



Short communication

Mutation in focus: first record of a wild chimeric individual for the subtribe Laeliinae (Orchidaceae)

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ABSTRACT

Variegated species are highly appreciated for their unique aesthetics. Although often confused, variegation and chimerism are distinct phenomena. Chimerism can also cause variation in the color of plant organs, but it is a specific type of genetic mosaic. Limited information is available on variegation and chimerism in Orchidaceae. Here, the first record of a wild foliar chimeric mutant for the subtribe Laeliinae (Orchidaceae) is presented. In July 2020, a sterile chimeric individual of *Epidendrum cinnabarinum* was found and photographed in a fragment of restinga in the Área de Proteção Ambiental das Lagoas e Dunas do Abaeté, a conservation unit in the municipality of Salvador in the state of Bahia, Northeast Brazil. The plant's phenotype is a mosaic of green, cream and yellow striped leaves in different proportions. Leaves on one caulome are distinctly colored, not only on the margins, but also in the central portion. Anatomical and ecophysiological aspects of the chimeric specimen need to be studied. The abundance and persistence of the chimeric variegation in the individual will be monitored while this phenomenon should be more closely examined for the species.

Keywords: conservation, foliage plants, *Epidendrum*, *Epidendrum cinnabarinum*, morphology, Neotropical, orchids, phenotype, restinga, variegation

Variegation in plants is mainly characterized by markings of different colors on leaves or petals, manifested as stripes, blotches and streaks, that are often located on the margins (Marcotrigiano 1997). It can be caused by nutritional disorders, pest damage, differential gene expression, leaf blisters, viruses

or genetic mosaicism (Marcotrigiano 1997). Species with variegated foliage are extremely appreciated by plant lovers and growers due to their peculiar morphology and unique aesthetics, and thus are of considerable economic value in the ornamental plant market (Behe *et al.* 1999; Valverde *et al.* 2012).

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Foliar variegation is common in certain botanical families such as Araceae, Araliaceae, Asparagaceae, Bromeliaceae, Euphorbiaceae and Myrsinaceae (Li *et al.* 2007; Khalekuzzaman *et al.* 2015), but relatively uncommon in Orchidaceae.

Some terrestrial orchids of the subfamily Orchidoideae have leaves that are green to variously splashed, blotched, lined or tinged with white or silver, such as species of *Cyclopogon* C.Presl and *Mesadenella* Schltr., or commonly with white and well-demarcated reticulated nerves, as seen in *Aspidogyne* Garay, *Goodyera* R.Br. and *Ludisia* A.Rich. However, variegated patterns are not exclusive to the subfamily Orchidoideae. Species of *Paphiopedilum* Pfitzer (Cypripedioideae) and *Oeceoclades maculata* (Lindl.) Lindl. (Epidendroideae) are other examples of bi-colored terrestrial orchids with green foliage with lighter green blotches. Furthermore, on the internet, it is possible to find photos of other variegated individuals of highly commercial genera of the subfamily Epidendroideae, such as *Dendrobium* Sw. and *Phalaenopsis* Blume, and even of less exuberant genera, such as *Epidendrum* L. and *Encyclia* Hook (e.g., Giulio Celandroni Orchidee 2020; Orchidéhuset 2020; Vintage Green Farms 2020). These individuals are mainly hybrids and have cream or yellow bands at the edges of the leaves and are especially rare (Mursyanti *et al.* 2016; Vintage Green Farms 2020). Variegated individuals of mini *Phalaenopsis* have been produced commercially, but less than 0.01 % of the plantlets derived from seeds from self-pollinated variegated plants exhibited a variegated pattern (Mursyanti *et al.* 2016).

Variegation and chimerism are often inseparable and confused, but they are distinct phenomena (Marcotrigiano 1997; Prina *et al.* 2012). Chimerism also causes variation in the color of plant organs, but it is a specific type of genetic mosaic; chimeric individuals have genetic differences in one or more layers of the apical meristem, and are classified as periclinal, mericlinal or sectorial chimeras based on the arrangement of the genetically dissimilar cells (Marcotrigiano 1997). Chimeras may be the result of genetic changes in the nuclear or chloroplast genome (spontaneous or induced), transposition of genetic elements, synthesis of graft chimeras, semigamy or tissue culture synthesis of chimeric meristems (Marcotrigiano 1997). Chimeras are frequently studied with regard to ontogenesis and have potential to be employed in the genetic improvement of cultivars (Bomfim 2014). Nonetheless, there is no information available about chimerism in Orchidaceae.

Laeliinae is probable the most ornamental subtribe of the family Orchidaceae, comprising ca. 2,100 species, in addition to thousands of hybrids, mainly artificial, with *Epidendrum* being its largest genus (Withner 1988; van den Berg 2008; Chase *et al.* 2015). Although numerous species of *Epidendrum* have been described, mainly in the past two decades and at a rate of roughly 25 per year (Barberena & Gonzaga 2016), there is no mention of collected specimens or individuals photographed in nature having leaves lined or tinged with white, cream or yellow.

Species of *Epidendrum* always have green to purple leaves (Pridgeon *et al.* 2005), but this variation in coloration is apparently associated with sun exposure (greater or lesser UV radiation) interfering with the synthesis of anthocyanins, as reported for some species of Bromeliaceae by Benzing & Friedman (1981). Similarly, I am unaware of any record in the literature regarding foliage with lighter non-green margins for other genera of Laeliinae.

Therefore, presented here is what can be considered the first record in the wild of an individual of the subtribe Laeliinae (Orchidaceae) with foliar chimerism. In July 2020, one sterile chimeric individual of *Epidendrum cinnabarinum* Salzm. was found and photographed in a fragment of restinga in the municipality of Salvador in the state of Bahia, Northeast Brazil.

The registered specimen is a well-developed terrestrial individual with two caulomes and two keikis. The phenotype is a mosaic of green, cream and yellow striped leaves in different proportions. Leaves on one caulome are distinctly colored, not only the margins, but also the central portion, ranging almost from one end of the color spectrum to the other, sometimes with striking to smooth cream or yellow stripes and sometimes almost totally green (Fig. 1A-D). Apparently, the chimeric individual does not differ morphologically from totally green individuals (Fig. 2); the leaves of the chimeric individual are regular in shape and texture, being coriaceous and predominantly oblong. Although measurements of vegetative parts have not been taken, it is almost certain that the chimeric individual has dimensions within those observed for the species.

Epidendrum cinnabarinum is restricted to Northeast Brazil, where it occurs from the state of Rio Grande do Norte to the state of Bahia (Pessoa 2020). It is particularly well distributed along the coast of Bahia state and forms a relatively large population (more than 150 individuals) in Área de Proteção Ambiental das Lagoas e Dunas do Abaeté (APA Abaeté) (Barberena *et al.* 2019), the conservation unit where the chimeric individual was found. The APA Abaeté consists of a vegetational mosaic with herbaceous, shrub and tree phytophysiognomies surrounded by partially urbanized to predominantly urbanized areas. The individual was found in a non-floodable shrub formation in one of the most preserved localities of APA Abaeté, which has regular surveillance carried out by the employees of Parque Municipal das Dunas, which is part of APA Abaeté (Diário Oficial do Município de Salvador 2011; Barberena *et al.* 2019).

The difference in color between green leaves and chimeric leaves are notorious (Figs. 1A-D, 2) and thus chimeric individuals are easily recognized by their inconsistent color pattern even on the same caulome. The individual reported and photographed here is a chimera since foliar chimerism is clear cut and expressed as elongated stripes in monocots (Prina *et al.* 2012). Further, chimerism is recognized mainly by most of the adventitious shoots sorting into component genotypes, the occasional appearance of nonvariegated shoots and the



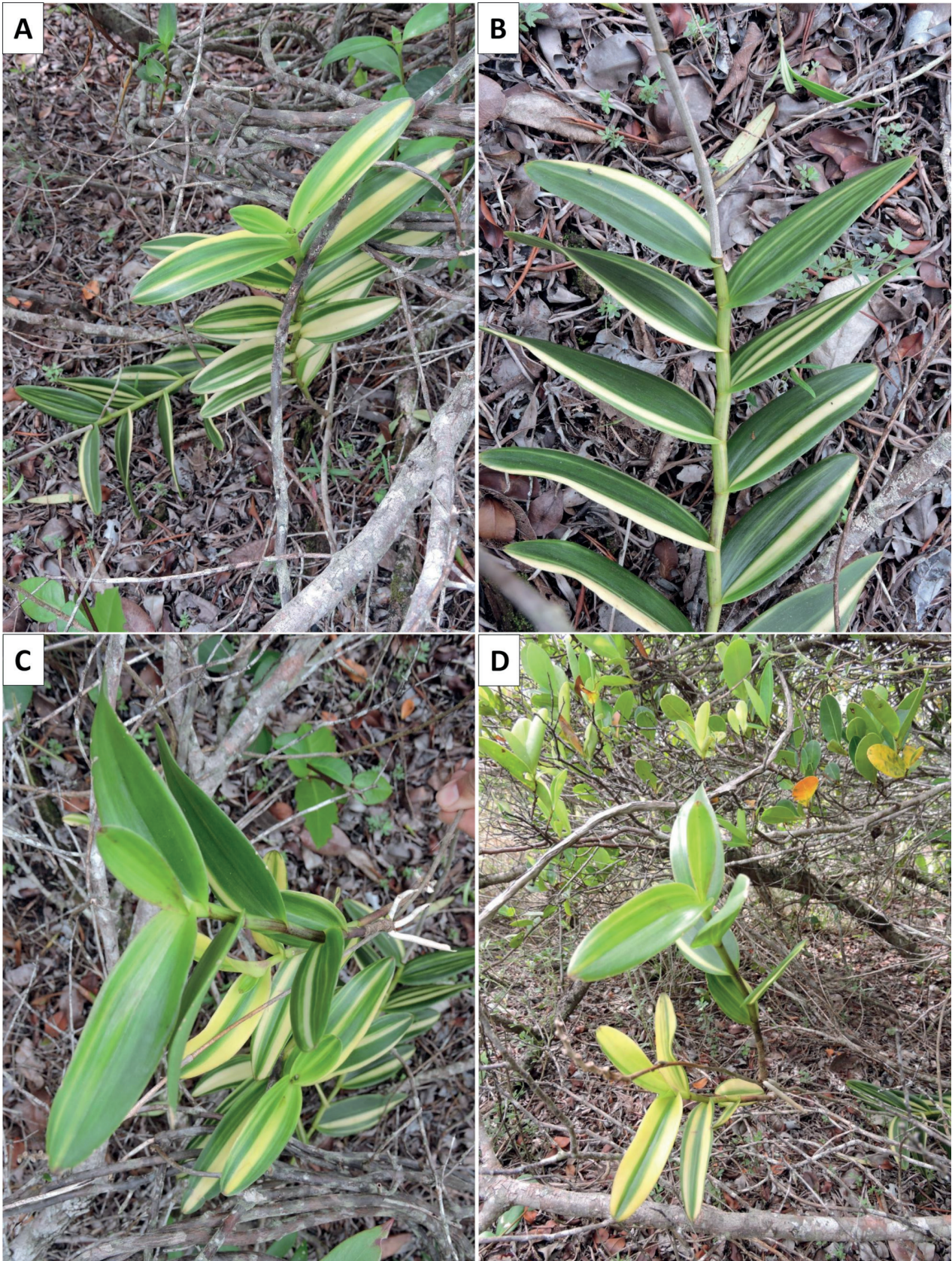


Figure 1. Chimeric individual of *Epidendrum cinnabarinum* Salzm. in Área de Proteção Ambiental das Lagoas e Dunas do Abaeté, Bahia, Brazil, showing an inconsistent color pattern of the leaves with green, cream and yellow striped leaves in different proportions even on the same caulome. Photographed by Felipe Fajardo V. A. Barberena.



lack of a relevant variegated phenotype in wild populations (Marcotrigiano 1997). All of these characteristics could be observed or related to the present case. The hypothesis of virus infection is ruled out since viruses in orchids often promote asymptomatic infections; when infections are symptomatic, they are mainly expressed by leaves with chlorotic or necrotic spots, which may be depressed or not and are irregularly distributed (Kubo *et al.* 2009; Kitajima *et al.* 2010; Moraes *et al.* 2017). In any event, infected plants do not display distinct cream or yellow and longitudinal stripes on the leaves.



Figure 2. Individual of *Epidendrum cinnabarinum* Salzm. in Área de Proteção Ambiental das Lagoas e Dunas do Abaeté, Bahia, Brazil, showing the typical totally green foliage of the species. Photographed by Felipe Fajardo V. A. Barberena.

The chimeric mutant of *E. cinnabarinum* could be used as a parental plant for horticultural breeding, but anatomical and ecophysiological aspects of the chimeric specimen would need to be studied first. Nonetheless, the immediate goal agreed to with the park manager is the *ex situ* cultivation of the individual in a greenhouse. The abundance and persistence of the phenotypic mosaic of the individual will be monitored while this phenomenon should be more closely examined for the species.

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