulis tubo 16 mm longo subrecto. Typus: Oahu I., Haiku, Takeuchi & Tate 2,999.

Cyrtandra catenulata sp. nov. Frutex est, ramulis foliosis 2-6 mm diametro dense hirsutis, petiolis 4.5-7 cm longis pilosulis, laminis 19-24 x 8-13.3 cm ovatis ovalibusve acutis acuminatisve basi cuneata infra puberulis et nervis salebrose puberulis, cymis 8-11 cm longis 5-9-floriferis pilosulis, pedicellis 19-40 mm longis, calycibus 10-12 mm longis lobis 7-9 mm longis lanceolatis acuminatis, corollis 11 mm longis hirsutulis. Typus: Oahu I., Kaluaa, Takeuchi & Pyle 2,039.

Cyrtandra dasygyna sp. nov. Frutex est, novellis pilosulis, petiolis 2-3 cm longis pilosulis, laminis 7.2-10.5 x 3-5 cm ellipticis acuminatis basi cuneata infra adpresse pilosulis et in nervis pilosis, cymis 6-8.5 cm longis 3-5-floriferis puberulis, pedicellis 16-20 mm longis, calycibus 11-13 mm longis puberulis lobis 8-11 mm longis anguste lanceolatis. Typus: Oahu I., Waikane, Takeuchi 2,016.

Cyrtandra discors sp. nov. Frutex est, ramulis foliosis puberulis, foliis oppositis inaequalibus, petiolis 1.5-7.3 cm longis pilosulis, laminis 7.2-15 x 1.6-5 cm oblanceolatis acuminatis basi cuneata infra glabra, cymis 4.5-6 cm longis 1-3-floriferis puberulis, pedicellis 13-22 mm longis, calycibus vivis 10-12 mm longis fere ad basim lobatis lobis ellipticis vel lanceolatis, corollis 16 mm longis pilosis tubo subrecto. Typus: Oahu I., Kaneohe, Takeuchi 2,921.

Cyrtandra haikuensis sp. nov. Frutex ramosus est, ramulis foliosis hirsutulis, foliis oppositis, petiolis 5-13.5 cm longis hirsutulis, laminis 15.5-22.8 x 8.5-10.7 cm ellipticis acuminatis basi cuneata infra nervis hirsutulis, cymis 6.5-9 cm longis 3-5-floriferis hirsutulis, pedicellis 12-22 mm longis, calycibus vivis 13 mm longis hirsutulis 3/4-lobatis lobis inferis 8.5 mm longis lanceolatis, corollis 16 mm longis inclusis tubo recto loba infera 6 x 5 mm ovata. Typus: Oahu I., Haiku, Takeuchi & Tate 2,945.

Cyrtandra ovalifolia sp. nov. Frutex 1.3-1.7 m altus est, novellis dense badie pilosis, foliis oppositis petiolis 4.5-10 cm longis, badie pilosis perfoliatis, laminis 17.5-25 x 10-14.5 cm ovalibus acuminatis basi cuneata marginibus denticulatis supra remote adpresse badie pilosulis infra minute adpresse badie puberulis nervis principalibus pilosis, cymis 6.5 cm longis 5-6-floriferis axillaribus pilosis, pedunculis 25-27 mm longis, bracteis 6-13 mm longis oblanceolatis, pedicellis 8-17 mm longis, calycibus siccatis 13-15 mm longis dense pilosis 2/3-partitis, lobis 8-10 mm longis lanceolatis, corollis villosis, ovario glabro, stylo 4 mm longo glabro. Typus: Oahu I., Haiku, Takeuchi 2,981.

Cyrtandra prorsiflora sp. nov. Frutex est, novellis adscendente badie pilosulis, foliis oppositis inaequalibus, petiolis 15-35 mm longis adscendente badie pilosulis, laminis 7-15 x 3-6.1 cm chartaceis ellipticis acuminatis basi cuneata marginibus serrulatis supra remote pilosulis infra minute adpresse badie pilosulis et nervis adscendente pilosulis, cymis axillaribus et caulifloribus 8-8.5 cm longis 3-floriferis pilosis, pedunculis 22-35 mm longis, bracteis 8-12 mm longis ellipticis, pedicellis 12-22 mm longis, calycibus siccatis 13-16 mm longis in basi dense pilosis supra deminuentibus, 5 lobis subaequalibus 11-13 mm longis late lanceolatis, ovario glabro, stylo 2 mm longo glabro. Typus: Oahu I., Haiku, W. Takeuchi 3,031.

Cyrtandra quinqueflora sp. nov. Frutex est, novellis pilosulis, petiolis 3.5-9 cm longis, laminis 10-20 x 5-10 cm ellipticis acuminatis basi cuneata infra pilosulis et nervis principalibus salebrose pilosulis, cymis 7-8 cm

longis 5-floriferis pilosulis, pedicellis 22-25 mm longis, calycibus 12-13 mm longis pilosulis lobis 8-12 mm longis ligulate lanceolatis subulatis, corollis 17 mm longis pilosulis lobis superis 4.5-5 mm longis suborbicularibus. Typus: Oahu I., Waikane, Takeuchi 2,014.

Cyrtandra triados sp. nov. Frutex est, novellis puberulis, laminis 15-18 x 6.6-7 cm ellipticis acutis basi cuneata infra nervis principalibus pilosis, cymis 4.5-6 cm longis 3-5-floriferis pilosulis, pedicellis 8-11 mm longis, calycibus 33-36 mm longis pilosis lobis inferis 22 mm longis subulatis, corollis 33-35 mm longis. Typus: Oahu I., Punaluu, Takeuchi et al. 1,792.

Cyrtandra trionanthe sp. nov. Frutex est, novellis pilosis, laminis 9-12.2 x 5.5-7.4 cm ovalibus acuminatis basi inaequaliter rotundatis infra nervis pilosulis, cymis 5-7 cm longis 3-floriferis pilosis, pedicellis 7-16 mm longis, calycibus 10-14 mm longis 2/3-lobatis lobis lanceolatis apicibus subulatis, corollis 19 mm longis pilosulis tubo 15 mm longo. Typus: Oahu I., Waiahole, Takeuchi et al. 1,871.

Cyrtandra villifera sp nov. Frutex ramosus est, ramulis foliosis villosis, foliis oppositis, petiolis 7.5-10 cm longis villosis, laminis 11-15.5 x 9-14.5 cm suborbicularibus cordatis apice acuminato supra adpresse puberulis infra pilosulis et nervis salebrose pilosis, cymis 6-7.5 cm longis 3-10-floriferis axillaribus villosis, pedicellis 12-30 mm longis, calycibus 13-14 mm longis in basi villosis lobis inferis 13-15 mm longis ovati-lanceolatis. Typus: Oahu I., Palolo, Takeuchi 2,619.

Cyrtandra wailupeensis sp. nov. Frutex est, ramulis foliosis pilosulis, foliis oppositis, petiolis 5.5-11.5 cm longis pilosulis, laminis 12-18.5 x 9.5-13.4 cm ellipticis acuminatis basi subcuneatis infra puberulis nervis pilosulis, umbellis 5-6 cm longis 4-6-floriferis pilosis, pedicellis 16-23 mm longis, calycibus vivis 8-9 mm longis pilosulis 5/6-lobatis lobis inferis 6 mm longis lanceolatis, corollis 16 mm longis pilosulis tubo recto. Typus: Oahu I., Wailupe, Takeuchi & Pyle 2,670.

Section VERTICILLATAE

Cyrtandra calpidicarpa (Rock) St. John & Storey, var. distincta var. nov. A var. calpidicarpa differt in cymis 4-5-floriferis, pedunculo 14 mm longo, bracteis 7-10 mm longis ellipticis, pedicellis 11-20 mm longis. Typus: Oahu I., Punaluu, W. Takeuchi et al. 2,291.

Cyrtandra deorsa sp. nov. Frutex est, novellis puberulis, foliis ternatis, petiolis 12-26 mm longis, laminis 8-25.5 x 3.4-8 cm ellipticis acuminatis subacuminatisve basi cuneata decurrenti infra minute puberulis nervis puberulis, cymis 3-6.5 cm longis

3-6-floriferis puberulis, pedicellis 9-15 mm longis, calycibus 15 mm longis puberulis lobis inferis 7-8 mm longis deltoideo-lanceolatis, corollis 24 mm longis pilosulis tubo 17 mm longo. Typus: Oahu I., Waiahole, Takeuchi 2,525.

Cyrtandra triens sp. nov. Frutex est, ramulis foliosis puberulis, laminis ternatis, petiolis 1.5-2 cm longis adpresse pilosulis, laminis 24-33 x 7-8.7 cm fusiformis subacuminatis basi cuneata et longe decurrenti infra adpresse puberulis sed nervis principalibus pilosulis, cymis 3.5-5 cm longis 9-15-floriferis, pedicellis 2-6 mm longis, calycibus 31-33 mm longis per 5 mm fissis, corollis 39 mm longis glabris lobis 16 mm longis. Typus: Oahu I., Waiahole, Takeuchi 2,524.

Cyrtandra trinalis sp. nov. Frutex est, novellis puberulis foliis ternatis inaequalibus, petiolis 3-6 cm longis puberulis, laminis 6-13 x 3-5.8 cm ellipticis acuminatis basi cuneata vel decurrenti supra et infra puberulis praesertim in nervis, cymis 3-6.5 cm longis 3-7-floriferis puberulis, pedicellis 3-12 mm longis, calycibus siccatis 7 mm longis lobis 3.5-3.8 mm longis subulatis obtusis, corollis 15 mm longis pilosulis tubo 13 mm longo. Typus: Oahu I., Haiku, Takeuchi & Tate 2,952.

KEY to Fig. 1. Locations of Cyrtandra species.

a. C. acuminifolia
b. C. basirotundata
c. C. biformalis
d. C. calpidicarpa var. distincta
e. C. catenulata
f. C. cuspidata
g. C. dasygyna
h. C. deorsa
i. C. depressa
j. C. discors
k. C. ferrea
l. C. fusata
m. C. glabriflora
n. C. haikuensis
o. C. imparilis
p. C. kamoolaliiensis
q. C. oppositifolia
r. C. ovalifolia
s. C. ovalis
t. C. pilosicalycis
u. C. prorsiflora
v. C. pukeleensis
w. C. quiqueflora
x. C. rotundata
y. C. scapiflora
z. C. subaequalis
2. C. subrubrum
3. C. tantalusensis
4. C. triados
5. C. triens
6. C. trinalis
7. C. trionanthe
8. C. villifera
9. C. wailupeensis
&. C. kremnes
+. C. piaensis

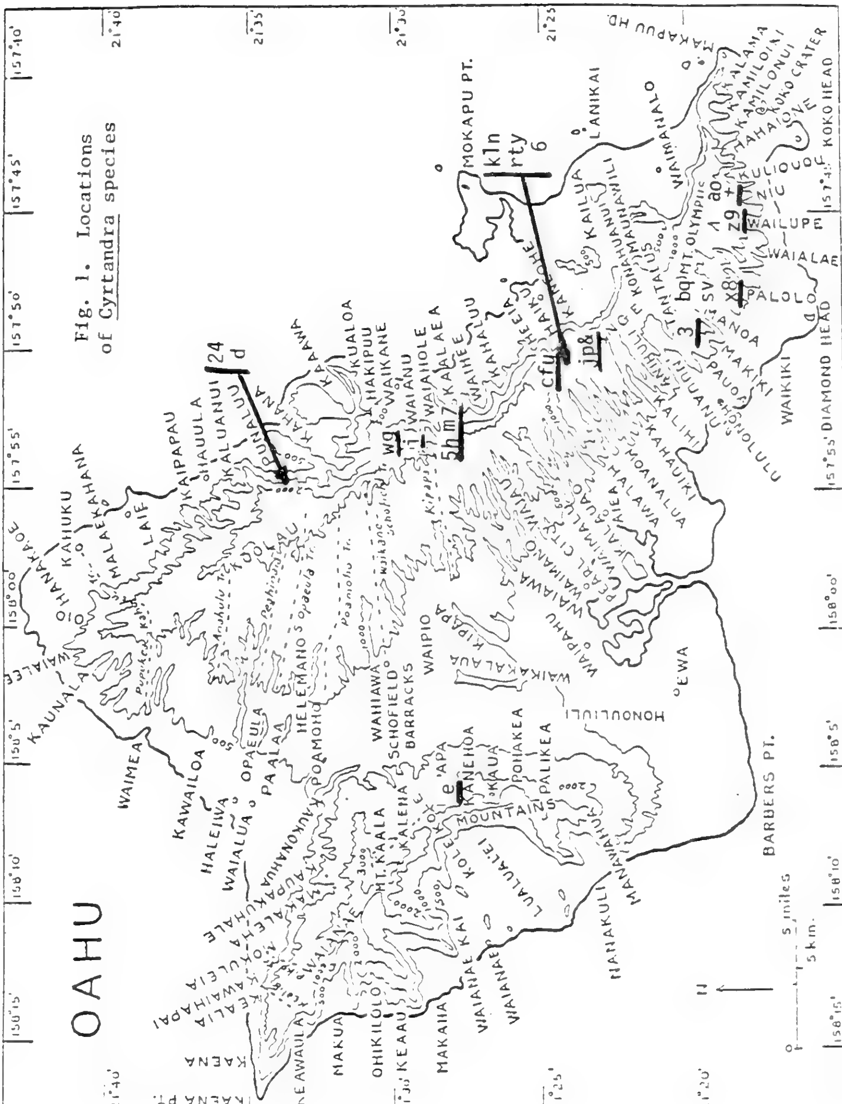

Fig. 1. Locations of *Cyrtandra* species

A NEW CALOCHORTUS FROM DOUGLAS COUNTY, OREGON

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Frank T. Callahan II, 6045 Foley Ln., Central Point, OR 97502

ABSTRACT

Calochortus coxii *Godfrey & Callahan, a serpentine endemic of Douglas County, Oregon is described. A comparison with Calochortus tolmiei H.& A., a related as species is made. A relationship between Calochortus howellii Wats. and Calochortus umpquaensis, N. Fredricks, (1989) ined., is established.*

On June 18, 1988, Marvin Cox of Canyonville, discovered a population of Calochortus in bloom on a serpentine slope between Boomer Hill and Myrtle Creek. He noticed some distinctive floral features and wondered if this could be a new species or a variety of *Calochortus tolmiei.* A short while later, news of his discovery was relayed to Ray Godfrey. On the 29th of June, the two met and proceeded to the site to collect herbarium specimens. At a later meeting with the authors, Mr. Cox requested their participation in describing his new discovery.

Calochortus coxii Godfrey & Callahan sp. nov. (Fig. 1)

Calochortus tolmiei H.& A. affinis, *Calochortus coxii* a qua differt florescencia seria circum duobus mensibus; folio ciliato secus venus superficie; glandula petali impressa profunde; pilis luteis proxime super glandulam; in petalo supra pilis luteis ∧-formi sublavendus; stigmate elevato in extensione gracili styliforme; antheris cinnamomeis; seminibus albo-stramineis maturitate.

Calochortus coxii Godfrey & Callahan. Bulb whitish 1-2 cm long x 1.5 cm wide, coated with dull chocolate brn. membranous bulb coats. Leaf solitary, ±erect to 3 dm long x 3-7 mm wide, with densely hairy inner surface, outer surface. Glabrous/shiny. Flowering stem erect to flexulose 15-25 cm tall with one or several bracts 2.5-3 cm long. Flowers 1-7 on erect pedicels, sepals ±20 mm long x ±8 mm wide ovate acuminate, petals broadly obovate 2.5 cm+ long white with reddish striations from base to deeply impressed gland, well covered with membranous scale. Scale covered with translucent very small rod-like hairs, inner base of gland green. Yellow hairs, ±overlapping gland, grading to white at petal tips. Just above gland exists a broad lavender chevron extending to petal edges. Petal edges ±fringed & with hairs. Anthers apiculate 3-7 mm long, reddish brown. Filament ±7 mm long. Capsule elliptic elongate 3-4 cm long x 1.5+ cm. wide with 4 mm long and recurved "style", 3 winged and nodding. Seeds lt. straw yellow with rough surfaces.

TYPE: USA: Douglas County, 43°01'48" 123°19'20"W 256 m. abundant northern slope, Oregon State Highway Dept. Survey Pt. "Myrtle", on ultramafic soil base, 29 June 1988 M. Cox & R. Godfrey Holotype: CAS. Isotypes: K, US, SOC, UC, OSC, Douglas Co. Museum, Roseburg, BLM Herbarium.

Calochortus coxii and *C. tolmiei* (both species of section Calochortus = Eucalochortus) share the following characteristics: have the same habitat locally, have similar petal size and shape, and have apiculate anthers (see Table I. and Fig.1)

TABLE 1. Differences between *C. coxii* and *C. tolmiei*.

	C. coxii	*C. tolmiei*
Blooming time	late June, early July	March, early May
Inner leaf surface	densely hairy along veins	glaucous/glabrous
Outer leaf surface	shiny dark green	glaucous
Petal gland	larger & strongly impressed	slightly impressed
Hairs above gland	yellow	purple, rarely pink
Stigma	raised on a style-like extension	sessile
Anthers (color)	reddish brown	pale lavender

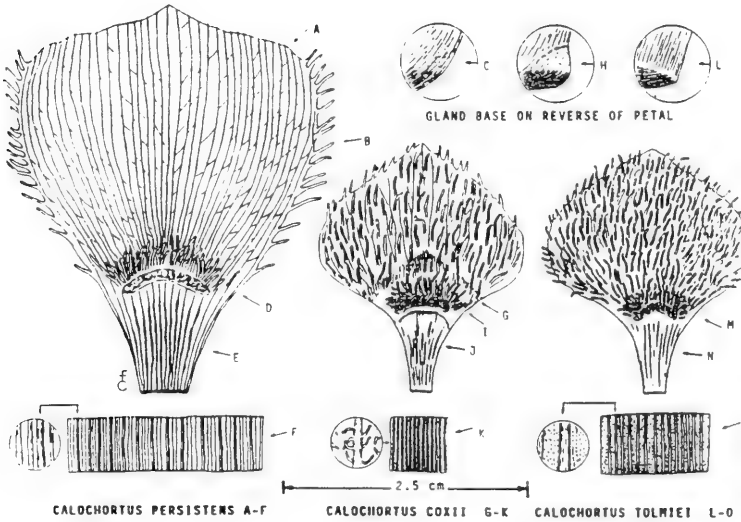

Fig. 1. A comparison of *Calochortus persistens*, *C. coxii* and *C. tolmiei*.

A. Petal base pink **B.** Fringed petal margins **C.** Gland base not strongly protruding **D.** Clustered yellow hairs above gland **E.** Pink/red striations petal base to gland **F.** Inner leaf surface section showing veins with glaucous, glabrous surface.

G. Lavender chevron on petal **H.** Protruding green gland base **I.** Yellow hairs above gland **J.** Red striations on white petal base **K.** Inner leaf surface section showing minute hairs on raised veining.

L. Protruding gland base **M.** Purple/pink hairs above gland **N.** Purple/pink striations **O.** Inner leaf surface section glabrous

Calochortus coxii is also compared with *C. persistens* Ownbey (subsection Nitidi), Fig. 1. The latter species also has nodding capsules, but differs in its persistent perianth parts (the perianth parts are shed as the capsule matures in all other Calochortus species). The seeds of both species are light yellow and the petals in bud are light pink.

Calochortus coxii shares many traits with *C. howellii* of Josephine Co. and *C. umpquaensis* of Douglas Co. *Calochortus howellii* is unique in having an erect capsule that is considerably smaller than capsules of the preceding two species. *C. coxii* and *C. howellii* bloom at about the same time, about a month later than *C. umpquaensis*. Because of their differences, these three species do not fit well in either subsection Eleganti or subsection Nitidi.

Ownbey (1940) placed *C. persistens*, with its apiculate anthers in subsection Nitidi, because "its nodding capsule separates it from the remainder of subsect Nitidi, and suggests affinity with subsect Eleganti, but on all other characters is best placed with the former subsection." *C. persistens* with its apiculate anthers and nodding capsules does not fit well in either subsections. In spite of this, Ownbey (1940) placed the species in subsection Nitidi. Ownbey (1940) placed *C. howellii* in subsection Nitidi based on its erect capsule and habit, but noted "it's distally branched gland processes and merely roughened seedcoats mark it as very distinct from any other known species of the section Eucalochortus." He evidently failed to notice the densely hairy inner leaf of *C. howellii*, a character mentioned in Peck's description (1973). However, in the same group, *C. coxii* and *C. umpquaensis* have nodding capsules.

It seems evident that these three species warrant a new subsection within the genus Calochortus. Considering the similar characters shared by *C. coxii*, *C. howellii*, *C. umpquaensis*: especially the densely hairy inner leaf surfaces not found in any other known species of Calochortus; the style-like extension of the ovary; the apiculate anthers; the light yellow seed with roughened testa and their serpentine endemicity. The subsection position of these species seems intermediate between that of subsection Nitidi and subsection Eleganti. *C. coxii* differs from *C. howellii* and *C. umpquaensis* having flowers with a strongly protruding gland base; yellow hairs above the gland; a light lavender chevron and red striations at the petal base. (See Fig.1). The ancient North Klamath province seems to be the center of speciation for this unique group of Calochortus. All species known of this group thus far, including two additional undescribed taxa, are Oregon endemics.

The principle plants associated with *Calochortus coxii*: *Calocedrus decurrens* (Torr.) Florin, *Festuca idahoensis* Elm, *Pinus jeffereyi* Murr., *Calochortus tolmiei* H&A. *Allium mirabile* Hend., *Pinus ponderosa* Doug. Plant associations of secondary importance include: *Umbellularia californica* (H&A.) Nutt., *Rhododendron occidentale* (T&G) Grey, *Pseudotsuga menziesii* (Mirb.) Franco, *Silene hookeri* Nutt. and *Arbutus menziesii* Pursh.

Because of its late blooming cycle and the dessicated soils of southern exposed slopes, *Calochortus coxii* is confined to shady north-facing mesic sites. The largest populations are found near ridge-line summits on soils derived from serpentinite rock. The plants are distributed from 256 m above the Umpqua River to 849 m at Myrtle Creek Mountain. The ultramafic intrusives are thrust thru early **Jurassic Dothan & Dothan volcanics** in line with a northeast tending fault band (Wells & Peck, 1983), with an exposed terminus north of Little River (along the North Umpqua River).

The Global Distribution Range (GDR) of C. coxii is 43°00' 15"N, 123° 21'53"N (Sheep Hill) northeast to 42°05'04"N, 123 00'15"W (T28S R5W Sec.35). The species grow on private, state, and federal lands, with considerable human disturbance i.e., livestock, roads (Interstate 5 intersects a large population), and logging. In fact, BLM roads and a gravel quarry disturb several populations. Part of the habitat has been grazed and logged since pioneer settlement, mostly without apparent damage to the Calochortus populations. We have observed that the germination of Lilium and Calochortus seems to be enhanced on mineral soils following soil disturbance (such as fires). Overgrazing by sheep, as on Sheep Hill, has apparently caused reduction in the size of the population. Large numbers of plants occur in an adjacent fenced area where sheep were excluded.

Calochortus coxii appeared to be quite rare where Mr. Cox made the original discovery, however, extensive field surveys by the authors showed a series of discontinuous populations widely distributed over an 11 square mile area (2851 hectares).

Calochortus coxii presently exhibits a good population base but should be placed on the "sensitive plant" list, as its survival seems linked to minimizing man's impact on the habitat areas. The authors recommend the status of *C. coxii* be determined by the office of the Oregon Endangered Plant Species Program.

Both authors are grateful to: Nelda Lewis & Joyce Schmidt, for the latin diagnosis; Dr. Frank A. Lang, for criticisms and reviews of the manuscript; Dr. Kenton Chambers, for his comments; Nancy Fredricks, the author of *C. umpquaensis*; the always generous Boyd Kline, for use of his living Calochortus collections; Cliff Bryden, for his assistance to explore much of the plant's distribution on his property; and Karen Callahan and Maria Ewaldsen who typed the manuscript.

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MEIOTIC DISORDERS INDUCED BY NADOLOL IN ALLIUM CEPA L.

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Several investigators studied the effect of drugs on either somatic or germ cells among them, Shahab et al. (1983, 1985), Shehab and Abo El-Kheir (1984), Reddy and Subramanyam (1985) and El-Bayoumi et al. (1985).

The present investigation was undertaken to elucidate the effects of Nadolol drug on meiosis of Allium cepa L. pollen mother cells (P.M.C.s).

Nadolol is used in the treatment of hypertension and angina pectoris. In hypertension the initial starting dose is usually 40 to 80 µg once daily. The usual maintainance dose is 80 to 320 µg once daily.

MATERIAL AND METHODS

Allium cepa (Var. Giza 5) flower buds were treated for 3 and 6 hours with the different concentrations of the drug (50, 100 µg/ml and 1 mg/ml) using a piece of cotton soaked with the drug solution. The treated flower buds were collected 24 and 48 hours after treatment (recovery test) at random from 20 plants for each treatment. Tap water was used for control in the same manner. Flower buds were fixed in Carnoy's fluid and examined using aceto carmine smear method.

RESULTS AND DISCUSSION

Tables 1 and 2 show that the drug induced a high percentage of aberrations in all treatments of the drug. This percentage increased with the increase of concentration in all treatments of 24 & 48 hours recovery, except 3 hrs treatment with 1 mg/ml after 24 hrs. recovery.

The effect of Nadolol drug was permanent, since the percentage of aberration increased with lapse of time of recovery. After 24 & 48 hrs. recovery the first division has the highest percentage of anomalis except 6 hrs. treatment with 100 µg after 24 hrs. recovery (Table 1) and 3 & 6 hrs. treatment with 50 µg/ml after 48 hrs. recovery (Table 2). The decrease in aberration percentage with the progress of meiotic stages from the first to the second division may indicate the loss (elimination) of aberrant cells (gametes) from the population, and not the recovery of these cells from aberration events Ashour (1988).

No trend was observed between the percentage of anomalis and time of treatment in the second division.

Tables 3 and 4 represent the percentage of the different types of abnormalities induced as a result of treatment of Allium cepa flower buds with the different concentrations of Nadolol drug.

Stickiness was the most prominent abnormality in all treatments of the drug. The highest percentage of stickiness was observed in diakinesis and MI and it gradually decreased in the later meiotic division. Fig.1 shows sticky MI with swallen and grouping of bivalents. The sticky clumped chromosomes when try to separate they form sticky bridges (Fig. 2).

A less dominant abnormality was the disturbed. Fig. 3 shows disturbed anaphase I and Fig. 4 shows the disturbance in one pole only of anaphase I.

Nadolol induced clastogenic effect such as laggards (Fig. 5) and fragment and bridges Fig. 6.

In addition to above mentioned abnormalities despiralization assynchronization, diagonal and univalent were observed in low percentage in some of the treatments.

Micro and multinucleate cells were observed which are a result of either spindle disturbance or lagging chromosomes. The same types of abnormality have been met with and discussed by a number of authors, among them Kunzel and Mirslaw 1966, Vig 1969 and Bezo et al., 1980.

SUMMARY

In this investigation the effect of nadolol on Allium cepa PMCs was studied. The drug gave high percentage of abnormalities. The percentage of abnormalities was higher in the 1st division. Metaphases have the highest percentage of aberrations.

Different types of abnormalities were met with stickiness, disturbed metaphases and ana-telophases, lagging chromosomes, bridges, fragments and despiralization. Micro and multinucleate cells were also recorded.

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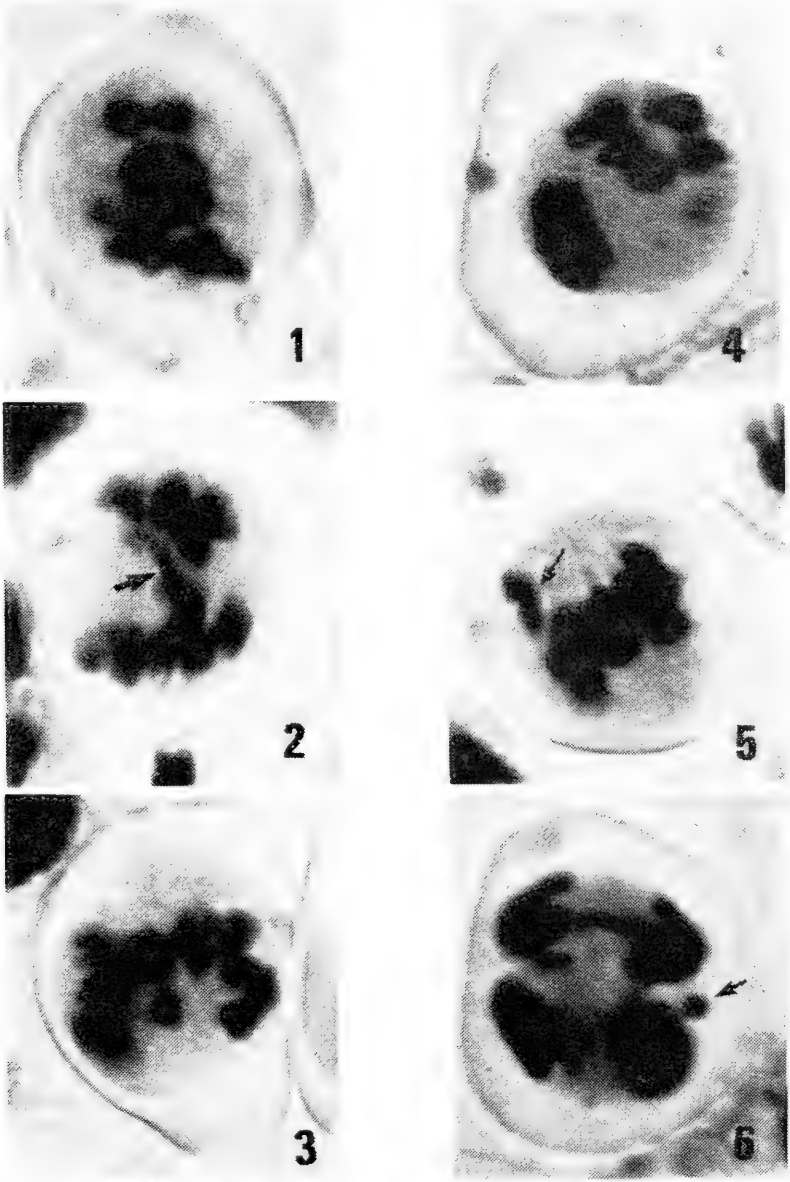

ILLUSTRATIONS: Fig. 1: Sticky MI (50 μg/ml) for 3 hr nadolol after 24 hr recovery. **Fig. 2:** AI with bridge (50 μg/ml) for 6 hr nadolol after 24 hr recovery. **Fig. 3:** Disturbed AI (1 mg/ml) for 6 hr nadolol after 48 hr recovery. **Fig. 4:** Disturbed AI at one pole only (100 μg/ml) for 3 hr nadolol after 24 hr recovery. **Fig. 5:** Lagging chromosome at MI (1 mg/ml) for 3 hr nadolol after 48 hr recovery. **Fig. 6:** AII with bridge and fragment (50 μg/ml) for 3 hr nadolol after 48 hr

M = Metaphase; A = Anaphase

Table (1): Percentage of total abnormalities and abnormalities in each phase of meiosis in Allium cepa L. treated with the drug after 24 hours recovery.

Experimental agent		No. of Counted cells	No. of abn. cells	% of total abn.	1st division				2nd division			
					% of abn. metaphase	% of abn. anaphase.	% of abn. telophase	Total % of abn.	% of abn. metaphase	% of abn. anaphase	% of abn. telophase	Total % of abn.
Control		4787	114	2.38	5.36	2.27	0.7	4.28	0.43	1.6	0.63	1.12
3 hours	50 µg/ml.	3581	709	19.80	29.4	53.54	20.00	25.87	19.17	21.26	8.15	15.46
	100 µg/ml.	2356	729	30.94	35.16	60.9	37.92	37.52	75.76	34.85	10.07	22.90
	1 mg/ml.	4182	846	20.23	27.34	75.00	16.59	23.99	46.25	52.14	5.75	18.17
4 hours	50 µg/ml.	3431	630	18.36	36.08	37.70	9.78	22.96	27.67	39.46	5.43	14.76
	100 µg/ml.	2464	532	21.59	20.71	29.48	11.71	19.04	29.36	29.75	11.52	23.59
	1 mg/ml.	3086	767	24.85	33.68	64.64	12.04	51.9	51.9	41.15	1.32	15.42

No = Number
Abn = Abnormal

Table (2): Percentage of total abormalities and abnormalities in each phase of meiosis in Allium cepa L. treated with the drug after 48 hours recovery.

Experimental agent		No. of counted cells	No. of abn. cells	% of total abn.	I st division				2nd division			
					% of abn. metaphase	% of abn. anaphase	% of abn. telophase	Total % of abn.	% of abn. metaphase	% of abn. anaphase	% of abn. telophase	Total % of abn.
	Control	4375	153	3.50	7.15	2.19	1.10	3.81	3.90	3.45	2.03	3.04
3 hours	50 µg/ml.	1549	358	23.11	34.15	30.56	9.14	26.54	32.27	36.80	4.25	54.19
3 hours	100 µg/ml.	1872	621	33.17	45.83	35.71	36.81	38.78	38.84	34.71	14.66	28.50
3 hours	1 mg/ml.	2011	725	36.05	47.49	39.76	33.82	41.57	44.29	40.87	21.44	31.30
6 hours	50 µg/ml.	1908	788	41.30	41.82	48.65	35.02	39.38	50.58	47.81	25.27	42.52
6 hours	100 µg/ml.	1119	483	43.16	51.72	51.02	45.46	48.89	53.82	59.13	16.85	39.31
6 hours	1 mg/ml.	1387	620	44.70	59.54	57.14	42.98	55.77	51.42	49.01	21.16	37.14

Table (3): Percentage of each type of abnormalities in Allium cepa L.P.M.Cs. treated with 50,100 µg/ml and 1 mg/ml Nadolol after 24 hours recovery.

Experimental agents		Stickiness	Disturbins	lagging	bridge	fragment	diagonal	univalent	micronuclei	multinucleate	assynchro-nization	despira-lisation
Control		78.95	7.01	10.53	0.88	-	-	-	0.88	1.75	-	-
3 hours	50 µg/ml.	39.35	12.83	9.03	11.14	5.78	1.41	0.56	13.68	5.08	0.42	0.71
	100 µg/ml.	44.72	3.98	6.31	8.92	10.70	3.57	-	20.85	0.69	0.27	-
	1 mg/ml.	50.24	14.54	8.87	3.31	3.43	0.70	0.95	9.10	8.51	0.35	-
6 hours	50 µg/ml.	53.81	13.49	8.41	7.46	1.75	1.43	-	8.89	4.26	0.48	-
	100 µg/ml.	46.8	11.28	7.14	4.51	9.02	4.70	-	15.04	1.13	0.19	0.19
	1 mg/ml.	54.63	12.65	6.00	15.25	4.69	1.57	-	3.13	0.65	0.13	1.30

Table (4): Percentage of each type of abnormalities of Allium cepa L.P.M.Cs. treated with 50, 100 µg/ml, 1 mg/ml Nadolol after 48 hours recovery during the 3 and 6 hours exposure.

Experimental agent		stickiness	disturbins	lagging	bridge	fragment	diagonal	univalent	micronuclei	multinucleate	assynchro-nization	despira-lisation
Control		71.90	10.46	9.15	2.61	-	-	-	1.96	3.92	-	-
3 hours	50 µg/ml.	49.44	12.29	5.87	10.89	10.62	2.51	1.68	2.79	3.35	0.56	-
	100 µg/ml.	42.51	10.31	8.21	13.21	4.35	0.16	1.77	18.68	0.64	0.16	-
	1 mg/ml.	37.93	9.38	11.17	17.66	4.41	1.38	-	14.90	2.35	0.14	0.68
6 hours	50 µg/ml.	37.18	12.06	9.52	10.15	6.22	1.78	0.51	10.03	12.18	0.25	0.13
	100 µg/ml.	38.92	7.87	4.97	5.38	11.39	2.28	1.45	19.67	7.45	0.62	-
	1 mg/ml.	50.32	9.52	5.97	5.00	6.29	0.97	1.13	0.48	20.00	-	0.32

CONTRIBUTIONS TO THE FLORA OF THE GALAPAGOS ISLANDS, ECUADOR.

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ABSTRACT

Passiflora foetida L. var. *galapagensis* Killip is sunk into *P. foetida* L. and *Passiflora tridactylites* Hook. f. is separated from *P. suberosa* L. New records of *Passiflora edulis*, *P. ligularis* and *P. quadrangularis* are reported. A key is provided to *Passiflora* in The Galápagos Islands. *Buddleja americana* L. and *Galium reynoldsii* Dempster are reported.

PASSIFLORACEAE

Passiflora edulis Sims., Bot. Mag. 45: pl. 1989. 1818.

This species is widespread in most tropical and subtropical areas. In The Galápagos Islands found at the inhabited islands (Black, 1973 and pers. obs.).

Collections studied: Santa Cruz, Los Gemelos, Lawesson 1996 (CDS); Close to Charles Darwin Research Station, Lawesson 2158 (CDS).

Passiflora foetida L., Sp. Pl. 959 (1753).

Passiflora foetida L. var. galapagensis Killip, Field Mus. Nat. Hist. Bot. Ser. 19: 505. 1938.

This widespread and polymorphic species has been divided into many subspecific taxa by Killip (1938), however most students of Passifloraceae today agree that the real number of varieties is lower. A number of varieties exist in Central America, probably connected with different pollination syndromes. However, the South American taxa are probably only represented by few polymorphic taxa (Holm-Nielsen et al. 1988). The pubescence, as used by Killip, is not found to be a consistent character. It therefore seems justified to include the variety described from The Galápagos Islands in *P. foetida* L.

Collections studied: Champion Island, Adsersen 1463 (C); Wiggins & Porter 494 (US) . Charles Island, Aggassiz s.n. (US); Lee s.n. (US); Schmitt 110 (US). Isabela Island, Sierra Negra, Cerro Paloma, East of El Quemado, M. & O. Hamann 2468 (C). San Cristobal Island, Adsersen 710 (C); Snodgrass & Heller 496 (US); Wreck Bay, Stewart 2072 (US). Santa Cruz Island, Academy Bay, Fosberg 44720 (US); Fournier 141 (US); M. & O. Hamann 1596 (C); Howell 9045 (US); Stewart 2073 (US); Taylor 18 (US); Charles Darwin Research Station, Adsersen 330 (C); Bentley 220 (US); van der Werff 2043 (AAU).

Passiflora ligularis Juss., Ann. Mus. Hist. Nat. 6: 113. pl. 40. 1805.

This species is introduced from continental Ecuador and is easily recognized by

the long petiolar glands.

Collections studied: Santa Cruz, North slope of Mount Crocker, *Scalesia* forest, M. & O. Hamann 2582 (C); Lawesson 2075 (AAU,CDS).

Passiflora quadrangularis L., Syst. ed. 10. 1248. 1759.

A widely cultivated passionflower which has been introduced to The Galápagos Islands. Found on the populated islands (Black, 1973 and pers. obs).

Collections studied: San Cristobal, near El Junco, Adsersen 1679 (C). Santa Cruz, Rancho Apolo XI, close to bellavista, M. & O. Hamann 2204 (C).

Passiflora suberosa L., Sp. Pl. 958, 1759.

Killip (1938) lumped *P. tridactylites* Hook. f. with this common American species. Although two variable species, both merit specific status, based on differences in morphology and ecological affinity, as pointed out in the key below and under *P. tridactylites*. *P. suberosa* is widespread but restricted to rather mesic habitats, whereas *P. tridactylites* occurs in dry lowland areas.

Collections studied: Isabela, Santo Tomas, 350 m, Adsersen 2374 (C). Fernandina, SE slope, 2-2.5 km below rim, 780 m, M. & O. Hamann 233 (C). Pinta, Central Crater, 520 m, Adsersen 1212 (C); NW. of Cabo Ibbotson, 350 m, M. & O. Hamann 834 (C); S. slope 240-400 m, Laweson 2587, 2620 (AAU, CDS); moist region, Stewart 2079 (F). Santa Cruz, half km N of C. Colorado, 600 m, Adsersen 197 (C); N. slope of C. Crocker, 590 m, M. & O. Hamann 646 (C); 630 m, M. & O. Hamann 630 (C); 650 m, M. & O. Hamann 624 (C). Santiago, "El Campamento Central", Central Highlands, 570 m, M. & O. Hamann 2017 (C).

Passiflora tridactylites Hook. f., Trans. Linn. Soc. 20: 222. 1851.

This species is easily distinguishable from *P. suberosa* by the narrow, long blade-lobes, and the very long androgynophore.

Collections studied: Espanola, Landing site area and trail to El Choco, 0-200 m, Lawesson 3126 (AAU; CDS). Fernandina, 300 m, Fosberg 45002, 45064 (F). Gardner (Espanola), Stewart 2045 (F). Isabela, Volcano Darwin, SW-slope, below rim of crater, 1150 m, M. & O. Hamann 1663 (C). San Cristobal, above P. Baquerizo, Wiggins & Porter 403 (F). Santa Cruz, 1,5 km N. of Cerro Colorado II, 450 m, Adsersen 211 (C). Santiago, Central Highlands, on rock-wall, 880 m, Adsersen 1102 (C); Howell 9665 (F); James Bay, 7 m, Werff 1095 (AAU).

Passiflora colinvauxii Wiggins, Madroño 20: 251. 1970.

This endemic is restricted to Santa Cruz Island.

Collections studied: Santa Cruz, Puntudo, 750 m, Adsersen 134 (C); Caseta, 150 m, Adsersen 372 (C); near El Chato, 180 m, M. & O. Hamann 1050 (C).

KEY TO THE *PASSIFLORA* OF GALAPAGOS

1. Stem quadrangular, winged	*P. quadrangularis*
1. Stem terete, not winged	2.
2. Petiolar glands ligulate to filiform, 3-8 mm	*P. ligularis*
2. Petiolar glands short stipitate to sessile, less than 3 mm	3.
3. Sepals with one pair of marginal glands	*P. edulis*
3. Sepals without glands	4.
4. Blades broader than long, 2-lobed	*P. colinvauxii*
4. Blades longer than wide, 3-lobed	5.
5. Lobes narrowly oblong, androgynophore 8-10 mm	*P. tridactylites*
5. Lobes broadly ovate, androgynophore 4-7 mm	*P. suberosa*

BUDDLEJACEAE

Buddleja americana L., Sp. Pl. 112. 1753.

A new family record to The Galápagos Islands (Lawesson & Norman, 1987). In Galápagos only known from the highlands of Floreana.

Collection studied: Floreana, Cerro Naranjo in central highlands, Lawesson & Zederkof 2849 (CDS).

RUBIACEAE

Galium reynoldsii Dempster, Allertonia 2 (4): 255-256, 1980.

This is a new record for The Galápagos Islands, hitherto known only from the type collection: Andes, Southern Chile (Dempster, 1980). How this species came from Southern America to Galápagos may never be revealed but migrant birds from the Southern Pacific pass every year and may have carried the propagules.

Collections studied: Floreana, highlands close to Cerro Naranjo, closed, moist *Psidium guajava* forest, Lawesson & Zederkof 2790, 2869 (CDS, AAU).

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POPULATIONAL ANALYSES AND NEW COMBINATIONS IN PSILOSTROPHE TAGETINA AND P. GNAPHALODES (ASTERACEAE, HELIANTHEAE)

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ABSTRACT

Populational analyses of P. tagetina and P. villosa strongly suggest that the latter is but a regional subset of a highly variable P. tagetina; intergradation of the two taxa occurs over a broad region along their areas of contact and within any one population in such areas individuals may be found representing one or the other "species." This being so it would seem more reasonable to treat these as but intergrading allopatric varieties: P. tagetina var. tagetina, largely confined to the more western regions, and P. tagetina var. cerifera (A. Nels.) B. Turner, comb. nov., largely confined to the more eastern regions. It is further suggested that the recently described P. mexicana is but a regional, albeit tetraploid, variant of the highly variable P. gnaphalodes, and the former is so reduced in the present study.

The small genus Psilostrophe (Asteraceae), long included in the polyphyletic tribe Helenieae but now largely acknowledged to belong to the Heliantheae (H. Robinson, 1981), is mostly confined to xeric habitats of the southwestern United States and adjacent Mexico, where some of the species are common roadside weeds. The plants are usually readily recognized by their epaleate receptacles, tomentose simple leaves, herbaceous habit and bright yellow rays which persist upon the achenes. At least two of the species, P. tagetina and P. gnaphalodes, are known to be poisonous to livestock (Mathews, 1934; Kingsbury, 1964; etc.).

The genus has received several comprehensive treatments: Nelson (1903), recognized 6 species, two of these with two varieties; Rydberg (1914), recognized 10 species; Heiser (1944), reverted to a 6-species concept; and Brown (1978), largely followed Heiser's treatment but added a seventh species, P. mexicana. Brown's treatment was by far the most thorough of those listed in that he had first-hand field knowledge with most of the species, combined with considerable cytogenetical and hybridization studies (Brown 1977, 1978).

In the senior author's treatment of Psilostrophe for the Asteraceae of Mexico (Turner and Nesom, in prep.), I have had to evaluate the above contributions and in the process have come to somewhat different taxonomic conclusions with respect to the Mexican species, P. tagetina and P. gnaphalodes. A partial distribution of these two taxa, as recognized here, is shown in Fig. 1.

Brown (1978) also mapped these two species but recognized, in addition, P. villosa Rydb. and P. mexicana R.C. Brown. The senior author would place specimens referrable to the former within P. tagetina, and

specimens referrable to the latter within P. gnaphalodes. My reason for these dispositions is the subject of the present paper.

COLLECTION OF SAMPLES -- "Randersonian" type samples were made from 9 populational sites across the region of intergradation between P. villosa and P. tagetina as shown in Fig. 1 (listed below; voucher collections are by B. Turner and are deposited at TEX):

1. TEX. Jeff Davis Co.: 18 mi SE Kent (15807) - Fig. 2
2. N. Mex. Eddy Co.: 13 mi SSW Whites City (15808) - Fig. 3
3. N. Mex. De Baca Co.: 18.5 mi S of Ramon (15816) - Fig. 4
4. N. Mex. Torrance Co.: 6.4 mi ESE Encino (15817) - Fig. 5
5. N. Mex. Santa Fe Co.: 14.8 mi SE Lemay (15818) - Fig. 6
6. N. Mex. Rio Arriba Co.: 39 mi NNW Espanola (15824) - Fig. 7
7. N. Mex. Guadalupe Co.: 25.5 mi SE Santa Rosa (15830) - Fig. 8
8. N. Mex. Curry Co.: 10 mi W Clovis (15827) - Fig. 9
9. Tex. Terry Co.: 3 mi S Brownfield (15836) - Fig. 10

A "randersonian" populational sample is the type of "random sample" favored by the late Edgar Anderson (1949) for sampling plant populations effectively and efficiently. In such samples one obtains most of his individuals from a large population by rather "random collection" but also includes within the sample several or more selected individuals that, because of their rarity, might be missed by the usual sample size being gathered. From among the exactly 50 plants gathered at any one populational site in the present study, no more than 1 to 5 such selected plants were included. These were selected by the senior author; the junior authors, who assisted in the sampling, collected at "random" in ignorance of the characters concerned.

Only two characters were measured on any one plant: ligule length and pedicel length. Both of these are the so-called "key characters" which are said to distinguish between P. tagetina and P. villosa (Brown, 1978). The parts measured were taken from the apex of primary stems on mature heads (i.e., the heads were in full flower). Since the heads occur in terminal subfasciculate corymbs, the pedicels of which are of varying lengths, measurements were obtained only from those heads with longest pedicels; ligule length was measured from those same heads. All measurements were obtained from fresh (living) material and measured using a stereomicroscope (x10) and a millimeter scale (roughly measured to the 0.5 mm level).

The sample sites were selected at roughly 100 km intervals across a region of the distribution of P. tagetina which housed the occasional, if not often, "intermediatae," between P. tagetina and P. villosa (Brown, 1978; Turner, pers. obs.).

RESULTS -- Populational analyses of the 9 sites sampled are shown in the scatter diagrams depicted in Figs. 2-10. Means, standard deviations and ranges are given for the characters measured in each population, and these are arranged for comparative purposes in Figs. 11-12.

DISCUSSION AND CONCLUSIONS -- As can be seen in the scatter diagrams, there is considerable variation within and among the populations

sampled. According to Brown (1978) P. tagetina is distinguished from P. villosa primarily by its mostly longer ligules (5-14 mm long vs 3-6 mm) and longer pedicels (10-40 mm long vs 1-9 mm). Except for population 2, which occurred largely on barren gypsum deposits and clearly falls within the variation pattern of P. villosa, all of the remaining populations contained plants which might be referred to as either P. villosa or P. tagetina. As can be seen in Figures 11 and 12, all of the populations overlap to some considerable extent in the range and standard deviations of the characters measured. Indeed, it is likely that additional sampling, even within the purported range of one or the other species, would yield yet similar variation patterns. (i.e., While most individuals might fall within the variation expected, at least a few individuals would fall within or approach the variation of its allopatric cohort.) In short, the regional variation for the two characters concerned are more like those of two contiguous, intergrading varieties than it is that of two "clean" allopatric species.

Brown (1978) does not show P. villosa (= P. tagetina var. cerifera) as occurring in Mexico nor has the senior author detected such individuals. The taxon does approach the Texas-Mexico border along the lower Pecos River, but it is apparently replaced in northern Mexico by either P. gnaphalodes var. gnaphalodes or P. tagetina var. tagetina, or both. However, occasional individuals from Mexico along this border region might be assignable to var. cerifera, but I view these as but populational extremes of var. tagetina, much as occurs throughout central and eastern New Mexico, as demonstrated in Figs. 2-10.

Brown (1978) also recognized a newly described Mexican taxon, P. mexicana R.C. Brown, a reportedly tetraploid species of southcentral Chihuahua and adjacent northcentral Durango. This taxon is very closely related to the contiguous P. gnaphalodes; indeed, other than chromosome number, the principal characters which he used to distinguish between these two are more or less the same as those used to distinguish between P. tagetina and P. villosa: corolla and peduncular lengths.

Brown (1974), in his original description of P. mexicana, provided a scatter diagram to distinguish between P. gnaphalodes and P. mexicana. In his diagram, he used peduncular length (= pedicel length, as used here) along the vertical axis and disk corolla length along the horizontal axis, much as we have used to discriminate between the varieties tagetina and cerifera in the present study. He did not, however, collect populational samples for analyses; instead, his data were obtained from herbarium sheets of the purported species in which it was shown that most of the material could be discriminated by these characters (cf. his Fig. 2), although there was some overlap in the characters concerned. While he presented data for 20 individuals of P. mexicana on his scatter diagram and 15 individuals of P. gnaphalodes, only 6 of the former were shown to be from tetraploid populations. The data for P. gnaphalodes was apparently taken from herbarium sheets for which chromosome counts were not known, but his paper is unclear on this point. At least voucher sheets were not cited for the specimens graphed.

Because of our experience with the populational variability within P. tagetina we attempted to construct a scatter diagram for the Mexican material of P. gnaphalodes from northern Mexico (Fig. 13, based upon 76

sheets at LL, TEX) using the same characters (and presumably some of the same sheets) selected by Brown (1974). This includes material referrable to P. mexicana.

In any case, the results of his study are also included in Fig. 13 of the present study. It can be noted that there is a wide range of variation in the characters which are said to discriminate between the two taxa and that, taken alone, the two characters will not serve to distinguish between P. mexicana and P. gnaphalodes with certainty, nor does there appear to be any strong correlation of the characters concerned with geographical regions, as implied in the studies of Brown (1974, 1978). Rather, there appears to be a tendency for shorter peduncles and shorter disk corollas to the east, with longer peduncles and longer disk corollas to the west. Whether tetraploids are confined to the region of southcentral Chihuahua and adjacent Durango is not known with much certainty, but even so there is insufficient morphological evidence to suggest that two species are involved. Indeed, we conclude that there are but two differentiated allopatric varieties which show considerable intergradation over a broad region, much as shown for P. tagetina. Of course, if future workers can show that P. mexicana is always tetraploid and that P. gnaphalodes is always diploid and that within or near the same sites the two taxa do not effectively hybridize, then we would concede to a two-species concept. Lacking such information, we feel that nomenclatural recognition of these regionally varying populations is best accommodated at the varietal level, as indicated below.

TAXONOMIC AND NOMENCLATURAL CONSEQUENCES -- Because of the field sampling and analyses presented above, it is concluded that P. villosa is best treated as an intergrading variant of P. tagetina. So considered it must take the following name:

PSILOSTROPHE TAGETINA var. CERIFERA (A. Nels.) B. Turner, comb. nov.

Based upon Psilostrophe cerifera A. Nels. var. cerifera, Proc. Biol. Soc. Wash. 16:21.1903.

This varietal combination is occasioned by the "DeMoulin Rule" of the most recent edition of the Botanical Code (1986) which permits the recognition of automatically established tautonymic infraspecific categories.

PSILOSTROPHE GNAPHALODES DC. var. MEXICANA (R.C. Brown) B. Turner, comb. nov.

Based upon Psilostrophe mexicana R.C. Brown, Brittonia 26:115.1974.

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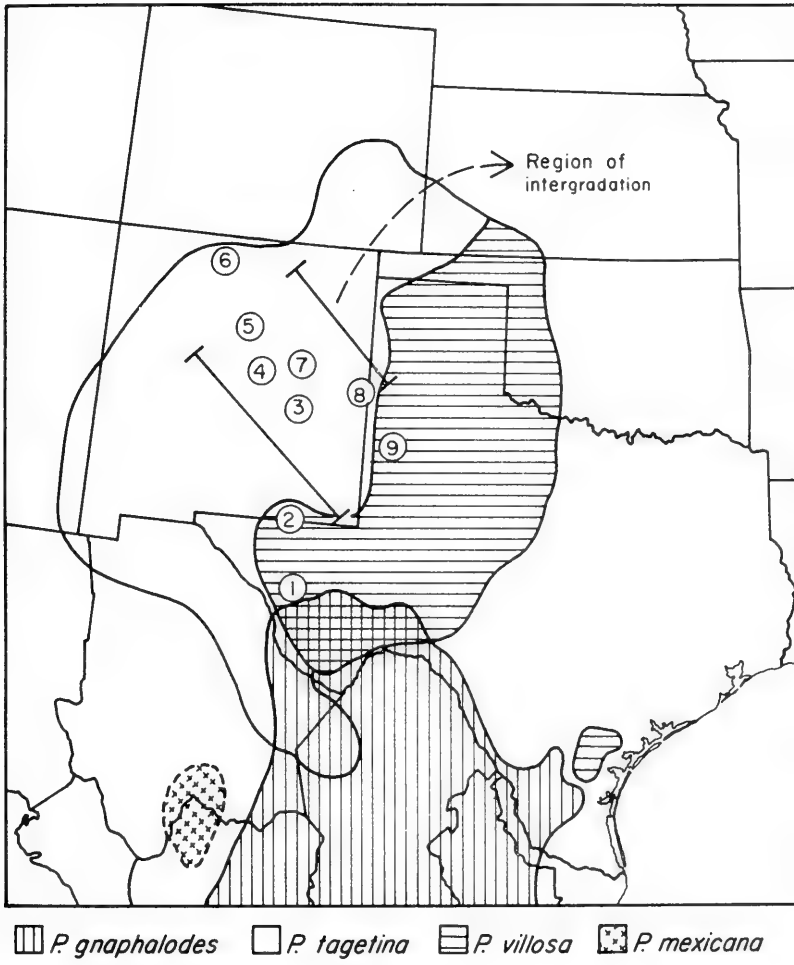

Figure 1. Approximate distribution and location of sample sites of the *P. tagetina - villosa* complex.

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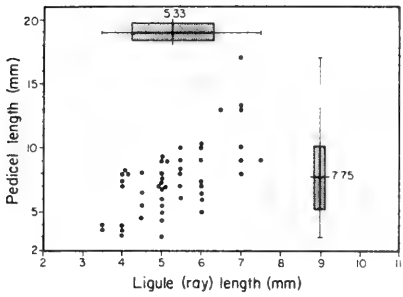

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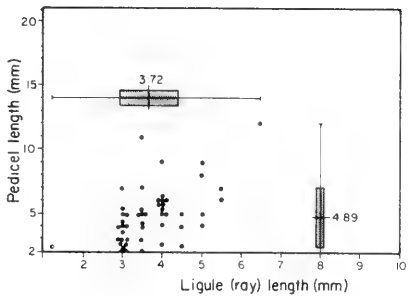

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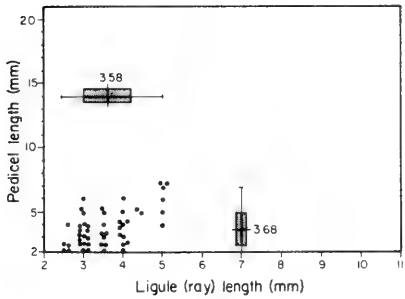
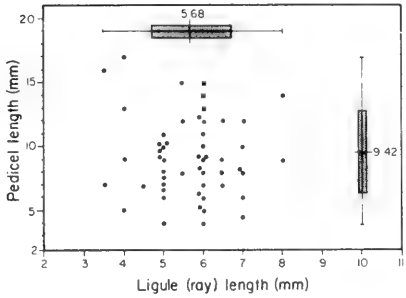


Figure 4.



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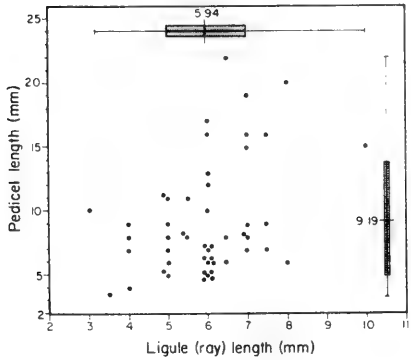

Figure 6

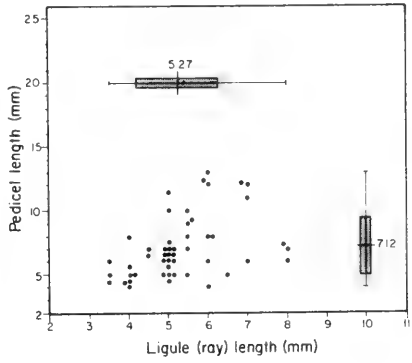

Figure 7.

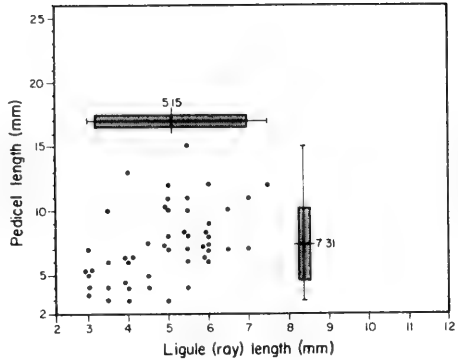

Figure 8.

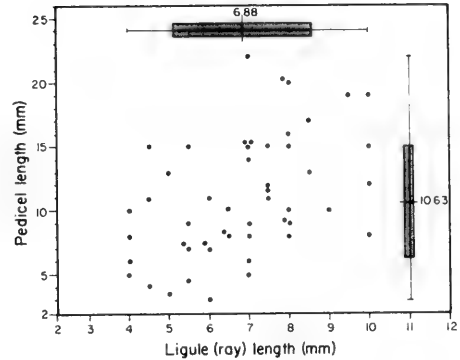

Figure 9.

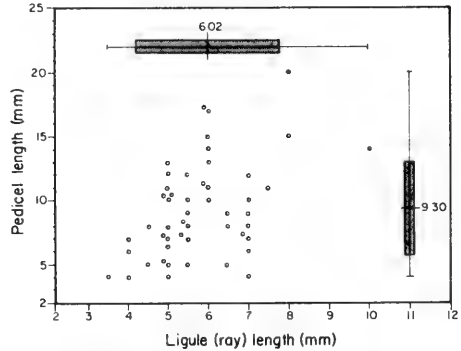

Figure 10.

Figures 2-10. Scatter diagrams of 50 individuals in each of 9 populations of the *Psilostrophe tagetina-villosa* complex. Pedicel length and ray are the key characters which reputedly distinguish between the two taxa.

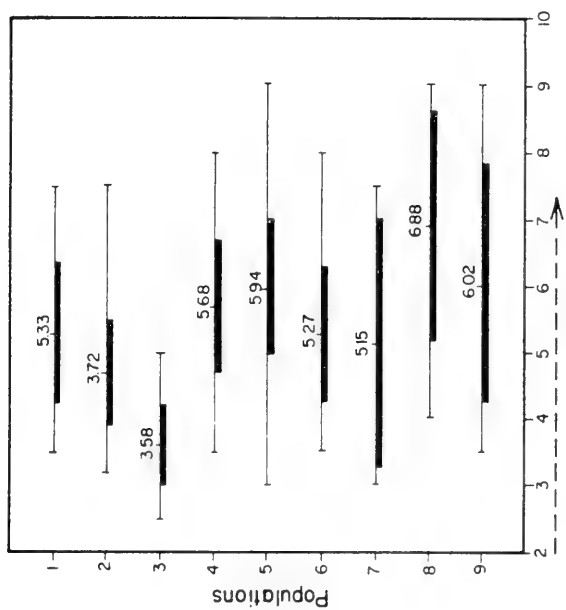

Figure 12. Mean, standard deviation and range of ligule length of the 9 populations

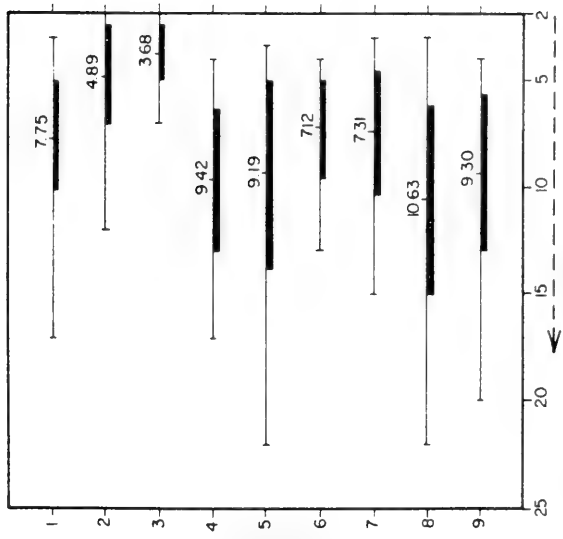

Figure 11. Mean, standard deviation and range of pedicel length of the 9 populations

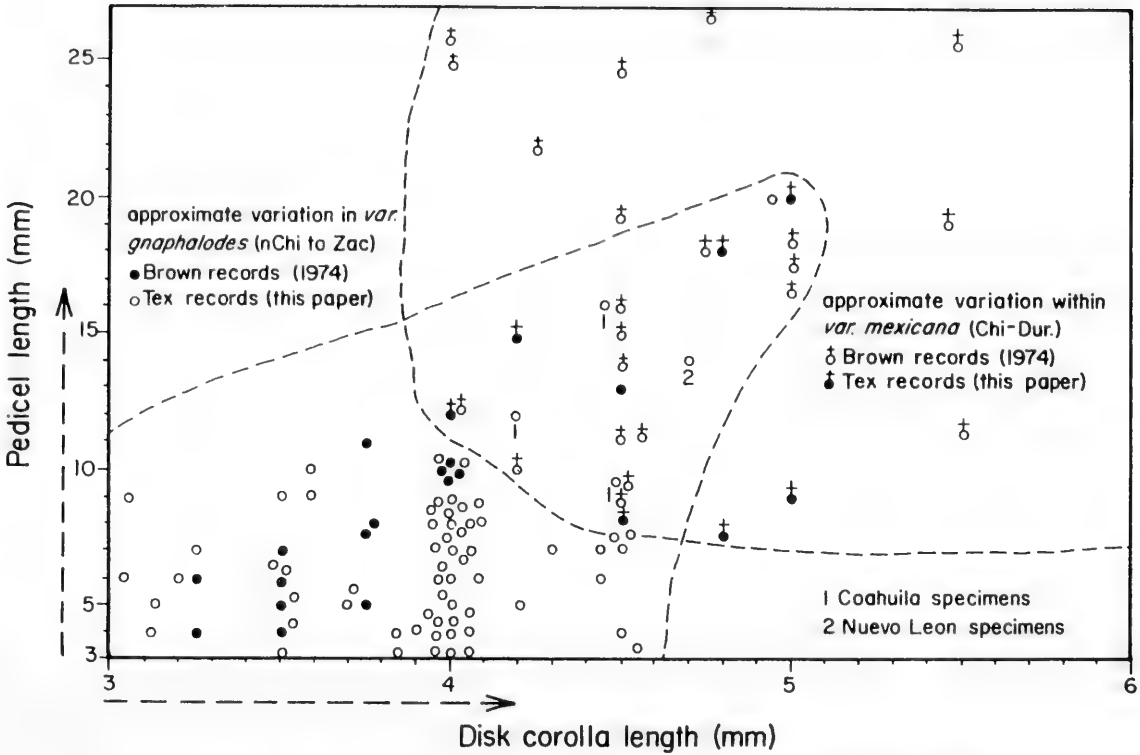

Figure 13. Scatter diagram of var. *mexicana* and var. *gnaphalodes*

NEW COMBINATIONS IN CALEA AND TETRACHYRON (ASTERACEAE-HELIANTHEAE)

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The following new combinations are proposed for an upcoming treatment of the Asteraceae of Mexico (Turner and Nesom, in prep.)

CALEA OAXACANA (B. Turner) B. Turner, comb. nov.

Based upon Tetrachyron oaxacanum B. Turner, Phytologia 60:251.1986.

This taxon appears to stand somewhere between the genera Calea and Tetrachyron. When publishing this I followed the suggestion of Dr. L. E. Urbatsch (pers. comm.) who thought the species closer to Tetrachyron than Calea. Subsequently J. Pruski (pers. comm.) has convinced me that it is perhaps closer to Calea where it would presumably relate to C. ternifolia. At least it has vegetative features, as well as involucral and pappus characters of the latter species, although it differs markedly in floral features.

TETRACHYRON WEBSTERI (Wussow & Urbatsch) B. Turner, stat. nov.

Based upon Tetrachyron orizabaensis var. websteri Wussow & Urbatsch, Syst. Bot. 4:313.1979.

Wussow and Urbatsch (1979) treated this taxon as but a variety of T. orizabaensis. However, T. websteri is markedly different from the latter, in a number of characters, having fewer larger heads on longer peduncles; the involucres also possess longer, subequal, phyllaries and the ray ligules are much longer. The two occupy different geographical regions and their ranges do not overlap, nor do intergrades between these appear to occur. In short, they appear to be good, albeit closely related, morphogeographical species.

LITERATURE CITED

Wussow, J. R. and L. E. Urbatsch. 1979. A systematic study of the genus Tetrachyron. (Asteraceae: Heliantheae). Syst. Bot. 4:297-318.

Studies on Mikania (Compositae)-XV

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The present paper describes three new species of Mikania (tribe Eupatorieae) from Colombia and is preliminary to a general treatment of the genus for that country. The most recent treatment of the genus for Colombia is that of Robinson (Contr. Gray Herb. 64:21-116. 1922), a work in which 32 species are recognized. Presently, over 60 species of Mikania are known to occur there (Holmes in prep.).

Mikania cuatrecasasii W.Holmes, sp. nov. (fig. 1).

Suffrutex volubilis; foliis ellipticis vel ovato-ellipticis, 10-17 x 2.7-5 cm, apice acuminatis, basi attenuatis, marginibus integris. Capitulescentiis corymbosis. Capitulis 7-8 mm longis. Corollis 4.3-4.7 mm longis, dentibus limbi lanceolatis, 1-1.3 mm longis. Pappis setis 30-35, ca. 5 mm longis. Achaenis ca. 1.5 mm longis.

Twining vine. Stems terete, costate, glabrate, pithy; internodes to 23 cm or more long. Leaf blades elliptic to ovate-elliptic, 10-17 x 2.7-5 cm, subpinnately 5-nervate, the first pair of nerves rather obscure, originating at the very base of the blade, arching forward and somewhat parallel to the margins, the second pair originating within 1.5-2 cm of the base, more conspicuous than the first pair, imparting a trinervate appearance, arching forward parallel to the margins, and extending nearly to the apex; the tertiary veinlets forming a somewhat obscure, slightly antrorse disposed pattern; apices acuminate; margins entire; bases attenuate; surfaces glabrous; petioles 1-1.5 mm long, glabrous. Capitulescence a trichotomously branching corymb, both axillary and terminal, ca. 10 x 11 cm; branchlets striate, glabrate to puberulent; bracts narrowly elliptic, 1-2 cm long, petiolate, similar to cauline leaves but reduced in size. Heads 7-8 mm long, sessile, ternately disposed; subinvolucral bracts ovate, 1-1.5 mm long, glabrous, apices acute, hispid, those of the outer pair of heads (of the sessile groups of threes) borne at the very base of the involucre, those of the center head borne slightly separated from the involucre. Phyllaries oblong-elliptic, ca. 7.2 mm long, glabrous, apices rounded, hispid, bases slightly swollen. Corollas (immature) white, 4.3-4.7 mm long; tube 1.7-2 mm long; throat tubular, 1-1.5 mm long; teeth lanceolate, 1-1.3 mm long. Pappus bristles white, 35-40, ca. 5 mm long, apices slightly thickened, margins scabrid. Achenes (immature) ca. 1.5 mm long.

TYPE: Colombia, Del Valle, Costa del Pacífico, río Yurumangui, El Papayo, bosques, 10-100 m, 5 Feb 1944, Cuatrecasas 15995 (holotype: F; isotypes: COL, F). Paratype: Colombia. Chocó: carretera Quibdó-

Guayabal, Duata, margen derecha de río Duata, 40 m, 27 Apr 1975, Forero, Jaramillo, & McElroy 1261 (COL).

Mikania cuatrecasasii is characterized by its trichotomously branching corymbs with ternately disposed sessile heads. The capitulescence indicates affinities with the Mikania parviflora (Aubl.) Karst. alliance (Robinson, Contr. Gray Herb. 64:3-21.1922). Most species in this group have much broader leaves than the species described above. Mikania cuatrecasasii appears to be the only member of the group with narrow leaves that has corolla teeth about the same length as the throat.

Mikania longicarpa W. Holmes, sp. nov. (fig. 2).

Suffrutex volubilis. Foliis ovatis, 5-9 x 3-4.3 cm, apice acutis vel acuminatis, basi rotundis, marginibus integris. Capitulescentiis paniculis, 4-15 x 9-25 cm. Capitulis ca. 10 mm longis. Corollis ca. 4 mm longis, dentibus limbi deltatis, 0.7 -1 mm longis. Pappi setis 30-35, ca. 4.5 mm longis, scabridis. Achaenis 4-5 mm longis.

Semiwoody twining liana. Stems terete, striate, glabrate. Leaves ovate, 5-9 x 3-4.3 cm; apices acute to acuminate, margins entire, bases rounded to acute; pinnately veined; above glabrous, the nerves impressed, below glabrate, reticulate, the nerves and veinlets exserted from the surface; petioles 1-2 cm long, glabrous. Capitulescence a panicle; 4-15 cm wide and 9-25 cm or more long; heads mostly clustered toward the tips of the branchlets in a (roughly) racemose pattern; branchlets striate, puberulent; ultimate branchlets 1-2 mm long, puberulent. Heads ca. 10 mm long; subinvolucral bracts linear-oblong, 2-3.5 mm long, glabrous, apices acute, borne slightly to well beneath the involucre. Phyllaries linear-oblong, 7-8 mm long, glabrous, striate, apices acute (often rounded in the immature state), slightly puberulent. Corollas ca. 4 mm long; tube 1.3 mm long; throat campanulate at anthesis, 1.7-2 mm long; teeth deltate, 0.7-1 mm long, slightly puberulent. Pappus bristles white, 30-35, 4.5 mm long, margins scabrid, apices slightly thickened. Achenes 4-5 mm long, dark brown, glabrate to sparingly pilose.

TYPE: Colombia, Boyacá, Tota, 2800 m, Dec 1951, Yepes-Agredo 3327 (holotype: COL). Paratypes: Colombia. Boyacá: Municipio de Tunja - Santuario de Iquaque, 30 Aug 1979, Michael 528 (COL); Cundinamarca: Municipio de Junín, Parama de Guasca, 3200-3300 m, 9 Nov 1979, Diaz 1713 (COL); La Vega - Fucatativa Highway, along stream at 2700 m, 5 Sep 1947, Haught 6152 (COL); Municipio de Boyacá, Vereda de San Antonio - "La Merced," proximo a la carretera Mosquera - Tena, 2500-2700 m, 6 Oct 1964, Lozano & Torres 166 (COL).

The new species appears to be related to Mikania lehmannii Hieron., also of Colombia. That species is distinguished from Mikania longicarpa by its more corymbosely disposed panicle composed

of strictly sessile heads.

Mikania tristachya W. Holmes, sp. nov. (fig. 3).

Suffrutex volubilis; foliis verticillatis ovatis, ad 9 x 4 cm, apice acuminatis, basi rotundis, marginibus integris. Capitulescentiis spicato-glomeratis. Capitulis 6-6.5 mm longis. Corollis ca. 3 mm longis, dentibus limbi lance-ovatis, ca. 0.75 mm longis. Pappi setis 33-37, ca. 3.3 mm longis, scabridis. Achaenis ca. 2.6 mm longis.

Slender twining vine. Stems sulcate, glabrous, fistulose. Leaves verticillate (3 at a node), blades ovate, ca. 9 x 4 cm, pinnately nerved with two pairs of secondary nerves originating in the basal one-third of the blade, these arching forward and generally parallel to the margins; apices acuminate; margins entire; bases rounded; upper surfaces glabrous, tertiary nerves rather prominent, forming a slightly antrorse disposed pattern, veinlets reticulate, exserted brom the surface; lower surfaces glabrous, veinlets more prominently reticulated than above; petioles ca. 1 cm long, glabrate, flattened above. Capitulescence a terminal and lateral panicle, ca. 4 x 3 cm, branching trichotomously, borne on puberulent peduncles of up to 10 cm long, these shortened upwards; heads sessile, clustered in spicate glomerules ca. 1-1.5 cm long; bracts similar to cauline leaves but reduced in size. Heads 6-6.5 mm long; subinvolucral bracts narrowly ovate, 2-2.5 mm long; phyllaries elliptic-oblong, ca. 5.5 mm long, glabrous, apices obtuse to rounded, bases slightly swollen. Corollas ca. 3 mm long; tube ca. 1.5 mm long; throat semicampanulate, ca. 0.75 mm long; teeth lance-ovate, ca. 0.75 mm long. Pappus bristles white, 33-37, ca. 3.3 mm long, apices slightly enlarged, margins scabrid. Achenes ca. 2.6 mm long, dark brown to blackish, angles white.

Type: Colombia, La Guajira, forest, 12 km south of Carraipía, 450 m, 31 Jul 1944, Haught 4281 (holotype: US; isotype: COL).

The new species is characterized by its verticillate leaves and long pedunculate capitulescence with the heads borne in spicate glomerules. The nature of the capitulescence indicates affinity to Mikania hookeriana DC., a species with opposite leaves having more palmate nervation and phyllaries with very conspicuously swollen bases.

The only other Colombina Mikania known to have spicately disposed heads and verticillate leaves is M. simpsonii W.Holmes & McDaniel, a species originally described from Peru. It is distinguished by the heads being remotely spaced on the rachis of the spikes.

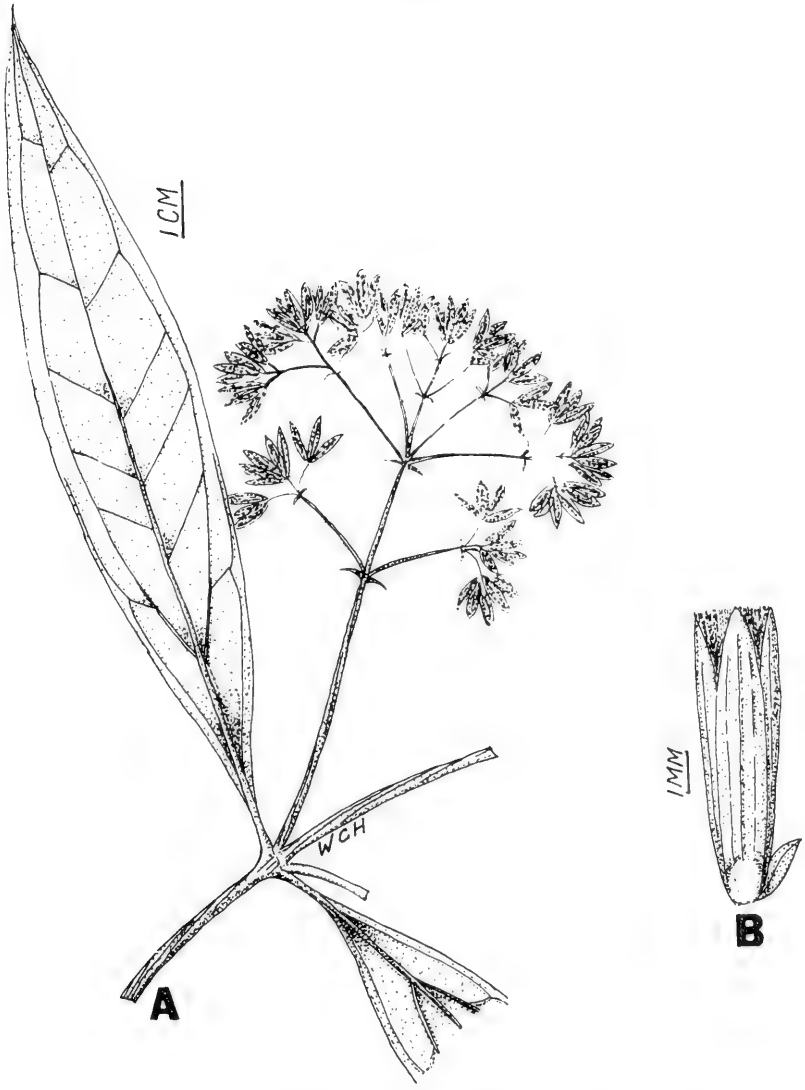

Fig. 1. Mikania cuatrecasasii W. Holmes. A. habit (leaf and capitulescence; b. capitulum.

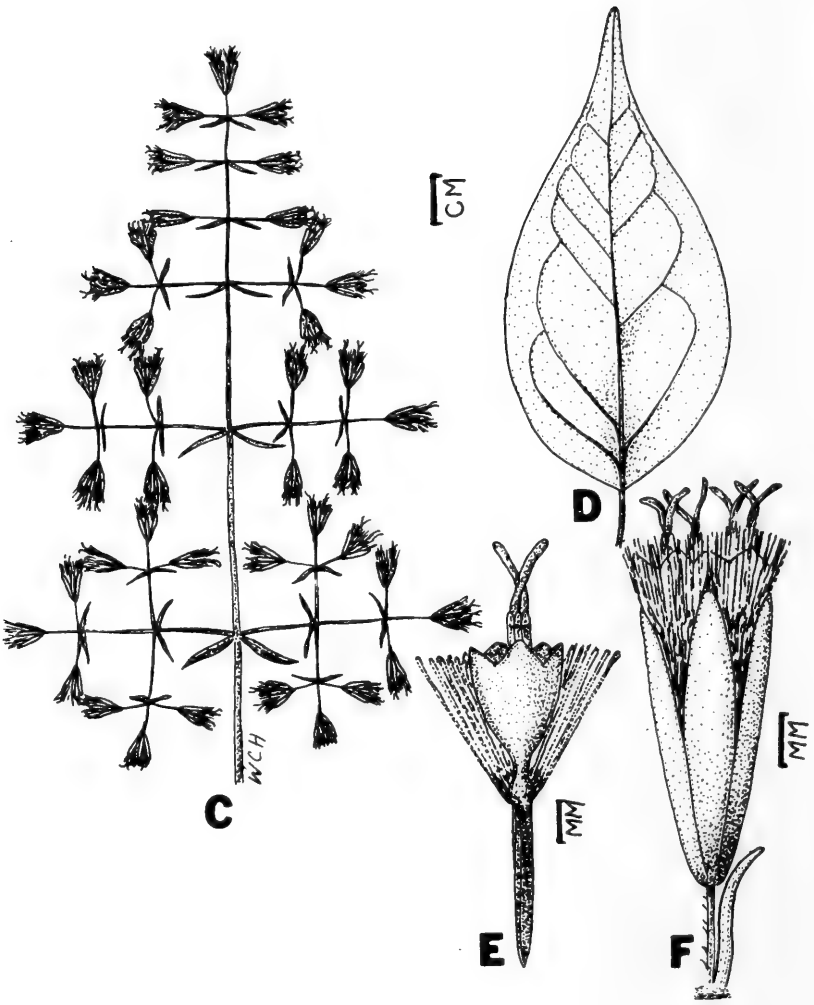

Fig. 2. Mikania longicarpa W. Holmes. C. capitulescence; D. leaf; E. flower and achene; F. capitulum.

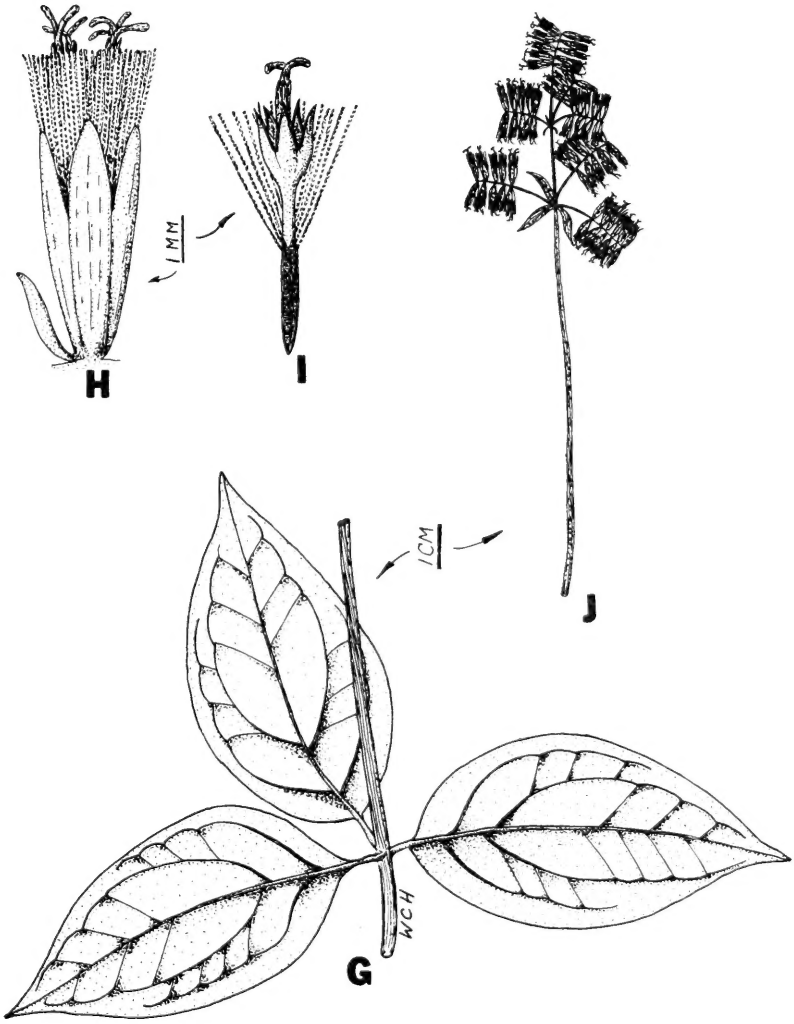

Fig. 3. Mikania tristachya W. Holmes. G. leaves and stem; H. capitulum; I. flower and achene; J. capitulescence.

BOOK REVIEWS

Alma L. Moldenke

"INVENTORY OF RARE AND ENDANGERED PLANTS OF CALIFORNIA" 3rd Edition, edited by James Payne Smith Jr. & Richard York, xxiv & 174 pp., 1 map & 4 appendix tab., California Native Plant Society, Berkeley, California 94704. 1985. $10.95 paperbound + $1.50 postage.

"California's flora, its rare plants especially, are increasingly threatened by the spread of cities, towns, and roads, by our conversion of land to agriculture, and by pollution.... The California Native Plant Society hopes by providing location and status information on rare and endangered plants, we will have made a contribution toward saving them. This Inventory should not become an obituary list." List IA has plants presumed extinct in California with year last seen and location indicated on a detailed grid map. Then there are lists of different status rare plants with common, scientific and family names, county, map quad(s), and any special notes. These updated careful studies and alerted group and student members should hopefully "rescue the perishing".

"THE BIOLOGY COLORING BOOK" by Robert D. Griffin - text & Cinthea Vadala - illustrations, x & 233 pp. with 111 pl., Harper & Row, New York, N.Y. 10022. 1986. $10.95 paperbound.

"The coloring activity is ... an integral part of what has proved to be a highly effective learning method. First you will color a heading or a title, which requires you to take a close look at the word and even its spelling. Then, with the same color, you will color the associated parts." The text covers the information typically presented in a high school course in biology, but it should not be a substitute for a regular text. In most public schools budgeting would not permit adding these "work books". It could be used effectively in a private school or for hospital or home study pupils. This idea would be more useful in a zoology or botany course stressing comparative anatomy.

Inasmuch as we do no editing, papers accepted for publication *must* be submitted in *exactly* the form that the author wants to have them published. They will then be photographed and printed by photo-offset in exactly the form as submitted except that we will add page numbers and running-heads.

Typescripts should be prepared single-spaced on clean white heavy bond smooth and opaque paper. Elite type is probably the most space-economical. Typescript text must not exceed a rectangle 5⅝ inches wide (horizontal) by 8⅝ inches high (vertical), not including the running-head and page number.

The title of the paper should be typed in all uppercase (capital) letters with 2 blank lines above the title and one beneath; then the name of the author in ordinary upper- and lower-case letters, along with his address (if so desired); followed by 2 blank lines; then the first line of text. It is usually best to leave a blank line between paragraphs.

All scientific plant and animal names and group names should be typed either in italic type (if available) or underscored. Any corrections in the text made by the author must be complete and neat as they will be photographed as they are.

The finished typescript as submitted by the author will be reduced from the 8⅝ x 5⅝ inch size as submitted to 6⅛ x 4 inches by the printer. It is therefore advisable to place a centimeter or millimeter scale on all text figures and plates included.

Use a *new* heavily inked black typewriter ribbon and be sure to *clean* the type on the typewriter after each several pages of typing.

Cost of publication at present is $12.00 US per page, with no subsequent rebates, but this rate may vary depending on inflation and costs, so it is best to inquire as to current rates. The page charges are due *with* the typescript and no paper will be published before payment is received in full. Each author will receive gratis a proportionate share of the printed copies remaining after paid subscriptions are filled, but if separates (reprints or offprints) are desired, these will be charged extra in accord with the current rate for offprints provided by the printer. The cost of all such separates ordered must also be paid for in advance at the time the typescript is sent. No orders for separates will be accepted later, nor can additions or corrections be accepted.

Authors are asked to indicate in light pencil on the *reverse* side of each page of their typescript the page number so that no mistakes in sequence occur.

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Articles dealing with research in all lines of botany and plant ecology, in any reasonable length, biographical sketches, and critical reviews and summaries of literature will be considered for publication.