Flowering season and seed storage of dipterocarps

It is urgently needed to solve seed problems of tropical tree species for the regeneration of existing forests as well as rehabilitation of forests recklessly harvested after the World War II. Dipterocarps are the main commercial tree species of the tropical rain forests in Southeast Asia, and their seeds are notorious for an extremely short life. The authors carried out a series of experiments to solve some of the basic problems of dipterocarp seeds at the Forest Research Institute (FRI), Kepong, in West Malaysia for a period of three and half years since November 1971 under a cooperative research program between FRI and TARC.

Some works have already been done on the phenology of dipterocarps, but its flowering and fruiting behaviour are still left obscure. It was suggested by several authors that a prolonged dry period followed by warm soaking prolonged rains will induce the flowering on a large number of trees, resulting in a "gregarious flowering season". However, according to the thirty-eight flowering records obtained during the present experiment with the lowland forests, surrounding Kuala Lumpur, it was found that there were two flowering seasons every year that coincided with the pronounced rainy season (Fig. 1), and the flowering-to-fruiting period was between two and five months.

The loss of the flowers and young fruits during the seed maturation process was over 90% of the total flowers produced, including many cases of no fruit setting. Although the seed dry weight is a possible indicator of timing of the seed collection, it is recommended that preparation for the collection be made as soon as the seed-wing begin to turn brown, without waiting for the seeds themselves to turn brown.

Garrard (1955) suggested that the tropical climate is not suitable for the seeds which may require a period of 'after-ripening' before germination can occur, although the after-ripening of tropical tree seeds in general seems to be not clearly identified so far. Tang (1971) observed that the seeds of more important dipterocarps e.g. *Shorea leprosula, S. curtisii, S. platyclados* exhibited

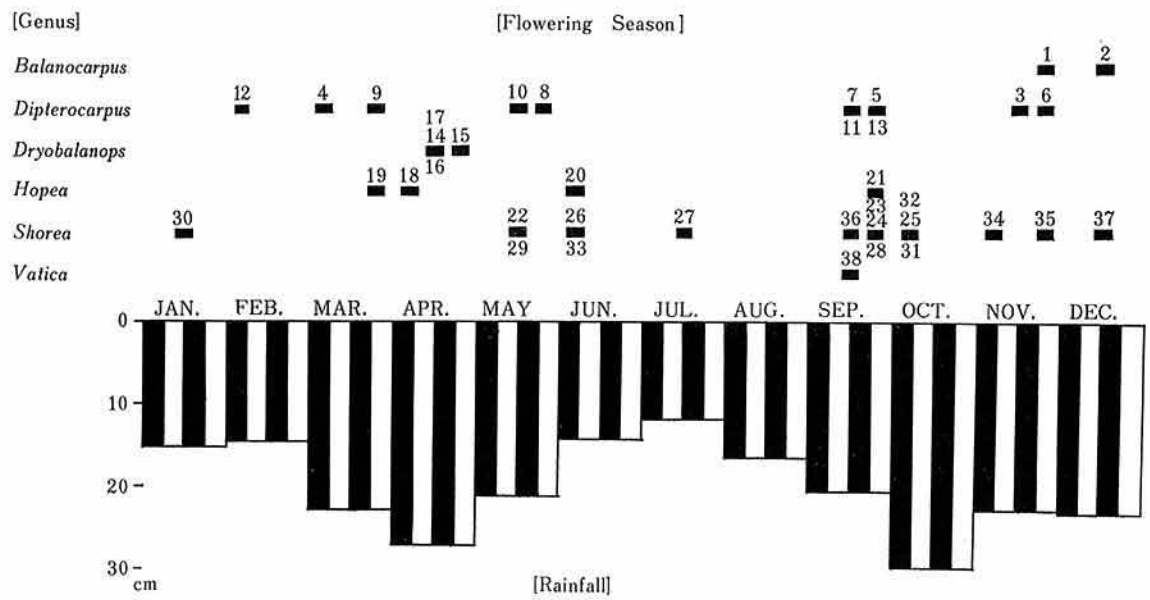

Fig. 1 Flowering season of dipterocarps and rain chart in kuala Lumpur and its surrounding areas

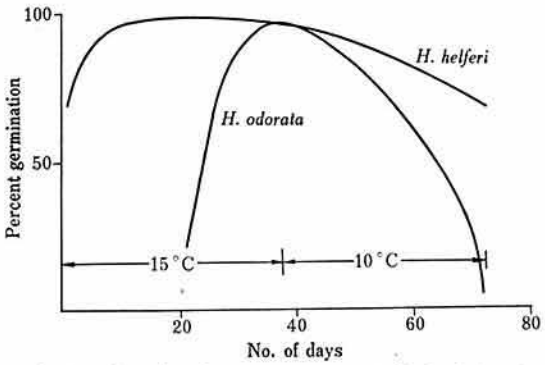

Fig. 2 Germination percentage of *H. helferi* and *H. odorata* seeds as effected by low temperature treatment

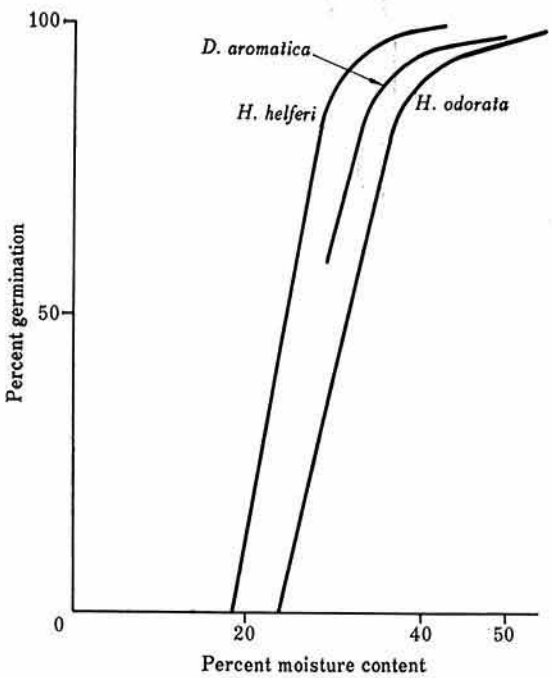

Fig. 3 Germination of *H. helferi*, *H. odorata* and *Dryobalanops aromatica* seeds at different moisture-content levels

very little or no normal dormancy. As a matter of fact, the 'after-ripening' or 'a resting period' of most tropical tree seeds is generally almost unknown. However, it was found in the present study that the germination of *Hopea* seeds was apparently effected by the prechilling treatment (Fig. 2), despite of many observations of germinated seeds on branches ahead of seed collection.

Seeds of *Quercus* and others in the temperate zone lose their viability very easily by drying seeds. Similarly, a simple drying treatment can not be applied to dipterocarps seeds. Namely, they showed over 60% of moisture content at the time when the seeds were collected, but they dry up rapidly in a few days after collection, and which resulted in a loss of viability in two to three weeks under normal conditions. The critical moisture content of dipterocarp seeds for a serious deterioration was estimated about 35% on a fresh weight basis (Fig. 3). This level of moisture content is similar to a critical level of 30 to 34% for seeds of *Acer saccharinum* in the temperate zone (Johns, 1920).

In the tropics with high and uniform temperature and humidity throughout the year, the application of stratification without accompanying low temperature treatment can not be expected to be effective for storage of the seeds, based on the result of this study, similar to Barnard's result (1950). However, the low temperature storage of seeds, sealed in polyethylene bags after gradual desiccation to a level just above the critical moisture content was found to be effective in keeping the seed viability for a prolonged period. In this study, *Hopea helferi* seeds could be stored for about two months at a temperature of 15°C for an initial period and 10°C for a later period, (Fig. 2), and *H. odorata* seeds for about three weeks at 4°C after the above-mentioned treatments without serious damage to the seeds. The polyethylene bags were placed under water of 4°C in order to avoid rapid temperature fluctuations. On the other hand, the optimum temperature for testing their germinability was 10°C or 25°C.

Anatomical investigations on reproductive process and more studies on the response of seeds to low temperature are needed.

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