

grams in India and other Countries, 16 papers were read. Six papers pointed out, more than anything else, the large gaps existing between the research findings obtained in the laboratories and the practices adopted by the farmers and the inadequacies of present extension methodology in transferring the knowledge to the farmer community. In this context, Venkataraman (Directorate of Agriculture, Madras) recommended for adoption by other coconut-growing countries the organizational structure for research and development of Sri Lanka and Jamaica.

In the Plenary Session, the delegates recognized the need for maintaining and strengthening the contacts made by

the coconut research workers during the symposium. It was decided to form an international secretariat with its headquarters at Kasaragod (Kerala State, India) for the present for this purpose. All the delegates agreed that this symposium, the first of its kind on coconut, was successful in bringing together a large number of coconut research workers from several countries of the world. It also took note that others had been invited but that travel expenses for several other foreign delegates had not been forthcoming.

The proceedings of the symposium will be published in late 1978 by Wiley Eastern Limited, New Delhi.

Principes, 22(2), 1978, pp. 74-76

PALM BRIEFS

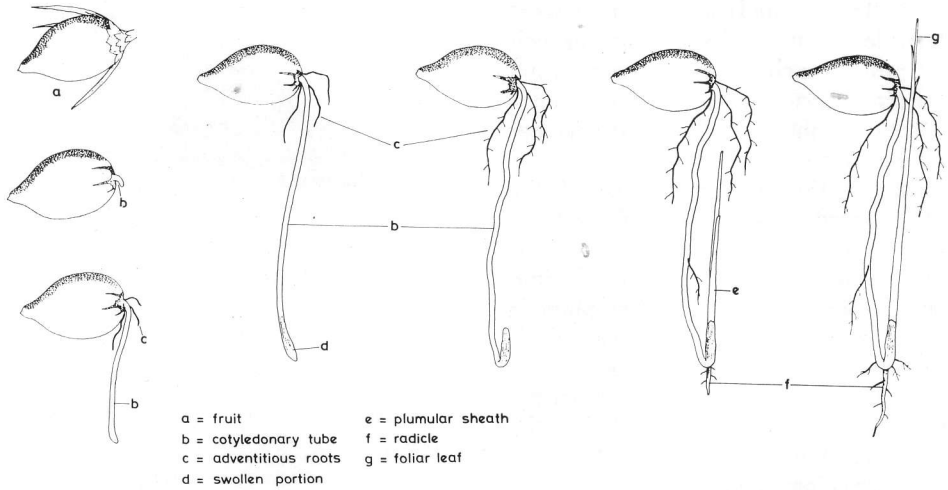
Mode of Germination in *Eugeissona tristis* Griff.

The lepidocaryoid genus *Eugeissona* with five species occurs only in the Malay Peninsula and Borneo. The species *E. minor* Becc., *E. insignis* Becc., and *E. utilis* Becc. are all Bornean. The two Malayan species are *E. brachystachys* Ridl., which is endemic to the National Park, Pahang, and *E. tristis* Griff., the common bertam (Fig. 1) occurring throughout dryland forests in the lowland and to about 2,500 ft in the mountains. There is little variation within the species *E. tristis* and only one variety (var. *gracilis* Dransfield) has been described from specimens collected in Johore.

The germination pattern of *E. tristis* does not conform to the variations described by Tomlinson (1960) for palm seedlings. Perhaps it is worthwhile here to present the sequence of events observed for discussion.



1. The clump-forming, "stemless" *Eugeissona tristis* at the fringe of the forest.



2. Sequence of germination of *Eugeissona tristis*.

The first sign of germination is a small protrusion formed by the cotyledon bursting through the micropyle at the basilar end of the palm fruit. This protrusion, which is positively geotropic, elongates and forms the extension or cotyledonary tube extricating the plantlet (radicle and shoot apex) from inside the seed to well below the soil surface. Lying within the seed in endosperm the remaining half of the cotyledon becomes

modified as a suctorial organ that swells to fill the entire cavity of the seed. The cotyledonary tube grows to a mean length of 21.86 ± 0.69 cm before orientating itself upright. The apex of the tube, which continues to push itself upwards in the soil, enlarges slightly. The plumule lies inside this swollen portion. The first plumular leaf or eophyll, which consist of a protective sheath, breaks through the apex and soon emerges

Table 1. Germination pattern of seedlings for 18 weeks after initiation of growth

Weeks*	Cumulative percentage of total seedlings recorded			
	Cotyledonary tube orientates upright	Appearance of swollen apex	Plumular sheath develops	First eophyll comes above ground
0	—	—	—	—
2	—	—	—	—
4	—	—	—	—
6	25.00	—	—	—
8	58.33	—	—	—
10	83.33	20.83	—	—
12	100.00	58.33	0.04	—
14	—	91.66	41.66	—
16	—	100.00	83.33	16.66
18	—	—	91.66	33.33

* Time as recorded from the first signs of germination.

above the ground level. Subsequent foliar leaves or eophylls issue through this protective sheath and are compound and pinnate, not unlike the adult fronds except that the number of leaflets per frond is less.

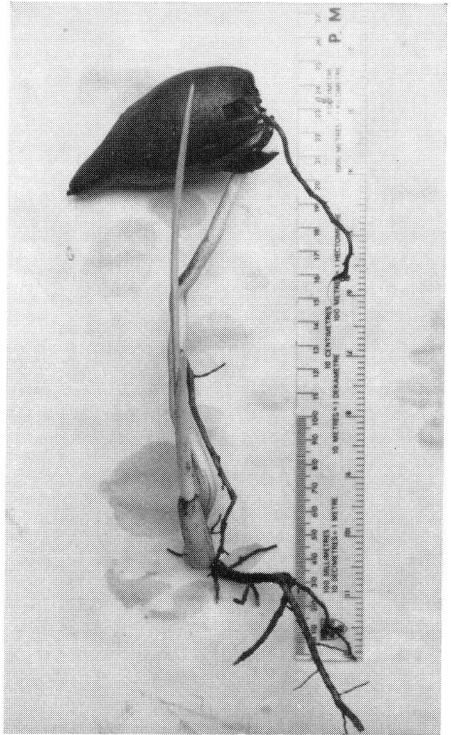
Shortly after the emergence of the cotyledonary tube, a few adventitious roots develop from near the orifice of the pericarp and grow downwards into the soil. The appearance of the plumule is preceded by that of the radicle, which develops from the base of the 'hook' where the cotyledonary tube turns negatively geotropic. More roots follow the development of the radicle at the base of the growing shoot.

The germination of *E. tristis* seems to comprise three phases:

- i) the extrication of part of the embryo from the seed in an undifferentiated state within the cotyledonary tube,
- ii) the cotyledonary tube plunges to a length of several centimetres in the soil before turning upright and
- iii) the plumule breaks through the distended region of the cotyledonary tube, and the first eophyll emerges from it above ground, the radicle elongating in the opposite direction below (Fig. 2).

Table 1 records the approximate time sequence of the various stages in the germination process. About half of the seedlings observed in a trial had produced a cotyledonary tube that began to grow upright by the eighth week. Towards the sixteenth week (Fig. 3) about a third of them had produced their first eophyll above ground. Thus, although the seeds had germinated for sometime they normally do not appear on the soil surface till another four months or so in the field.

Throughout the first year of its existence the seedling produces three to four leaves with an average length of 64.00 ± 0.54 cm. The first foliage leaf appears



3. Seedling of *Eugeissona tristis* 16 weeks old.

about five months after germination of the seedlings, followed by the second and third leaves in about another four to five months later.

LITERATURE CITED

TOMLINSON, P. B. 1960. Essays on the morphology of palms. I. Germination and the seedling. *Principes* 4: 56-61.

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