公孫樹前胚期ノ核分裂ニ就テ⁽¹⁾

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TAMAKI SHIMAMURA: A note on the mitotic division in the proembryo of *Ginkgo*, with special reference to a chromatin-elimination.*

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公孫樹ノ前胚期形成ニ於テ核ハ有絲核分裂ニヨリテ等比級數ヲ以テソノ數ヲ増加シ各核間ニハ隔膜ナク多數ノ核ガ共通ノ細胞質中ニアル狀態ヲ示シ核分裂ノ際ニハ分裂像ハ全然核內的ニ舊核内ニテ形成セラルルモノニテ舊核ノ非染色質即チ染色體ヲ形成スルニ與ラザル部分ハ大部分細胞質中ニ消エ去ルモノノ如シ。之ハ分裂像及ビ新シク生ジタル娘核ノ大サガ舊核ニ比シテ著シク小ナルコトカラ見テモ肯定シ得ル事實ナリ。第一圖ニ示セルガ如ク授精後ノ癒合核（第一圖 1, 2.）ガ 85μ — 100μ ノ直徑ヲ有スルニ核分裂ヲ重ネル中ニ次第ニ小トナリ各核間ニ隔膜ヲ生ズル頃ニハ 20μ ノ直徑ヲ有スルニ至ルモノナリ（第一圖、9.）。

筆者ハ前ニ（1928）コノ核分裂殊ニ前胚期ノ初期、換言スレバ核ノ數ガ 16 又ハ 32 個迄ノ期ニ於テ分裂像ノ兩極近クニ多數ノヘマトキシリンニテヨク染色セラルル顆粒ヲ特ニ觀察セシガ之等ノ顆粒ノ核分裂ニ於ケル行動、染色體トノ關係ニ就テハ當時未ダ不明ナリキ。其後前胚期初期ノ標品ヲ檢スル中ニ前述ノ核分裂ニ際シテ染色質ノ一部ハ娘核ニ入ルコトナク非染色質ト同様ニ細胞質中ニ消失スル現象ヲ觀察シコノ現象ガ所謂 Chromatin-elimination** ナリト思ハルルヲ以テ以下核分裂ノ諸期ニ於ケル染色質ノ行動ヲ記述セントスルモノナリ、固定液ニブアン液、フレミング中液ヲ用キ染色ハハイデンハインヘマトキシリンヲ使用セリ。

前期。核分裂前期ニ於テ大ナル核ノ一局部ニ染色質ガ集マリテスパイリームヲ形成スルモノニシテ核ノ大部分ト染色體形成ノ部分ト著シク區分セラル、ヲ見ル（第一圖 4, 8.）。スパイリームハ細長ク旋卷シテ密ニ凝着シ細クシテ單條ナルカ複條ナルカ決定ニ苦シムモノナルモ觀察セル範圍内ニテハ未ダ複條ノ形ヲ示セルコトナ

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** BĚLĀR 氏ハ 'Chromatin-diminution' ト 'Chromatin-elimination' トヲ區別シ定義セリ、筆者ハ同氏ノ定義ニ從ヒ此ノ語ヲ使用セリ。BĚLĀR; (1928), 頁 102 參照。

第一圖 前胚期ニ於ケル核ノ大サノ比較

Fig. 1. Comparison of the successively decreasing sizes of nuclei during the first 7 divisions in proembryo. 1, 2. Fusion nuclei. 3. Second mitosis of proembryo, showing a large mitotic figure in the nuclear cavity, whose outline is indicated with dotted line. 4. Third mitosis of proembryo, corresponding Fig. II. 1. Spireme in localized position. 5, 6. Fourth mitosis. 7, 8. Prophase of fifth mitosis. 9. Nuclei after seventh nuclear division.

キヲ以テ中期ノ核板ニ配布スル頃マデ單條ナリト思考セラル。第二圖 2a, 2b, ハ連續セル二切片ヲ示シ第二圖 1a, 1b, 1c, ハ相連續セル三切片ヲ示ス。之等ノ圖ニ於テ紐狀ノ部分ガスパイリウムニテ、黑色ニ色ヅケタル部分ハヘマトキシリンニテ染色セラル、問題ノ染色質ナリ紡錘體モ之等スペテハ核内ニ形成出現セルモノト思ハル、スパイリウムガ甚ダシク旋卷セルヲ以テ比較ニ困難ナルモノ不規則形ノ顆粒トスパイリウムトノ比ハ分裂ノ他ノ期ニ比シテ顆粒ガ著シク多大ナルコトヲ認メラルベシ、顆粒ノ位置ハスパイリウムノ周圍ニ繞集シ紡錘體内ニ散布セリ、此點ニ於テミトコンドリア並ニプラスチツドトハ異ナル位置ニアリ。(第二圖 1, 2, 第六圖版 1, 2.)

中期。染色體ハ核板ニ配置セラル、ソノ形 L 字形ノモノ多ク往々染色體ノ一部分ハ長ク極ニ近キ處マデ延ビタルモノアリ染色體ノ太サハスパイリウム期及ビ後期ノモノニ比シテ倍程ノ太サニテ縦裂ハ明ラカニ觀察シ得ザルモノ太サヨリシテ縦裂ス

第二圖 公孫樹ノ前胚期ニ於ケル染色質消棄

Fig. II. Chromatin-elimination in the proembryo of *Ginkgo*

1. Prophase, spireme with the elimination-chromatin masses (black). a, b, c. are consecutive sections. 2. Prophase, later spireme stage with the elimination-chromatin masses closely associated with spireme thread. a, b. are from consecutive sections. 3, 4. Chromosomes forming nuclear plate, while elimination-chromatin masses (black) being distributed in polar regions. 5. Early anaphase. 6. Anaphase; among the chromosomes some elimination-chromatin masses are found. 7. Late telophase, groups of the elimination-chromatin masses are found outside of the daughter nuclei. (ca. $\times 625$).

ベキモノト思ハル。コノ期ニ於テノ不規則形ノ染色性顆粒ハスパイリーム期ニ比スレバ數少ク位置ハ兩極ニ近クアルモノ又ハ染色體ノ間ニ散在セルモノ、兩極ヘ向ツテ移リ行ク中間ニアルヲ示スモノ多シ。(第二圖 3, 4.) (第六圖版 3.)

後期。縦裂シタル染色體ガ兩極ニ向ヒテ離レ行ク際ニハ V 字形ノモノヨリモ J 字形ノモノ多ク觀察セラル。極ニ近クナルニ從ヒテ極ノ側ニ各染色體ハ極集ノ状態ヲ示ス。コノ期ノ前半ニ於テハ(第二圖 5.) 染色性ノ顆粒ハ染色體ノ間ニ介在スルモノアルヲ見ルモ概シテコノ期ニ於ケル染色性顆粒ノ位置ハ兩極近ク集リテ塊狀ヲナスモノト形小ニシテ染色體群ト塊狀ノモノトノ間ニ散布セルモノト大體二ツニ區別セラレ何レモ染色體群ヨリ極近クニ存スルヲ見ル、染色體群ガ兩極ニ近ヅク期ヨリ塊狀トナレル顆粒ハヘマトキシリンニヨリ染マルコトヲ減ジ暗藍色ヨリ灰色トナル。(第二圖 6.) (第六圖版 4, 5.)

終期。娘核ノ核膜ヲ生ズル期ニアリテハ核中ニハヘマトキシリンニテヨク染マルリボン狀染色質ヲ見ル、コノ期ニ核膜外ニヘマトキシリンニテ良ク染色セザル灰色ノ塊狀ノ顆粒群ヲ觀察セリ、コレ前述ノ染色性ノ顆粒ノ一部ト見ルベキモノニシテ大部分ハ細胞質中ニ消失シタルニ兩極ノ周圍ニ集マレル顆粒ノミ娘核膜ノ生ズル期ニアリテモ見ラル、モノナルベシ、コノ期ノモノハ細胞質中ニ散在スル他ノモノト見分ケ難キモ注意深ク觀察スルトキハ他ノ細胞質ノ顆粒ト固定像ノ工合ヲ異ニスルコト位置ノ兩極ニ相對シテ存スルコトヨリシテ見出し得ルモノナリ。(第二圖 7.) (第六圖版 6.)

上述ノ觀察ヨリ染色體以外ニ核分裂ニ際シテ現ハル、染色性顆粒ノ存在及ビ核分裂ニ於ケル行動ヲ知り得タルガ該顆粒ハ染色體ノ如ク一定ノ形態及ビ個數ヲ有セズ大部分ハ分裂終期前ニ消去スルモノナリ。カク核分裂ノ際顯微鏡的ニ觀察シ得ル染色性ノ物質ガ核内ヨリ細胞質中ニ移行シ消ヘ去ル現象ハ SEILER 氏ガ *Lymantria dispar*, *Fumea casta*, *Solenobia pineti* 等ニ就テ觀察シタル染色質消棄(Chromatin-elimination)ナル現象アリ。筆者ハ公孫樹ノ前胚期ノ核分裂ノ際ニモ染色質消棄行ハレ上述染色性顆粒ヲ elimination-chromatin ト見做サントス。即チ SEILER 氏ガ觀察シタル材料ニテハ核分裂ノ中期ヨリ後期ニ移ル際染色質ノ一部分ガ染色體ヨリ取り殘サレ遂ニ細胞質ニ消エ失セルモノナルガ、公孫樹ノ場合モヤハリ一種ノ染色質消棄ニテ核分裂ノ前期ニ於テスパイリームガ出現スル際ニ剩餘ノ染色質ガ取り殘サレ染色體ト區別セラレ終期ニ至ルマデ染色體ト同ジク兩極ニ分配セラレ後消失スルモノナリ。前胚期形成ノ際核ノ數ノ増加ニ伴ヒテ核ノ大サハ次第ニ小トナル。而

シテ前述ノ染色性顆粒ヲ有絲核分裂ノ兩極近クニ見タルハ前胚期ノ初期ノミニシテ分裂像ノ大ナル時ニ限ラル、ガ故ニ前胚期ノ初期ノ核ノ大サノ變化ト該染色質消棄トハ關係アルモノト考ヘラル。次ニ HERZFELD 氏* ガ二様ノ形狀及ビ染色性ノ異ナル染色體ヲ前胚期ノ初期 32 個ノ核ヲ有スル期迄ニ（嚴密ニ云ヘバ 32 個ノ核カラ 64 個ノ核ニナル分裂期、氏ノ所謂 32-Spindel 即チ 32 個ノ紡錘體ヲ見ル期迄ニ）見出シタルコトハ該染色性顆粒ノ核分裂ノ際ノ行動ト一致セル現象ニシテ氏ハ筆者ガ elimination-chromatin トセン該染色性顆粒ヲ染色體トシテ觀察セルモノナルベシ。

觀察セン範圍内デハ該染色性顆粒ト仁ト如何ナル關係アルカ差當リ決定スル能ハズ、以上前胚期ノ初期ニ於ケル核分裂ニ際シテ觀察シタル染色性顆粒ニ就テ概要ヲ述ブ。

擱筆スルニ際シ懇切ナル指導ヲ賜リタル藤井健次郎博士及ビコノ研究ニ便宜ヲ與ヘラレシ柴田桂太博士並ビニ東大理學部植物學教室ノ諸學兄ニ對シ深甚ナル感謝ノ意ヲ表ス。

昭和六年九月

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Résumé

1. During the successive division of nuclei in the formation of proembryo of *Ginkgo* the size of nucleus decreases with each division, the fusion nucleus being 85–100 μ , while the nucleus after seventh division 20–25 μ in diameter.
2. During the prophase of the nuclear division of the early proembryo, considerable amount of deeply staining basophilic granules are found among the spireme thread. They are neither of a definite form, nor of a constant number and are distinguished from the mitochondria or plastids by the fact that they are found only in the 'atractoplasm'*** (spindleplasm, 'Spindelraum'). These granules represent chromatin which is eliminated during the prophase. As the chromosomes form the equatorial plate these eliminated chromatin granules are found scattered mostly toward both poles, and in a later stage, they partly form larger masses of less basophilic nature, and smaller fragments, both finally disappearing.

* 同氏論文 (HERZFELD, 1928b.) ノ Fig. 2, ノ Abb. 1, 2, ハ本論文ノ第二圖、1, 2, ノ分裂期、Fig. 7, ノ Abb. 2 ハ本論文ノ第二圖ノ 5, ノ分裂期ニ相當スルモノナラン。

** Atractoplasm; *ατρακτος*, spindle. first used by FUJII (1931)

3. The chromatin-elimination in mitotic division in the proembryo is found only in its early developmental stage, in which the mitotic figures are of huge dimensions. The writer observed the phenomenon up to the 32-nucleate stage. It seems that the chromatin-elimination has a close relation with the diminution of the nucleus.
4. The relation between the basochromatic elimination-granules and the nucleoli is not yet clear.

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Explanation of Plate VI

All figures are microphotos taken with the aid of LEITZ "Makam", using LEITZ achromatic objective $\frac{1}{12}$ and 'periplan' ocular 8. ca. $\times 800$.

- Fig. 1. and 2. Prophase, spireme with the elimination-chromatin masses.
- Fig. 3. Metaphase, Chromosomes forming nuclear plate, elimination-chromatin masses being distributed toward polar regions.
- Fig. 4. Early anaphase, among the chromosomes some elimination-chromatin masses are found.
- Fig. 5. Anaphase. Various sizes of the elimination-chromatin masses are observed near the polar regions.
- Fig. 6. Later telophase, groups of the elimination-chromatin masses found outside of the daughter nuclei.

T. SHIMAMURA Photo.

T. SHIMAMURA—On *Ginkgo*.