The present study in the genealogy of *Populus ciliata* Wall. ex Hoyle was conducted to understand the biology, phenology, ecology, extent of natural variation and potentiality of inheritance in provenance material and its environmental interactions, so as to have an insight into the biological systems of the species. This was essential before the improvement programme of the species could be initiated. A general introduction to the importance of such studies is given with available information on the species. To this is added a chapter about the systematics and evolution of the species. It is argued here that on the basis of species migration, adaptation and morphological characters like leaves being ciliate, bracts being ciliate, stamens being more than 40 and capsule being 2-4 valved, it should be placed under the new proposed section *Ciliata* including two other Himalayan poplars *P. glauca* and *P. gamblei*. This ends the long standing dispute regarding their placement in either section *Leucoides* or *Tacamahaca*.

Observations were made on the phytogeography, silvical characters, reproductive biology and provenance variation, which are presented as separate chapters under results and discussion. Each chapter contains a general introduction, introduction to the topic, results obtained and
discussion. In the end a general discussion on the basis of results obtained is given.

The species was found to be distributed throughout the temperate Himalaya invading new ecological niches created in the forests by fires, landslides, and in river flood plain deposits. The ultimate succession to climax community was dependent on geology of the area. The commonest occurrence was in association with *Alnus* and *Ulmus* species, occasionally with blue pine, deodar, fir and spruce. Its rare occurrence with chir pine was also noticed. It occurred on all kinds of soils which were freshly exposed. The soil chemical analysis revealed them to be slightly acidic to normal in reaction (pH 5.6-7.4) having low to high organic carbon content (0.30-0.75) with medium to high available phosphorus and potash content.

The species flowered at ±12 years and reached its optimum reproductive phase at 25-30 years. The species produced highly viable seed, and a germination up to 75 per cent had been observed in the present studies. Under normal conditions the seed retained its viability only for a month but it could be stored under proper conditions of low temperature. Mature wood cuttings had a low rooting ability (23 per cent) which increased on rejuvenation in the stool-bed nursery to 35 per cent in the first crop of cuttings in first year and 76 per cent in the second crop of cutting.
production. On an average under the natural conditions tree was found to grow 1 m in height and 1 cm in diameter per year. Occasionally the diameter increase was 1.5-2.0 cm per year, which was basically determined by the moisture level of the substratum, as trees in the river flood basins invariably had higher growth rate. The species tended to be force pruned under competition, otherwise had poor pruning ability and the bark pattern tended to be rougher with increase in age and altitude. Fertilization produced no statistically significant variation in growth of cuttings, though apparently 7.5 kg/ha N, 25 kg/ha P and 12.5 kg/ha K seemed beneficial.

Phenologically the bud break, leafing, flowering and pollen shedding was temperature dependent. With an increase in elevation of 600 m, one week's difference in phenology was observed, and the sunny or shady aspect at one site could also enhance or delay the bud break and pollen dispersal up to three days. Pollen viability and germination tests revealed the pollen to be highly viable, but degradation of pollen proteins was noticed on storage, which may be responsible for inviability on aging. The species had obligatory cross-pollinated, cross-compatible system. The species was also self-compatible, however, species was cross-incompatible with *Populus deltoides*. Embryologically in the crossed embryo-sacs degeneration of the egg apparatus was noticed while intra-specific crosses showed normal development of embryo. The species also exhibited sexual dimorphism as
bisexual catkins were noticed in one tree. The placement of male and females flowers was found to be variable and even the pollen size was slightly larger in these as compared to the normal male flowers. The sex ratio was confirmed to be 3 males:2 females but no sex chromosomes could be detected besides the non-observance of any other anomaly.

Natural phenotypic variation was studied in relation to sex and ecological constraints. It revealed no relationship or effect of sex on any of the growth features observed i.e., height, diameter, clear bole, bole, taper, specific gravity and fibre length. But the analysis and comparison of the data collected from 25 provenances and grouped into four ecological blocks on the basis of their occurrence reveal the genotype of ravine populations to be most plastic. Here, height and diameter were found to be highly correlated besides their high correlation with age. The anatomical observations also revealed the wood of riverain and river flood basins to be more porous and uniform as compared to other places of its occurrence. The wood of the species was found to contain 7-15 per cent extractives, 5-24 per cent lignin, 64-38 per cent holocellulose and 0.5-3.5 per cent ash.

Clonal provenance trial initially started with 84 clones and later on expanded to include 134 clones, revealed eight provenances to be promising, which were later on again tested and of these Sahar and Kumarsain with an
average of 1.50 m and 1.30 m height increase and 1.60 cm and 1.40 cm diameter increase, respectively, seem to have exploitation potential. In these further selections are being made to achieve at least a minimum of 2.0 m height increase with corresponding 2 cm diameter increase per year. The site-interaction studies conducted to find out the site zones of its growth and adaptation of the particular provenance reveal the outer low hills to be totally unsuitable for its growth. The suitable provenances for mid hills have been found to be Gahar (for Shillu), Chhatri (for S.N.S. Complex) and Kumarsain (for Palampur). For the inner mountain zone tested at Manali, Gahar clone was again found to be quite promising. The leaves of the species have been analysed to have fodder value as they contain 10-14 per cent protein, 49-55 per cent Nitrogen free extract (NFE), 19-27 per cent crude fibre content.

To unravel the broad pattern of the genealogical variation in the species, three manifestations namely systematics and evolution, adaptations and provenance variation are critically evaluated in the general discussion. The species though having a long migration history is now thought to be evolutionarily at the dead end, since with discontinuous variation it shows no racial clinal variation. The genetic diversity throughout the geological clock has been utilized for eco-specific adaptations.