The Chromosome Complements of Some New Zealand Plants—I.

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INTRODUCTION.

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THIS investigation was undertaken with the object of finding a family of New Zealand plants suitable for experimental cytological research. For this reason, attention was directed to such families as have provided elsewhere most of the recent advances in the knowledge of the structure and behaviour of chromosomes, in particular the Liliaceae. It should be pointed out, however, that this family is not well represented in New Zealand. Of the ten genera, one is monotypic and four have only one New Zealand representative; of the remainder, the largest genus, *Astelia* (10 species) has been found to possess a large number of small chromosomes, while the balance have but few species, some difficult of cultivation, others flowering but rarely under domestication.

In addition, the chromosomes of 20 *Epilobium* species were counted. This was incidental to a proposed cytogenetic study of wider scope which was abandoned on account of technical difficulties.

MATERIAL AND METHODS.

Preliminary observations of pollen mother-cells were made in aceto-carmine, and in this medium also chromosome numbers were established where the material did not warrant further work, e.g., in *Arthropodium*. Pollen mother-cell material, of *Chrysobactron hookeri* was fixed in 2 BE, of *Clematis indivisa, Dianella intermedia* and *Epilobium* species in Allen's Bouin, following immersion for a few seconds in Carnoy.

Wherever possible, haploid counts were verified by somatic counts in root tips, all fixed in 2 BE.

Paraffin sections were cut at 24 μ in *Chrysobactron,* 18 μ in *Clematis,* 16 μ in all other cases.

All drawings were made at bench level with the aid of a camera lucida and are $\times$ 4500, excepting the somatic plates in *Chrysobactron* and *Clematis,* which are $\times$ 3270.

RESULTS.

Table I lists the species for which chromosome numbers were established.

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Table I.

Species.	Locality.	Chromosome Number. n	2n
Orchidaceae.			
Thelymitra longifolia	Tataraimaka	—	26
Liliaceae.			
Dianella intermedia	Tataraimaka	8	16
Arthropodium candidum	Otari	11	22
A. candidum var. *purpuratum* Simpson and Thomson, MS.	Rough Peaks, Lake Wakatipu	11	22
A. cirrhatum	Piha	22	44
Chrysobactron hookeri	Mount Torlesse	7	14
Onagraceae.			
Epilobium.			
Section A: Similes.			
Epilobium erectum	Queen Charlotte Sound ..	18	36
E. pubens	Governor's Bay	18	—
E. junceum	Governor's Bay	18	—
E. pallidiflorum	Tataraimaka	18	—
Section B: Microphyllae.			
E. chloraefolium	Cass	18	—
E. cookaynianum	Botanic Grdns., Christchurch	18	—
E. alsinoides	Tataraimaka	18	—
E. pictum	Hope Valley	18	—
E. rotundifolium	Tataraimaka	18	—
Section C: Sparsiflorae.			
E. nummularifolium	Tataraimaka	18	—
E. pedunculare	Cass	18	—
Section D: Dermatophyllae.			
E. crassum	Lake Sumner	18	—
E. microphyllum	Cass	18	—
E. glabellum	Mount Torlesse	18	—
Undescribed Forms.			
E. sp., affinities with *E. tasmanicum*	Botanic Grdns., Christchurch	18	—
E. sp., affinities with *E. crassifolium* and *E. brevipes*	Botanic Grdns., Christchurch	18	—
E. sp., affinities with *E. melanocaulon*	Arthurs Pass	18	—
A-typical, possible Hybrid Forms.			
E. nerterioides × *E. pedunculare*?	Cass	18	—
E. linnaeoides × *E. rotundifolium*?	Cass	18	—
E. billardierianum, a-typical ..	Botanic Grdns., Christchurch	18	—
Ranunculaceae.			
Clematis indivisa	Tataraimaka	—	16

ORCHIDACEAE.

Thelymitra longifolia, which occurs also in Australia and Tasmania, has 26 somatic chromosomes, varying in length from 3·2 to 4·9 μ. Two pairs are distinguished by the presence of trabants (Fig. 1). The centromere in all is median or nearly so.

Thelymitra falls into the systematic sub-group Neottieae. For other genera of this group, Gaiser (1930) records chromosome numbers as follows:—

Epipactis .. .. n = 12; 2n = 24.
Neottia .. .. .. n = 16, 18.
Spiranthes .. .. n = 12.
Gastrodia .. .. n = 8–9; 2n = 16–18.

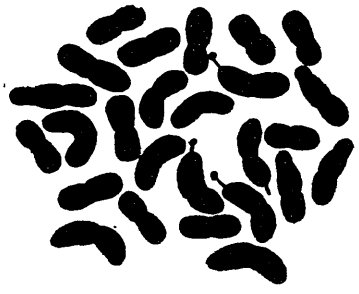

Fig. 1

Fig. 2

Fig. 3

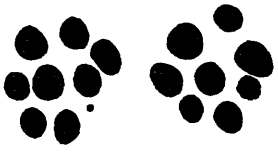

Fig. 4

Fig. 5

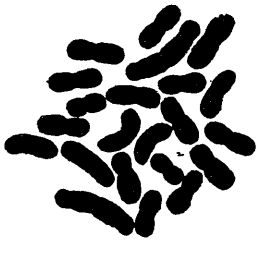

Fig. 6

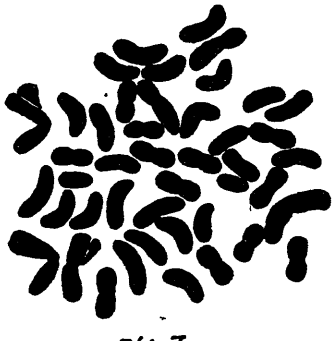

Fig. 7

FIG. 1—*Thelymitra longifolia.* Somatic metaphase; 2n = 26.
FIG. 2—*Dianella intermedia.* Somatic metaphase; 2n = 16.
FIGS. 3–4—*D. intermedia.* Metaphase I, anaphase I; n = 8.
FIG. 5—*Arthropodium candidum.* Somatic metaphase; 2n = 22.
FIG. 6—*A. candidum* var. *purpuratum.* Somatic metaphase; 2n = 22.
FIG. 7—*Arthropodium cirrhatum.* Somatic metaphase; 2n = 44.

LILIACEAE.

Dianella intermedia. Eight chromosomes were counted in first metaphase and anaphase of meiosis (Figs. 3–4) and 16 chromosomes in mitotic metaphases (Fig. 2). The somatic complement consists of 8 pairs of M* chromosomes, with a range in length from approximately 4·5 to 9·3 μ.

Arthropodium. Aceto-carmine preparations of pollen mother-cells of *A. candidum* and the bronze-leaved variety of *A. candidum* (var. *purpuratum* Simpson and Thomson, MS.) showed n = 11 in

* M = chromosomes with median or submedian centromere.

metaphase I and II of meiosis (Figs. 8–9). *A. cirrhatum* was found to be relatively tetraploid with n = 22 (Fig. 10). It is a much larger plant than the former varieties, which fact agrees with their polyploid relationship. These findings were verified from somatic counts. The somatic chromosomes are too small for detailed study, but in both diploid forms there may be distinguished a larger pair of chromosomes (4·5 μ) with approximately median centromere, and a shorter pair (2·2 μ). The remainder of the complement ranges between these two extremes (Figs. 5–6). The centromeres are all median or nearly so.

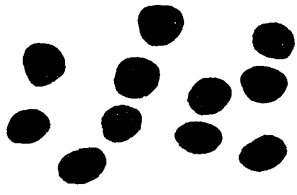

Fig. 8

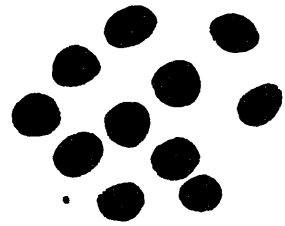

Fig. 9

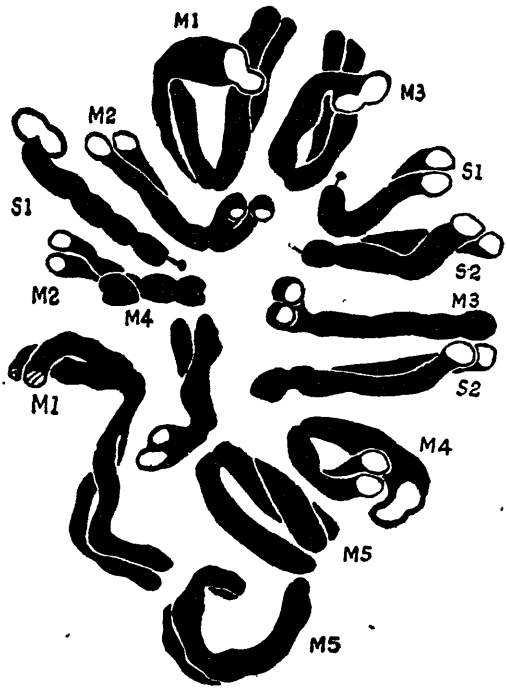

Fig. 11

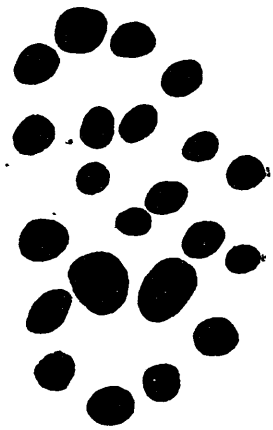

Fig. 10

FIG. 8—*A. candidum.* Metaphase I; n = 11.
FIG. 9—*A. candidum,* bronze-leaved var. Metaphase I; n = 11.
FIG. 10—*A. cirrhatum.* Metaphase I n = 22.
FIG. 11—*Chrysobactron hookeri.* Somatic metaphase; 2n = 14.

The bronze-leaved variety of *A. candidum* has another long pair (3·6 μ). The tetraploid, *A. cirrhatum*, shows quite clearly 4 large chromosomes (4·5 μ), two very short pairs (1·8–2·3 μ), and with less certainty two pairs of intermediate length (3·6 μ). No quadrivalents were seen in meiosis, so that this species may be assumed to be an allo-tetraploid.

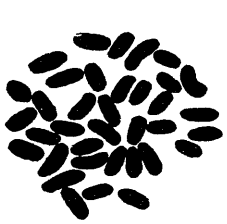

Fig. 12

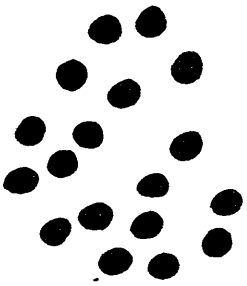

Fig. 13

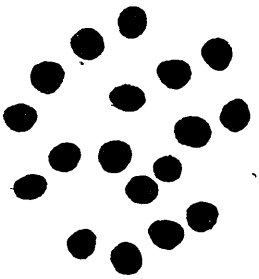

Fig. 14

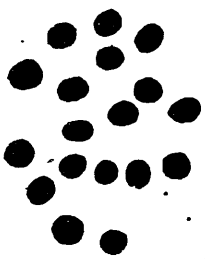

Fig. 15

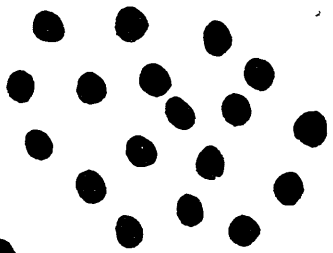

Fig. 16

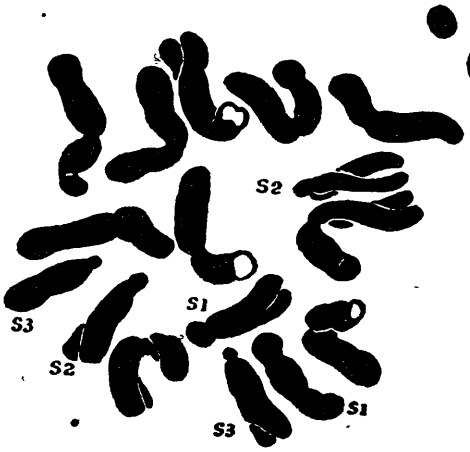

Fig. 17

FIG. 12—*Epilobium erectum.* Somatic metaphase; 2n = 36.
FIG. 13—*E. junceum.* Metaphase I; n = 18.
FIG. 14—*E. chloraefolium.* Metaphase I; n = 18.
FIG. 15—*E. nummularifolium.* Metaphase I; n = 18.
FIG. 16—*E. crassum.* Metaphase I; n = 18.
FIG. 17—*Clematis indivisa.* Somatic metaphase; 2n = 16.

Chrysobactron hookeri. The limited amount of pollen mother-cell material available was poorly fixed, but side-views of metaphase I indicated the presence of 7 bivalents, with 2–4 chiasmata per bivalent. The chiasmata are random and unterminalised.

A study of somatic plates verified the presence of 7 pairs of chromosomes, $2n = 14$ (Fig. 11). There are 5 M pairs, M_1–M_5, with a range in length from 12·5 to 18·5 μ; and 2 S* pairs, S_1–S_2, ranging from 10–11 μ in length. The S_1 pair is further distinguished by the presence of a trabant; while one of the S_2 chromosomes shows a lacuna, which in several cells was seen in both S_2 chromosomes.

ONAGRACEAE.

Epilobium. Representatives of all four systematic groups have $n = 18$ chromosomes (Figs. 13–16), and this applies also to 3 a-typical, possibly hybrid and to 3 undescribed, forms. It may be noted that the endemic division Dermatophyllae, in particular the very distinct *E. crassum,* conforms to the rule for the remaining divisions, and that all agree in this respect with species of the northern hemisphere: the 6 species and 4 hybrids recorded by Gaiser (1930) have also $n = 18$, $2n = 36$ chromosomes. The small size of the chromosomes, with a range of only 1·3–2·7 μ in root-tips (Fig. 12), did not invite a detailed study; no irregularities were observed in meiosis.

RANUNCULACEAE.

Clematis indivisa has 5 M chromosome pairs and 3 S pairs, making a somatic complement of $2n = 16$ (Fig. 17). Those with median centromere cannot be paired off with certainty and vary in length from approximately 6·6 to 9 μ. In the S pairs, S_1 and S_2 are about 5 μ long, S_3 slightly shorter, but the 3 pairs are further differentiated by a progressive decrease in the size of the short arm from S_1 through S_2 to S_3, where the centromere is almost terminal.

C. indivisa is one of 9 endemic species. Its somatic chromosome number agrees with that established for *Clematis* species elsewhere by Langlet (Gaiser, 1930) and Meurman and Therman (1939). The chromosome complement of *C. indivisa* approximately corresponds in morphology also to that of the species studied by Meurman and Therman (1939). These authors record also tetraploid and hexaploid species.

No pollen mother-cell material was available.

ACKNOWLEDGMENTS.

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* S = chromosomes with sub-terminal centromere.