



Geraniol as component of *Rosa alba* L. essential oil possess anti-genotoxic activity against MNNG-induced chromosome aberrations in higher plants and cultured human lymphocytes



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White rose is a rich source of natural antioxidants and holds promise to be successfully used in perfumery, cosmetics and pharmacy. The natural monoterpene compound Geraniol isolated from *Rosa alba* L. essential oil is 18.28% of the whole oil ingredients. The compound was tested with respect to its potential to protect cells against DNA alkylating agent N-methyl-N' -nitro-N-nitrosoguanidine (MNNG), as well as to its cytotoxic and genotoxic activities in two types of eukaryotic test-systems: *Hordeum vulgare* and human lymphocytes *in vitro*. Such studies with physiologically different types of test-systems could provide more informative and representative assessment about the cytotoxic/genotoxic effect and protective potential of the compounds isolated from white rose essential oil against genotoxins.

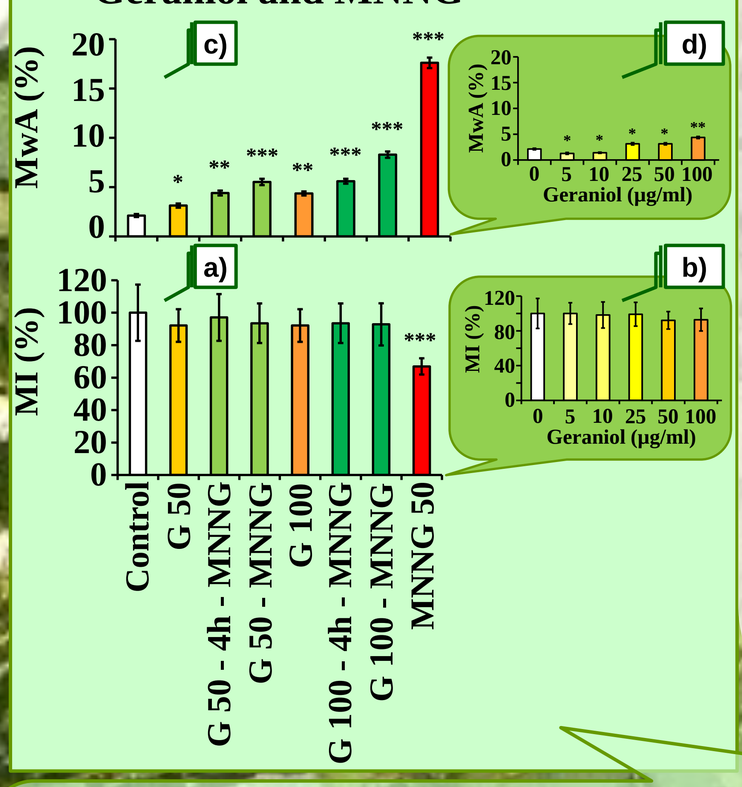
Material and Methods:

In the current work two different test-systems: meristem cells of *Hordeum vulgare* and human lymphocytes were used. Cytotoxicity/anti-cytotoxicity of Geraniol was assessed by mitotic index (MI). Endpoint for genotoxicity/anti-genotoxicity was induction of chromosome aberrations (MwA). Two types of experimental schemes were used. First scheme included single treatment with Geraniol. Barley root tip meristems were treated with 5 - 100 µg/ml Geraniol and lymphocytes of healthy donors with 10 – 100 µg/ml, respectively. The second scheme applied to test the protective potential of Geraniol included conditioning treatment with low dose Geraniol followed by challenge with MNNG and 4 h inter-treatment time. Untreated cells were used as a negative control and MNNG (50 µg/ml) was used as a positive control.

The results were analyzed statistically by Student's t-test and chi-square method.



Combined treatment with Geraniol and MNNG



Results

1. The presented data reveals no cytotoxic effect in all Geraniol individual treatment variants compared with the untreated control (Fig. 1a, b; Fig, 2a, b). This monoterpene showed no high genotoxicity in human lymphocytes and a lack of such effect in barley cells.

2. The protective potential of ethanol extract of Geraniol depended on the concentration applied and the treatment variant (Fig. 1 c; Fig 2 c). The frequency of chromosome aberrations was decreased ($p<0.001$; $p<0.05$). It was detected 34 to 60% less injuries in lymphocytes and 53-75% in barley compared with the treatment with MNNG alone (50 µg/ml).



Combined treatment with Geraniol and MNNG

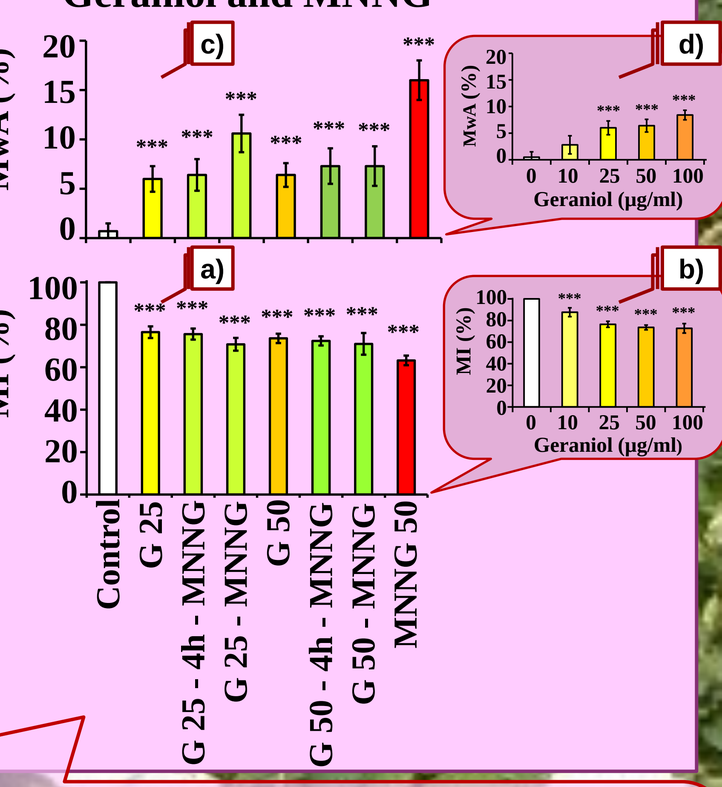


Fig. 1. The cytotoxic/anti-cytotoxic (MI) as well as clastogenic/anti-clastogenic potential (CA) of Geraniol ethanol extract evaluated after exposure at different concentrations in two different treatment variants in barley root tip meristem cells. $*p < 0.05$; $**p < 0.01$; $***p < 0.001$

Fig. 2. The cytotoxic/anti-cytotoxic (MI) as well as clastogenic/anti-clastogenic potential (CA) of Geraniol ethanol extract evaluated after exposure at different concentrations in two different treatment variants in human lymphocytes *in vitro*. $***p < 0.001$

Conclusions:

Geraniol ethanolic extract showed low cytotoxic and clastogenic effects in *H. vulgare* root tip meristem cells. Human lymphocytes *in vitro* were more sensitive to Geraniol than barley cells. The effect depended on the concentration applied. This monoterpene isolated from *Rosa alba* L. showed well expressed defense potential against alkylating agent MNNG in both test-systems.

The current investigations, concerning the anti-cytotoxic and anti-genotoxic potential of Geraniol could be useful in health research on the pharmacological capacity and activity of the present and other natural plant compounds.

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As sweet as the breath that goes
From the lips of the white rose,
As weird as the elfin light
That glimmer of frosty nights,
As wild as the winds that tear
The curled red leaf in the air,
Is the song I have never sung.
"Unsung"
-- from Flower and Thorn

by Thomas Bailey Aldrich

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