

EULOPHIA GRAMINEA LINDL.: A REPORT OF KEIKIS ON ITS LEAVES

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Abstract

During the present study, the *keikis* were found on leaf apex of *Eulophia graminea* Lindl., a terrestrial orchid species found in Odisha. The species though a threatened species at many places, 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. The species has medicinal importance and is being used for curing several chronic diseases since long, in India. Hence, the presently reported unique propagation method of the species may be a blessing or a matter of serious concern amongst the scientists.

Introduction

ORCHIDACEAE IS the most diverse and widespread family comprising more than 28,000 species; the family is divided into five subfamilies and account for 8% of total angiosperms present, worldwide (Chase *et al.*, 2015; Willis, 2017). However, only about 1,000 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 threat (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) is a species native to Southern and Central Asia and designated as a threatened species in Sri Lanka. All the species under the genus *Eulophia* (23 species) are known as *Amarkand* in India (Singh *et al.*, 2019); these have been used as a remedy against various diseases such as diarrhoea, stomach pain, rheumatoid arthritis, cancer, asthma, bronchitis, sexual impotency, and tuberculosis. These are also known to possess antioxidant, anti-inflammatory, and anti-diarrheal properties. Upadhyay *et al.* (2009) from India have filed a patent on novel Phenanthrene derivative 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). Their natural populations are on decline due to over exploitation for medicinal uses and other anthropogenic pressures.

Pseudobulbs extracts of *Eulophia graminea* have been used as ear drops to treat ear ache (Karuppusamy, 2007). Nutritionally, it is considered as an excellent food for children and convalescents (Narkhede *et al.*, 2016). Besides its ethnobotanical uses, 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 county, USA in 2007, it has spread 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) is 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 (EDD maps, 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-Mullarz, 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).

Keikis (Hawaiian for *baby or child*, literally *the little one*) are asexually produced clones of a mother plant. It is a relatively easier method of asexual propagation for producing genetically identical plants. Usually, these are formed along the length of the cane or at the end or on a node along the flower stem depending upon the species.

However, formation of *keikis* has not been mentioned in terrestrial orchids, till date. The present study reports its propagation method by formation of *keikis* (arising from its leaves)

Material and Methods

Pseudobulbs of *Eulophia graminea* were collected accidentally by the author from a vegetable field located

Table 1. Morphological characteristics of *Eulophia graminea*.

Character		Character	
Plant height	3.03 cm	Bloom life of individual floret	4.89 days
Number of leaves	8.89	Bloom life of whole spike	22.89 days
Nature of stem	Bulbous	Pedicle length	2.03 cm
Flowering season	February-March	Flower width	1.91 cm
Flowering pattern	Compound raceme	Flower opening from bud initiation	28 days
Inflorescence orientation	Erect	Number of florets/stalk	16
Stalk length	79.99 cm	Spur length	0.5 cm

at Bolagada block of Khordha district of Odisha, India. Pseudobulbs were planted at pots using suitable potting mixtures of leaf moulds, compost, and soil in equal

tree. Leaves are thin and are with longitudinal ridges. Leaf shape is linear and apex is acuminate. Its inflorescence is a compound raceme. The flower stalk

Table 2. Specific flower and leaf characters of *Eulophia graminea*.

Parameters	Flower characters			Leaf characters
	Petal	Sepal	Lip	
Base colour	Green	Green	White	Green
Mark	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
Length (cm)	0.9	1.1	1.4	44.5
Width (cm)	0.4	0.3	0.8	4.1

proportions and kept under Agro shade nets of Bio technology- cum- Tissue culture Centre, OUAT, Bhubaneswar, India for further study during 2017-2020. Data on several qualitative and quantitative parameters of this particular species was recorded. Quantitative characters like length and width of leaves, stem, sepal, petal, lip etc. were recorded and expressed in centimeters (cm). Table 1 shows the data of the species with 3 flowering season (2018-2020) and Table 2 shows data regarding various plant characters including flower.

Results and Discussion

Eulophia graminea Lindl. is a terrestrial orchid emerging from underneath pseudobulbs. The pseudobulbs, deep green in colour possess nodes, but are devoid of scales at its basal parts. Average weight of a pseudobulb was around 40-70 g and it gets enlarged with age and kind of nutrients, it receives. The pseudobulb divides very quickly to form daughter pseudobulbs and subsequently, the plants. Its grassy leaves resemble the leaves of newly emerging coconut

is often very large and can grow from 30 cm to 100 cm; flowers are very small with greenish tepals and purplish brown venation lines. Lip is attractive with white base and pinkish hail like fleshy fimbrials on it; lip is obovate and its margin is undulated or wavy. It flowers during February-March, in leafless condition. Each flower stalk contains 12-20 florets and subsequently, bears 60-70% fruits. Fruits are around 5 cm long capsules with 0.8 cm circumference at its widest point.

During the present study, one most peculiar feature was noted, only once in the species *i.e.* the formation of keiki on its leaf tip. The formation of *keikis* has so far been reported only on the epiphytic orchids like *Dendrobium*, *Epidendron*, *Oncidium*, *Phalaenopsis* etc.

Dendrobiums produce *keikis* on older shoots or pseudobulbs. The keiki doesn't need special care for propagation, when it is mature (Gurung and Gurung, 2014). *Phalaenopsis* are also reported to produce a large number of *keikis* on its flowering shoots.



Fig. 1. A-F. *Eulophia graminea*: A, Full plant; B, Plant in bloom; C, Individual flower; D, Fruit formation; E, Initiation of keiki formation on leaf; F, Keiki development on leaves.

The *keikis* were formed during October-November. Initially there was a formation of black blunt on the leaf tip which gradually increased to form a bulbil like structure within 10-15 days. These bulbil like structures developed leaves and roots and hence eventually *keiki* were formed. On coming in contact with the substratum, these mature *keikis* established themselves as new plants. The leaves are seen to dry out to be dead after the formation of matured *keikis*. This method of propagation is very unique to this species as each and every leaf may have the potential for the production of an identical plant.

Presently, the fruit set was reported to be very high (60-70%), which may be due to availability of its suitable pollinators in its natural habitat. However, Ackerman and Gonzalez-Orellana (2021) reported it to be very low *i.e.* 4.5% to 9.2%.

Conclusion

The importance of the terrestrial orchid species, *Eulophia graminea* is yet to be assessed to its full potential. Its ethno-botanical importance has elated many and needs further attention. Hence, the unique propagation method reported here by the production of *keikis* on its leaves may be a blessing for the naturalists. However, the literature reports regarding its invasive nature has raised concerns amongst the scientists.

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