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HORTICULTURE

Growth Performance of *Ipomoea pes-caprae* (L.) R. Br. Cuttings in different Media Combinations

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ABSTRACT

Ipomoea pes-caprae (L.) R. Br. is widely distributed as a beach plant and associated with mangroves. *I. pes-caprae* possesses ornamental and medicinal potential. This plant is used as folk and tribal medicine as well as in traditional system of medicine. Cuttings of *I. pes-caprae* were raised in different media combinations like soil, sand, cocopeat, soil+sand (1:1), soil+cocopeat (1:1) and soil+compost (1:1) under fresh water condition. Two replicates of each combination were prepared. One set of *Ipomoea* cuttings in each media was placed under direct sunlight condition and another set was placed under shadenet condition. Growth performance was studied by using various media. The cuttings of *I. pes-caprae* were found to be growing successfully in fresh water. Growth performance was better in soil+compost media in shadenet condition as compared to cuttings raised in direct sunlight condition. Increment in height (71.53 cm), number of leaves (27.67) and the survival percentage (96%) were observed. *Ipomoea* cuttings raised in soil +compost media under shade net condition. Similarly, increment in the height (49.2 cm), number of leaves (25.66) and survival percentage (88%) was observed for *Ipomoea* cuttings raised in soil +compost media under direct sunlight condition. Analysis of variance (ANOVA) was done (P≤0.05) and t-Test was used for comparing treatments.

Highlights

- *Ipomoea pes-caprae* is a sand dune plant, it is successfully grown in soil, cocopeat, soil+sand, soil+cocopeat and soil+compost (1:1) and in fresh water condition.
- Most suitable media for *I. pes-caprae* cuttings were soil+compost.

Keywords: *I. pes-caprae,* fresh water, survival percentage, shadenet, direct sunlight

Ipomoea pes-caprae (L.) R. Br. belongs to family convolvulaceae. Common name of *Ipomoea* is maryadvel and Railroad vine. They are characterised with very long, strong stems and form thick mat on the open beach. Leaves are smooth, thick, two lobed and it looks like goat's foot print. Flowers of *Ipomoea* are lavender in colour and very attractive. It is found on sandy beaches and near mangrove areas. It has ornamental and medicinal properties. Under favourable condition, cuttings of *Ipomoea* are used for regeneration and they produces identical new plants (Mohyeldeen 2009). *I. pes-caprae* (L.) R. Br. is a commonly occurring plant and is observed in sand dunes, sandy beaches, and encroached mangrove areas and along the mangroves (Gokhale *et al.* 2011). Sand dune plants play an important role in protecting the coast from flooding and erosion (Desai 2000). In Orissa roots and leaves of *Ipomoea* are used for treatment of gonorrhoea, stomachache and rheumatism, skin infection (Pattanaik *et al.* 2008). Seeds of *Ipomoea* are used for treatment of fatigue. All plant parts are used for treatment of inflammation caused by jellyfish allergy and swelling in the body caused by wind element (Ravindran *et al.* 2005). *I. pes-caprae* showed pharmacological activity (Manigaunha *et al.* 2010) and possess antispasmodic, anticancer, antioxidant, analgesic and antinflammatory, antinociceptive, antihistaminic, insulogenic and hypoglycemic activities (Kumar *et al.* 2014). Genistein and 5,7,4′

Trihydroxisoflavone isolated from roots of *I. pes-capre* are used as pharmaceutical components to cure human disease (Robrert *et al.* 2016). Leaf extract of *Ipomoea* showed a considerable amount of sun screen activity, perhaps treated with antioxidant activity (Ratnasooriya 2017).

Nichols and Savidov (2009) suggested that growth media plays the main role in plant growth and consistency. Shinde and Chavan (2013) studied the propagation of mangrove associate plant *Ixora coccinea* L. and noted that growth hormone (GA) and nursery conditions played an important role in growth performance of plants. Shinde and Chavan (2017) studied seed germination of mangrove associate plant *I.coccinea*. Flowers of *I. pes-caprae* are pinkish lavender coloured. Due to its attractive flowers, this plant is used as an ornamental plant (Divya and Thomas, 2015). Singh *et al.* (2015) studied effect different IBA concentrations and different media combinations on growth performance of *Citrus limon* cuttings. *I. pes-caprae* possesses ornamental and medicinal potential, through vegetative propagation conservation attempt will be made.

MATERIALS AND METHODS

Healthy cuttings of *Ipomoea* were collected from Achara beach in Sindhudurg district. These cuttings were washed with water and leaves were removed, then cut into 15 cm length. These cuttings are raised in different media like soil, sand, cocopeat, soil + sand, soil + cocopeat and soil + compost (1:1). Two replicates of each sets were prepared for *Ipomoea* cuttings with above media. One set of *Ipomoea* with each medium was in direct sunlight condition (Set 1). Another set was placed in shade net condition (Set 2). All these cuttings were irrigated with fresh water and monitored after every two days. After 30, 60, 90, 120 and 180 days, increment in height (cm), increment in number of leaves, survival percentage of *Ipomoea* cuttings were recorded.

RESULTS AND DISCUSSION

Increment in height of *Ipomoea pes-caprae* (L.) R. Br. cuttings in different media combinations

Analysis of variance was done from the values of Fig 1 using Microsoft excel 2013. The obtain values of F statistics as F 3, 6 =13.19. Calculated F is 13.19 ≥ table F 2.60 and p value is smaller than 0.05 and also for media combinations, calculated F is 12.92 ≥ 2.60 table F and p value is smaller than 0.05. So the null hypothesis was rejected, Ho: significant difference in treatment effects.

Cuttings of *Ipomoea pes-capae* raised in direct sunlight condition (Set 1), and in different media like soil, sand, cocopeat, soil+sand, soil+cocopeat and soil+compost. Increment in height of *Ipomoea* cuttings was studied after 30, 60, 90, 120, 150 and 180 days. After 30 days, higher stem length was observed in soil+compost followed by soil + cocopeat. Lower stem length observed in the cocopeat followed by sand. After 60 days, higher stem length was observed in soil+compost and the lower stem length observed in sand. After 90 days maximum stem length was recorded in soil+compost followed by soil+cocopeat and the lower stem length observed in sand followed by soil, After 120, 150 and 180 days, higher increment in the stem length was observed in soil+compost, while the short stem length was found in the sand (Fig. 1).

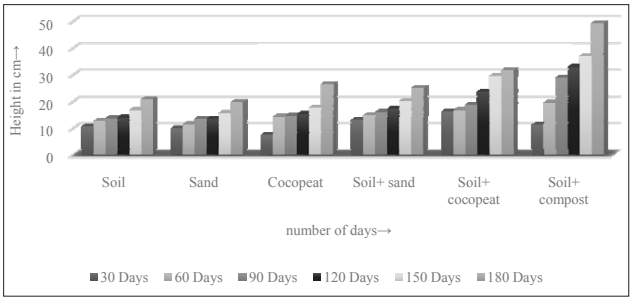

Fig. 1: Increment in height of *Ipomoea* cuttings in different media combinations (Set 1)

Increment in number of leaves of *Ipomoea* cuttings in different media combinations (Set 1)

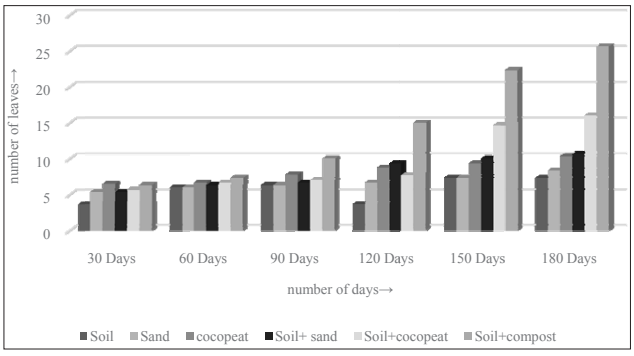

Fig. 2: Increment in number of leaves in *Ipomoea* cuttings in different media combinations (Set 1)

Analysis of variance was done from the values of Fig. 2. The values obtained for F statistics as F

3, 6 = 6.89, calculated F is 6.89 ≥ table F 2.60 and p value is smaller than 0.05 and also for media combinations calculated F is 6.67 ≥ 2.60 table F and p value is smaller than 0.05. So rejected the null hypothesis. Ho: there is significant differences in treatment effects.

Increment in number of leaves of *Ipomoea* cuttings in different media combinations (direct sunlight condition) was recorded. After 30 days, maximum number of leaves of *Ipomoea* cuttings were observed in the cocopeat followed by soil+cocopeat and less number of leaves were observed in soil. According to Swetha (2005), *Bursera delpechiana* cuttings raised in cocopeat showed better performance in vegetative parts. After 60 days, higher number of leaves were noted in soil+compost and lower number of leaves was recorded in soil and sand. After 90 days, higher increment in the number of leaves was recorded in soil+compost followed by cocopeat, while less increment in the number of leaves was found in soil and sand. After 120, 150 and 180 days maximum number of leaves of *Ipomoea* cuttings was observed in soil+compost while less increment in the number of leaves were found in soil. Ratna *et al.* (2006) prescribed that soil+sand medium was most appropriate for growth of leaves and increment of shoot of Banana cv. Raja., while in present study *Ipomoea* cuttings showed moderate number of leaves and increment in the shoot in soil+sand media.

t-Test was done for testing significant differences in pair of treatments in between media combinations. For testing range of increase in height, number of leaves and survival percentage of *Ipomoea* cuttings in open condition. Df value is 5, critical values of ts of one-tail is 2.01 and critical values of ts two-tail value is 2.57. t-Test is applied for testing significant differences in pair of treatments of soil and sand, cocopeat and soil+sand, soil and cocopeat, soil+cocopeat and soil+compost, soil and soil+sand, soil and soil+cocopeat, also soil and soil+compost. Soil and sand, soil+cocopeat and soil+ compost, soil and soil+sand, soil and soil +cocopeat, also soil and soil +compost cuttings raised in these media show significance difference in increase in height, because p value is smaller than 0.05 (Table 1). Thus, average values can be considered for higher increment in height. Soil+compost media shows higher increment in height, i.e. 29.81 cm and cuttings raised in sand media showed lower height 13.97 cm as compared to control (14.77) and other media combinations in open condition (Fig. 1).

For testing range of increasing in number of leaves t-Test was done. Soil and cocopeat, soil+cocopeat and soil+compost, soil and soil+sand, soil and

Table 1: t-Test for growth parameters of *I. pes-caprae* cuttings in different media combinations (Set 1)

Media combination → / t = Test ↓	soil and sand	cocopeat and soil + sand	soil+ cocopeat and soil+ compost	soil and cocopeat	soil and soil + sand	soil and soil + cocopeat	soil and soil + compost
Value of ts (Height in cm)	4.506	-1.83	-2.201	-1.080	-6.030	-5.420	-3.707
P(T<=t) one-tail (Height in cm)	0.003	0.062	0.039	0.164	0.0009	0.001	0.006
Value of ts (Number of leaves)	-1.89	0.49	-3.03	-3.99	-2.81	-2.77	-2.98
P(T<=t) one-tail (Number of leaves)	0.05	0.31	0.014	0.005	0.01	0.01	0.01
Value of ts (Survival percentage)	7.26	0.22	-0.28	-0.67	-0.38	-2.44	-1.16
P(T<=t) one-tail Survival percentage)	0.0003	0.41	0.39	0.26	0.35	0.02	0.14

t-Test- Df=5, Critical value of ts for one tail was 2.01 and ts for two tail was 2.57.

soil+cocopeat, also soil and soil+compost showed that, there significance difference in increasing number of leaves of *Ipomoea* cuttings in above media combinations because p value is smaller than 0.05. So, average values considered for the increasing number of leaves. Soil+ compost media showed a higher number of leaves i.e. 29.81, while lower leaves was found in sand (13.97) cm as compared to control (14.77) and other media combinations (Fig. 2).

t-test was done for testing significant differences in pair of treatments in between media combinations. For testing range of increasing survival percentage of *Ipomoea* cuttings. Cocopeat and soil+sand, soil+cocopeat and soil+ compost, soil and soil+compost, soil and soil+sand showed that there is no significance difference in survival percentage of *Ipomoea* cuttings in above media combinations. (Table 1). Thus, average values can be considered for higher survival percentage. Soil+compost media showed maximum survival percentage, i.e. 92.33% while cuttings raised in sand showed lower survival percentage i.e. 68% as compared to control (86.66 %) and other media combinations in cuttings raised in open condition (Fig. 3).

Survival percentage (%) of *Ipomoea pes-caprae* cuttings in different media combinations (Set 1)

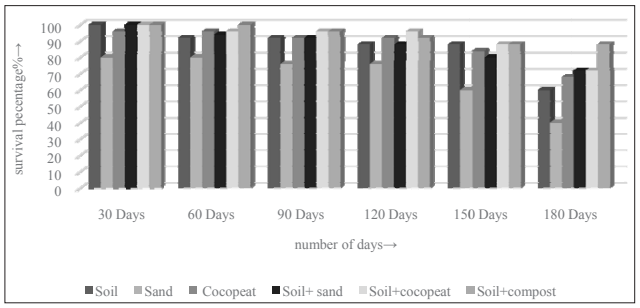

Fig. 3: Survival percentage of *Ipomoea* cuttings in different media combinations (Set 1)

Analysis of variance was done from the values of Fig. 3. The values obtained of F statistics are as F 3, 6 =17.07, calculated F is 17.07 ≥ table F 2.60 and p value is smaller than 0.05 and also for media combinations calculated F is 25.45 ≥ 2.60 table F and p value is smaller than 0.05. So, the null hypothesis was rejected. Ho: significant difference in treatment effects.

Cuttings of *Ipomoea* raised in soil, sand, cocopeat, soil+sand, soil+cocopeat and soil+compost media and the survival percentage were recorded after 30, 60, 90, 120, 150 and 150 days in direct sunlight condition. After 30 days, 100% survival percentage was observed in soil, soil+sand, soil+cocopeat and soil+compost and lower survival percentage was recorded in sand (80%). After 60 days 100% survival was found in soil+compost followed by soil+cocopeat (96%), while lower survival percentage was recorded in sand (80%). After 90 days maximum survival percentage was recorded in soil+compost and soil+cocopeat (96%) and lower survival percentage was recorded in sand (76%). After 120 and 150 days higher survival percentage was recorded in soil+compost and lower survival percentage was recorded in sand. After 180 days cuttings raised in sand showed 40% survival percentage, this result are in agreement with findings of Lal and Danu (1985) who reported that survival percentage of Carnation cvs. Scania and Arthursim in sand. After 180 days maximum survival percentage was noted in soil+compost (88%).

Increment in height of *I. pes-caprae* L.R. Br. cuttings in different media combinations (Set 2)

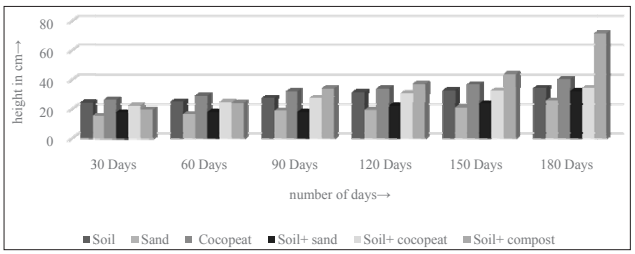

Fig. 4: Increment in height of *Ipomoea* cuttings in different media combinations (Set 2)

Analysis of variance is done from the values of Fig. 4. The obtained values of F statistics as F 3, 6 =8.30, calculated F is 8.30 ≥ table F 2.60 and p value is smaller than 0.05 and also for media combinations calculated F is 7.87 ≥ 2.60 table F and p value is smaller than 0.05. So the null hypothesis was rejected. Ho: significant difference in treatment effects.

I. pes-caprae cuttings raised in soil, sand, cocopeat, soil+sand, soil+cocopeat and soil+compost (Shadenet condition) and increment in height of cuttings were recorded after 30, 60, 90,120,150 and 180 days. After 30, 60 days higher stem length was observed in cocopeat. Cocopeat has great physical properties, high aggregate pore space, and maximum water

content, low shrinkage, low mass thickness and moderate biodegradation (Evans *et al.* 1996 and Prasad 1997, Nazari *et al.* 2011). So, cocopeat was used in a number of experiments singly or mixed in other medium, it was beneficial for roses (Blom 1999), gerbera (Lebeke and Dambre 1998) and many potted plants (Kreij and Leeuven 2001, Pickering 1997), also applicable for vegetables. *Epipremnum aureum* Lindl. and Andre 'Golden Pothos' raised in cocopeat, it was shown that higher performance in increment in the shoot and also number of roots (Khayyat *et al.* 2007). In present investigation cocopeat was more suitable to maximum increment in height of *Ipomoea* cuttings up to 60 days. Batista *et al.* (2011) reported that cuttings of pomegranate when planted in coconut fibre showed the highest shoot length. After 90 days higher stem length was observed in soil+compost followed by cocopeat while lower stem length observed in sand. After 120,150 and 180 days higher increment in stem length was observed in soil+compost (Fig. 4). Decomposed organic matter enhances pore spaces, water holding limit and microbial action that result in a maximum shoot growth (Wazir *et al*. 2003).

Increment in number of leaves of *Ipomoea* cuttings in different media combinations (Set 2)

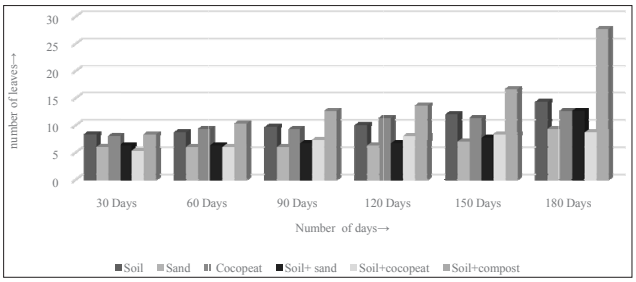

Fig. 5: Increment in number of leaves of *Ipomoea* cuttings in different media combinations (Set 2)

Analysis of variance was done from the values of Fig. 5. The obtained values of F statistics as F 3, 6=13.19, calculated F is 13.19 ≥ table F 2.60 and p value is smaller than 0.05 and also for media combinations calculated F is 12.92 ≥ 2.60 table F and p value is smaller than 0.05. So the null hypothesis was rejected. Ho: significant difference in treatment effects.

I. pes-caprae cuttings raised in different media combinations (Shadenet condition) and increment in the number of leaves were recorded after 30, 60, 90,120,150 and 180 days. After 30 days, maximum number of leaves were noted in soil+compost and soil followed by soil+sand while the less number of leaves observed in sand. After 60, 90 and 120 days, higher number of leaves found in soil+compost and the less number of leaves found in sand. After 150 and 180 days, higher number of leaves found in soil+compost followed by soil while the less number of leaves found in sand. Maximum growth performance of *Ipomoea* cuttings observed in soil+compost, similar observations are reported by Waziri, *et al.* (2015) that proper mixture of soil and animal dung or manure showed better growth of *Delonix regia* cuttings.

t-Test was done for testing significant differences in pair of treatments in between media combinations. For a testing range of increasing in height, number of leaves and survival percentage of *Ipomoea* cuttings in shade net condition. The t critical value of one-tail is 2.015, t critical two-tail value is 2.570 and Df value id 5 for all media combinations. t-Test was done for testing significant differences in pair of treatments of soil+cocopeat **and** soil+compost, soil **and** soil +cocopeat, soil and soil+compost showed that there is no significance difference in height of *I. pes-caprae* cuttings. Soil **and** sand, cocopeat **and** soil+sand (Table 2). Soil and sand, cocopeat and soil+sand, soil and cocopeat, soil and soil+sand cuttings raised in these media shows their significance difference because p value is smaller than 0.05. So, the average values can be considered for higher increment in height soil+ compost media shows higher increment in height i.e. 38.43 cm, while short stem length was found in sand (19.6 cm) as compared to control (29.29 cm) and other media combinations in shade net condition (Fig. 4).

t-Test was done for testing significant difference in pair of treatments of soil +cocopeat showed that there is significance differences in increasing number of leaves of *Ipomoea* cuttings in above media combinations because p<0.05 in set 2. Soil and sand, soil+cocopeat and soil+ compost, soil and soil+sand, soil and, cocopeat and soil+sand, soil and soil+cocopeat and also soil and soil+compost cuttings raised in these media shows their significance difference because p value is smaller than 0.05 (Table 2). So average values can be considered for higher increasing number of leaves. Soil+ compost media showed a higher increment in number leaves i.e. 14.89 cm, while cuttings in sand media showed

Table 2: t-Test for growth performance of *I. pes-caprae* cuttings in different media combinations (Set 2)

Media combination → / t = Test ↓	soil and sand	cocopeat and soil + sand	soil + cocopeat and soil + compost	soil and cocopeat	soil and soil + sand	soil and soil + cocopeat	soil and soil + compost
Value of ts (Height in cm)	14.34	11.434	-1.634	-6.736	6.270	1.738	-1.510
P(T<=t) one-tail (Height in cm)	1.49E-05	4.48E-05	0.081	0.0005	0.0007	0.071	0.095
Value of ts (Number of leaves)	8.11	3.93	-3.18	0.39	6.93	5.96	-2.29
P(T<=t) one-tail (Number of leaves)	0.0002	0.005	0.01	0.35	0.0004	0.0009	0.03
Value of ts (Survival percentage)	5	2.42	-1.58	-1.46	1.16	-1.58	-3.16
P(T<=t) one-tail Survival percentage)	0.002	0.02	0.08	0.101	0.14	0.08	0.01

t-Test- Df=5, Critical value of ts for one tail was 2.01 and ts for two tail was 2.57.

lowest leaves 6.77 cm as compared to control (10.5) and other media combinations in shade net condition (Fig. 5).

t-test was done for testing range of survival percentage of *Ipomoea* cuttings in shadenet condition. t-test was applied for testing significant difference in pair of treatments of soil+cocopeat and soil+ compost, soil and cocopeat, soil and soil+sand, soil and soil +cocopeat. Ho: no significance difference in survival percentage of *Ipomoea* cuttings in above media combinations because p value is greater than 0.05 (Table 6). Soil and sand, cocopeat and soil+sand, Soil and soil+compost cuttings raised in these media shows there significant difference because p value is smaller than 0.05 (Table 2). So, average values can be considered for of survival percentage of *Ipomoea* cuttings. Soil+ compost media shows the higher survival percentage of *I. pes-caprae* cuttings (96.66) and cuttings raised in sand media showed a lower survival percentage of *I. pes-caprae* cuttings (90.66%) as compared to control 94%) and other media combinations (Fig. 6).

Survival percentage (%) of *I. pes-caprae* cuttings different media combinations (Set 2)

Analysis of variance was done from the values of Fig. 6 using Microsoft excel. The obtained values of F statistics as calculated F is 6.85 ≥ table F 2.60 and p value is smaller than 0.05 and also for media combinations calculated F is 13.54 ≥ 2.60 table F and p value is smaller than 0.05 So, the null hypothesis was rejected. Ho: significant difference in treatment effects.

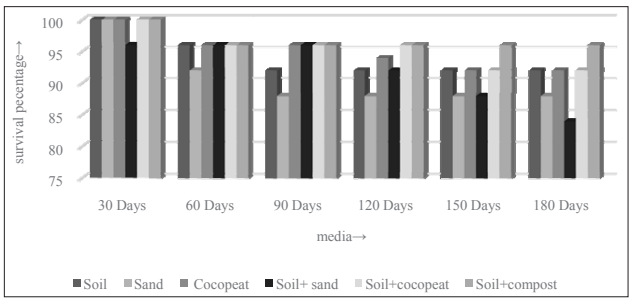

Fig. 6: Survival percentage of *Ipomoea* cuttings in different media combinations (Set 2)

I. pes-caprae cuttings raised in soil, sand, cocopeat, soil+sand, soil+cocopeat and soil+compost (Shadenet condition) and survival percentage of cuttings were recorded after 30, 60, 90,120,150 and 180 days. After 30 days, 100 % survival percentage was noted in soil, sand, cocopeat, soil+cocopeat and soil+compost. After 60 days, cuttings raised in the sand showed 92% survival and other media showed 96% survival percentage. After 90 days, cuttings raised in cocopeat, soil+sand, soil+cocopeat and soil+compost showed 96% survival and cuttings raised in soil and sand showed 92% and 88% survival percentage

respectively. Present result lined with Marjenah *et al.* (2016) reported that *S. balangeran* raised in soil showed 93.33% survival percentage and soil+cocopeat showed higher survival percentage after 90 days. After 120 days, maximum survival percentage noted in soil+compost and soil+cocopeat (96%) and lower survival percentage observed in sand (88%). After 150 and 180 days higher survival percentage found in soil+compost while lower survival percentage noted in sand (88%).

CONCLUSION

It was observed that *Ipomoea pescaprae* (L.) R. Br. cuttings can be successfully grown in different media such as soil, sand, cocopeat, soil+sand, soil+cocopeat and soil+compost under different light conditions like sunlight condition and shade net condition in fresh water. Cuttings raised in sunlight condition (Set 1) showed poor growth as compared to shade condition (Set 2). Shade net condition was good for foliage of *I. pes-caprae* cuttings. Soil+compost was found to be more suitable for better growth of cuttings. Though the *I. pes-caprae* plant growing in sandy environment and requires sea water for growth, it can be adapted well in fresh water condition by using soil +compost media.

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