EFFECT OF GEMINVIRUS INFECTION ON LEAF ANATOMY AND MORPHLOGY OF *MALVASTRUM COROMANDELIANUM* (L.) GARCKEIS: A NEW INSIGHT

MUHAMMAD NAVEED SHAHID[1*], SAMRA JAVAID[2], SHABNUM SHAHEEN[2]

[1]Department of Botany, University of Education, Lahore, Pakistan.
[2]Department of Botany, Lahore College for Women University, Lahore, Pakistan.
**Corresponding author's email: naveed.shahid@ue.edu.pk*

Abstract

This review highlights changes of leaf anatomical characters in *Malvastrum coromandelianum* (L.) GARCKEIS plants infected with *Hollyhock leaf curl virus* (HoLCV). Malvaceae is one of the important families of plants. Different types of phytochemicals, antioxidants and metabolites present in *M. coromandelinanum* indicate that it has anti-microbial activity. The anatomy of infected leaves of *M. coromandelianum* is almost similar with the anatomy of its healthy leaves. The slight difference is that the trichome is long, twisted, which has rod-like structure, is present in virus infected leaves. Anatomical and morphological investigations of the virus compromised plants are important due to its medicinal importance and to advance scientific knowledge.

Keywords: *Malvastrum coromandelianum* (L.), *Hollyhock leaf curl virus* (HoLCV), Biological activities, Morphological features, Anatomical characters

Introduction

Medicinal plants are perceived as traditional medicinal services/cure for people. Hence the plants as medicinal sources became less important the modern civilization. World Health Organization (WHO) reports revealed that the herbal medicines as an aspect of primary health care are used by approximately 80 % of the world population. Commercial medications being utilized now-a-days to treat sicknesses are likewise derived from the plants (Ebadi, 2002). The compounds which are synthesized by plants have crucial functions *viz*., development, growth and specific functions like pollinator attraction and defense against herbivores etc. These compounds are commonly known as plant secondary metabolites. The representative examples of plant metabolites are polysaccharides, lignin, alkaloids, sterols, phenol, proteins and tannins (Devi, 2019).

The *Malvaceae* is a family of herbs, shrubs and small trees found at global level, frequently in the humid regions and consist of about 110 genera and over 2000 species (Bibi, 2010). *Malvastrum coromandelianum* (L.) Garckeis an upright, woody, perennial, branched herb or under shrub belongs to the family *Malvaceae*. It is 20-60 cm tall; its shoots have basal leaves but only cauline leaves are present at flowering (Pandey, 2015). It is found in trash dumps, by the road sides and also in fertile land (Devi, 2019).

M. coromandelianum is has been well known for its medicinal properties for many years (Sanghai, 2018). Due to the presence of alkaloids, essential oils and phenolic compounds, the plant is recognized for its antibacterial and antifungal activities. Some irritant and allergic compounds are also present in the plant. They contain a wide variety of cytokines which are efficient to cure inflammation (Islam *et al.*, 2010). The plant also shows antioxidant activity (Sexena and Rao, 2018). Reports revealed that some phytoconstituents such as alkaloids, tannins, proteins, carbohydrates are present in the plant (Dhirendra *et al*., 2013) and vitamin-C is also present in roots and leaves of plant (Chauhan and Rawat, 2000). The phytochemicals reported from upper parts of the plant are β-phenylethylamine, dotriacontane, dotriacontanol, β-sitosterol, stigmasterol, campesterol, lutein, N-methyl-b-phenylethylamine and indole alkaloids. The seeds usually have fatty oils. Glycosides, alkaloids, resins, tannins and saponins are present in other parts of plants (Devi, 2019; Zafar *et al*., 2010).

Plant viruses that belong to the *Geminiviridae* family are accountable for major crop diseases in the world. They have circular single stranded (ss) DNA genome whose length varies between 2.5 to 5.2 kb in length occupying twinned icosahedral particles. Nowadays, this family has nine genera, for example, *Becurtovirus, Begomovirus, Capulavirus, Curtovirus, Eragrovirus, Grablovirus, Mastrevirus, Topocuvirus*,

and *Turncurtovirus* (Varsani *et al*., 2017). Among them, genus begomovirus is the largest genus that are specifically transmitted by whitefly (*Bemisia tabaci* Gennadius.) in dicotyledonous plants and become a source of major economic yield losses (Yang, 2007). Two indistinguishable sized DNA components, known as DNA-A and DNA-B, are present in bipartite genome of begomoviruses, both of which are essential for infectivity (Guo *et al.*, 2008). They produce yellow netting on the leaves of plant that suppress the plant growth (Yang, 2007).

Several reports have explained that begomoviruses infect the *M. coromandelianum* and their molecular characterization has been done. But no one has studied the morphological and anatomical changes in the diseased plants. Furthermore, identification of chemical classes of secondary metabolites responsible for the antimicrobial activity is an important step towards the identification of the pure chemical structures. If the identified antimicrobial compounds from this research are suitable to be directly used as antibiotic drugs or preservatives, their structures and mode of actions could still lead to the discovery of novel bacterial target sites to be used for future synthetic drug development. *M. coromandelianum* (L.) is an erect, woody, lasting, fanned herb or under bush of the family *Malvaceae*. They are 20-60 cm long in height, shoots have basal leaves however at blossoming just cauline leaves are present, having 2-furnished to 4-outfitted stellate hairs with arms oppressed and basically 180° apart (Pandey, 2015).

Oppressed stellate hairs are present on the stems. The plant is normally littler, velvet-furry with trademark 4-rayed hairs. Leaves are basic, interchange, (20-80) mm x (10-30) mm, praise applaud elliptic to lanceolate, intense to taper at zenith, comprehensively adjusted to cuneate at base, edges dentate to about serrate; 3-5 nerved at base; petioles 20-30 mm long, 1-3.5 cm wide, sharp or obtuse tipped, edges serrated, 3-nerved from base stellate bristly; stipules 3-5mm long, lanceolate, sharpen and early deciduous. Leaf stalks are 1.5-4 cm long. Light yellow blossoms happen separately in leaf axils. Blossoms are yellow, about 1.3 cm expansive, with 5 petals, are infrequently combined or terminal. Petals are forestalling, shallow lopsidedly lobed at the tip. axillary, single; pedicels slim, 5-8 mm long; epicalyx flaps filiform, 5x1 mm, pilose; calyx shallowly cup formed, 5-7 mm, accrescent to 8-10 mm in natural products, external surface meagerly pubescent with stellate hairs; petals-5, yellowish, obovate, marginally inconsistent bilobed at summit, (6x8) mm - (4x5) mm; stamens various, combined in a section, 3-4mm long; fibers organizing just close to peak of segment; anthers reniform; carpels-10, syncarpous, ovary unrivaled, 10 locular with one ovule in every locule; style extended, filiform with capitates stigma. Flower tail is 5 mm long. Natural products are discoid, schizocarp about raised side. Seeds are minute, compacted, reniform. (Sanyal, 2016; Dhiman, 2005; Verma *et al.*, 2000; Sanghai *et al.*, 2018; Devi, 2019).

The morphology of infected leaves of *M. coromandelianum* (L.) is almost similar with the morphology of healthy leaves of *M. coromandelianum* (L.). There is a slight difference which is yellowing of veins, yellow mosaic and thickening of veins. Indications have been seen as tainted by begomoviruses. (Zhou *et al*., 2003; Jiang and Zhou, 2004; Ma *et al*., 2004; Guo and Zhou, 2005; Xiong *et al*., 2005). Weeds have been accounted for to be potential wellsprings of essential inocula of infections and assume a significant job in the tirelessness and spread of the infections (Hallan *et al*., 1998).

The leaf lamina is dorsiventral with single layered lower and upper epidermis, minimally masterminded and cuticularized. The epidermis indicated two kinds of alterations, i.e., trichomes and stomata. The two kinds of trichomes that are unicellular, uniseriate, lignified covering trichomes which are more on lower epidermis than upper one; while bi-cell head, sessile, non-lignified glandular trichomes are found on both epidermis. The three celled inconsistent anisocytic type stomata are all around circulated in lamina locale. The light parenchyma of mesophyll shows the absence of drastic cell content (Sanghai *et al.*, 2018).

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