す い ば ノ ポ リ プ ロ イ デ ー

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T. Ono: Polyploidy in *Rumex Acetosa*.

すいばノ染色體倍律性ト性ニ關シ既ニ其一部ヲ報告スルトコロガアツタ（小野、下斗米 1928, 小野 1928, 1930）。其後トリプロイド植物ヲ母トスル子孫ニ多數ノヘテロプロイド ($2n+1$, 2, 3, 4, 5)* 及ビポリプロイド ($3n$, $4n$) 植物ヲ得タ。其中ニ未ダ報告サレテナイトリプロイド雄、テトラプロイド雄及ビ雌ノ個雄ガ發見サレ、目下すいばノ各 $2n$, $3n$, $4n$ 植物ニ夫々雌雄及ビ中間性が全部揃フコトニナツタ。即チ

倍律性	染色體式	X:A	性
$2n$	$14=2X+12a$ (Fig. 1)	2:2	♀
	$15=X+2Y+12a$ (Fig. 2)	1:2	♂
	$15=X+2Y+a'+11a$ (Fig. 3)	1:2	♀
$3n$	$21=3X+18a$ (Fig. 4)	3:3	♀
	$21=X+2Y+a'+17a$ (Fig. 5)	1:3	♂
	$22=X+3Y+2a'+16a$ (Fig. 26)	1:3	♂
$4n$	$22=2X+2Y+18a$ (Fig. 6)	2:3	♀
	$28=4X+24a$ (Fig. 7)	4:4	♀
	$29=2X+3Y+a'+23a$ (Fig. 8)	2:4	♂
	$29=3X+2Y+24a$ (Fig. 9)	3:4	♀

染色體式中 a ハ棒狀其一端ニ小頭ヲ有スルモノ、 a' ハ稍ミ中央ニ狹搾ヲ有スル小形ナル染色體ヲ示ス。

以上ノ關係ハ大體ニ於テ *Drosophila* (BRIDGES 1925) ノ結果ト一致スル。*Drosophila* ニハ尙 X:A ガ 3:2 ナル超雌ノ個體ガ發見サレテキル。然シ一方すいばニハディプロイド中間性、テトラプロイド雄及ビ中間性ノ如キ *Drosophila* ニ未ダ發見サレナイ場合ヲ見ルコトガ出來ル。コレ等すいばノポリプロイド植物ハ染色體數ノ増加ニ伴ヒ形態上ノ變化ヲ示ス。Fig. 10-18 ハ其一例トシテ各 $2n$, $3n$ 及ビ $4n$ 植物ノ種子ヲ包ム翼、雄花被及其花粉粒ノ大サヲ比較シタモノデアル。

次ニ二三ポリプロイド雄植物ノ花粉母細胞成熟分裂ニ就テ簡單ニ述ベヨウ。

No. S10-4 ($21=X+2Y+a'+17a$):— コノ個體ハトリプロイド雌植物 No. S10ノ一子孫デ一個ノ X ト二個ノ Y 及ビ十八個ノ普通染色體ヲ有ス、普通染色體中一個ハ中央ニ狹搾ヲ有シ他ハ其一端ニ乳首狀ノ小頭ヲ有ツ。花ハ完全ナ雄性ヲ呈スレ共花序中晩ク開花スルモノハ全ク空虚ノ葯ヲ生ズルコトアリ。花粉母細胞成熟分裂ニ際シ多少ノ不規則性ヲ見ルモトリプロイド中間性植物ノ場合（小野 1928）ト異ナリ大體ニ於テ順調ナ經過ヲ示ス。十八個ノ普通染色體ハ通常六個ノ三價染色體ヲ作

* ヘテロプロイド植物ノ染色體式ハ多種多樣デアリ隨ツテ其性モ種々ナ場合ガ見ラレルガ詳細ハ近ク本報ニ於テ報告スル。

Rumex Acetosa. Somatic nuclear plates of di-, tri- and tetraploid plants. Fig. 1. $14=2X+12a$ (♀). Fig. 2. $15=X+2Y+12a$ (♂). Fig. 3. $15=X+2Y+a'+11a$ (♀). Fig. 4. $21=3X+18a$ (♀). Fig. 5. $21=X+2Y+a'+17a$ (♂). Fig. 6. $22=2X+2Y+18a$ (♀). Fig. 7. $28=4X+24a$ (♀). Fig. 8. $29=2X+3Y+a'+23a$ (♂). Fig. 9. $29=3X+2Y+24a$ (♀).

ル、併シ屢々アルモノハ其結合力弱ク一價ト二價トナルコトガアル。Fig. 19 ハー母細胞ノディアキネシス期ヲ示シタモノデ、○- 或ハ Y 状ヲナス五個ノ三價染色體ト一個ノ一價及ビ二價染色體ヲ見ル。又 Fig. 20 ハ其中期ノ側面觀デ完全ナ六個ノ三價染色體ヲ見ルガ、Fig. 21 ノ極面觀ノモノデハー組ガ一價ト二價ニ離レテキル。性染色體組 $X+2Y$ ノ結合ハ正常雄植物ノ場合ト異ナル所ナク $Y-X-Y$ ノ

Rumex Acetosa. Size difference of fruiting calyces, (♀) perigons (♂) and pollen-grains in di-(Fig. 10, 13, 16), tri-(Fig. 11, 14, 17) and tetraploid (Fig. 12, 15, 18) plants.

三連染色體ヲ形成シ、中期デハ ∇ 或ハ $\wedge$ 形ヲナシ核板ニ並ブ。後期ニ於テ三價ヲナス普通染色體ノ分離ハ全ク機會的デアルガ性染色體組ハ X ト $2Y$ ニ分離スル。今第一分裂後期ニ於テ兩極ニ分配サレタ 染色體數ノ種々ナ場合ヲ 149 ノ花粉母細胞第二分裂核板ニ於テ檢スルニ次表ニ示ス如ク其頻度ハ大體理論數ト一致シテキル。各娘核ニ於ケル普通染色體數ハ 6, 7, 8, 9, 10, 11 及ビ 12 ノ變化アリ、コレ等ハ又 X 或ハ $2Y$ ノモツ故第二分裂デハ十種ノ核板ヲ區別シ得ラレ、尙普通染色體

第二分裂兩核板ニ於ケル染色體	$X+$ $2Y+$	6 12	7 11	8 10	9 9	10 8	11 7	12 6
頻度		6	19	33	45	34	10	2
期待頻度		1	6	15	20	15	6	1

Rumex Acetosa. Meiosis in PMC of triploid males. Fig. 19-24. No. S10-4 ($21 = X + 2Y + a' + 17a$). Fig. 19. Diakinesis. Fig. 20. Metaphase, side view ($YXY + 6m$). Fig. 21. Metaphase, polar view. Fig. 22-24. Homotypic nuclear plates in PMC. Fig. 22. ($2Y + 9a$) + ($X + a' + 8a$). Fig. 23. ($X + a' + 6a$) + ($2Y + 11a$). Fig. 24. ($X + 6a$) + ($2Y + a' + 11a$). Fig. 25-27. No. 61-1 ($22 = X + 3Y + 2a' + 16a$). Fig. 25. Heterotypic metaphase, side view ($YXY + Y + 6m$). Fig. 26. Diploid nuclear plate in homotypic division ($X + 3Y + 2a' + 16a$). Fig. 27. Pollen-tetrads.

中ニハ a' 染色体ノ有無ニヨリ更ニ多クノ種類ノ核板ヲ區別スルコトガ出来ヨウ。

No. 61-1 ($22 = X + 3Y + 2a' + 16a$):— コノ個體ハトリプロイド中間性植物 No. 61 ノ子孫デ完全ナ雄性ヲ示ス。前者ト異ナル點ハ Y ラ一箇多ク有スルコト、普通染色体中二個ノ a' ガ見ラレルコトデアル。花粉母細胞成熟分裂ノ經過ハ前ノ場合ト略同様デ Fig. 25 ニ示ス如ク六個ノ三價 (其中一組ハ既ニ分離ス) ヲナス普

通染色體ト $Y-X-Y$ ノ三連染色體及ビ分離シター一個ノ Y ラ見ルコトガ出來ル。
 $X+3Y$ 要素ノ第一分裂ニ於ケル結合ハ必ラズシモ前述ノ如キ $Y-X-Y$ ト Y トハ
 限ラナイ、場合ニヨリ $X-Y$ ト $Y-Y$ 及ビ其他種々ノ場合ガ見ラレル (小野 1931)。
 第二分裂ニ於テ前ノ場合ト同様 6 乃至 12 ノ普通染色體ト更ニ $(X+2Y)$ 或ハ $(X+Y)$
 等ノ性染色體要素ノ加ツタ種々ノ核板ガ見ラレル。往々非還元核板モ見ラレル

Rumex Acetosae. Meiosis in PMC of tetraploid male. No. 12-11 ($2X+3Y+a'+23a$). Fig. 28. Diakinesis ($XX+Y+Y+Y+5IV+2II$). Fig. 29. Metaphase, polar view ($XX+Y+Y+Y+4IV+4II$). Fig. 30-33. Metaanaphase, side view. Fig. 34. Types of tetravalent in side view of metaphase. Fig. 35. Anaphase ($X+Y+12$)+(X+2Y+12). Fig. 36. Anaphase ($X+2Y+10$)+(X+Y+14). Fig. 37. Homotypic nuclear plates ($X+2Y+13a$)+(X+Y+a'+10a). Fig. 38. Homotypic nuclear plate ($X+Y+12a$). Fig. 39. Pollentetrad.

(Fig. 26)。花粉四分子ハ通常四個、屢々二個、三個ノ大小種々ノモノガ現レル。

以上ノトリプロイド雄植物ノ花粉粒ハ葯ガ多クノ場合開裂スルコトナキ爲メ葯中デ死滅シテ了フ

No. 12-11 ($29=2X+3Y+a'+23a$):— コノ植物ハトリプロイド中間性植物 No. 12 ノ子孫デ完全ナ雄性ヲ示ス。テトラプロイド中間性植物ノ花粉母細胞成熟分裂ハ著シイ不規則性ヲ示スニ對シコノテトラプロイド雄ニアツテハ常ニ平滑ニ進行シ完全ナ花粉粒ヲ生ズ。花粉母細胞異型核分裂ニ於テ六個ノ四價染色體ヲ期待サレルガ實際ハ完全ナ結合ヲ見ルコトナク二三ハ離レテ二價トナル。ディアキネシスヨリ中期ニ移ルニツレ漸次四價ノ數ガ減少スル傾向ガアリ中期ニ於テ全ク四價染色體ヲ認め得ナイ場合モアル。Fig. 28 ハディアキネシス期デ五個、Fig. 30 ノ中期ニ於テ完全ナ結合ヲナスモノ四個、Fig. 31, 32, 33 ノメタアナフェースデハ夫々 0, 4, 1 ノ四價染色數ノ變化ヲ示ス。ディアキネシスニ於ケル四價染色體ノ結合ハ普通 ---- 或ハ $\bigcirc$ -- 型デ又 $\bigcirc$ 及ビ $\div$ モ見ラレル。Fig. 34 ハメタアナフェースニ於ケル四價染色體ノ種々ノ分離像デアル。性染色體組 $2X+3Y$ 中 $2X$ ノ結合ハ常ニ固クディアキネシス及ビ中期デハ常ニ大ナル環狀ヲ呈シ他ノ要素ト容易ニ區別スルコトガ出來ル。 $3Y$ ハ離レテキルカ或ハ屢々二個ノミガ弛ク結合ヲナス (Fig. 30)。後期ニ於ケル普通染色體ノ分離ハ通常 $12+12$, $2X$ ハ $X+X$, $3Y$ ハ $2Y+Y$ デ $3Y+0$ ノ場合ハ未ダ見出サレナイ。後期ノ兩極ニハ通常 $(X+2Y+12)+(X+Y+12)$ ヲ見ル。Fig. 35 ハ其後期、Fig. 38 ハ第二分裂ノ一核板ヲ示ス。普通染色體ノ分離ハ場合ニヨリ多少ノ不規則性ヲ示シ $12+12$ ノ外 $11+13$, $10+14$ トナルコトガアル。Fig. 3 ハ其一後期デ $(X+2Y+10)+(X+Y+14)$, Fig. 37 ハ第二分裂ノ兩核板デ $(X+2Y+13)+(X+Y+11)$ ヲ見ル。花粉粒ハ殆ンド全部正常デ雌植物トノ交配ニヨリ多數ノ種子及ビ子孫ヲ得ルコトガ出來タ。

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Daraus folgt, dass dieser F_1 -Bastard, der zwischen zwei verschieden chromosomenzähligen Stammarten entstanden ist, als eine in bezug auf die Chromosomenzahl konstant gewordene neue Art anzunehmen sei.

T. ONO: Polyploidy in *Rumex Acetosa*.

1. The relationship between the poliploidy and sex hitherto found in *R. Acetosa* are denoted as follows:

Poliploidy	Chromosome formula (A=6 autosomes)	X : A		Sex
2n	14=2X+2A (Fig. 1)	2	2	♀
	15=X+2Y+2A (Fig. 2)	1	2	♂
	15=X+2Y+2A (Fig. 3)	1	2	♀
3n	21=3X+3A (Fig. 4)	3	3	♀
	22=X+2Y+3A (Fig. 5)	1	3	♂
	22=X+3Y+3A (Fig. 26)	1	3	♂
	22=2X+2Y+3A (Fig. 6)	2	3	♀
4n	28=4X+4A (Fig. 7)	4	4	♀
	29=2X+3Y+4A (Fig. 8)	2	4	♂
	29=3X+2Y+4A (Fig. 9)	3	4	♀

These findings agree generally with those in the cases of *Drosophila*. The poliploid plants show obvious external differences in size accompanied with an increase in the number of chromosomes (Fig. 10-18).

2. The meiosis in the pollen mother cells of some triploid and tetraploid male plants is described as follows:

a. Triploid male: No. S10-4 ($21=X+2Y+a'+17a$), No. 61-1 ($22=X+3Y+2a'+16a$).

In the heterotypic dia- and metaphases of the pollen mother cells of these plants usually appear six trivalent autosomes, but univalent and bivalent autosomes are sometimes seen. X+2Y-elements in the plant No. S10-4 form a V-shaped tripartite complex, connecting as Y-X-Y in the heterotypic metaphase, but X+3Y-elements in the case of No. 61-1 conjugate as Y-X-Y and Y, X-Y and Y-Y or in other ways. Division of trivalents in the anaphase occurs by chance. The chromosome counts taken from 149 pollen mother cells in the homotypic divisions of plant No. S10-4 are shown in the following table:

Assortment of chromosomes in both nuclear plates	X+	6	7	8	9	10	11	12
	2Y+	12	11	10	9	8	7	6
Frequency		6	19	33	45	34	10	2

Diploid nuclear plates in the homotypic division were sometimes found. The tetrad-cells are mostly 4 in number, but cases of 2 or 3

are also observed. The pollen-grains are mostly sterile.

b. Tetraploid male: No. 12-11 ($29 = 2X + 3Y + a' + 23a$).

In the late prophase of pollen mother cells tetravalency of autosomes is to be found. We see in the diakinesis usually not more than five tetravalents and some bivalents. The tetravalents decrease in number usually in the later metaphase and sometimes only bivalents are found. The normal conjugation mode of $2X + 3Y$ -elements in the heterotypic division is $X_{II} + Y + Y + Y$. Division of autosomes and sex-chromosomes in the anaphase occurs generally as $(12) + (12)$ and $(X + 2Y) + (X + Y)$ respectively, but other abnormal types are also not uncommon. Pollen-grains are functional.

M. KUMAZAWA: The Medullary Bundle System in the Ranunculaceae and Allied Plants. (The original with one text-fig. in pp. 327-332)

1. Among Ranunculaceous and allied plants, medullary bundles are found in the aerial stem of following species or genera: *Thalictrum* spp, *Delphinium* spp, *Anemone japonica*, *A. vitifolia*, *A. rivularis*, *Ranunculus chinensis*, *Cimicifuga*, *Anemonopsis*, *Glaucidium*, *Hydrastis*, *Podophyllum*, *Diphylleia*.

2. The medullary bundles may be divided into five types in respects of their course and origin (text-figs. A—E in p. xxx).

Type I. (Fig. A) Large leaf trace strands become medullary immediately at a node, and descending downwards through the pith migrate gradually to the periphery. Trace strands from the perianth do not enter into the pith:—*Delphinium* spp., *Thalictrum* spp., *Ranunculus chinensis*, *Cimicifuga foetida*, *Anemonopsis*.

Type II. (Fig. B) The same to type I, but trace strands from the perianth enter into the pith. These strands migrate outwards in the lower internode:—*Anemone japonica*, *A. vitifolia*, *Glaucidium*.

Type III. (Fig. C) Leaf trace strands descend throughout the first internode, in the ordinary circle of the bundles and then enter into the pith in the second internode:—*Hydrastis*.

Type IV. (Fig. D) Trace strands from the perianth occupy the central part of the pith throughout the stem:—*Podophyllum peltatum*, *Diphylleia Grayi*.

Type V. (Fig. E) Leaf trace strands are in periphery, the cauline bundles and the bundles from lateral shoots are in rather medullary part of the stem, being dominant in size:—*Cimicifuga japonica*.

3. The differences of these types may or may not show the systematic affinities.