Factors Affecting Seed Production in *Endospermum Malaccense*

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Introduction

Endospermum malaccense (Sesenduk) is one of the many commercially important hardwoods indigenous to Malaysia for which genetic selection, tree improvement programs and seed orchards are being planned. The species is a member of the Euphorbiaceae, is dioecious, flowers periodically but often abundantly, however, the fruit and viable seed production is low. Abundant empty fruits and seeds are produced making germination percentage very low. Little is known about its reproductive biology, except some general morphological features and that it: (1) commonly flowers and sets fruit twice a year, September through November and January through May; (2) suffers from high degree of insect predation on fruits and seeds; and (3) only a small percentage of seeds are sound (less than 1%). Presently, propagation is primarily from cuttings and wildings, which are reasonably successful but expensive. Ultimately, if seed orchards are to be established attempts must be made to manage the crown for more efficient control of flowering and ease of fruit collection. Flowering periodicity should be reduced and pollination enhanced in order to increase fruit and seed production while reducing insect predation of fruits and seeds. To accomplish these goals a fundamental and applied study of the reproductive biology is required in order to determine the most important constraints to fruit and seed production. Then, recommendations may be made about how to best manage Sesenduk in order to provide propagules through a combination of cuttings, wildings and seedlings for reforestation. The important first stage in managing seed production is to understand the flowering process, seed ontogeny and the causes of flower, seed and fruit loss. The purpose of this study was to determine the causes of flower, seed and fruit loss and the stage of development at which losses occur. Specific study objectives were to 1) determine the general phenology of flowering and fruit development 2) determine the fruit and seed potential and the reproductive success 3) observations of possible pollinators 4) determine the common insect predators 5) determine the detailed development of the most important stages of seed and fruit development and the time when losses occur and their possible causes.

Materials and Methods

Several reproductively mature trees were selected in a natural regeneration stand in Air Hitam Forest Reserve , near Puchong, Selangor. *E.malaccense* is a dioecious species and sex of the tree can only be confidently determined when flowers appear. Scaffoldings were erected around trees to be sampled in order to obtained specimens from flowering branches high in the crown. Specimens were lightly moistened (sprayed) with water and placed immediately into plastic bags. The bags were placed in a styrofoam cooler with some ice and transported from field to the lab. Small samples of male and female inflorescences were collected at various stages of development, fixed in formalin acetic-acid-alcohol (FAA) and were critical point dried and observed using the scanning electron microscope (SEM) to determine the flower structure. Specimens of male and female inflorescences were also sampled regularly every alternate day from the earliest possible until maturity. At each collection date 10 – 20 individual flowers and young fruits dissected from the flowering stalks. All the specimens were fixed in FAA. Flowers were left attached to a short (5mm) portion of the stalk in order to make orientation of specimen easier. The special techniques for fixing and sectioning were specific for the type of species (nature of the fruit, seed coats and hardseededness), it will be detailed at a later time. Samples of male flowers from each tree were placed dry in a scintillation vial with the cap left off for a few hours so pollen would be shed. The cap then replaced and the vials were kept for the SEM study of mature pollen morphology. The first year of the study were actually exploratory, whereby the observations will form the basis of a detailed developmental study of embryo seed and fruit development and identify the times and possible causes for losses of these structures. The increase in fruit size was monitored through weekly collections and notes on fruit shapes, colour and texture noted and photographs taken. The specimen collected in the first year of the study were wax embedded and sectioned using the microtone. The sections about one millimicron were then mounted on slides and passed through staining procedures. Based on Year 1 observations, traps or nets for collecting the potential pollinators were erected or used.

Results and Discussion

The results of the first year of the study was quite promising as many trees both male and female were flowering within 50 meter radius. However, heavily flowering trees were mostly very tall and scaffolding on them was not practical. The flowers were quite minute and very difficult to detect. They were only detected when it has grown bigger and consequently missed the first few stages of the flower and fruit development. Due to the constraint scaffolding was constructed quickly using mangroves poles on a reasonably short tree(15 meter) but flowers were not heavy enough for the entire work. However, enough samples were taken and monitored as planned. The samples were wax embedded, sectioned,

mounted and stained. Sixty-four slides were produced. SEM on the flower samples has managed to produce for the first time pictures of the male and the female flowers showing also the morphology of the pollen grains. Filled seeds were quite scarce and seeds were infested by a larvae of an insect identified as *Dichoerocis puntiferalis*. My hypothesis is that the same insect pollinated the flower during anthesis, and at the same time impregnating the ovary and depositing its eggs, which lay dormantfor, some time until the fruit ripened. Morphologically good-sized fruit of Sesenduk without any signs of predation often bore empty seeds inside them as the embryos were eaten by the insect. As I have missed samplings the initial stages of fruiting my slides did not show any evidence of the insect eggs. The project were then shelved temporarily after the second, third, and fourth year as no flowering and fruiting was sighted at the sites during those years, perhaps it could be attributed to the haze condition and the El Nino phenomenon that hindered sesenduk flowering. But in August and September 2001, heavy flowering of Sesenduk were witnessed and two trees were logged to obtain the seed for a Master Project. However, almost 95% of the seeds were empty.

Conclusions

Despite the flowering constraints, some good slides on the flower and fruit development (though incomplete) and SEM micrographs of the reproductive structures were produced of the species studied. This IRPA project is well-planned, it was unfortunate that flowering were not observed during the later part of the study periods, especially the second and third year study that will helped to elucidate the objectives set at the onset of this report. I have used only 17%(RM13,188.43) of the fund allocated to me and would like to continue to pursue this study in the near future.

Benefits from the study

The study is incomplete, otherwise some of the answers if not all that were posed in the objectives could have been answered. This would certainly give much needed input to the forest plantation industry in Malaysia, as this species is one of the ten species being FRIM- earmarked for plantation.

Literature cited in the text

None.

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None.

Graduate Research

None.

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