SEEDLING EMERGENCE AND PERFORMANCE OF TEN ACCESSIONS OF *DALIUM GUINEENSE* IN DIFFERENT GROWTH MEDIA

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ABSTRACT

The black velvet tamarind, which is of the family Fabaceace is a minor fruit crop whose pulpy fruit is deeply rich in tartaric acid that is a strong anti-oxidant against free radicals in the human body as well as a number of vital vitamins and minerals. The fruit is also rich in a couple of volatile pytho-chemicals, hence has strong medicinal values while its wood is a veritable source of charcoal. A study was initiated to generate information on seedling emergence and growth of ten accessions of velvet tamarind collected from different locations in southeast Nigeria with the aim of determining the effect of different growth media on seedling emergence and growth in velvet tamarind. The accessions were sown in growth media containing different ratios of sawdust, poultry manure and top soil (1:2:3, 2:3:1, 3:2:1 and 3:1:2). The studies revealed that the seedlings of velvet tamarind responded significantly ($P<0.05$) to the different growth media compositions evaluated with combination ratio of 3:1:2 exhibiting the best response while 2:3:1 had the least response. Among the velvet tamarind accessions studied, accession one (1) closely followed by accession ten (10) which had the highest seedling emergence, while accession four (4) had the lowest seedling emergence as well as low growth. The results have shown that media compositions, especially sawdust, poultry manure and top soil in the ratio of 3:1:2 have strong influence on seedling emergence and growth of velvet tamarind accessions.

Key words: Velvet tamarind; accession; growth media; seedling growth.

INTRODUCTION

Indigenous fruit trees such as velvet tamarind contribute to food and nutrition security, health and income generation of rural communities in sub-Saharan Africa (SSA). According to Teklehaimanot (2008) and Jamnadass *et al.* (2011) most African indigenous fruits are relatively unknown in global markets and most species remain undomesticated due to inadequate knowledge and bias of research and development in favour of Large-scale agriculture.

Velvet tamarind (*Dialium guineense*), which is of the family Fabaceae is a woody plant commonly found in the forest and savannah belts of Nigeria and there are three main species viz: *Dialium dinklagei*, *Dialium pachyphyllum* and *Dialium guineense* of

which *Dialium guineense* is the commonest and most widely spread in Nigeria. Its fruit is a good snack because of its refreshing properties and pleasant scorching taste. The mature dry circular pods are cracked open to release the semi-dry edible fruit pulp, which also embeds the seed. The fruit is a veritable source of protein, minerals, vitamin C, lysine and tryptophan (Ogbe and Egharevba, 1992; Arogba *et al.*, 2006). Studies by Okegbeli and Taiwo (1990), David *et al.*, (2011) as well as Ogu and Amiebenomo (2012) showed that fruits of velvet tamarind contain fibre, sugars (namely, fructose, glucose, sucrose and maltose), ascorbic acids, polysaccharides, protein and lipids, while according to David *et al.* (2011), some of the phytochemicals identified in the leaf and stem bark extracts of the plant include tannins, alkaloids, flavonoids, saponins, steroids and cardiac glycosides. However, the young leaves are sometimes chewed for its tangy taste.

In sub-Sahara Africa, large plantation schemes of velvet tamarind have not been easy to establish due to inherent slow growth, problems of irregular fruiting, pests and diseases attack, as well as seed dormancy associated with the plant. According to Ogbe and Egharevba (1992), the fruits of velvet tamarind has high consumption rate but the tree is of less priority in terms of research, production, improvement and storage. Hence, it has no known domestication.

Previous studies have shown that germination of velvet tamarind, whose seed is characterized by its thick gelatinous seed coat, has being a problem depending on the planting media used in the propagation (Nwaoguala and Osaigbovo, 2009). Furthermore, Egharevba *et al*. (2005) submitted that a potting medium containing topsoil and manure at a 2:1 ratio produced superior growth in African walnut (*Plukenettia conophorus*) while Osaigbovo *et al*. (2009) recommended sole decomposed oil palm refuse bunch as a superior growth medium for African star apple (*Gambeya albida*) seedlings. A number of studies have shown that poor growth of seedlings in potting media can be attributed to poor physical composition of the growth source, which hinders aeration resulting in poor water and nutrients utilization by the plant (Khan *et al*., 2006; Osaigbovo *et al*., 2009). The amendment of growth media with coarse materials such as sawdust to enhance aeration and drainage is imperative. Hence, the objective of this study, was to determine the effect of different growth media on seedling emergence and growth in velvet tamarind.

MATERIALS AND METHODS

Ten accessions of velvet tamarind collected from different locations in the humid rainforest zone of southeast Nigeria (Table 1) were evaluated at the Forestry Research Institute of Nigeria, Eastern Research Centre, Ahieke, Umuahia, Abia State, Nigeria, (latitude 5^{o} 32′ N and longitude 7^{o} 29′ E, altitude 122 m above sea level). The location is characterized by an annual rainfall of

about 2,238 mm, mean air temperature range (23 to 34 ºC) and mean relative humidity range (50 to 86.4 %).

Table 1: Source and geographical location of accessions with their accession numbers

Accession no.	Source	Longitude	Latitude
Acc 1	Owerri	5º 42′ N	7º 10′ E
Acc 2	Okigwe	5º 84′ N	7º 34′ E
Acc 3	Orlu	5º 74′ N	7º 06′ E
Acc 4	Okpala	5º 31′ N	7º 22′ E
Acc 5	Ohaji	5º 32′ N	6º 97′ E
Acc 6	Umuahia	5º 52′ N	7º 49′ E
Acc 7	Aba	5º 10′ N	7º 35′ E
Acc 8	Umudike	5º 49′ N	7º 53′ E
Acc 9	Isuikwuato	5º 79′ N	7º 50′ E
Acc 10	Ohafia	5º 69′ N	7º 64′ E

The 10 x 4 factorial arranged experiment was laid out in a split plot in completely randomized design (CRD) with growth media as the main plot and the velvet tamarind accessions fitted into the sub-plots and there were three replications giving a total of 120 plot observations. The growth media, which comprised of different ratios of sawdust, poultry manure and top soil, are indicated in Table 2.

Five litre nursery seed pots were filled with different growth media ratios as specified in the main plot treatments. Five de-pulped seeds per accession were sown into the pots and kept under a shade tree of *Pinus caribeen* to conserve moisture, reduce the direct effect of solar radiation, and heat on the seedlings as well as lower the temperature of the media mix. The seedlings were appropriately watered in the mornings at two days interval to ensure that the moisture content of media was kept at field capacity throughout the period of the experiment. The watering continued until the rains were established.

Table 2: Growth media, comprising of different ratios of sawdust, poultry manure and top soil

Media sources			Ratio
Saw dust	Poultry manure	Top soil	1:2:3
Saw dust	Poultry manure	Top soil	2:3:1
Saw dust	Poultry manure	Top soil	3:2:1
Saw dust	Poultry manure	Top soil	3:1:2

Samples of the growth media ratios were collected and subjected to laboratory analysis for their chemical characteristics. Total nitrogen was determined by MicroKjeldahl method of Bremmer and Mulvancy (1982) while available phosphorus was determined by Bray No. 2 method of Bray and Kutz (1945). Ca, Mg, K and Na were extracted following the procedure outlined by Maclean (1982) using the neutral Ammonium Acetate Saturation (AAS) method. Soil organic carbon was determined by the improved chromic acid digestion and spectrophotometric method (Heanes, 1984).

Data collection

Seedling emergence was scored on daily basis from the period plumule emerged above the soil in the seedling pots Data on plant height (cm) was taken with the aid of a meter rule by measuring from the soil surface to the tip of the plant, number of leaves seedling^{-1} was obtained by counting and stem collar diameter (cm) read with the aid of a venier caliper. These data were collected at different growth stages (6, 8, 10, 12 weeks after planting) while data on root length, number of roots seedling^{-1} were taken only at 12 weeks after planting (WAP.) Seedling fresh weight (g), root fresh weight, and shoot dry weight which was obtained by subjecting it to oven drying at a temperature of 70 ^{o}C until a constant weight was obtained was taken at 12 WAP with the aid of a sensitive weighing scale mode (Sartorius Basic, BA 2105).

All the obtained data were subjected to Analysis of Variance using Genstat Discovery 10.3 DE Edition 12. Difference between means was separated using Fisher's LSD at 5% level of probability following the procedure laid out by Obi (2002).

RESULTS

The main effects of nutrient compositions of media compositions (Table 3) obtained from the Analyses of Variance (ANOVA) indicated that except sodium (Na) and magnesium (Mg), most of the nutrients in the media differed significantly ($P<0.05$). Organic matter (OM), organic carbon (OC), Nitrogen and Na were highly significant ($P<0.001$) compared to potassium (K) and phosphorus (P) that showed significance ($P<0.05$).

TABLE 3: Main effects of nutrient compositions of media combinations

Media	Ratio	N (%)	Avail. P (mg kg-1)	K (cmol kg-1)	Na (cmol kg-1)	Ca (cmol kg-1)	Mg (cmol kg-1)	O C (%)	OM (%)
Sawdust + poultry manure + top soil	1:2:3	1.61	0.33	1.08	0.24	2.40	0.43	4.54	7.82
Sawdust + poultry manure + top soil	2:3:1	3.15	0.48	0.73	0.26	1.05	0.43	15.05	25.95
Sawdust + poultry manure + top soil	3:2:1	2.87	0.19	1.09	0.19	1.20	0.55	12.45	21.46
Sawdust + poultry manure + top soil	3:1:2	2.35	0.25	1.29	0.18	1.10	0.52	8.50	14.66
Mean		2.494	0.313	1.049	0.22	1.437	0.482	10.13	17.47
$LSD_{0.05}$		0.27***	0.17*	0.29*	ns	0.22***	Ns	1.17***	2.01***

***= P<0.001, ** = P<0.01, * = P<0.05, ns=Not significant

Media combination of sawdust, poultry manure and top soil in the ratio of 2:3:1 had the highest amount of N, P, Na, OC and OM but gave very low K, Ca and Mg relative to the other media combinations.

Seedling emergence at 8 WAP (Table 4) of some velvet tamarind accession as influenced by media combinations of saw dust, poultry manure and top soil in the ratio 3:1:2 gave the highest seedling emergence which was higher by 21.5, 47.4 and 20.8 % compared to 1:2:3, 2:3:1 and 3:2:1 media ratios used in the study.

Table 4: Seedling emergence of some velvet tamarind accessions as influenced by different media combinations

Media	Accessions											
	Ratio	1	2	3	4	5	6	7	8	9	10	Mean
Sawdust + poultry manure + top soil	1:2:3	31.10	28.83	31.10	15.53	33.27	17.77	22.17	11.09	22.20	22.20	23.53
Sawdust + poultry manure + top soil	2:3:1	13.32	13.32	13.30	6.65	17.77	17.73	24.40	17.73	15.53	17.75	15.75
Sawdust + poultry manure + top soil	3:2:1	44.40	24.40	28.87	11.09	26.63	31.07	11.09	19.97	22.20	17.77	23.75
Sawdust + poultry manure + top soil	3:1:2	39.97	33.27	33.30	11.09	35.53	37.77	17.75	13.30	17.77	59.97	29.97
Mean		32.20	24.95	26.64	11.09	28.30	26.08	18.85	15.52	19.42	29.42	23.25
$LSD_{0.05}$		**Media = 6.063****			**Accessions = 8.696*****			**Media x Accessions = 17.20****				

***= P<0.001, ** = P<0.01**

Media combinations of sawdust, poultry manure and top soil significantly (P<0.05) increased plant height, number of leaves plant-1, and collar diameter of velvet tamarind at 8 WAS (Figure 1). The lowest plant height (4.50 cm), number of leaves $plant^{-1}$ (2.12 cm) and collar diameter (0.49 cm) were obtained when the media combination of sawdust, poultry manure and top soil in the ratio of

2:3:1 was used. Except plant height and collar diameter, number of leaves plant^{-1} among the velvet tamarind accessions evaluated varied significantly ($P<0.01$) and subsequently increased in this order Acc 5> Acc 6> Acc 3> Acc 4> Acc10> Acc 7> Acc 1> Acc 2> Acc 8> Acc 9.

The interaction between growth media and velvet tamarind accessions was not significant ($P>0.05$).

The main effects, of some growth attributes such as root length, number of roots plant^{-1}, stem fresh weight, shoot fresh weight, root fresh weight and shoot dry weight (Figure 2) showed significant ($P<0.05$) variations among the growth media while among the accessions, except seedling fresh weight and shoot dry weight, the other attributes varied significantly.

The root length of the seedlings were longer and exhibited more number of roots plant^{-1} when planted in the media ratio of 3:2:1 (sawdust: poultry manure: top soil) compared with the other media ratios while 1:2:3 media ratio induced higher seedling fresh weight (0.35 g), root fresh weight (0.02 g) and shoot dry weight (0.12 g) relative to other ratios studied, especially that of 2:3:1.

Among the accessions, ACC 3 gave the longest root length, number of roots plant^{-1} and seedling fresh weight compared to the other velvet tamarind accessions. Significant ($P<0.05$) highest root fresh weight was obtained in ACC 4 while ACC 6 gave the highest shoot dry weight relative to the other accessions. The interaction between the two factors (growth media and velvet tamarind accession) was not significant.

DISCUSSION

The planting media (sawdust, poultry manure and top soil in the ratios of 1:2:3, 2:3:1, 3:2:1 and 3:1:2) proportions, increased seedling plant height, number of leaves plant-1, collar diameter, root length, number of roots plant-1, seedling fresh weight plant^{-1}, root fresh weight plant-1, shoot fresh weight plant^{-1}, and root dry weight plant^{-1}.

The results obtained corroborated similar studies on manure application by Baiyeri and Tenkouano (2008), Aba *et al*. (2011) and Ndukwe *et al*. (2011) who averred that animal manure is a veritable source of crop nutrition, which enhances the soil biophysical conditions thus making it more productive and sustainable for plant growth and performance. Also, it corroborates with related studies by Orhue *et al*. (2007) on some chemical properties of soils amended with brewery effluent in which they indicated that the application of effluent increased plant nutrient uptake and leaf production.

The difference in the nutrient composition of the media may not be unconnected with the variation in the organic matter content in the different components of the growth media. Most of the accessions differed distinctively and significantly ($P<0.05$) from each other. Highest significant number of leaves plant-1, longest root length and root fresh weight plant-1 were obtained under

accessions 6, 3 and 4, respectively. The study indicated that growth media in different ratios induced better performance of velvet tamarind seedlings compared to planting them on any unmarked soil or media. Media combinations of sawdust, poultry manure and top soil in ratios of 3:1:2 and 1:2:3 had the right proportions of nutrient compositions suitable for the crop. Our findings are in consonance with similar studies by Aghatise and Egharevba (1994), Nwaoguala *et al*. (2007), Adepoju and Onasanya (2008) as well as Oboho and Ogana (2012) on response of velvet tamarind to different and potting media.

CONCLUSION

The media combinations of sawdust, poultry manure and top soil in ratios of 3:1:2 and 1:2:3 had the correct proportions of nutrient composition suitable for velvet tamarind germination, and seedling establishment, hence could be encouraged as one of the standard potting media for the crop.

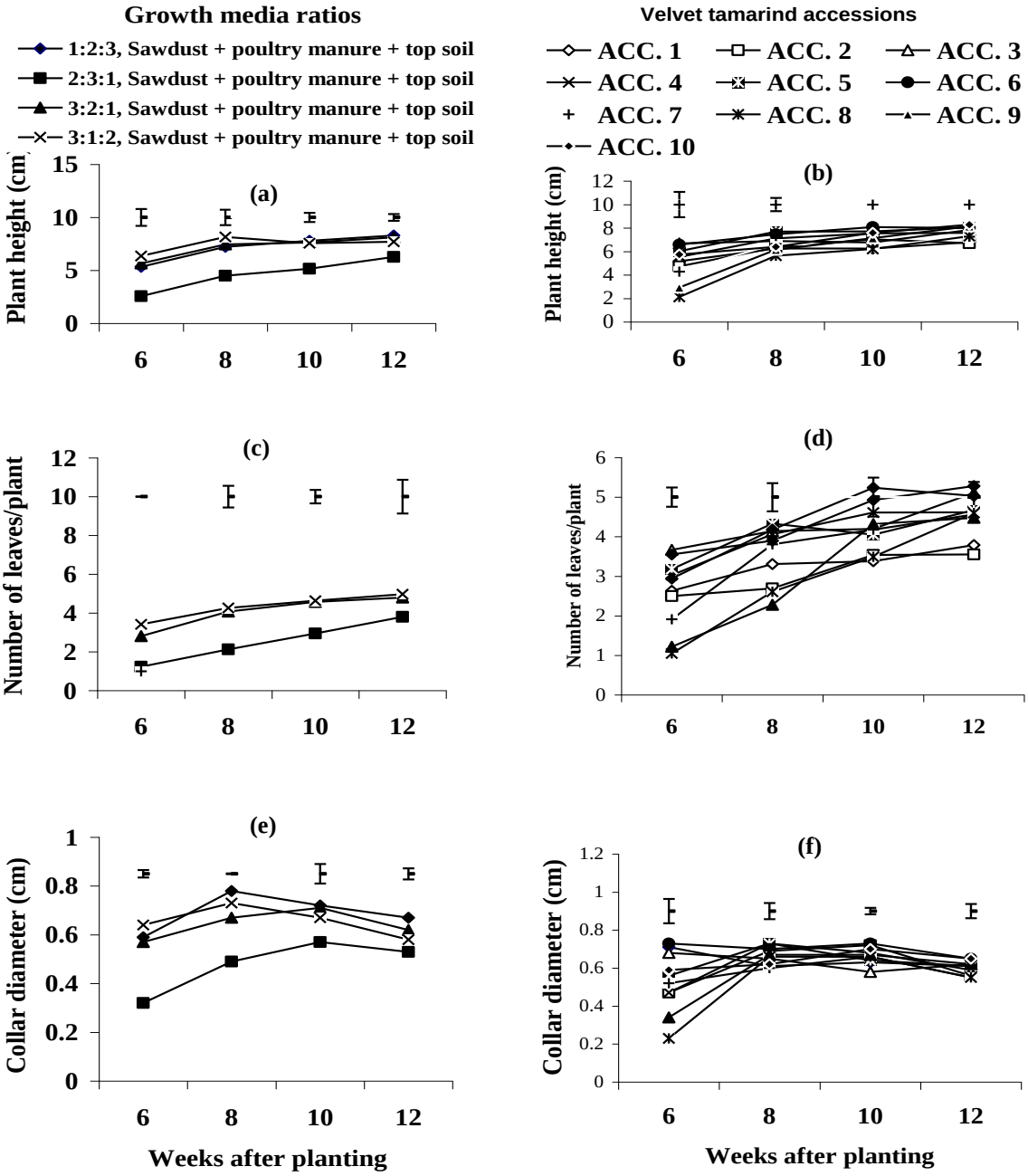

Fig. 1: Main effects of (a, b) plant height (cm), (c, d) number of leaves plant-1 and (e, f) collar diameter (cm) of some velvet tamarind accessions as influenced by different media combinations. (Error bars on graph represent standard error of difference between means).

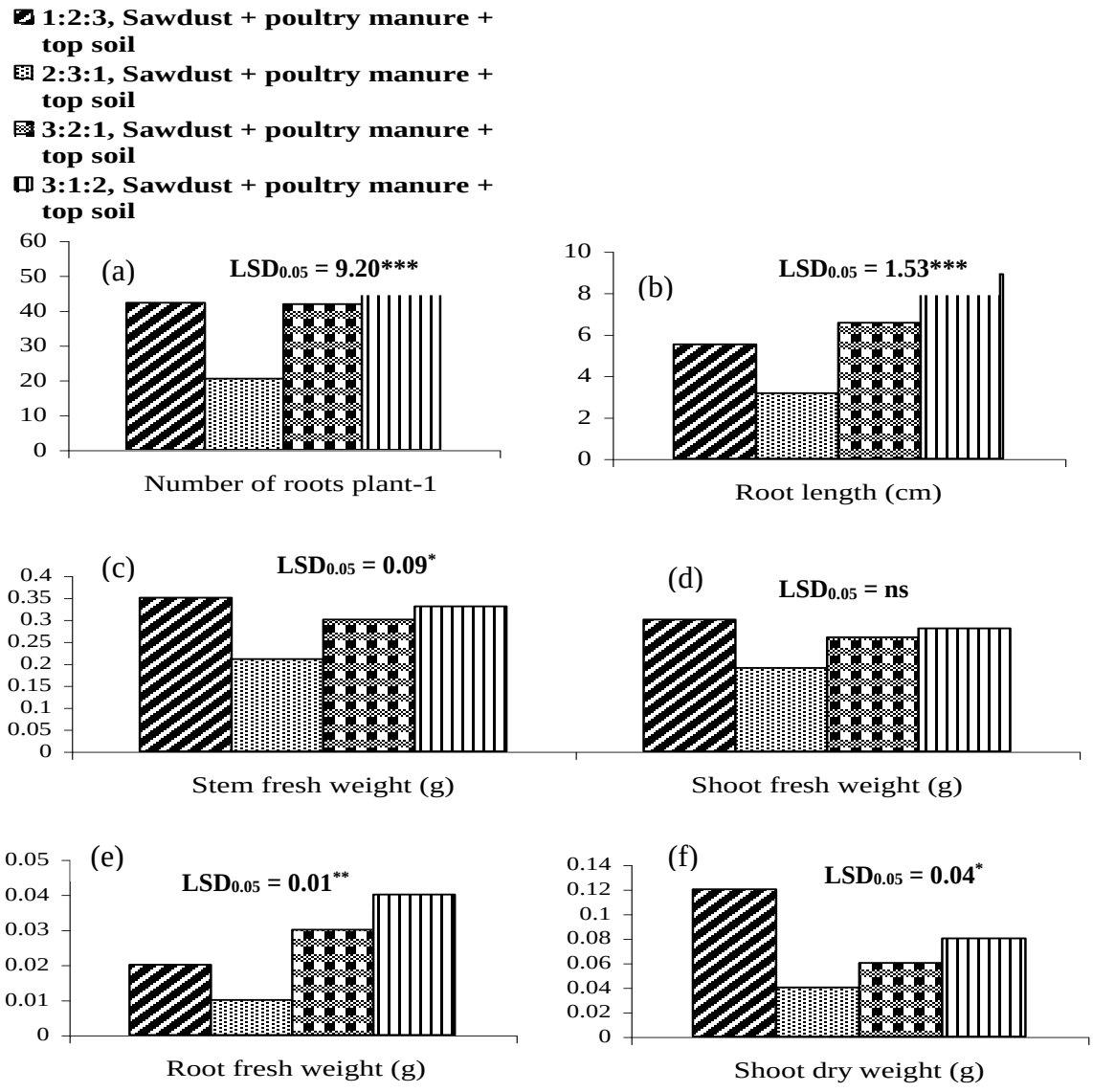

Fig. 2: Main effects (media combination) of (a) number of roots plant-1, (b) root length (cm), (c) stem fresh weight (g plant-1), (d) shoot fresh weight (g plant-1), (e) root fresh weight (g plant-1) and (f) shoot dry weight (g plant-1) of some velvet tamarind accessions as influenced by different media combinations. (*** = P<0.001, ** = P<0.01, * = P<0.05, ns = non-significant).

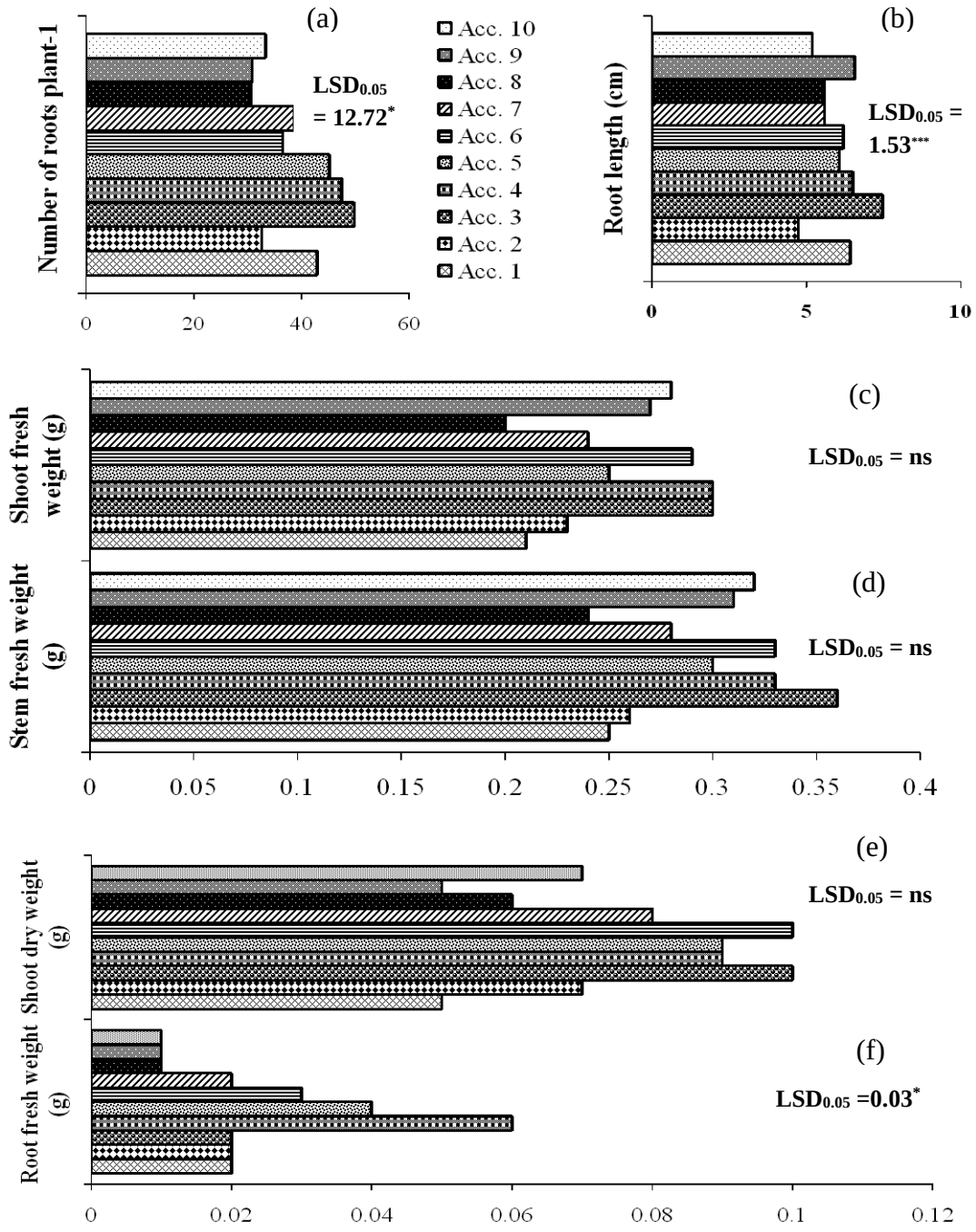

Fig. 3: Main effects (accession) of (a) number of roots plant-1, (b) root length (cm), (c) stem fresh weight (g plant-1), (d) shoot fresh weight (g plant-1), (e) root fresh weight (g plant-1) and (f) shoot dry weight (g plant-1) of some velvet tamarind accessions as influenced by different media combinations. (*** = P<0.001, ** = P<0.01, * = P<0.05, ns = non-significant).

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