Cytoprotective and genoprotective potential of *Rosa damascena* Mill. hydrosol

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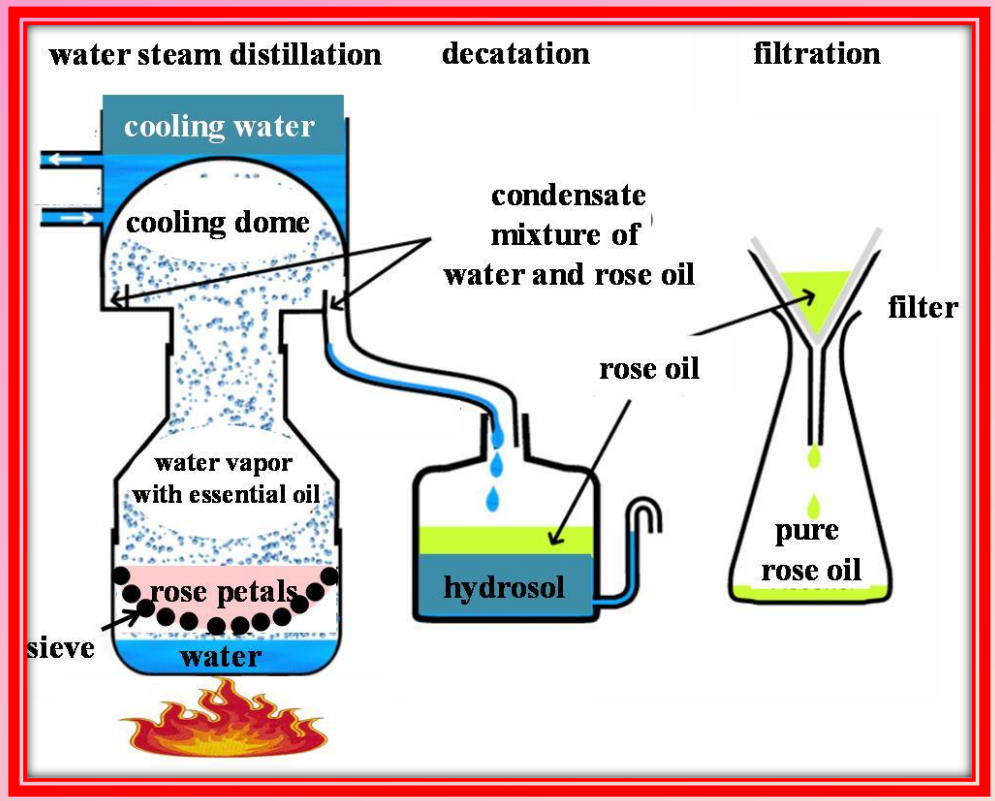
Introduction

Rosa damascena Mill. (Rosaceae) is an emblematic plant for Bulgaria and is well known for its high-quality oil, hydrosol and other rose products.

It is mainly used in high perfumery and cosmetics and also finds application in pharmacology and food industry.

R. damascena Mill. possesses many biological activities due to the valuable compounds in the rose oil.



Hydrosol or rose water is a by-product produced during the classical method of water-steam distillation of essential oil from rose petals.

The hydrosol can also be viewed as a suitable source of bioactive compounds, and the extraction of these substances in further studies led to detection of new products.

This aromatic product has many applications in human life.

Aim

Limited studies exist about the cytotoxic/genotoxic activities of *R. damascena* Mill. hydrosol and there are no researches on its anti-cytotoxic and anti-genotoxic effects.

This provoked us **to investigate the cytoprotective and genoprotective potential of *Rosa damascena* Mill. hydrosol** against the direct alkylating mutagen N-methyl-N'-nitro-N-nitrosoguanidine in two different types of test-systems (higher plant and human lymphocytes) applying appropriate experimental schemes.

Material and methods

Hydrosol was prepared from water-steam distillation of rose petals of *R. damascena* Mill. collected in the experimental field of the Institute for Rose and Aromatic Plants, Kazanlak during the harvest season 2019/2020.

Test-systems

Plant test-system
H. vulgare (barley) -
reconstructed karyotype
MK14/2034

Human lymphocyte cultures prepared from blood of men and women (aged 33-40)

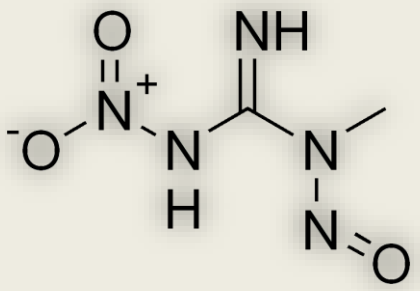
Material and methods

Endpoints

For cytotoxicity – mitotic index **(MI)** (Jovtchev et al., 2010) and nuclear division index **(NDI)** were calculated (Fenech , 2007).

For genotoxicity - induction of chromosome aberrations **(CA)** (Evans, 1983; Jovtchev et al., 2010) and micronuclei **(MN)** were determined (Fenech, 2007; Jovtchev et al., 2010).

Standard mutagen N-methyl -N'-nitro -N-nitrosoguanidine 50 μg/ml (MNNG) was a positive control. Untreated cells were a negative control.



Statistics

The results were assessed statistically by one-way ANOVA with a two-tailed Fisher's exact test.

Material and methods

Experimental schemes

Single treatment

6% 14% 20%

Hydrosol

3% 6% 11% 14% 20%

barley

lymphocytes

Combined treatment

20%

Hydrosol

6%

4 hrs

Inter-treatment

MNNG

barley

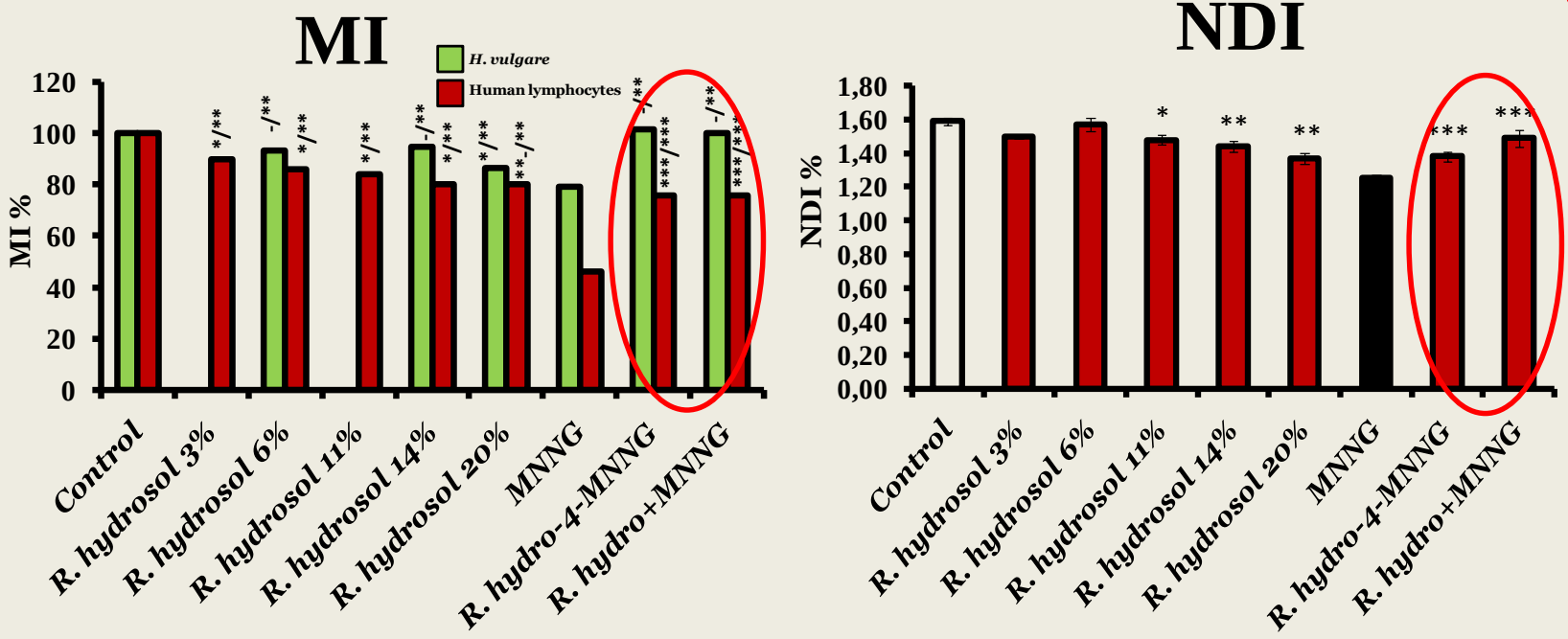
Hydrosol 20% + MNNG

Hydrosol 6% + MNNG

lymphocytes

Results

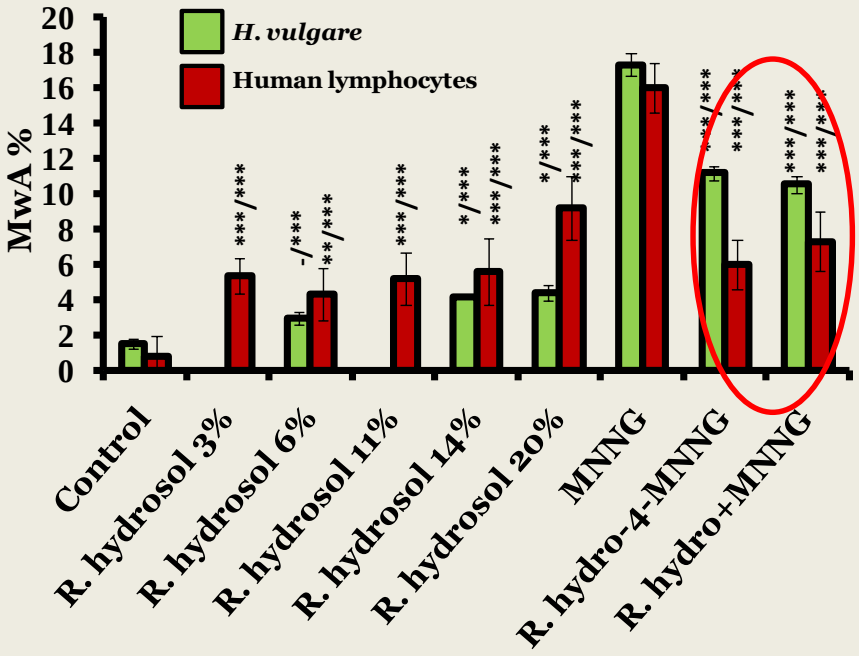
Cytotoxicity/anti-cytotoxicity



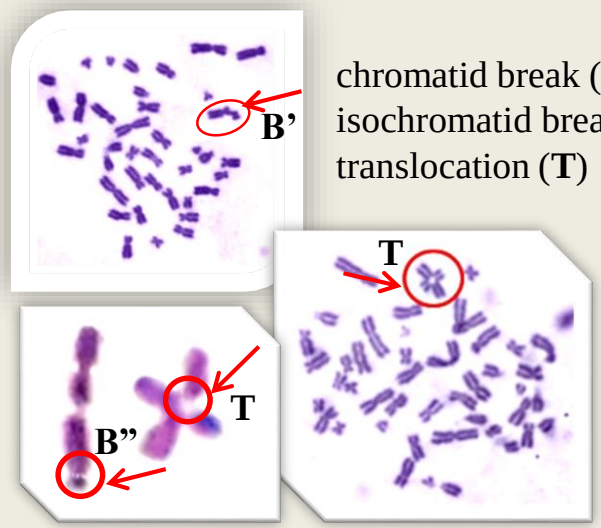
- Hydrosol's concentrations did not show a cytotoxic effect (MI) in *H. vulgare*. Low cytotoxicity ($p<0.05$, $p<0.01$) was observed in lymphocytes compared to the untreated control assessed both by MI and NDI.
- **Hydrosol decreases the cytotoxic effect (MI and NDI) of MNNG** ($p<0.01$, $p<0.001$) applied as with conditioning treatment prior to MNNG (50µg/ml) with 4 hrs between treatment, as with combined treatment with the mutagen without time between treatments both in barley and lymphocytes .

Results

Genotoxicity/anti-genotoxicity (CA)



Chromosome aberrations

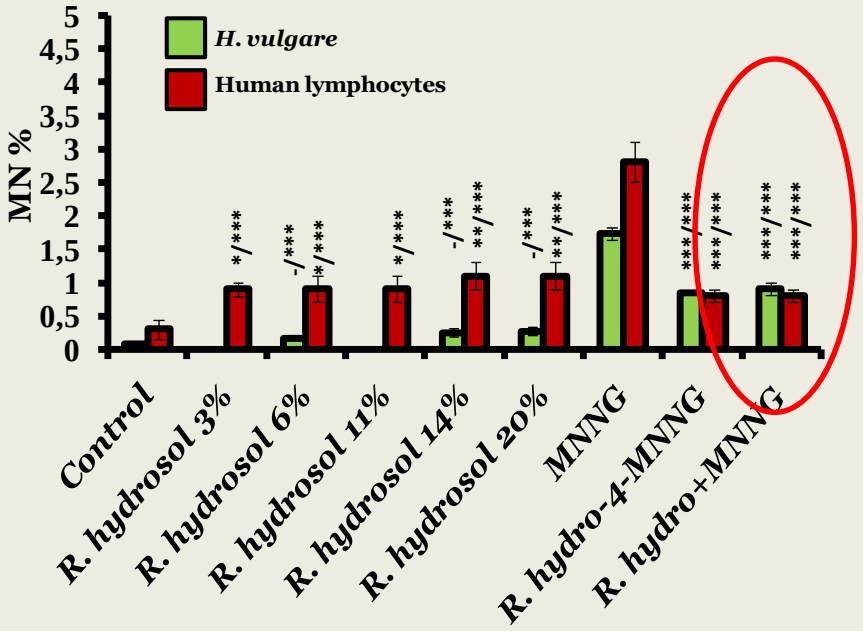


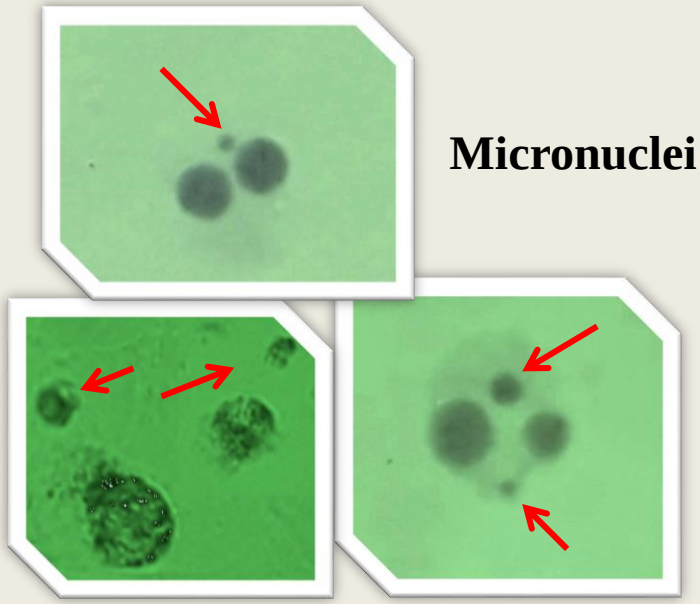
chromatid break (**B'**)
isochromatid break (**B"**)
translocation (**T**)

- Hydrosol concentrations did not show or possessed a very low genotoxic effect in *H. vulgare* assessed by induction of chromosome aberrations (CA). In lymphocyte cells, a low but statistically significant ($p < 0.05$; $p < 0.001$) increase in the values of aberrations were observed.
- **Reduction of CA induced by MNNG was observed** ($p<0.001$) when the cells were treated using both schemes with combined treatment in both test-systems. The results were more pronounced in lymphocyte cells where the chromosome damages were reduced more than twice.

Results

Genotoxicity/anti-genotoxicity (MN)





Micronuclei

- All hydrosol concentrations induced very low values of MN in barley without any statistical differences with the negative control. Human lymphocytes were more sensitive to the hydrosol ($p<0.05$, $p<0.01$) than barley. The genotoxic effect of hydrosol assessed by MN was lower ($p<0.001$) than that of MNNG.
- **The genoprotective activity of the rose hydrosol against MNNG using MN** as an endpoint applying both schemes with combined treatment was well expressed. A statistically significant lower values ($p<0.001$) of micronuclei were observed both in plant and human lymphocyte test-systems.

Conclusions:

Treatment with the *R. damascena* Mll. hydrosol concentrations demonstrated weak cytotoxic and clastogenic effects depending on the test-system used.

R. damascena Mill. hydrosol generated during water-steam distillation of the essential oil manifested effective cyto- and genoprotective activity against DNA damaging agent MNNG in two different experimental test-systems - higher plant *H. vulgare* and human lymphocytes *in vitro*.

The protective effect was manifested applying both types of experimental schemes with combined treatment.

The obtained data are promising for further application of the rose hydrosol as a natural product with pharmacological potential.

Thank you for your attention

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