

***Eulophia graminea*: The Orchid with Keiki on the Leaf**

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ABSTRACT: Keikis are asexually produced clone of mother plant whose literary meaning is a baby in Hawaiian language. It's a relatively easier method of asexual propagation with identical plants. Usually it is formed on the older shoots or flowering pseudo bulbs varying with species of Orchids. But no mention of formation of Keikis in terrestrial Orchids are found till date. The keik is were found by the authors on *Eulophia graminea*, a terrestrial Orchid species found in Odisha, that too on its leaf apex, which is a novel characteristics and yet to be reported by any. *Eulophia graminea*, though a threatened species in many places, but has been designated as Early Detection and Rapid Response (EDRR) species by the Florida Keys Invasive Species Exotics Task Force due to its invasive nature. However this species has got some medicinal importance and is being used against several chronic diseases in India since long. Hence this novel propagation method of this species may be a blessing or a matter of serious concern for the environmentalists.

Keywords: Leaf Keikis, *Eulophia graminea*, invasive Orchid.

INTRODUCTION

Orchidaceae is the most diverse and widespread family constituting more than 28000 species divided into five sub families account for 8% of total angiosperms present worldwide (Chase *et al.*, 2003, 2015; Willis, 2017). However only about 1000 species have made into the IUCN global red list to date (IUCN, 2017), out of which 56.5% of them are grouped under the categories of threatened (critically endangered, endangered and vulnerable) (Fay, 2018). *Eulophia graminea*, also called as Chinese crown Orchid or grass leaved *Eulophia* (North American Orchid Conservation Centre, 2021), a species native to southern and central Asia is designated as a threatened species in Srilanka. All the species under the genus *Eulophia* (around 30 species) are known as Amarkand in India (Narkhede *et al.*, 2016). Amarkand species have been used as a remedy against various diseases such as diarrhea, stomach pain, rheumatoid arthritis, cancer, asthma, bronchitis, sexual impotency, tuberculosis, and also possess antioxidant, anti-inflammatory, anti-diarrheal properties. Tuber extracts of *Eulophia graminea* has been used as ear drops to treat ear ache (Kapurswamy, 2007). Nutritionally, it is considered as an excellent food for children and convalescents (Narkhede *et al.*, 2016). Upadhyay *et al.* (2009) from India have filed a patent on novel derivatives of phenanthrene, Eulophiol from *Eulophia* species and its potential application in

inhibition of immune stimulation involving toll-like receptor ligands, especially TLR-4. But the nutritional and ethnomedical claims are uncertain due to their single local name as “Amarkand” to different species of *Eulophia* (Narkhede *et al.*, 2016). Besides its ethnobotanical use, some perturbing facts especially on *Eulophia graminea* have emerged from the new world. After first report of just five plants of *Eulophia graminea* in Miami-Dade country, USA in 2007, it has spreaded over to 67 locations of seven countries by 2010 (Pemberton, 2013). The Florida Keys Invasive Species Exotics Task Force's Early Detection and Rapid Response (EDRR), a multi response task force under the United States Geological Survey (USGS) has categorized this species under it, whose primary objective is to find and eradicate potential invasive species before they spread and cause harm (EDDmaps, 2021). Even a website (<http://www.eddmaps.org>) and an android based smart phone app (IveGot1) supported by the Center for Invasive Species and Ecosystem Health at the University of Georgia has been dedicated to track and control this invasive species in the USA (Leonard-mularz, 2021). In last two decades, *E. graminea* has become naturalized in Australia, South Africa and Florida, USA (Macrae 2002, O' Conner *et al.*, 2006; Pemberton *et al.*, 2008; PIER 2021). Its propagation method by division of corms has been a matter of concern till date. But now the author has been pioneer in reporting its potential very fast unique

propagation method by “Keikis” arising from its leaves may raise concerns in its invasiveness to a great extent or may be a boon to the pharmaceutical industries if its medicinal uses are explored.

MATERIALS AND METHODS

Corms of the terrestrial Orchid species *Eulophia graminea* were collected accidentally by the author from a vegetable field located at Bolagada block of Khordha district of Odisha, India during its weeding.

Corms were planted in pots using suitable media mixtures of leaf moulds, compost and soil in equal proportions and kept under Agro shade nets of Bio technology-cum-tissue culture centre, OUAT, Bhubaneswar for further study during 2017-2020. The plant was then multiplied vegetative to maintain a healthy population. Data on several qualitative parameters of this particular species was recorded and expressed below in Table 1 & 2.

Table 1: Characteristics of *Eulophia graminea*.

Nature of stem	Bulbous
Flowering season	February - March
Flowering pattern	Compound raceme
Inflorescence orientation	Erect

RESULTS AND DISCUSSION

It is a terrestrial Orchid species emerging from corm like structures from the ground. The corms possess nodes, but are devoid of scales at its basal parts. Corms are deep green in colour. Average weight of corm is around 40-70 g and gets enlarged with age and kind of nutrients it receives. The corm divides very quickly to form daughter corms and plants. Its grassy leaves resemble the leaves of newly emerging coconut tree. Leaves are thin and have longitudinal ridges on it. Leaf shape is linear and apex is acuminate. The flower stalk is often very large and can grow from 30 cm to 100 cm, but with minute flowers. Its inflorescence is a compound raceme. Flowers are not that much attractive and it does not have any ornamental importance. It flowers during February- March in aphyllous condition of the plant. Flowers are very small with greenish tepals and purplish brown venation lines on it. Lip is attractive with white base and pinkish hair like fleshy fimbrials on it. Lip is obovate and lip margin is undulated or wavy. It comes to fruiting easily. Each flower stalk contains 12-20 florets in it and bears around 60-70% fruits. Fruits are around 5 cm long capsules with 0.8 cm circumference at its widest point.

Apart from these morphological data, one most important feature was noted from this species and it occurred only once till now. It was the formation of Keikis on its leaf tips. Whatever reports and papers available till date, mentions the formation of Keikis on the epiphytic Orchids like *Dendrobiums*, *Phalanoopsis*, *Oncidioms*, *Epidendrons* etc. *Dendrobiums* produce Keikis on older shoots or pseudobulbs. The Keiki doesn't need special care for propagation, when it is matured (Gurung and Gurung 2014). *Phalanoopsis* are also reported to produce large numbers of Keikis on its flowering shoots. Somewhere reports are also available on keiki emergence from the base of the stem. But

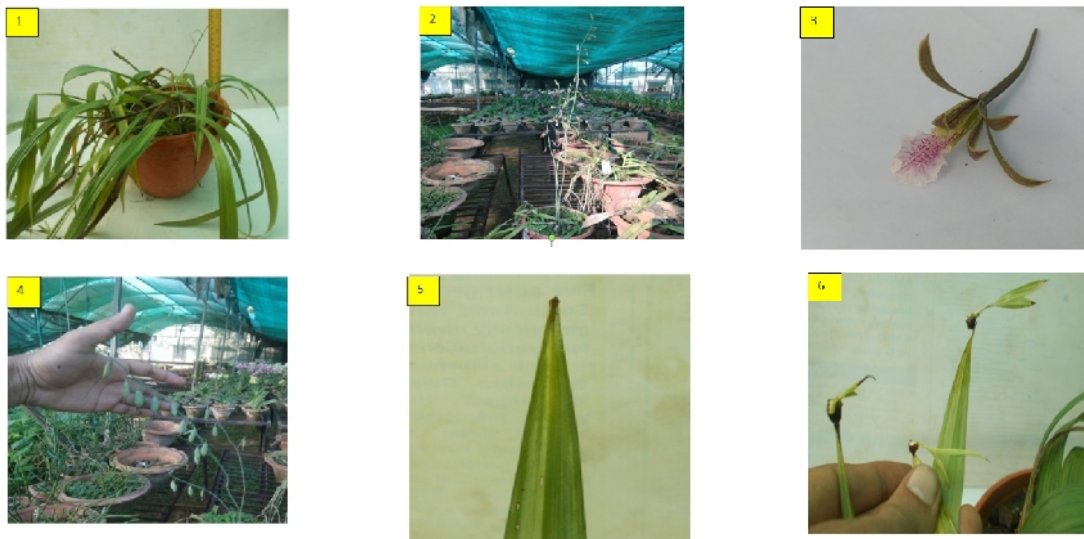
formation of Keikis on *Eulophia* and on leaf apex is unique and novel one.

Its Keikis were formed during October- November months. Initially there was a formation of black blunt in the leaf tip and that gradually increases to form a bulbil like structure within 10-15 days. Eventually small leaves were developed from the bulbils and it converted to a matured Keiki after initiation of roots. Wherever these matured Keikis touch soil/ media surface, they establish themselves as a new plant. The leaves are seen to dry out to be dead after the formation of matured Keikis. These are unique propagation method and very unique to this species as every leaf can produce an identical plant.

Though its unique propagation method is reported for the first time here, other morphological characteristics were reported by several scientists previously. The reports described here corroborates with the previous scientists in many cases, but differs with that of pollination behavior and fruit set, which was reported to be very low by previous authors, i.e., 4.5% to 9.2% (Ackerman and Gonzalez-Orellana 2021), but we found it very high (65.5% to 68 %), which may be due to availability of its suitable pollinators and original habitat. However, the unique method of formation of bulbils or tubers on the leaf apices may also be of immense importance not only for propagation or ethnobotanical use, but also for consumption of tubers in beverage industry. Dried tubers of terrestrial Orchids are widely used in the Middle East and Minor Asiatic region as a traditional beverage known as "Salep" due to their high glucomannan content and are essential to medicine, food and horticulture industries (Gholami *et al.*, 2021; Ghorbani *et al.*, 2014; Kasperek and Grimm 1999). Hence, this method of tuber formation may be of immense importance in reducing natural exploitation of orchid tubers and propagating plants in easier way.

Table 2: Qualitative leaf and flower characters of *Eulophia graminea*.

Parameters	Petal	Sepal	Lip	Leaf
Base colour	Green	Green	White	Green
Mark type	Brown lines	Brown lines	Pink fimbrials	Ridged
Mark position	Throughout	Throughout	Middle	Throughout
Percentage of mark (%)	70	70	20	50
Shape	Oblong-elliptic	Linear-oblong	Obovate	Strap
Apex/ Margin (lip)	Acute	Acute	Undulate	Acuminate



1. Full plant, 2. Flower stalk, 3. Individual Flower, 4. Fruits, 5. Initiation of Keiki on leaves, 6. Keiki development stages.

Fig. 1. *Eulophia graminea*.

CONCLUSION

The importance of the terrestrial Orchid species, *Eulophia graminea* is yet to be assessed to its full potential. Its ethno-botanical importance has eluded many and needs further attention. Hence this unique propagation method noticed here by leaf keikis may be a blessing for the naturalists. However, the invasive nature of this species has raised concerns among the scientists and this novel propagation behavior of this species may add to the agony for the environmentalists to control the invasive species.

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Conflict of interest. None.

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