（Format　No. 3）

SUMMARY OF DOCTORAL THESIS

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Title: Studies on *Leymus* Species as Genetic Resources for Wheat Breeding
（コムギ育種の遺伝資源としてのハマニンニク属植物の研究）

Wheat related wild species having valuable genes for drought and salt tolerance and disease resistance are useful genetic resources for wheat breeding. Many wheat addition lines carrying a pair of alien chromosome from wild relatives have been produced because a vast field of genetic diversity exists in the wild relatives of wheat. However, these lines cannot be directly used for wheat breeding because of genetic imbalance by aneuploidy. Development of technique to introduce the segment of the alien chromosome with a useful gene to a wheat genome is required. When alien chromosomes are transferred to wheat, it is needed to identify behavior of alien chromosomes during meiosis in wheat genetic background.

This study involved information about effect of the chemical with particular function on wheat addition line carrying alien chromosomes and about homology between alien chromosomes in wheat genetic background.

In the first chapter, I investigated effects of zebularine on wheat mitotic chromosomes. Zebularine, cytidine analog is known as DNA methylation inhibitor such as 5-azacytidine and 5-aza-2'-deoxycytidine, and it is more stable in aqueous solution than the others. A wheat disomic addition line carrying a pair of alien chromosomes (*Leymus racemosus* chromosome ℓ) was treated with zebularine at various concentrations. The alien chromosomes were discriminated from the wheat chromosomes by genomic *in situ* hybridization, facilitating observation of any rearrangements between the wheat and alien chromosomes. Root growth was obviously inhibited by zebularine because of reduction of the mitotic division cells. Rearrangements such as ring chromosomes, insertions, deletions, and translocations were observed in the treated mitotic chromosomes. The aberrations were increased in a concentration-dependent manner of zebularine.

In the second chapter, meiotic chromosome behavior of different chromosome

relationships in allopolyploid species (homologous, homoeologous or non-homologous) was studied. To discern the behavior of chromosomes in each of these relationships, wheat double monosomic addition lines (DMAs) in different combination were produced by crossing between wheat-*Leymus racemosus* and wheat-*L. mollis* addition lines as disomic additions. These DMAs have two alien chromosomes. One chromosome was from *Leymus racemosus* and the other chromosome was from *Leymus mollis*.

I observed the *Leymus* chromosomes in meiosis by differential genomic *in situ* hybridization. First I observed the distribution of these alien chromosomes in tetrad cells and measured their homology by an index of their interaction. Values differed greatly among DMAs. I observed prophase to anaphase cells of meiotic division I and elucidated the differences in homology through chromosome behavior in meiosis. A line carrying chromosomes [l^r] of *L. racemosus* and [M^m] of *L. mollis* formed bivalents in about half of the prophase cells, but these chromosomes became univalent in metaphase because of a lack of chiasmata, and segregated normally to each pole. The chromosomes in the other half of the prophase cells did not associate and behaved randomly from anaphase to tetrads. The DMAs proved useful in studying the homology of chromosomes.

From these studies, it was suggested that the phenomenon of zebularine-induced chromosome breakage might be useful for introducing useful genes from wild relatives. In DMAs of wheat, the recognition level of homology between alien chromosomes during meiosis is strict in wheat genetic background. However, occurrence of association between alien chromosomes even in strict condition indicates the DMAs will be useful for study to reveal the factors to chromosome pairing and recombination in meiosis. The results obtained in this doctor thesis will be used for wheat breeding by transfer of alien chromosomes.