Influence of Colored Shade Nets and Media Types on the Development of *Rhoeo discolor* (Boat Lily)

Abstract

Study on "Influence of Colored Shade Nets and Media Types on the Development of *Rhoeo discolor* (Boat Lily)" was carried out Department of Floriculture and Landscaping, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha during 2018-19. The experiment was designed to determine the optimal conditions for enhancing plant growth, focusing on the effects of different colored shade nets (green, white, red and black) with open light and various media mixture combinations (soil, coco peat, and FYM). Key growth parameters such as plant height, plant spread, leaf number, leaf area, chlorophyll content, and number of suckers were measured over a specified growth period. Results indicated that boat lily grown under red shade net and pots filled with soil, FYM and cocopeat media mixture in 1:1:1 (v/v) proportion performed best in all the characters. It has significantly enhanced plant height (22.11 cm), number of leaves per plant (15.89) and leaf area (110.42 cm^2), plant spread in E-W direction (28.78 cm), plant spread in N-S direction (28.78 cm) and leaf thickness (1.32 mm.

Keywords: Photoselective, shade nets, *Rhoeo discolor*, plant height, cocopeat, FYM, chlorophyll

Introduction

Ornamental plants are grown for their aesthetic appeal, which is influenced by various factors such as light, temperature, humidity, and growing media. Shade nets are commonly used in ornamental plant production to provide physical protection and modify the light environment. Most of the pot plants have a different natural habitat compared to the conditions under which they are commercially grown. The shade nets fulfil the task of giving appropriate micro-climate conditions to these plants. The primary purpose of shade net is protection from scorching sunlight, heat, cold and wind. Each plant has its specific requirements for sunshine and shade under which it flourishes at its best. There is a noticeable difference in performance amongst

different species and even within the cultivars of the same species under different coloured shade nets (Gaurav *et al.*, 2016).

Coloured shade netting is a new tool that can be used for a wide variety of purposes by horticulturists (Stamps, 2009). The colored shade nets significantly impact plant growth and microclimate conditions by altering light intensity and quality. These nets selectively filter light wavelengths, with red and yellow nets promoting vegetative growth, while blue nets may inhibit it, affecting leaf morphology and nutrient accumulation. Additionally, shade nets help regulate temperature and humidity; for instance, black nets can increase humidity and lower canopy temperature, which may benefit crops but also encourage pest infestations. Overall, shade nets enhance soil moisture retention and improve water use efficiency, contributing to more sustainable horticultural practices.

The coloured shade cloths are manufactured in the following colours: blue, grey, pearl, red, white, and yellow. The blue shade cloth is designed to absorb ultraviolet (UV), red, and far-red; enriching the blue spectral region. The red shade cloth absorbs UV, blue, and green and enriches the red and farred spectral region. The yellow shade cloth is designed to reduce the UV and blue; enriching the green, yellow, red, and far-red wavelengths. The white shade cloth absorbs UV and enriches the wavelengths blue, green, yellow, red, and far-red. The pearl and grey shade cloths do not enrich or absorb the different wavelengths, but the pearl is designed to scatter the light to a greater extent than the other shade cloth colours mentioned Traditional black shade cloth does not scatter light (Shahak*et al.*, 2004).By selectively filtering light wavelengths, these nets alter the intensity and quality of light reaching the plants, which in turn influences crucial physiological processes such as photosynthesis and nutrient accumulation. Additionally, shade nets play a role in regulating temperature and humidity levels within the growing environment, with potential effects on pest dynamics and water use efficiency. Understanding the specific impacts of each colored shade net is essential for optimizing growing conditions and promoting sustainable horticultural practices(Rajapakse and Shahak, 2007).

Growing media are vital components of plants in containers as they determine the physical support, accessibility to water and nutrients for the plants. Potting mix is the most common form of growing media available from nurseries, and it usually contains a mixture of inorganic and organic substrates. Inorganic materials may be directly mined, such as sand or originate from processed materials such as perlite, vermiculite and polystyrene. Organic material added to the potting mix because of its low bulk density and its ability to increase the fine structural component of media. Thus, water available to plant is enhanced. Currently, organic materials used in nurseries include cocopeat, farmyard manure, peat, sawdust, wood bark, Vermicompost and sphagnum moss, etc.

Cocopeat is a versatile natural fiber extracted from monocarp tissue or husk of the coconut. The husk contains 20% to 30% fiber of varying length and holds 8-9 times its weight in water. Can be reused for up to 4 years. The properties of Cocopeat make it resistant to bacterial

and fungal growth, easy to handle and excellent oxygenation properties, which is vital for healthy root development. Environment-friendly (Sandeep *et al*., 2019).

Farmyard manure (FYM) is composed of dung and urine of farm animals along with litter and leftover materials from roughages or greens fed to the farm animals. Usually, cow dung and urine of animals along with their litter and waste fed or collected and placed in trench daily and when filled in, it is covered with the field. It decomposes in two-three months when it is considered useable (Sandeep *et al*., 2019). So readily available and economically feasible potting mixture may efficient in the vertical garden establishment.

Hence, the present experiment has been planned out to investigate the effect of different coloured shade net and potting media mixture contributing to growth and development of *Rhoeo discolor*.

Material and Methods

The experiment was laid out at Department of Floriculture and Landscaping, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha during the year 2018-2019 in a completely randomized block design (CRD) with three replications.

Plant species:

Tradescantia spathacea: synonym *Rhoeo discolor*, boat lily or Moses-in-thecradle, is a herb in the Commelinaceae family. Native to Belize, Guatemala, and southern Mexico but widely cultivated as an ornamental and naturalized in parts of Florida, Texas, Hawaii, and various oceanic islands. It has fleshy rhizomes and rosettes of waxy lance-shaped leaves. Leaves are dark to metallic green with white streaks above, with glossy purple underneath and also grown as ornamental houseplants.

Table 1. Characteristics of plant used in the experiment

Boat lily	**Venation**	**Shape**	**Arrangement**	**margins**	**Apex**	**texture**	**Leaf type**	**persistence**
	Parallel	Linear	Alternate	Entire	Acuminate	Medium	Simple	Evergreen

Net characteristics: The present experiment deals with the microenvironment created by the four different coloured shading nets (green, white, black, and red) with shading intensity of 75% and plant response under these shade nets compared with the open field microenvironment.

Growing media: Three types of potting media used for this experiment consisting of 100% soil used as a control, Mixture of soil and farmyard manure 1:1 (v/v) proportion and the third is a mixture of soil, farmyard manure and cocopeat 1:1:1 (v/v) proportion. These filled in standard 6” sized earthen pots.

Preparation of planting material: In *Rhoeo discolor*, divisions were collected from matured plants with one or two roots per division. Later the divisions were planted in each pot according to treatments.

Table 2. Experimental Layout

Design	CRD
Replications	3
Treatments	15
Growing conditions	control (without shade net) and Colored shade net (green, white, black and red)
Container	The dimension of pot Height: 6" Top width 15 cm and Bottom width 8 cm
Media	Soil, FYM and Cocopeat
Period of study	Five months

Table 3. Treatment Details

T1: Control {Open + Soil}	**T9**: White colour shade net + Soil + FYM + Coco peat
T2: Open + Soil + FYM	**T10**: Black colour shade net + Soil
T3: Open + Soil + FYM + Coco peat	**T11**: Black colour shade net + Soil + FYM
T4: Green colour shade net + Soil	**T12**: Black colour shade net + Soil + FYM + Coco peat
T5: Green colour shade net + Soil + FYM	**T13**: Red colour shade net + Soil
T6: Green colour shade net + Soil + FYM + Coco peat	**T14**: Red colour shade net + Soil + FYM
T7: White colour shade net + Soil	**T15**: Red colour shade net + Soil + FYM + Cocopeat
T8: White colour shade net + Soil + FYM	* Open- control, Soil- control.

Result and Discussion:

The results of the experiment entitled the influence of coloured shade net and media mixture on growth and development of *Rhoeo discolor*,at 30 DAP revealed that treatment T15 with red shade-net and soil + FYM + cocopeat mixture (1:1:1 v/v) significantly enhanced the plant height (11.74 cm) and that stood at par with treatments T12 (black shade net + soil + FYM+ cocopeat), T9 (white shade net + soil + FYM + cocopeat) and T14 (red shade net + soil + FYM), the minimum plant height (3.67 cm) recorded in T4 (green shade net + soil) (Table 4). The number of leaves per plant was significantly higher (8.12) in T12 (black shade net + soil + FYM + cocopeat) and the data remained at par with T3 (open + soil + FYM+ cocopeat), T5

(green shade net + soil + FYM), T6 (green shade net + soil + FYM+ cocopeat), T8 (white shade net + soil + FYM), T9 (white shade net + soil + FYM + cocopeat), T11 (black shade net + soil + FYM), T14 (red shadenet+ soil + FYM)and T15 (red shade net + soil + FYM + cocopeat), minimum (4.23) in T4 (green shade net + soil).

Hence at 30 DAP, T15 (red shade net + soil + FYM + cocopeat), significantly increased the plant height (11.74 cm) and number of leaves per plant (8.12) per plant along treatments T9 (white shade net + soil + FYM+ cocopeat), T12 (black shade net + soil + FYM+ cocopeat) and T14 (red shade net + soil + FYM) were also showing better result for both the character. (Table 4)

At 90 DAP, T15 (red shade net + soil + FYM+ cocopeat), increased the plant height (19.35 cm) over other treatments being lowest (4.33 cm) in T4 (green shade net + soil). The T15 (red shade net + soil + FYM+ cocopeat) also increased the leaf number, and the data stood at par with T14 (red shade net + soil + FYM). Hence after (13.67 cm) 90 DAP the plant height as well as the number of leaves per plant significant in T15 (red shade net + soil + FYM+ cocopeat) over other treatments presented in the Table 4.

Results at 150 DAP given in Table 5 reveals that among treatments plant height recorded significantly maximum (22.11 cm) in T15 (red shade net + soil + FYM+ cocopeat) and that stood at par with T14 (red shade net + soil + FYM, T13 (red shade net + soil), T12 (black shade net + soil + FYM+ cocopeat) and T9 (white shade net + soil + FYM + cocopeat) and lowest (5.11 cm) in T4 (green shade net + soil).

Plant spread for East-West direction was significantly maximum (30.56 cm) in T5 (green shade net + soil + FYM) and it was at par with T12 (black shade net + soil + FYM + cocopeat), T14 (red shade net + soil + FYM) and T15 (red shade net + soil + FYM + cocopeat), the least (10.44 cm) in T1 (open + soil)(Table 5). Plant spread from North-South direction significantly wider (29.33 cm) in T14 (red shade net + soil + FYM) and data abide at par with T15 (red shade net + soil + FYM + cocopeat) and T13 (red shade net + soil), the spread narrow (11.44 cm) in T1 (open + soil).

There was a significant difference between growing conditions for the number of suckers per plant (Table 5). The maximum number of suckers per plant (6.22) was recorded in T3 (open + soil + FYM + cocopeat) and data stood at par with T9 (white shade net + soil + FYM + cocopeat) and T15 (red shade net + soil + FYM + cocopeat), whereas plants under T4 (green shade net + soil) and T10 (black shade net + soil) did not produce any suckers.

Table 4: Influence of coloured shade nets and potting media on Plant Heightand Number of Leaves per plant of *Rhoeo discolor* at 30 and 90 days after planting

Treatments	30 DAP		90 DAP	
	Plant Height (cm)	Number of Leaves per plant	Plant Height (cm)	Number of Leaves per plant
T_1-Soil	5.48	5.33	7.72	7.00
T_2- Soil + FYM	5.91	5.80	7.95	6.96
T_3 - Soil + FYM+ Cocopeat	7.26	7.42	9.33	9.20
T_4- Green Shade Net+ Soil	3.67	4.23	4.33	6.44
T_5- Green Shade Net+ Soil + FYM	7.50	7.00	9.53	9.60
T_6 - Green Shade Net+ Soil + FYM+ Cocopeat	7.40	8.00	9.57	10.20
T_7- White Shade Net+ Soil	6.80	4.44	9.33	7.22
T_8- White Shade Net+ Soil + FYM	9.56	6.78	13.78	8.46
T_9 - White Shade Net+ Soil + FYM+ Cocopeat	10.60	7.98	14.22	9.20
T_{10}- Black Shade Net+ Soil	6.58	4.56	7.78	5.80
T_{11}- Black Shade Net+ Soil + FYM	9.83	6.78	13.41	8.82
T_{12} - Black Shade Net+ Soil + FYM+ Cocopeat	11.32	8.12	17.21	9.82
T_{13}- Red Shade Net+ Soil	7.19	5.22	10.12	7.67
T_{14}- Red Shade Net+ Soil + FYM	10.37	6.89	17.22	12.33
T_{15} - Red Shade Net+ Soil + FYM+ Cocopeat	11.74	7.78	19.35	13.67
S.Em±	0.47	0.51	0.62	0.70
CD @ 5%	1.37	1.47	1.78	2.03

The number of leaves per plant was found to be significantly higher (15.89) in T15 (red shade net + soil + FYM + cocopeat) and minimum (7.22) in T10 (black shade net + soil)(Table 5).

The leaf area recorded maximum (110.42 cm^2) in T15 (red shade net + soil + FYM + cocopeat) and the data stood at par with T12 (black shade net + soil + FYM + cocopeat) and T14 (red shade net + soil + FYM) (Table 5), it was minimum (38.32 cm^2) in T4 (green shade net + soil).

Leaf thickness significantly augmented (1.56 mm) in T5 (green shade net + soil + FYM)and the data stood at par with T6 (green shade net + soil + FYM + cocopeat), T11 (black shade net + soil

+ FYM), T12 (black shade net + soil + FYM + cocopeat), T14 (red shade net + soil + FYM) and T15 (red shade net + soil + FYM + cocopeat) being lowest (0.79 mm) in T4 (green shade net + soil)(Table 5).

The SPAD reading for chlorophyll content (Table 5) found to be significantly higher (22.43) in T4 (green shade net + soil) and data stood at par with T5 (green shade net + soil + FYM) and T6 (green shade net + soil + FYM + cocopeat), the lowest (5.33) was in T12 (black shade net + soil + FYM + cocopeat).

Thus, at 150 DAP the T5 (green shade net + soil + FYM) increased Plant spread East-West (30.56 cm) and leaf thickness (1.56 mm) significantly, while T15 (red shade net + soil + FYM + cocopeat) performed best in all the characters and it had significantly enhanced the plant height (22.11 cm), the number of leaves per plant (15.89) and leaf area (110.42 cm^2). Whereas T14 (red shade net + soil + FYM) increased the plant spread North-South (29.33 cm) and also showed good results for all the characters. The number of suckers per plant was maximum (6.22) in T3 (soil + FYM + cocopeat), and T4 (green shade net + soil) significantly increased the SPAD readings for chlorophyll content of the leaf.

The results of the present investigation revealed that Boat lily plants grown under red shade net and pots filled with soil, FYM and cocopeat media mixture in 1:1:1 (v/v) proportion significantly enhanced the various growth parameters viz., plant height (22.11 cm), number of leaves per plant (8.12), leaf area (110.42 cm^2), plant spread EW (28.78 cm), plant spread N-S (28.78 cm) and leaf thickness (1.32 mm). The luxuriant vegetative growth with high plant height under red shade net confirms the study conducted by Crowley and Kessler (2007), where Ageratum was tallest after 4 weeks and 8 weeks under red shade net and shortest under control.

Table 5: Influence of coloured shade nets and potting media on different growth parameters

Treatments	Plant Height (cm)	Plant Spread E-W (cm)	Plant Spread N-S (cm)	Number of Suckersper plant	Number of Leaves per plant	Leaf Area (cm^2)	Leaf Thickness (mm)	Chlorophyll Content (SPAD)
T_1–Soil	8.89	10.44	11.44	1.44	8.33	44.26	1.20	6.28
T_2 - Soil + FYM	9.22	13.78	13.78	1.78	8.22	52.60	1.16	9.72
T_3 - Soil + FYM+ Cocopeat	10.78	16.56	15.22	**6.22**	10.67	63.20	1.23	9.69
T_4 - Green Shade Net+ Soil	5.11	18.11	16.22	0.00	9.22	38.32	0.79	**22.43**
T_5 - Green Shade Net+ Soil + FYM	10.67	**30.56**	28.22	1.22	11.22	65.23	**1.56**	21.29
T_6 - Green Shade Net+ Soil + FYM+ Cocopeat	10.89	25.33	25.11	1.22	11.33	73.62	1.33	18.69
T_7 - White Shade Net+ Soil	13.56	17.78	19.56	0.78	9.67	44.28	0.92	12.70
T_8 - White Shade Net+ Soil + FYM	17.00	22.67	21.11	3.67	10.11	74.26	0.86	15.26
T_9 - White Shade Net+ Soil + FYM+ Cocopeat	19.44	23.11	22.11	5.78	10.78	75.21	1.19	10.71
T_{10} - Black Shade Net+ Soil	11.00	15.89	16.78	0.00	7.22	46.28	1.07	7.33
T_{11} - Black Shade Net+ Soil + FYM	16.89	24.33	24.89	1.78	10.56	78.36	1.32	6.52
T_{12} - Black Shade Net+ Soil + FYM+ Cocopeat	19.67	26.78	24.22	2.33	11.22	96.43	1.40	5.33
T_{13} - Red Shade Net+ Soil	20.67	25.67	26.56	0.11	11.78	72.68	1.19	8.34
T_{14} - Red Shade Net+ Soil + FYM	21.89	29.33	**29.33**	3.11	12.22	108.20	1.30	12.33
T_{15} - Red Shade Net+ Soil + FYM+ Cocopeat	**22.11**	28.78	28.78	4.89	**15.89**	**110.42**	1.32	14.82
S.Em±	1.05	1.59	1.28	0.48	0.94	5.66	0.09	1.31
CD @ 5%	3.05	4.60	3.69	1.37	2.72	16.36	0.27	3.79

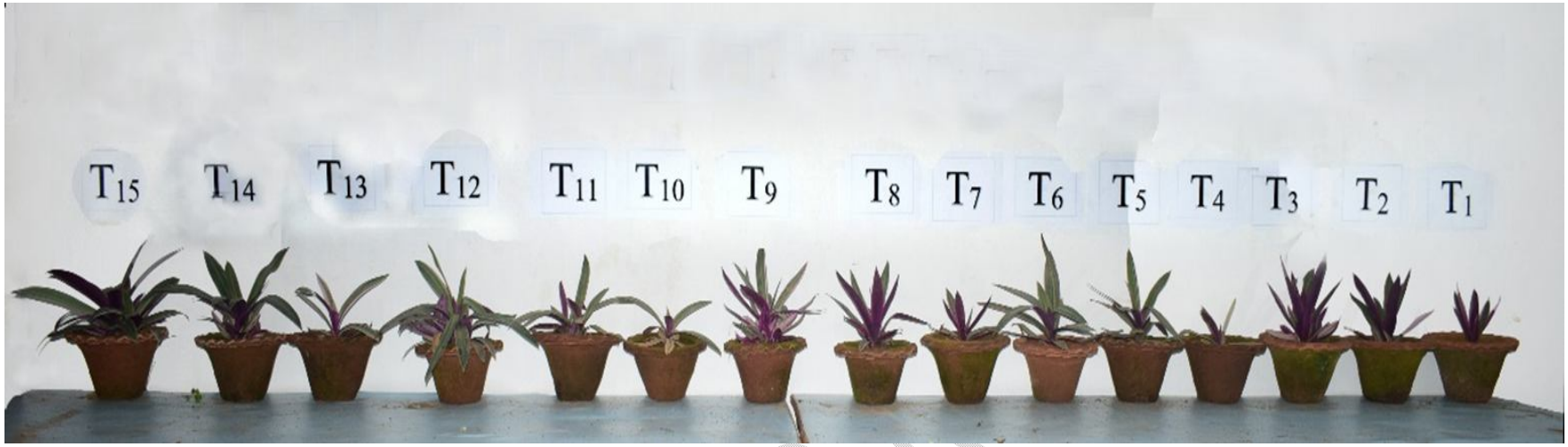

Fig 1: General view ofdifferent treatment effects on Rhoeo *discolor*

Fig:2Best treatment T_{15} (red shade net with soil + FYM + cocopeat media)

More number of leaves under red shade net similar observation was also represented by Kawabata *et al*. (2007) in *Dracaena marginata* under red shade net, has influenced more new cane growth and produced more new leaves compared to other treatments, this may be attributed to the enhanced metabolic activities like high photosynthesis and low transpiration during the plant growth due to the quality of light received by the plants. The result corroborated with the findings of Cummings *et al*. (2008) in peas, Leite *et al.* (2008) in Phalaenopsis and Oren-Shamir *et al* (2001) in *Pittosporium variegatum*.

Splendid growth in the media mixture comprised soil, FYM and cocopeat; wider plant spread under this media is supported by the study conducted on pot mums by Nair *et al*. (2015) found that Cocopeat only gave wider plant spread N-S, plant spread E-W. Khelikuzzaman (2007) conducted study on *Tradescantia* spp. and proved that soil mixture cocopeat, topsoil and sand (1:1:1 v/v) was significantly increasing vegetative growth and better than other soil mixtures. More number of suckers per plant under this media was supported by the studies of Smitha (1999) reported more number of suckers per plant in Anthurium with cocopeat applied alone or in combinations with farmyard manure. The reason might be due to the ability to provide proper aeration to plants in order to sustain the development and growth of roots and shoots. The media improved water relationship, free air movement, retains moisture and nutrients for the growth of the plants perhaps due to optimum bulk density, the potentiality of adequate water absorption of this growing media (Padhiyar*et al.,* 2017).

Conclusion:

The experiment demonstrated that the combination of a red shade net and a media mixture of soil, farmyard manure (FYM), and cocopeat (1:1:1 v/v) significantly enhances the growth and development of *Rhoeo discolor*. At 150 days after planting (DAP), treatment T15 yielded the highest plant height (22.11 cm), leaf number (15.89), and leaf area (110.42 cm^2), indicating superior vegetative growth. Additionally, the results showed that the red shade net positively influenced various growth parameters, corroborating findings from previous studies on other plant species. The study underscores the importance of optimal growing conditions, including shade and media composition, in maximizing plant performance. Overall, the findings provide valuable insights for improving the cultivation practices of *Rhoeo discolor* and similar ornamental plants.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

References:

1. Crowley K and Kessler J R. 2007. Effects of colored plastic film on several field grown and greenhouse grown cut flower species, *MS Thesis*, Auburn University, Auburn, AL.
2. Cummings I G, Foo E, Weller J L, Reid J B and Koutoulis A. 2008. Blue and red photo selective shade cloths modify pea height through altered blue irradiance perceived by the cry1 photoreceptor, *Journalof Horticultural Science & Biotechnology*, 83 (5): 663-667.
3. Gaurav A K, Raju D V S, Janakiram T, Singh B, Jain R and Gopala Krishnan S. 2016. Effect of coloured shade net on production of *Dracaena fragrans*, *Indian Journal of Horticulture*, 73 (1): 94-98.
4. Kawabata A, Lichty J, Kobayashi K and Sahai W. 2007. Effects of photoselective shade cloths on potted *Dracaena deremensis* 'Janet Craig' and *Dracaena marginata* 'Colourama', *Journal of Hawaiian and Pacific Agriculture*, 14: 49–54.
5. Khelikuzzaman M H. 2007. Effect of different potting media on growth of a hanging ornamental plant (*Tradescantia* sp.), *Journal of tropical agriculture and food science*, 35(1): 41–48.
6. Leite C A, Ito R M, Lee G T S, Ganelevin R and Fagnani M A. 2008. Light spectrum management using colored nets to control the growth and blooming of Phalaenopsis, *Acta Horticulturae*, 770:177-184.
7. Nair A S and Usha-Bharathi T. 2015. Influence of potting media composition on pot mum production, *International Journal of life sciences*, 10(1): 73-76.
8. Oren-Shamir M, Gussakovsky E, Shpiegel E, Nissim-Levi A, Ratner K, Ovadia R, Giller Y, and Shahak Y. 2001. Coloured shade nets can improve the yield and quality of green decorative branches of *Pittosporum variegatum*, *The Journal of Horticultural Science and Biotechnology*, 76: 353-361.
9. Padhiyar B M, Bhatt D S, Desai K D, Patel VH and Chavda J R. 2017. Influence of different potting media on growth and flowering of pot chrysanthem var. Ajina purple, International Journal of Chemical Studies, 5(4): 1667-1669.
10. Rajapakse N C and Shahak Y. 2007. Light quality manipulation by horticulture industry. In: G. Whitelam and K. Halliday (eds.), Light and Plant Development, Blackwell Publishing: 290-312.
11. Sandeep K, Fatmi U, Talang D and Priyatham K. 2019. Effect of potting media on growth and development in different species of *Nephrolepis* fern under shade net conditions (*N. falcata*, *N. cardifolia*duffi, *N. multifolia*), *Journal of Pharmacognosy and Phytochemistry*, 7(5): 3006-3009.
12. Shahak Y, Elazar G, Gal E and Ganelevin R. 2004. Colornets: Crop protection and light-quality manipulation in one technology, *Acta Horticulturae*, 659: 143- 151.

13. Smitha. 1999. Effect of different growing media and pH on growth and development of *Anthuriumandreanum* Lind, *M.Sc. (Hort.) Thesis* submitted to University of Agricultural Sciences, Bangalore: 53-54.
14. Stamps R H. 2009. Use of colored shade netting in horticulture, *Horticultural Sciences*, 44(2): 239-241.