PART II
REPRODUCTIVE BIOLOGY
INTRODUCTION
The young fern gametophyte represents the simplest photosynthetic organism capable of normal development in culture. The cells are large with distinct differentiated cell types but each gametophyte is small enough to be examined intact under the microscope. The possibilities presented by the fern gametophyte for experimental studies were recognized long ago by many workers such as: Prantl (1879, 1881), Leitgeb (1880), Heald (1898) etc. It was only in the last 30 years or so that intensive studies have been carried out and the virtues of the reproductive system have been more widely recognized (Naf, 1962; Bopp, 1968; Miller, 1968; Wagner, 1971; Brandes, 1973; De Maggio and Raghavan, 1973). Further work in this field was carried out by Klekowski and Lloyd (1968), Klekowski (1969a,b, 1972a,b, 1973a,b, 1976a,b, 1979), Verma (1969), Ganders (1972), Hickok and Klekowski (1973), Lloyd (1974a,b), Klekowski and Hickok (1974), Saus and Lloyd (1976), Lovis (1977), Walker (1979), Cousens (1979) etc.

The choice of species, the techniques of spore storage, sterilization, sowing and germination, the composition of the medium and the cultural conditions of temperature, light quality and intensity all influence the way in which the gametophytes develop. Since the fern gametophyte is a small structure (c 1.2mm across) with usually both sex organs, the general tendency is to believe that self-fertilization is probably the rule. This would lead to a great deal of homozygosity and consequently little morphological variation. However, it is the general experience of fern workers that the ferns exhibit a lot of morphological and cytological variations. These obviously could not be a result of self-fertilization but is due to cross fertilization. To analyse this hypothesis various workers have done a great deal of work as evidenced by the literature referred above. Klekowski and Lloyd (1968) also favoured low probability of intragametophytic selfing in Onoclea sensibilis and some genetic load was documented in the sample implying heterozygous nature of the source sporophyte.

It is being realized that not all the homosporous ferns can undergo intragametophytic selfing habitually. There are several kinds of adaptations that tend to favour intergametophytic mating like:

(i) Different timing in the appearance of sex organs: Antheridia and Archegonia appear at different times in the same gametophyte.

(ii) Mutual effect of gametophytes: When a fast growing gametophyte reaches a spatulate stage certain chemicals are leached out from the notch area. These leachates called antheridiogens inhibit the
growth of other gametophytes so that they grow slowly and produce sex organs a little later than the fast growing gametophytes. Most of the time the slow growing gametophytes remain only antheridial.

(iii) Incipient type of heterospory: In many cases it has been noticed that a large number of gametophytes produce only a single type of sex organs i.e. they are either only male or female.

(vi) Genetic Load: Two recessive lethals come together in a homozygous state.

Presently sixteen species of homosporous ferns were gathered from Garhwal Himalaya and studied for their reproductive biology. Gametophytic populations were raised in the laboratory. These sixteen species are:

Adiantum capillus-veneris, Adiantum edgeworthii, Adiantum fimbriatum, Asplenium dalhousiae, Asplenium laciniatum, Athyrium pectinatum, Cheilanthes bicolor, Dryopteris caroli-hopei, Dryopteris cochleata, Dryopteris wallichiana, Thelypteris erubescens, Hypodematium crenatum subsp. crenatum, Polystichum discretum, Polystichum nepalense, Polystichum piceo-paleaceum. The mating system analyses are based on the position, sequence and duration of sex organs along with the percentage of male, female and bisexual gametophytes.