1. INTRODUCTION

The alkaloid colchicine is basically a polyploidizing agent with some mutagenic potential as well and is obtained from the plant *Colchicum autumnale* (Liliaceae). Its use is known since long (Eigsti, 1938). Doubling of genome through the use of colchicine is an well established procedure in plant improvement programme and is associated with the induction of giganticism at the cellular and organismic levels. Since the discovery of this potential, it was considered a boon and a handy tool to plant breeders and horticulturists. Though colchicine has been found to be effective in the induction of polyploidy (duplication of the chromosome set), other chemicals like acenapthane, gammexane have been found to be effective as well. (Sharma and Sarma, 1961; Sharma and Ghosh, 1969).

Generally the criteria which are used for quick identification of polyploids include increase in stomatal size and reduction in their frequency per unit area (Stebbins, 1950; Eigsti and Dustin, 1955; Bradgo, 1955; Kapoor and Kedharnath, 1976; Arya *et al.*, 1988), chromosome number doubling (Muntzing, 1941; Dustin *et al.*, 1949), cell size increase (Hutton and Peak, 1954; Sen and Bhowal, 1960; Sen and Marimuthu, 1960), increase in the sizes of plant parts, both vegetative and reproductive (Srivastava 1955; Chauhan and Raghuvanshi, 1977; Singh and Roy, 1988), changes in size and fertility status of pollen grains (Stebbing, 1950; Eigsti and Dustin, 1955; Singh and Roy, 1988; Arya *et. al*, 1988), delayed growth and flowering (Stewart, 1951; Sen and Bhowal, 1960; Singh and Roy, 1988; Arya *et al.*, 1988), and changes in the chemical contents including alkaloids and sugars (Noggle, 1946; Eigsti and Dustin, 1955; Cromibie and O' Conner, 1962). Such screening parameters help to make a rough estimate of induced polyploids among large populations of treated plants.

The basic principle of genetic improvement of a plant by tetraploidy remains the same whether it is a tree species or a field crop. However, operational aspects are different, because of the woody and parennial nature of tree species and seed to seed time is usually too long. For most trees, the generation time ranges from 5 - 20 years. Thus tree breeders are faced with the problem of selection of elite species (Elridge, 1984). To accrue the greatest gain in shortest possible period, assessment is desired to be made as early as possible at a young stage.

In India, about 75 million hectares of land (roughly 23%) is under forest cover (Kedharnath, 1986). Moreover essentially due to tropical nature, majority of the forests are comprised of broad-leaved angiosperms including many tree legumes.

Genetic improvement of forest trees in India has largely been based on selection and other conventional methods including grafting, towards attaining superior stem characteristics as to height and width, rate of growth and disease resistance. Attempts to utilise artificial polyploidy in forest trees for giganticism and other wood characteristics and their maintainance through clones are rather late approaches. They have been restricted to a few species of *Tectona, Eucalyptus, Santalum* and *Populus* (Kedharnath, 1984). Seed orchards or germplasm banks are also being given trial in certain centres.

The utility of polyploid induction in forest tree breeding was first put forth by Nilsson-Ehle as early as 1936, while working with the giant aspen *Populus tremula*. The discovery of fast growing aspen encouraged foresters to utilise the potentialities of breeding polyploid forest trees. Not only the artificial ones, but the necessity of exploiting natural polyploidy in forest tree improvement has also been suggested by various authors (Mergen, 1959; Hyun, 1960; Gustafsson, 1960; Wright, 1962).

In many woody and semi-woody species polyploid induction have been recorded. In cranberry (Dermen and Bain, 1944) and in peach (Dermen,1947) colchicine treatment produced mostly sectorial and periclinal diploid/polyploid chimeras with the latter ones showing larger leaves, stomata and pollen grains. Even one half of a leaf was found to be larger (polyploid). Though the role of polyploidy has been appreciated in tree genera like *Alnus* ,*Betula* (Johnsson 1950; 1959), *Populus* (Johnsson 1959) and a few gymnosperms (Mehra, 1968) exhibiting better growth features, yet it might not always lead to better wood quality (Mehra and Hans, 1973). However, in a few other tree species, other economic characteristics are reported to have been improved at the polyploid level. In *Emblica officinalis* (Janaki - Ammal and Raghavan, 1958) natural polyploids had always larger fruits and more of vitamin c (ascorbic acid) content. In *Anona squamosa* (Islam, 1953) induced 4n flowered early as opposed to normal delayed flowering. In natural cultivated *Terminalia*, 4n had more of tannin in its tissue (Janaki Ammal, 1962) which again was found to be directly correlated with fruit size. Natural tetraploid guava (Naithani and Srivastava, 1966) flowered more or less throughout the year, while the 3n were completely seedless with more developed outer wall (Rahman *et al*, 1971) In apricot (Lapins, 1975) induced 4n fruits were mostly larger but uneven in size. Not only the fruit size, changes in many other important characters like stoutness of stem, vigour of growth, larger sizes of leaves, stoma, and pollen grains were also observed in mulberry (Das *et al*.,1970), *Antidesma* (Hans, 1970 a) and sandalwood (Kapoor and Kedharnath, 1976). Induction of ploidy in *Delonix regia* and *Pithecolobium dulce* (Pal *et al*., 1992) showed considerable potentiality with regard to enhancement of biomass.

Although colchicine has been widely used for polyploidization of different plants, but it has its inherent limitation due to reduction in fertility wrought by meiotic disbalance.Colchiploidy has been particularly encouraging in horticulture with specific need of giganticism of different plant parts and their clonal multiplication.

However little work has been done towards ploidy induction in majority of woody angiosperms, particularly in tree legumes. Due to paucity of such knowledge in leguminous trees, the present investigation was carried out in *Albizia lebbek* (L). Benth, the common East Indian Walnut. The study included the effects of colchicine on various morphological, anatomical and cytological parameters.

Moreover, alongside the improvement of various features, the basic desirable ones in tree species are the improvement in biomass and wood quality including its fuel wood value. Thus the present study not only includes attempts to induce polyploidy in *Albizia lebbek* (L). Benth and possibility of its stability in the years to come, but also tries to assess the calorific value (CV) in the colchicine treated materials in relation to the control.