polar cell occupy the chalazal half of the sac, also juxtaposed (Figs. 3–6). The embryo sac, therefore, consists of four decussate cells although rarely an isobilateral arrangement is also noticed. Organization of the nucellar plasmodium will be complete when the ovule attains the 2-nucleate embryo sac stage.

In the hitherto investigated taxa of Podostemaceae the sequence of development and organization of the embryo sac conforms to the Apinagia or the Podostemum or the Polypleurum types, all of which are exclusive to this family[1–4]. The organized embryo sac of the Apinagia type has nuclear derivatives from the micropylar megaspore nucleus only, and consists of two synergids, an egg and a polar cell. This type of embryo sac has been recorded in the majority of the investigated taxa of the family[5]. In the Podostemum type, both chalazal and micropylar megaspore nuclei of the 2-nucleate embryo sac, contribute nuclei to the organized embryo sac also consisting of the usual egg apparatus and a polar cell[2]. The Polypleurum type develops like the Podostemum type but the organized embryo sac has reverse polarity. It consists of an egg apparatus at the chalazal end and a polar cell at the micropylar end; there are no antipodal cells[6].

The organized embryo sac of *Willisia selaginoides* has nuclear derivatives from both micropylar and chalazal nuclei of the 2-nucleate embryo sac and in this respect, it is similar to the Podostemum and the Polypleurum types in being truly bisporic. While the organized embryo sac of Polypleurum type presents an inverted image of the Podostemum type, the organization in *W. selaginoides* of the present study is totally distinct and the complements of the embryo sac are disposed in unusual planes. Since the organized embryo sac in *Willisia* is different from all other investigated angiosperms, it is appropriate to designate it as the "Willisia type". The Willisia type is characterised by a bisporic, 4-nucleate embryo sac where the components are disposed in a decussate or isobilateral manner.

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DIFFERENTIAL SUSCEPTIBILITY OF *ALLIUM CEPA* AND *A. TUBEROSUM* TO COLCHICINE TREATMENT

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THE induction of polyploidy through colchicine in plant system is well established[1]. Irspite of its importance several species of plants fail to produce polyploids following colchicine treatment. There is either seedling lethality or reversion to diploid level after mixoploidy, through selective value of diploids at the initial stage. In such cases, low radiation after colchicine has been successfully applied in this laboratory[2] which allows the survival of polyploids with the elimination of diploids which are more radiosensitive.

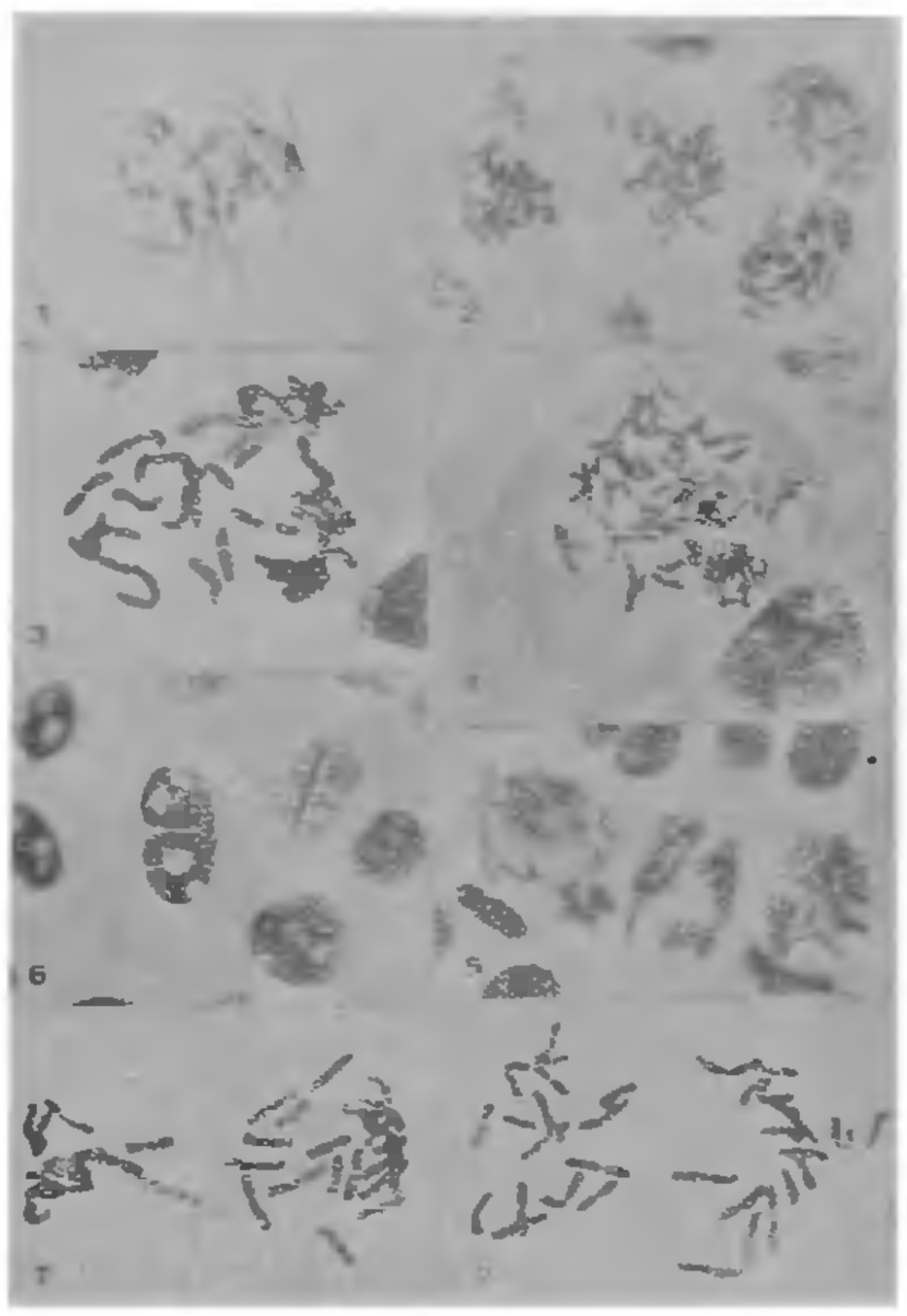
As colchicine treatment is one of the important practices in improvements of crop species which are often met with failure, it was desired to determine precisely the degree to which polyploid and diploid species differ in their sensitivity to colchicine treatment, so that the data might help in programming of research on colchiploidy in plant system. Two allied species of *Allium*, viz., *A. cepa* and *A. tuberosum* were taken. *A. cepa* is an established diploid species ($2n = 16$), whereas *A. tuberosum* is an autotetraploid forming clear 8-quadrivalents in meiosis[3,4].

Young healthy bulbs and plants with fresh roots were taken and placed in jars containing the required concentration of colchicine for 24 h. at 20° C. After the treatment, the plants were taken out and placed for recovery in standard Knop's medium. After every 24 h., root tips were taken and fixed in acetic ethanol (1 : 2) for 2h. After rising in 45% acetic acid, root tips were heated in orcein mixture (2% acetoorcein : N·HCl : 9 : 1) for a few seconds, kept in that mixture for 1h and squashed in 45% acetic acid.

Of the different concentrations of colchicine tried 0·25% and 0·5% yielded very satisfactory results. Cytological manifestation revealed marked differences of colchicine effect between *A. cepa* and *A. tuberosum*. In *A. cepa*, clear spindle arrest was noted after colchicine treatment followed by the appearance of polyploid cells after recovery (Figs. 1, 2).

In *A. tuberosum* on the other hand, appearance of cells with chromatids often separated as in anaphase but with no poles indicating arrest, was found to be present in approx. 20% of the dividing cells. Here

individual members represent chromatids instead of chromosoms (Fig. 4). But no clear polyploid cell was observed, excepting in one case out of 200 dividing nuclei studied. Moreover, the formation of chromosome groups even with nuclear membrane intact has been recorded (Fig. 5). The total number of chromosomes involved in the grouping did not exceed 32. In metabolic nuclei too, occasional tendency of cleaving into two groups was observed (Fig. 6). Another feature was the separation of chromosomes as such, with two chromatids intact to two sides of the nucleus showing reductional groupings in approximately 50% of the cells. Of these again, such reduction may be of unequal number of chromosomes in two poles (18–20%), but in most cases (70–80%) separation involved 16 chromosomes (Figs. 7, 8).



FIGS. 1–8. Colchicine action on *Allium cepa* and *A. tuberosum*. Figs. 1–2. Diploidy and induced tetraploidy in *A. cepa*. Figs. 3–8. *A. tuberosum*. Figs. 3–4. Natural tetraploid and diplochromatid appearance following treatment. Fig. 5. Chromosome grouping. Fig. 6. Tendency of nuclear cleaving at the metabolic stage. Figs. 7–8. Somatic reduction showing unequal and equal separation respectively.

The absence of polyploidy through colchicine treatment even after spindle disturbance and chromatid separation without pole formation indicates that at this autotetraploid species there is an inbuilt genetic mechanism to check uninterrupted increase of chromosomes through duplication. It is operating through no further division of cells thus affected after colchicine treatment, resulting in almost absence of polyploid cells after recovery.

The formation of groupings hinder the origin of polyploid cells. A reflection of the inherent mechanism of checking polyploidy is the reductional separation of chromosomes. As each chromosome in diploid nuclei contains two chromatids, there is the possibility of restoration of tetraploid level in the next cell cycle. In otherwise apparently autotetraploid species where cryptic gene changes might have been involved in some of the chromosomes not sufficient to hinder multivalent formation, such reductional separation followed by duplication may prove to be helpful in securing a true autotetraploid level in relation to such cryptic alterations. Such alterations may include some controlling units as well.

The above data may be taken to indicate that in this autotetraploid species, there is an inbuilt mechanism of resisting colchicine action. Moreover colchicine treatment in such species may be utilized to induce somatic reduction. Nuclei with reduced chromosomes may help on the one hand the recovery of diploids and on the other, if they form tetraploids as well, the homozygosity of certain gene changes may be secured at the tetraploid level. Investigations are in progress to find out the applicability of this behaviour in other species as well.

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