PHYTOLOGIA

An international journal to expedite botanical and phytoecological publication

Vol. 65 September 1988 No. 2

CONTENTS

(continued over)

Published by Harold N. Moldenke and Alma L. Moldenke
590 Hemlock Avenue N.W.
Corvallis, Oregon 97330-3818
U.S.A.

Price of this number $3.00; for this volume $16.00 in advance or $17.00 after close of the volume; $5.00 extra to all foreign addresses and domestic dealers; 512 pages constitute a complete volume; claims for numbers lost in the mail must be made immediately after receipt of the next following number for free replacement; back volume prices apply if payment is received after a volume is closed.

INVESTIGATIONS ON STOMATA AND STOMATAL CLUSTERS IN BEGONIA:

A Possible Stomatal Indicator of Tropical Seasonal Climate Change

W. Scott Hoover
Research Associate
Missouri Botanical Garden
718 Henderson Road
Williamstown, MA 01267

ABSTRACT

An initial investigation of stomatal length and leaf age in a population of Begonia nelumbiifolia Cham. and Schlect. from northeastern Hidalgo, Mexico suggests stomatal length may be an indicator of seasonal climatic change. At five sample sites, adult leaves have medium sized stomata, and young leaves have the smallest stomata.

Several ecological and climatic factors appear to causally affect stomatal size in this Hidalgo B. nelumbiifolia population. These factors include: 1) the life zone category at the Hidalgo site is considered tropical premontane wet forest and one distinguishing characteristic of this life zone is a semi-deciduous canopy, thus reflecting a distinct dry season; 2) at the upper elevation limit in the B. nelumbiifolia population, the premontane wet forest graduates into pine/oak forest, suggesting ecotone type habitat conditions may prevail through the population; 3) the northernmost limit of any tropical rainforest life zone in the New World tropics is within about 75 kms of this Hidalgo B. nelumbiifolia population, further implying the possibility of unusual ecological and climatic conditions.

INTRODUCTION

In recent years several reports describe morphological indicators of climatic or environmental change. Some examples include the following: oxygen-isotope ratios in trees reflect annual temperature and humidity values (Burk and Stuiver 1981). Chondrites, a trace fossil of possible nematode affinity, indicates the presence of anoxia in sediments (Bromley and Ekdale 1984). Paleoclimatological studies concerning leaf physiognomy reflect microclimatic conditions under which the plants grew (Davis and Taylor 1980). The annual growth patterns in the bivalve mollusk Spisula solidissima record temperature variations in marine waters (Jones 1981); and possibly the most widely recognized method for indicating climate variations is dendochronology (Stokes and Smiley 1968; and Fritts 1976).

Stomatal size and density are characters within species known to vary significantly depending upon environmental conditions (Meidner and Mansfield 1968 and Zeiger et al. 1987). Increased stomatal density and reduced guard cell length are reported to accompany xerophytic Israelian trees

(Gindel 1969). Populations of Danthonia sericea, growing on dry, sandy, upland sites in the New Jersey Pine Barrens are known to have a higher stomatal frequency than populations growing in low, boggy areas (Clay and Quinn 1978). When Kalenchoe fedschenkoi was subjected to different experimentally designed habitats, stomatal frequency was reported to be lowest under humid conditions (Sharma and Dunn 1968). Frequency of single stomata, stomatal density, and stomatal length in B. nelumbiifolia were characters correlated with elevation in samplings from various areas of tropical forest in Mexico (Hoover 1986).

In this paper, data are presented suggesting that stomatal size in Begonia nelumbiifolia varies with tropical seasonal climate changes and thus may serve as a morphological indicator of such seasonal changes. This conclusion is based on a statistical analysis between leaf age and stomata length in population samples along an elevational gradient in Hidalgo, Mexico.

SAMPLE SITES AND METHODS

In October 1979, a large population of B. nelumbiifolia was located on steep embankments and cliffs above the highway between Chapulhuacan and Jacala, in the state of Hidalgo (Fig. 1), an area from which numerous herbarium specimens have been collected (Burt-Utley 1985). Five sites from the B. nelumbiifolia population were sampled at different elevations, 1080 m, 990 m, 839 m, 704 m, and 420 m; these sample sites respectively are referred to as TM1 - TM5.

The vegetation zone for samples TM1 - TM5 in Hidalgo is Bosque Mesofolio de Montana, according to Rzedowski's 1978 system of classification. In Holdridge's et al. (1971) system of classification, the sample sites would be Tropical Premontane Wet Forest, based on general observations of the canopy, ground layer, and density of epiphytes within the forest. Of importance is the observation that several kms past TM1 the Premontane Wet Forest grades into pine and oak forest, or in Rzedowski's (1978) terminology, Bosque Coniferas et Quercus.

In the field, three healthy individual plants from similar microhabitats were selected for sampling at each site. Three leaves from each plant were chosen and the leaves were determined by the position on the rhizome to be old, adult (recently mature) and young (developing). From each individual leaf three areas were selected for sampling, one each from the apex, mid-section and basal area. The sampling procedure involved painting colorless Revlon fingernail polish on a 50 mm^2 area of the lower surface for each of the described locations, waiting for the epidermal peel to dry, then removing it with forceps. From each sample site 27 epidermal peels were collected; thus, 135 peels for all sites. Using the position method for distinguishing between different leaf ages provided a

degree of standardization, though tagging individual plants and observing them over a period of several years is preferable, but lacks practicality for an initial inquiry; the author felt the best approach was first to determine if any generalized trends were apparent in the data. It should be noted that Reich and Borchert (1988), in their study of stomatal function and leaf age in several tropical trees, employed two methods for sampling tree leaves: one method was based on the different times when individual trees flushed, and the other method involved sampling trees that retained several flushes, which is similar to the method employed in this study. Epidermal peels were analyzed in the laboratory using an Edmund Scientific Microprojector. A screen was placed in front of the projector at a measured distance, stomata length measurements were made in millimeters, and converted to microns. Fifteen stomatal measurements per epidermal peel were made. All data were entered into the Harvard University Science Center computer. The specific statistical test utilized, an F-test of Variation, was carried out on this machine using the Minitab program.

RESULTS AND DISCUSSION

B. nelumbiifolia is a herbaceous perennial with a creeping, rhizome-like stem, and every year drops several leaves. This species has one of the widest geographical distributions of any species in the Section Gireoudia, to which it is assigned, and ranges from Mexico to Colombia, though has not been collected in Honduras or Nicaragua (Burt-Utley 1985, Smith and Schubert 1946). The occurrence of B. nelumbiifolia in Hidalgo and adjacent San Luis Potosi represents the northern geographical range of the species as it is presently reported (Burt-Utley 1985).

The F-tests for determining variation among leaf ages and stomatal size at each site indicate high degrees of significance (Fig. 2).

At the five sample sites for this Hidalgo population of B. nelumbiifoiia the old leaves have the largest stomata, while adult leaves indicate moderate sized stomata at four sites, with young leaves having the smallest sized stomata at four sites also (Fig. 2). The exception to the trend is found between the adult and young leaves at site TM2, where the young leaves exhibit larger stomata than do the adult leaves.

Several factors may be suggested to explain this observed stomatal size variation with leaf age. Premontane wet forest is characterized by a semi-deciduous canopy, which indicates the presence of a distinct wet and dry season (Holdridge et al. 1971). The onset of dry seasonal conditions in the tropics causes varied response from organisms: fewer insects are flying, less activity of decomposers on the forest floor, fewer birds and mammals breeding, and, of course, particular species of trees shedding their leaves. Many plant species indicate specific phenological rhythms in response to the climatic conditions brought on by the dry season (Leigh et al. 1980). Thus, it is possible that B. nelumbiifolia exhibits a rhythmic variation in stomatal size in response to these climatic variations. Other

species of Begonia in the section Gireoudia indicate an increased thickening of the hypoderm in response to the onset of the dry season, which may serve the temporary function of storing water (Burt-Utley 1985). Also, the pine and oak forest several kms past TM1 suggests the possibility of an ecotone type habitat where environmental conditions from both forest types overlap. The effect of ecotone habitat conditions would not likely be limited to just sample site TM1, but could extend for several kms into both forest types and thus would affect other sample sites as well. Ecotone conditions may further exaggerate the effect of a dry season and dramatically affect stomatal size in B. nelumbiifolia. The stomata on leaves developing during the rainy season may be consistently different in size compared to stomata developing during the dry season, and likewise stomata developing during the transition of seasons may exhibit a distinct size variation as well.

According to Rzedowski's map (1981), the Bosque Mesofolio de Montana of northeastern Mexico extends as a thin strip through Hidalgo and terminates about 75 kms past Chapulhuacan at a latitude of 22°N. Samples TM1 - TM5 were collected between 21°N and 21°20'N latitude, which is about 40' from the northernmost limit of this forest type in the New World tropics. Considering this population of B. nelumbiifolia is found so far north may further assist in explaining stomatal size variation with leaf age. This rainforest may experience more variable climatic fluxes than tropical forests of a similar type further south. These B. nelumbiifolia data suggest a stomatal indicator of tropical climate variation in Hidalgo and it will be interesting to determine if such a morphological character has applicability throughout other regions of the tropics.

ACKNOWLEDGMENTS

This work was supported by The American Begonia Society and several branches, including the Buxton, Chicago, Southwest Region, Potomac, Miami, Connecticut, Minnesota, Sacramento, Theodosia Burr Shepard, Palomar and Alamo. A number of individuals have been instrumental in sustaining my field work on Begonia over the past ten years: Barbara and Howard Berg, Mabel Corwin, Joan Coulat, Daniel Hezeltine, Thelma and Tim O'Reilly, Martin Johnson, Barbara Philips and Rudolf Ziesenhenne. I thank Dr. Thomas Givnish for statistical analysis of the data. My appreciation always extends to Drs. Thomas Croat, Bernice Schubert, and Richard Schultes for moral support and logistical help over the past 15 years.

LITERATURE CITED

Bromley, R. G. and A. A. Ekdale. 1984. Chondrites: A Trace Fossil Indicator of Anoxia in Sediments. Science 224:872-874.

Burk, R. L. and M. Stuiver. 1981. Oxygen Isotope Ratios in Trees Reflect Mean Annual Temperature and Humidity. Science 211:1417-1419.

Burt-Utley, K. 1985. A Revision of Central American Species of Begonia Section Gireoudia (Begoniaceae). Tulane Studies in Zoology and Botany 25 (1):1-131.

Clay, K. and J. A. Quinn. 1978. Density of Stomata and Their Responses to a Moisture Gradient in Danthonia sericea Populations from Dry to Wet Habitats. Bull. Torr. Bot. Club. 105 (1):45-49.

Davis, J. M. and S. E. Taylor. 1980. Leaf Physiognomy and Climate: A Multivariate Analysis. Quat. Res. 14:337-348.

Fritts, H. C. 1976. Tree Rings and Climate. Academic Press, London.

Gindel, I. 1969. Stomatal Number and Size as Related to Soil Moisture in Tree Xerophytes in Israel. Ecology 50 (2):263-267

Holdridge, L. R., W. C. Grenke, W. H. Hatheway, T. Liang, and J. A. Tosi, Jr. 1971. Forest Environments in Tropical Life Zones: A Pilot Study. Pergamon Press, San Francisco.

Hoover, W. S. 1986. Stomata and Stomatal Clusters in Begonia: Ecological Response in Two Mexican Species. Biotropica 18 (1):16-21.

Jones, D. S. 1981. Annual Growth Increments in Shells of Spisula Solidissima Record Marine Temperature Variability. Science 211:165-167.

Meidner, H. and T. A. Mansfield. 1968. The Physiology of Stomata. McGraw-Hill, New York.

Leigh, E. G., A. S. Rand, and D. M. Windsor. 1982. The Ecology of a Tropical Forest: Seasonal Rhythms and Longer Term Changes. Smithsonian Institution Press, Washington, D. C.

Reich, P. B. and R. Borchert. 1988. Changes with Leaf Age in Stomatal Function and Water Status of Several Tropical Tree Species. Biotropica 20 (1):60-69.

Rzedowski, J. 1978. Vegetacion de Mexico. Editorial Limusa, Mexico.

Sharma, G. K. and D. B. Dunn. 1968. Effect of Environment on the Cuticular Features in Kalanchoe fedschenkoi. Bull. Torr. Bot. Club 95 (5):464-473.

Smith, L. B. and B. E. Schubert. 1946. Begoniaceae of Colombia. Caldasia 4 (16):3-38.

Stokes, M. A. and T. L. Smiley. 1968. An Introduction to Tree-ring Dating. University of Chicago Press, Chicago.

Zeiger, E., G. D. Farquhar, and I. R. Cowan. 1987. Stomatal Function. Stanford University Press, Stanford, Calif.

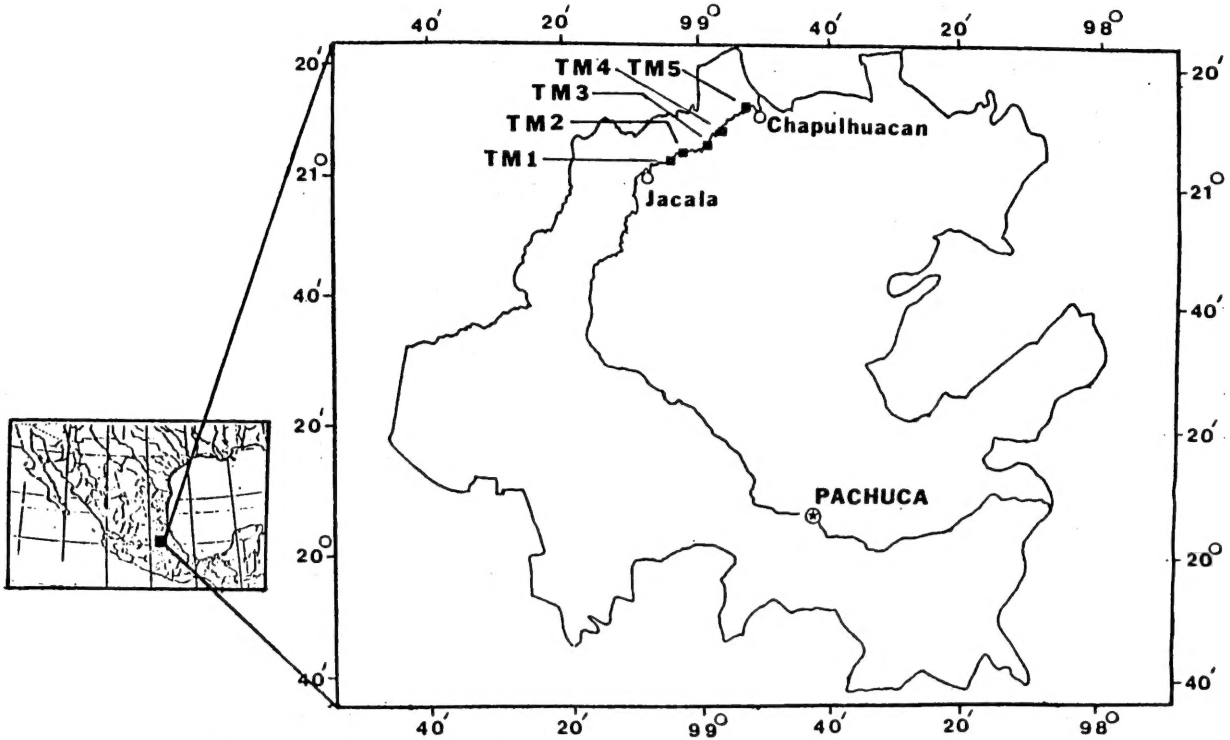

Fig. 1 - Geographical locations of B. nelumbiifolia sample sites in Hidalgo, Mexico.

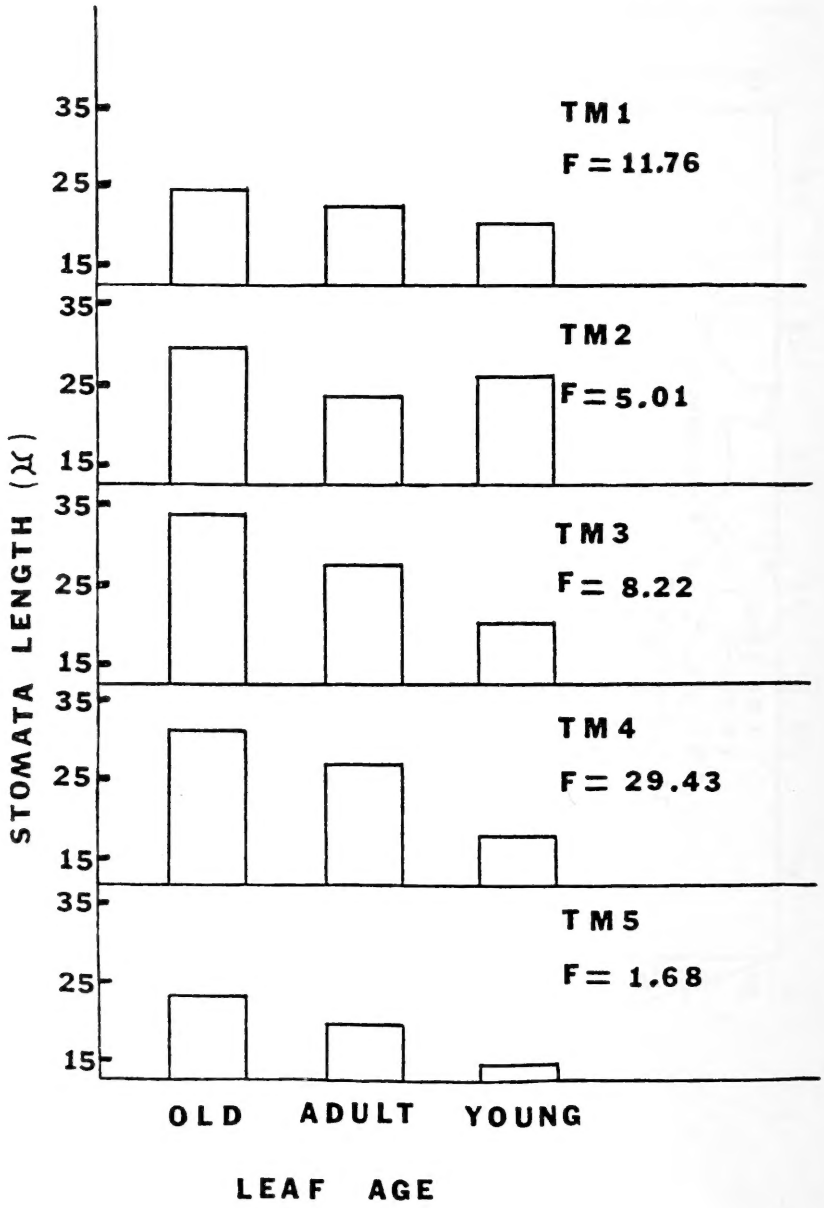

Fig. 2 - Stomata length and leaf age analysis in B. nelumbiifolia population samples.

OBSERVATIONS ON COLONIES AND ON SEEDLING GROWTH OF APPARENT HYBRIDS BETWEEN *ERYTHRONIUM ALBIDUM* AND *E. PROPULLANS*

Thomas Morley
Department of Botany, University of Minnesota, St. Paul, 55108

ABSTRACT

Two colonies of apparent hybrids between *Erythronium albidum* and *E. propullans* are described, one colony mostly like *E. propullans* but with some characters of *E. albidum*, the other the reverse. Seeds from *E. propullans* of probable hybrid origin were planted and the resulting seedlings grown for 6-8 years, with great attrition. Non-flowering bulbs of these plants occasionally divided, a trait of *E. albidum*. One plant has bloomed to date, showing hybrid characters but lacking the offshoot of *E. propullans*. Occasional dormancy of transplanted bulbs was noted. Figures on bulb multiplication are given.

While studying *Erythronium propullans* Gray and *E. albidum* Nutt. in the field in 1980 the author discovered a hillside with several colonies that appeared to be hybrids between these species. Two of these colonies were studied in some detail, and are reported on here. The hillside is the north-facing slope of a bluff overlooking the Cannon River in Rice County, Minnesota; its general legal description is T 110 N, R 20 W, S 1/2 SE 1/4 sec. 17. The site is in the north-central part of this tract; its owner is D. Borgstahl.

The first colony is near the top of the slope. Approached from above, it was conspicuous by its violet flowers. Examination of the plants suggested a possible hybrid origin, so they were studied further. (See Banks, 1980 and Morley, 1978, 1982 for morphological distinguishing characters of the two species.) Most of their characteristics were those of *E. propullans:* the stems of the flowering plants bore offshoots; the tips of the leaves of the flowering plants had narrow angles; 42% of the

plants in the colony were flowering; and the flowers were frequently tetramerous. However, the blooming time was synchronous with that of the *E. albidum* colonies in the vicinity, not with those of *E. propullans;* the large leaves were the size of *E. albidum* leaves; and the non-flowering plants that were dug bore rapidly growing runners, often two each. The tepals and peduncles were intermediate in length. The light violet to pink violet tepals I have not seen in either species.

When the same colony was visited in 1988 it appeared much the same but no non-flowering plants with runners were found. Whether due to the previous dry winter and spring or some other cause is unknown.

The second colony, a small one, was situated part way down the slope and appeared in all respects to be typical of *E. albidum*, even on close inspection. Leaf size, runner formation from the non-flowering bulbs, peduncle length, tepal color and size were unquestionable. However, the proportion of flowering to non-flowering plants seemed unduly high for the species, so a count was made. 27% of the plants were in bloom, a number typical of *E. propullans* but outside the range for *E. albidum* which is 1-10. The range for *E. propullans* is 11-51. At first the 27% was taken as an extension of the range of that feature for *E. albidum*. However, while digging to check the runners it was discovered that each flowering stem bore a small rudimentary offshoot ca. 3-5 mm long. This can only mean that some genes of *E. propullans* were present, thus accounting for the high proportion of flowering plants as well as the abortive offshoot. Offshoots of *E. propullans* at this time had well-developed runners. The general resemblance of the plants to those of *E. albidum* gave the impression that the colony represented some stage in introgression from *E. propullans*. When searched for in 1988, this colony could not be found, although there were a few non-flowering plants in the vicinity.

Previously (1982) the author pointed out that the flowering frequencies of *E. albidum* he encountered in the range of *E. propullans* were much higher than those cited by others for other states. It appears possible that introgression from *E. propullans* is responsible for the difference. Banks (1980) pointed

out that *E. albidum* is 73% fertile when pollinated with *E. propullans* pollen, so there would appear to be ample opportunity for introgression. Banks found that plants of *E. propullans* rarely if ever form seed when pollinated by their own pollen, whether selfed or outcrossed to other clones or populations; however, she did demonstrate 20% fertility when pollen of *E. albidum* was used. Because the fertility of*E. albidum* when pollinated by *E. propullans* is higher than that of the latter in the reverse cross, there would be more F_1's and thus more opportunities for backcrosses in the general populations of *E. albidum* than in those of *E. propullans*. The pollinating insects also prefer flowers of *E. albidum*, Banks learned. If the F_1 produces no offshoot, as suggested by the plant raised to flower from a presumed hybrid seed (see below) then the F_1's would be hard to recognize in a population of *E. albidum* and the backcrosses would often pass undetected.

Because of the near total sterility of conspecific crosses in *E. propullans*, when fruits are occasionally found on plants of *this species* these are assumed to result from pollination by *E. albidum*, at least in the great majority of cases. The author undertook to verify this interpretation in practice by collecting and growing seeds from wild plants of *E. propullans*. Seven seeds were collected in 1980, 44 in 1981, and 48 in 1982, from four different localities, not attempting to keep separate the seeds of different plants within one locality. Germination and subsequent attrition are shown in Table 1.

Germination took place the first year when it did occur; it varied from 0-69% per pot and 8-59% per locality. Attrition of the seedlings was very great, perhaps influenced by the unnatural environment. Most of the seedlings were very weak and brittle, and some broke off accidentally when weeding the pots. By 1988 only two plants produced leaves, a 11% survival rate for the 1981 seedlings, the best year of the three. Presumably the rest of the plants are dead, although some may be dormant. For a short time in the winter of 1987-88 and possibly that of 1986-87 there was improper cold protection for the pots which may have permitted some losses.

Table 1

Year collected	1980	1981			1982		
No. seeds per pot	7	17	14	13	16	16	16
No. seedlings							
first year	1	2	7	9	6	2	0
Second year	1	2	6	6	6	2	0
Third "	1	2	6	5	6	2	0
Fourth "	1	1	3	2	6	**3**	0
Fifth "	0	1	3	**3**	0	1	0
Sixth "	0	0	2	**2**	0	0	0
Seventh "	0	0	2	0			
Eighth "	0						

The bold face underlined numbers in Table 1 indicate years when more seedlings appeared than were present the year before. In the example in the fourth column one cannot tell if the additional plant was dormant the preceding year or if it was produced by division of one of the two existing bulbs. Leaf widths the year before were 15 and 20 mm, and the next year they were 9, 25, and 33 mm. The 9 mm leaf does not fit the growth pattern and its bulb may have been dormant. In the second example of increase in number, the third plant must have been produced by the division of one of the two original bulbs. The three leaves measured 15, 16, and 25 mm wide, so presumably the smallest two are the products of that division. Bulb division in non-flowering plants never occurs in *E. propullans* it is common in *E. albidum*. Therefore the occurrence of such a division in a plant raised from seed from an *E. propullans* plant is evidence of the hybrid nature of the former plant.

Only one plant has bloomed, in its sixth year, one of the two in the double-underlined numeral 2 in the third column of 1981. Probably an F_1 hybrid, its leaf tips were inrolled, as in *E. propullans*; its whitish tepals were 15 mm long, a length intermediate between those of the two species, but it bore no trace of an offshoot, the major feature of *E. propullans* .

Most transplanted bulbs leafed out regularly, but sometimes they lay dormant for one or two years. In four cases bulbs were dormant for one year after transplanting. In one instance a bulb was dormant for two consecutive years after having leafed out its first year; and in the case of a plant of *E. propullans* that bloomed in 1984, producing two bulbs from one in the process, both were dormant the following year and leafed out the next. Dormancy after flowering did not occur in the seven other examples noted. The causes of dormancy are unclear but probably include available moisture and amount of stored food. Mycorrhizal fungi probably aid in the nutrition.

A few figures on multiplication of bulbs are available from this work. All bulbs were planted in 1980. The bulb increase is based on leaf count only. Five bulbs of *E. albidum* increased to 21 in 1985 and 1986, dropped to 15 in 1987, none in 1988. Of *E. propullans*, one set of three became 8 in 1985 and 1986, 2 in 1987, none in 1988. Another set of three produced 13 by 1986, then dropped to zero. A single bulb remained so until 1986 when there were two, then none. The abrupt decreases are probably due to failure to re-pot in 1985 and in 1986 to a failure to sink the pots deeply enough when they were moved. The results suggest that under good conditions *E. propullans* could nearly hold its own with *E. albidum* in vegetative reproduction.

The growth pattern of *E. propullans* in which the flowering bulb produces a second bulb but the non-flowering one remains single was nicely illustrated. In one example three bulbs planted in 1980 produced one flowering and two non-flowering bulbs in 1981, then three and one in 1982, three and four in 1983, and three and seven in 1984. Then the sequence was interrupted by dormancy or death of some of the bulbs. Non-flowering bulbs never divided.

Several colonies of *E. propullans* have been established at the University of Minnesota Landscape Arboretum at Chanhassen, Minnesota. These were started with plants taken from a site near Kenyon in Goodhue County. Three of the colonies are relatively isolated from any other species of *Erythronium* in the garden. Fruits and seeds on plants of these three might

reasonably be presumed to have resulted from pollination within their colonies, and thus to be examples of true seed production by *E. propullans*. Fruits are rare. The one collected contained a single seed which did not germinate. Two others were lost to animals.

Literature Cited

Banks, J. A. 1980. The reproductive biology of *Erythronium propullans* Gray and sympatric populations of *E. albidum* Nutt. (Liliaceae). Bull. Torrey Bot. Club 107: 181-188.

Morley, T. 1978. Distribution and rarity of *Erythronium propullans* of Minnesota with comments on certain distinguishing features. Phytologia 40: 381-389.

--------- 1982. Flowering frequency and vegetative reproduction in *Erythronium albidum* and *E. propullans*, and related observations. Bull. Torrey Bot. Club 109: 169-176.

NEW BOLIVIAN TAXA OF SOLANUM (SECT. PETOTA)

*By C. M. Ochoa**

The following new taxa are being published in connection with the author's forthcoming works on the Potatoes of South America.

Solanum* x *ajanhuiri *Juz. et Buk. f.* ***jancko-ajanhuiri*** *Ochoa f. nov.*
Folia cum foliolis lateralibus 5-6-juga, (2-)3-4 paria interfoliolorum. Caulis et tubercula sine pigmentis. Corolla atro-cyanea. Tubercula fusiformia, subfalcata, albo-cremea. Type: ***Ochoa 3881*** *(OCH), Urmiri, 3750 m alt., prov. Poopó, dept. Oruro, Bolivia.*

Solanum* x *ajanhuiri *Juz. et Buk. var.* ***yari*** *Ochoa var. nov.*
Foliola 4(-5)-juga, 0-1(-2) paria interfoliolorum. Foliola lateralia minora quam foliolum terminale, sessilia vel anguste decurrentia. Cálix acuminatissimus, acumina inaequilonga. Corolla azureoviolacea vel caesia. Type: ***Ochoa 3887*** *(OCH), Urmiri, 3750 m alt., prov. Poopó, dept. Oruro, Bolivia.*

Solanum phureja *Juz. et Buk. f.* ***viuda*** *Ochoa f. nov.*
Pedicelli fortiter pigmentati tamquam calyx. Pedicelli nunc ad 1/3 superum, nunc paululum supra medium articulati. Corolla infuscato-violacea. Tubercula rotunda usque ad oblonga, obscuro-azulviolacea cum areis flavis. Type: ***Ochoa 3536*** *(OCH), Sorata, 2700 m alt., prov. Larecaja, dept. La Paz, Bolivia.*

Solanum phureja *Juz et Buk. var.* ***caeruleus*** *Ochoa var. nov.*
Foliola 4-5-juga, plerumque cum interfoliolis paucis. Articulatio 4-5 mm sub calyce. Corolla dilutecoerulea cum acuminibus albis. Type: ***Ochoa*** *et* ***Salas 14973*** *(OCH; CIP, F, isotypes), Queara, 3350 m alt., prov. Franz Tamayo, dept. La Paz, Bolivia.*

Solanum phureja *Juz. et Buk. var.* ***sanguineus*** *Ochoa var. nov.*
Folia obscure viridia, foliola 5-juga, 3-4 paria interfoliolorum. Tubercula longa usque ad oblonga, crassa, rubro-vinosa obscura. Corolla violaceo-nigra. Type: ***Ochoa*** *et* ***Salas 15515*** *(OCH; CIP, isotype), Quime, 2900 m alt., prov. Inquisivi, dept. La Paz, Bolivia.*

Solanum phureja *Juz et Buk. var.* ***flavum*** *Ochoa var. nov.*
Folia pallide viridia, foliola 5-6-juga, elliptico-lanceolata, 3-7 paria interfoliolorum. Articulatio 3-4 mm sub calice. Corolla dilute lilacina. Tubercula rotunda, flava. Type: ***Ochoa*** *et* ***Salas 14970*** *(OCH; CIP, isotype), Queara, 3350 m alt., prov. Franz Tamayo, dept. La Paz, Bolivia.*

Solanum phureja *Juz. et Buk. var.* ***flavum*** *f.* ***sayhuanimayo*** *Ochoa f. nov.*
Folia parum dissectis quam var. ***flavum****, foliola plus anguste lanceolata. Articulatio vix 2 mm sub calice. Corolla lilacina. Tubercula longa, subcylindrica, pallide rosea. Type:* ***Ochoa*** *et* ***Salas 15001*** *(OCH; CIP, isotype), Sayhuanimayo, 3200 m alt., prov. Franz Tamayo, dept. La Paz, Bolivia.*

* *International Potato Center, P.O. Box 5969, Lima, Peru.*

Solanum phureja *Juz. et Buk. var.* ***janck'o-phureja*** *Ochoa var. nov.*
Folia pallide viridia, foliola 3-4-juga, elliptico-lanceolata, 0-2 paria interfoliolorum. Calyx zygomorphus, 8-10 mm longus. Corolla alba. Pedicelli 15-25 mm longi, versus 1/3 superum articulati. Tuberculo longa, albo-flava. Type: ***Ochoa*** *et* ***Salas 15472*** *(OCH; F, isotype), Sorata, 2600 m alt., Larecaja, dept. La Paz, Bolivia.*

Solanum phureja *Juz. et Buk. var.* ***janck'o-phureja*** *f.* ***timusi*** *Ochoa f. nov.*
A var. ***janck'o-phureja*** *numero mayor interfoliolis, corolla pallide-violeta et tuberculo piriforme differt. Type:* ***Ochoa 3910*** *(OCH), Timusi, 3600 m alt. prov. Larecaja, dept. La Paz, Bolivia.*

Solanum phureja *Juz. et Buk. var.* ***rubro-rosea*** *Ochoa var. nov.*
Foliola 6-7-juga, anguste elliptico-lanceolata, 13-15 paria interfoliolorum. Articulatio 4-5 mm sub calice. Corola alba. Tubercula ovoidea usque ad subcylindrica, crassa, obscure roseo-vinosa, carne alba. Type: ***Ochoa*** *et* ***Salas 14971*** *(OCH; CIP, isotype), Queara, 3400 m alt., prov. Franz Tamayo, dept. La Paz, Bolivia.*

Solanum phureja *Juz. et Buk. var.* ***rubro-rosea*** *f.* ***orbiculata*** *Ochoa f. nova*
Folia similis var. ***rubro-rosea****, sed minus segmentatis. Tubercula rotunda, obscure rubro-vinosa, carne flava. Type:* ***Ochoa*** *et* ***Salas 15009*** *(OCH; CIP, F, isotypes), ca. Puina, inter Ayamachay et Sayhuanimayo, 3200 m alt., prov. Franz Tamayo, dept. La Paz, Bolivia.*

Solanum stenotomum *Juz. et Buk. f.* ***alkka-phiñu*** *Ochoa f. nov.*
Foliola ellipticolanceolata. Corolla lilacina cum acuminibus albis. Calyx zygomorphus 10 mm longus. Tubercula longa, subcylindrica, crassa, oculi multi cum areis flavis. Peridermis rubrum. Type: ***Ochoa 3911*** *(OCH), ca. La Paz, 3650 m alt., prov. Murillo, dept. La Paz, Bolivia.*

Solanum stenotomum *Juz. et Buk. f.* ***chiar-ckati*** *Ochoa f. nov.*
Folia plus segmentata, foliola plis anguste lanceolata quam var. ***phiñu*** *f.* ***chiar-phiñu****. Corolla obscure violacea. Tubercula crassa longo-subcylindrica usque ad compressa, peridermis obscure azureoviolacea, pallide variegata. Type:* ***Ochoa 3925*** *(OCH), prov. Murillo, dept. La Paz, Bolivia.*

Solanum stenotomum *Juz. et Buk. f.* ***chiar-phiñu*** *Ochoa f. nov.*
Folia obscure viridia, longa et angusta, 6-7 paria foliolorum et multis interfoliolis amplitudine valde variabiles. Tubercula similis cum var. phiñu, sed peridermis dense azureo-violacea. Corolla dilute coerulea cum acuminibus albis. Type: ***Ochoa 3924*** *(OCH), La Paz, 3650 m alt., prov. Murillo, dept. La Paz, Bolivia.*

Solanum stenotomum *Juz. et Buk. f.* ***pacajes*** *Ochoa f. nov.*
Plantae subtiles. Folia cum foliolis lateralibus 5-6 juga et 3-6 paria interfoliolorum. Petioluli 5 mm vel plus longi. Corolla alba. Type: ***Ochoa 3551*** *(OCH), Caquiaviri, 3960 m alt., prov. Pacajes, dept. La Paz, Bolivia.*

Solanum stenotomum *Juz. et Buk. f.* ***pulu-wayk'u*** *Ochoa, f. nov.*
Planta gracilis. Pedicelli usque ad 35 mm longi, articulatio 4-5 mm sub calyce. Calyx 10-12 mm longus cum acuminibus anguste subspathulatis. Corolla valde obscuro-violeta. Type: ***Ochoa 10493*** *(OCH), Oruro, 3650 m alt., prov. et dept. Oruro, Bolivia.*

Solanum stenotomum *Juz. et Buk. var.* ***chojllu*** *Ochoa var. nov.*
Folia cum foliolis elliptico-lanceolatis 6-juga, 6-8 paria interfoliolorum. Corola 2.0-2.5 cm diam., lilacina. Pedicelli 12-14 mm longi, articulatio 4-5 mm sub calice. Type: ***Ochoa 3912*** *(OCH), La Paz, 3650 m alt., prov. Murillo, dept. La Paz, Bolivia.*

Solanum stenotomum *Juz. et Buk. var.* ***chojllu*** *f.* ***janck'o-chojllu*** *Ochoa f. nov.*
Folia pallide viridia. Foliola anguste elliptico-lanceolata 5-6(-7)-juga. Interfoliolula usque ad 9 paria. Pedicelli usque ad 25 mm longi, paululum supra centrum articulati. Corolla lilacina. Type: ***Ochoa 3938*** *(OCH), La Paz, 3650 m alt., prov. Murillo, dept. La Paz, Bolivia.*

Solanum stenotomum *Juz. et Buk. var.* ***chojllu*** *f.* ***wila-chojllu*** *Ochoa f. nov.*
Folia pallide viridia, foliola elliptico-lanceolata 5-juga. Interfoliolula 4-6-juga. Pedicelli breves, ad centrum articulati. Corolla roseo-lilacina. Type: ***Ochoa 3942*** *(OCH), La Paz, 3650 m alt., prov. Murillo, dept. La Paz, Bolivia.*

Solanum stenotomum *Juz. et Buk. var.* ***kkamara*** *Ochoa var. nov.*
Planta valida. Caulis crassus, ramosus. Folia obscure viridia, foliola 5(-6)-juga, elliptico-lanceolata, 4-6 paria interfoliolorum. Corolla atrocyanea. Type: ***Ochoa 3920*** *(OCH), La Paz, 3650 m alt., prov. Murillo, dept. La Paz, Bolivia.*

Solanum stenotomum *Juz. et Buk. var.* ***luru*** *Ochoa var. nov.*
Planta mollis. Caulis gracilis. Foliola anguste lanceolata, usque ad 6-juga, 4-6 paria interfoliolorum. Corolla alba. Type: ***Ochoa 3949*** *(OCH), Tinguipaya, 3900 m alt., prov. Frias, dept. Potosí, Bolivia.*

Solanum stenotomum *Juz. et Buk. var.* ***ari-chuwa*** *Ochoa var. nov.*
Folia dilute viridia. Foliola 5-juga, anguste lanceolata, 5-8 paria interfoliolorum. Pedicelli usque ad 25 mm longi, versus 1/3 superum articulati. Corolla violaceo-nigra. Type: ***Ochoa 3937*** *(OCH; F, isotype), Huatajata, 3850 m alt., prov. Ingavi, dept. La Paz, Bolivia.*

Solanum stenotomum *Juz. et Buk. var.* ***pitiquiña*** *Ochoa var. nov.*
Folia fortiter dissectae, foliola 6-7 juga, anguste elliptico-lanceolatae usque ad abovatae, interfoliola numerossisima. Corolla lilacina, 2.0-2.5 cm diam., acumina alba. Tubercula rubida, longa, crassa, transversaliter constricta, aspectu prominentis, apicem versus et basi obtusa, oculi profundus, multi. Type: ***Ochoa 3535*** *(OCH), Tiahuanaco, 3650 m alt., prov. Ingavi, dept. La Paz, Bolivia.*

Solanum stenotomum *Juz. et Buk. var.* ***pitiquiña*** *f.* ***alkka-pitiquiña*** *Ochoa f. nov.*
Similis var. ***pitiquiña****, sed peridermis rosea ad rubidam et cum areis angustis albo-flavis in oculis. Type:* ***Ochoa 3148*** *(OCH), Palculo, 3800 m alt., prov. Los Andes, dept. La Paz, Bolivia.*

Solanum stenotomum *Juz. et Buk. var.* ***pitiquiña*** *f.* ***azureo-ckati*** *Ochoa f. nov.*
Caulis fortiter pigmentatus colore obscuro azureo-violaceo. Pedunculus 6 cm longus. Corolla obscure violacea. Tuberculum epidermide obscure azureoviolacea et cum areis angustis albo-flavis in oculis, carne alba. Type: ***Ochoa*** *et* ***Salas 15514*** *(Ochoa; CIP, isotype), Quime, 3200 m alt., prov. Inquisivi, dept. La Paz, Bolivia.*

Solanum stenotomum *Juz. et Buk. var.* ***pitiquiña*** *f.* ***laram*** *Ochoa f. nov.*
Caulis pigmentatus colore rubro-vinoso. Corolla lilacina. Tuberculum epidermide atrocyanea, faintly colore roseo, carne cremea. Type: ***Ochoa 3926*** *(OCH), La Paz, 3650 m alt., prov. Murillo, dept. La Paz, Bolivia.*

Solanum stenotomum *Juz. et Buk. var.* ***pitiquiña*** *f.* ***phiti-kalla*** *Ochoa f. nov.*
Planta mollis. Foliola 6-juga, anguste elliptico-lanceolata, interfoliola 4-6-juga. Corolla pallide violacea. Epidermide pallide roseo-violacea. Type: ***Ochoa 3928*** *(OCH), La Paz, 3650 m alt., prov. Murillo, dept. La Paz, Bolivia.*

Solanum stenotomum *Juz. et Buk. var.* ***pitiquiña*** *f.* ***quime*** *Ochoa f. nov.*
Foliola 6-juga, anguste elliptico-lanceolata, interfoliola usque ad 12-juga. Corolla violeta-lilacea. Tubercula obscure rubro-vinosa cum areis angustis in oculis. Type: ***Ochoa*** *et* ***Salas 15513*** *(OCH; CIP, isotype), Quime, 2900 m alt., prov. Inquisivi, dept. La Paz, Bolivia.*

Solanum stenotomum *Juz. et Buk. var.* ***zapallo*** *Ochoa var. nov.*
Folia brevia et lata. Foliola 4-5(-6)-juga, plerumque late ellipticolanceolata, 3-4(-6) paria interfoliolorum. Pedicelli 15-20 mm longi. Articulatio 3-4 mm sub calyce. Calyx cum lobulis late spathulatis. Corolla albocremea. Tuberculus rotundus. Peridermide obscuro-lutea, carne flava, surculi basi rosei. Type: ***Ochoa 3145*** *(OCH), Tiahuanaco, 3680 m alt., prov. Ingavi, dept. La Paz, Bolivia.*

Solanum stenotomum *Juz. et Buk. var.* ***zapallo*** *f.* ***churi-puya*** *Ochoa f. nov.*
Pedicelli usque ad 18 mm longi. Articulatio nunc ad centrum nunc paululum sub centrum (8-10 mm sub calyce). Corolla coerulea. Surculi tuberculorum in basi et apice azureo-violacei. Type: ***Ochoa 3152*** *(OCH), Walata Chico, 3850 m alt., prov. Murillo, dept. La Paz, Bolivia.*

Solanum stenotomum *Juz. et Buk. var.* ***zapallo*** *f.* ***kkarachi-pampa*** *Ochoa f. nov.*
Planta robustior et plus ramosa quam var. ***zapallo****. Folia etiam plus segmentata. Foliola cum petiolulis longis, plerumque cum interfoliolis basiscopicis. Corolla alba cum acuminibus pallide lilacinibus. Type:* ***Ochoa 10481*** *(OCH; CIP, isotype), Kkarachipampa, 4000 m alt., prov. Linares, dept. Potosí, Bolivia.*

Solanum *x* ***juzepczukii*** *Buk. var.* ***ckaisalla*** *(Lechn.) Ochoa f.* ***ck'oyu-ckaisalla*** *Ochoa f. nov.*
Planta similis var. ***ckaisalla*** *(Lechn.) Ochoa (typus:* ***Juzepczuk 1637****, WIR), sed epidermide tuberis pallide nigro-violacea aliquandum colore alboflavido variegata. Type:* ***Huaman 821*** *(OCH), Jango Cala, prov. Carangas, dept. Oruro, Bolivia.*

Solanum* x *juzepczukii *Buk. var.* ***ckaisalla****, f.* ***janck'o-ckaisalla*** *Ochoa f. nov.*
Planta et folia pallide viridia. Caulis sine pigmento. Tubercula alba. Type: ***Huaman 809*** *(OCH), Toledo, 3700 m alt., prov. Poopó, dept. Oruro, Bolivia.*

Solanum* x *juzepczukii *Buk. var.* ***ckaisalla*** *f.* ***wila-ckaisalla*** *Ochoa f. nov.*
Tubercula peridermide roseo-violacea. Type: ***Huaman 815*** *(OCH), Saucari-Toledo, prov. Poopó, dept. Oruro, Bolivia.*

Solanum* x *juzepczukii *Buk. var.* ***lucki*** *Ochoa var. nova.*
Planta rosulata vel subrosulata, persimilis ***S. acaule****. Tubercula rotunda usque ad oblonga, modice compressa, peridermis plerumque alba vel nonnumquam in apice pigmentata pallide violacea, oculi superficiales. Type:* ***Huaman 789*** *(OCH), Ingavi, prov. Ingavi, dept. La Paz, Bolivia.*

Solanum* x *juzepczukii *Buk. var.* ***lucki*** *f.* ***lucki-pechuma*** *Ochoa f. nov.*
Planta persimilis var. ***lucki****. Tubercula alba, oculi profundissimi. Type:* ***CIP-702631*** *(CIP), Challa, dept. Oruro, Bolivia.*

Solanum* x *juzepczukii *Buk. var.* ***lucki*** *f.* ***lucki-pinkula*** *Ochoa f. nov.*
Folia obscure viridia, foliola 6-7-juga, interfoliola 4-6-juga. Tubercula pyriformia, subfalcata, alba. Type: ***Ochoa 10571*** *(OCH), Challactiri, 3900 m alt., prov. Frias, dept. Potosí, Bolivia.*

Solanum* x *chaucha *Juz. et Buk. var.* ***ckati*** *Ochoa var. nov.*
Calyx simmetricus vel asymmetricus cum 5-6 lobis. Corolla obscure violacea cum acuminibus albis. Tubercula longa, apice versus incrassata, obtusa, basi attenuata, acuta, peridermis obscuro azureo-violacea. Type: ***Ochoa 3929*** *(OCH), La Paz, 3650 m alt., prov. Murillo, dept. La Paz, Bolivia.*

Solanum* x *chaucha *Juz. et Buk. var.* ***ccoe-sullu*** *Ochoa var. nov.*
Foliola 5-juga, elliptico-lanceolata et aliquot interfoliola. Pedicellus 20-25 mm longus. Articulatio 4 mm sub calice. Corolla violacea. Tubercula longa compressa usque ad oval-compressa, peridermis maculata zonis obscure violaceis et flavis alternantibus. Type: ***Ochoa 7848*** *(OCH), Ccatcca, 3680 m alt., prov. Quispicanchis, dept. Cusco, Peru. Necnon in Lequezana, 3300 m alt., prov. Saavedra, Bolivia, n.v. Kkoyllur,* ***Ochoa 3950*** *(OCH).*

Solanum* x *chaucha *Juz. et Buk. var.* ***khoyllu*** *Ochoa var. nov.*
Folia pallide viridia, foliola 5(-6)-juga, elliptico-lanceolata, apex breviter acuminatus, interfoliola 3-5-juga. Corolla violeta-lilacea cum 5-7 petalis. Tubercula rotunda, peridermis obscuro-rubro-vinoso maculata zonis obscure violaceis. Type: ***Ochoa 3948*** *(OCH), Cochabamba, (brought from Colomi, 3200 m alt.), prov. et dept. Cochabamba, Bolivia.*

***Solanum* x *chaucha* Juz. et Buk. var. *puca-suitu* Ochoa var. nov.**
Folia cum foliolis 4-5-juga, elliptico-lanceolatis, apice obtuso, 3-4 paria interfoliolorum. Corola obscuro-violacea. Tubercula graciles, longa subcylindrica, apice obtusa, basi acuta. Peridermis rosea vel rubida, aliquando albo-flavide variegata. Type: **Ochoa 006** *(OCH), Chacapalpa, 3700 m alt., prov. Yauli, dept. Junin, Peru. Necnon in Maragua, 3700 m alt., prov. Chayanta, dept. Potosi, Bolivia, n.v. Sallimani,* **Ochoa 10603** *(OCH).*

***Solanum* x *chaucha* Juz. et Buk. var. *surimana* Ochoa var. nov.**
Folia cum foliolis elliptico-lanceolatis 4-5-juga, apice acuto vel breviter subacuminato, 2-4 paria interfoliolorum. Calyx plerumque symmetricus. Corolla pallide violacea. Tubercula longa et subcylindrica vel longa compressa, peridermis obscure violaceo-rosacea, albido variegata. Type: **Ochoa 3946** *(OCH), Urmiri, 3750 m alt., prov. Poopó, dept. Oruro, Bolivia.*

***Solanum tuberosum* L. subsp. *andigena* (Juz. et Buk.) Hawkes var. *chiar-imilla* Lechn. f. *nigrum* (Lechn.) Ochoa f. nov.**
Caulis fortiter pigmentatus. Folia plus dissecta quam var. ***chiar-imilla****. Corolla azurea. Tuberculum rotundum, peridermis atro-cyanea fere nigra, surculi obscure azureo-violacei. Type:* ***Juzepczuk 1660-b*** *(WIR), La Paz, prov. Murillo, dept. La Paz, Bolivia.*

***Solanum tuberosum* L. subsp. *andigena* (Juz. et Buk.) Hawkes var. *chiar-imilla* Lechn. f. *sani-imilla* Ochoa f. nov.**
Caulis e basi 1/3 subpigmentatus. Foliola 5-juga, interfoliola 5-6-juga. Corolla obscure coerulea. Tubercula rotunda usque ad oblonga, oculis profundis, peridermis albo-grisea circa oculi et 1/3 apicalis obscure-violaceo pigmentata. Type: **Ochoa 3972** *(OCH), Huatajata, 3850 m alt., prov. Murillo, dept. La Paz, Bolivia.*

***Solanum tuberosum* L. subsp. *andigena* (Juz. et Buk.) Hawkes var. *chiar-imilla* Lechn. f. *isla-imilla* Ochoa f. nov.**
Caulis e basi 1/3 dense pigmentatus. Corolla alba vel colorata, stella interna obscure violacea. Tubercula rotunda, peridermis maculata zonis obscure violaceis vel obscure rosco-violaceis et albo-flavis alternantibus. Type: **Ochoa 3969** *(OCH), La Paz, 3650 m alt., prov. Murillo, dept. La Paz, Bolivia.*

***Solanum tuberosum* L. subsp. *andigena* (Juz. et Buk.) Hawkes var. *chiar-imilla* Lechn. f. *janck'o-chockella* Ochoa f. nov.**
Pedunculus 10-12 cm longus. Corolla alba. Tuberculo rotundo, peridermis albo-cremea, oculi cum areis rosaceis variegatis. Var. ***chiar-imilla*** *f.* ***ccompis*** *valde affine. Type:* ***CIP-702616*** *(CIP), Sullcatiti, prov. Ingavi, dept. La Paz, Bolivia.*

***Solanum tuberosum* L. subsp. *andigena* (Juz. et Buk.) Hawkes var. *chiar-imilla* Lechn. f. *alkka-imilla* Ochoa f. nov.**
Pedicellus 2-4 mm sub calyce articulatus. Corolla lilacea vel violeta-lilacea. Tubercula rotunda, peridermis rubra vel roseo-obscura, oculi cum areis albo-flavis. Type: **Ochoa 3902** *(OCH; CIP, isotype), La Paz, 3650 m alt., prov. Murillo, dept. La Paz, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***chiar-imilla*** *Lechn. f.* ***wila-imilla*** *Ochoa f. nov.*
Pedicellus 5-7 mm sub calyce articulatus. Corolla alba. Tubercula rotunda, peridermis rubida vel roseo-obscura, surculi roseo-violacei. Type: ***CPP-1810*** *= Peruvian Potato Collection, La Molina Agrarian University, Lima, (OCH), Chiclaya Grande, 3840 m alt., prov. Murillo, dept. La Paz, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***chiar-imilla*** *Lechn. f.* ***wila-monda*** *Ochoa f. nov.*
Pediceli 14-18 mm longi, ad centrum articulati. Corolla violeta vel violeta-linacina cum acuminibus albis. Type: ***Ochoa 3967*** *(OCH; CIP, isotype), La Paz, 3650 m alt., prov. Murillo, dept. La Paz, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***bolivianum*** *Juz. et Buk. f.* ***chiar-pala*** *Ochoa f. nov.*
Caulis fortiter pigmentatus. Corolla obscure azureo-violacea. Tubercula oval-compressa, peridermis obscuro-azureo-violacea fere nigra, surculi obscuro-azureo-violacei. Type: ***Ochoa 3977*** *(OCH), Huanccollo, 3680 m alt., prov. Ingavi, dept. La Paz, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***bolivianum*** *Juz. et Buk. f.* ***janck'o-pala*** *Ochoa f. nov.*
Caulis nonnisi ad 1/3 basi subpigmentatus. Tubercula oval-compressa, peridermis plerumque albo-flava, surculi basi et apice rosei. Type: ***Ochoa 3996*** *(OCH), Urmiri, 3750 m alt., prov. Poopó, dept. Oruro, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***bolivianum*** *Juz. et Buk. f.* ***wila-pala*** *Ochoa f. nov.*
Folia 5-juga cum foliolis longe petiolulatis, apice breviter acuminato, interfoliola 8-12-juga. Corolla lilacina. Tubercula oval compressa, peridermis rubra vel rubida, nonnumquam albo-flavo variegata. Type: ***Ochoa 3986*** *(OCH), Huanccollo, 3680 m alt., prov. Ingavi, dept. La Paz, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***longibaccatum*** *Juz. et Buk. f.* ***chojo-sajama*** *Ochoa f. nov.*
Caulis pigmentatus colore violaceo-nigro. Corolla pallide violacea cum acuminibus albis. Tubercula longa subcylindrica, falcata vel subfalcata, peridermis obscure violaceo-nigra. Type: ***Ochoa 3971*** *(OCH), Huatajata, 3850 m alt., prov. Omasuyos, dept. La Paz, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***aymaranum*** *Juz. et Buk. f.* ***amajaya*** *Ochoa f. nov.*
Caulis fortiter pigmentatus quam var. ***aymaranum*** *f.* ***huaca-lajra****. Corolla violacea. Tubercula longa, graciles, subcylindrica usque ad compressa, apice obtusa, basi acuta, peridermis pallido-violacea. Type:* ***Ochoa 10508*** *(OCH), Azangaro, 3800 m alt., prov. Frias, dept. Potosi, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***aymaranum*** *Juz. et Buk. f.* ***huaca-zapato*** *Ochoa f. nov.*
Folia 5-juga cum foliolis breviter acuminatis, interfoliola 5-7-juga. Corolla violaceo-lilacea. Tubercula longa subcylindrica, basi acuta, apice obtusa, peridermis pallide azureo-violacea. Type: ***CPP-1843*** *= Colección Peruana de Papa, La Molina Agrarian University, Lima (OCH), Pucarani, 3900 m alt., prov. Los Andes, dept. La Paz, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***aymaranum*** *Juz. et Buk. f.* ***kunurana*** *Ochoa f. nov.*
Folia 4-juga, cum foliolis longe petiolulatis, interfoliola 5-6-juga. Corolla violaceo-lilacea cum acuminibus albis. Tubercula rotunda usque ad paulo compressa, peridermis obscure roseo-violacea. Type: ***Ochoa 12115*** *(OCH), Ravelo, 3500 m alt., prov. Chayanta, dept. Potosi, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***aymaranum*** *Juz. et Buk. f.* ***overita*** *Ochoa f. nov.*
Pedicelli 25-35 mm longi, ad 1/3 superum articulati. Corolla lilacea cum acuminibus albis. Tubercula longa, compressa, in extremis obtusa; peridermis albo-flava cum areis azureo-violaceis obscuris usque ad violaceo-nigris. Type: ***Ochoa 3991*** *(OCH), La Paz, 3650 m alt., prov. Murillo, dept. La Paz, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***aymaranum*** *Juz. et Buk. f.* ***surico*** *Ochoa f. nov.*
Corolla violaceo-nigra. Tubercula oblonga; epidermis albo-flava versus apicem et oculi colore azureo violaceo variegata. Type: ***Ochoa 2803*** *(OCH), Puerto Acosta, 3850 m alt., prov. Camacho, dept. La Paz, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***aymaranum*** *Juz. et Buk. f.* ***tinguipaya*** *Ochoa f. nov.*
Folia plerumque 4-juga, interfoliola 3-5-juga. Corolla alba. Tubercula rotunda usque ad paulo compressa, peridermis albo-flava. Type: ***Ochoa 10648*** *(OCH; CIP, isotype), Tinguipaya, 3900 m alt., prov. Frias, dept. Potosí, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***aymaranum*** *Juz. et Buk. f.* ***wila-huaycku*** *Ochoa f. nov.*
Foliola late elliptica, apex acuminatus. Corolla pallide violacea cum acuminibus albis. Tubercula longa, crassa, cylindrica vel subcylindrica, peridermis rubida usque ad rosacea. Type: ***Ochoa 3897*** *(OCH), La Paz, 3650 m alt., prov. Murillo, dept. La Paz, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***aymaranum*** *Juz. et Buk. f.* ***jancck'o-kkoyllu*** *Ochoa f. nov.*
Folia 5-juga cum foliolis breviter acuminatis, petiolulis longis, interfoliola 6-8-juga. Corola violaceo-lilacea. Tubercula longa, compressa, peridermis albo-flava faintly violacea. Type: ***CPP-1814*** *(OCH), Huancané, 3900 m alt., prov. Murillo, dept. La Paz, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***aymaranum*** *Juz. et Buk. f.* ***milagro*** *Ochoa f. nov.*
Folia brevia et lata, foliola 4-5 juga, interfoliola 4-6-juga. Corolla alba. Tubercula ovalia et compressa usque ad oblonga, subcylindrica, peridermis albo-flava, faintly rosea. Type: ***CPP-1807*** *(OCH), Huatajata, 3850 m alt., prov. Murillo, dept. La Paz, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***aymaranum*** *Juz. et Buk. f.* ***huichinkka*** *Ochoa f. nov.*
Folia 5(-6)-juga, foliolos cum petiolulis validis et longis, interfoliola 7-10-juga. Tubercula ovalia et compressa, peridermis profunde azureo-violacea. Type: ***Ochoa 10671*** *(OCH), Gran Peña, 3800 m alt., prov. Frias, dept. Potosí, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***lelekkoya*** *Ochoa var. nov.*
Pedicelli 18-23 mm longi, versus 1/3 superum articulati. Corolla rotata-pentagonalis, azureo-violacea. Tubercula rotunda usque ad oblonga vel ovalia et compressa, peridermis alba nonnumquam versus apicem violaceo-nigro pigmentata. Type: ***Ochoa*** *et* ***Salas 11792*** *(OCH), ca. Sorata, 2700 m alt., prov. Larecaja, dept. La Paz, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***lelekkoya*** *Ochoa f.* ***laram-lelekkoya*** *Ochoa f. nov.*
Corolla profunde violacea, 4 cm diam. Tubercula oblonga usque ad ovalia, compressa, peridermis dilute azureo-violacea. Type: ***Ochoa 11976*** *(OCH), Higueras, 2600 m alt., prov. Sud Cinti, dept. Chuquisaca, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***lelekkoya*** *Ochoa f.* ***chiar-lelekkoya*** *Ochoa f. nov.*
Caulis fortiter pigmentatus. Corolla coerulea vel azureo-violacea cum acuminibus albis. Tubercular longa subcylindrica, apice obtusa ad calcem angustata vel acuta, peridermis profunde azureo-violacea quasi atra. Type: ***Ochoa*** *et* ***Salas 11795*** *(OCH; CIP, isotype), Curupampa, 2700 m alt., ca. Sorata, prov. Larecaja, dept. La Paz, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***malcachu*** *Ochoa var. nov.*
Folia brevia et lata. Foliolum terminale majus quam foliola lateralia. Tubercula longa, compressa ad apicem angustata, peridermis lilacina vel pallide-violaceo-nigra, paucc albo-flavo variegata. Type: ***Ochoa 3959*** *(OCH), Lequezana, 3300 m alt., prov. Saavedra, dept. Potosí, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***runa*** *Ochoa var. nov.*
Caulis pallide viridis. Foliola longe petiolulata. Corolla lilacina vel pallide violeto-lilacea cum acuminibus albis. Tubercula oblonga vel longa compressa ad apicem angustata et obtusa ad calcem plus lata et subquadrata, peridermis albida vel pallide grisea; oculi et supercilia pallide rosacea. Type: ***Ochoa 3999*** *(OCH), Cochabamba (brought from Punata, 3200 m alt.), dept. Cochabamba, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***runa*** *Ochoa f.* ***azul-runa*** *Ochoa f. nov.*
Caulis ad 1/3 basi pigmentatus. Corola pallide violeto-lilacea. Tubercula forma sicut in var. ***runa****, peridermis pallide azureo-violacea. Type:* ***Ochoa 3954*** *(OCH), Lequezana, 3300 m alt., prov. Saavedra, dept. Potosí, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***sicha*** *Ochoa var. nov.*
Caulis inordinatim pigmentatus. Folia glauco-viridia, foliola 5(-6)-juga, interfoliola 5-7(-8)-juga. Corolla rotata-pentagonalis, obscure violacea. Tubercula rotunda, peridermis nigra, carne profunde flava. Type: ***Ochoa*** *et* ***Salas 15517*** *(OCH; CIP, isotype), ca. Quime, 2700 m alt., prov. Inquisivi, dept. La Paz, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***sipancachi*** *Ochoa var. nov.*
Folia plerumque 4-juga, interfoliola 4-6-juga. Corolla violacea. Tubercula oval-compressa, peridermis albo-flava ad calcem violaceo variegata. Type: ***Ochoa 3958*** *(OCH), Lequezana, 3300 m alt., prov. Saavedra, dept. Potosi, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***stenophyllum*** *Juz. et Buk. f.* ***wila-k'oyu*** *Ochoa f. nov.*
Folia cum foliolis 5(-6)-juga, interfoliola 2-5-juga. Corolla profunde violacea. Tubercula rotunda usque ad oblonga, peridermis pallide rosacea. Type: ***CIP-702691*** *(OCH; CIP, isotype).*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***stenophyllum*** *Juz. et Buk. f.* ***pulo*** *Ochoa f. nov.*
Foliola elliptico-lanceolata, apice acuminata, basi longe petiolulata. Corolla pallide violacea. Tubercula oblonga usque ad ovalcompressa, peridermis alba. Type: ***CIP-702704*** *(OCH; CIP, isotype), Sacaca, prov. Alonso Ibañez, dept. Potosi, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***muru'kewillu*** *Ochoa var. nov.*
Foliola elliptico-lanceolata vel ovata, apex breviter acuminatus. Corolla obscuro-violacea. Tubercula longa subcylindrica, graciles, recta vel subfalcata; peridermis profunde azureo-violacea fere nigra, oculi cum areis albis vel pallide violaceis. Type: ***Ochoa 4020*** *(OCH), Inter Chumpe et Paro-Paro, 3700 m alt., prov. Calca, dept. Cusco, Perú. Necnon in La Paz, 3650 m alt., prov. Murillo, dept. La Paz, Bolivia, n.v. Anu-ikisca,* ***Ochoa 3893*** *(OCH).*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***taraco*** *Ochoa var. nov.*
Folia 4-5-juga, foliola cum petiolulis 3-5 mm longis, interfoliola 5-7-juga. Corolla violacea. Tubercula ovoideo-compressa, peridermis rubida usque ad rubro-violacea, oculi cum areis angustis albidis. Type: ***Ochoa 2791*** *(OCH), Huatajata, 3900 m alt., prov. Aroma, dept. La Paz, Bolivia.*

Solanum tuberosum *L. subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***taraco*** *Ochoa f.* ***yurac-taraco*** *Ochoa f. nov.*

Folia cum foliolis late elliptica, 4-5-juga. Tubercula ovoideo-comprassa, peridermis albo-flava, gemmae rubidae vel roseae. Type: ***Ochoa 10685*** *(OCH), Santa Lucía, 3800 m alt., prov. Frias, dept. Potosí, Bolivia.*

Solanum tuberosum *L., subsp.* ***andigena*** *(Juz. et Buk.) Hawkes var.* ***taraco*** *Ochoa f.* ***alkka-silla*** *Ochoa f. nov.*

Folia 5-juga, foliola elliptico-lanceolata. Tubercula ovoideo-depressa, peridermis ad 1/3 apicalis albo-flava, reliqua azureo-violacea-nigra, nonnumquam areis albido-flavis vel albido-flavis variegata. Type: ***Ochoa 3989*** *(OCH), Esquiri, 2600 m alt., prov. Saavedra, dept. Potosí, Bolivia.*

TWO NEW TUBER-BEARING SOLANUM SPECIES FROM MEXICO: S. TARNII AND S. MATEHUALAE

J.G. Hawkes, J.P. Hjerting and T.R. Tarn

University of Birmingham, U.K.
Botanical Garden, Copenhagen, Denmark
Agriculture Research Station, Fredericton, Canada.

During the joint US-Mexico-Canada-Denmark potato collecting expeditions to Mexico in 1982, 1983 and 1984, two hitherto unknown species were discovered, which are described below. We thank Dr. R Hanneman, Director of the Potato Introduction Station at Sturgeon Bay, Wisconsin and the Inter-Regional Potato Introduction Project (IR-1) for sponsoring the expeditions and the U.S.D.A. for providing the funding. We are also most grateful to the Mexican Instituto Nacional de Investigaciones Agricolas and the Mexican Potato Programme, through its Director Ing Manuel J. Villareal for support provided during the three expeditions. We offer our thanks also to Mr. D. Costa for kindly checking the latin concordances.

The members of the expeditions were T.R. Tarn (Canada), A. Rivera-Peña (Mexico), J.P. Hjerting (Denmark), R.W. Ross (U.S.A.) and J. Gómez (Mexico). Species TYPE citations indicate the collectors actually present when the specimens were gathered.

S. tarnii Hawkes & Hjerting, sp. nov.

Stem erect to spreading, from 60 - 100 cm tall, branched towards the base, (2.5-) 4 - 5 mm diam., green splashed with dark purple, slightly angled, provided with fairly frequent short appressed hairs, sparser below or sub-glabrous.

Leaf 8 - 12 (-15) cm long x 6 - 8 (-10) cm broad, 3 - 4 (-5) - jugate, with 0 - 3 (-7) pairs of small ovate interjected leaflets; lateral leaflets 3 - 4 (-5) cm long x 0.6 - 1.5 (-2) cm broad, lanceolate to narrowly lanceolate with obtuse to acute or acuminate apex, the base rounded; petiolules 2 - 5 (-8) mm long; terminal leaflet about the same size as the upper laterals; semi-lunate pseudostipular leaflets well-marked; upper leaf surface often dark green and glossy, occasionaly medium green, covered with inconspicuous rather short appressed hairs; hairs on lower surface shorter, mostly confined to the veins.

Inflorescence rather few-flowered; peduncle 3 - 6 (-13) cm long, sometimes unforked, with dense short to medium-lengthed sub-appressed upward-pointing hairs; pedicels (10-) 15 - 20 (-30) mm long, articulated above the centre, with pubescence as for peduncle but sparser, though denser below calyx base.

Calyx large, 10 - 15 mm diam., very spreading, with (1-) 2 - 4 (-5) mm long reflexed acumens; whole calyx fairly densely covered with long thin appressed hairs.

Corolla white, stellate, showy, very reflexed, 25 - 35 mm diam; lobes 8 - 10 (-14) mm long x 5 (-9) mm broad at the base.

Anthers 5 - 8 mm long, not markedly narrower towards the apex; filaments 1 - 2 mm long.

Style (8-) 10 - 13 mm long, exserted for 2 - 3 mm above the anther column; stigma capitate, only slightly thicker than style apex.

Berries spherical to ovoid, about 15 -20 mm diam, with dark green stripes and white spots.

Chromosome number: 2n = 24

Caulis rectus ad extendentem, 60 - 100 cm altus, e basi ramosus, viridis atropurpureo maculatus, pilis brevibus appressis admodum frequentibus obtectus.

Folium 3 - 4 (-5) - jugatum, foliolis interjectis ovatis parvis 0 - 3 (-7) - jugis; foliola lateralia lanceolata ad anguste lanceolata, basaliter rotundata, petiolulis 2 - 5 (-8) mm longis; foliolum terminale lateralibus simile; foliola pseudostipulata semilunata bene notata; superficies supra folium atrovirens, lucens, pilis appressis inconspicuis admodum brevibus.

Inflorescentia admodum pauciflora; pedunculus brevis, nonnunquam infurcatus, pilis densis subappressis sursum versis; pedicelli (10-) 15 - 20 (-30) mm longi, articulati supra medium, pubescentia ut in pedunculo sed sparsior, densior tamen sub calycis basi.

Calyx 10 - 15 mm diametro, acuminibus (1-) 2 - 4 (-5) mm longis; calyx totus satis tectus pilis longis angustis appressis.

Corolla alba, stellata, 25 - 35 mm diametro.

Antherae 5 - 8 mm longae , non valde angustiores ad apicem.

Stylus (8-) 10 - 13 mm longus, 2 - 3 mm exsertus supra columnam antherarum; stigma capitatum, quam apex styli solum leviter crassior.

Baccae sphericae ad ovoideas, ca 15 - 20 mm diametro, striis atroviridibus et maculis albis.

TYPE: MEXICO, Hidalgo State, highway 85 from Zimapán to Tamazunchale at Las Trancas, about 6 km east along track towards Nicolás Flores. Alt. 2420 m. 6 Sept. 1983. Among small woody shrubs and perennial herbs. Tarn, Ross and Gómez 62 (K - HOLOTYPE).

Note: The above description was compiled from collecting numbers 36, 62, 64, 78, 79, 88, 98, 101, 103, 255, 256 and 257 from the same expeditions, grown at Sturgeon Bay, Wisconsin and Copenhagen, Denmark. The species was first seen by A. Rivera-Peña (No. 36). Occurs in the mountainous regions of Hidalgo, Querétaro and Vera Cruz States at an altitude range of 2360 - 2650 m in open habitats with well-drained soil.

The striking features of S. tarnii are the delicate leaves with generally narrow lanceolate leaflets, large white stellate flowers, large anthers, style not very exserted from the anther column and stigma slightly thicker than the style apex. It belongs to series Pinnatisecta, but differs from S. pinnatisectum Dun. in the possession of well-marked pseudostipular leaflets and less well-dissected leaves, and from S. trifidum Corr, in the pubescence and berry shape, as well as its adaptation to open places, whilst S. trifidum seems to favour shaded habitats in pine forests.

S. matehualae Hjerting & Tarn, sp. nov.

Stem erect to spreading, 40 cm tall or more, branched, 4 - 5 mm diam, cylindrical or slightly angled, bearing sparse short hairs below, more frequent above.

Leaf to 19 cm long x 11 cm broad, 2 - 3 (-4) - jugate; lateral leaflets 4 - 5 cm long x 2 - 3 cm broad, broad ovate to broad ovate-oblong, with cordate base and obtuse apex; interjected leaflets usually absent but occasionally up to 2 pairs per leaf; terminal leaflet generally almost the same size as the laterals but occasionally longer and broader, with truncate to cordate base and obtuse apex; petiolules of lateral leaflets 3 - 5 (-8) mm long; leaves dark green and glabrous above or with a few short hairs on the central vein;

paler below, with short hairs on the veins; pseudostipular leaflets semilunar, well-marked.

Inflorescence rather few-flowered; peduncle rather short, 2 - 4 (-6) cm long, usually forked above, provided with moderately frequent very short appressed hairs; pedicels (10-) 15 - 20 mm long, articulated slightly above the centre; pubescence as for peduncle.

Calyx campanulate, dark purple, very small, 3 - 4 mm long and 3 - 4 mm diam, with parallel-sided 1 - 2 mm long acumens; pubescence very sparse, almost absent on the lobes and acumens.

Corolla dark purple below, paler above, rotate-pentagonal, 20 (-25) mm diam, with well-marked lobes and 2 mm long acumens.

Anthers 4 - 5 mm long; filaments 0.5 to 1 mm long.

Style 12 - 13 mm long, curved above, exserted up to 8 mm above the stamen column; stigma short, conical, about the same thickness as the style apex.

Berries spherical, about 1 - 1.5 cm diam., dark green with slightly darker stripes.

Chromosome number: 2n = 48.

Caulis rectus ad extendentem, 40 cm altus vel altior, ramosus, pilis sparsis ad frequentes tectus.

Folium 2 - 3 (-4) - jugatum, foliola interjecta plerumque absentia, interdum ad 2 juga per folium; foliola lateralia late ovata ad late ovato-oblonga basaliter cordata et apicale obtusa; foliolum terminale lateralibus simile, sed interdum longius et latius; petioluli 3 - 5 (-8) mm longi; foliola pseudostipulata semilunata, bene notata; folia atrovirentia et fere vel omnino glabra supra, palidiora infra.

Inflorescentia admodem pauciflora; pedunculus 2 - 4 (-6) cm longus, pilis aliquantum frequentibus, brevissimis appresis instructus; pedicelli (10-) 15 - 20 mm longi, leviter supra medium articulati; pubescentia ut in pedunculo.

Calyx atropurpureus minutissimus, 3 - 4 mm longus et diametro acuminibus 1 - 2 mm longis; pubescentia sparsissima.

Corolla infra atropurpurea, supra pallidiora, rotata ad quinquangularem, 20 (-25) mm diametro; lobis bene notatis et acuminibus 2 mm longis.

Antherae 4 - 5 mm longae.

Stylus 12 - 13 mm longus, supra arcuatus, usque ad 8 mm exsertus supra columnam antherarum; stigma breve conicum circa tam crassum quam apex styli.

Baccae sphericae, 1 - 1.5 cm diametro, atrovirentes cum striis modice perviridioribus.

TYPE: MEXICO, San Luis Potosí State, Sierra de Catorce, road turning off 10 km west of Cedral (north of Matehuala), track to Real de Catorce, 2 km above tunnel. Alt. 2740 m. 13 Oct. 1983. Border of maize field, on path, among stones. Hjerting, Ross and Gómez 155 (K - Holotype).

This species is distinguished by the dark green almost glabrous leaves, broad ovate to broad ovate-oblong leaflets, small anthers, very long curved style, exserted up to 8 mm above the stamen column, and small stigma. It belongs to Series Longipedicellata and is probably most closely related to S. hjertingii.

NOMENCLATURAL NOTES ON HOUSTONIA (RUBIACEAE)

Edward E. Terrell
Department of Botany, University of Maryland,
College Park, Maryland 20742

In the course of continued study of Houstonia I found the following nomenclatural changes and notes to be necessary.

1. Houstonia ouachitana (E. B. Smith) Terrell, comb. nov., based on Hedyotis ouachitana E. B. Smith, Brittonia 28: 457. 1976.

This transfer of a member of the Houstonia purpurea group is in accord with my previous work on Houstonia. The relationships of Hedyotis, Houstonia, and Oldenlandia were discussed by Terrell (1975). The type species of these genera represent three different extremes, and union of these three genera under Hedyotis, as sometimes suggested, would create an unreasonably heterogeneous genus. The 39 North American species of Houstonia are themselves a varied assemblage, as shown by data from seed types, chromosome numbers, and pollen morphology (Terrell et al., 1985). I plan to publish on these subjects elsewhere in further support of the genus Houstonia.

2. Neotypification of Houstonia longifolia Gaertner, Fruct. Sem. Pl. 1: 226. Tab. XLIX. 1788.

It was noted previously (Terrell, 1959) that Gaertner's (1788) description and drawings of fruits and seeds (only) of H. longifolia could just as well apply to any member of the H. purpurea group, viz., H. purpurea L., H. canadensis Willd. ex Roem. & Schult., H. tenuifolia Nutt., H. ouachitana, or H. longifolia. The only reference to a specimen is "ex herbario Banksiano". I have not found any pertinent specimen in the herbaria of BM or K. The Tübingen (TUB) herbarium, the repository for Gaertner specimens, does not have any material of Gaertner's H. longifolia (correspondence from F. R. Oberwinkler, 22 Nov 1982).

Willdenow (Sp. Pl. 1 (2): 583-584. 1798) described Houstonia longifolia as a new species, while citing Gaertner's binomial followed by a question mark. Willdenow's description and a specimen (microfiche 2685, US!, inscribed "Houstonia longifolia foliis lanceolatis utrinque attenuatis, floribus corymbosis") in the Willdenow Herbarium, Berlin (B),

agree with the present concept of H. longifolia, a rather common species in the eastern and central parts of the United States. In the interests of nomenclatural stability it seems advisable to neotypify (Articles 7.4, 7.8, Voss et al., 1983) H. longifolia Gaertner on the Willdenow description and specimen.

3. Houstonia wrightii A. Gray, Proc. Amer. Acad. Arts 17: 202. 1882.

Hedyotis pygmaea Roem. & Schult., Syst. Veg. 3: 526. 1818. (non Houstonia pygmaea C. H. and M. T. Muller, 1936).

Hedyotis cervantesii H. B. K., Nov. Gen. Sp. 3: 390. 1820. Nom. illegit.

Houstonia wrightii, a member of the H. rubra group, is a small herb that occurs at higher altitudes in the southwestern United States southward to central Mexico. When placed in Hedyotis, the name Hedyotis pygmaea is correct (Lewis, 1966). As implied in the above synonymy, the name Hedyotis pygmaea cannot be legally transferred to Houstonia because of an earlier use of the epithet under Houstonia for a different species. In recent years I supposed for a time that Hedyotis cervantesii, the next available binomial, would have to be transferred to Houstonia. Meanwhile, the name Hedyotis cervantesii was taken up by Rzedowski (1985) in a flora of the valley of Mexico. The purpose of this note is to point out that the name Hedyotis cervantesii is illegitimate because it was superfluous when published (Art. 63, Voss et al., 1983). Hedyotis pygmaea and H. cervantesii were described independently from Mexican material obtained during the Humboldt and Bonpland expedition and are based on the same type specimen (see McVaugh's 1955 discussion). Photos of the type material in the herbaria of Berlin (B) and Paris (P) have been examined and will be discussed in detail elsewhere.

Acknowledgement

I wish to acknowledge the assistance of Drs. D. H. Nicolson and F. R. Fosberg (US), of F. R. Oberwinkler (TUB), and J. L. Reveal (MARY). This paper is Scientific Article No. A-4816, Contribution No. 7842, of the Maryland Agricultural Experiment Station.

Literature Cited

Lewis, W. H. 1966. The Asian genus Neanotis nomen novum (Anotis) and allied taxa in the Americas (Rubiaceae). Ann. Missouri Bot. Gard. 53: 32-46.

McVaugh, R. 1955. The American collections of Humboldt and Bonpland, as described in the Systema Vegetabilium of Roemer and Schultes. Taxon 4: 78-86.

Terrell, E. E. 1959. A revision of the Houstonia purpurea group (Rubiaceae). Rhodora 61: 157-180; 188-207.

_____. 1975. Relationships of Hedyotis fruticosa L. to Houstonia L. and Oldenlandia L. Phytologia 31: 418-421.

_____. W. H. Lewis, H. Robinson, and J. W. Nowicke. 1986. Phylogenetic implications of diverse seed types, chromosome numbers, and pollen morphology in Houstonia (Rubiaceae). Amer. J. Bot. 73: 103-115.

Rzedowski, J. 1985. Rubiaceae, pp. 390-402, in, Rzedowski, J. and G. C. de Rzedowski, eds. Flora Fanerogamica del Valle de Mexico. Inst. Ecol., Mexico, D. F.

Voss, E. G., Chairman, et al. 1983. International Code of Botanical Nomenclature. Bohn, Scheltema, and Holkema, Utrecht, The Netherlands.

STUDIES IN MEXICAN ARCHIBACCHARIS (COMPOSITAE)

Guy L. Nesom

Department of Botany, University of Texas, Austin 78713

ABSTRACT

The taxa of Archibaccharis hieraciifolia, as treated by Jackson (1975) are recognized as A. hieracioides (S. F. Blake) S. F. Blake and A. auriculata (Hemsley) Nesom. Each of Jackson's four varieties of A. hirtella (DC.) Heering is treated as a separate species: A. hirtella, A. intermedia (S. F. Blake) B. Turner, A. albescens (J. D. Jackson) Nesom, and A. taeniotricha (S. F. Blake) Nesom. Archibaccharis asperifolia (Benth.) S. F. Blake is veiewed as a variable species that includes A. sescenticeps (S. F. Blake) S. F. Blake. A new species of sect. Hirtella from Veracruz is described: A. veracruzana Nesom.

Archibaccharis was recently revised by Jackson (1975), but even since his incisive study many new collections have been made, allowing a better understanding of species limits and variabitility. One new species has been described from Costa Rica (Sundberg 1984), and Turner (1984) has presented observations resulting from his study of the genus in Veracruz. During my study of the Mexican taxa of Archibaccharis, another new species has come to light, and several new combinations and changes in rank are required.

I. The Archibaccharis hieracioides group

The nomenclature of Archibaccharis hieraciifolia Heering sensu lato (and sensu Jackson) has been discussed by Blake (1927), McVaugh (1972, 1984) and Jackson (1975). Jackson treated the group as represented by three varieties, but McVaugh (1984) could not distinguish between vars. glandulosa and hieraciifolia of Jackson, nor can I. Thus, I recognize only two taxa, though the nomenclature is arranged differently, since each is treated as a separate species. McVaugh also was the first to recognize that an earlier name at the species rank is available for Archibaccharis hieraciifolia Heering (Pluchea auriculata Hemsley).

Archibaccharis auriculata and A. hieracioides appear to be closely related and are easy to recognize because of the glands on both their stems and leaves. Although the two have sympatric distributions over a large range, each maintains its unique features and behaves as a distinct species. Some plants may show intermediacy, perhaps due to hybridization, but certainly not to the degree expected if they were conspecific. Archibaccharis campii S. F. Blake is retained here until more material can be examined, but it is very similar to A. hieracioides and perhaps conspecific with it.

1. Upper leaf surface with appressed, eglandular hairs; Mt. Zempoaltepetl, Oaxaca ..... A. campii

1. Upper leaf surface with erect, gland-tipped hairs; Oaxaca and northward. (2)

2. Stems hairs 0.1-0.4 mm long; leaves densely glandular, the bases strongly clasping; pedicels 1-5 (-15) mm long; phyllaries long-linear-acuminate, 6-8 mm long ..... A. auriculata

2. Stem hairs mostly 0.8-1.5 mm long; leaves sparsely glandular, the uppermost with clasping bases, the lower not clasping to barely subclasping; pedicels 8-26 mm long; phyllaries lanceolate, 5-5.5 mm long on the staminate heads, 6-6.5 mm long on the pistillate heads ..... A. hieracioides

Archibaccharis auriculata (Hemsley) Nesom, comb. nov.
Pluchea auriculata Hemsley, Diagn. Pl. Nov. 32. 1879. TYPE: MEXICO. Guanajuato, Hartweg 112 (Holotype: K, as noted by McVaugh, 1984).

Baccharis glandulosa Greenm., Proc. Amer. Acad. Arts 40:36. 1904. TYPE: MEXICO. Distrito Federal, Serranía de Ajusco, 7 Dec 1903, C. G. Pringle 8782 (Holotype: GH; isotypes: BM, C, F, K, LL!, MICH, MIN, MO!, NY, P, POM, UC, US, VT!). Hemibaccharis glandulosa (Greenm.) S. F. Blake, Contr. U. S. Natl. Herb. 20:546. 1924. Archibaccharis glandulosa (Greenm.) S. F. Blake, Contr. U. S. Natl. Herb. 23:1508. 1926. A. hieraciifolia var. glandulosa (Greenm.) J. D. Jackson, Phytologia 28:296. 1974.

A. hieraciifolia Heering, Jahr. Hamb. Wissensch. Anst. 21, Beiheft. 3:40. 1904. TYPE: MEXICO. Oaxaca, Sierra de San Felipe, 13 Dec 1895, C. G. Pringle 6257 (Holotype: HBG; isotypes: BM, F, GH, K, MIN, MO!, MSC, NY, P, UC, US, VT!). Archibaccharis hieraciifolia var. hieraciifolia J. D. Jackson, Phytologia 28:296. 1974.

Baccharis oaxacana Greenm., Proc. Amer. Acad. Arts 40:37. 1904. TYPE: Pringle 6257, data as for A. hieraciifolia Heering (Holotype: GH). Hemibaccharis oaxacana (Greenm.) S. F. Blake, Contr. U. S. Natl. Herb. 20:546. 1924. Archibaccharis oaxacana (Greenm.) S. F. Blake, Contr. U. S. Natl. Herb. 23:1508. 1926.

Jalisco, Michoacán, México, Hidalgo, Veracruz, Puebla, Guerrero, and Oaxaca; shaded or open exposures, usually in pine-oak or pine woods; 2000-3300 m; flowering Nov-Mar.

Plants of Archibaccharis auriculata from Oaxaca, including Jackson 1030 (noted below) and the type of Baccharis oaxacana, have relatively less glandular leaves than those from further north.

ARCHIBACCHARIS HIERACIOIDES (S. F. Blake) S. F. Blake

Baccharis hieraciifolia Hemsley, Biol. Centr. Amer. Bot. 2:129. 1881; not Lam. 1783; not Archibaccharis hieraciifolia Heering. TYPE: MEXICO. México, Desierto Viejo, Valley of Mexico, 3 Nov 1865, Bourgeau 1230 (Lectotype (Jackson, 1974): K; isolectotypes: C, C photo-TEX!, GH, P, US). Hemibaccharis hieracioides S. F. Blake, nom. nov., Contr. U. S. Natl. Herb. 20:547. 1924. A. hieracioides (S. F. Blake) S. F. Blake, J. Wash. Acad. Sci. 17:60. 1927. A. hieraciifolia Heering var. hieracioides (S. F. Blake) J. D. Jackson, Phytologia 28:296. 1974. As pointed out by McVaugh (1972), Blake could have legitimately used Hemsley's epithet "hieraciifolia" in a combination to Hemibaccharis, but his later transfer of this species to Archibaccharis, using the same epithet, was justified since the type of Heering's name is a different species.

Michoacán, Jalisco, Guerrero, Oaxaca, San Luis Potosí, Hidalgo, México, Morelos, Tlaxcala; oak-pine, pine-fir, or fir forests; 2750-3200 m; flowering Nov-Feb (-Mar).

Jackson (1975) cited both his collections 1029 and 1030 (made "directly across the road" from each other in Oaxaca) as A. hieraciifolia (= A. auriculata in the present treatment), but only 1030 is typical A. auriculata. Collection 1029 has long pedicels, long phyllaries, and acute leaf apices similar to A. hieracioides, but is different in its leaf bases that are merely "petioliform" and slightly widened at the base though not auriculate, and in its upper leaf surfaces with gland-tipped hairs only sparsely interspersed among the more numerous, short, appressed, non-glandular hairs. In this last feature, the plants are similar to A. campii.

II. The Archibaccharis hirtella group

Jackson (1975) noted that the four varieties, as he treated them, of Archibaccharis hirtella (DC.) Heering "may represent distinct biological entities" and predicted that "Future studies may more fully justify the elevation of each of these varieties to species status." Turner (1984) has already raised var. intermedia S. F. Blake to specific rank, and I extend this by recognizing the other three varieties as distinct species. All are more or less scandent in habit with fractiflex stems, but each has a very distinctive morphology and a separate geographic range, allopatric with the others; I have not seen intermediates between any of them. In fact, I believe they probably are more closely related to other species than they are among themselves.

Archibaccharis albescens (J. D. Jackson) Nesom, comb. et stat. nov. Archibaccharis hirtella var. albescens J. D. Jackson, Phytologia 28:298. 1974. TYPE: MEXICO, Oaxaca, Sierra de Clavellinas, 18 Oct 1894, C. G. Pringle 4988 (Holotype: MIN; isotypes: BM, ENCB, G, GH, K, MICH, MO! ,MSC, NY, P, POM, UC, VT!).

Endemic to central Oaxaca; pine-oak and oak woods, often with alder; 1900-2900 m; flowering (Aug-) Oct-Jan.

Stems moderately pubescent with spreading, thick, eglandular hairs 0.5-1.2 mm long. Lower leaf surfaces with minute but prominent short-stipitate resin glands among the longer, eglandular hairs, otherwise sparsely hairy, the upper surface eglandular, sparsely hairy only along the veins. Pistillate heads 2-2.6 mm long.

Archibaccharis albescens may be related to A. schiedeana (Benth.) J. D. Jackson, a scandent species with minute resin glands on the upper leaf surfaces and sometimes on the lower.

Archibaccharis taeniotricha (S. F. Blake) Nesom, comb. et stat. nov. Archibaccharis hirtella var. taeniotricha S. F. Blake, J. Wash. Acad. Sci. 24:434. 1934. TYPE: GUATEMALA. Dept. Chimaltenango, Santa Elena, 24 Feb 1933, A. F. Skutch 276 (Holotype: US; isotypes: A, DS, MICH).

Chiapas to El Salvador; slopes and ravines in cloud forests, usually with oak, pine, or cypress, 1200-3800 m; flowering Dec-Jan.

Upper stems and veins of lower leaf surfaces densely covered with stiffly spreading, often deflexed, vitreous, reddish-brown hairs 0.5-1.5 mm long, the lamina often similarly hairy but eglandular. Pistillate heads 2-2.5 mm long. Pistillate style branches 0.5-0.6 mm long.

Archibaccharis taeniotricha may be more closely related to A. flexilis (S. F. Blake) S. F. Blake, another similarly hairy, scandent species restricted to Central America from Chiapas to Costa Rica, than to the taxa originally included as varieties of A. hirtella by Jackson. Archibaccharis flexilis has curving-twining stems, pistillate phyllaries 3.5-4.5 mm long, and pistillate style branches 1-1.2 mm long.

ARCHIBACCHARIS HIRTELLA (DC.) Heering, Jahrb. Hamb. Wissensch. Anst 21, Beiheft 3:41. 1904. Baccharis hirtella DC., Prodr. 5:418. 1836. TYPE: MEXICO. Between Acapulco and Mexico city, 1791(?), Haenke s.n. (Holotype: G-DC, photo-TEX!; isotypes: fragments-F(?), P, P photo-MIN).

Guerrero, Morelos, México, and Oaxaca; moist or rocky slopes in oak, oak-fir, pine-oak, or pine woods, 600-3200 m; flowering Oct-Feb.

Stems and phyllaries densely glandular with minute, stipitate resin glands 0.1 mm or less high, sometimes mixed with a few biseriate hairs 0.1-0.2 mm high. Pistillate heads 2-2.5 mm long, staminate heads 1.5 mm long. Disc flowers usually with dark purple lobes and throats, the tube whitish and densely hairy, style branches 0.1-0.2 mm long.

ARCHIBACCHARIS INTERMEDIA (S. F. Blake) B. Turner, Phytologia 56:377. 1984. Archibaccharis hirtella var. intermedia S. F. Blake, J. Wash. Acad. Sci. 24:434. 1934. TYPE: MEXICO. Veracruz, near Orizaba, 25 Jan 1895, C. G. Pringle 6108 (Holotype: US; isotypes: BM, C, F, GH, K, MICH, MIN, MO!, MSC, NY, P, POM, UC, VT!).

Veracruz, Hidalgo, and Puebla; cloud forests, usually with pine, oak, or alder, 1000-2400 m; flowering Oct-Feb (-Mar).

Stems straight to slightly fractiflex but probably scandent in habit. Completely eglandular. Leaves small, abruptly petiolate, the blades mostly ovate, 25-45 (-60) mm long, 9-30 mm wide, coarsely serrate-mucronulate with 1-5 pairs of teeth, the apices long, entire, acuminate or acute. Heads small in leafy, open capitulescences, the ultimate peduncles mostly 5-12 mm long.

III. Archibaccharis asperifolia (including A. sescenticeps)

I agree with McVaugh (1984) that A. sescenticeps can only be arbitrarily separated from A. asperifolia. In Michoacan, Guerrero, Mexico, and Hidalgo, a tendency exists for the leaves to be glabrous above and more ovate and the leaf and stem pubescence more dense, traits said to distinguish A. sescenticeps, but these morphologies are intergrading in that region and not indicative of the presence of two taxa.

ARCHIBACCHARIS ASPERIFOLIA (Benth.) S. F. Blake

Baccharis asperifolia Benth., Pl. Hartweg. 86. 1841. TYPE: GUATEMALA. Mixco, 1840, Hartweg 589 (Holotype: K; isotypes: G photo-TEX!, fragments, GH, K, NY, P). Conyza asperifolia (Benth.) Benth. & Hook. ex Hemsley, Biol. Centr.-Amer. Bot. 2:126. 1881. Hemibaccharis asperifolia (Benth.) S. F. Blake, Contr. U. S. Natl. Herb. 20:552. 1924. Archibaccharis asperifolia (Benth.) S. F. Blake, Contr. U. S. Natl. Herb. 23:1509. 1926.

Baccharis scabridula Brandegee, Univ. California Publ. Bot. 6:77. 1914. TYPE: MEXICO. Chiapas, Cerro del Boquerón, Aug 1913, Purpus 6665 (Holotype: UC; isotypes: BM, F, GH, MO!, NY, US)

Hemibaccharis sescenticeps S. F. Blake, Contr. U. S. Natl. Herb. 20:552. 1924. TYPE: MEXICO. Mexico, Mt. Ixtaccíhuatl, Nov 1905, Purpus 1501 (Holotype: US; isotypes: BM, C, DS, F, GH, MO!, POM, UC). Archibaccharis sescenticeps (S. F. Blake) S. F. Blake, Contr. U. S. Natl. Herb. 23:1509. 1926.

Jalisco, Michoacán, México, Hidalgo, San Luis Potosí, Veracruz, Puebla, Guerrero, Oaxaca, and Chiapas, to Nicaragua: oak, pine-oak, pine-fir, deciduous or evergreen cloud forests, often in open areas; 1700-3000 [-3900] m; flowering (Sep-) Oct-Feb.

Erect subshrubs. Stems terete to angled, usually purplish, glabrous or very sparsely hairy below the capitulescence. Leaves mostly lanceolate-ovate to elliptic with acute to short-acuminate apices, the margins serrate, scabrous above or rarely glabrate, very sparsely hairy to glabrous beneath, midvein and primary lateral raised beneath, the smaller, reticulate veins sunken and conspicuously darker than the lamina. Pistillate heads 3.5-4 mm long; filiform flowers eligulate or the ligules barely if at all reaching the bifurcation of the style branches. Chromosome number, n=9 pairs.

Archibaccharis asperifolia is similar to A. serratifolia (H.B.K.) S. F. Blake, another widespread and relatively variable species, which occurs from Sinaloa and Chihuahua to Veracruz and south to Guatemala. They can be distinguished by the contrasts in the following couplet.

1. Stems glabrous or glabrate below the capitulescence; leaves glabrous to very sparsely short-hairy beneath, midvein and primary laterals raised beneath with the smaller, reticulate veins sunken and conspicuously darker than the lamina; pistillate flowers eligulate or the ligules barely if at all reaching the bifurcation of the style branches ..... A. asperifolia

1. Stems hairy to well below the capitulescence; leaves moderately to densely pilosulous beneath, sometimes merely hispid with shorter, stiffer hairs, midvein, primary lateral, and main reticulating veins raised, whitish; pistillate flowers with ligules usually as long as the style branches ..... A. serratifolia

IV. A new species of sect. Hirtella

Archibaccharis veracruzana Nesom, sp. nov.

A. salmeoidi (S. F. Blake) S. F. Blake similis sed caulibus pilis biseriatis glandiferis 0.1-0.6 (-1.0) mm longis et capitulorum pistillatorum phyllariis ad maturitatem non elongatis non lanceolatis differt.

A "climbing shrub" (from the label). Stems purplish-brown, slightly fractiflex, angled at the nodes 35-50 mm apart, densely glandular with biseriate hairs with colored cross-walls. the hairs 0.1-0.6 (-1) mm long, tipped with a small but easily visible head. Leaves thick, slightly shiny, glabrous except for a few small hairs along the margins and larger veins, lanceolate-ovate with short-acuminate apices and rounded to obtuse bases, the blades 45-95 mm long, 15-45 mm wide, on distinct petioles 5-8 mm long, margins serrulate-mucronulate with 5-9 pairs of teeth. Capitulescences axillary and terminal, many-headed but somewhat diffuse, corymbose panicles, ebracteate or with a small bract immediately subtending some of the heads. Staminate heads not observed. Pistillate heads 3 mm long, with 9-10 filiform pistillate flowers and 1 disc flower;

phyllaries prominently purplish, ovate to oblong-ovate, in 3-5 strongly graduate series, the inner 3 mm long, glabrous except for the fringed-ciliate margins. Pistillate flowers with tube 2 mm long, ligules 0.1-0.5 mm long, sometimes dissected into linear segments; style branches 0.8 mm long, exserted well above the corolla. Disc flowers with tube whitish, densely hairy, 1.6-1.8 mm long, throat 0.4 mm long, and lobes 1 mm long, the throat and lobes dark purple; style branches ovate, 0.6-0.8 mm long. Mature achenes not observed; pappus bristles 2-2.5 mm long.

TYPE: MEXICO. Veracruz, Mpio. Atzalan, La Florida, oak woods, side of arroyo, 1700 m, 22 Jan 1970, F. Ventura A. 372 (Holotype: LL!; isotype: WIS!)

The fractiflex (zig-zag at the nodes) stems, scandent habit, and capitulescences that are both terminal and axillary of this plant place it with the species of Archibaccharis sect. Hirtella J. D. Jackson. Among these, it is most similar to A. salmeoides (S. F. Blake) S. F. Blake, with which it shares petiolate, thick, shiny leaves and ovate phyllaries. The latter species, however, has stems with uniseriate, eglandular hairs and phyllaries of the pistillate heads that become lanceolate and 5-5.5 mm long at maturity. Archibaccharis veracruzana has biseriate-glandular stems and shorter, ovate to oblong-ovate phyllaries. The only other species of sect. Hirtella that has glandular stems is A. hirtella, but the glands are minute, stipitate resin glands 0.1 mm or less high, its leaves lack the thick texture and shiny surfaces, and its heads are formed of glandular, lanceolate phyllaries less than 2.5 mm long.

Acknowledgements

I thank the curators of WIS and VT for loans of specimens and the staff of SMU and MO for their hospitality.

Literature Cited

Blake, S. F. 1926. Archibaccharis, in Trees and shrubs of Mexico. Contr. U. S. Natl. Herb. 23:1507-1509.

Blake, S. F. 1927. New Asteraceae from Costa Rica. J. Washington Acad. Sci. 17:59-61.

Jackson, J. D. 1974. Notes on Archibaccharis (Compositae--Astereae). Phytologia 28:296-302.

Jackson, J. D. 1975. A revision of the genus Archibaccharis Heering (Compositae--Astereae). Phytologia 32:81-194.

McVaugh, R. 1972. Nomenclatural and taxonomic notes on Mexican Compositae. Rhodora 74:495-516.

McVaugh, R. 1984. Archibaccharis, pp. 69-76 in Flora Novo-Galiciana, Vol. 12, Compositae. University of Michigan Press, Ann Arbor.

Sundberg, S. 1984. Archibaccharis jacksonii (Compositae, Astereae): a new species from Costa Rica. Syst. Bot. 9:295-296.

Turner, B. L. 1984. Archibaccharis intermedia (Blake) Turner, comb. nov. Phytologia 56: 377-379.

TWO NEW SPECIES OF TAGETES (ASTERACEAE-TAGETEAE) FROM MEXICO

B.L. Turner

Department of Botany, Univ. of Texas, Austin, TX 78713, U.S.A.

Preparation of a treatment of Tagetes for the Asteraceae of Mexico (Turner and Nesom, in prep.) has revealed the following novelties. I am grateful to Dr. G. Nesom for the Latin diagnoses. Doris Tischler provided the illustration.

TAGETES OAXACANA B. Turner, sp. nov., Fig. 1.

T. linifolia Seaton simile sed habitu fruticoso gracili usque ad 1 m alto et foliis 1-pinnatisectis divisionibus plerumque 15-27 filiformibus torulosis 10-20 mm longis et ca. 0.5 mm latis differt.

Slender glabrous shrubs to nearly 1 m high; stems terete, glabrous, striate, purplish; leaves opposite throughout, pinnately once-dissected, the divisions mostly 15-27, these filiform or nearly so, torulose, mostly 10-20 mm long, ca 0.5 mm wide, pustulate glands abundant along their length; heads radiate, ovoid in bud, borne solitary on peduncles 5-8 cm long; involucres broadly turbinate, 12-13 mm high, the bracts 5, their apices obtuse, glandular with linear pustules below, these becoming elliptical or round apically; ray florets 5, the ligules yellow, 12-15 mm long, 6-8 mm wide; disk florets 30-50, the corollas yellow, 8-9 mm long, the lobes linear, 1.5-2.0 mm long; disk achenes linear oblanceolate, 7.5-8.0 mm long, minutely hispidulous throughout to only moderately so, the pappus of 2-4, mostly united, erose scales, 3-4 mm long, and 1-3 much longer subulate awns 8-10 mm long, those of the ray with only short united scales ca 4 mm long.

A very distinct species, clearly related to T. linifolia but differing in numerous characters including habit, leaf shape, etc.

Tagetes oaxacana was distributed as T. cf. linifolia. The latter is a low divaricately branched shrublet which is relatively common on the drier western side of Mount Orizaba and Cofre de Perote in s. Puebla and adjacent Veracruz where it occurs among volcanic rocks and on ashy volcanic soils (Turner 15194 and 15248; TEX, XAL). The present species is described by its collectors as "slender shrubs up to nearly 1 m., but also blooming the first year".

TYPE: MEXICO. OAXACA: 25 mi SE of Tlaxiaco, ca 7200 m, "Brushy places on thin soil on sloping limestone rocks along the north base of the Sierra Madre del Sur", 25 Oct 1965, A. Cronquist & M. Sousa 10409 (holotype TEX; isotypes MEXU, NY, etc.).

TAGETES EPAPPOSA B. Turner, sp. nov.

T. pringlei S. Wats. simile sed acheniis parvioribus (5.0-6.0 mm longis) since pappo, capitulis plerumque 8-10 mm altis in pedicellis 2-4 cm longis, et flosculis disci 6-9 corollis plerumque 4-lobis 4-6 mm longis differt.

Slender erect aquatic annuals 30-45 cm high. Stems terete, striate, glabrous, the internodes as long as or longer than the leaves. Leaves opposite, linear-oblanceolate, connate, those at mid-stem 3-6 cm long, 3-4 mm wide, the surfaces glabrous, very weakly glandular-pustulate, the margins serratulate. Heads radiate, fusiform, 8-10 mm high, 3-4 mm thick, borne terminal or axillary on slender peduncles mostly 2-4 cm long. Involucre 8-9 mm high, the bracts 3-5 connate for 5/6 their length or more, red-striate, without or only a few round glandular-pustules present. Ray florets much-reduced, 1-2 per head, the ligules yellow, ca 1 mm long or less. Disk florets 6-8 per head, the corollas yellow, 4-6 mm long, the tube 2 times as long as the throat, the lobes mostly 3 or 4 in number, rarely 5. Anthers mostly 4, rarely 3. Style branches with short hispid acute appendages ca 0.7 mm long. Achenes linear-elliptical, 5-6 mm long, ca 1.5 mm wide, the pappus absent or nearly so.

TYPE: MEXICO: DURANGO: 9 mi N of Los Coyotes railroad station, ca 50 miles W of Durango, in shallow standing water in open pine-oak woods atop plateau in the Sierra Madre Occidental, 8100 ft, 29 Sep 1962, A. Cronquist 9562 (holotype TEX; isotypes NY, etc.).

Additional specimen examined: DURANGO: ca 5 mi NE of El Salto in low wet meadow along highway 40, ca 60 mi SW of Durango city, 8 Sep 1965, R. C. Jackson 7255 (TEX).

The holotype was distributed as Pectis connata Cronq., sp. nov., but the late D. Flyr annotated the sheet as "T. pringlei S. Wats. (Cronquist, pers. comm.)". Certainly it is close to the latter but differs in a number of features, the most obvious being the epappose achenes, the only truly epappose species of the genus known to date. The pappose Tagetes pringlei is a robust widespread species of the Central Plateau of Mexico extending from the type locality in Central Chihuahua to the State of Mexico. It is typically much-branched and the heads are usually clustered and sessile or only shortly pedunculate. Specimens from Jalisco are typically fewer-headed (much like T. epapposa) and shortly pedunculate, in habit somewhat between T. pringle and T. epapposa, but always pappose.

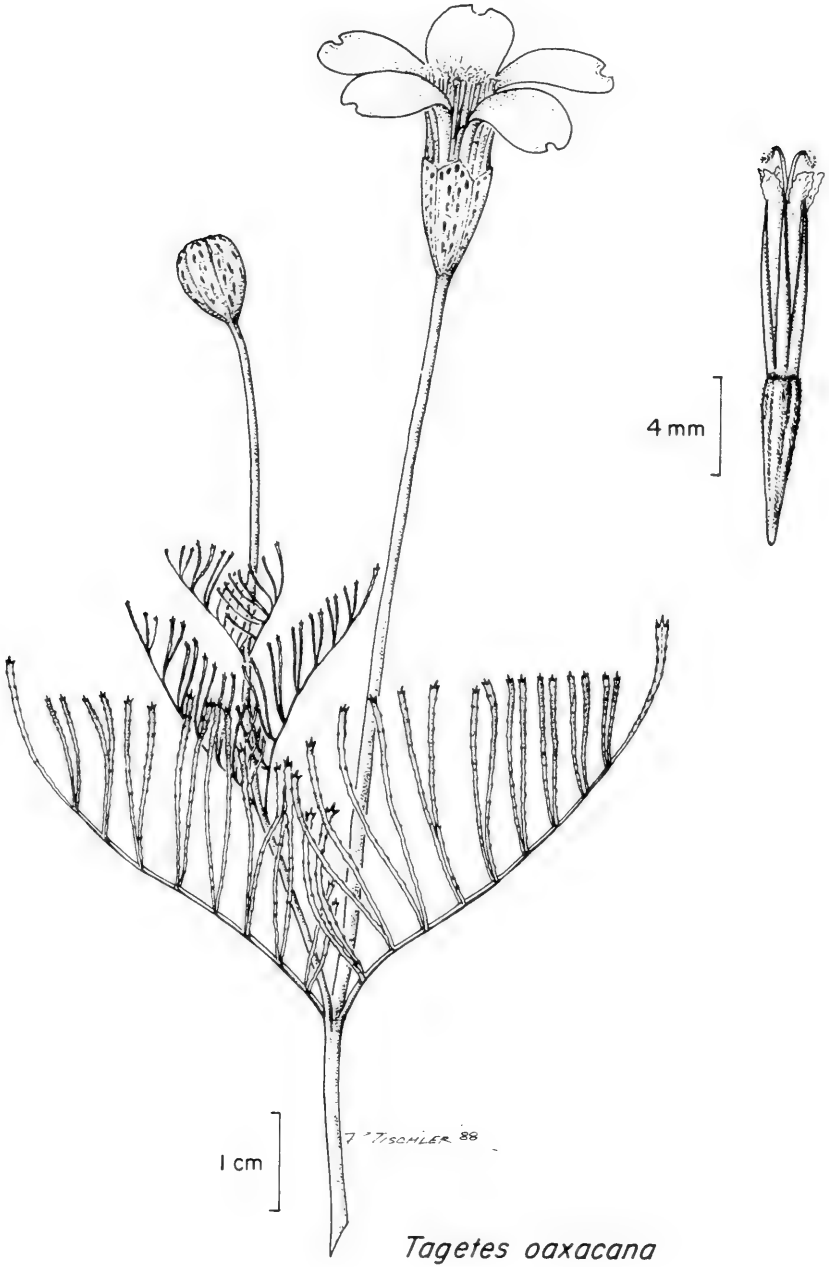

Fig. 1. *T. oaxacana*, from holotype

HYDROPECTIS STEVENSII (TAGETEAE) POSITIONED IN A NEW MONOTYPIC GENUS HYDRODYSSODIA

B. L. Turner

Department of Botany, University of Texas
Austin, TX, U.S.A. 78713

The genus Hydropectis was first proposed as a monotypic element by Rydberg (1915) to house Pectis aquatica S. Wats., a simple-leaved, annual aquatic which is native to the Sierra Madre of Western Chihuahua where it occurs in shallow pools with Potamogeton and yet other acknowledged aquatics. He positioned this in his subtribe Pectidinae with Pectis, the only other genus recognized in the group. In proposing Hydropectis stevensii McVaugh, its author stated that "I originally thought the Hydropectis stevensii might represent an aberrant species of Dyssodia, and I am indebted to Dr. John L. Strother for reminding me of Hydropectis." Strother (1969, 1986) is the acknowledged doyen of the tribe Tageteae, contributing a systematic review of that tribe for the Reading Symposium (Heywood, Harborne and Turner, 1977). Nevertheless, in this overview he retained H. stevensii within Hydropectis noting "that the genus is better treated as a member of Tagetinae [as opposed to Pectidinae]. I suggest an alliance with Dyssodia subgen. Hymenatherum." Keil and Stuessy (1977) subsequently obtained a chromosome count of $n = 9$ pairs for Hydropectis aquatica and observed that no other member of the Tageteae had been reported with $n = 9$, but that the number was closer to Dyssodia and relatives ($x = 7$, 8, 10 and 13) than it was to Pectis ($x = 12$) and, considering all available evidence, generally concurred with Strother's evaluation that it "would be better placed in the Tagetinae than in the Pectidinae."

In the preparation of a treatment of the tribe Tageteae for the Asteraceae of Mexico (Turner and Nesom, in prep.) I have had occasion to reevaluate the relationship of Hydropectis. In this I conclude that Hydropectis, as presently construed, is biphyletic, composed of 2 discordant elements, H. aquatica, which relates more closely to Tagetes than it does to its congener, H. stevensii, the latter of which appears much closer to Dyssodia. Indeed, apart from chromosome number and pappus features, H. aquatica shares most of its morphological features with Tagetes: 5 involucral bracts in a single series united for 4/5 of their length or more and without a calyculus; linear-oblanceolate achenes; a pappus of tawny bristles, instead of sclerose scales as in most Tagetes.

Hydropectis stevensii, on the other hand, has involucral features of the genus Dyssodia, 5 free phyllaries in seemingly 2 series; achenes also like that genus (clavate, relatively short with mostly trifid scales). The disk florets of both species, however, possess similar style branches (short, with papillose obtuse appendages); they also have more or less similar corollas. In short, the two species seem to be included together in Hydropectis largely because they are both aquatics.

Aquatic species also occur in Tagetes, namely T. pringlei S. Wats and T. epapposa B. Turner (Turner, 1988). Both of these, however, are clearly members of Tagetes, possessing most of the features of that genus. What I am suggesting here is that, within the tribe Tageteae in Mexico, adaptation to aquatic conditions (i.e., restriction to vernal pools and dependent upon such sites for germination and productive growth), has occurred independently in several lines as contrasted in the following:

Comparison of aquatic taxa with Dyssodia.

	T. pringlei	Hydropectis	Hydrodyssodia	Dyssodia
Habitat:	aquatic	aquatic	aquatic	terrestrial
Head shape:	fusiform	narrowly turbinate	globoid	turbinate campanulate
Phyllaries:	connate	connate	free	free
Calyculus:	absent	absent	absent	present
Receptacles:	convex knobby	subconical knobby	subconical knobby	subconical fimbrilliate
Style branches:	long, apiculate	short, obtuse	short, obtuse	short, obtuse
Achenes:	Linear-clavate not stipitate	linear-oblanceolate stipitate	clavate not stipitate	obpyramidal not stipitate
Pappus:	scales and awns w/o bristles	bristles only	scales with 3-5 bristles	scales with 5-10 bristles
Anther appendages:	ovate, ratio length/wid. = 2/1	ovate 2/1	broadly ovate 1/1	lanceolate 5/1
Corolla tube/throat ratio:	2/1	ca 1/1	ca 1/1	ca 1/1
Chromosome number	?	X = 9	?	X = 13

In summary, Hydropectis aquatica appears more closely related to Tagetes than to its congener, H. stevensii, which appears more closely related to Dyssodia. Neither appear to belong to one or the other genus;

however, each possesses one or more unique traits that preclude inclusion in the generic groups to which they relate. Perhaps inclusion of H. stevensii within Dyssodia, as originally envisioned by McVaugh, might be defensible, but Strother's (1986) recent dismemberment of that large variable complex prevents any meaningful inclusion; at least it would not fit comfortably into any of his segregate genera.

HYDRODYSSODIA B. Turner, gen. nov.

Dyssodiae Cav. simile sed habitu aquatico, capitulis ovoideis sine calyculo, bracteis involucri 5-6 liberis fere eglandulosis, appendicibus antherarum ovatis, receptaculis convexis nodosis, et squamis pappi setis 3-5 differt.

The genus contains the single following species:

HYDRODYSSODIA STEVENSII (McVaugh) B. Turner, comb. nov.

Based upon Hydropectis stevensii McVaugh, Contr. Univ. Michigan Herb. 9:416. 1972.

LITERATURE CITED

Heywood, V., J. Harborne and B.L. Turner. (eds.) 1977. Biol. Chem. Compositae I, II, Academic Press.

Keil, J.K. and T.F. Stuessy. 1977. Chromosome counts of Compositae from Mexico and the United States. Amer. J. Bot. 64: 791-798.

McVaugh, R. 1972. Hydropectis stevensii, in Contr. Univ. Michigan Herb. 9: 416.

Rydberg, P.A. 1915. Hydropectis, in N. Amer. Fl. 34: 216.

Strother, J.L. 1969. Systematics of Dyssodia...Univ. Calf. Publ. Bot. 48: 1-88.

_____. 1986. Renovation of Dyssodia...Sida 11: 371-378.

Turner, B.L. 1988. Two new species of Tagetes... Phytologia 65: (in press).

NEW COMBINATIONS IN MEXICAN *VERNONIA* (SECT. LEPIDAPLOA)

B. L.Turner
Department of Botany, University of Texas
Austin, Texas 78713, USA

Gleason (1906, 1922), in his treatments of the North American *Vernonia*, recognized 4 species within his *Texanae* "species-group" of the sect. *Lepidaploa* (Paniculatae verae): *V. ervendbergii*, *V. greggii*, *V. schaffneri* and *V. texana*.

Chapman and Jones (1978) presented a biosystematic study of these 4 taxa. They retained *V. texana* but included the remaining taxa as but 3 subspecies in a highly variable *V. greggii*, to which they added a fourth subspecies, *V. greggii* subsp. *faustiana*. In the preparation of a treatment of *Vernonia* for Mexico I have had to go over their contribution and, in the process, have interpreted the group somewhat differently. I can recognize *V. texana* (not known from Mexico) and *V. greggii*, but to the latter I can only discern 2 infraspecific categories, both of which I treat as regional varieties since these intergrade over a narrow region along the lower Gulf slopes of the Sierra Madre Oriental (Fig. 1). I have elevated their subsp. *faustiana* to specific rank since the few collections known to me are quite different from both varieties of *V. greggii*, and these occupy an isolated region remote from the other several taxa in the *V. texana* complex. My interpretation of the Mexican taxa of these groups follows.

1. Heads 1-10 in a subfasciculate or subumbellate capitulescence; involucres 10-12 mm high, the outer bracts with slender subulate apices 2-4 mm long; achenes glabrous or punctate-glandular------*V. faustiana*

1. Heads mostly 10-numerous in corymbose panicles, not manifestly subfasciculate or subumbellate; involucres 4-10 mm high, the outer bracts obtuse to acute or apiculate but not with slender subulate apices 2-4 mm long; achenes pubescent (2)----------*V. greggii*

    2. Heads relatively small, mostly with 15-35 florets; involucral bracts mostly 4-6 mm long; Gulf slopes of Sierra Madre Oriental, mostly 900-1700 m ----------var. *ervendbergii*

2. Heads relatively large, mostly with 40-80 florets; involucral bracts mostly 6-9 mm long; interior mountains, mostly 1500-2500 m---------var. greggii

VERNONIA FAUSTIANA (Chapman & Jones) B. Turner, comb. nov. Based upon Vernonia greggii A. Gray subsp. faustiana

Chapman & Jones, Sida 7: 279. 1978.

This taxon was known to Chapman and Jones only by the holotype (TEX!). Two additional collections have subsequently been made, both somewhat north of the type locality: COAHUILA. MCPIO. DE MUZQUIZ: Rincon de Maria, 28° 27' 30"N, 102° 04'W, 1750 m., 23 Aug 1975, Wendt et al. 1273, 1273A (LL).

VERNONIA GREGGII A. Gray var. GREGGII
Vernonia greggii A. Gray subsp. greggii
Vernonia greggii var palmeri A. Gray
Vernonia greggii subsp. schaffneri (A. Gray) Chapman & Jones
Vernonia schaffneri A. Gray
Vernonia taylorae Standl.

The holotype of V. greggii and V. schaffneri are both deposited at GH(!). Strangely, the type of var. palmeri was not located at GH; Chapman and Jones credit the holotype as being at NY.

Chapman and Jones distinguished their subsp. schaffneri from subsp. greggii by floret number (ca 36 vs 40+) and leaf shape (lanceolate to linear-lanceolate vs elliptic to ovate). These are very variable characters and are not effective in discriminating anything other than the extremes and even these do not fall out into meaningful distributions, at least as judged by a wide range of collections assembled since the work of Chapman and Jones.

The var. greggii intergrades with var. ervendbergii up slope along the front range of the Sierra Madre Oriental. Indeed, some of the specimens are simply more-or-less intermediate between the populational extremes and naming these becomes somewhat arbitrary, as noted by Chapman and Jones.

VERNONIA GREGGII var. ERVENDBERGII (A. Gray) B. Turner, comb. nov.

Based upon Vernonia ervendbergii A. Gray, Proc. Amer. Acad. Arts 17: 203. 1882.

Vernonia greggii subsp. ervendbergii (A. Gray) Chapman & Jones.

A. Gray based his original discription upon sheets, all on deposit in GH(!): an Ervendberg collection from "Wartenberg, near Tantoyuca" Prov. Huesteca, Veracruz; Palmer 750 from near Monclova, Coahuila and a Gregg "collection" from near Monterrey, Nuevo Leon. From among these Chapman and Jones neglected to select a lectotype. I have selected the Ervendberg collection, which is in the southern part of the range of var. ervendbergii. The Gregg "collection" was ruled out because Gray cited no collection number but merely noted, "Apparently also near Monterrey, Gregg." The very abbreviated descriptions fits both of the aforementioned sheets but more so the Ervendberg collection since it has leaves somewhat scabrous on the upper surfaces, a feature mentioned in the protologue not found on the Palmer collection. Furthermore, the Palmer collection is, in my opinion, somewhat intermediate to the regional varieties recognized here, perhaps even closer to the var. greggii than var. ervendbergii. It also occurs in more inland habitats, characteristic of the former taxon.

LITERATURE CITED

Chapman, G. C. and S. B. Jones. 1978. Biosystematics of the Texanae Vernonias...Sida 7:264-281.

Gleason, H. A. 1906. A revision of the North American Vernonieae. Bull. N.Y. Bot. Gard. 4:203-205.

_____. 1922. Vernonieae, in N. Amer. Fl. 33:85-86.

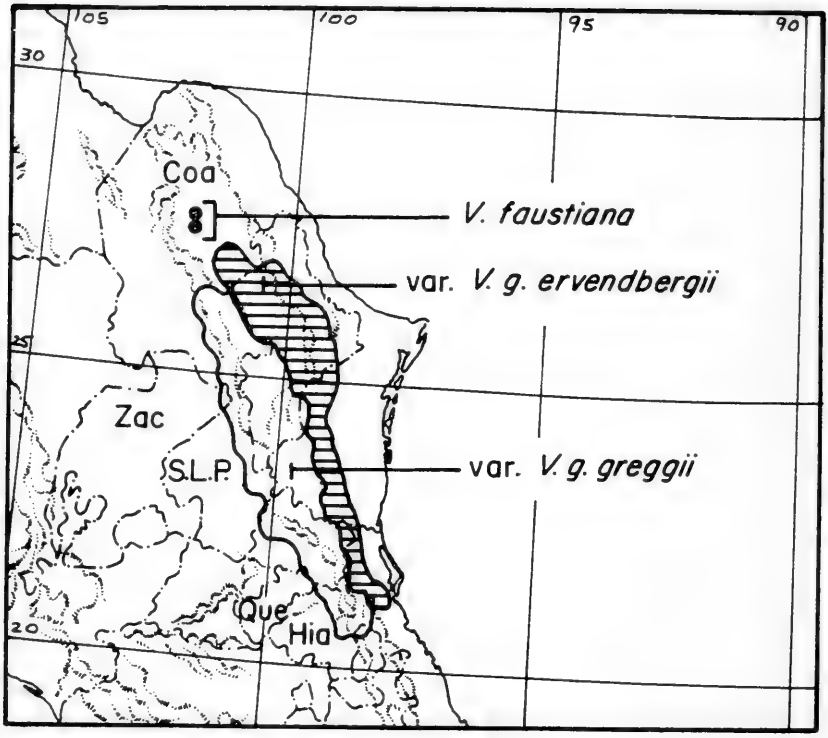

Fig.1. Distribution of Vernonia taxa.

A NEW SPECIES OF TRIDAX (ASTERACEAE-HELIANTHEAE) FROM OAXACA, MEXICO

B. L. Turner, Department of Botany, University of Texas, Austin, TX 78713, USA

In the preparation of a treatment of the genus Tridax for the Asteraceae of Mexico the following novelty, closely related to the Guatemalan Tridax purpurea, was detected.

Tridax oaxacana B. Turner, sp. nov.

T. purpureae S. F. Blake simile sed foliis ovatis fere sessilibus, bracteis involucri glabris, et flosculis disci purpuratis differt.

Stiffly erect, perennial, herb to 1 m high; stems simple, mostly unbranched, pubescent below with spreading glandular-trichomes, 1.0-1.8 mm long, these shorter above (ca 0.5 mm long) and interspersed among these a few longer, glandless trichomes (ca 1 mm long); leaves ovate, 4-7 cm long, 1.5-2.5 cm wide, sparsely rough-hispid, the petioles 0-2 mm long, the margins serratulate; heads radiate, 6-8 in long lax panicles 50-60 cm long, the ultimate peduncles 1-7 cm long; involucres campanulate, 10-12 mm long, 10-12 mm wide, the bracts 5-6 seriate, markedly graduate, chartaceous, glabrous or nearly so, the margins scarious, rounded at the apices; receptacles conical, paleate, the pales scarious, ovate-linear, 6-8 mm long, somewhat 3-fid; ray florets 3, fertile, the ligules lavender, obovate, ca 15 mm long, ca 14 mm wide; disk florets, 16-20, the corollas purplish-black, the tube ca 2 mm long, hirsutulous, the throat ca 5 mm long, glabrous above for ca 2/3 its length, the lobes 5, ca 1 mm long; achenes ca 4 mm long, 4-sided, pubescent throughout with appressed silky hairs, the pappus of 10-12 fimbriate scales ca 1.2 mm long.

TYPE: MEXICO. OAXACA: 12.1 km N of Sola de Vega, pine-oak forests, 1840 m, 21 Oct 1985, B. Bartholomew 3270 holotype TEX; isotypes (CAS, MEXU).

The species is closely related to Tridax purpurea Blake, and will key to that taxon in the treatment of Powell (1965). The latter species is known by only a few collections from Guatemala. Tridax oaxacana differs in having its lower stems glandular-pubescent, leaves ovate with nearly sessile blades, and disk florets purple-black.

REFERENCE

POWELL, A. M. 1965. Taxonomy of Tridax (Compositae). Brittonia 17: 47-96.

CALEA TERNIFOLIA Kunth var. HYPOLEUCA (Rob. & Greenm.) B. Turner, comb. nov.

Based upon Calea hypoleuca Rob & Greenm., Proc. Amer. Acad. Arts 32: 24. 1986.

Wussow et al. (1985; Syst. Bot. 10: 241-267.) included this taxon in their broad concept of Calea ternifolia var. calyculata (B. L. Rob.) Wusson et al. The latter taxon, as noted by these authors, is largely confined to northeastern Mexico (Nuevo Leon, Tamaulipas, San Luis Potosi and Queretaro) while the var. hypoleuca is confined to Oaxaca. The latter variety is readily distinguished from var. calyculata by having leaves densely velutinous beneath, soft to the touch and heads sessile or nearly so; the leaves of var. calyculata are variously hispid or hispid-puberulous beneath and the heads are mostly borne on peduncles 2-10 mm long. To my knowledge the two taxa do not intergrade and appear to be well-marked, geographically isolated, varieties, if not species.

THE NATURAL DISTRIBUTION AND BIOLOGICAL STATUS OF HELENIUM AMARUM AND H. BADIUM (ASTERACEAE, HELIANTHEAE)

Nancy Stanford[1] and B.L. Turner[2]

Dept. of Geography[1] and Dept. of Botany[2]
The University of Texas at Austin, Austin, Texas 78713 USA

Helenium amarum and H. badium, according to Bierner (1972) make up the only elements of the section Amarum of the genus Helenium. They are both highly weedy taxa and, while originally native to the southcentral United States (mainly Texas and Louisiana), they have become widespread weeds elsewhere. The species are characterized by having ray florets with broadly obdeltoid ray ligules, involucral bracts narrow and reflexed at maturity, the outer series longer than the inner, and mostly linear-filiform, nondecurrent, leaves. Rydberg (1915) distinguished between the two species as follows:

Disk yellow; leaves all entire....H. tenuifolium (= H.amarum)

Disk purple-brown; some of the lower stem-leaves pinnately parted.....H. badium

The two species, as noted, were maintained by Rock (1957), Correll and Johnston (1970) and Bierner (1972, 1974) although the latter author has long recognized the very close relationship of the taxa (pers. comm.). Bierner (1974) also was aware of its weedy nature and its proclivity to spread as an immigrant to other regions, commenting that H. amarum "probably owes much of its present-day distribution to our highway systems since it appears to have spread eastward from Texas-Louisiana mainly during the past 50-75 years." While he does not document this statement, the present contribution shows that his surmize is largely accurate.

Helenium amarum was apparently first described by Rafinesque in 1817, who dubbed this Galardia amara, this being an earlier name for Helenium tenuifolium (Rock, 1957) which name Rydberg (1915) adopted for his treatment of Helenium in the North American Flora. Rock (1957) typified Rafinesque's name, which was accompanied by a fairly good protologue but without cited specimens, with a neotype (Ball 182, 6 Sep 1898, collected at Alexandria, Rapides Parish, Louisiana, US).

Fig. 1 shows the current distribution of Helenium amarum and H. badium as determined from specimens at GH, TEX and US. The question arises as to whether the collections of H. amarum

indicated as occurring outside of Texas and Louisiana are relatively recent introductions, as suggested by Bierner (1974). To this end we have tabulated some of the earliest collections of this taxon for various states.

TEXAS:

Goliad Co.: Berlandier 2514 (=1084) May 1834 (GH)
Harris Co.: Engelmann s.n. May 1842 (GH)
Comal Co.: Lindheimer 108 1843 (GH)

LOUISIANA:

New Orleans: Drummond 157 1832 (GH, TEX)

OKLAHOMA:

Tulsa Co.: Bush 322 Jul 1894 (GH)
(said to be "common" on the label)

ARKANSAS:

Hot Springs: Rau s.n. Aug 1879 (GH)
Little Rock: Hasse s.n. May 1886 (GH)

MISSISSIPPI:

Jackson Co.: Seymour 91827.60 Aug 1891 (TEX)

KANSAS:

Labette Co.: Hitchcock 738 1896 (GH)

MISSOURI:

Butler Co.: Eggert s.n. Jul 1892 (GH)
Dunklin Co.: Bush 71 Sep 1893 (GH)
Barry Co.: Blankenship s.n. Aug 1895 (GH)
(The label records,"This is now its furtherist range northward, passing up from south along lines of travel.")

TENNESSEE:

Chattanooga: Biltmore 3982b Aug 1897 (GH)

ALABAMA:

Mobile Co.: Crawford 853 Aug 1950 (TEX)

FLORIDA:

Manatee Co.: Garber s.n. Sep 1877 (GH)

INDIANA:

"Yankietown": Deam 51497 Oct 1931 (TEX)
("In hoglot", "first record for Indiana")

KENTUCKY:

Whitley Co.: Smith 3810 Jul 1937 (GH)

GEORGIA:

Thomas Co.: Taylor s.n. Sep 1903 (LL)

SOUTH CAROLINA:

Anderson Co.: Davis 8042 Jul 1917 (TEX)

NORTH CAROLINA:

New Hanover Co.: Williamson s.n. 1892 (LL)

VIRGINIA:

Fairfax Co.: Blake 8913 Oct 1924 (LL)

MARYLAND:

Baltimore Co.: Foreman s.n. before Oct. 1871 (GH)
(This specimen is mounted on a sheet with H. amarum from Texas, Parry 522; in the packet with this specimen is a letter to A. Gray from E. Foreman, dated 31 Oct 1871 which reads "I have failed to find it [the plant] described in your Manual (1876) ... collected 3 mi. NW of Baltimore")

CONNECTICUT:

"Bridgeport, railroad yard" Eames 8139 Sep 1908 (GH)

As can be seen from the above, H. amarum was first noted for Louisiana and adjacent east Texas. It apparently spread northwards and northeastwards out of this area as commerce, railways and roadwards developed into or out of this region. The taxon prospers in disturbed areas, especially in fallow fields and overgrazed grassy regions, the plant being bitter, bestowing a bitter taste to milk obtained from cows forced to feed upon it, as noted by Rafinesque in his original description of the species. No doubt yet earlier collections exist for this taxon for the various states mentioned above, but perhaps not much earlier than those listed.

Helenium amarum is largely found in open woodlands or grassy regions on heavy clay soils with an annual rainfall of 30-60 inches. It is not unexpected then, that this weedy taxon has expanded northwards and eastwards. Helenium badium, on the other

hand, is largely a taxon of the drier regions of the southwestern U.S.A. occurring mostly in central Texas with peripheral populations in adjacent Oklahoma and along the Rio Grande in adjacent Mexico.

Nevertheless a single collection of H. badium has been recorded by the late S.F. Blake from Washington, D.C. as follows:

"Rays yellow; disk purple. Single plant in dirt around tree on sidewalk, Independence Ave. between 12th and 14th Sts. S.W." 3 Aug 1940, Blake 12224 (LL).

This brings us to the final question posed in this paper: are the two taxa of the section Amarum (sensu Bierner, 1972) good species, or merely regional variations of a single species, H. amarum.

As indicated by the above key leads constructed by Rydberg to distinguish between these taxa, they reportedly differ primarily by disk color and the degree of dissection of the lower leaves. Actually these are very variable characters, presumably controlled by relatively few genes. Indeed, over a 10 year period, or more, the junior author has observed a single "mixed" population of these two head-forms along the Colorado River in Austin, Texas (just north of the Zilker Botanical Gardens) come up each year from the seeds spread naturally from the previous years' growth and without fail the population has maintained individuals with both reddish-brown disks and yellow disks. In some years the 100 or more individuals concerned have had predominately yellow disks, in other years predominately reddish-brown disks. But no other character or group of characters will serve to distinguish between them.

Nevertheless, as one ascends the Edwards Plateau and proceeds westwards to drier regions (rainfall 15-30 inches per year) the populations soon become completely reddish-brown and the lower leaves take on a more pinnatisect aspect; likewise, as one leaves the Edwards Plateau eastward the plants tend to become somewhat more robust with only yellow disks and the lower leaves are less dissected.

Correll and Johnston (1970) were well aware of the relatively trivial features which have been used to distinguish between the two taxa, commenting under their Helenium badium: "Identical to the last [H. amarum] but the lobes of the disk corolla red-brown so that the disk appears dark.... This can easily be considered merely a variety of H. amarum but it is more restricted geographically to calcareous disturbed soils of the Edwards Plateau, Plains Country and Trans-Pecos, infrequently farther e... also Okla." Clearly this was also the view of Gray who originally treated H. badium as a variety of H. tenuifolium (=H. amarum, cf. below).

It appears then that Sect. Helenium of Rock is best treated as monotypic, the single species comprised of two regional

intergrading varieties as follows

HELENIUM AMARUM (Raf.) Rock var. AMARUM, Rhodora 59:131. 1957.

Galardia amara Raf.
Helenium tenuifolium Nutt.

Type and distribution as discussed above.

HELENIUM AMARUM var. BADIUM (S. Wats.) Waterfall, Rhodora 62: 321. 1960.

Helenium badium (S. Wats.) Greene

Helenium tenuifolium var. badium A Gray ex S. Wats.

In his protocol Watson cited several collections as follows: Bluffton, Texas, E. Palmer 716 (GH!); "Bottoms," Austin, Texas, May 20, 1872, E. Hall 364 (GH!); and J. Reverchon, "Southwestern Texas." Bierner, by annotation at GH, lectotypified var. badium with the Hall Collection. The type locality is probably not too far removed from the populations observed by the junior author, mentioned above, bottoms along the Colorado River, on sandy shelves.

We are grateful to the Directors at GH and US for permitting use of their facilities and to Dr. M. Bierner for discussion relating to the above.

LITERATURE CITED

Bierner, M.W. 1972. Taxonomy of Helenium sect. Tetrodus and a conspectus of North American Helenium (Compositae). Brittonia 24: 331-355.

_____ . 1974. The taxa of Helenium in Tennessee. Castanea 39: 346-349.

Rock, H.F.L. 1957. A revision of the vernal species of Helenium (Compositae). Rhodora 59: 101-216.

Rydberg, P.A. 1915. Helenium, in N. Amer. Fl. 34: 120-131.

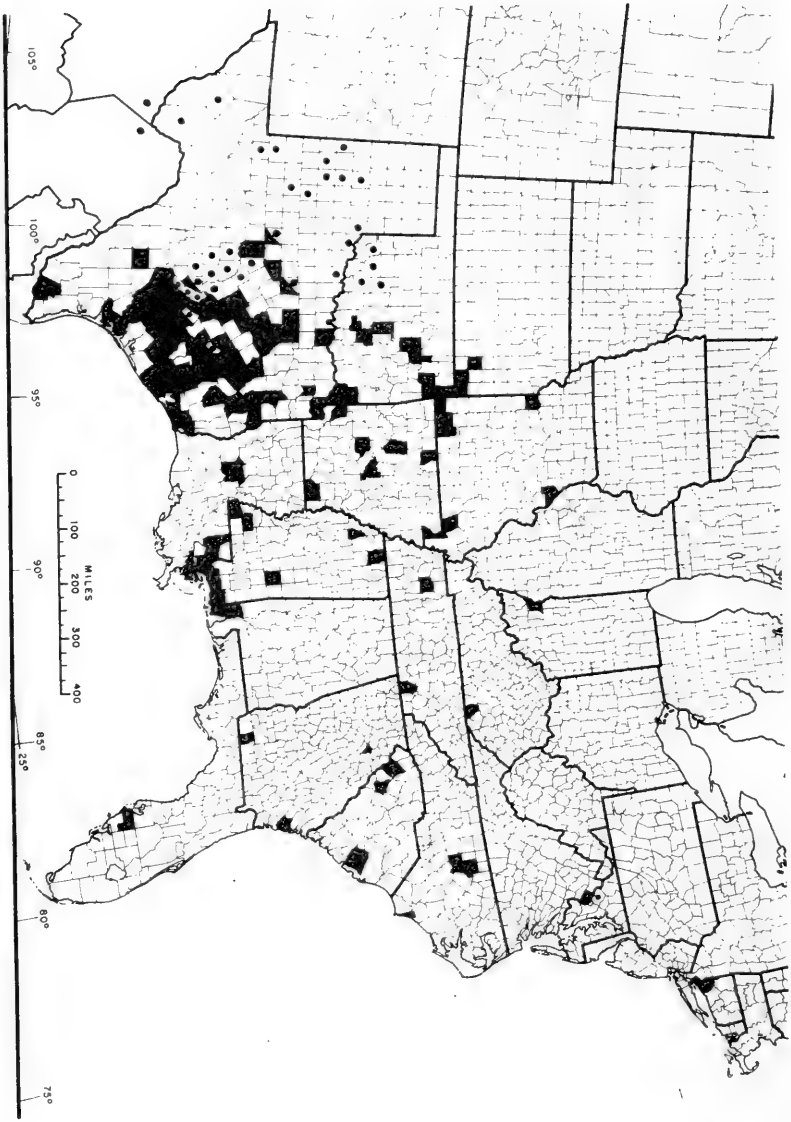

Fig. 1. Distribution of *Helenium amarum*: (•) var. *badium*; county shading, var. *amarum*

NUEVOS REGISTROS DE GRAMINEAS PARA EL ESTADO DE DURANGO II*

Yolanda Herrera Arrieta**
Herbario CIIDIR-IPN-Unidad Durango
Zarco 113, Vicente Guerero, Dgo.
C.P. 34890, Mexico

INTRODUCCION

Como resultado de la segunda etapa del proyecto florístico Agrostología de los pastizales de Durango que lleva a cabo el Centro Interdisciplinario de Investigación para el Desarrollo Integral Regional del I.P.N., Unidad Durango, se presentan doce taxa de la familia Gramineae cuya localización amplía su distribución hasta hoy conocida.

Los taxa de esta familia han sido citados en general para México por: Hitchcock (1913 y 1951), Beetle (1977), varios autores en North American Flora (1909-39) y para algunas áreas específicas por: McVaugh (1983), Wiggins (1980), Gould & Moran (1981), Shreve & Wiggins (1964), Johnston (1943) y Gould (1975).

RESULTADOS

Agropyron arizonicum Scribn. & Smith

Durango: Mpio. de Súchil, Reserva de la Biosfera La Michilía, bosque de pino-encino, S. Gallina # 309 (ENCB, CIIDIR).

Esta especie se distribuye según Hitchcock (1939, 241-242) en lomeríos rocosos del W de Texas, Nuevo México, Arizona, Nevada, California y Chihuahua. Según Gould (1975, 170) se ha registrado para el W de Texas a California y el N de México.

---

* Investigación parcialmente subvencionada por el CONACYT como parte del proyecto Flora de Durango.
** Becario de la COFAA del Instituto Politécnico Nacional.

Brachiaria fasciculata **(Swartz) Parodi**

Durango: Mpio. de Gomez Palacio, 1150 m, arvense, C. Rodriguez 1183 (ENCB). Mpio. de Mapimi, cerca del canal de riego, Reeder, Reeder and Gooding 1662 (ENCB, MEXU). Mpio. de Ceballos, 1000 m, S. Martinez 1349 (MEXU).

Se ha encontrado, segun McVaugh (1983, 289), en bosque subcaducifolio de *Brosimum y Orbignya*, en pantanos y cienegas, y en planicies humedas con pastizal, a 600 m de altitud en la vertiente del Pacifico. A menudo se le encuentra como maleza de cultivos y en la orilla de carreteras. Ha sido reportada para el SW de E.U.A.; para los estados mexicanos de: B.C., Son., Chih., Sin., Nay., Jal., Yuc., Chis.; Centro America; Jamaica; Sud America.

Eragrostis ciliaris **(L.) R. Br.**

Durango: Mpio. del Mezquital, 9 km al NE del Pastor, limite del estado de Durango con Nayarit, 1100 m, Bosque Tropical Caducifolio, 8 May 83, Y. Herrera 552 (CIIDIR).

Esta especie ha sido encontrada en suelos arenosos y deltas cerca del oceano, a orilla de carreteras, en claros del bosque tropical subcaducifolio con *Brosimum, Orbignya y Hura*, ocasionalmente en bosque de encino abierto y como maleza en lugares con disturbio a los 1000 m de altitud, segun McVaugh (1983,164-165). Se cita para el SE de los E.U.A.; los estados mexicanos de B.C., Son., Chih., Sin., Nay., Jal., Col., Mich., Gro., Mor., Oax., Ver., Pue., Tams., Tab., Yuc.; Centro America; Jamaica; Sud America; regiones calidas del mundo.

Eriochloa aristata **Vasey**

Durango: Mpio. de Villa Ocampo, 45 miles south of Parral, along highway #7 (3 miles north of Las Nieves), growing in a small depression at foot of slope, 13 Jul. 1950, Reeder, Reeder & Gooding #1677, (ENCB).

Especie citada por McVaugh (1983,177) para laderas con pastizal y bosque abierto, limite de campos de cultivos, manglares y orilla de carreteras, desde el nivel del mar hasta los 1000 m de altitud en la vertiente del Pacifico.

Festuca breviglumis Swallen

Durango: Mpio. de Topia, 1.8 km al E del entronque Topia-Canelas, por el camino a Durango, 2600 m, cañada con bosque de *Abies*, 6 Oct. 85, S. González 3477 (CIIDIR).

Se ha encontrado, según McVaugh (1983, 183), en laderas y barrancas; y en bosque húmedo de pino o abeto, por lo general con suelos profundos, entre los 1500 y 2700 m de altitud; para Jal., Mich., Mor., Chis.; Centro América.

Muhlenbergia glabrata (HBK.) Kunth

Durango: Mpio. de Durango, Parque El Tecuán, 58 km al Este de Durango, bosque de pino-encino, 30 Ag. 84, Casillas, Flores y Ruiz # 13 (CIIDIR).

Se ha encontrado, según Hitchcock (1935, 475), en lomerios rocosos en Guanajuato y en el S de México. Este registro constituye el primero del N de México.

Muhlenbergia quadridentata (HBK.) Kunth

Durango: Mpio. de Durango, Parque El Tecuán, 59 km al este de Durango, bosque de pino-encino, 16 Oct. 84, Casillas, Flores y Ruiz # 8 y 26 (CIIDIR). Mpio. del Mezquital, 19 km de los charcos, por el camino de Santa María de Ocotán, 2400 m, bosque de *Pinus lumholtzii* con *Quercus sp.*, 4 Oct. 83, S. y M. González 2570 (CIIDIR). 14 km al ENE de Canoas, 2300m, bosque de pino encino, 31 Oct. 82, González & Rzedowski 2253 (CIIDIR). 30 km al S de El Tronconón, por el camino a Temoaya, 2100 m, bosque de *Quercus, Arctostaphylos y Pinus*, 24 Sep. 82, González y Fernández 2203 y 2205 (CIIDIR). W de Santa Ma. de Ocotán, veg. riparia en medio del bosque de pino-encino, 16 Oct. 84, González y Acevedo 1488 (CIIDIR).

Planta registrada, según McVaugh (1983, 253), para Mich., Mex., Mor., D.F., Tlax., Pue.; Guatemala; para bosque de *Pinus hartwegii* en ocasiones asociado con *Abies o Alnus*, o como componente especial del pastizal alpino; entre los 3300 a 4100 m de altitud. En la sierra S de Durango, *M. quadridentata* ha sido encontrada entre los 2100 y 2750 m en bosque de pino-encino.

Muhlenbergia watsoniana Hitchc.

Durango: Mpio. de El Mezquital, Cordón de las

culebras, Reserva de La Michilia, 2670 m, bosque de *Pinus lumholtzii* y *Quercus* spp., 26 Nov. 85, S. González 3728 (CIIDIR).

Conocida solamente en la localidad tipo: San Luis Potosí (Schaffner 1067), reportada por Hitchcock (1935, 471). Los recientes hallazgos de esta planta en Durango, quizá sean los segundos que se mencionan de México.

Paspalum plicatulum Michx.

Durango: Mpio. El Mezquital, 9 km al NE de El Pastor, en el límite del estado de Nayarit con Dgo., 1100 m, bosque tropical caducifolio, 8 May. 83, Y. Herrera 561 (CIIDIR).

Aparentemente conocida en las elevaciones bajas en la vertiente del Pacífico de México, según McVaugh (1983, 321), reportada para el SE de E.U.A.; Sin., Nay., Ags., Jal., Col., Mich., Gro., Mor., Oax., Ver., S.L.P., Tab., Chis.; Centro América, Sud América.

***Sporobolus trichodes* Hitchc.**

Durango: Mpio. de Súchil, La Mesa del Burro, rancho De la Peña, bosque de encino-pino, 18 Sep. 85, Y. Herrera 749 (CIIDIR). 6 km al SW de Piedra Herrada, 2650 m , bosque de pino-encino, 16 Sep. 82, Y. Herrera 235 (CIIDIR). 9 km de Súchil, rumbo a El Mezquital, pastizal asociado al matorral xerófolio, 20 Ag. 85, García s.n. (CIIDIR).

McVaugh (1983, 375 y 376) lo cita para Chih., Zac., Ags., Jal., Mich., Mex., Mor. y Gro. Encontrado sobre laderas y planicies con pastizal o bosque de encino abierto, en depresiones húmedas o sobre suelos someros, en áreas rocosas con matorral de *Acacia* y nopalera, entre 1500 y 2700 m de altitud.

***Trisetum viride* (HBK.) Kunth**

Durango: Mpio. de Durango, 10 km al N de Durango, carr. Durango-Mazatlán, sobre la brecha que va a Otinapa, entronque a 43 km al W de Durango , 2450 m, bosque bajo de *Quercus y Pinus* con *Arctostaphylos*, 6 Oct. 78, Koch 78155, (CIIDIR, CHAPA, ENCB, MEXU). Mpio. de Pueblo Nuevo, 14.5 miles W of La Ciudad, 2560 m, 20 Sep. 53, Reeder & Reeder 2517 (MEXU). 25 miles W of La Ciudad, 2375 m, 29 Sep. 53, Reeder & Reeder 2507 (MEXU). El Salto, aserraderos, 2500 m, 30 Ag. 34, F.

W. Pennell 18516 (MEXU). Mpio. El Mezquital, cerca de La Escondida por el camino a Charcos, 19 Sep. 84, Jiménez & Acevedo 63 y 64 (CIIDIR).

Se conoce, según McVaugh (1983,400) para Jal., Gto., Qro., Gro., Oax.; Guatemala. Parece ser que ha sido poco colectada.

Trisetum virletii Fourn.

Durango: Mpio. de Pueblo Nuevo, along the Mazatlán Durango highway, 3-15 km from El Palmito toward El Salto Pblo. Nvo., 1950 a 2200 m, pine forest zone with deciduos trees in the humid ravines, 13 Abril 1965, R. McVaugh 23605 (ENCB).

Esta especie ha sido citada para laderas escarpadas húmedas y barrancas con bosque de pino o abetos, entre 2400 a 3000 m. Según McVaugh (1983, 400) se registra para S.L.P., Jal., Mich., D.F., Mor. y Ver.

LITERATURA CITADA

Beetle, A.A. 1977 Noteworthy grasses from Mexico V. Phytologia Vol. 37(4): 317-407.

Chase, A. 1929. The North American species of *Paspalum* Contr. U.S. Nat. Herb. 28(1): 310.

Gould, F.W. 1975. The grasses of Texas. College Station, Texas A. & M. Univ. Press. 653 pp.

Gould, F.W. & R. Morán. 1981. The grasses of Baja California, Mexico. San Diego Society of Nat. Hist. Memoir. 12. 140 pp.

Hitchcock, A. S. 1912. Mexican grasses in the United States National Herbarium. Contr. U.S. Nat. Herb. 171: 181-389.

------- 1951. Manual of the grasses of the United States, U.S. Dept. Agr. Misc. Publ. 200 ed. 2, revised by Agnes Chase. Washington, D.C. 1051 pp.

Johnston, I.M. 1943. Plants of Coahuila, Eastern Chihuahua and adjoining Zacatecas and Durango II. Jour. Arn. Arb. 24: 375-421.

McVaugh, R. 1983. Flora Novo-Galiciana. Vol. 14 Gramineae. Univ. of Michigan. 1032 pp.

North American Flora. Vol. 17 Gramineae. 1909-1939. The New York Botanical Garden. 8 parts.

Wiggins, I.L. 1980. Flora of Baja California. Stanford University Press. 1025 pp.

A NEW SPECIES OF EVOLVULUS (CONVOLVULACEAE) FROM VERACRUZ, MEXICO

Andrew McDonald, University of Texas

EVOLVULUS CHOAPANUS McDonald, sp. nov.

A E. lithospermoides Mart. floribus solitariis axialibus et spicis terminalibus bracteis inflorescentiae ovatis vel ellipticis corolla 7-8 mm longa recedit.

Herbs erect, suffrutescent, pilose. Stems erect or ascending, terete, 20-40 cm long, 0.5-1.0 mm in diameter, branching at the base, smooth, appressed pilose, hairs silver, ascending; internodes 6-9 mm long. Leaves simple, persistent, sessile; lamina linear-lanceolate, 1.0-1.8 cm long, 2-3 mm wide, chartaceous, upper surface green and glabrous or glabrescent, undersurface silver-sericeous, margins entire, apex attenuate or rarely acute, basally attenuate; venation palmate with 3-5 major nerves. Inflorescence variable, flowers solitary and axillary on proximal portions of the stems, and in terminal, bracteate, spicate capitula, flowers 1 per node, bracts 3-12 per spike, ovate or broadly elliptic, 2-5 mm long, 2-5 mm wide, densely sericeous to lanate, margins entire, apices attenuate; pedicels pendulous or erect during anthesis, reflexed when in fruit, terete, to 2 mm long, ca. 0.5 mm in diameter, green, sericeous; sepals equal, herbaceous, green, lanceolate, basally subovate, 4-5 mm long, 1-2 mm wide, membranous; corolla infundibular-campanulate, 7-8 mm long, the tube ca. 2.5 mm long, limb subentire, dilating gradually, white to pale blue, 8 mm wide, the plicae glabrous, interplicae appressed pilose; stamens included, inserted at base of corolla tube, white, glabrous; styles 2, equal, ca. 4.5 mm long; stigmas 2, equal, linear. Fruit not known.

TYPE: Mexico, Veracruz, 11 km S of hwy. 180 (Cardenas to Coatzacoalcos) towards Las Choapas, in tropical savannah, 50 m, 17 Jun 1970, Orozco 188 (Holotype XAL; isotypes F,MEXU).

Distribution. Known only from type locality.

Evolvulus, a New World genus of Convolvulaceae with about 100 species, is divided into two subgroups on the basis of inflorescence morphology (Oostrstroom, 1934). The "sparsiflori" complex (ca. 80 spp.), of widespread distribution throughout the Americas, includes species with simple, axillary inflorescences, while the "spicati" complex (ca. 20 spp.), hitherto known only from South America, includes species with terminal, bracteate, spicate capitula. The newly described taxon, E. choapanus, represents the first species of the spicati complex reported in North America, as it inhabits tropical savannahs in the Río Uxpanapa watershed of southern Veracruz.

The new species keys most closely to E. lithospermoides (sect. Phyllostachii Meissn.) on the basis of linear-lanceolate leaves with a green and sparsely pubescent upper surface, leaflike bracts that form the spicate capitula, and lanceolate sepals (van Oostrstroom, 1934). However, E. choapanus is distinguished from E. lithospermoides by leaves with a silver-sericeous undersurface, flowers both in proximal nodes and in terminal spikes, inflorescence bracts ovate to broadly elliptic, and a corolla 7-8 mm long with limb to 8 mm wide. Evolvulus lithospermoides has leaves with a sparsely pubescent undersurface, flowers restricted to terminal spikes, inflorescence bracts linear-lanceolate, and corollas 1.2-1.5 cm long with limb 1.0-1.5 cm wide.

A number of Convolvulaceae that occur in the humid regions of the Isthmus of Tehuantepec have distributions extending into South America, including I. batatoides Choisy, I. fimbriosepala Choisy, I. phyllomega (Vell.) House, I. tiliacea Willd. and Odonellea hirtiflora (Mart. & Gal.) Robertson, among others. The new species appears to fall within this same distributional pattern, although isolation from its South American relatives has apparently led to speciation.

Literature Cited

Oostrstroom, S. J. van, 1934. A monograph of the genus Evolvulus. Med. Bot. Mus. Herb. Rijksuniv. Utrecht 14:1-267.

A PREVIOUS VALID SPECIFIC EPITHET FOR *GELASINE AZUREA* (IRIDACEAE)

Pierfelice Ravenna

INTA, Universidad de Chile, Santiago, Chile

ABSTRACT. A previous valid epithet for *Gelasine azurea* Herbert (1840) is recognized in *Ferraria elongata* R. Graham (1830). The new combination *Gelasine elongata* (R. Grah.) Ravenna, is therefore established.

Herbert (1840) proposed the genus *Gelasine*, with *G. azurea* Herb. as the type. This binomial has been used since then in several papers up to the present (Ravenna 1965, 1984, Kenton & Rudall 1987). However, an antedating, valid epithet in *Ferraria*, *F. elongata* R. Grah. had been designed to the same species. A transference is therefore needed.

GELASINE ELONGATA (R. Grah.) Ravenna, comb. nov.

Basionym: *Ferraria elongata*, Edinb. N Phil. J 1830: 173. Syn.: *Gelasine azurea* Herbert, Curtis's Bot. Mag. 66: tab. 3779, 1840.- *Herbertia stricta* Grisebach, Goett. Abhandl. 24: 324, 1879.- *Alophia stricta* (Gris.) Kuntze, Rev. Gen. Pl. 3 (2): 304, 1898.

According to R. Graham, a bulb of this species had been sent to Mr. Mc Neill by Tweedie, from Buenos Aires. Its description leaves no doubt about the actual identity of the species.

REFERENCES

Herbert, W. 1840. *Gelasine azurea*, in Curtis's Bot. Mag. 66: tab. 3779.

Kenton, A. & Rudall, P. 1987. An unusual case of complex-heterozygosity in *Gelasine azurea* (Iridaceae), and its implications for reproductive biology; Evolut. Trends Pl. 1(2): 95-103.

Ravenna, P. 1965. Notas sobre Iridaceae II; Bol. Soc. Arg. Bot. 10: 311-322.

———— 1984. The delimitation of *Gelasine* (Iridaceae), and a new species from Uruguay; Nord. J. Bot. 4: 347-350.

ANEUPLOIDY IN THE *MUHLENBERGIA SUBBIFLORA* COMPLEX (GRAMINEAE)

John R. Reeder & Charlotte G. Reeder
Herbarium, University of Arizona, Tucson, AZ 85721

Muhlenbergia subbiflora was described by A. S. Hitchcock (North American Flora 17(6): 437. 1935), based on an annual plant, *Palmer 948* from Durango, Mexico. Another collection from the same locality, *Palmer 731* is also cited. These two Palmer collections had been determined as *Chaboissaea ligulata* Fourn. by Scribner & Merrill, who made the transfer to *Muhlenbergia*, as *M. ligulata* (Fourn.) Scribn. & Merr. (U.S.D.A. Div. Agrostol. Bull. 24: 19. 1901). *Chaboissaea ligulata*, however is a perennial with a considerably different habit. Scribner & Merrill's transfer is quite legitimate, and is the valid name for *C. ligulata* if one considers it to belong in the genus *Muhlenbergia*. It is not the correct name for *Muhlenbergia subbiflora* A. S. Hitchcock.

We first collected *Muhlenbergia subbiflora* in 1963 in a marshy area just east of Ciudad Durango. Examination of anther squashes from this gathering revealed a chromosome number of $2n = 16$. This was interesting, since the species frequently has two, or even three, florets per spikelet, and for that reason is somewhat anomalous in *Muhlenbergia*, in which the chromosomes are usually multiples of 10. Perhaps *M. subbiflora* had been improperly assigned. It should be pointed out, however, that it is not unusual to encounter two-flowered spikelets in other species of *Muhlenbergia*, e.g. *M. asperifolia* (Nees & Mey.) L. Parodi. Two years later we collected *M. subbiflora* again, this time in a region of cienegas some 65 km north of Cd. Durango, and to our surprise determined a chromosome number of $2n = 14$!

The following year on a trip to Mexico, we made a point of visiting localities in which *Muhlenbergia subbiflora* had been found previously, along with other habitats in which we thought it might occur. Chromosome counts from these gatherings were even more frustrating. Two collections yielded $2n = 14$, one $2n = 16$, and a fourth $2n = 18$. We were reluctant to publish these numbers until we had acquired a better understanding of what was happening in these populations. We were not in *M. subbiflora* country again until 1974. On that trip, seven collections were made north and northeast of Ciudad Durango. Of the seven, four were $2n = 14$, two were $2n = 16$, and one was $2n = 18$. It can be seen that in our sampling, 14 was the most common number (seven counts), followed by 16 (four counts), but the number 18 appeared twice. One might logically ask whether the basic number for this taxon is $x = 7$, 8, or 9? Another annual but apparently not closely related, *M. filiformis* (Thurb.) Rydb., is known to have a chromosome number of $2n = 18$.

During the 1966 trip, and again in 1967, we collected and were able to make chromosome counts of the related *Muhlenbergia decumbens*

Swallen, which is known only from the state of Chihuahua. We determined 2n = 32 in three different gatherings of this taxon, suggesting, perhaps, a tetraploid based on x = 8. The related M. subbiflora, which had caused us so much trouble, might be a diploid with 2n = 16, and the 14 and 18 counts could be interpreted as aneuploids.

The reader is reminded that Scribner & Herrill determined Muhlenbergia subbiflora as Chaboissaea liqulata. That species also has two or three florets per spikelet, which suggests a relationship to the annuals we had been examining. We reported a chromosome count of 2n = 16 for this latter species, based on a collection from Zacatecas (Bull. Torrey Bot. Club. 94: 1--17. 1967), and this number was subsequently confirmed in two additional gatherings from the state of Durango (Bull. Torrey Bot. Club 95: 69--86. 1968).

Several years ago, in a paper presented at the AIBS Meetings in Corvallis, Oregon (Abstracts of Papers to be presented at the Meeting of the Bot. Soc. Amer. and certain affiliated groups, 17--22 August, 1975. pg. 58) we reported chromosome numbers of 2n = 16 for Muhlenbergia subbiflora, and 2n = 32 for M. decumbens, and suggested that these two taxa were members of the genus Chaboissaea. At that time we did not report aneuploidy in M. subbiflora, expecting to have an opportunity to study the populations further. Moreover, we did not make the indicated transfers then nor subsequently. We offer them here:

Chaboissaea decumbens (Swallen) J. & C. Reeder comb. nov.
Muhlenbergia decumbens Swallen, Bol. Soc. Bot. Mexico 23: 30. 1958. Type: Mexico: Chihuahua, Hernandez X. & Tapia J. N-359 (US-2237023).

Chaboissaea subbiflora (A. S. Hitchcock) J. & C. Reeder comb. nov.
Muhlenbergia subbiflora A. S. Hitchcock, North Amer. Flora 17: 437. 1935. Type: Mexico: Durango, Palmer 948 (US-995434)

Returning to aneuploidy in the subbiflora taxon, it is of interest that all seven collections in which we had determined a chromosome number of 2n = 14, had predominately 1-flowered spikelets. In those with a 2n number of 16 or 18, most of the spikelets had two florets, although in one with 2n = 16, our 6488a, the spikelets usually had a single floret. Plants with differing chromosome numbers do not appear to be concentrated in a particular area. Although the 2n = 14 plants, the most numerous in our sample, were mostly found in an area 29--41 miles (46--66 km) north of Ciudad Durango, we encountered one population with this number 10 miles (16 km) northeast of the city. Concerning the 2n = 16 gatherings, three of these were about 4 miles (6 km) east of Cd. Durango, but one came from 26 miles (42 km) north of the city. Of the two with 2n = 18, one of these was 4 miles (6 km) east of the city, whereas the other was 22 miles (35.4 km) north of Cd. Durango.

In spite of the fact that the 2n = 14 chromosome number dominated in our samples, we believe that it is reasonable to conclude that x = 8 is the basic number, and that the plants with a pair of chromosomes more or less than this are aneuploids. This concept is strengthened by the fact that the similar, and obviously related decumbens taxon was found to have 2n = 32, which we interpret as tetraploid, and that the perennial, and clearly related Chaboissaea has been demonstrated to be diploid with 2n = 16 chromosomes. The fact that plants making up the subbiflora taxon appear similar whether they have 14, 16, or 18 chromosomes is a subject for further investigation.

As indicated, the annual plants discussed above are all found in cienegas or other marshy habitats. For the record, chromosome vouchers are listed below. Collection numbers are those of John R. & Charlotte G. Reeder. The specimens are at ARIZ; duplicates will be distributed to US. Although some of the gatherings are from the same general area, each represents an individual plant, and in a number of cases they were made in different years. Since these plants are annual, collections in different years must, perforce, represent different plants.

Chaboissaea decumbens (2n = 32)

Mexico: Chihuahua: 11 mi (17.7 km) W of Cuauhtémoc, 7600 ft (2316 m), 5 Oct 1966, 4593, 4601; 4 Sep 1967, 4848.

Chaboissaea subbiflora

(2n = 14)

Mexico: Durango: 40 mi (64.5 km) N of Cd. Durango, 6400 ft (1950 m), 1 Sep 1965, 4485; 41 mi (66 km) N of Cd. Durango, 6500 ft (1980 m), 5 Oct 1974 6479, 6481; 39 mi (63 km) N of Cd. Durango, 6400 ft (1950 m), 9 Oct 1966, 4636; 34 mi (55 km) N of Cd. Durango, 6400 ft (1950 m), 5 Oct 1974, 6485; 29 mi (46.7 km) N of Cd. Durango, 6400 ft (1950 m), 9 Oct 1966, 4640; 10 mi (16 km) NE of Cd. Durango, 6300 ft (1920 m), 5 Oct 1974, 6491.

(2n = 16)

Mexico: Durango: 4 mi (6.5 km) E of Cd. Durango, 6300 ft (1920 m), 26 Sep 1963, 3828; 9 Oct 1966, 4643; 5 Oct 1974, 6488a; 26 mi (42 km) N of Cd. Durango 6400 ft (1950 m), 5 Oct 1974, 6487.

(2n = 18)

Mexico: Durango: 4 mi (6.5 km) E of Cd. Durango, 6300 ft (1920 km), 5 Oct 1974, 6488; 22 mi (35.4 km) N of Cd. Durango, 6400 ft (1950 m), 9 Oct 1966, 4642.

A NEW SPECIES OF ARCHIBACCHARIS (COMPOSITAE: ASTEREAE) FROM CENTRAL AMERICA

Guy L. Nesom

Department of Botany, University of Texas, Austin 78713

Observations in Archibaccharis since recently published studies (Jackson, 1975; Nesom, 1988) have brought to light an undescribed species from Nicaragua. It is a member of sect. Archibaccharis and apparently most closely related to A. standleyi S. F. Blake.

Archibaccharis nicaraguensis Nesom, sp. nov.

A. standleyi S. F. Blake similis sed pubescentia caulium trichomatum septis fuscatis, internodiis brevioribus, foliis basalilter attenuatis, foliis et pedicellis eglandulosis, et capitulis et corollis minoribus differt.

Erect shrubs ca. 1 m tall. Stems straight, not angled, densely hispid-puberulent with stiff, sharply upcurved trichomes 0.2-0.5 mm long with dark cross-walls visible with a dissecting microscope. Leaves densely arranged, at least on the upper stems, on nodes 0.5-1.8 cm apart, unreduced in size until well into the capitulescence, narrowly elliptic-lanceolate, 55-80 mm long, 12-20 mm wide, gradually narrowed-acute to a subpetiolar base 2-3 mm long, margins sparsely hairy to glabrate, serrulate-mucronulate with 7-13 minute but prominent mucros on each side, the apices acute to acuminate, the lower surface conspicuously lighter-colored than the upper, with dark, finely reticulate venation, glabrous lamina but sparsely hairy veins, the upper surface slightly shiny, glabrous to very sparsely, minutely, and inconspicuously hispidulous on the lamina, the main veins usually hairy. Capitulescence terminal, paniculate, with the lower branches spreading and originating from among the unreduced cauline leaves. Heads with phyllaries sparsely hairy, oblong-lanceolate, the outer ca. half as long as the inner. Staminate heads ca. 3 mm long, 3-4 mm wide, with 0-2 marginal, eligulate, pistillate flowers; staminate corollas white, 3 mm long, the tube 1.2 mm long, the lobes 2 mm long, cut to the very top of the tube, abaxially glandular-dotted near the apices. Pistillate heads 4.0-4.5 mm long, with 2-3 central staminate flowers; pistillate corollas white, 3.8 mm long, the tube 2.5 mm long, with ligules 1.0-1.3 mm long, the style 4.2 mm long with branches 1.1 mm long. Achenes narrowly oblong-oblanceolate, flattened, 1.6-1.8 mm long, 0.4-0.5 mm wide, sparsely hairy, gland-dotted, 4-5 ribbed; pappus of 24-26 bristles 3.5-4.0 mm long.

The two collections were made ca. 90 km apart in or very near the Cordillera Isabelia in northern Nicaragua. Probably flowering ca. Jan-Apr (-May).

TYPE: **NICARAGUA**, Dept. Zelaya, Cerro Saslaya, elfin forest, shrub on rock face at summit, 1650 m, 4 May 1978, [pistillate, mostly past flower and fruit], D. Neil 3843 (Holotype: TEX!; isotype: MO!).

Additional collection examined: **NICARAGUA**, Dept. Jinotega, Fila Piedra Pelona, al S del Cerro Kilambé, 13°34' N, 85°41' W, elev. ca. 1500-1665 m, bosque enano, 28 Mar 1981, [staminate], P. Moreno 7803 (MO-unicate).

The erect habit of Archibaccharis nicaraguensis along with its straight stems and terminal capitulescences place it in sect. Archibaccharis (see Jackson, 1975). Among the taxa of this group, the new species appears to be most closely related to A. standleyi S. F. Blake. The two share stems that are densely puberulent with upcurved hairs, staminate corollas with long, linear, lobes cut to the top of the tube and gland-dotted near the apex on the abaxial surfaces, and gland-dotted achenes. Archibaccharis standleyi, however, has shorter, denser, and reddish stem pubescence, longer internodes, leaves with rounded to cordate bases, pedicels and lower leaf surfaces with resin dots, larger heads and corollas, and eglandular achenes.

The only other species of sect. Archibaccharis known from Nicaragua is A. asperifolia, which is similar in habit and overall appearance to A. nicaraguensis. The two are different in many features, however, and easily separated. Archibaccharis asperifolia has stems sparsely and loosely pilosulous, leaves with very prominently hispidulous upper and lower surfaces, glabrous or glabrate phyllaries, pistillate flowers with essentially eligulate corollas, staminate corollas with the throat nearly as long as the eglandular lobes, and eglandular achenes.

ACKNOWLEDGEMENTS

I appreciate the loan of specimens from MO and the hospitality of their staff on a recent visit there and comments on the manuscript by B. L. Turner.

LITERATURE CITED

Jackson, J. D. 1975. A revision of the genus Archibaccharis Heering (Compositae--Astereae). Phytologia 32:81-194.

Nesom, G. L. 1988. Studies in Mexican Archibaccharis (Compositae). Phytologia, in press.

BACCHARIS MONOICA (COMPOSITAE: ASTEREAE), A MONOECIOUS SPECIES OF THE B. SALICIFOLIA COMPLEX FROM MEXICO AND CENTRAL AMERICA

Guy L. Nesom

Department of Botany, University of Texas, Austin 78713, U.S.A.

ABSTRACT

All plants of the Baccharis salicifolia (Ruiz & Pavon) Pers. complex from Nicaragua to eastern Oaxaca in Mexico are strictly monoecious, each individual bearing both pistillate and staminate heads. This population system is separated as a new species, B. monoica, which is geographically interposed between the dioecious plants of this complex in South America and those to the north in Mexico and the United States. Also noted is the occurrence in Baccharis of other deviations from the typical dioecious condition.

In preparation of a systematic treatment of the Mexican species of Baccharis, a reevaluation of the B. salicifolia (Ruiz & Pavon) Pers. complex has been necessary. A longer paper treating various other taxonomic problems in Mexican Baccharis is forthcoming, but these results are presented here separately because of their particular biological interest and implications.

Cuatrecasas (1968) recognized all the plants of this complex as a single species, B. salicifolia, with three varieties -- ranging in western South America from Argentina to Colombia to Central America and Mexico and northward to California and Texas in the United States. He dismissed the South American varieties established by Heering (1914) as "confusas, de tipificacion dificil y no se pueden identificar." Cuatrecasas himself, however, presented no key and only rather vague distinctions between the taxa that he recognized. He considered all the plants north of South America as var. longifolia (DC.) Cuatr. Both Blake (1926) and Matuda (1957) also treated this complex in Mexico as a single species conspecific with the South American plants, but neither commented on infraspecific variation. Nor have more recent studies, e.g. McVaugh (1984) and Rzedowski (1985), adopted the varietal status proposed by Cuatrecasas for the northern segment of this complex. The types of B. salicifolia and B. glutinosa Pers., the latter a name widely used in the past but a synonym of the former (see Cuatrecasas, 1968) are from Peru and Chile, respectively.

In reviewing the Mexican and Central American material identified as Baccharis salicifolia, I find, in contrast to previous systematists, that a remarkable discontinuity exists among them. The plants from the Isthmus of Tehuantepec in eastern Oaxaca southward to

Nicaragua bear homogamous heads but are strictly monoecious. Each plant bears mostly pistillate heads, but staminate heads are scattered through the capitulescence. I have not been able to discern a predictable pattern in the occurrence of the staminate heads. Counts on specimens from LL and TEX show a ratio of pistillate:staminate heads of (1-) 5-15:1. A specimen from Oaxaca (Maya J. 460) is unusual in having nearly an equal number of pistillate and staminate heads. Rarely a skimpy or fragmentary herbarium specimen may appear to have only pistillate heads, but I believe this is clearly because the collector preserved an inadequate sample. Plants with only staminate heads are not to be found. Among the collections I have examined from MO, LL, and TEX, all plants from this area, with only the caveat noted above, have both types of heads. Northward, from Oaxaca through Mexico to California and Texas in the United States, the plants are uniformly dioecious (see below). All the South American plants I have seen are either pistillate or staminate, indicating that the plants there are dioecious, also.

Before I saw that they were radically different, I had annotated many specimens from Central America and southern Mexico as Baccharis salicifolia. After realizing, however, that they are monoecious, this feature of the plants is simple to observe. They also proved to be morphologically differentiated in several other characteristics, although, as noted below, there is some overlap and the only way to distinguish them with absolute certainty is by ascertaining the sexual condition. I recognize the monoecious plants of this widespread and geographically discrete population system as a distinct species, the first such taxon to be admitted to a genus heretofore composed only of dioecious species.

Baccharis monoica Nesom, sp. nov.

B. salicifoliae (Ruiz & Pavon) Pers. arcte affinis a qua imprimis differt plantis monoeciis, capitula homogamae aut pistillatae aut staminatae, planta omnis ferens capitula pistillata et staminata.

Glabrous shrubs or small trees 1-5 m tall, reported by some collectors to have an agreeable fragrance. Leaves lanceolate to elliptic-lanceolate, 3-nerved, 5.5-12.5 cm long, 5-15 mm wide, (7-) 14-23 times longer than wide, the margins nearly entire to prominently serrate mostly with 2-4 teeth per cm. Heads in corymbose panicles; phyllaries ovate-lanceolate, stramineous with a brown midline or central area at the apex, usually with sharply delimited, scarious margins, ciliolate at the apex; pistillate and staminate heads 4.5-6.0 mm high, 3-5 mm wide. Pistillate corollas tubular-filiform, 2.5-3.0 mm long, the styles 3.8-4.0 mm long with branches 0.3-0.4 mm long. Staminate flowers completely without ovaries, the corollas 4.0-4.5 mm long, the tube 2.2-3.0 mm long, the lobes cut almost all the way to the top of the tube. Achenes 0.9-1.1 mm long, terete to slightly flattened, glabrous, with 4-7 delicate nerves; pappus a single series of 24-27 bristles 3-4 mm long.

Eastern Oaxaca (the Isthmus of Tehuantepec) through Chiapas in México, to Guatemala, El Salvador, Honduras, and Nicaragua; dry to moist habitats, shrubby slopes, tropical deciduous forests, seasonal evergreen with oak, or pine-oak with liquidambar or arbutus; 30-1400 (-2400) m; Jul-Feb.

TYPE: **MEXICO**, Chiapas, Mpio. Bochil, 7 km NE of Bochil along road to Simojovel, 10 Oct 1972, D. E. Breedlove 28727 (Holotype: LL).

Representative specimens examined: **MEXICO**: Oaxaca, Mpio. Sn. Miguel Chimalapa, Río Escondido (Arroyo Baul) 0.8 km W of its union with Río Portamonedas, ca. 38 km in a straight line N of San Pedro Tapanatepec, 17 Aug 1984, Maya J. 460 (TEX). Chiapas, between Mazapa and Motozintla, 19 Jul 1941, Matuda 4875 (LL). **GUATEMALA**, Dept. Huehuetenango, beside stream, 3 Sep 1934, Skutch 1107 (LL). **HONDURAS**, Dept. Morazán, bank of Yeguare River, Zamorano Valley, 10 Sep 1946, Williams and Molina R. 10514 (LL). **NICARAGUA**, Dept. Esteli, along road from Condega to Yali, ca. 16.9 km NE of Hwy 1 and ca. 3.5 km SE of Valle Santa Rosa, 19 Nov 1979, Stevens 15819 (TEX).

Baccharis monoica is geographically interposed between the South American representatives of the B. salicifolia complex and those to the north. Further, a significant distributional hiatus exists from the southern end of the range of B. monoica in Nicaragua to Colombia, where B. salicifolia occurs but is rare. The South American plants appear to be highly variable, with significant differences among them in leaf shape and size as well as corolla and achene morphology. In Argentina, Cabrera (1978) found the species to be variable in viscosity, leaf shape and margin, and head size; he did not distinguish varieties in the region of this flora. In my opinion, the varietal categories offered by Cuatrecasas are too vague to be of value in dealing with the complex variation found in South America.

Plants of the dioecious population system to the north of B. monoica are common in Oaxaca but apparently are allopatric with the latter in distribution, although the two evidently approach each other closely. I have seen one collection of the dioecious species from the Isthmus of Tehuantepec in Oaxaca (4 km N of Matias Romero, King 722-LL), slightly to the west of the monoecious collection cited below. The two taxa usually can be distinguished by leaf shape and head size in addition to their differences in sexual constitution (see the key below). Until a more detailed study is rendered of the complex over its entire geographic range, particularly in South America, I regard the dioecious North American element as conspecific with the South American. Although the former is more uniform in morphology and, because of its geography, reproductively isolated, it appears to be largely within the limits of variability of the latter.

Key to the taxa of the Baccharis salicifolia complex north of South America

1. Monoecious, individual plants with both pistillate and staminate heads; leaves (7-) 14-23 times longer than wide; heads 4.5-6 mm high; achenes 0.9-1.1 mm long ..... B. monoica

1. Dioecious, individual plants with either pistillate or staminate heads; leaves 6-14 (-16) [-20] times longer than wide; heads 2.5-4.5 (-5) mm high; achenes 1-1.5 mm long ..... B. salicifolia

Although the leaf shape usually distinguishes these two taxa, particularly in Oaxaca where they approach one other geographically, enclaves of more narrow-leaved forms (up to 20 times longer than wide) of B. salicifolia exist in western Jalisco to Nayarit and in central Chihuahua. In these areas, however, the heads are still smaller than is typical for B. monoica.

Although this is the first monoecious species to be included in a genus of about 400 dioecious ones, it does not seem so unexpected from one perspective. I believe that B. monoica has been derived through the stabilization and spread of a sexually deviant population of the dioecious B. salicifolia complex. Sexual abnormalities in Baccharis have been known and commented on in the past, although this is the first example I am aware of in Baccharis where individual plants produce both homogamous pistillate and staminate heads. McVaugh (1984) observed a plant of B. salicifolia from Nueva Galicia that had produced hermaphroditic but sterile flowers in an otherwise pistillate head. He also said that he had observed the same phenomenon in plants of B. salicifolia (=B. monoica) from "Chiapas to Costa Rica," but I have not been able to confirm this. I have seen, however, plants of B. monoica (Williams and Molina 10514-LL) and B. myrsinites (Lam.) Pers. (Mejia 540-TEX) that produced a few outer pistillate flowers in the staminate heads. I have observed pistillate heads with inner staminate flowers in B. cotinifolia (Willd.) Urb. (Proctor 26002-LL) as well as in a remarkable collection of B. multiflora H.B.K. (Rzedowski 25375-WIS). Such populations are technically polygamo-dioecious and (technically) might be placed in the genus Archibaccharis Heering.

Archibaccharis is separated from Baccharis primarily on the basis of the peculiar sexual constitution of its pistillate heads. Otherwise, there is seemingly no single characteristic that can be used to consistently distinguish one genus from the other. Jackson (1975) treated the taxonomy of Archibaccharis in detail, and I have presented refinements of Jackson's study and additional taxa (Nesom, 1988a, 1988b). A discussion of the relationship of Archibaccharis to Baccharis is in preparation.

The relationship of the genus Baccharidastrum Cabrera, including two monoecious species with heterogamous heads, to Baccharis is discussed in a paper presented concurrently with this one (Nesom, 1988c). The monotypic Baccharidiopsis, another genus of the

Baccharidinae (Barroso, 1975), is said to have three types of plants, each individual with either pistilllate, staminate, or hermaphroditic flowers, but I have not yet been able to study specimens of this.

ACKNOWLEDGEMENTS

I appreciate loans of specimens from MO and WIS and comments by Verne Grant, Jim Henrickson, Marshall Johnston, Billie Turner, and particularly those by John Strother, who verified the existence of the monoecious population system.

LITERATURE CITED

Barroso, G. M. 1975. Baccharidiopsis---um genero novo da Substribo Baccharidinae Hoffman (Tribo Astereae). Sellowia 26:95-101.

Blake, S. F. 1926. Baccharis, in Standley, P. C., Trees and Shrubs of Mexico. Contr. U. S. Natl. Herb. 23:1499-1507.

Cabrera, A. L. 1978. Flora de la Provincia de Jujuy, Republica Argentina. Parte X. Compositae. Inst. Nac. Tecn. Agropecuaria.

Cuatrecasas, J. 1968. Notas adicionales, taxonomicas y corologicas, sobre Baccharis. Rev. Acad. Colomb. Cienc. 13:201-226.

Heering, W. 1914. Systematische und pflanzengeographische Studien uber die Baccharis-Arten des aussertropischen Sudamerikas. Jahrb. Hamburg. Wiss. Anst. 31:65-173.

Jackson, J. D. 1975. A revision of the genus Archibaccharis Heering (Compositae--Astereae). Phytologia 32:81-194.

Matuda, E. 1957. El genero Baccharis en Mexico. Anales Inst. Biol. Mexico 28:143-174.

McVaugh, R. 1984. Baccharis. Pp. 93-107 in Anderson, W. R. (ed.), Flora Novo-Galiciana, Volume 12, Compositae. Univ. Michigan Press, Ann Arbor.

Nesom, G. L. 1988a. Studies in Mexican Archibaccharis (Compositae: Astereae). Phytologia, in press.

Nesom, G. L. 1988b. A new species of Archibaccharis (Compositae: Astereae) from Central America. Phytologia, this issue.

Nesom, G. L. 1988c. Baccharis (Compositae: Astereae) sect. Baccharidastrum, including two monoecious and one dioecious species. Phytologia, this issue.

Rzedowski, J. 1985. Flora fanerogamica del Valle de Mexico. Volumen II, Dicotyledonae. Instituto de Ecologia, Mexico, D. F.

BOOK REVIEWS

Alma L. Moldenke

"THE FASCINATING WORLD OF THE NIGHTSHADES: Tobacco, Mandrake, Potato, Tomato, Pepper, Egg-plant, etc." by Charles B. Heiser Jr., ix + 200 pp., 11 black/white photo. & 15 pl., Dover Publications, Mineola, N.Y. 11501. 1987. $5.95 paperbound.

Welcome to this republication of the fascinating "Nightshades: The Paradoxical Plants" originally published in 1969 by W.H. Freeman & Co. It makes pleasant, highly informative reading on these economically important Solanaceae. The author's preface to this new edition lists nomenclatural changes and the new, highly important literature sources. The line drawings and plates are very clear. Students and readers interested in ethnobotany, economic botany, and systematic botany of this family will gain much valuable information, so interestingly and accurately presented, by the well known botanist, author, researcher and university teacher.

"THE CARTOGRAPHY OF NORTH AMERICA 1500-1800" by Pierluigi Portinaro & Franco Knirsch, 320 pp., 180 colored maps & 90 black/white illus., Facts on File Publications, New York, N.Y. 10016. 1987. $60.00.

This admirable, valuable, amazingly inexpensive, large book can be perused and/or studied at many levels from the coffee table, to libraries and desks of students, teachers and professionals in geography, history, navigation, art, naturalists, ecologists, botanists and zoologists. After a brief history of cartography from its first example on Cosa's oxhide, the maps are grouped by centuries - 15th through 18th - showing the accuracy and faults of the ever expanding discoveries of North America.

"THE CAMBRIDGE ILLUSTRATED DICTIONARY OF NATURAL HISTORY" by R.J. Lincoln & G.A. Boxshall, ii & 413 pp., 700+ black/white illus., 6 tab. & 5 maps, Cambridge University Press, Cambridge & London, U.K., and New York, N.Y. 10022, 1987, $24.95.

This dictionary is a modernized and somewhat simplified version of the "Dictionary of Ecology, Evolution and Systematics" of 1982 and planned so that it is more useful for teachers who are not scientifically trained and students in the pre-college

and pre-technical schools and for amateur naturalists. The definitions are clear cut and well cross referenced. The printing, though small, is legible and the illustrations are clear cut, accurate and attractive.

"CONSERVATION AND MANAGEMENT OF RARE AND ENDANGERED PLANTS" edited by Thomas S. Elias x & 630 pp., 175 black/white fig. including 165 maps & 45 photos and 97 tab., California Native Plant Society, Sacramento, California 95814. 1987. $45.00 clothbound, $24.00 paperbound.

The component 97 papers succinctly and interestingly presented at what was in 1986 the largest conference on this topic ever held in North America are herein now made available to many more as readers. The papers are very well presented on this field of imminent and great importance. They cover such topics as: California's endangered plants and habitats, legal aspects, population dynamics, species management, current conservation activities and educational awareness.

"100 FAMILIES OF FLOWERING PLANTS" Second edition by Michael Hickey & Clive King xvi + 619 pp., hundreds of black/white drawings, diagrams and tables, Cambridge University Press, London & Cambridge, U.K. & New York, N.Y. 10022. 1988. $75.00.

These families are arranged according to Davis & Cullen in "The Identification of Flowering Plants" reflecting G.L. Stebbins in "Flowering Plants -- Evolution Above the Species Level". Among some expected additions, corrections and larger page-size there is the ecologically sad decision "to omit Ulmaceae, since the elm population in Britain has been greatly reduced by Dutch Elm disease". The diagrammatic illustrations remain all in black and white and not the batches of expensive, but not necessarily educational, multicolors. Hopefully this newer edition will have wider use as a supplementary text or reference source in the U.S. courses in plant taxonomy.

"A REVISED HANDBOOK TO THE FLORA OF CEYLON Volume VI" edited by M.D. Dassanayake & F.R. Fosberg for the Smithsonian Institution & the National Science Foundation, both of Washington, D.C. printed by the Amerind Publishing Co., New Delhi, India, vii & 424 pp., 26 black/white figures, 32 photo. & 1 map. 1987.

This is a huge and valuable undertaking to update Trimen's flora (1893-1900) and Alston's additions (1931). In this volume 23 families are treated by either known taxonomic specialists or by native scientists including the former guardian of the original herbarium K. Amaratunga, the former botany professor in Perideniya University M. Dassanayaka, and a fine young assistant in the project at the time of our work there D. Sumithraarchchi. The families treated in the volume are Ancistrocladaceae, Aponogetonaceae, Araceae, Balanophoraceae, Datiscaceae, Dipsacaceae, Droseraceae, Geraniaceae, Hernandiaceae, Loranthaceae, Magnoliaceae, Melastomataceae, Nepenthaceae, Ochnaceae, Oleaceae, Piperaceae, Polygalaceae, Puniceae, Rubiaceae, Solanaceae, Valerianaceae, Viscaceae and Zygophyllaceae.

"SAFARI -- The East African Diaries of a Wildlife Photographer", Photographs by Günter Ziesler, Diary Notes by Angelika Hofer, 199 pp., 138 color photo. & 4 maps. Facts on File Publications, New York, N.Y. 10016. $24.95. 1984.

This is a favorite among the many truly beautiful books of photographs and text about the wild life in the game parks in East Africa that we have been fortunate enough to visit with an excellent native guide. The accompanying text for the wonderful photographs in Amboseli, Tsavo West, Lakes Area and Mount Kenya is given in diary style by an ecologically and zoologically astute observer.

"FUNGAL INFECTION OF PLANTS" Symposium of the British Mycological Society edited by G.F. Pegg & Peter G. Ayres, xiii + 428 pp., 67 black/white fig incl. 47 photo. & 21 Tab. Cambridge University Press, Cambridge & London, U.K., & New York, N.Y. 10022. 1987. $89.50.

The orientation of this book is particularly interesting and important as it treats "fungal infection (parasitism) as a theme common to pathogenic and symbiotic interactions". It provides plant pathologists and mycorrhizal workers with up-to-date information to stimulate comparisons. There are 20 well presented papers by 32 contributors with such topics as "Specificity of Active Resistance in Plant-Fungus Interactions", "Pathways for the Exchange of Materials in Mycoparasitic and Plant-Fungal Interactions" and "Genetic Analysis of Interactions between Microbes and Plants". This book should become an important library acquisition in colleges, universities and involved laboratories.

"THE ECOLOGY OF THE NITROGEN CYCLE" by Janet I. Sprent viii + 151 pp., 47 black/white fig. & 47 tab., Cambridge University Press, London & Cambridge, U.K., & New York, N.Y. 10022. 1987. $39.50 cloth bound & $14.95 paperbound.

This is the ninth publication in the Cambridge Studies in Ecology which, like the others, is "aimed mainly at the senior undergraduate, research worker, university teacher, --- and professional ecologist in industry and government research." Case histories are explained not only with text but also with many excellent figures and charts for dry areas, aquatic ecosystems, and those impacted by man.

"THE INSTANT GUIDE TO HEALTHY INDOOR BULBS AND ANNUALS" by Norman Simpson
"THE INSTANT GUIDE TO HEALTHY CACTI" by John Pilbeam
"THE INSTANT GUIDE TO HEALTHY SUCCULENTS" by John Pilbeam

There are nine volumes planned for this Complete Plant Doctor Series. These are most attractively and copiously illustrated, consist of 80 pages each, give common and scientific names, and provide all necessary instructions for indoor planting, nurturing and disease control. The U.S. publication date is 1985. The price is $5.95 each. The U.S. publisher is TIMES BOOKS, New York, N.Y. 10022. Individual home plant enthusiasts, florists, horticulturalists and the horticulture departments of junior and regular colleges and universities could well acquire this series.

"EXPERIMENTAL PHYCOLOGY - A Laboratory Manual" edited by Christopher S. Lobban, David J. Chapman & Bruno P. Kremer, xiii + 295 pp., 47 black/white fig. incl. 13 photo. & 13 tab. Cambridge University Press, London & Cambridge, U.K., & New York, N.Y. 10022. 1988. $44.50 cloth bound & $16.95 paper bound.

The introduction presents "the basics of scientific style so that your laboratory reports can be practice papers." There are 32 experiments in fine format and with excellent instructions ranging from Exp. I on 'cell counting' to 'thin-layer chromatographic analysis of polyols', and lastly to 'regeneration of flagella by green flagellates after experimental amputation' by different authors. For more advanced students this laboratory text may prove to be more valuable than the usual mimeographed sheets of instructions.

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 6⅜ 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.

All manuscripts accepted will be published in the next issue, so that the size of the numbers may vary greatly. A volume will contain 512 pages. The plan insures prompt publication of all accepted manuscript.

Illustrations will be published according to the desires of the authors. No extra charge is made for line drawings, such as are ordinarily reproduced in zinc, or for diagrams, tables, or charts, provided they conform to certain limitations of size and proportion. An extra charge will be made for halftones, depending on their size, as fixed by the engraver.

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.