

PRELIMINARY CHROMOSOME STUDIES ON THE VASCULAR PLANTS OF TAIWAN (III)

The Aster Family, Compositae.

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INTRODUCTION

During the past one year and several months, a large number of flower buds and root tips have been fixed in the field and brought back to the university laboratory. These materials have been studied cytologically and a part of the work has been published in previous papers.⁽²⁾⁽³⁾ This is the third report on the chromosome counts in the series of this study. One of the most common and widely distributed families, the Compositae, is here selected for cytological investigation.

Hayata (1904) was the first person who made a thorough taxonomical study of the Taiwan Compositae. He enumerated 39 genera and 77 species based on the limited material available at that time. During the years between 1932 and 1941, a series of taxonomical works were carried out by an aster family specialist, Prof. S. Kitamura (1932, '35, '37, '40, '41) of Kyoto University, Japan. That outstanding taxonomical revision covers nearly all the Taiwan species and established a general outline of the family in Taiwan. Recently Hu (1965-'68) enumerated the Chinese species of Compositae. According to the Masamune list (1954) there are 71 genera, 190 species and 21 infraspecific taxa of Compositae recorded on Taiwan. Not all but some notes on the Taiwan plants can be found in the works of Prof. S. Kitamura (1968-) entitled "Compositae of Southeast Asia and Himalayas."

However, a very limited number of the indigenous species have been studied cytologically. A total of 16 taxa belonging to the aster family were recorded by Chuang et al. (1962). Hsu (1967) reported the chromosome counts of 19 taxa belonging to 14 genera in the family Compositae which were found in Taipei and its vicinity. The range of collection has been extended in this study both as to latitude and altitude. Table 2 gives the record of the localities, date of collection and the collection numbers.

MATERIALS AND METHODS

These materials were all treated with the standard 3:1 alcohol-glacial acetic acid solution for at least 24 hours, then stored in 70% alcohol at 5°C in a refrigerator. The aceto-carmin or aceto-orcein smear techniques were used to stain the PMC

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while the latter was used for the root tips. All materials were identified and a complete set of the voucher sheets were deposited in the Herbarium of the National Taiwan University (TAI).

RESULTS

The chromosome counts in the present study are listed in the Table I. The genera and species treated are arranged alphabetically. The chromosome number was counted repeatedly on a taxon if it was found growing in different localities or if its external appearance was somewhat different. An asterisk(*) indicates the count of a chromosome number appearing here for the first time. References to the previous records of chromosome counts are based on Darlington and Wylie (1955), Cave's Index (1958-1965), and Ornduff's Index (1967, 1968).

SUMMARY

1. This is a third paper on the chromosome studies of the vascular plants of Taiwan. The chromosome counts of 64 taxa belonging to 36 genera of the aster family, Compositae, are reported in the present study.
2. Of these chromosome observations, a total of 25 taxa are reported here for the first time and not be found in the previous records.
3. The basic number of the following genera is proposed to be:

<i>Ainsliaea</i>	X = 6
<i>Blumea</i>	X = 10
<i>Carpesium</i>	X = 10
<i>Conyza</i>	X = 9
<i>Dichrocephala</i>	X = 9
<i>Hemistepta</i>	X = 9
<i>Microglossa</i>	X = 9
<i>Myriactis</i>	X = 13

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Table 1. Chromosome Counts in some Taiwan Compositae

Fig.	Taxon	Voucher	n	2n	Locality	Previous counts & authority
1	<i>Ageratum</i> X=10 <i>conyzoides</i> L.	3072	10	20	Taipei	2n=20, Ishikawa ('16); Cooper & M. ('35); Hsu('67).
	<i>conyzoides</i> L.	3081		20	Chinankung	n=10, 2n=20, Koul ('64).
	<i>conyzoides</i> L.	3094	10		Chinankung	n=10, Mehra et al. ('65). n=20, Turner & K. ('64); Turner & L. ('65).
	<i>houstonianum</i> Milt.	3393	10		Chitpen	n=10, Turner et al. ('61), ('62); Mehra et al. ('65); Hsu('67). 2n=40, Morrison & K. ('60).
2	<i>Ainsliaea</i> X=6* <i>morrisonicola</i> Hay.	3310	6		Kueihu	*
3	<i>Anaphalis</i> X=7 <i>contorta</i> Hook.	3542	14		Luanshan	n=14, Mehra et al. ('65).
	<i>contorta</i> Hook.	3548	14		Luanshan	
	<i>contorta</i> Hook.	3781	14		Tayuling	
	<i>contorta</i> Hook.	3941	14		Yushan- chienshan	
	<i>contorta</i> Hook.	4001	14		Yushan- chienshan	
4	<i>Artemisia</i> X=8, 9; X2=17 <i>asiatica</i> Nakai	3809	17		Hobuanshan	*
	<i>asiatica</i> Nakai	3904	17		Alishan	
5	<i>kawakamii</i> Hay.	3797	9		Hobuanshan	*
6	<i>morrisonensis</i> Hay.	3948	17		Yushan- chienshan	*
7	<i>Aster</i> X=5, 8, 9 <i>baccharoides</i> Steetz.	3666	9		Luanshan	n=9, Chuang et al. (1962).
	<i>baccharoides</i> Steetz.	3952		18	Yushan- chienshan	
	<i>taiwanensis</i> Kitamar	3586	18		Luanshan	*
8	<i>Didens</i> X=12 <i>bipinnata</i> Linn.	4047	12		Chihpen	*
	<i>bipinnata</i> Linn.	4109	12		Kenting	
	<i>pilosa</i> L. var. <i>minor</i> Sch.	3084	12		Chinankung	n=12, 24, Turner et al. ('61); Hsu ('67).
9	<i>pilosa</i> L. var. <i>minor</i> Sch.	4361	12		Tanshui	2n=72, Gelin ('34); Coras & S. ('46); Diers ('61) n=12, Powell & T. ('63). n=c. 36, 38, Turner & K. ('64). 2n=48, Arano & Nak. ('64). n=24, Smith ('65).
	<i>Blumea</i> X=10* <i>balsamifera</i> DC.	4268	10		Shimen	n=10, Chuang et al. ('62).
11	<i>lacera</i> DC	4514	10		Chiti	*
	<i>Carpesium</i> X=10* <i>acutum</i> Hay.	3209	10		Chihshingshan	*
	<i>acutum</i> Hay.	3552	10		Luanshan	

Fig.	Taxon	Voucher	n	2n	Locality	Previous counts & authority
12	<i>acutum</i> Hay. <i>Cirsium</i> X=10, 17 <i>japonicum</i> DC.	3704	19		Luanshan	2n=34, Alishan ('34); Arano ('57).
	var. <i>australe</i> Kitam.	3200	17		Chihsingshan	*
13	var. <i>australe</i> Kitam.	4390	17		Tanshui	
	<i>Conyza</i> X=9* <i>japonica</i> Less.	3527	9		Luanshan	n=9' Mehra et al. ('65).
	<i>japonica</i> Less.	3566	9		Luanshan	
14	<i>japonica</i> Less.	3574	9		Luanshan	
	<i>Dichrocephala</i> X=9* <i>integrifolia</i> O. K.	3887	9		Alishan	2n=18, Borgmann ('64).
15	<i>integrifolia</i> O. K.	4349	9		Tanshui	n=6, Hsu ('67) as <i>D. bicolor</i> .
16	<i>Eclipta</i> X=11 <i>prostrata</i> Linn.	4074	11		Fengkang	n=11, 2n=22, Arano ('62); Hsu ('67). 2n=22, Jatindra, Mohan et al. ('62)—var. <i>alba</i> 2n=18, Jatindra, Mohan et al. ('62)—var. <i>erecta</i> .
17	<i>Elephantopus</i> X=11 <i>tomentosus</i> Linn.	3443	11		Chusuiipo	n=11, Chuang et al. ('62). 2n=22, Baldwin & S. ('55); Hsu ('67).
18	<i>Emilia</i> X=5 <i>sonchifolia</i> DC.	3089	10		Chinankung	2n=10, Boldwin ('46).
	<i>sonchifolia</i> DC.	3142	10		Yangming- shan	n=5, Turner & K. ('64); Mehra et al. ('65). n=10, 2n=20, Arano ('62), '65). n=10, Hsu ('67).
	<i>Erechites</i> X=10 <i>valerianaeifolia</i> DC.	3099	20		Chinankung	2n=20, Turner & I. ('60).
19	<i>valerianaeifolia</i> DC.	4383	10		Tanshui	n=10, 2n=20 Hsu ('67).
	<i>Erigeron</i> X=9, 16 (polyploids apomictic) <i>fukuyuzmai</i> Kitam.	3629	9		Luanshan	*
20	<i>sumatrensis</i> Retz.	3056	18		Taipei	2n=54, Burgmann ('64).
	<i>sumatrensis</i> Retz.	3394	18		Chihsen	
21	<i>sumatrensis</i> Retz.	3545	18		Luanshan	
	<i>sumatrensis</i> Retz.	3925	18		Alishan	
	<i>sumatrensis</i> Retz.	4364	18		Tanshui	
	<i>Eupatorium</i> X=10, 17 (triploids apomictic) <i>amabile</i> Kitam.	4049	20		Chihsen	*
	<i>amabile</i> Kitam.	4127	20		Kenting	
22	<i>amabile</i> Kitam.	4279	20		Chihsen	
	<i>chinense</i> Linn.					

Fig.	Taxon	Voucher	n	2n	Locality	Previous counts & authority
23	var. <i>simplicifolium</i> Kitam.	3168	20		Chihsinshang	*
24	var. <i>simplicif.</i> Kitam. <i>formosanum</i> Hay.	3203 3535	10 20		Chihsingshan Luanshan	*
25	<i>formosanum</i> Hay. <i>formosanum</i> Hay.	3580 3581	20 20		Luanshan Luanshan	
26	<i>tuchuense</i> Nakai	3855	10		Yehliu	*
27	<i>variabile</i> Makino <i>Farfugium</i> (<i>Ligularia</i> X=30) <i>japonicum</i> Kitam.	3389 3149	10 60		Chihpen Chihsingshan	*
28	<i>japonicum</i> Kitam.	3190	30		Chihsingshan	
29	<i>Gnaphalium</i> X=7 <i>affine</i> D. Don <i>affine</i> D. Don	3528 3573	7 7		Luanshan Luanshan	2n=14, Arano ('56), ('63).
30	<i>hypoleucum</i> DC. <i>hypoleucum</i> DC. <i>hypoleucum</i> DC.	3785 3906 3977	14 14 14		Tayuling Alishan Yushan- chienshan	2n=14, Arano ('63). *
31	<i>involucratum</i> Forst. var. <i>simplex</i> DC.	4023	14		Alishan	2n=28, Arano ('56).
32	<i>japonicum</i> Thunb.	4462	14		Chihsingshan	2n=28, Arano ('63), ('65); Hynh ('65).
33	<i>purpureum</i> Linn. <i>purpureum</i> Linn.	4294 4365	14 14		Taipei Tanshui	
34	<i>Hemistepta</i> X=9* <i>lyrata</i> Bunge	4385	9		Tanshui	2n=36, Arano ('57), ('63), ('65).
35	<i>Heteropappus</i> X=(9)8 <i>hispidus</i> Less.	3883	9		Yehliu	n=36, Simotomai & H. ('42); Huziwaru ('58). n=36, Inoue ('61). n=18 Chuang et al. ('62).
36	<i>Ixeris</i> X=5, 6, 7, 8 (triploids apomictic) <i>chimensis</i> Nakai	3414	6		Tawu	2n=32, Babcock et al. ('37).
37	<i>debilis</i> A. Gray <i>debilis</i> A. Gray	4242 4384	12 12		Yehliu Tanshui	*
38	<i>dentata</i> Nakai <i>laevigata</i> Sch.-Bip. var. <i>lanceolata</i> Kitam.	2884 3141	6 14		Yehliu Yangmingshan	2n=21, Babcock et al. ('37). 2n=24, Ono ('41). n=7, 14, Nishioka ('60). n=7, Chuang et al. ('62). 2n=14, Chuang et al. ('62). as <i>I. oldhamii</i>

Fig.	Taxon	Voucher	n	2n	Locality	Previous counts & authority
39	var. <i>lanceolata</i> Kitam.	3192		14	Chihshingshan	
	var. <i>lanceolata</i> Kitam.	3460	7		Huoshaochang	2n=16, Hsu ('67).
	var. <i>lanceolata</i> Kitam.	3517	7		Wulai	
40	<i>microcephala</i> Nakai	3671	14		Lunshan	*
	<i>microcephala</i> Nakai	3847	14		Lishan	
	<i>transnokoensis</i> Kitam.	3968	12		Yushan-chienschan	*
41	<i>Lactuca</i> X=8, 9 (Old World); X2=17 (New World)					
	<i>indica</i> Linn.	4013	9		Tungpu	2n=18, Thompson et al. ('41); Hsu ('67).
	<i>indica</i> Linn.	4570	9		Taipei	
42	<i>Microglossa</i> X=9*					
	<i>pyrifolia</i> O. K.	4280	9		Chihpen	2n=18, Borgmann ('64).
43	<i>Myriactis</i> X=13*			26		
	<i>humilis</i> Merr.	3338			Kueihu	*
	<i>humilis</i> Merr.	3889	13		Alishan	
44	<i>Picris</i> X=5					
	<i>morrisonensis</i> Hay.	3555	10		Luanshan	*
	<i>morrisonensis</i> Hay.	3800	10		Hohuanshan	
45	<i>morrisonensis</i> Hay.	3963	10		Yushan-chienschan	
	<i>okuwana</i> Kitam.	3538	10		Luanshan	*
46	<i>Senecio</i> X=5, 9, 11, 12, 23					
	<i>morrisonensis</i> Hay.					
	var. <i>dentata</i> Kitam.	4905	20		Alishan	*
47	var. <i>dentata</i> Kitam.	3942	20		Yushan-chienschan	
	<i>nemorensis</i> Linn.	3274	20		Kueihu	2n=40, M. & S. ('35).
	<i>nemorensis</i> Linn.	3601	20		Luanshan	n=40, Chuang et al. ('62), as <i>S. angustifolius</i>
48	<i>nemorensis</i> Linn.	3958	20		Yushan-chienschan	
	<i>scandens</i> Buch.-Ham.	3775	10		Tayuling	2n=20, Alzelius ('24); Arano ('62). n=10, Chuang et al. ('62).
	<i>Siegesbeckia</i> X=10					
49	<i>orientalis</i> Linn.	3069	15		Taipei	n=15, 30, 2n=60, Mehra et al. ('65).
	<i>orientalis</i> Linn.	4355	15		Tanshui	2n=30, Diers ('61). n=15, Hsu ('67).
	<i>Solidago</i> X=9					
40	<i>virgaurea</i> Linn.	3799	9		Hohuanshan	2n=18, Scheerer, Löve & L. ('42).
	<i>Sonchus</i> X=7, 8, 9					
	<i>arvensis</i> Linn.	3356	9		Kueihu	2n=64, Wulff ('37).
	<i>arvensis</i> Linn.	3564	9		Luanshan	2n=54, Löve & L. ('56); Mulligan ('67); Gadella & K. ('63).

Fig.	Taxon	Voucher	n	2n	Locality	Previous count & authority
50	<i>arsensis</i> Linn.	3580	9		Luanshan	n=9, Mehra et al. ('65).
	<i>arsensis</i> Linn.	4492	9		Chiti	n=9, 2n=18, Sorsa ('62), ('63).
	<i>arsensis</i> Linn.	4540	9		Nanjenshan	
	<i>arsensis</i> Linn.	5219	9		Taipei	
	<i>oleraceus</i> Linn.	3197	16		Chihshingshan	2n=32, Stebbins et al. ('53); Mullign ('57); Nishioka ('58).
51	<i>oleraceus</i> Linn.	3908	16		Alishan	n=16, Jinno ('56); Turner et al. ('61); Mehra et al. ('65).
	<i>oleraceus</i> Linn.	4171	16		Kenting	n=16, 2n=32, Koul ('64).
	<i>oleraceus</i> Linn.	4284	16		Taipei	
	<i>oleraceus</i> Linn.	4336	16		Taipei	
	<i>oleraceus</i> Linn.	4376	16		Tanshui	
52	<i>oleraceus</i> Linn.	4450	16		Hsinhuatienn	
	<i>Synedrella</i> X=? <i>nodiflora</i> Gaertn.f.	4026	16		Chihpen	n=19, Gajapathy ('62).
53	<i>Tridax</i> X=9 <i>procumbens</i> Linn.	3406	18		Chihpen	2n=36, Raghavan & V. ('41).
	<i>procumbens</i> Linn.	4194	18		Kenting	n=18, Turner, Ell. & King ('61).
54	<i>Veronia</i> X=7, 8, 9; X2=15, 17; X3=26 <i>cinerea</i> (L.) Less.	3465	9		Huoshacchang	n=9, Chuang et al. ('62); Turner & L. ('65); Mehra et al. ('65); Hsu ('67).
	<i>cinerea</i> (L.) Less.	4072	9		Tawu	
	<i>cinerea</i> (L.) Less.	4102	9		Fengkang	2n=18, Grant ('53); Miede ('60); Manganot & M. ('67). n=9, 2n=18, Koul ('64); Turner & K. ('64).
55	<i>Wedelia</i> X=? <i>biflora</i> DC.	4083	15		Tawu	n=15, Chuang et al. ('62).
56	<i>prostrata</i> Hemsl.	3872	15		Shihmen	
	<i>prostrata</i> Hemsl.	4418	15		Hsinhuatienn	
57	<i>robusta</i> Kitam.	3875	15		Yehliu	*
58	<i>Xanthium</i> X=9 <i>sternarium</i> Linn.	4261	18		Kenting	2n=36, M. Ishikawa ('16); Arano ('64).
59	<i>Youngia</i> X=5, 8 <i>formasana</i> Hara	3343		16	Kueihu	*
	<i>formasana</i> Hara	3594	8		Luanshan	
	<i>japonica</i> DC.	3049	8		Taipei	2n=16, Babcock et al. ('37); Nishioka ('56).
	<i>japonica</i> DC.	3082	8		Chinankung	
	<i>japonica</i> DC.	4173	8		Kenting	n=8, Hsu ('67); Chuang et al. ('62), as <i>Crepis japonica</i>
	<i>japonica</i> DC.	4291	8		Taipei	

Table 2. A List of Collections

Alishan (阿里山)—CHIAIYI CO.: 23°32'-120°47' Alt. 2,230 m. Sept. 28, 1967—3887, 3889, 3904, 3905, 3906, 3908, 3925. Sept. 30, 1967—4023.
Chihpen (知本)—TAITUNG CO.: 22°42'-121°01'. Feb. 20, 1968—4279 (Kao 7143), 4280 (Kao 7142). July 30, 1967—3393, 3394, 3406. Oct. 1, 1967—4025, 4047, 4049.
Chinankung (指南宮)—TAIPEI CO.: 24°51'-121°24', Alt. 230 m. June 11, 1967—3081, 3082, 3084, 3089, 3094, 3099.
Chihshingshan (七星山)—TAIPEI CO.: 25°10'-121°33', collected from elevation of about 700m to the mountain top, Alt. 1,113 m. in sulphur spring area. May 11, 1968—4462. June 17, 1967—3149. July 15, 1967—3168, 3190, 3192, 3197, 3200, 3203, 3209.
Chiti (淡底)—NANTOU CO.: ca. 23°36'-120°38', collected from elevation of about 1,000 m. May 16, 1968—4429 (Kao 7238), 4514 (Kao 7231).
Chusaiipo (出水坡)—TAITUNG CO.: 22°23'-120°49', collected from elevation of about 400 m to 550 m. July 31, 1967—3443.
Fengkang (楓港)—PINGTUNG CO.: 22°12'-120°41', collected from gravel river bed. Oct. 2, 1967—4074, 4102.
Hohuanshan (合歡山)—NANTOU CO.: 24°04'-121°16', collected from elevation of 2,565m to 3,250 m. Aug. 22, 1967—3797, 3799, 3800, 3809.
Hsinhuatien (興化店)—TAIPEI CO.: 25°13'-121°27', collected from the sandy coastal region. Apr. 28, 1968—4418, 4430.
Huoshaochang (火燒寮)—TAIPEI CO.: 24°55'-121°35', collected from elevation of about 200 m. Aug. 5, 1967—3463, 3465.
Kenting (墾丁)—PINGTUNG CO.: 21°57'-120°47', collected from the coastal region. Feb. 18, 1968—4261. Oct. 3, 1967—4109, 4127. Oct. 4, 1967—4171, 4173. Oct. 5, 1967—4194.
Kueihu (龜湖)—TAITUNG CO.: ca. 22°46'-120°53', collected from elevation of about 1,600 m to 2,000 m. July 27, 1967—3274. July 28, 1967—3310. July 29, 1967—3338, 3343, 3356.
Lishan (梨山)—TAICHUNG CO.: 24°16'-121°14', collected around elevation of 1,700 m. Aug. 23, 1967—3847.
Luanshan (巔山)—HUALIEN CO.: ca. 23°55'-121°26', collected from elevation of about 1,800 m to 2,100 m. Aug. 16, 1967—3527, 3528, 3535, 3538, 3542, 3545, 3548, 3550, 3552, 3555. Aug. 17, 1967—3564, 3566, 3573, 3574, 3580, 3581, 3586, 3594, 3601. Aug. 18, 1967—3629, 3666, 3671. Aug. 19, 1967—3704.
Nanjenshan (南仁山)—PINGTUNG CO.: 22°05'-120°51', collected around elevation of 200 m. June 15, 1968—4540 (Kao 7288).
Shihmen (石門)—TAIPEI CO.: 25°18'-121°33', collected from the sandy coastal region. Feb. 19, 1968—4268 (Kao 7118). Sept. 10, 1967—3872.
Taipei (臺北)—TAIPEI CITY: 25°03'-121°31', collected around the University Campus, NTU. March 7, 1968—4284. March 11, 1968—4291, 4294.

- March 12, 1969—5219.
 March 28, 1968—4336.
 June 7, 1967—3049, 3056, 3069, 3072.
 July 7, 1968—4570.
 Tanshui (淡水)—TAIPEI CO.: 25°11'-121°26', collected from the opposite side, across the Tanahui River.
 Apr. 9, 1968—4349, 4355, 4361, 4364, 4365, 4376, 4383, 4384, 4385, 4390.
 Tawu (大武)—TAITUNG CO.: 22°22'-120°54', collected from the coastal region.
 July 31, 1967—3414.
 Oct. 2, 1967—4072, 4083.
 Tayuling (大禹嶺)—HUALIEN CO.: ca. 24°11'-121°18', collected from elevation of about 2,565 m.
 Aug. 21, 1967—3775, 3781, 3785.
 Tungpu (東埔)—NANTOU CO.: 23°32'-120°53', collected from elevation of about 2,500 m.
 Sept. 30, 1967—4013.
 Wulai (烏來)—TAIPEI CO.: 24°52'-121°33', Alt. 145 m.
 Aug. 13, 1967—3517.
 Yangmingshan (陽明山)—TAIPEI CO.: 25°09'-121°42', collected from elevation of about 400 m.
 June 17, 1967—3141, 3142.
 Yehliu (野柳)—TAIPEI CO.: 25°13'-121°42', collected from the coastal region.
 Feb. 13, 1968—4242.
 Sept. 10, 1967—2855, 3883, 3884.
 Yushanchiengshan (玉山前山)—CHIAYI CO.: 23°28'-120°54', collected from elevation of about 3,000 m to 3,200 m.
 Sept. 29, 1967—3941, 3942, 3948, 3952, 3958, 3963, 3968, 3977, 4001.

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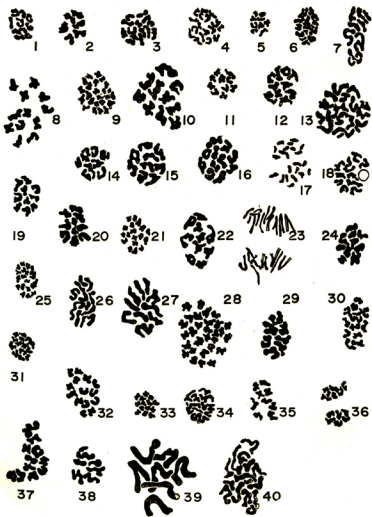
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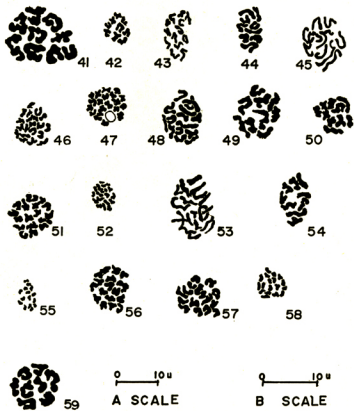
Explanation of Plate Figures

(N. B.: An asterisk(*) indicates the magnification should be measured by B Scale, in the end of Plate II, and all others by Scale A).

Plate I

- Fig. 1. *Ageratum coryzoides* Linn., early diakinesis with 10 bivalents.
 Fig. 2. *Ainsliaea morrisonicola* Hay., diakinesis with 6 bivalents.
 Fig. 3. *Anaphalis contorta* Hook., early diakinesis with 14 bivalents.
 Fig. 4. *Artemisia asiatica* Nakai, early diakinesis with 17 bivalents.
 Fig. 5. *Artemisia kawakamii* Hay., diakinesis with 9 bivalents.
 Fig. 6. *Artemisia morrisonensis* Hay., early diakinesis with 18 bivalents.
 Fig. 7. *Aster baccharoides* Steetz., one side of the anaphase I, showing 10:10 distribution of bivalents.
 Fig. 8.* *Bidens bipinnata* Linn., diakinesis with 12 bivalents.
 Fig. 9. *Bidens pilosa* Linn. var. *minor* (Blume) Scherff., diakinesis with 24 bivalents.
 Fig. 10.* *Blumea balsamifera* DC., diakinesis with 10 bivalents.
 Fig. 11. *Blumea lacera* DC., diakinesis with 10 bivalents.
 Fig. 12. *Carpesium acutum* Hay., diakinesis with 10 bivalents.
 Fig. 13.* *Cirsium japonicum* DC. var. *australe* Kitamura, early diakinesis with 17 bivalents.
 Fig. 14. *Conyza japonica* (Thunb.) DC., diakinesis with 9 bivalents.
 Fig. 15.* *Dichrocephala integrifolia* (Linn.f.) O. Kuntze, diakinesis with 9 bivalents.
 Fig. 16.* *Eclipta prostrata* Linn., diakinesis with 11 bivalents.
 Fig. 17. *Elephantopus tomentosus* Linn., anaphase I, showing 11:11 distribution of bivalents.
 Fig. 18.* *Emilia sonchifolia* DC., diakinesis with 10 bivalents.
 Fig. 19. *Erechthites valerianaeifolia* DC., diakinesis with 10 bivalents.
 Fig. 20. *Erigeron fukuyamai* Kitamura, diakinesis with 9 bivalents.
 Fig. 21. *Erigeron sumatrensis* Retz., diakinesis with 18 bivalents.
 Fig. 22.* *Eupatorium amabile* Kitamura, diakinesis with 10 bivalents.
 Fig. 23. *Eupatorium chinense* Linn. var. *simplicifolium* (Makino) Kitamura, somatic anaphase showing 20:20 distribution of chromosomes.
 Fig. 24. *Eupatorium chinense* Linn. var. *simplicifolium* (Makino) Kitamura, diakinesis with 10 bivalents.
 Fig. 25. *Eupatorium formosanum* Hay., diakinesis with 20 bivalents.
 Fig. 26. *Eupatorium lachuense* Nakai, early metaphase I with 10 bivalents.
 Fig. 27. *Eupatorium variabile* Makino, early metaphase I with 10 bivalents.
 Fig. 28. *Farfugium japonicum* Kitamura, diakinesis with 30 bivalents.
 Fig. 29. *Gnaphalium affine* Don, diakinesis with 7 bivalents.
 Fig. 30. *Gnaphalium hypoleucum* DC., early metaphase I with 14 bivalents.
 Fig. 31. *Gnaphalium involucreatum* Forst. var. *simplex* DC., diakinesis with 14 bivalents.
 Fig. 32.* *Gnaphalium japonicum* Thunb., diakinesis with 14 bivalents.
 Fig. 33. *Gnaphalium purpureum* Linn., diakinesis with 14 bivalents.
 Fig. 34. *Hemistelea lyrata* Bunge, diplo-nema with 9 slender chromosomes.
 Fig. 35. *Heteropappus hispidus* (Thunb.) Less., diakinesis with 9 bivalents.
 Fig. 36. *Ixeris chinensis* Nakai, anaphase I showing 6:6 distribution of bivalents.
 Fig. 37. *Ixeris debilis* A. Gray, diplo-nema with 12 chromosomes.
 Fig. 38. *Ixeris dentata* (Thunb.) Nakai, diakinesis with 6 bivalents.
 Fig. 39. *Ixeris laevigata* (Blume) Sch.-Bip. var. *lanceolata* (Makino) Kitamura, early diakinesis with 7 bivalents.
 Fig. 40. *Ixeris microcephala* Nakai, early metaphase I with 14 bivalents.





Explanation of Plate Figures

Plate II

- Fig. 41. *Lactuca indica* Linn., diakinesis with 9 bivalents.
Fig. 42.* *Microglossa pyrifolia* O. Kuntze, diakinesis with 9 bivalents.
Fig. 43. *Myriactis humilis* Merr., early diakinesis with 13 bivalents.
Fig. 44. *Picris morrisonensis* Hay., early metaphase I with 10 bivalents.
Fig. 45. *Picris oluiana* Kitamura, diplonema with 10 slender chromosomes.
Fig. 46. *Senecio morrisonensis* Hay. var. *dentata* Kitamura, diakinesis with 20 bivalents.
Fig. 47. *Senecio nemorensis* Linn., diakinesis with 20 bivalents.
Fig. 48.* *Siegesbeckia orientalis* Linn., early diakinesis with 15 bivalents.
Fig. 49. *Solidago virgaurea* Linn., diakinesis with 9 bivalents.
Fig. 50. *Sonchus arvensis* Linn., diakinesis with 9 bivalents.
Fig. 51.* *Sonchus oleraceus* Linn., diakinesis with 16 bivalents.
Fig. 52. *Synedrella nodiflora* (Linn.) Gaertn. f., diakinesis with 19 bivalents.
Fig. 53. *Tridax procumbens* Linn., diplonema with 18 slender chromosomes.
Fig. 54. *Veronia cinerea* Less., diakinesis with 9 bivalents.
Fig. 55. *Wedelia biflora* (Linn.) DC., early metaphase I with 15 bivalents.
Fig. 56. *Wedelia prostrata* (Hook. et Arn.) Hemsl., diakinesis with 15 bivalents.
Fig. 57. *Wedelia robusta* (Makino) Kitamura, diakinesis with 15 bivalents.
Fig. 58. *Xanthium sturmairium* Linn., diakinesis with 18 bivalents.
Fig. 59. *Youngia japonica* DC., diakinesis with 8 bivalents.