and 3.05 and 4.12, respectively. The average values were 7.32 ± 1.09 and 3.53 ± 0.46, respectively. There is a want of literature giving information of mineral assay on dry wt % basis for comparison with the present findings. The poor freezability of 4 bulls could be explained on the basis of variations in the levels of mineral elements.

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MONOSOMICS IN *BRASSICA CARINATA* A. BR

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A MONOSOMIC is a $2n-1$ aneuploid with one chromosome missing from a normal $2n$ somatic complement. Monosomics occur spontaneously at very low frequencies. At relatively higher frequencies they occur in the progeny of triploids, interspecific hybrids, asynaptic mutants and translocation heterozygotes. Cytogenetically, they are important because of their usefulness in assigning genes to specific chromosomes and establishing independence of linkage groups. For this reason, monosomic series have been developed for several crop plants[1,2]. However, in amphidiploid *Brassica* species monosomics were reported only recently in *B. napus*[3,4]. There are no previous reports of the occurrence of monosomics in *Brassica carinata*.

B. carinata is an amphidiploid species ($2n = 34$, BBCC) derived from natural hybridization between the two diploid species *B. nigra* ($2n = 16$, BB) and *B. oleracea* ($2n = 18$, CC)[5]. In a study on artificial synthesis of *B. carinata* from its diploid progenitors, a hybrid was obtained from crosses between *B. oleracea* var. *italica* and *B. nigra*[6]. This paper reports the occurrence of monosomic and double monosomic plants in the progeny of this hybrid.

B. oleracea var. *italica* was crossed with *B. nigra* and only one hybrid could be raised to maturity. This hybrid was designated BN and was cytologically confirmed to be a triploid ($2n = 26$). Twenty plants (BN-1 to BN-20) were obtained from the seeds set on BN. Based on meiotic analysis of these plants, two plants, BN-7 and BN-12, were identified as double monosomic and monosomic respectively (figures 1–4).

In the double monosomic plant BN-7 ($2n = 32$), the pollen mother cells showing 15 bivalents and 2 univalents were most frequent at metaphase I (figure 1). At anaphase I, chromosome distribution to the two poles varied considerably in different cells. Distributions of 16:16 and 17:15 (figure 2) were frequent.

In the monosomic plant, BN-12 ($2n = 33$), a majority of pollen mother cells showed a chromosome configuration of 16 bivalents and 1 univalent at metaphase I (figure 3). The univalent lay away from the metaphase plate. At late anaphase I all the cells examined contained 16 chromosomes at one pole and 17 at the other (figure 4).

Meiotic abnormalities in pollen mother cells of the two monosomic plants BN-7 and BN-12 resulted in reduced pollen fertility. The monosomic plant BN-12 had pollen fertility of 17% compared to 95% in natural *B. carinata*. Even with the loss of two chromosomes, the double monsomic plant BN-7 had a relatively higher pollen fertility of 53%. Thus, pollen grains having chromosome numbers other than the haploid need not always be abortive in amphidiploid species such as *B. carinata*. Similar observations were reported in the amphidiploid species *B. napus* ($2n = 38$, AACC) where a plant with 6 chromosomes missing had a pollen fertility of 66%[3,4,7].

Both the plants, BN-7 and BN-12, were morphologically indistinguishable from their sib plants and natural *B. carinata*. The loss of one chromosome in BN-12 and of two non-homologous chromosomes in BN-7 was thus not only tolerated but apparantly failed to alter the gross morphology of these plants. This indicates the possibility of establishing a monosomic series in *B. carinata*.

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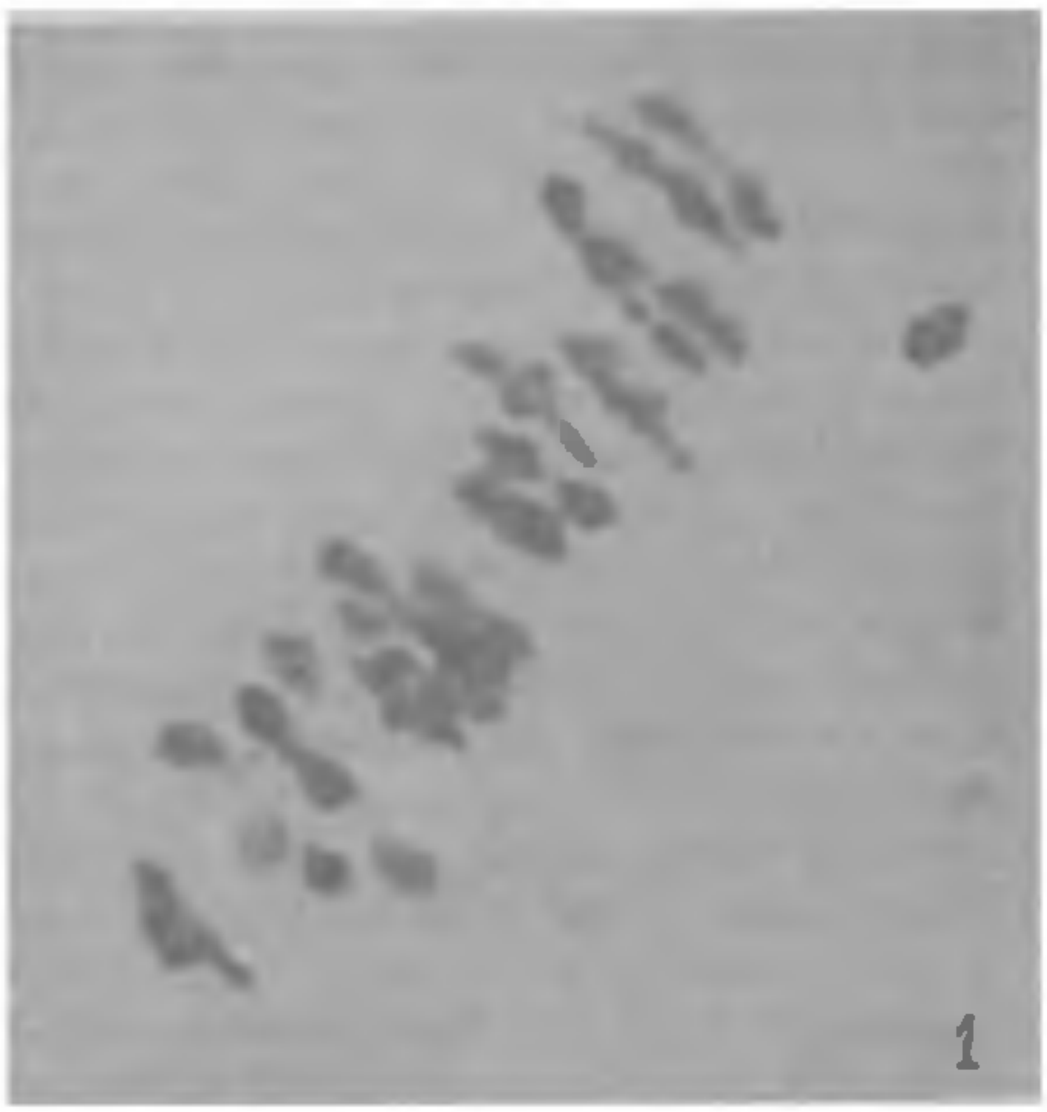

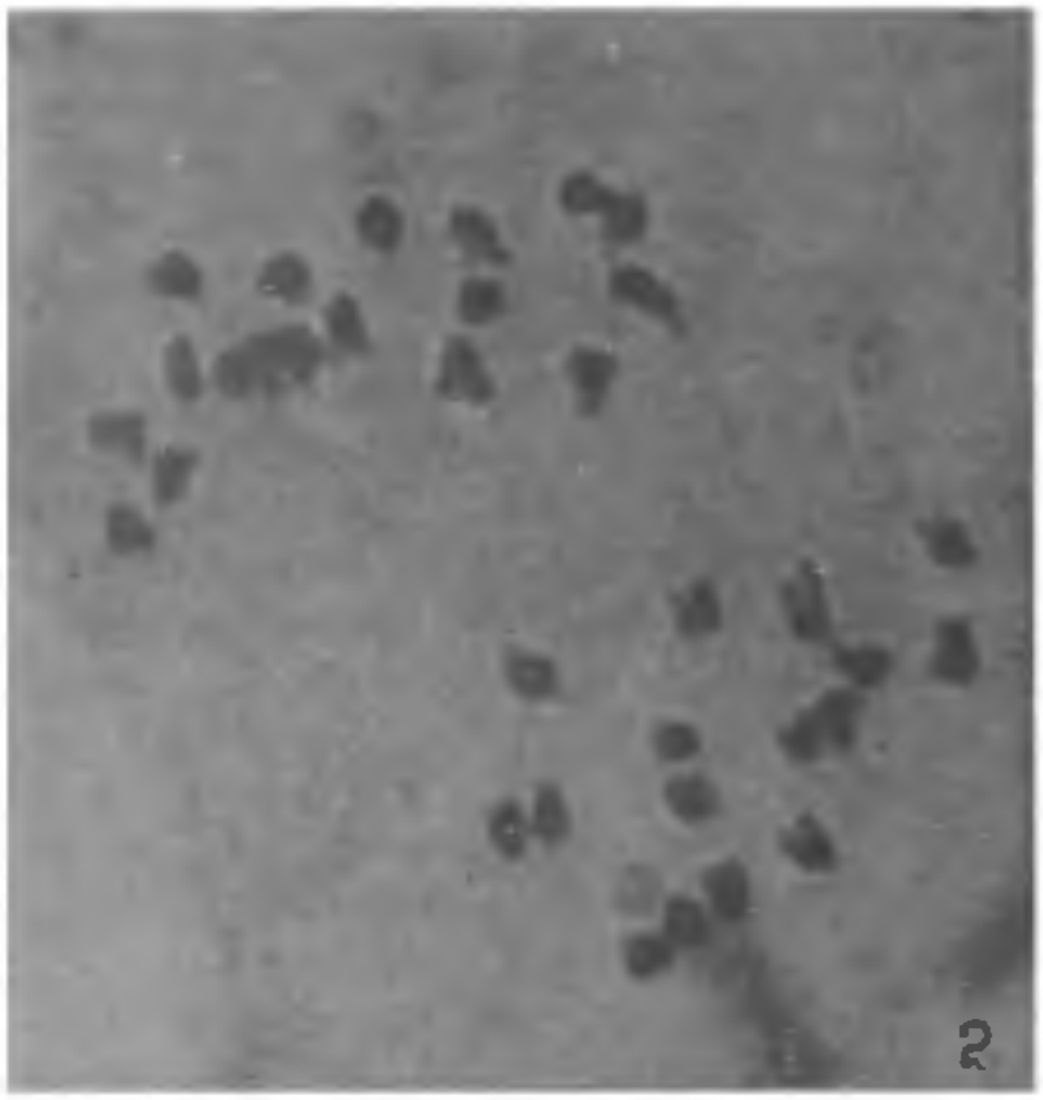

Figures 1–4. 1 and 2. Meiosis in monosomic plant BN-12. **1.** $16_{II} + 1_{I}$ at metaphase I. **2.** 16:17 distribution at anaphase I. (× 4000). **3 and 4.** Meiosis in double monosomic plant BN-7. **3.** $15_{II} + 2_{I}$ at metaphase I. **4.** 17:15 distribution at anaphase I. (× 4000).

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