A NEW KIND OF EPICOTYL DORMANCY IN SEEDS OF RAIN FOREST UNDERSTOREY TREE, *HUMBOLDTIA LAURIFOLIA* (FABACEAE, CEASALPINIOIDEAE)

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Introduction

Seed dormancy and seed storage behaviour of many tropical Fabaceae species remain unknown. Available information, mainly on temperate species, indicates that a majority of the Fabaceae species produce orthodox seeds with physical dormancy (i.e. caused by water impermeable seed or fruit coat, PY). However, there are some reports of physiological dormancy (caused by low growth potential of the embryo, PD), combinational dormancy (PY + PD) and nondormancy in seeds of some Fabaceae species (Baskin and Baskin, 1998). Neither morphological dormancy (caused by an underdeveloped embryo, MD) nor morphophysiological dormancy (PD + MD, MPD) is present in this family (Baskin and Baskin, 1998). To add to knowledge of seed dormancy of tropical Fabaceae species, we initiated a study on dormancy and storage behaviour of seeds of this family in Sri Lanka. Surprisingly, we observed that the germination characteristics of *Humboldtia laurifolia* are unlike those reported in the literature for a legume. Thus, special attention was devoted to germination of this species. The main objective of this research was to characterize seed dormancy and storage behaviour of *Humboldtia laurifolia* Vahl. (*Gal-karanda*), a tropical rainforest understory tree species native to Sri Lanka and India. No information is available on germination or seedling establishment of this species.

Materials and Methods

Mature seeds were collected from numerous *H. laurifolia* trees growing on a stream bank in Palawaththe degraded lowland rain forest in the Kaluthara district, on 15 December 2008 and on 5 February 2009. Seeds were placed in polythene bags and taken to the University of Peradeniya. Experiments were initiated within one week from the date of collection. Imbibition of nontreated and of manually scarified seeds was monitored by sequentially weighing individual seeds kept on moistened filter papers for 8 days. Hand sections of seeds were made, observed under a light microscope, and photographed with an Olympus DP 20 SE camera. Moisture content (MC) of fresh seeds was measured using the oven-drying method. Germinability and viability were determined at various temperature and light conditions for seeds dried to 30 %, 20 %, 15 % and 10 % MC or stored at -1 °C and 5 °C for 1 or 2 months. Time taken from radicle emergence to plumule

emergence was monitored. Plumule, hypocotyl and seed lengths of seeds at different germination stages were measured. Seeds at different stages of germination were photographed using Leica L2 stereo microscope camera.

Results and Discussion

Both nontreated (intact) and manually scarified seeds took up water, indicating that seeds do not have PY. Further, no palisade cells were observed in the seed coat, unlike seeds of Fabaceae species with PY. Seeds of both collections had high MC (42 – 58 %, fresh mass basis), suggesting that they are recalcitrant in storage behaviour. Recalcitrancy of these seeds were confirmed: seeds dried to 30 % and 20 % MC germinated to 40 % and 13.3 %, respectively, and none of the seeds dried to 15 % and 10 % MC germinated. Further, none of the seeds stored for 1 or 2 months at -1 °C or 2 months at 5 °C germinated. Radicles of > 80 % of the seeds of both collections tested under different conditions emerged within 1 month. The plumule of seeds of both collections in all treatments took a long (> 40 days) time to emerge after the emergence of the radicle. Prior to radicle emergence, both radicle and plumule were small compared to the whole seed, and the embryo axis was about 20 % of the length of the seed (Fig. 1). When the radicle first emerges, the plumule was still small. Under ambient laboratory conditions, the plumule began to increase in size about 20 - 25 days after radicle emergence (Fig. 1). Plumules take about 20 days to reach full length, after which they emerge from the side of the seed. Thus, seeds have epicotyl dormancy. Plumules of seeds incubated at high illuminance (glass house or outside) or in the dark took a longer time to emerge.

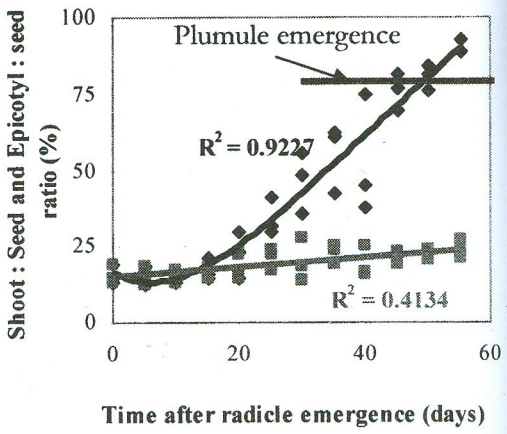

Figure 1. Length of plumule (diamond symbols) and length of epicotyl (square symbols) during seed germination up to plumule emergence of February-collected *H. laurifolia* seeds incubated at ambient laboratory conditions in Peradeniya.

These experiments show that seeds of *H. laurifolia* are recalcitrant and have epicotyl dormancy. However, most cases of epicotyl dormancy are reported for seeds with MPD. Seeds of *Chionanthus retusus* (Oleaceae) (Chien *et al.*, 2004), *Platonia insignis* (Clusiaceae) (Carvalho *et al.*, 1998), *Quercus alba, Q. prinus* (Farmer, 1977) and *Q. ilicifolia* (Fagaceae) (Allen and Farmer, 1977) were reported to have a delay in plumule emergence, but they also do not have MPD. Epicotyl dormancy of *H. laurifolia* differs from that of these species. Seeds of *Chionanthus retusus* are orthodox in storage behavior, and although there is a delay of plumule

emergence, the plumule starts to grow as soon as the radicle emerges. Unlike the situation in *H. laurifolia, P. insignis* and *C. retusus*, the epicotyl in seeds of the *Quercus* spp. is "fully developed" at seed maturity and thus does not have to grow within the seed before it emerges; emergence is coincident with the beginning of growth. In contrast to *H. laurifolia,* the radicle of *P. insignis* is also dormant and radicle emergence is delayed for > 30 days.

Conclusion

Seeds of *H. laurifolia* have an epicotyl dormancy that previously has not been reported. For this new kind of epicotyl dormancy, we propose the formula C_{nd} (root) – C_{1b}^{p} (epicotyl), *i.e.* the root is nondormant [C_{nd} (root)] and the epicotyl (plumule, superscript p) has nondeep physiological dormancy (C_{1b}), requiring exposure to a period at warm temperatures to emerge from the seed [C_{1b}^{p} (epicotyl)].

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