

Off-Season Flower Induction of ‘Praying mantis ginger’ *Larsenianthus careyanus* (Benth.) W.J. Kress & Mood (Zingiberaceae) through Low Temperature and Night Break

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Received: 07 April 2014

Accepted: 15 June 2014

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The experiment was carried out to study the impact of chilling and night break on the flowering of ornamental plants in their off-season period. *Larsenianthus careyanus* (Benth.) W.J. Kress & Mood is a wild potential ornamental ginger naturally growing in the evergreen forest of North Eastern states of India was selected for the current study. The rhizomes were collected and stored at 15°C for 8 months during March to October. The sprouted rhizomes after chilling treatment were planted at regular interval and sprouted plants were transferred to greenhouse with controlled light during night hours using incandescent lamp to extend flower production from December to March. Off-season flowering was observed during January to March. A detailed morphological analysis of 23 attributes of plants under study was recorded.

Abstract

Keywords: *Hitchenia careyana*, *Larsenianthus careyanus*, Night break, off-season flowering, Zingiberaceae.

INTRODUCTION

Ornamental horticulture has become one of the important commercial trade areas in India due to steady increase in demand of cut flowers and landscape plants. Floriculture products include cut flowers, landscape, hedge and potted plants, cut foliage, seeds, bulbs, etc. The various sizes, flower colors and postproduction longevity (up to 4 weeks or longer) are adding needed diversity to the greenhouse industry (Kuehny, 2001). The family Zingiberaceae consists of about 53 genera and more than 1200 species (Kress *et al.*, 2002). Among this, more than 250 ginger species are widely used as ornamental in other parts of the world *viz.* United States, Europe and SE Asia. Gingers have become a prominent component of ornamental horticulture in many countries such as Europe and SE Asia (Sabu *et al.*, 2013). India is blessed with the rich diversity of gingers with about 200 species, though we have a good number of potential ornamental species in the wild, hardly 25 species are used in our gardens, of which majority are exotics (Sabu, 2006).

The climate and soil of our country is suitable for the cultivation of these plants, Indian horticultural field has to exploit its ornamental value. Now the gingers are slowly becoming popular in the gardens in India. The main problem in their cultivation is most of them are dormant and lose their leaves in winter and summer. It reduces the scope among floriculturists about the ornamental aspects of them (Prabhu *et al.*, 2013). If we can produce the plants throughout the year then it will become a great achievement in the floriculture field. With this objective, one wild and threatened (Kress *et al.*, 2010) potential ornamental ginger, *Larsenianthus careyanus* has been selected for the present study.

L. careyanus ('Praying mantis ginger') is an under exploited wild ginger having good potential as a cut flower and an ornamental plant (Prabhu *et al.*, 2011). The plant was first described by Benthum as *Hitchenia careyana* and recently it was transferred to *Larsenianthus careyanus* (Kress *et al.*, 2010). The plant grows in the evergreen forests of North-East India especially in Assam, Meghalaya, Arunachal Pradesh, Manipur and neighbouring country Bangladesh (Jain and Prakash, 1995; Kress *et al.*, 2010).

The plant is a rhizomatous perennial herb, almost reaching a height of 2-3 m and is growing at an altitude ranging from 150-1000 m above MSL. It produces a number of tillers from the rhizome and forms a clump within a year. Leaves are large, sub sessile with shining, glossy upper side. The spikes are produced at the tip of the aerial stem. The size of the spike varies from 12-25 cm with many recurved bracts arranged spirally on a stalk. The bracts are green with white margins and fused to form a pouch with 3-7 flowers in each bract. The flowers open from the base to top with 2-6 in a day, which will continue for 5-10 days. It is a tropical plant well thriving in humus rich organic soil and full sun to partial shade. It performs well in drained moist organic soil. Plants flower during July to January and set seeds. Flowers are pale lilac in colour, with the shape of the insect 'praying mantis', so termed as 'praying mantis ginger' (Nissar *et al.*, 2008). The inflorescence shows a good vase life of 5-10 days hence they can be kept for many days on an oasis. The plant can be grown in pots or as hedge plant in gardens. It is a good foundation planting especially in front of blank walls and near garden ponds. The bulbils are found produced from the base of the inflorescence after completion of flowering. The propagation methods of this plant include suckers, bulbils and stem cuttings (Sabu *et al.*, 2011).

MATERIALS AND METHODS

The rhizomes of praying mantis ginger was collected from North-East India and domesticated in Calicut University Botanical Garden (CUBG), Kerala, India. All experiments were carried out in the CUBG. The experiment was started from in the beginning of autumn season. The rhizomes with root tubers were treated with Copper oxy chloride (COC) for 30 min. to

eliminate fungal contamination and were dried under shade (Prabhu *et al.*, 2013). The COC treated rhizomes were stored at 15 °C, for 6-9 months from March-November. Observations were made at regular intervals to assess the condition of the rhizomes. The rhizomes were started sprouting August onwards. The sprouted rhizomes after chilling were planted at regular intervals with a gap of one month i.e., September, October and November. The rhizomes were planted in 8" earthen pots using potting mixture containing soil, sand and cow dung in 1:1:1 proportion. After sprouting each set were transferred to an experimental setup chamber in the greenhouse.

The night break treatments were carried out in the greenhouse by exposing the plants to 2 hours additional illumination during 20 - 22 Hrs. using 100 Watt incandescent bulb controlled by an electronic timer. There were four treatments: T1 - night break supplied from sprouting of the first shoot until the floral spike emerged; T2 - the experiment continued until the first floret opened; T3 - plants without night break., T4 - the control plants without chilling and night break. For each treatment, 4 rhizomes were taken. All data regarding the morphological analysis of 23 attributes of plants under study were observed and recorded.

RESULTS AND DISCUSSION

An induced off-season flowering was obtained in praying mantis ginger through low temperature and night break (Fig. 1). There was an extension of flower production from December to March, when normal plants remain dormant under soil. Four sets of tests were carried out for the current study. The first two experiments, T1 and T2 did not show any significant variation in the growth performance, floral characters and flowering. No flower initiation was observed in T3 and growth pattern was similar to that of T1 and T2. The control T4 did not germinate and T1 and T2 showed better rate of growth and performance than T3 (Table 1).

The induction of flowering of a plant can be achieved by adjusting the factors affecting flowering behavior, viz. photoperiod and temperature. Interruption of dark period by light, called night break, can lead to floral promotion in Long Day plants (Thomas and Vince-Prue, 1997). Plant absorbs red and blue lights and used in controlling photosynthesis, leaf development and flowering. Incandescent light can supplement natural day light and give a large amount of red light and infra red light (Barkley, 2005). Thomas *et al.* (2010) successfully induced off-season flowering in three ornamental gingers viz. *Curcuma inodora*, *C. aurantiaca* and *Zingiber zerumbet* and Ruamrungsri *et al.* (2007) in *Curcuma alismatifolia* Gagnep. through chilling treatment and night break. Recently Prabhu *et al.* (2013) also induced off-season flowering in one rare and endemic ornamental ginger *Boesenbergia siphonantha* through the same method.



Fig.1. *Larsenianthus careyanus* (Benth). W.J.Kress & Mood. A. Vegetative phase of experimental plants; B. Inflorescence; C. Off-season flowering of plant (In sight-close up of flower).

Table 1: Comparison of characters: experimental plants with control plant

Sl. No	Characters (cm)	Average of T1 & T2	(Control)	
			T3 Without chilling	T4 After chilling
1	Standing duration of inflorescence (days)	38	NG	NF**
2	Plant height	37.5	NG	36
3	Leaf number	8	NG	8
4	Leaf length	28.5		25.5
5	Leaf breadth	10.6	NG	9.8
6	Length of inflorescence	12.8	NG	NF
7	Length of spike	9.2	NG	NF
8	Number of comma bracts	6	NG	NF
9	Number of fertile bracts	28	NG	NF
10	Number of flowers per inflorescence	21	NG	NF
11	Flower length	5.95	NG	NF
12	Length of sepal	1.28	NG	NF
13	Breadth of sepal	0.55		
14	Length of petals	1.32	NG	NF
15	Breadth of petals	0.28	NG	NF
16	Labellum length	1.80	NG	NF
17	Labellum breadth	0.70	NG	NF
18	Staminode length	0.30	NG	NF
19	Staminode breadth	0.28	NG	NF
20	Length of stamen	2.40	NG	NF
21	Anther length	0.50	NG	NF
22	Length of epigynous glands	0.45	NG	NF
23	Length of ovary	0.42	NG	NF

*NG – No Germination, **NF – No Flowering

CONCLUSION

Night break experiments gave 100% flowering in praying mantis ginger. The beautiful purple coloured flowers and shining broad leaves throughout the year through night break is a great achievement and benefit to horticulturists and farmers to meet the requirements of customers. By this method, we can produce highly important seasonal ornamental plants in off-season period and increase our country to the top position in horticulture field. Comparatively the experiment is less expensive than any other treatments. From the present studies and previous literatures it is clear that *L. careyanus* is a suitable ornamental plant to the tropics as a hedge as well as cut flower plant, they are easy to propagate, cultivate and are relatively disease and pest free.

ACKNOWLEDGEMENTS

The authors are grateful to Department of Biotechnology, Govt. of India, New Delhi for the financial assistance to the research project on “Potential Ornamental Gingers: Domestication, Improvement and Development of Agrotechniques” (BT/PR/5275/PBD/16/917/2011 dt. 15.03.2012). We express our thanks to Mr. Prasanth A.V. for his help during the study.

Literature Cited

- Barkley, S. 2005. House Plants: Artificial Light at- <http://www1.agric.gov.ab.ca/department/eptdocs.nsf/all/webdoc1374>.
- Jain, S.K., Prakash, V. 1995. Zingiberaceae in India: Phytogeography and Endemism. *Rheedea*, 5: 154-169.
- Kress, W.J., Mood, J.D., Sabu, M., Prince L.M., Dey, S., Sanoj, E. 2010. *Larsenianthus*, a new Asian genus of gingers (Zingiberaceae) with four species, *PhytoKeys*, 1: 15-32.
- Kress, W.J., Prince, L.M., Williams, K.J. 2002. The phylogeny and new classification of the gingers (Zingiberaceae). Evidence from Molecular data. *American Journal of Botany*, 89 (11): 1682-1696.

- Kuehny, J.S. 2001. Potting ornamental ginger. *Greenhouse Production News*, pp. 30-32.
- Nissar, M.V.A., Thomas, V.P., Sabu, M. 2008. Vegetative propagation of *Hitchenia careyana* Benth. (Zingiberaceae) through stem cuttings. *Indian Journal of Botanical Research*, 4 (2): 325-328.
- Prabhu K.K.M., Sabu, M., Thomas, V.P., Rajendran, A. 2011. Effect of sucrose, benzyl adenine and 8-hydroxyquinoline sulphate in the promotion of cut flower vase life in *Larsenianthus careyanus* (Benth.) W.J. Kress & Mood (Zingiberaceae); a charming ornamental ginger from Northeast India. In: Ramachandran VS (ed.) *Taxonomy, Plant Diversity and Conservation*. Pointer Publishers Jaipur, India, pp. 227-232.
- Prabhu K.K.M., Sabu, M., Thomas, V.P. 2013. Effect of temperature and light on the promotion of off-season flowering in Island purple ginger, *Boesenbergia siphonantha* (Baker) M. Sabu *et al.* (Zingiberaceae) – a promising ornamental ginger from Andaman Islands. *Journal of Horticulture, Forestry and Biotechnology*, 17 (1): 144 - 147.
- Ruamrungsri, S., Uthai-Butra, J., Wichailux, O., Apavatjirut, P. 2007. Planting date and night break treatment affected off-season flowering in *Curcuma alismatifolia* Gagnep. *Gardens Bulletin Singapore*, 59 (1 & 2): 173-182.
- Sabu, M. 2006. Zingiberaceae and Costaceae of South India. Indian Association for Angiosperm Taxonomy. University of Calicut, Kerala.
- Sabu, M., Thomas, V.P., Prabhu K.K.M. and Mohanan, K.V. 2011. Package of practices of ornamental gingers. Indian Association for Angiosperm Taxonomy, pp. 1-54.
- Sabu, M., Prabhu K.K.M., Thomas, V.P., Mohanan, K.V. 2013. Variability studies in 'Peacock Ginger', *Kaempferia elegans* Wall. *Annals of Plant Science*, 2 (5): 138-140.
- Thomas, V.P., Prabhu K.K.M., Prasanth, A.V., Sabu, M., Mohanan, K.V. 2010. Induction of off-season flowering in three species of Zingiberaceae through low temperature treatment and night break. *Indian Journal of Botanical Research*, 6 (1 & 2): 129-134.
- Thomas, B., Vince-Prue, D. 1997. *Photoperiodism in Plants*, 2nd ed. Academic Press, New York.