Anatomical aspects of leaf variegation – a review

Elisa Mitsuko Aoyama*
Universidade Federal do Espírito Santo, São Mateus, ES, Brazil.
Alexandre Indriunas
Instituto de Botânica, São Paulo, SP, Brazil.
Mariana Maciel Monteiro
Universidade Federal do Espírito Santo, São Mateus, ES, Brazil.

*Corresponding author: elisaoyama@yahoo.com.br

INTRODUCTION

Variegation can basically be understood "by the presence of different colors disposed on the leaf surface as irregular or regular patches" (Sheue et al. 2012), or more specifically "means the absence location, masking or reducing the chlorophyll on parts of the upper leaf surface, often in a pattern of spots" (Givnish 1990).

According to Font Quer (1985) variegation is the "state of the plant that show tissue or vegetative parts of different colors or different constitution [...] the variegation can be phenotype, for example, caused by a virus," as noted by Parker (1934) and Gerola et al. (1969) for Phaseolus vulgaris; Saitoh and Terauchi (2002) for Nicotiana benthamiana and Garmey (1975) for citrus. The bacterium Xylella fastidiosa which causes the disease chlorosis citrus variegated (CCV), considered the most severe disease of citrus in Brazil has as initial symptom the variegation of the leaves with yellow spots (Rossetti & De Negri 2011).

Font Quer (1985) also points out as the cause of the variegation the genetic factor as reported by Sabnis (1924) in Hydrangia sp., Sabnis (1932) in Mentha rotundifolia Huds. var. variegata and Evenari (1989) in a review work on the types of inheritance related to the variegation. The variegation may be caused also by chimeras (Marcotrigiano and Stewart 1984) or mutations (Evenari 1989, Sangsiri et al. 2007, Wu et al. 2011). Several other studies have addressed the molecular aspect as Hung et al. (2010) for Epipremnum aureum, and especially for Arabidopsis thaliana as Sakamoto (2003), Miura et al. (2007), Suzuki et al. (2007), Yu et al. (2007) and Wu et al. (2011).

This review aims to compile, summarize, the main studies concerned with the anatomical characterization of variegation, will also be discussed the patterns and the main structures related to the variegated appearance in the leaves.

DISCUSSION

The first studies on the anatomy of variegated leaves were Bateson (1919) with Veronica sp. and Massey (1928) with Pelargonium elegans, the species studied in this work showed the variegation characterized by white spots, and the main observations of the authors
were in the absence of chlorophyll in these regions. The most important work on variegation of the leaves is Hara (1957) with 55 species of 24 families, which identified four types of mechanisms or patterns for this character, which he named as ‘chlorophyll type’, ‘pigment type’, ‘air space type’, and ‘epidermis type’. The parameters used for this rating were the presence of pigments (chlorophyll and pigments) and structure (air space and epidermis). For the ‘chlorophyll type’, light areas are caused by deficiency of chlorophyll, for the ‘pigment type’, other than chlorophyll pigments are present, however the structural variegation does not show changes in the pigments. Most structural variegation observed by Hara (1957) was caused by diffuse reflection of light from air spaces just beneath the epidermis (the ‘air space type’), or variegation was caused by structural variation in epidermal cell thickness.

From this study was possible to elucidate that variegation is not always related to the lack of functional chloroplasts or chlorophyll, since Dedecca (1957) with coffee and Fooshee and Henny (1990) with Aglaonema nitidum, obtained similar results of inheritance of a leaf variegation in the common forms may have a common epidermis or below the tissue that store water, both intracellular space may occur below the superior epidermis or below the tissue that store water, both forms may have a common origin, where the dermal tissues it is loosely connected to mesophyll.

CONCLUSION

Recent discoveries of new anatomic patterns of leaf variegation show that, although a feature studied by several authors, further research especially with species of other families is necessary.

References


