CHAPTER - I

INTRODUCTION
The medicinal herbs assume a tremendous importance especially at a time when the whole world is showing a resurgence of interest in the healing properties of plants. These herbs not only provide raw materials for the manufacture of allopathic drugs but have also served the hillman for decades and suit his local medical system. Drugs obtained from the plants are believed to be much safer and exhibit a remarkable efficacy in the treatment of various ailments. It may be pointed out here, that the age of synthetic drugs is increasingly falling prey to its own limitations which include controversies arising out of the side effects and the financially prohibitive manufacture of the synthetic drugs. Evidently, therefore, reliance on the medicinal plants is once again gaining ground even in the most developed countries. What aptly reflects the renewed
interest in the curative effects of plants is the very fact that the annual export of the medicinal herbs from India alone increased from Rs. 36.34 million in 1963-64 to Rs. 76.99 million in 1973-74 and to Rs. 213.68 million in the year 1982-83 (Thakur, 1986). There is thus an increasing pressure on the utility of the medicinal plants which as a consequence has led to the depletion of many such species from their natural home in various parts of the world. The situation assumes wide ranging implications particularly with respect to the Kashmir Himalayas which represent a rich repository of a highly variable germplasm, many species of which are utilitarian in nature. This part of the Himalayas is subject to numerous types of stresses, which have impoverished our natural resources and are leading to the loss of the species. Some of these include: wanton destruction of the forests by the governmental and private agencies, establishment of various hydro-electric power projects, construction of a reticulum of roads, urbanization and encroachment of the forest land and meadows, soil erosion, overgrazing of pastures and meadowlands and the non-judicious exploitation of the important plants for commercial purposes.

If the present rate of habitat destruction and exploitation goes unchecked, the commercially important species will be lost for all times to come. The available records reveal that several pharmaceutically important
species growing in Kashmir Himalayas are already on their way to extinction and face a serious threat. It may be mentioned here that among these quite a few are endemic to this region (Dhar and Kachroo, 1983); hence are localised within restricted geographical ranges and constitute thinly scattered populations in the area. Such taxa are particularly at a high risk rate and once lost, they will be extinct from the biological world itself. Following the criteria of Ward (1979) and IUCN, the species such as these genuinely qualify for "rare" and "threatened" categories. There are indications that in the absence of long-term conservation programmes, the situation can reach cataclysmic proportions. It is therefore, immediate need of the hour to salvage whatever we can, by launching action to conserve the existing germplasm. This will not only protect the species from extinction but will also ensure sustained supply of the raw material to the drug industry of the country as well as the indigenous systems of medicine.

It is now becoming increasingly evident that for conservation to be effective, knowledge of the species biology is absolutely essential. Unfortunately, the rare and threatened species we have in Kashmir Himalayas have remained neglected partly on account of the comparative inaccessibility of their natural home and partly on account of their rarity. No scientific stock taking of
this germplasm has ever been made and information regarding their genetic diversity particularly in respect of the utilitarian characters, modes of propagation, dispersal mechanisms, reproductive efficiency and nature of the breeding systems is totally wanting. Upon the breeding system depends not only the reshuffling of the genetic material through recombination but also the reproductive potential of a species. The breeding system would constitute the mechanics of gamete differentiation, pollen transfer and flowering phenology etc. The mechanism of gamete formation can, however, not be understood in absence of the knowledge regarding chromosome structure and behaviour. Unfortunately, the cytological data of these species are woefully inadequate. Whatever little has been done pertains to chromosome count alone.

This fluid situation calls for an indepth study of these taxa. The data generated will be of immense use for designing various conservation measures such as multiplication, domestication and genetic improvement. For genetic improvement, it is imperative to exploit the spate of variability existing in the valley's germplasm and work out correlations among different characters particularly the ones linked with the breeding system. Knowledge about the time and duration of flowering, stigma receptivity in relation to anther dehiscence and nature
of the breeding system is a pre-requisite to the genetic improvement through hybridization. These data are also helpful in commercial cultivation. Realizing the profound importance of such studies especially in respect of the rare and threatened species, numerous workers (Massey and Whitson, 1977; Primack, 1980; Ayensu, 1981; Henifin et al., 1981, a,b etc.) have from time to time stressed the need to unravel the nature of their breeding system, pollination mechanisms they operate, morphological variation and other reproductive features.

As a part of such studies, the present work aims at a detailed assessment of three most important and heavily exploited medicinal herbs of the area namely *Podophyllum hexandrum* (Podophyllaceae), *Aconitum heterophyllum* (Ranunculaceae) and *Saussurea lappa* (Asteraceae). While the former is restricted to parts of the Himalayas, Afghanistan and provinces of Yunan and Szechwan in South west China, the latter two are endemic to north west Himalayas including Kashmir and Pakistan (Dhar and Kachroo, 1983). Belonging to three different phylogenetic lines, all of them face rarity and being under heavy economic stress they are potentially at risk struggling hard for their sustained survival in the natural habitats.

The work embodied in the thesis aims at evaluating
the above taxa for:

(i) Variability in morphological details of the subterranean perennating organs and the aerial shoots including the foliage, flower, fruit and the seed.

(ii) Flowering phenology - from sprouting to senescence.

(iii) Breeding systems which include anther dehiscence, stigma receptivity, pollen viability, pollen-ovule ratio, pollination mechanisms, nature of the breeding behaviour through bagging experiments and the modes of propagation (vegetative and sexual).

(iv) Resource allocation patterns to the various plant parts including the sex organs.

(v) Chromosome complement and pollen mother cell meiosis.