CYTOGENETIC STUDIES OF *ORYZA OFFICINALIS* COMPLEX

2. Meiotic Studies of Induced Autotetraploids of *O. officinalis*[1]

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The so-called "Officinalis Complex" in genus *Oryza* L. is the diploid *O. officinalis* Wall. (2n=24) and its close relatives, *i.e.*, *O. minuta* Presl. (2n=48), *O. latifolia* Desv. (2n=48), *etc.*; They constitute a part of Section *Sativa* Roschev. and similar in characteristics. However, the differences in morphologies between any two species in this complex and between the diploid and tetraploid strains of the same species are rather insignificant (Tateoka, 1962, 1965). Several plant taxonomists (Hooker, 1897: Bor, 1960; *etc.*) considered *O. latifoiia, O. officinalis* and *O. minuta* to be synonymous. Rice cytogeneticists (Morinaga, 1943; Morinaga and Kuriyama, 1960; *etc.*) based on the chromosome pairing at metaphase-I of meiotic division of F_1 hybrids, assumed that these species are closely related and *O. officinalis* has genome C, *O. minuta* and *O. latifolia* have genomes BC and CD. But the genome B and/or D species have not been found at the present time.

From the cytological studies of interspecific hybrid, Nandi (1936 1938), and Okura (1937) considered that one of the genomes in *O. minuta* is similar to that of *O. sativa*. Recently, Kihara and his coworkers proposed that genome B in *O. minuta* is partially homologous with genome A of cultivated species *O. sativa* (Nezu, *et al.*, 1960; Kihara, *et al.*, 1961). Li, *et al.*, (1962) noted that *O. latifolia* and *O. sativa* might have one genome in common. Later, studies on various interspecific hybrids of *O. latifolia* and Li (1964) concluded that the bivalents could be occur between two sub-genomes of *O. latifolia* by meaning of autosyndesis. Katayma (1965, 1966a, b), however, considered C and A genome to be partially homologous.

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An alternative hypothesis is that genome B, C and D might have originated from the same source (O^2, O^1 and O^3 were symbolized by Richharia, 1960) in which gene mutations, such as complete controlling of chromosome pairing, have occurred in these species (Sampath, 1962) during the process of differentiation. The purpose of this study is to investigate whether genomic differentiation has occurred in this species complex. The first paper of this study has indicated that high hybrid-sterility can be found in geographic race crosses and multivatents and unpairing univalents were found within the *O. officinalis* (Hu and Chang, 1967). The present paper reports the results of observations of chromosome pairing in meiosis of induced autotetraploid plants of *O. officinalis*.

Materials and Methods

Two induced autotetraploid plants which were derived from the diploid of *O. officinalis* by colchicine treated with different concentrations of colchcine solution by diffierent methods. A plant whose chromosome number being completely doubled, was induced in strain W002 (Bangkok, Thailand origin). The other one was kindly supplied by Mr. S. Sampath of the Central Rice Research Institute of India. According to Mr. Sampath this tetraploid plant was induced from an inter-racial hybrid of *O. officinalis* (perhaps is an F_1 hybrid between two strains of Ceylon and India).

Meiosis of pollen mother cells of the above two induced autotetraploid plants was studied by aceto-carmine smearing method. The young panicle were fixed with Farmer's solution, to which a trace of ferric chloride was added. The freshly prepared slides were used for observation and photography.

Various characteristics of diploid and induced autotetraploids were measured with the pot-cultured plants in the spring season of 1967.

Results of Observations

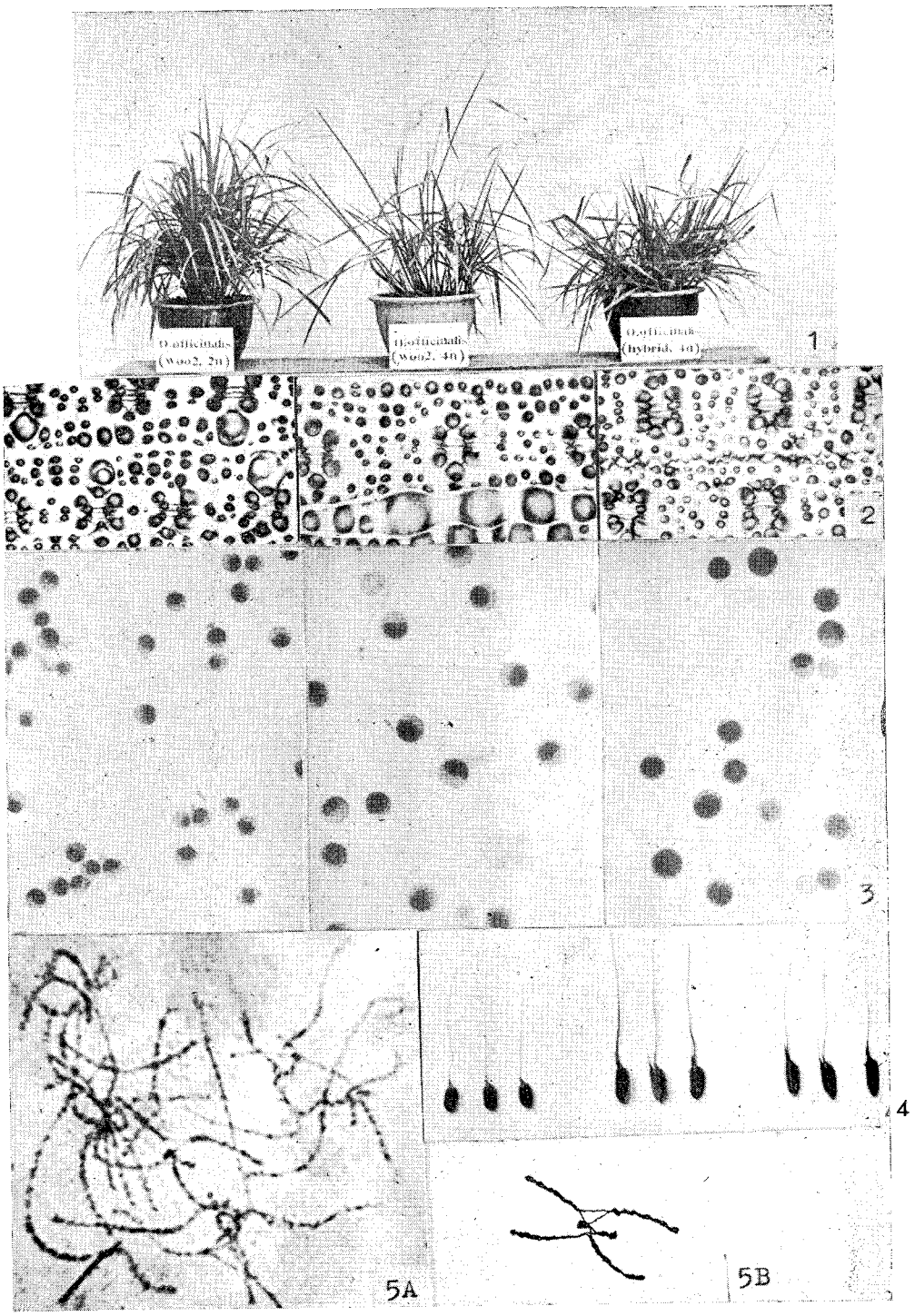
1. *Plant morphology of induced autotetraploids*

The plant of diploid and artifically induced autotetraploids of *O. officinalis* are shown in Fig. 1. Comparision of stomata in leaf, pollen grains and the

Explanation of figures

Comparision of diploid and its induced autotetraploids of *O. officinalis*. Left: Strain of W002 (2n); Center: Induced autotetraploid of W002 (4n); Right: Inter-racial hybrid (4n).

Fig. 1. Morphologies of plant.
Fig. 2. The size of leaf stoma.
Fig. 3. The size and fertility of pollen grain.
Fig. 4. The size of spikelet (full size).
Fig. 5. 5A: A pachytene cell of meiotic division of W002 (4n) an X type quadrivalent is found in the center of the cell. 5B: Camera lucida drawing indicated the quadrivalent is formed by two zigag chromatids and two parallels.


O. officinalis (W002, 2n)
O. officinalis (W002, 4n)
O. officinalis (hybrid, 4n)
1
2
3
4
5A
5B