Ferns occupy a unique position in the plant kingdom. They are the only vascularized land plants in which both the generations lead an independent life. Here, therefore, both the gametophyte and the sporophyte generations are available for experimental work. Regeneration of gametophytes from sporophyte or parts of sporophyte (apospory) and of sporophyte or its parts from gametophyte (apogamy) are important deviations from normal life cycle in ferns. Experimental investigations of these phenomena have been the endeavour of many workers. Most of the early work on regenerations was either about their natural or spontaneous occurrence (Steil, 1939, 1951). Later in vitro studies on regenerations in various ferns were made by many workers (Steeves, Sussex and Partanen, 1955; Bristow, 1962; Kato, 1962; Takahashi, 1962, 1964, 1965; Munroe and Sussex, 1969). They started their investigations from spore cultures. Thus they obtained first mature gametophytes and from them the sporophytes either through apogamy or through fertilization or from gametophytic callus. Parts of the young sporophytes raised under aseptic conditions were used by them directly for further culture work. Thus, they used detached young juvenile leaves, young
roots or pieces of rhizomes or aerial stems. They reported regenerations of three types from parts of sporophyte in culture as follows:

(1) regenerations of gametophyte or parts of gametophyte,
(2) regenerations of leaves, roots or entire sporophytes,
(3) regenerations of intermediate nature.

The physiology of regenerations, however, remained obscure although a number of factors such as concentration of sucrose and/or the presence of growth substances such as IAA, kinetin, 2,4-D, NAA, etc. have been found to either initiate or suppress their occurrence in cultures. Ageing, drying up of the medium, concentration of the agar in the medium, intensity of the incident light, malnutrition have also been reported to be responsible for initiation of regenerations of one type or the other (Bell, 1959). Recently, Bell (1979) has emphasized the similarities between the egg cell, the spore mother cell and the cell or cells giving rise to aposporic outgrowths and has advocated autolysis as a major factor in the initiation of such changes.

In India, fern tissue culture is relatively a recent development (Mehra and Sulklyan, 1969; Kshirsagar and Mehta, 1978). Thus, Chowdhury in the introduction to his book *On the Researches on Living Pteridophytes in India, Burma and*
Ceylon (Chowdhury, 1971) states "Not all groups of Pteridophyta have been adequately studied in this part of the globe and the families like Cyatheaceae, Parkeriaceae ..... demand more attention of the pteridologists here. Also the new avenues of research like tissue culture .... appear to offer vast fields of unexplored deliberations of morphological or even evolutionary interest."

Ceratopteris, a genus of aquatic ferns, which, because of their unique characters such as their specialized aquatic habitat, the nature of sporophylls, sporangia and spores and their characteristic ameristic and male or assymetric, lop-sided or many-lobed and hermaphroditic gametophytes, is often separated from the Polypodiaceous ferns and placed in a separate unigeneric family of its own, the Parkeriaceae (Benedict, 1909) or the Ceratopteridaceae (Maxon, 1926). This view, however, is not accepted by many Pteridologists (Bower, 1923, 1926, 1928; Christensen, 1938; Holttum, 1949; Copeland, 1947), who place them either in the Adiantaceae or the sub-family Gymnogrammeaeidae of Polypodiaceae or in the Polypodiaceae itself. C. thalictroides Brogn. is one of the most common species found in lakes and ponds of tropics including India. The other species numbering 6 (Benedict, 1909) are restricted in their distribution to the tropical parts of Asia, Africa and some tropical islands. It is one of the many bud-bearing
ferns such as *Adiantum caudatum* L., *Goniopteris prolifera* Bedd., *Tectaria crenata* Cav. etc.

The many-times pinnate compound leaves of this fern bear in the axils of their segments a single bud meristem per segment. Each meristem under natural conditions or when cultured in tap water or in Knop’s solution, invariably develops into a single bud. In *in vitro* cultures, on the other hand, a single bud meristem could be made to differentiate into a callus and later into a large number of buds, there being, at times, as many as 500 buds per meristem. This is highly significant and is being discussed at length in the thesis.

In view of all the above it was thought, therefore, that the use of leaf bud meristem culture to obtain different parts of the sporophyte such as leaves, roots etc. from plantlets grown in completely aseptic conditions, would not only save time but would also give a genetically perfect clonal group for *in vitro* studies on regenerations. There is nothing in the previous literature on the use of leaf bud meristem in such studies. It was also thought that this would afford a better means to reinvestigate the factors responsible for the initiation of regenerations of one type or the other. Again, there is nothing in the literature on controlled differentiation of parts of sporophyte into regenerates of
different types in *C. thalictroides* except for the early report by Goebel (1907) about the spontaneous occurrence of callus and of regenerates of various types in the detached juvenile leaf culture of this fern. Loyal and Chopra (1977) published a note on in vitro studies on *Ceratopteris pteridoides*, though details of this work are not available till date.

Javalgekar and Phartale (1978) reported an interesting case of apogamy in this fern.

Javalgekar (1960) studied the sporogenesis, germination of spores and development of gametophytes in *C. thalictroides* from plants native to Bassein near Bombay and Khandala near Pune, India. He found the sporogenesis to be normal and reported n=78 for these plants. All the meiospores formed were viable and germinated into normal gametophytes. With this background and for all the reasons stated above it was suggested by him to me to undertake detailed experimental investigations on regenerations starting from the aseptic culture of leaf bud meristem in this fern.

The thesis incorporates the results of all the experimental investigations on regenerations in *Ceratopteris thalictroides* Brogn. The thesis is fully supported by 36 coloured plates and 149 black and white photographs. This provides visual proof for almost all the statements made in the thesis regarding the gametophytic or sporophytic regenerations arising either from callus or directly from various organs raised in cultures. It is thought that a lot of misgivings about the occurrence or the morphology of the regenerations of the gametophytic or sporophytic nature exist in most of the previous literature due to either a lack of proof or poor illustrations.