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MYCORRHIZAL ASSOCIATION IN *PORPAX RETICULATA* AN EPIPHYTIC ORCHID FROM WESTERN GHATS, INDIA

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Abstract

Porpax reticulata is a very small epiphytic or lithophytic orchid. Pseudobulbs are greenish, discoid 0.5 cm to 1.5 cm in diameter, enclosed in a sheath of reticulated fibres. Roots are thin light green in colour. Present investigation was carried out to report the mycorrhizal association in the roots of *Porpax reticulata* obtained from Western Ghats. An important observation in the present study is the occurrence of infection not only in the cells of cortical region but also in the layers of the cortex adjoining the endodermis. Some of the endodemal cells were also seen with hyphal entry in the stellar region.

Key words: *Porpax reticulate,* Pelotons, Western Ghats

Introduction

Mycorrhizal association were known since 1880's (Frank, 1885). It constitutes one of nature's most ubiquitous, widespread, persistent and interesting examples of parasitism. All the orchid seeds growing in wild requires association of the fungus for the purpose of germination. It was in 1903 Noel Bernard, a French Physiologist who first discovered that a fungus was necessary for the germination of orchid seeds. Of the seven types of mycorrhizae *viz.*, VAM, ecto, ericoid, orchid, arbutoid, monotropoid and ectendo mycorrhiza (Peterson, and Fraquhar, 1994), extensive work has been carried out on ectomycorrhizae and vesicular arbuscular mycorrhizae (VAM) where as the other five types are poorly studied. The orchid mycorrhizae have been paid less attention because of their great variability in life.

The importance of mycorrhizal infection for the germination of orchid seeds and for successful seedling development has been well documented in the past (Peterson and Currrah, 1990; Richardson *et al*., 1992). Occurrence of root infection in temperate species have been reported by Harley and Harley (1987). Similarly, Senthilkumar and Krishnamurthy (1998) and Peterson and Farquhar (1994) have also reported the occurrence of mycorrhizal infection in the ground orchid *Spathoglottis plicata*, Blume. However the reports on mycorrhizal association in epiphytic orchid are scarce (Senthilkumar *et al*., 2000; Bukhari and Herlekar, 2015).) The present investigation is an attempt to study the endosymbiotic association in an epiphytic orchid *Porpax reticulata* from Western Ghats.

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Materials and methods

Porpax reticulata (Lindl.) was collected from Amboli hills (2673 ft above MSL) from the neighbouring Maharashtra State and from Cancacona in the district of South Goa (Fig.1a-b). The Orchids along with the roots were collected in polyethylene bags and transported to the laboratory for further processing. Roots were rinsed with water and preserved in 70% alcohol for microscopic observations. Thin free hand sections were taken just above the root tip and stained with 0.05% tryphan blue (Phillips and Hayman, 1970). Selected sections were observed for mycorrhizal colonization (hyphae and pelotons). The photographs in the field were taken using digital camera. Photomicrographs of the transverse sections were taken using camera attached to an Olympus microscope.

Results and Discussion

Cross sections of the roots of *Porpax reticulata* an epiphytic orchids exhibited the presence of mycorrhizal association. Peloton were observed in the entire cortical region (Fig. 1. c-e). About 80% of the cortical cells in the

cross section showed the presence of pelotons. Apart from peloton in the cortical cells, hyphae were also observed randomly in the cortical region. Peloton were also found in the stelar region penetrating through the endodermal cells via the passage cells (Fig. 1 f).

The occurrence of mycorrhizal colonization in the roots of epiphytic orchids in the present study is in agreement with Senthilkumar *et al.,* (2000), who have reported the mycorrhizal association in the epiphytic orchid *Acamphe praemorsa*. Occurrence of loose hyphal network in the cortical region of *Porpax reticulata* are in agreement with Bukhari and Herlekar, (2015) who have made similar observations in their studies on epiphytic orchids from Western Ghats. However in some parasitic species *Rhizoctonia*, chlamysopsores and sclerotia have been reported occasionally in the epidermal cells of the host (Sneh *et al.,* 1991).

The present study reveals that the mycorrhizal fungus which resides inside the roots in the cortical cells helps in absorbing minerals and other nutrients from the surrounding medium which is then utilized by the host by a process of digestion of the fungal cells within the host tissue. The mycorrhizal fungus in the epiphytic orchid may probably be responsible for the supply of sugars to the orchid seed for the purpose of germination.

The occurrence of mycorrhizal association in the epiphytic orchid has led to the general assumption that they play an important role in the epiphytic orchid as well (Senthilkumar *et al.,* 2000). An important observation in the present investigation is the occurrence of the infection in the layers of the cortex adjoining the endodermis. Some of the endodermal cells were also seen with hyphal entry in the stellar region. In the present study digestion was randomly observed in the cortex and not in some definite

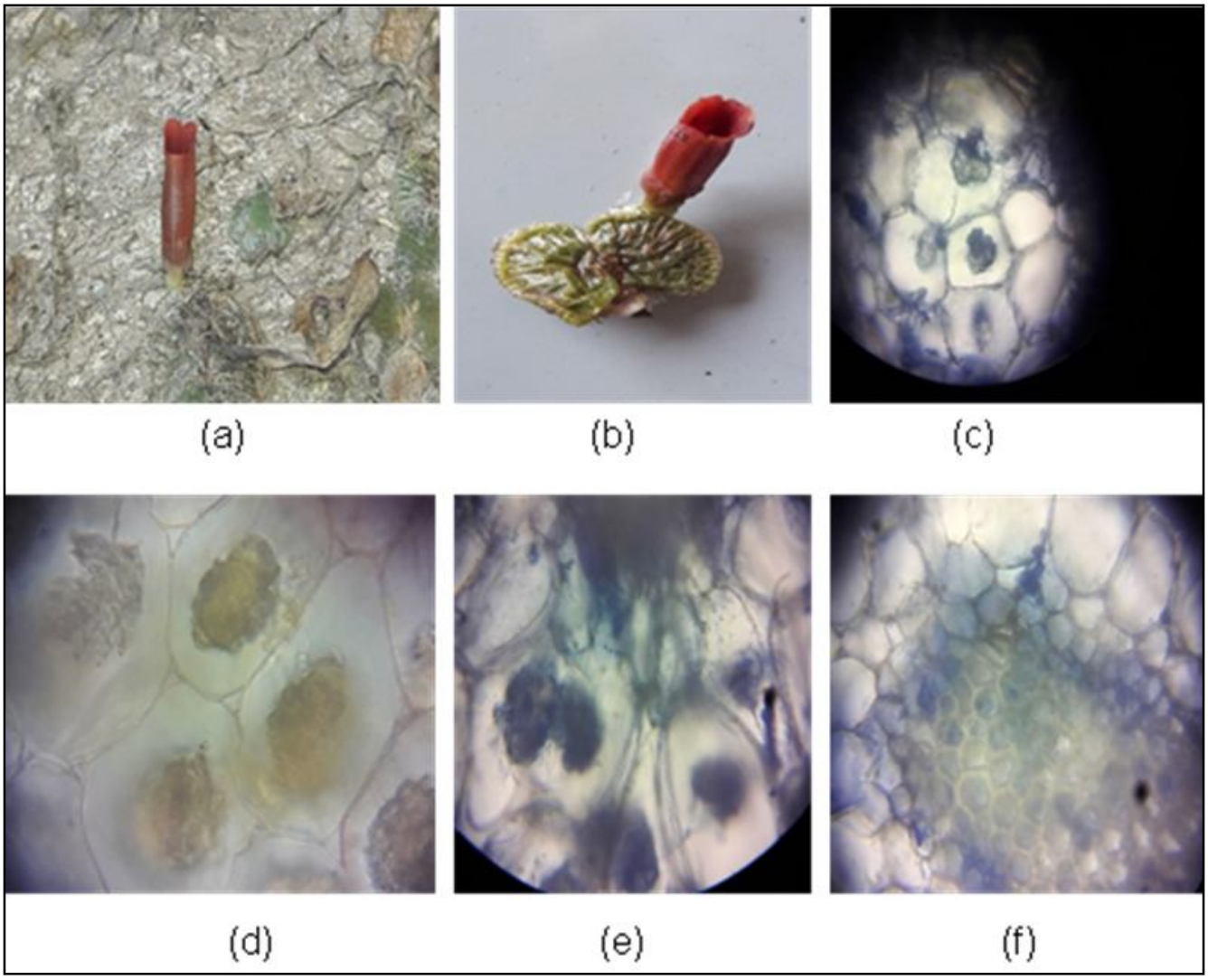

Fig.1. (a&b) – Habit :*Porpax reticulata*; (c-e) Peloton formation in the cortical region, (f) Fungus mycelium penetrating the stelar region

cells, designated as digested layers' Which have been recognized in some species in the inner cortex (Hadley 1982; Williamson and Hadley, 1970). Pelotons, formed within the cells in the form of coiled structures greatly increases the interfacial surface area between orchid and fungi. However since infection is a continuous process in this epiphytic orchid and since all cells of the cortex are not colonized at the same time, in a mature root there was a mix-up of younger and older colonization (Senthilkumar and Krishnamurthy, 1999).

Mycorrhizal fungi are well known for the translocation of sugars and phosphates to the orchid (Richardson *et al.,* 1992). This type of fungal symbiotic association has already been reported in terrestrial orchid (Senthilkumar *et al*., 2000). In the cross section the pelotons appears as loosely arranged fungal mycelial network which appears as spherical and hexagonal balls in the parenchymatous cells of the cortical region. One of the important feature of the orchid mycorrhizae is the lysis of the pelotons (Peterson and Currah, 1990) These cells where lyses of the peloton take place, were digested 'digestion cells (Burgeff, 1959).

Our results are contradictory to the observation made by Bermudas and Benzing, 1989) show suggest that mycorrhizal fungi do not colonize epiphyte and are in agreement with Senthilkumar *et al*., (1998), Bukhari and Herlekar (2015) who have reported the occurrence of mycorrhizal association in epiphytic orchids. The present study shows that orchid mycorrhizae are one of the most complex symbiotic interactions, in which dynamic balance is achieved between pathogenesis of the host tissue and dissolution of the fungus. Epiphytic orchids as they do not have the advantage of a regular supply of water absorbed from the soil, they live under more or less xerophytic conditions and develop a peculiar habit of depending upon mycorrhizal fungus in their roots, for their entire supply of nourishments.

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