

CHROMOSOME NUMBERS OF THE VASCULAR PLANTS OF TAIWAN I¹

by

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Taiwan is the largest island that lies in the Tropic of Cancer. It has a rich and interesting flora. On the island, temperate as well as tropical plants thrive side by side. In the "Flora of Formosa", Masumune (1936) listed about 4840 species of vascular plants. Since then a number of new species have been added to the flora. Endemic species are comparatively numerous.

In spite of rather extensive taxonomic studies, the flora of Taiwan has been cytologically neglected. Recently Chen and Hsu (1961, 1962) reported the chromosome numbers of about 73 species of Taiwan grasses. Liu, Chao and Chuang (1961) made cytotaxonomic studies of 23 species of Taiwan Umbelliferae. Further cytological survey of the flora of Taiwan will be not only toward better understanding of its nature but also exploiting valuable cytological materials.

In this paper, chromosome numbers of 98 species of vascular plants of Taiwan are listed, of which about 72 species are presented here for the first time. The families in Table I are listed according to Hutchinson's classification system (1959). No discussion will be made at this time. It will be undertaken until sufficient data on the chromosome numbers of this flora are accumulated.

For chromosome count, flower buds or root tips were fixed in Farmer's fluid. The root tips were then treated with 1N HCl and Carnoy's solution. Propiono-carmine smear technique was followed for both PMCs and root tips.

The drawings were made with the aid of the camera lucida, using an oil immersion objective and a 10X compensating eyepiece.

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Species	n =	Fig.	Collector	Locality	Pre- vious count n =	Reference to previous count
Flagellariaceae						
<i>Flagellaria indica</i>	19	57	Shimizu 12210	Pingtung		
Zingiberaceae						
<i>Alpinia formosana</i>	24	62	Kao & Chuang TIC3976	Taipei		
Liliaceae						
<i>Dianella ensifolia</i>	16	59	Shimizu & Kao 11609	Hwalien	16	Sato, 1942
<i>Disporum Kawakamii</i>	8	60	Kao K3989	Hwalien		
<i>Heloniopsis umbellatus</i>	17	68	Chuang & Lin TIC4790	Yangming Shan, Taipei		
<i>Smilacina formosana</i>	18	69	Kao K4145	Muh-kwa- shan, Hwalien		
<i>Veratrum formosanum</i>	8	61	Chuang TIC3977 Shimizu 12412	Taipei Hwalien		
Araceae						
<i>Arisaema ringens</i>	14	65	Chuang & Lin TIC4809	Yangming Shan, Taipei	14	Ito, 1942
Cyperaceae						
<i>Fimbristylis aestivalis</i>	5	63	Chuang & Lin TIC4779	Nankang, Taipei	5	Sharma & Bal, 1956
<i>Fimbristylis miliacea</i>	5	64	Chuang & Lin TIC4632	Nankang, Taipei	5	Tanaka, 1939

Table 1. Chromosome Numbers of Vascular Plants of Taiwan

Species	n =	Fig.	Collector	Locality	Previous count n =	Reference to previous count
Lauraceae						
<i>Cinnamomum camphora</i>	12	73	Chuang & Kao CCC2030	Tawu Taitung	12	Sugiura, 1936
<i>Cinnamomum reticulatum</i>	12	74	Chuang & Lin TIC4900	Olunpi, Pingtung		
Rosaceae						
<i>Photinia serrulata</i>	17	10	Shimizu 12603	Hwalien		
Papilionaceae						
<i>Crotalaria saltiana</i>	8	11	Shimizu & Kao 10487	Hwalien		
<i>Desmodium scorpiurus</i>	11	76	Chuang & Kao CCC2021	Akongtein, Tainan		
<i>Desmodium sequax</i> var. <i>sinuatum</i>	11	12	Huang & Kao 1602	Chiayi		
<i>Flemingia strobilifera</i>	11	77	Chuang & Kao CCC2024	Akongtien, Tainan		
<i>Indigofera suffruticosa</i>	8	13	Kao K3653	Miaoli	8	Frahm-Leliveld, 1957 Krapov. & Fuchs de 1957
Hydrangeaceae						
<i>Hydrangea chinensis</i>	18	75	Chuang & Lin TIC4811	Yangming Shan, Taipei		
Caprifoliaceae						
<i>Sambucus formosanus</i>	18	45	Hu 1001	Taipei		
<i>Lonicera hypoglauca</i>	8	94	Chuang & Lin TIC4945	Yangming Shan, Taipei		
Ulmaceae						
<i>Celtis nervosa</i>	13	2	Shimizu 12056	Pingtung		
<i>Trema cannabina</i>	10	70	Kao K4033	Lien-hwa-chih, Nantou		
Thymelaeaceae						
<i>Wikstroemia indica</i>	18	19	Shimizu 12115	Pingtung		
Violaceae						
<i>Viola verecunda</i>	12	80	Chuang & Lin TIC4795	Yangming Shan, Taipei		

Species	n =	Fig.	Collector	Locality	Previous count n =	Reference to previous count
Cucurbitaceae						
<i>Melothria mucronata</i>	12	95	Chuang TIC4734	Yangming Shan, Taipei		
Euphorbiaceae						
<i>Gelonium aequoreum</i>	11	14	Shimizu 12121	Pingtung		
<i>Macaranga Tanarius</i>	11	15	Chuang TIC3907	Taipei		
<i>Mercurialis leiocarpa</i>	24	16	Shimizu & Kao 10547	Hualien	24	Morinaga et al. 1929
<i>Phyllanthus Niruri</i>	13	78	Kao K4223	Kenting, Pingtung	13	Raghavan, 1957
<i>Phyllanthus Urinaria</i>	7	17	Kao K3673	Taipei		
Theaceae						
<i>Adinandra formosana</i>	42	79	Chuang & Lin TIC4942	Yangming Shan, Taipei		
Ericaceae						
<i>Lyonia ovalifolia</i>	12	85	Chuang & Lin TIC4960	Yangming Shan, Taipei		
<i>Vaccinium Wrightii</i>	12	25	Shimizu & Kao 11971	Hualien		
Combretaceae						
<i>Terminalia Catappa</i>	12	81	Chuang & Lin TIC4911	Oluanpi, Pingtung		
Melastomaceae						
<i>Bredia Oldhamii</i>	14	20	Shimizu & Kao 11713	Hualien		
Rhamnaceae						
<i>Rhamnus oiwakensis</i>	12	18	Chuang, Kao & Kou TIC 4301	Chiayi		
Myrsinaceae						
<i>Ardisia Sieboldii</i>	24	26	Chuang	Taipei		
<i>Ardisia squamulosa</i>	24	86	Chuang & Lin TIC4909	Olaunpi, Pingtung		
<i>Myrsine seguinii</i>	23	87	Chuang & Lin TIC4770	Yangming Shan, Taipei		
Loganiaceae						
<i>Buddleia asiatica</i>	38	32	Shimizu & Kao 10450	Hualien	38	Moore, 1947

Species	n =	Fig.	Collector	Locality	Pre- vious count n =	Reference to previous count
Oleaceae						
<i>Chionanthus retusus</i>	46	29	Chuang TIC3327	Taipei		
<i>Jasminum subtriplinerve</i>	13	30	Chuang TIC3328	Taipei		
<i>Ligustrum seisuiense</i>	23	31	Shimizu & Kao 11721	Hwalien		
Apocynaceae						
<i>Rauwolfia verticillata</i>	11	35	Shimizu 12065	Pingtung		
Rubiaceae						
<i>Wendlandia formosana</i>	11	93	Kao K4013	Lien-hwa- chih, Nantou		
Verbenaceae						
<i>Callicarpa formosana</i>	18	39	Chuang TIC3899	Taipei		
<i>Callicarpa Loureiri</i>	17	88	Kao K4032	Lien-hwa- chih, Nantou		
<i>Vitex rotundifolia</i>	16	40	Kao K3589	Taipei	16	Jinno, 1956
Ranunculaceae						
<i>Clematis Gouriana</i>	8	71	Kao K4090	Tai-lu-kou, Hwalien		
<i>Ranunculus japonicus</i>	7	4	Kao & Chuang TIC3337	Taipei	7	Hara & Kurosawa, 1956
<i>Ranunculus ternatus</i>	8	72	Kao K4499	Yingko, Taipei	8	Kurita, 1955
<i>Ranunculus Vernyii</i>	16	5	Chuang TIC3329	Taipei		
<i>Ranunculus Zuccarini</i>	8	6	Kao & Chuang TIC3334	Taipei	8	Yamasaki & Miduno, 1956
Lardizabalaceae						
<i>Akebia longeracemosa</i>	16	7	Shimizu & Kao 11559	Hwalien		
Saururaceae						
<i>Saururus chinensis</i>	11	1	Kao & Chuang TIC3378	Taipei	11	Suzuka, 1950
Caryophyllaceae						
<i>Silene Fortunei</i>	15	3	Kao 3592	Taipei		
Onagraceae						
<i>Jussiaea suffruticosa</i>	24	21	Chuang & Lin TIC4780	Taipei		
		82	Chuang TIC3905	Taipei		
<i>Jussiaea stipulacea</i>	12	83	Chuang TIC4966	Taipei	8	Sinoto, 1928, Sharma & Sarkar, 1956

Species	n =	Fig.	Collector	Locality	Previous count n =	Reference to previous count
Halorrhagaceae						
<i>Halorrhagis micrantha</i>	6	22	Kao & Chuang TIC3973	Taipei		
Gentianaceae						
<i>Gentiana flavo-maculata</i>	12	33	Kao K3864	Nantou		
<i>Gentiana scabrida</i>	22	34	Chuang, Kuo & Kao TIC 4084	Chiayi		
Primulaceae						
<i>Anagallis arvensis</i>	20	27	Tsai & Kao K3957	Taipei	20	Wulff, 1937
<i>Lysimachia mauritiana</i>	10	28	Tsai & Kao K3958 Chuang TIC3947	Taipei Keelung	10	Jinno, 1956
Plantaginaceae						
<i>Plantago Sawadai</i>	12	92	Chuang TIC4936	Nankang, Taipei		
Saxifragaceae						
<i>Deutzia pulchra</i>	52	8	Shimizu & Kao 11551	Hwalien		
<i>Hydrangea aspera</i>	18	9	Huang & Kao 1601	Chiayi		
Umbelliferae						
<i>Eryngium foetidum</i>	8	84	Kao K4082	Lien-hwa- chih, Nantou Taipei		
<i>Peucedanum formosanum</i>	11	23	Chao 1001			
<i>Sanicula lamelligera</i>	8	24	Shimizu & Kao 11702 Kao K3936	Hwalien Ta-tun Taipei	8	Bell and Constance, 1960
Compositae						
<i>Aster baccharoides</i>	9	96	Kao K4168	Muh-kwa- shan, Hwalien		
<i>Blumea balsamifera</i>	10	46	Shimizu 12030	Pingtung		
<i>Crepidiastrum lanceolatum</i>	5	47	Shimizu & Kao 11572	Hwalien		
<i>Crepis japonica</i>	8	97	Chuang TIC4700	Urai, Taipei	8	Babcock, Stebbins, Jenkins, 1937
<i>Elephantopus mollis</i>	11	48	Kao K3759	Taipei		
<i>Gnaphalium formosanum</i>	7	49	Huang & Kao 1678	Chiayi		
<i>Gynura formosana</i>	10	50	Tsai & Kao K3956	Taipei		
<i>Heteropappus hispidus</i>	18	51	Shimizu & Kao 10653	Hwalien	18	Shimotomai & Huziwarra, 1942

Species	n =	Fig.	Collector	Locality	Pre- vious count n =	Reference to previous count
<i>Ixeris dentata</i>	7	98	Chuang TIC4723	Yangming Shan Taipei Hwalien	7,14	Nishioka, 1960
<i>Ixeris Oldhami</i>	7	52	Shimizu & Kao 10671	Hwalien		
<i>Lactuca formosana</i>	9	53	Shimizu & Kao 10618			
<i>Microglosa volubilis</i>	9	99	Chuang & Lin TIC4861	Sun-moon- lake Nantou		
<i>Senecio angustifolius</i>	40	54	Huang & Kao, 1637	Chiayi		
<i>Senecio scandens</i>	10	100	Chuang TIC4741	Yangming Shan Taipei	10	Afzelius, 1924
<i>Vernonia cinerea</i>	9	55	Kao, Kwan & Hu K3781	Taipei	9	Grant, 1953
<i>Wedelia biflora</i>	15	56	Chao et al 3840	Taipei		
Solanaceae						
<i>Solanum nigrum</i>	12	43	Chuang TIC3896	Taipei	12	Bhaduri, 1933
Convolvulaceae						
<i>Ipomoea pes-caprae</i>	15	36	Kao K3587	Taipei	15	Miege, 1960
Scrophulariaceae						
<i>Scoparia dulcis</i>	20	91	Kao K4030	Lien-hwa- chih, Nantou		
Acanthaceae						
<i>Lepidagathis formosensis</i>	21	44	Kwan, Hu & Kao K3781	Taipei		
Borraginaceae						
<i>Ehretia Dicksoni</i>	20	37	Shimizu & Kao, 11557	Hwalien		
<i>Trigonotis formosana</i>	24	38	Shimizu & Kao, 11668	Hwalien		
Labiatae						
<i>Ajuga bracteosa</i>	16	41	Chao et al 1002	Taipei		
<i>Dysophylla auricularia</i>	17	89	Kao K4323	Shih-pei, Taipei		
<i>Hyptis capitata</i>	15	90	Kao K4029	Lien-hwa- chih, Nantou		
<i>Leonurus sibiricus</i>	10	42	Kao K3848	Nantou	10	Suzuka, 1950
Commelinaceae						
<i>Aneilema angustifolium</i>	20	58	Kao K3765	Taipei		
<i>Aneilema divergens</i>	16	66	Kao K4011	Yangming Shan, Taipei		

EXPLANATION OF PLATE FIGURES

(Figs. 1—62×1100; 63—100×2100)

Plate I

- Fig. 1. *Saururus chinensis*, diakinesis with 11 bivalents.
 Fig. 2. *Celtis nervosa*, diakinesis with 13 bivalents.
 Fig. 3. *Si'ene Fortunei*, AI showing 15:15 distribution of chromosomes
 Fig. 4. *Ranunculus japonicus*, diakinesis with 7 bivalents.
 Fig. 5. *Ranunculus Vernyii*, MI with 8 bivalents and 16 univalents.
 Fig. 6. *Ranunculus Zuccarini*, diakinesis with 8 bivalents.
 Fig. 7. *Akebia longeracemosa*, MI with 16 bivalents.
 Fig. 8. *Deutzia pulchra*, late diakinesis with 52 bivalents.
 Fig. 9. *Hydrangea aspera*, early AI showing 36 chromosomes.
 Fig. 10. *Photinia serrulata*, diakinesis with 17 bivalents.
 Fig. 11. *Crotalaria saltiana*, MI with 8 bivalents.
 Fig. 12. *Desmodium sequax* var. *sinuatum*, diakinesis with 11 bivalents.
 Fig. 13. *Indigofera suffruticosa*, diakinesis with 8 bivalents.
 Fig. 14. *Gelonium aequoreum*, diakinesis with 11 bivalents.
 Fig. 15. *Macaranga Tanarius*, AI showing 11:11 distribution of chromosomes.
 Fig. 16. *Mercurlialis leiocarpa*, diakinesis with 24 bivalents.
 Fig. 17. *Phyllanthus Urinaria*, diakinesis with 7 bivalents.
 Fig. 18. *Rhamnus oiwakensis*, late diakinesis with 12 bivalents.

Plate II

- Fig. 19. *Wikstroemia indica*, AI showing 18:18 distribution of chromosomes.
 Fig. 20. *Bredia Oldhamii*, diakinesis with 14 bivalents.
 Fig. 21. *Jussiaea suffruticosa*, AI showing 24:24 distribution of chromosomes.
 Fig. 22. *Halorrhagis micrantha*, MI with 6 bivalents.
 Fig. 23. *Peucedanum formosanum*, early AI showing 22 chromosomes.
 Fig. 24. *Sanicula lamelligera*, MI with 8 bivalents.
 Fig. 25. *Vaccinium Wrightii*, MI with 12 bivalents.
 Fig. 26. *Ardisia Sieboldii*, diakinesis with 24 bivalents.
 Fig. 27. *Anagallis arvensis*, diakinesis with 20 bivalents.
 Fig. 28. *Lysimachia mauritiana*, diakinesis with 10 bivalents.
 Fig. 29. *Chionanthus retusus*, diakinesis with 46 bivalents.
 Fig. 30. *Jasminum subtripinnerve*, diakinesis with 13 bivalents.
 Fig. 31. *Ligustrum seisuiense*, diakinesis with 23 bivalents.
 Fig. 32. *Buddleia asiatica*, diakinesis with 38 bivalents.
 Fig. 33. *Gentiana flavo-maculata*, AI showing 12:12 distribution of chromosomes.
 Fig. 34. *Gentiana scabrida*, late diakinesis with 22 bivalents.
 Fig. 35. *Rauwolfia verticillata*, late diakinesis with 11 bivalents.
 Fig. 36. *Ipomoea pes-caprae*, diakinesis with 15 bivalents.
 Fig. 37. *Ehretia Dicksoni*, diakinesis with 20 bivalents.

Plate III

- Fig. 38. *Trigonotis formosana*, diakinesis with 24 bivalents.
 Fig. 39. *Callicarpa formosana*, prometaphase I with 18 bivalents.
 Fig. 40. *Vitex rotundifolia*, diakinesis with 16 bivalents.
 Fig. 41. *Ajuga bracteosa*, late MI with 16 bivalents.
 Fig. 42. *Leonurus sibiricus*, MI with 10 bivalents.

- Fig. 43. *Solanum nigrum*, prometaphase I with 12 bivalents.
- Fig. 44. *Lepidagathis formosensis*, diakinesis with 21 bivalents.
- Fig. 45. *Sambucus formosanus*, late diakinesis with 18 bivalents.
- Fig. 46. *Blumea balsamifera*, diakinesis with 10 bivalents.
- Fig. 47. *Crepidiastrum lanceolatum*, diakinesis with 5 bivalents.
- Fig. 48. *Elephantopus mollis*, diakinesis with 11 bivalents.
- Fig. 49. *Gnaphalium formosanum*, MI with 7 bivalents.
- Fig. 50. *Gynura formosana*, diakinesis with 10 bivalents.
- Fig. 51. *Heteropappus hispidus*, diakinesis with 18 bivalents.
- Fig. 52. *Ixeris Oldhami*, diakinesis with 7 bivalents.
- Fig. 53. *Lactuca formosana*, diakinesis with 9 bivalents.
- Fig. 54. *Senecio angustifolius*, diakinesis with 40 bivalents.
- Fig. 55. *Vernonia cinerea*, diakinesis with 9 bivalents.
- Fig. 56. *Wedelia biflora*, diakinesis with 15 bivalents.
- Fig. 57. *Flagellaria indica*, late diakinesis with 19 bivalents.
- Fig. 58. *Aneilema angustifolium*, MI with 20 bivalents.
- Fig. 59. *Dianella ensifolia*, AI showing 16:16 distribution of chromosomes.
- Fig. 60. *Disporum Kawakamii*, AI showing 8:8 distribution of chromosomes.
- Fig. 61. *Veratrum formosanum*, MI with 8 bivalents.
- Fig. 62. *Alpinia formosana*, MI with 24 bivalents.

Plate IV

- Fig. 63. *Fimbristylis aestivalis*, AI showing 5:5:5:5 distribution of chromosomes.
- Fig. 64. *Fimbristylis miliacea*, diakinesis with 5 bivalents.
- Fig. 65. *Arisaema ringens*, somatic metaphase with 28 chromosomes.
- Fig. 66. *Aneilema divergens* diakinesis with 15 bivalents and 2 univalents.
- Fig. 67. *Dianella ensifolia*, late diakinesis with 16 bivalents.
- Fig. 68. *Heloniopsis umbellatus*, somatic metaphase with 34 chromosomes.
- Fig. 69. *Smilacina formosana*, somatic metaphase with 36 chromosomes.
- Fig. 70. *Trema cannabina*, diakinesis with 9 bivalents and 2 univalents.
- Fig. 71. *Clematis Gouriana*, late diakinesis with 8 bivalents.
- Fig. 72. *Ranunculus ternatus*, AI showing 8:8 distribution of chromosomes.
- Fig. 73. *Cinnamomum camphora*, diakinesis with 12 bivalents and 2 nucleoli.
- Fig. 74. *Cinnamomum reticulatum*, diakinesis with 12 bivalents.

Plate V

- Fig. 75. *Hydrangea chinensis*, AI showing 18:18 distribution of chromosomes.
- Fig. 76. *Desmodium scorpiurus*, diakinesis with 11 bivalents.
- Fig. 77. *Flemingia strobilifera*, MI with 11 bivalents.
- Fig. 78. *Phyllanthus Niruri*, AI showing 13:13 distribution of chromosomes.
- Fig. 79. *Adinandra formosana*, late diakinesis with 42 bivalents.
- Fig. 80. *Viola verecunda*, diakinesis with 12 bivalents.
- Fig. 81. *Terminalia Catappa*, prometaphase with 12 bivalents.
- Fig. 82. *Jussiaea suffruticosa*, MI with 24 bivalents.
- Fig. 83. *Jussiaea stipulacea*, MI with 12 bivalents.
- Fig. 84. *Eryngium foetidum*, MI with 8 bivalents.
- Fig. 85. *Lyonia ovalifolia*, early AI with 24 chromosomes.
- Fig. 86. *Ardisia squamulosa*, diakinesis with 24 bivalents.
- Fig. 87. *Myrsine seguinii*, AI showing 23:23 distribution of chromosomes.

Plate VI

- Fig. 88. *Callicarpa Loureiri*, late diakinesis with 17 bivalents.

- Fig. 89. *Dysophylla auricularia*, late diakinesis with 17 bivalents.
- Fig. 90. *Hyptis capitata*, MI with 15 bivalents.
- Fig. 91. *Scoparia dulcis*, diakinesis with 20 bivalents.
- Fig. 92. *Plantago Sawadai*, diakinesis with 12 bivalents.
- Fig. 93. *Wendlandia formosana*, late diakinesis with 11 bivalents.
- Fig. 94. *Lonicera hypoglauca*, diakinesis with 8 bivalents.
- Fig. 95. *Melothria mucronata*, diakinesis with 12 bivalents.
- Fig. 96. *Aster baccharoides*, steets diakinesis with 9 bivalents.
- Fig. 97. *Crepis japonica*, early diakinesis with 8 bivalents.
- Fig. 98. *Ixeris dentata*, AI showing 7:7 distribution of chromosomes.
- Fig. 99. *Microglossa volubilis*, diakinesis with 9 bivalents.
- Fig. 100. *Senecio scandens* diakinesis with 10 bivalents.

PLATE I

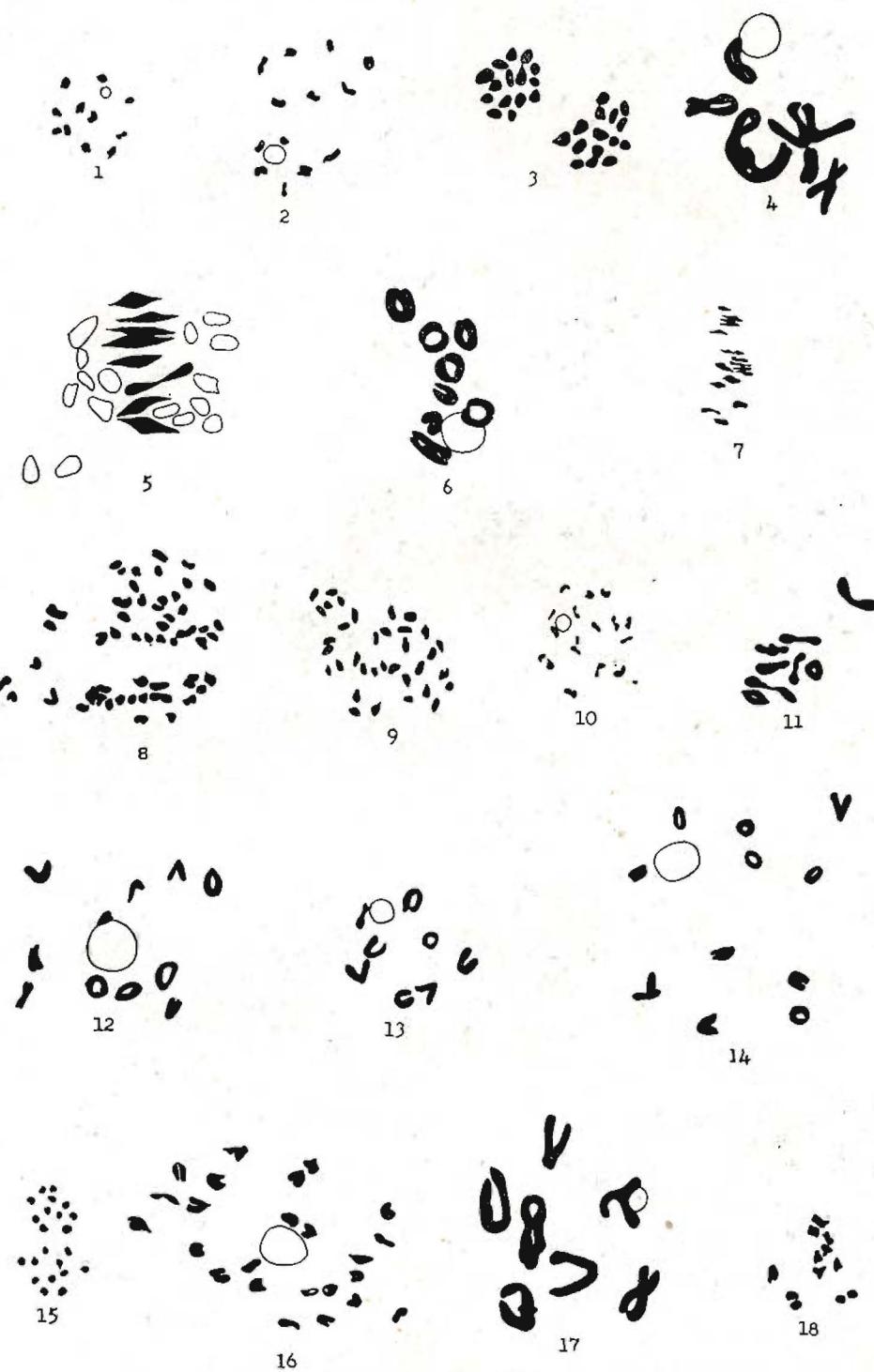


PLATE II

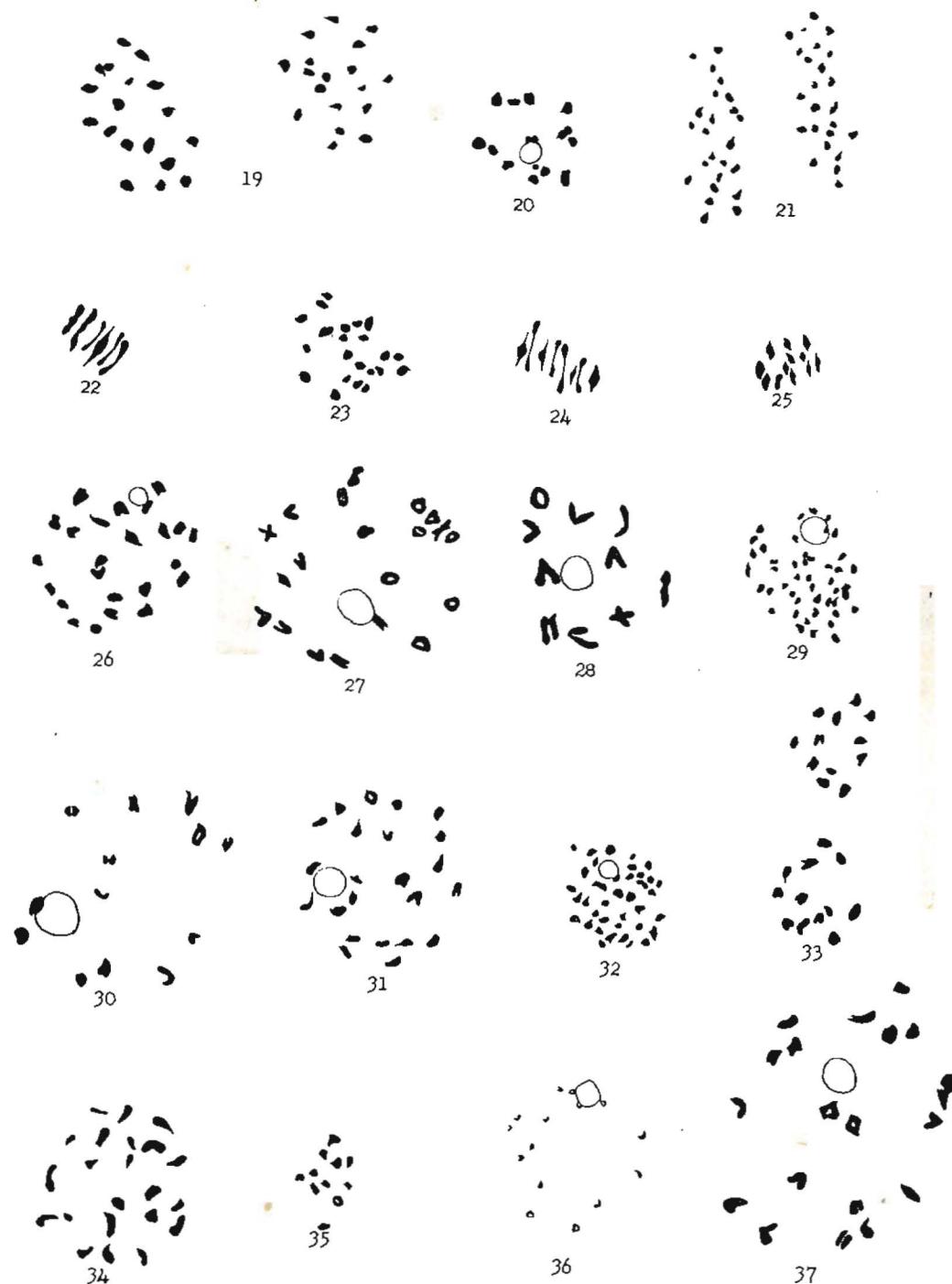


PLATE III



PLATE IV



PLATE V

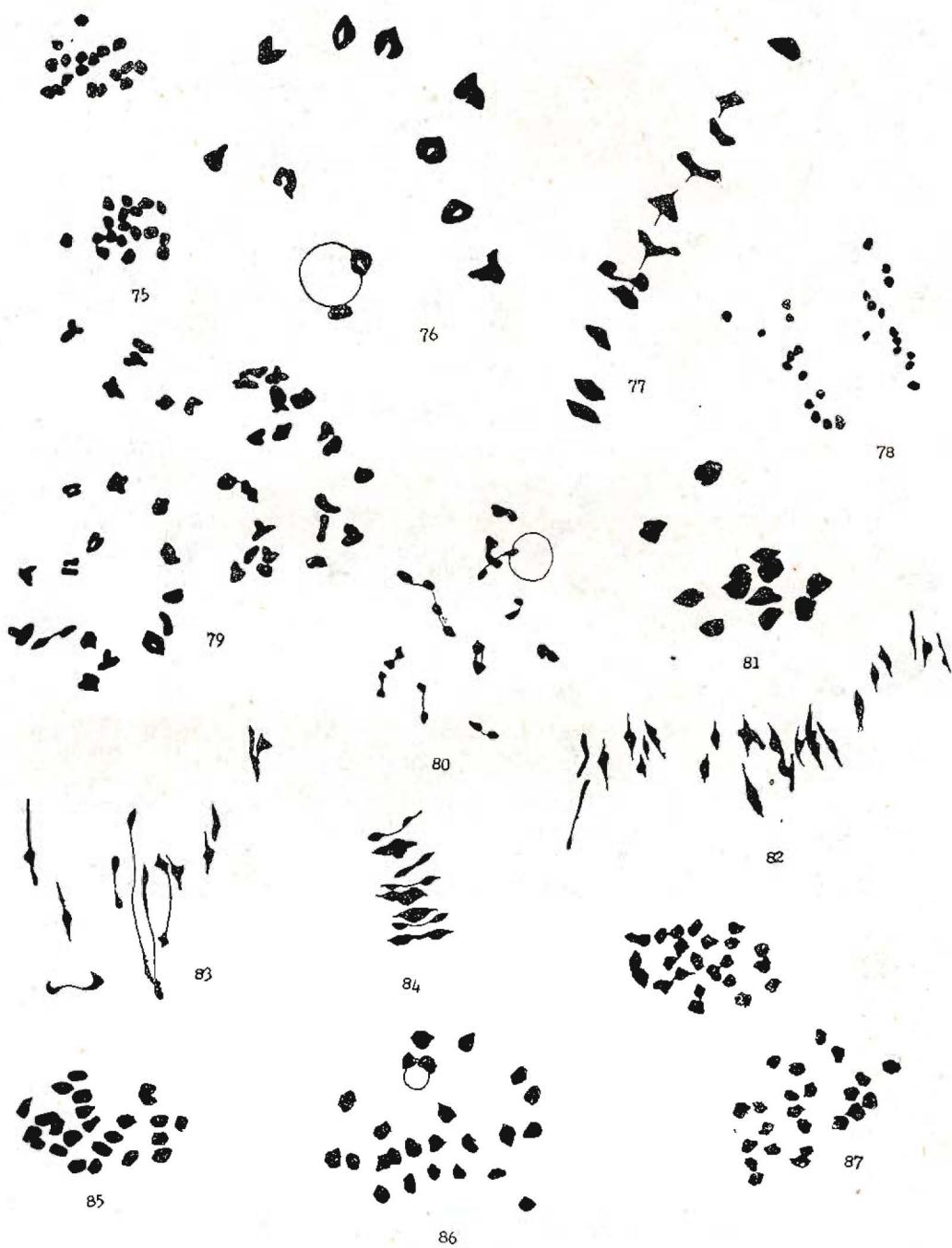


PLATE VI

