**SUMMARY AND CONCLUSION**

Induction of polyploidy was successfully attempted in *Pueraria phaseoloides* (Roxb.) Benth \((2n = 2x = 22)\) and the resultant autotetraploids \((2n = 4x = 44)\) were evaluated for different cytomorphological and physiological traits. Diploid (untreated) *P. phaseoloides* served as the control, for comparison.

Seeds and seedlings were treated with various concentrations of aqueous colchicine for different durations and application of 0.75 per cent colchicine for 4 h yielded the highest number of tetraploids. Seed treatment failed to induce polyploidy.

Manifestation of genome doubling with respect to various traits studied was bidirectional. The autotetraploids registered a slow but vigorous growth rate with bigger leaf size, thicker leaves with intensified colour and an increase in number of leaflets per leaf. They also showed an increase in size of the guard cells, trichome length and pollen diameter and a reduction in internodal length number of inflorescence and pollen stainability as compared to the diploids. These parameters could be utilised for the preliminary screening of tetraploids to a considerable degree. Pod set was drastically reduced in the autotetraploids and seeds obtained were nonviable.

Cytologically the 'raw' tetraploids were characterised by a high frequency of quadrivalents and bivalents and a low frequency of trivalents and univalents. Data on chromosome configurations at diakinesis, metaphase-I and abnormalities in anaphase I and II were analysed and their possible role in lowering pollen stainability and reduced pod set are discussed.
Pollen morphological studies revealed that 3-zono colporate grains were common in the diploids. Additional pollen types including 4-zono colporate, syncolporate, brevicolporate and spiraperturate grains appeared in the tetraploids indicating pollen structural and sculptural variations through induced polyploidy. A possible line of evolution of these different types from the normal ones has been proposed.

Foliar anatomical studies showed profound increase in cell dimensions in various zones including epidermis, palisade, paraveinal mesophyll and spongy cells. Moderate correlation was established between palisade thickness and carbon dioxide exchange rate but not with the total leaf thickness. Increased leaf thickness with prominent vascular bundles serves to boost up the functional efficiency of leaves in the tetraploids.

With respect to gas exchange properties, the tetraploids and diploids showed similar rates of photosynthesis on a unit leaf area basis. However carbon dioxide exchange rate on a per leaf basis, and canopy photosynthesis (on a per plant basis) was higher in the tetraploids. The tetraploids also showed a higher rate of transpiration, on a per leaf basis, which might be due to increased stomatal pore size. An increase in leaf, stem and root tissues resulted in an improvement in total biomass in the tetraploids. Correlation figures pointed out a moderate association of canopy photosynthesis \((r = 0.59 \ P < 0.01)\) and a higher association of total leaf area \((r = 0.70 \ P < 0.01)\) with whole plant dry weight.

The effect of ploidy on the level of major nutrients has also been worked out. The nutrient content in the leaf, stem, root and nodule tissues of both the cytotypes with respect to N, P, K, Ca and Mg were
comparable. However the better growth of tetraploids facilitated greater uptake of nutrients.

The tetraploids varied with the diploids in the pattern of nodulation and nitrogenase activity. Nodules were graded visually into three categories as small, medium and large and arbitrary nodule scores were worked out for the two cytotypes. The tetraploid plants produced a few, very large nodules than the diploids and the total nodule scores were also higher in the former. Nitrogenase activity in the tetraploids were higher during the first sampling date, six weeks after their establishment, but showed comparable rates with that of the diploids during the second sampling which was done nine weeks after establishment.

An optimum level of ploidy exists for every crop species, above which an increase in chromosome number results in a decline in productivity. The vigorous growth exhibited by the induced tetraploids in *P. phaseoloides* indicates that the plant is promising upto the tetraploid level. The production of large sized nodules in the second vegetative generation was indicative of the persistence of polyploid characters. The enrichment of soil with augmented level of organic matter in the tetraploids might facilitate better aeration and water retention capacity of soil. The prolonged growth cycle in the polyploids might also be beneficial in extending the period of ground coverage and also in leaf litter addition. The possibility of vegetative multiplication in *P. phaseoloides* is an added advantage in multiplying the tetraploids. Moreover, the induced autotetraploids serves to enrich the genetic stock of *P. phaseoloides*, which in turn could be incorporated in future crop improvement programme.