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INTRODUCTION

Shea tree (*Vitellaria paradoxa*) is a drought-tolerant oleaginous tree indigenous to savannah regions of sub-Saharan Africa. The shea fruit is consumed as a staple during the beginning of the rainy season while the butter extracted from the kernel is used to manufacture confectionery and as a base for medicines and lotions in the pharmaceutical industries (Masters et al 2004). Despite its huge economic benefits, the tree still remains wild. The germination of *V. paradoxa* is described as cryptogeal (Jackson, 1968) but the morpho-anatomical features of the seed that account for that germination type remain unreported. Thus, we used topographical tetrazolium (TTZ) test to determine the exact location of the embryonic axis and describe the morpho-anatomical features of the cotyledonary tube (pseudoradicle). The effect of seed size on germination was also evaluated.

APPROACH

Mature shea fruits were collected from parkland trees in the Upper West Region of Ghana and transported to the Biotechnology Centre of GAEC for the various studies (Figure 1).

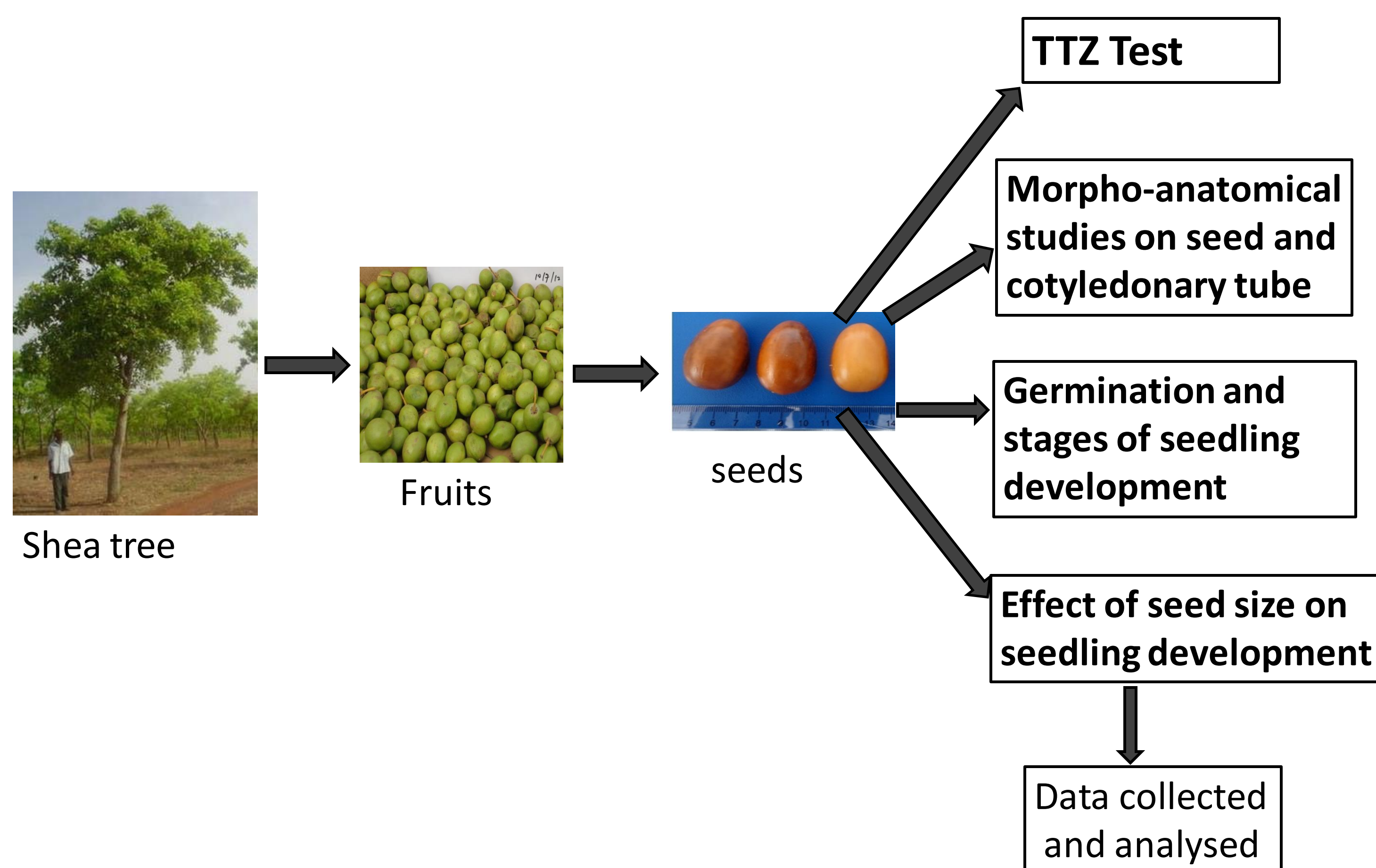


Figure 1. Flow chart showing the study approach from fruit collection to data analysis

RESULTS AND DISCUSSION

Identification and location of the embryo in *V. paradoxa* seed

All the fresh seeds in the tetrazolium chloride (TTC) solution stained deep red towards the proximal end, indicating the location of the embryonic axis (Figure 2A & B). A longitudinal section through a stained seed showed two differentially stained regions: a lighter portion suggesting the presence of the radicle and a deeper section indicating the presence of the plumule.

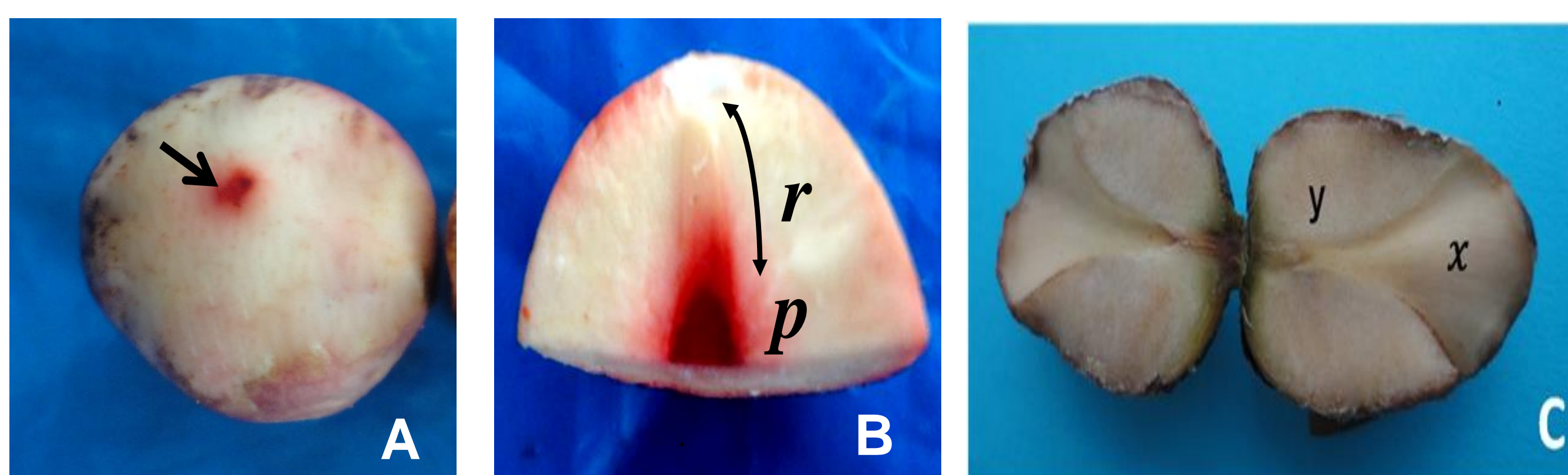


Figure 2. Cotyledon morphology of *V. paradoxa*: (A) Deep red stain by TTC (arrowed) shows a live embryo, (B) Embryonic axis showing radicle *r* and plumule *p*, and (C) Syncotylous (*y*) and schizocotylous (*x*) sections of a shea seed

Role of the cotyledonary tube in seedling development

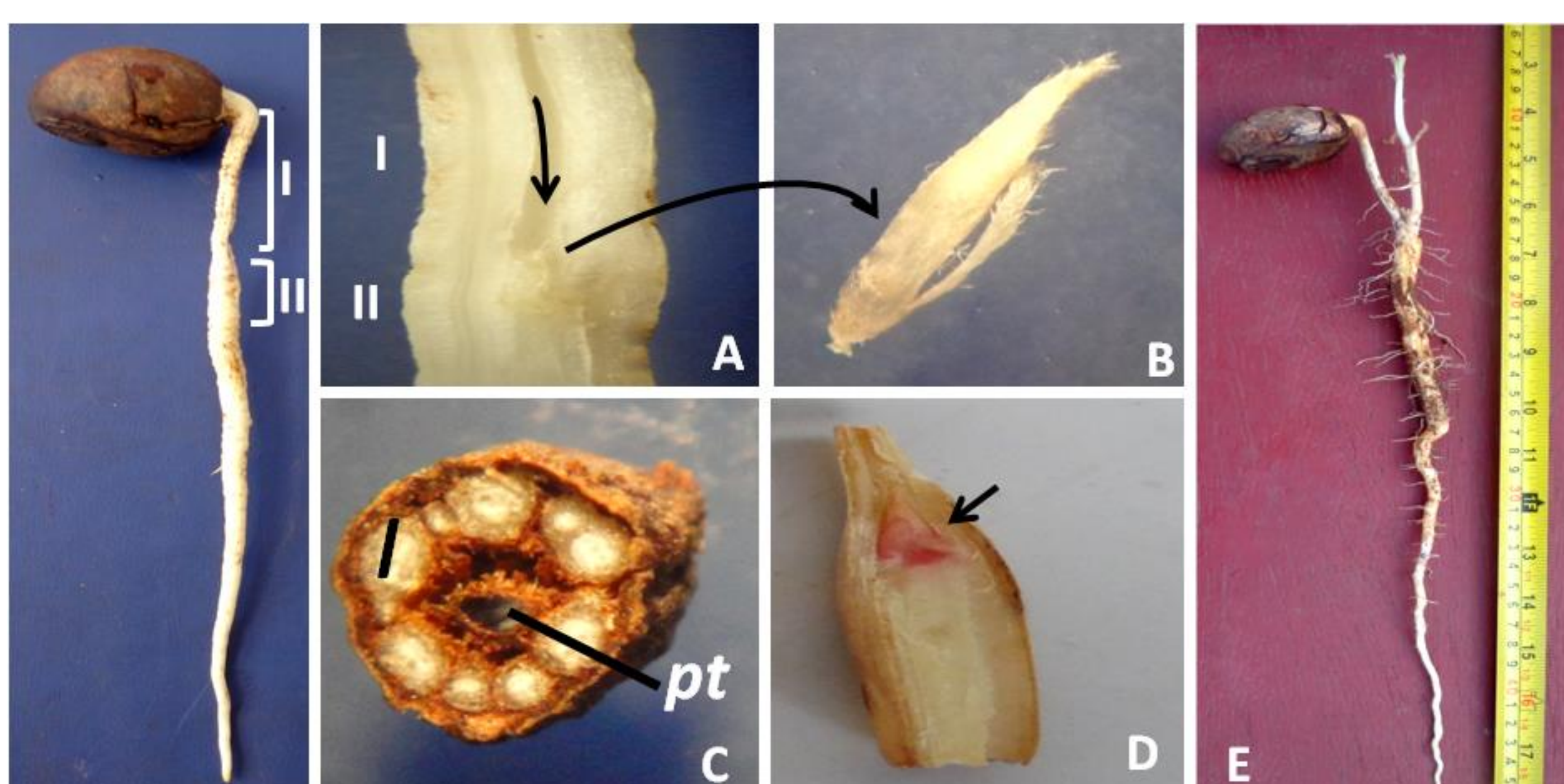


Figure 3. Morpho-anatomical features of the cotyledonary tube (I): (A) Longitudinal section showing a central tube (arrowed) and bulge (II), (B) Plumule, (C) Transverse section showing laticiferous vessels (I) and central tube (pt), (D) Rudimentary shoot (arrowed) and (E) Four-week old full cryptohypogeal seedling

Germination and developmental stages of shea seedlings

- The germination is cryptohypogeal (plumule-burying): the cotyledonary petioles distend into a 3–8 cm hollow tube and the plumule descends through the tube to develop into a rudimentary shoot which grows upwards (Figure 4).
- The developmental stages are 7: the first-five stages are skotomorphogenic whereas the last two are photomorphogenic.

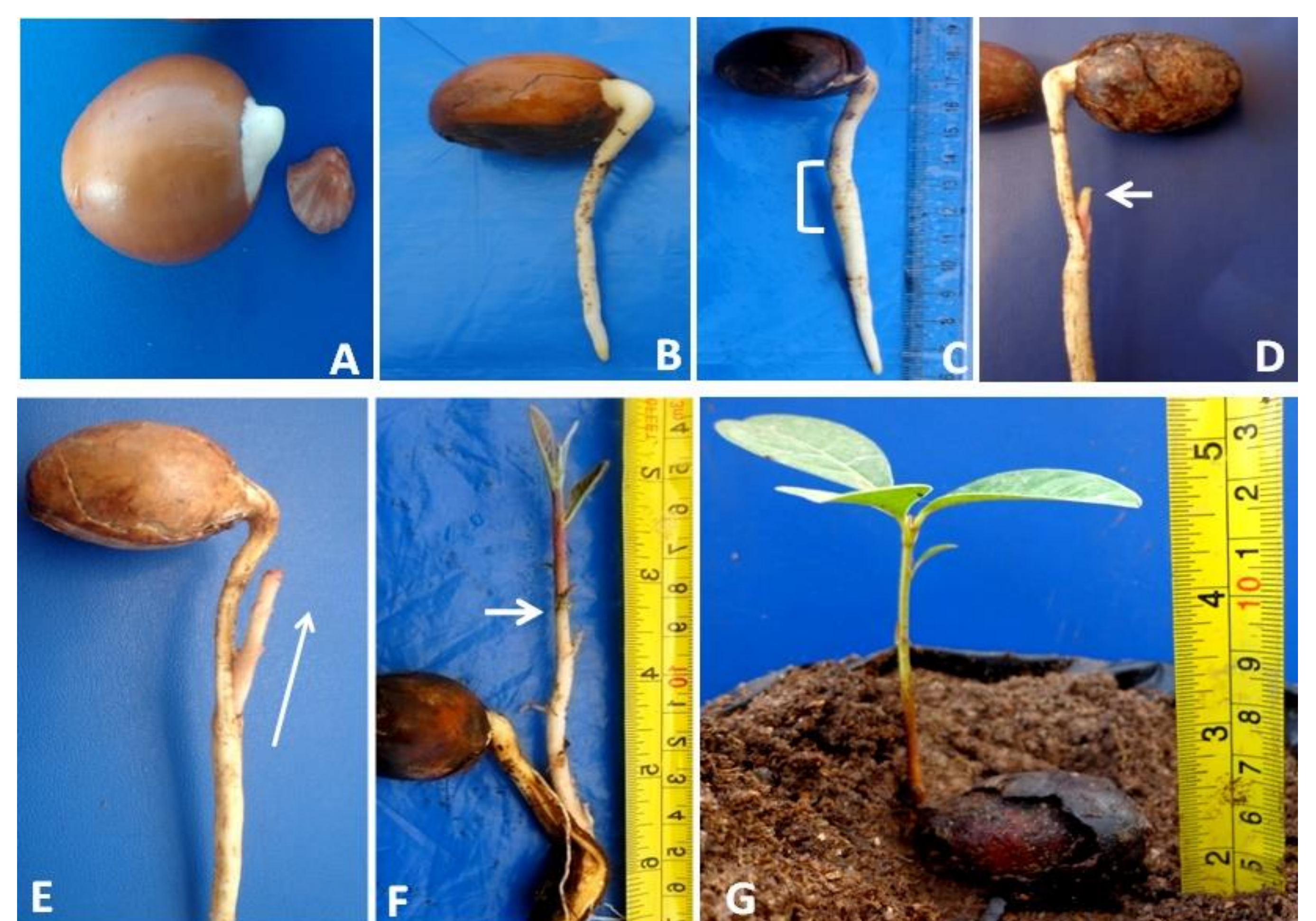


Figure 4. Stages of seedling development: (A) Sprouting, (B) Cotyledonary tube elongation, (C) Bulging, (D) Shoot appearance, (E) Shoot elongation, (F) Emergence and (G) Establishment

Seed size affects seedling development in shea

Table 1. Effect of seed size on the stages of shea seedling development

Seed size	Days to						
	MGT	CTE	Bulging	SA	*SE	Emergence	EST
Small	11.52c	21.52b	27.86c	37.99c	37.03	75.02b	97.42a
Medium	9.15b	15.89ab	25.69b	33.31b	32.16	65.47a	99.29a
Large	6.98a	11.55a	20.76a	25.36a	35.34	60.70a	114.26b
LSD _(0.05)	1.95	5.78	1.85	3.49	-	5.57	6.55

MGT: Mean germination time; CTE: Cotyledonary tube elongation; SA, Shoot appearance; SE, Shoot elongation; EST, Establishment and *SE = Emergence – SA.

CONCLUSIONS

- The embryonic axis of *V. paradoxa* seed is located at the proximal end.
- The cotyledons are fused at the proximal end but are free at the distal end.
- The proximal syncotily makes the seeds exhibit cryptohypogeal germination.
- A cotyledonary tube comprises sheath, laticiferous vessels and central hollow tube.
- Seed size has a significant effect on seedling development with either small or medium-sized seeds producing vigorous seedlings.

REFERENCES

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