Natural Hybridization in Japanese *Calamagrostis*

I. Several Interspecific Combinations in Central Honshu

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Morphological and pollen studies were made for the collections belonging to *Calamagrostis langsdorfi*, *C. sachalinensis*, *C. longiseta*, *C. nana* and various intermediates between these species from central Honshu, the chromosome numbers of which were reported in a previous paper (Tateoka, 1976). Additional collections made from the Akaishi Range in 1976 were also subjected to the present work. The intermediates showed 0%, or nearly 0%, pollen stainability and a mosaic of morphological features of putative parental taxa which can be estimated to occur for F₁ hybrids. This estimation was sustained by a comparison with the pattern of character expressions for the artificially raised F₁ hybrids of various European species of *Calamagrostis* as reported by Nygren (1962). These results as well as field observations strongly suggested that the intermediates may be wholly or almost wholly F₁ hybrids. The hybrids were sometimes found in abundance within a limited area, but seemed to have little capacity to migrate from the places where they originated. The following combinations, which were not previously recorded, were disclosed: *C. longiseta × C. sachalinensis*, *C. langsdorfi × C. nana*, *C. langsdorfi × C. longiseta*, *C. longiseta × C. nana*. Possibilities of introgression in these hybridizing species were discussed. The hybrids were tetraploids except one hexaploid which was discovered in a mixed population of *C. nana*, *C. longiseta* and their putative F₁ hybrids at the tetraploid level. The hexaploid in question, which seemed to have resulted from the participation of an unreduced gamete, was very similar morphologically to *C. nana* subsp. *hayachinensis* distributed in the mountain far distant from central Honshu. Geographical distributions of the hybrid plants were surveyed through examination of the herbarium specimens.

The occurrence in nature of interspecific hybrids is reported with increasing frequency in recent plant taxonomic literature on the phanerogams of Japan: *Lysimachia* (Nakamura, 1975a, b), *Cucalia* (Ito and Koyama, 1975), *Macroclividium* (M. Suzuki, 1975), *Epimedium* (K. Suzuki, 1976) and *Rubus* (Naruhashi, 1976), to cite some of the more recent. Along with these studies, the present investigation on the grass genus *Calamagrostis* was undertaken with the hope of providing useful information about the "Flora of Japan".

The natural hybridization of *Calamagrostis* is a well known phenomenon which has been reported since the last century in Europe. A number of putative hybrids have been described (cf. Chase and Niles, 1962; Tzvelev, 1965), and experimental investigations of the hybridization in this genus have also been attempted by various workers.

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During my explorations in various mountains of central Honshu, I sometimes encountered plants of *Calamagrostis* which seemed to be outside the range of variation for any "pure" species. They were reported as "interspecific intermediates" in a previous paper (Tateoka, 1976), in which an enumeration of the specimens coupled with the chromosome number was given. The intermediates were mostly tetraploids with 2n=28 chromosomes (cf. Table 1 of this paper), one hexaploid was discovered along with the tetraploids in the intermediates between *C. longiseta* and *C. nana*, and the intermediates between *C. langsdorffii* and *C. sachalinensis* were throughout octoploids. In the summer of 1976, some additional collections were made from the southern part of the Akaishi Range of central Honshu. Chromosome counts of these collections have been completed, and their voucher specimens are listed in Appendix 1 of this paper together with their chromosome numbers. No comment is necessary on their chromosomes. These new voucher specimens are treated here as equivalent to those enumerated previously.

Studies have been extended to morphological and pollen features of the specimens mentioned above, and analyses of flavonoid compounds from the leaves have also been adopted to clarify the nature of the intermediates in some species combinations. The results obtained for these specimens, when combined with the observations of their habitats, strongly suggest that the occurrence of these intermediates may represent natural hybridization. These results are reported in a series of papers, the first of which is the present. The species concerned here are: *Calamagrostis langsdorffii* Trin., *C. sachalinensis* Fr. Schm., *C. longiseta* Hack. and *C. nana* Takeda.

As described earlier (Tateoka, 1976), the structures of these species are complicated by polyploidy. So far as is known, *C. langsdorffii* in Japan has three cytotypes (4X, 6X, 8X) as well as some aneuploids, *C. sachalinensis* has three cytotypes (4X, 6X, 8X), *C. longiseta* includes two (4X, 6X) though the tetraploids are predominant, and *C. nana* is throughout tetraploid.

Of the six possible combinations from the four species, five combinations have been detected in the collections from central Honshu. The combination of *C. langsdorffii* and *C. sachalinensis* is not taken up here, and references to the octoploids of these taxa are also avoided. This combination is dealt with in the second paper, which deals with these two species as an agamic complex in which their morphological distinction becomes quite obscure at the octoploid level so far as the plants in central Honshu are concerned. The occurrence of the intermediates between *C. fauriei* and *C. longiseta* in central Honshu has also been denoted (Tateoka, 1976). The hybridization between