SUMMARY AND CONCLUSIONS

The present study is an attempt to characterize the morphophysiological and biochemical changes occurring in the seeds of five palm species, *Borassus flabellifer, Corypha umbraculifera, Caryota urens, Licuala peltata* and *Livistona rotundifolia*, all of which show remotive type of germination. In these seeds, during germination, the haustorium is developed from the distal part of the cotyledon. The proximal part of the cotyledon is developing into a tubular protrusion called cotyledonary sheath, which pushes the embryo proper to some distance away and deep into the soil. The tip of the cotyledonary sheath differentiates into radicle and plumule, the former producing the root system and the latter giving rise eventually to a plumular sheath and a leafy shoot.

For the present study, ripened fruits/seeds were collected from different parts of North Kerala. Both entire fruits and dehusked/depulped seeds were stored under different storage conditions in the laboratory viz. in open trays at room temperature, in polythene bags at room temperature and in polythene bags at 4°C. The germination percentage and moisture content of the seeds stored in different conditions were determined at regular intervals. Tissue samples were drawn from seedlings at different stages of germination and analyses were carried out to unravel the biochemical processes associated with mobilization in palm seeds of remotive type germination. A comparison of germination, storage, dormancy, desiccation tolerance, chilling sensitivity and reserve mobilization in the seeds of the five species was envisaged through the present study.

The following observations and inferences are drawn from the present investigation.
1. *Prima facie* all the seeds exhibit recalcitrant behaviour. But, among the seeds of the five species studied, *Corypha umbraculifera* and *Licuala peltata* are identified as recalcitrant and the three others, *Borassus flabellifer*, *Caryota urens* and *Livistona rotundifolia* are considered as of intermediate storage category.

2. True dormancy is apparently recognized in all the five seeds. Dormancy shown by all the species belongs to morphophysiological category. The pericarp and the impenetrable endosperm impose morphological dormancy while constraint of water relations contributes to physiological dormancy.

3. Storage has been found to induce early seed germination in *B. flabellifer, C. urens* and *L. rotundifolia*.

4. Of the three different storage conditions employed, seeds stored in polyethylene bags at room temperature yielded maximum storability since these seeds are less vulnerable to desiccation stress than the fresh seeds stored at open RT.

5. Removal of the husk or pulp has been found to enhance the rate of germination. But the dormancy is not fully broken by the depulping process, presumably due to the constraint imposed by the hard endosperm.

6. The main reserve material in the endosperm is mannan and/or galactomannan, which provide maximum metabolites for reserve mobilization to the seedling following germination. Other reserve materials like starch, lipids and proteins occur only in low quantities.

7. During germination, hydrolytic degradation of the stored polysaccharide occurs to release mannose and galactose which are then mobilized into the haustorium where it is converted into starch as
transient storage material. Galactomannan/mannan degradation in the endosperm and starch formation in the haustorium occurs concurrently.

8. During germination, dry weight of the endosperm declines only insignificantly due to the water resistant nature of mannan/galactomannan.

9. The increase in the sugar content in the endosperm of *B. flabellifer, C. umbraculifera* and *C. urens* indicates active catabolism involving degradation of starch and galactomannan of the endosperm. In *L. peltata* and *L. rotundifolia* the metabolism is less intense as indicated by a lesser rate of increase in soluble sugars.

10. Very high amylase activity observed in the haustorium is indicative of transient starch accumulation and its high turn over.

11. The increase in soluble as well as reducing sugars in the haustorium suggests continuous translocation of metabolites from the endosperm and degradation of starch within the haustorium.

12. Following germination, metabolites are mobilized from the haustorium to cotyledonary sheath, which serves as a passage for the translocation of reserves from the haustorium to the growing plumular sheath.

13. The plumular sheath is a secondary storage site for starch, which is utilized during the differentiation of shoot and root systems.

14. During germination, proteins exhibit only slight fluctuation and cotyledonary sheath contains maximum proteins, which are presumed to function as translocators for mobilization of soluble carbohydrates from haustorium to plumular sheath, tissues of which are rich in starch.

15. The present study has established that in all the five species studied, the reserve material is mannan rich and germination is of remotive type, characterized by slow rate of germination and enhanced elongation of
the cotyledonary sheath and subsequent differentiation into plumular sheath followed by seedling establishment.

16. When a comparison is made on the germination, storage behaviour and mobilization pattern among the five palm species studied, noticeable variations have been observed which may be due to species specific morphological and physiological differences.