

India is performing at a fraction (approximately a tenth in the case of GDP) of what the norm could be. So, if the estimates in figure O-1 are correct, it could only mean that we have been miseducating the youth in a way that nearly 90% of our graduates neither contribute to the economy nor enable its innovation. Degrees in India are not without value

and the SEI data allow this to be quantified. There is such unevenness that our higher education system is largely ineffective in improving scientific output in particular or economic output in general.

1. <https://www.nsf.gov/statistics/2016/nsb20-161/#/> (accessed on 12 January 2018).

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Tricotyledony in *Pterocarpus santalinus* L.f. (red sanders; Faboidae), an endemic and endangered tree species of Kadapa hill ranges, southern Eastern Ghats, India

The presence of three cotyledons among dicots in contrast to the primary characteristic feature of having two cotyledons is rare and is referred as tricotyledony. It may be caused due to genetic variability¹. The incidence of tricotyledony was also reported among trees like *Acacia mellifera* (Vahl) Benth², *Butea monosperma* (Lam.) Taub³, *Emblica officinalis* Gaertn⁴ and shrubs like *Hippophae rhamnoides* L.⁵, *Withania somnifera* (L.) Dunal⁶, *Punica granatum* L.⁷ and even in critically endangered plants like

Ceropegia mahabalei Hemadri et An-sari⁸. In this study we present an observation of tricotyledony in *Pterocarpus santalinus* L.f. (red sanders). It is an economically important and endemic timber tree species with restricted natural habitat in Kadapa and Sheshachalam hill ranges of southern Eastern Ghats, Andhra Pradesh, India. It is also the dominant tree across the reserve forests of Kadapa hill ranges⁹. The tree reproduces mainly by seeds as well as vegetatively by stumps raised from cut stems.

Pods were collected during April–May 2017 from Kadapa hill ranges and seeds were extracted from the pods mechanically using secateurs. A total of 720 pods and 360 seeds were used, and similar kind of germination experiment was carried out for both pods and seeds for a period of six months with an interval of one month. Germination percentage of 53 (range 40–55%) was observed when pods were considered and lower rate was observed (31.3; range 15–33%) when seeds were germinated. Furthermore, out of

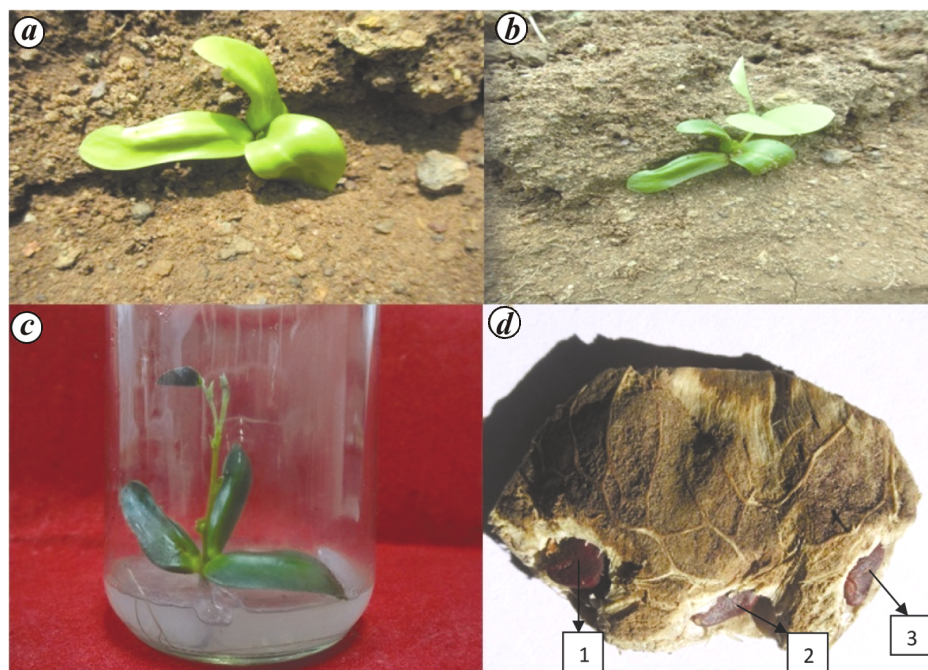


Figure 1. a, Incidence of tricotyledons in *Pterocarpus santalinus* L.f. seed germinated in the soil. b, Healthy seedling with tricotyledony featuring normal first true leaves. c, Seed germination with tricotyledony in basal MS medium. d, Pod showing trilocules filled with one seed.

Table 1. Details of number of pods and seeds used in germination experiments and their corresponding germination percentage

Variable	Frequency	Germination (%)
No. of pods used in the net house for germination (120 pods per month for six months)	720	381 (53) (range – 40–55)
No. of seeds used in the net house for germination (60 seeds per month for six months)	360	113 (31.3) (range – 15–33)
No. of seeds used in the 1× MS medium for germination in the laboratory	100	74 (74)

100 seeds, 74 (74%) were germinated in the 1× MS medium (Table 1). During these germination experiments in the net house, we observed a seedling with tricotyledons and another tricotyledonous seedling among the seeds germinated in the 1× MS medium (Figure 1 a–c). This indicates that the three cotyledons are symmetrically arranged in similar shape and size. The tricotyledon seedling observed in the net house is being successfully grown, while that identified in the laboratory did not survive after being transplanted in the net house. The growing seedling did not show any alteration in leaf phyllotaxy and shape. Usually, the pod of red sanders contains two locules filled with either one or two seeds¹⁰. Among the 600 pods examined, 94.7% (568 pods) was found to be with 2 locules and 32 pods were found with 3 locules. Out of 32 trilocular pods, a rare

event of a single seed in each locule was observed in two trilocular pods (Figure 1 d) and the other 30 pods were filled with either one or two seeds.

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