

GLANDULAR AND NON-GLANDULAR TRICHOMES AND ANTIPHYTOVIRAL ACTIVITY OF *Inula spiraefolia* L.

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INTRODUCTION

Inula spiraefolia L. (Asteraceae) is a sub-Mediterranean species native to southern and eastern Europe. Like many other members of the Asteraceae, the aerial organs of the species bear glandular and non-glandular trichomes. In this study, we analysed the leaf trichomes of this still insufficiently studied plant. Since the biological potential of *I. spiraefolia* is poorly investigated, we tested the antiviral activity of *I. spiraefolia* hydrosol on plants infected with tobacco mosaic virus (TMV). Our results, which focus on the trichomes and biological activity, show that *I. spiraefolia* has potential for future research.



MATERIALS AND METHODS

Light microscopy

Micromorphology and distribution of glandular and non-glandular trichomes on the leaf of *I. spiraefolia* L. were investigated using light microscopy. Hand-cut cross sections of the leaf were observed using light microscope (Leica DM 3000 LED, Leica Microsystems, Germany) and the images were captured with Leica DMC 4500 camera and image processing software (Leica Application Suite, LAS 4.9, Leica Microsystems).

Antiviral activity

Hydrosol of *I. spiraefolia* was applied as a spray solution to the leaves of the local host plant *Datura stramonium* L. on two consecutive days prior to virus inoculation. The antiviral activity was evaluated on the fourth day after inoculation, when clear and visible local lesions had developed. Inhibition of local lesions was calculated by comparing the average number of viral lesions on the leaves of treated and control plants. All data are expressed as mean±SD ($n = 3$). Statistical significance was determined using a *t*-test.

RESULTS

Light microscopy

Light micrographs of the leaf of *I. spiraefolia* show three types of non-glandular trichomes (Fig. 1): i) tiny, multicellular, erect trichomes with a long, narrow and sharply pointed apical cell; ii) multicellular trichomes inclined towards the organ surface with linearly arranged basal cells; iii) branched trichomes with a short basal part.



Fig. 1. Non-glandular trichomes on the leaves of *I. spiraefolia*



Fig. 2. Glandular trichomes on the leaf of *I. spiraefolia*

Glandular trichomes with a short stalk cell and a round glandular cell are also found on the leaf surface. The apical trichome cell layers show characteristics of secretory cells.

Antiviral activity

The hydrosol applied to the leaves of the host plants before TMV inoculation reduced the number of local lesions (Fig 3b). On average, the hydrosol-treated plants developed 24 lesions per leaf compared to 31 lesions per leaf in the control plants (Fig 3a). An inhibition of local infection of 23% indicates a moderate antiviral potential of *I. spiraefolia* hydrosol.

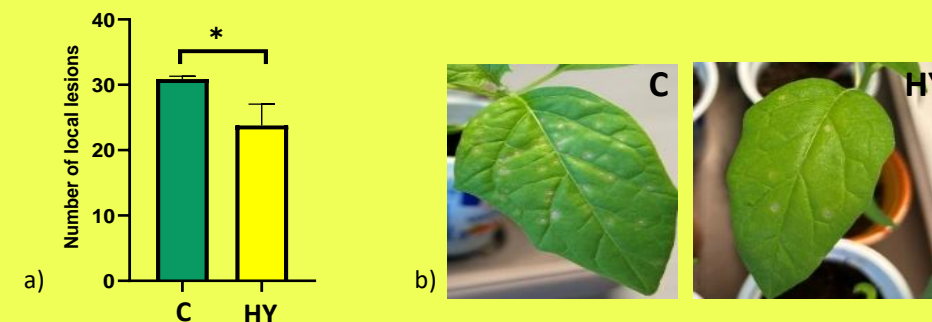


Fig. 3. a) Number of local lesions on control (C) and hydrosol-treated plants (HY) infected with TMV; b) developed lesions on control (C) and hydrosol-treated plants (HY)

CONCLUSION

- Three types of non-glandular trichomes on the leaves of *I. spiraefolia* are presented. In addition to tiny, multicellular, erect trichomes, which have already been described, multicellular trichomes filled with reddish contents and inclined towards the organ surface as well as branched, multicellular, non-glandular trichomes are described for the first time in *I. spiraefolia*.
- The hydrosol of *I. spiraefolia* reduced the number of TMV lesions on local host plants, probably by activating the plant defense response, suggesting that hydrosols from aromatic plant species have the potential for the development of natural antiphytoviral preparations.
- The antiviral activity of hydrosol and the new results on the trichomes of *I. spiraefolia* show that this plant deserves further attention.