

as possible. After a preliminary delineation of *R. canadensis* as an essentially smooth blackberry, he combined *R. elegantulus* with it as only "a small and usually slender phasis" (see Bailey loc. cit. p. 475). The Grand Manan plants present a particular problem because they combine the prickliness of *R. elegantulus* and *R. amicalis* with the features that are commonly associated with *R. canadensis* including large size and strongly racemose inflorescences. Except for the degree of prickliness, most of the bigger plants certainly resemble *R. canadensis*.

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LITERATURE CITED

1. WEATHERBY, C. A. AND JOHN ADAMS. 1945. A list of the Vascular Plants of Grand Manan, Charlotte County, New Brunswick, Contrib. Gray Herb. CLVIII.
2. FERNALD, M. L. 1945. Notes on *Betula* in eastern North America. *Rhodora* 47: 303-329.
3. CRAIG, DONALD L. 1959. The Cytology and Breeding Behavior of *Rubus canadensis* L., Thesis, University of New Hampshire.
4. BAILEY, L. H. 1944. Gent. Herb. Vol. V Fasc. VII pp. 465-476.
5. FERNALD, M. L. 1950. Gray's Manual of Botany. Eighth ed. p. 832.

CYTOLOGICAL OBSERVATIONS OF POLYGALA IN EASTERN NORTH AMERICA

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For a genus of over 450 species, of which no fewer than 200 are described in North and Central America, only 15 species of *Polygala* have been studied cytologically. No New World species are included in this meager total.

Unfortunately, the *Polygala* material is not particularly favorable for study. At meiosis the greatest difficulty is the low number of pollen mother cells formed in each anther, giving few figures for observation when a satisfactory stage is obtained. Under these circumstances, we have found that much more fixed bud material must be

¹Undergraduate Research Participant, National Science Foundation G-12059.

collected for results than is usual for most genera. When to this need is added the paucity of plants at any one locality, particularly for those species endemic to the Mexican highlands where the greatest number of North American species occur, it is apparent why this feature limits chromosomal research. The meiotic process also is a hindrance. Although prophase I appears to be of unusually long duration, we agree with Glendinning (1960) that diakinesis is deceptive in that some chromosomes are still very poorly stained. The most satisfactory stages between prometaphase I and telophase I, however, are completed in very short periods of time which markedly decrease the chance of locating satisfactory figures. Complete restitution nuclei are formed only to be followed in rapid sequence by the phases of meiosis II. Finally the chromosomes of most species are very small and high in number.

A list of reported chromosome numbers in *Polygala* has been compiled (Table 1). Five of the 15 species have been examined by two or more authors, but except for *P. myrtilifolia* L. none of these has been given the same chromosome number. This is perhaps the best illustration of the technical difficulties to be encountered in *Polygala*. The 3 African species listed have a basic number of $x = 19$ which are according to Larsen (1959) secondary diploid species probably of tribasic origin from $6 + 6 + 7$ stocks. The single Asian species, *P. japonica* Houtt., has $n = 21$ chromosomes and may be a hexaploid species with a base of $x = 7$. As many as 73% of the European species counted have basic numbers of $x = 17$. As noted in Table 1, the reports are not unanimous for species considered in this series, but the numerous counts from several localities made by Glendinning (1960) outweigh the evidence of earlier authors. It cannot be overruled, however, that chromosomal races may exist for a single species, so that *P. amara* L. may have an $n = 14$ race in eastern Europe (Baskay, 1956; Skalińska *et al.*, 1959) and an $n = 17$ race in western Europe (Glendinning, 1960). The remaining European species have basic numbers of $x = 7, 8$, and 23 (Table 1).

Of other genera in the Polygalaceae records exist for only

4 species, one each in *Atroxima*, *Bredemeyera*, *Carpalobia*, and *Securidaca*. These are *A. liberica* Stapf., $2n = 18$ (Mangenot and Mangenot, 1957) *B. colletioides* Phil., $2n = 14$ (Covas and Schnack, 1946), *C. lutea* G. Don, $2n = 20$ (Mangenot and Mangenot, 1957), and *S. longipedunculata* Fres., $2n = 32$ (Mangenot and Mangenot, 1958; Miège, 1960).

MATERIALS AND METHODS

From 39 collections of immature flower buds made from localities in the eastern United States and Mexico, chromosome numbers for 24 species of *Polygala* are reported. The buds were fixed in the field in modified Carnoy's solution (4: 3: 1) and shortly thereafter were stored in the refrigerator for periods up to 6 months before squashing in 1% acetic-orcein. The results are mostly from the study of pollen mother cells or more rarely from premeiotic mitosis. The chromosome number reported for each species is when possible based on the study of more than one plant from several localities. Voucher specimens were obtained for each collection. A complete set has been filed at the Southern Methodist University herbarium (SMU), except for a few which are deposited elsewhere as indicated in Table 2. Duplicates of most collections are filed at the University of Texas herbarium (TEX). We wish to thank the curators of these herbaria for accepting specimens for permanent accession and we especially appreciate receiving fixed material of 3 species from Dr. Robert Kral, Virginia Polytechnic Institute, Blacksburg.

RESULTS

The gametic chromosome numbers for 24 species of *Polygala* are listed by sections (Blake, 1924) in Table 2. Most of the data are based on distinct figures giving definite counts, although the numbers for a few species are only approximations. With rare exceptions (*P. praetervisa* Chod., fig. 11), meiotic behavior was regular. The chromosomes of all species were found to be generally small with the smallest in the sections *Hebeclada* (fig. 5), *Monninopsis* (fig. 15), and *Timutua* (fig. 3, 10, 11, 14), and the largest

in the section *Timutua* (fig. 2, 7-9). Chromosomes of individual karyotypes often varied from very short to intermediate in length as shown by the mitotic chromosomes of *P. reducta* Blake (fig. 13).

The most striking result was the diversity of chromosome numbers for such a small fraction of species. Numbers ranging from $2n = 16$ for *P. scoparia* HBK. to $2n = \text{ca. } 104$ (108) for an undescribed Mexican species related to *P. alba* Nutt. represent both the lowest and the highest numbers known in the genus. Basic numbers were equally as variable. The species are separable into a primary aneuploid series with basic numbers of $x = 6(12)$, $7(14)$, 8 , and 10 , and a secondary basic series of $x = 15$, 17 , and 23 . Probably the closely related *P. cruciata* L. and *P. chapmanii* T. & G. with $n = 18$ and 36 , respectively, represent species in still another series of $x = 9$, but until further research reveals the existence of species with 9 haploid chromosomes or until some other evidence is presented, all species having chromosome multiples of 6 are grouped in the $x = 6(12)$ line.

Common to species in the sections *Monninopsis* and *Timutua*, the basic number of $x = 17$ includes about 30% of the species studied. The tetraploid species are slightly more common than the diploids. The basic number of $x = 6$ was also shared by species in these sections. Species with $x = 7$ are distributed in 3 sections, *Eurhinotropis*, *Hebeclada*, and *Timutua*, which illustrates a greater degree of morphological diversity than do species of other basic series in eastern North America. The $x = 8$ and 10 lines are represented by one species each in the sections *Monninopsis* and *Timutua*.

Since at least 4 primary basic numbers are reported for *Polygala*, the secondary dibasic and tribasic lines may have arisen in a number of ways. The $x = 15$ group, common to 2 species in the section *Microthrix*, could have formed from species with $n = 7$ and 8 or, providing stronger evidence is found for the existence of an $x = 9$ series, 6 and 9 chromosomes. In view of the chromosomal diversity recorded by this small sample, it is not inconceivable that these species are unibasic polyploids at the $6x$ and $12x$ levels of an $x = 5$

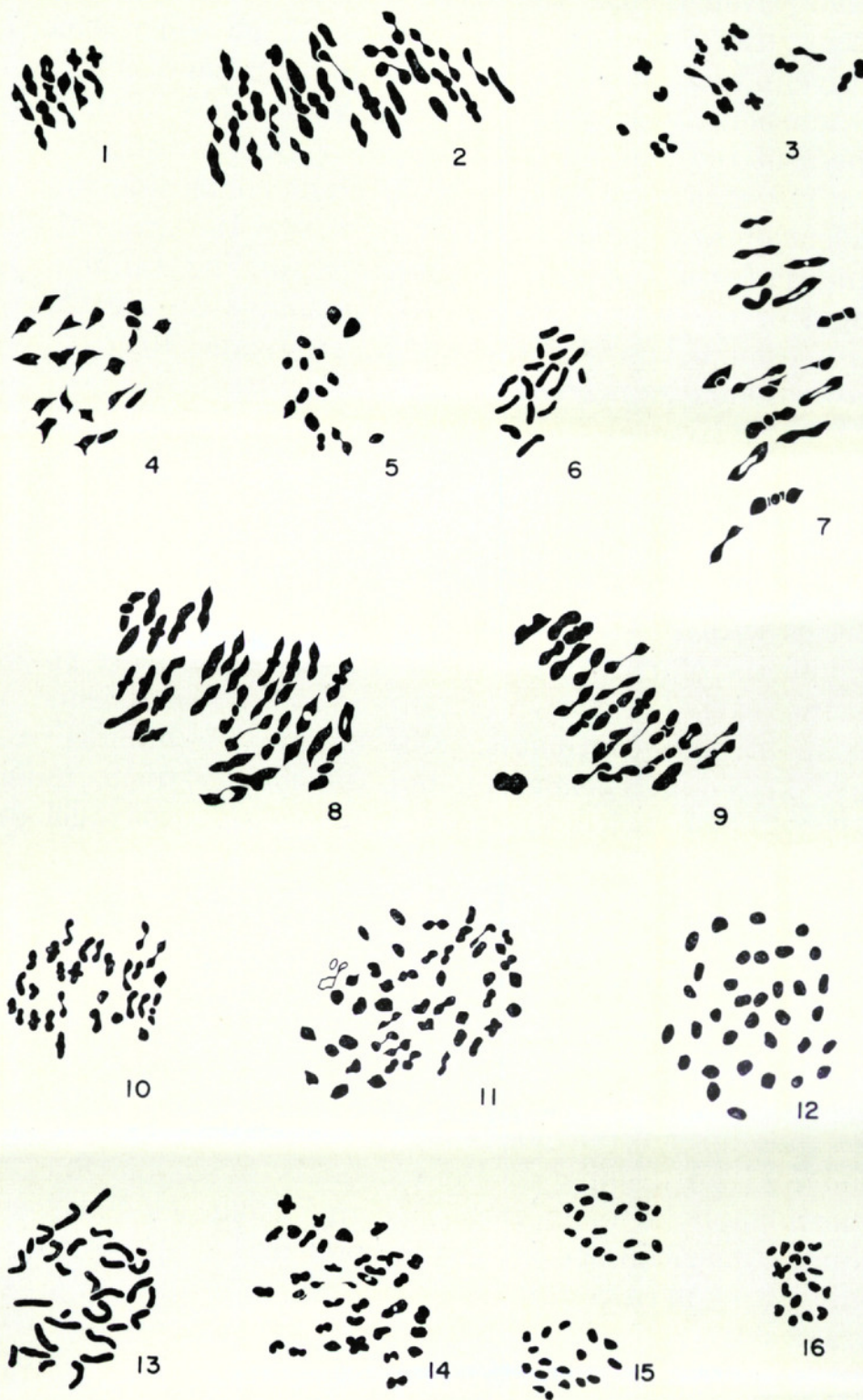
series. There is less doubt that the $x = 17$ series is of dibasic origin and it may have formed by hybridization of species with 7 and 10 or 8 and 9 haploid chromosomes. The single species with $x = 23$, *P. nuttallii* T. & G., is most probably of tribasic origin and numerous combinations exist in species of the same section to give the necessary chromosomal complement. Without experimental evidence and with only limited counts in the genus as a whole, it is far too speculative at the present time to suggest definite origins for the secondary lines.

The levels and frequencies of ploidy exhibited by the 24 North American species are summarized as follows: primary diploids, 5%; secondary diploids, 21%; primary polyploids, 53%; and secondary polyploids, 21%. Since the secondary diploids are probably all amphidiploids, this gives a total polyploid frequency of 95% or a markedly higher one than the average of 30-35% estimated for the angiosperms in general (Stebbins, 1938). These data are tabulated in Table 3 by basic chromosome number, except that species no. 4 (Table 2) is omitted.

DISCUSSION

Although the total number of species studied is only 39, it is sufficiently large to show the importance of polyploidy in addition to hybridization and aneuploidy in the phylogeny of *Polygala*. The numerical modifications have been so extensive, however, that they have obscured the original chromosome number of the genus. The most frequent number, $x = 17$, can be derived from several primary lines and gives no direct evidence of the composition of the original complement. The numbers of $x = 7, 8, 9$, and 10, in four

FIGURES 1-16. Chromosomes of *Polygala*, drawn with the aid of a camera lucida at $\times 2300$ reduced by ca. 1/3 in reproduction. Fig. 1. *P. alba*, $n = 12$, Lewis 5537; fig. 2. *P. chapmanii*, $n = 36$, Lewis 5690; fig. 3. *P. cruciata*, $n = 18$, Lewis 5692; fig. 4. *P. curtissii*, $n = 20$ (1 side of metaphase II), Kral 13817; fig. 5. *P. grandiflora*, $n = 14$, Lewis 5680; fig. 6. *P. scoparia*, $2n = 16$, Lewis 5753; fig. 7. *P. mariana*, $n = 17$, Lewis 5625; fig. 8. *P. nana*, $n = 34$, Lewis 5654; fig. 9. *P. nuttallii*, $n = 23$, Kral 13791; fig. 10. *P. polygama* var. *obtusata*, $n = 28$, Lewis 5621; fig. 11. *P. praetervisa*, $n = 48$ (as $46\text{II} + 1\text{III} + 1\text{I}$), Lewis 5667; fig. 12. *P. ramosa*, $n = 34$ (1 side of anaphase I), Lewis 5691; fig. 13. *P. reducta*, $2n = 30$, Lewis 5757; fig. 14. *P. rugelii*, $n = 34$, Lewis 5681; fig. 15. *P. scoparioides*, $n = 17$, Lewis 5545; fig. 16. *P. verticillata* var. *isocycla*, $n = 17$ (1 side of metaphase II), Lewis 5628.



other polygalaceous genera are too limited to suggest a trend. Even though the series with $x = 7$ includes just 7 species, they are native to Asia, Europe, and North America, to give in total the most extensive distribution of any series. In addition, these species are classified in 5 sections and represent the most diverse morphology of any series. Further research may suggest a different conclusion, but the evidence now available supports $x = 7$ as the original basic number for *Polygala* and probably for the family. The origin of the $x = 6$ line can be postulated on the basis of chromosomal loss and the $x = 8, 9(?)$, and 10 groups by chromosomal gain from 7.

A suggestion of the antiquity of the primary aneuploid lines is found in the widespread occurrence of the $x = 17$ stock in the modern flora. A majority of the European and southeastern North American species now known have this number in common. It is reasonable to speculate that the species with $x = 17$ had a single origin and that migration around the North Atlantic, when it was effectively possible in the early Tertiary (Axelrod, 1960), established the group in both continents. Alternately, the number could have arisen independently, but the chance of forming a derived stock twice with both giving rise to parallel lines of descent of about equal significance and success in two continents seems much less probable. If the $x = 17$ series had formed in either Europe or North America by the early Tertiary, then the basic aneuploid differentiation must have occurred in the Cretaceous or earlier. The great antiquity of the primary series may account to some extent for the loss of most of the diploid species (1 out of 39 species) and for the high level of polyploidy reached by the $x = 6$ ($16x$) and 7 ($12x$) groups. In the secondary aneuploid lines, unquestionably of more recent origin, about one-half of the North American species are diploids and all polyploids are only $4x$. — DEPARTMENT OF BIOLOGY, STEPHEN F. AUSTIN STATE COLLEGE, NACOGDOCHES, TEXAS.

LITERATURE CITED

- AXELROD, D. I. 1960. The evolution of flowering plants. Evolution

- After Darwin. Vol. 1, Evolution of Life. The University of Chicago Press.
- BAKSAY, L. 1956. Cytotaxonomical studies on the flora of Hungary. Budapest. Magyar Nem Muz. Evkän 7: 321-334.
- BLAKE, S. F. 1924. *Polygala*, in N. Am. Fl. 25: 305-370.
- CONTANDRIOPOULOS, J. 1957. Nouvelle contribution a l'étude caryologique des endemiques de la Corse. Bull. Soc. Bot. Fr. 104: 533-538.
- COVAS, G., and B. SCHNACK. 1946. Numero de cromosomas en antófitas de la región de Cuyo (Republica Argentina). Rev. Argent. Agron. 13: 153-166.
- GLENDINNING, D. R. 1955. La cytologie de *Polygala chamaebuxus* L. Bull. Soc. Neuchatel. Sci. Nat. 78: 161-167.
- . 1960. Cytology of *Polygala*. Nature 188: 604-605.
- HAGERUP, O. 1932. Über Polyploidie in Beziehung zu Klima, Ökologie und Phylogenie Chromosomenzahlen aus Timbuku. Hereditas 16: 19-40.
- LARSEN, K. 1956. Chromosome studies in some Mediterranean and South European flowering plants. Bot. Not. 109: 293-307.
- . 1959. On the cytological pattern of the genus *Polygala*. Bot. Not. 112: 369-371.
- LÖVE, A., and D. LÖVE. 1944. Cyto-taxonomical studies on boreal plants. III. Some new chromosome numbers of Scandinavian plants. Ark. Bot. 31A: 1-22.
- MANGENOT, S., and G. MANGENOT. 1957. Nombres chromosomiques nouveaux chez diverses dicotylédones et monocotylédones d'Afrique occidentale. Bull. Jard. Bot. Bruxelles 27: 639-654.
- . 1958. Deuxième liste de nombres chromosomiques nouveaux chez diverses dicotylédones et monocotylédones d'Afrique occidentale. Bull. Jard. Bot. Bruxelles 28: 315-329.
- MATTICK, T. 1950. in G. Tischler, Die Chromosomenzahlen der Gefäßpflanzen Mitteleuropas. 'S-Gravenhage, The Netherlands.
- MIÈGE, J. 1960. Nombres chromosomiques de plantes d'Afrique occidentale. Rev. Cyt. Biol. Vég. 21: 373-384.
- SKALINSKA, M., R. CZAPIK, M. PIOTROWICZ, *et al.* 1959. Further studies in chromosome numbers of Polish angiosperms (dicotyledons). Act. Soc. Bot. Polon. 28: 487-529.
- STEBBINS, G. L. 1938. Cytological characteristics associated with the different growth habits in the dicotyledons. Am. Jour. Bot. 25: 189-198.
- SUZUKA, O. 1950. Chromosome numbers in pharmaceutical plants. I. Rep. Kihara Inst. Biol. Res. 4: 57-58.
- WULFF, H. D. 1938. Chromosomenstudien an der Schleswig-Holsteinischen Angiospermen-Flora II. Ber. Deutsch. Bot. Ges. 56: 247-254.

Table 1. Chromosome numbers reported for the Old World *Polygala*.

Taxon	<i>n</i>	<i>2n</i>	Author
AFRICA			
<i>P. myrtifolia</i> L.	19	. .	Larsen (1959)
<i>P. myrtifolia</i> L.	. .	ca. 38	Glendinning (1960)
<i>P. triflora</i> L.	19	. .	Hagerup (1932)
<i>P. virgata</i> Thunb. var. <i>speciosa</i> (Sims) Chod.	. .	38	Larsen (1959)
ASIA			
<i>P. japonica</i> Houtt.	. .	42	Suzuka (1950)
EUROPE			
<i>P. alpestris</i> Rchb.	17	ca. 34	Glendinning (1960)
<i>P. alpina</i> Perr. & Song.	. .	ca. 34	Glendinning (1960)
<i>P. amara</i> L.	14	. .	Baksay (1956)
<i>P. amara</i> L. subsp. <i>amarella</i> Cr.	17	34	Glendinning (1960)
<i>P. amara</i> L. subsp. <i>brachyptera</i> (Chod.) Hay.	. .	28	Skalinska <i>et al.</i> (1959)
<i>P. calcarea</i> Schultz	17	34	Glendinning (1960)
<i>P. chamaebuxus</i> L.	. .	38	Mattick (1950)
<i>P. chamaebuxus</i> L.	22, 23, 24	. .	Glendinning (1955)
<i>P. chamaebuxus</i> L.	. .	ca. 46	Glendinning (1960)
<i>P. comosa</i> Schkr.	. .	28-32	Mattick (1950)
<i>P. comosa</i> Schkr.	. .	28	Larsen (1956)
<i>P. comosa</i> Schkr.	17	34	Glendinning (1960)
<i>P. major</i> Jacq.	. .	32	Mattick (1950)
<i>P. nicaensis</i> Risso subsp. <i>corsica</i> Graebn.	. .	34	Contandriopoulos (1957)
<i>P. serpyllifolia</i> Hose.	17	34	Glendinning (1960)
<i>P. vayredae</i> Costa	. .	28	Glendinning (1960)
<i>P. vulgaris</i> L.	24-28	. .	Wulff (1938)
<i>P. vulgaris</i> L.	. .	ca. 70	Löve & Löve (1944)
<i>P. vulgaris</i> L.	. .	28, 32, ca. 56	Mattick (1950)
<i>P. vulgaris</i> L.	34	68	Glendinning (1960)

Table 2. Chromosome numbers for 24 North American species of *Polygala*.

Taxon	Gametic Number (<i>n</i>)	Voucher
Section <i>Eurhinotropis</i>		
<i>P. tweedyi</i> Britt.	ca. 14	TEXAS. San Patricio Co., 2.1 miles NW of Mathis, <i>Lewis & Jones 5583</i> (1). ^c
Section <i>Hebeclada</i>		
<i>P. grandiflora</i> Walt.	14	FLORIDA. Glades Co., 8.6 miles SE of Palmdale, <i>Lewis 5680</i> (3).

Taxon	Gametic Number (<i>n</i>)	Voucher
Section <i>Microthrix</i>		
<i>P. ovatifolia</i> Gray	28-30 ^a	TEXAS. San Patricio Co., 2.1 miles NW of Mathis, <i>Lewis & Jones</i> 5586 (1).
<i>P. reducta</i> Blake	15 ^a	NUEVO LEON. 15.2 miles E of Hwys. 57 and 60 junction, <i>Lewis</i> 5757 (2).
<i>P. scoparia</i> HBK.	8 ^a	NUEVO LEON. 11 miles E of Hwys. 57 and 60 junction, <i>Lewis</i> 5753 (4).
<i>P. scoparioides</i> Chod.	17	TEXAS. Brewster Co., Big Bend National Park, Chisos Mts., <i>Lewis</i> 5545 (1); Panther Junction, <i>Lewis</i> 5466 (1).
<i>P. sp.</i> (1) ^b	12 ^a	NUEVO LEON. 9.9 miles E of Hwys. 57 and 60 junction, <i>Lewis</i> 5746 (1, US).
Section <i>Timutua</i>		
<i>P. alba</i> Nutt.	12	TEXAS. Brewster Co., Big Bend National Park, <i>Lewis & Oliver</i> 5455 (2); Culberson Co., North McKittrick Canyon, <i>Lewis</i> 5537 (2).
<i>P. boykinii</i> Nutt.	ca. 14 ^a	FLORIDA. Dade Co., Homestead, <i>Lewis</i> 5676 (1).
<i>P. chapmanii</i> T. & G.	36	MISSISSIPPI. Hancock Co., 0.5 miles W of St. Louis Bay & Hwy. 90, <i>Lewis</i> 5690 (2).
<i>P. cruciata</i> L.	18	MISSISSIPPI. Hancock Co., 6.2 miles ENE of Pearl River and Hwy. 90, <i>Lewis</i> 5692 (3); VIRGINIA. Brunswick Co., 10.5 miles WNW of Emporia, <i>Kral</i> 13633 (2, VPI).
<i>P. curtissii</i> Gray	20	VIRGINIA. Southampton Co., 8 miles E of Emporia, <i>Kral</i> 13817 (2, VPI).
<i>P. lutea</i> L.	34	MISSISSIPPI. Hancock Co., 0.5 miles W of St. Louis Bay and Hwy. 90, <i>Lewis</i> 5689 (1).
<i>P. mariana</i> Mill.	17	TEXAS. Hardin Co., Kountze Lookout Tower, <i>Lewis</i> 5629 (2); Jasper Co., 50 yds. S of Hwys. 96 and 1004 junction, <i>Lewis</i> 5625 (1); Polk Co., 3 miles SW of Barnum, <i>Lewis</i> 5633 (2); San Augustine Co., 0.7 miles SW of Boykin Spring entrance and Hwy. 63, <i>Lewis & Oliver</i> 5511 (1).
<i>P. nana</i> (Michx.) DC.	34	FLORIDA. Citrus Co., 0.4 miles N of Citrus Co.-Hernando Co. line and Hwy. 19, <i>Lewis</i> 5654 (2); TEXAS. Jasper Co.,

Taxon	Gametic Number (<i>n</i>)	Voucher
		50 yds. S of Hwys. 96 and 1004 junction, <i>Lewis</i> 5623 (2); Newton Co., 4.7 miles S of Newton, <i>Lewis</i> 5619.
<i>P. nuttallii</i> T. & G.	23	VIRGINIA. Nansemond Co., N of Cleopus, <i>Kral</i> 13791 (1, VPI).
<i>P. polygama</i> Walt. var. <i>polygama</i>	28	TENNESSEE. Polk Co., 1 mile N of Hwys. 64 and 30 junction, <i>Lewis</i> 5640 (1).
<i>P. polygama</i> Walt. var. <i>obtusata</i> Chod.	28	GEORGIA. Henry Co., 10 miles N of Griffen, <i>Lewis</i> 3648 (3); TEXAS. Hardin Co., 1.4 miles SE of Votaw, <i>Lewis</i> 5631 (2); Newton Co., 2.5 miles N of Burkeville, <i>Lewis</i> 5616 (1), 2.8 miles S of Newton, <i>Lewis</i> 5621 (1).
<i>P. praetervisa</i> Chod.	48	FLORIDA. Monroe Co., Big Pine Key, <i>Lewis</i> 5667 (1).
<i>P. ramosa</i> Ell.	34	MISSISSIPPI. Hancock Co., 6.2 miles ENE of Pearl River and Hwy. 90, <i>Lewis</i> 5691 (4).
<i>P. rugelii</i> Shuttlw.	34	FLORIDA. Glades Co., 8.6 miles SE of Palmdale, <i>Lewis</i> 5681 (1).
<i>P. verticillata</i> L. var. <i>isocycla</i> Fern.	17	TEXAS. Hardin Co., Kountze Lookout Tower, <i>Lewis</i> 5628 (3); Nocogdoches Co., 0.6 miles E of Martinsville, <i>Lewis</i> 5723 (1); Panola Co., 2.3 miles NE of Pinehill, <i>Lewis</i> 5720 (2).
<i>P. sp.</i> (2) ^b	ca. 42 ^a	NUEVO LEON. 11 miles E of Hwys. 57 and 60 junction, <i>Lewis</i> 5754 (1, US).
<i>P. sp.</i> (3) ^b	ca. 36	OAXACA. N of Huaguapán de León, <i>Oliver</i> 136 (1, US).
<i>P. sp.</i> (4) ^b	52-54 ^a	COAHUILA. 3.1 miles N of Los Llanos, <i>Lewis</i> 5728 (2, US).
<i>P. sp.</i> (4)	ca. 52 ^a	NUEVO LEON. 15.2 miles E of Hwys. 57 and 60 junction, <i>Lewis</i> 5755 (1, US).

^aBased on the somatic number of premeiotic cells.

^bProbably represent new species to be discussed in a subsequent paper.

^cNumber of plants examined for the chromosome number.

Table 3. Basic chromosome numbers and levels of ploidy with numbers of species by sections for 23 North American species of *Polygala*.

Basic number	Ploidy	Number of species	Section
$x = 6$	$4x$	2	<i>Monninopsis</i> , <i>Timutua</i>
	$6x$	1	<i>Timutua</i>

	12x	2	<i>Timutua</i>
	16x	1	<i>Timutua</i>
$x = 7$	4x	3	<i>Eurhinotropis</i> , <i>Hebeclada</i> , <i>Timutua</i>
	8x	1	<i>Timutua</i>
	12x	1	<i>Timutua</i>
$x = 8$	2x	1	<i>Monninopsis</i>
$x = 10$	4x	1	<i>Timutua</i>
$x = 15$	2x	1	<i>Microthrix</i>
	4x	1	<i>Microthrix</i>
$x = 17$	2x	3	<i>Monninopsis</i> , <i>Timutua</i>
	4x	4	<i>Timutua</i>
$x = 23$	2x	1	<i>Timutua</i>

SYNTHESIS OF ASTER HERVEYI

LEONARD J. UTTAL

Long suspected to be a hybrid between *Aster spectabilis* Ait. and *A. macrophyllus* L.¹, *A. Herveyi* Gray can now be reported as so in fact. The putative parents have been artificially crossed and resulting progeny compare satisfactorily with naturally occurring *A. Herveyi*. Subsequent reference to this plant will be as *A. × Herveyi* Gray.

A. spectabilis is a coastal plain species from Massachusetts to South Carolina². *A. macrophyllus* is a species of the eastern North American upland. The two are allopatric except in a few counties of southeastern New England and eastern Long Island. Here the two ranges impinge ecologically and physiographically, and here occur the hybrid swarms of *A. × Herveyi*. A specimen from Plainfield, New Jersey collected in 1909, now in the New York Botanical Garden Herbarium, indicates that sympatry between the parent species existed in parts of the New York metropolitan area before its development.

A. spectabilis and *A. macrophyllus* are both present in the

¹Fernald, M. L. 1950. Gray's Manual of Botany, 8th. Ed.: 1430.

²Southern limit based on information from North Carolina herbaria. (Harry E. Ahles, pers. com.)



Lewis, Walter H and Davis, Shirley A . 1962. "CYTOLOGICAL OBSERVATIONS OF POLYGALA IN EASTERN NORTH AMERICA." *Rhodora* 64, 102–113.

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