# 372º – “Erva-baleeira” secondary metabolism under eliciation

LUCAS VINICIUS DALLACORTE[1], CAROLINA HOPPEN TONIAL[2], EMANUELI PEREIRA DA SILVA[1], ALEXIA KOZELINSKI[1], BÁRBARA NICOLE DABOIT[1], JOSÉ ABRAMO MARCHESE[1]

[1]UTFPR – Universidade Tecnológica Federal do Paraná, Pato Branco. Via do Conhecimento, Km 1 - CEP 85503-390 - Pato Branco - PR - Brasil, lucasdallacorte@alunos.utfpr.edu.br, , eps.emanueli@gmail.com alexiakozelinski@alunos.utfpr.edu.br, barbaradaboit@alunos.utfpr.edu.br, , abramo@utfpr.edu.br

[2]IFPR. Instituto Federal Do Paraná, Campus Palmas. Av. Bento Munhoz da Rocha Neto s/nº, PRT 280, CEP: 85555000 - Palmas, PR – Brasil.

## INTRODUCTION

Terpenoids are the largest class of plant natual products, having a variety of roles.

“Erva-baleeira” (*Varronia curassavica* Jacq., fig. 1) is a medicinal plant, very branched and aromatic, that measures about 1.5 to 2 m high. Extracts and essential-oil compounds shown anti-inflamatory effects, growth inhibitor of microorganisms, antiulcer and antioxidant activity. The anti-inflammatory action dues to the presence of two sesquiterpenes in the plant essential oil, which are α-*humulene* and β-*caryophyllene*.

The elicitation in plants can induce a cascade of events and signals by stimulating the stress response, also known as induced resistance. This results in changes in their cellular metabolism and in the implementation of secondary metabolites, mainly in plant defense.

For these reasons, the aim of this work was to evaluate metabolism responses as a function of elicitors application in order to induce resistance

**Figure 1** – “Erva-baleeira” plants on the field. UTFPR, Pato Branco, 2022.

## METHODOLOGY

*V. curassavica* plant material was obtained from CPQBA/Unicamp selection and breeding program.

Field-based plants received the application of acibenzolar-S-methyl (ASM, 500 mg $L^{-1}$), 1,6 β-D-glucan obtained (GLUCAN, 50 mg $L^{-1}$) and distilled water (DW) as a control.

For biochemical analysis, terpene enzymes phenylalanine ammonialyase (PAL), superoxide dismutase (SOD), guaiacol peroxidase (POX) and catalase (CAT) activity was evalueted 0, 24, 48, 72, 96 and 120 hours after elitiation.

Gas exchange evaluation was carried 0, 24, 48, 72, 96, 120, 144 and 168 hours after elitiation, by measuring the variables net carbono assimilation rate (A, μmol $CO_2$ $m^{-2}$ $s^{-1}$), stomatal conductance (gs, mol $H_2O$ $m^{-2}$ $s^{-1}$), transpiration rate (E, mmol $H_2O$ $m^{-2}$ $s^{-1}$), intercellular $CO_2$ concentration (Ci, μmol $CO_2$ $mol^{-1}$) and water use efficiency (WUE, mmol $mol^{-1}$).

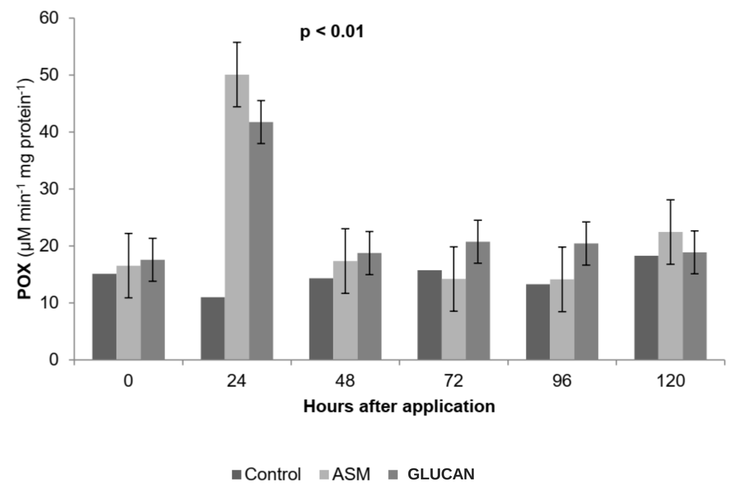
The plants were harvest 7 days after elitiation. The leaves were separated from steams and dried at 40ºC in air-circulating oven with forced ventilation. The essential ois was extracted of approximately 50 g of dry leaf mass by dydrodistillation, and the essential oil yield was determined.

The identification of essential oil substances was performed by comparison of their mass spectra against the GC-MS system database (Nist. 62 lib., Wiley 139 lib.) and the retention indexes (RI) with literature data (ADAMS, 2007).

## RESULTS AND DISCUSION

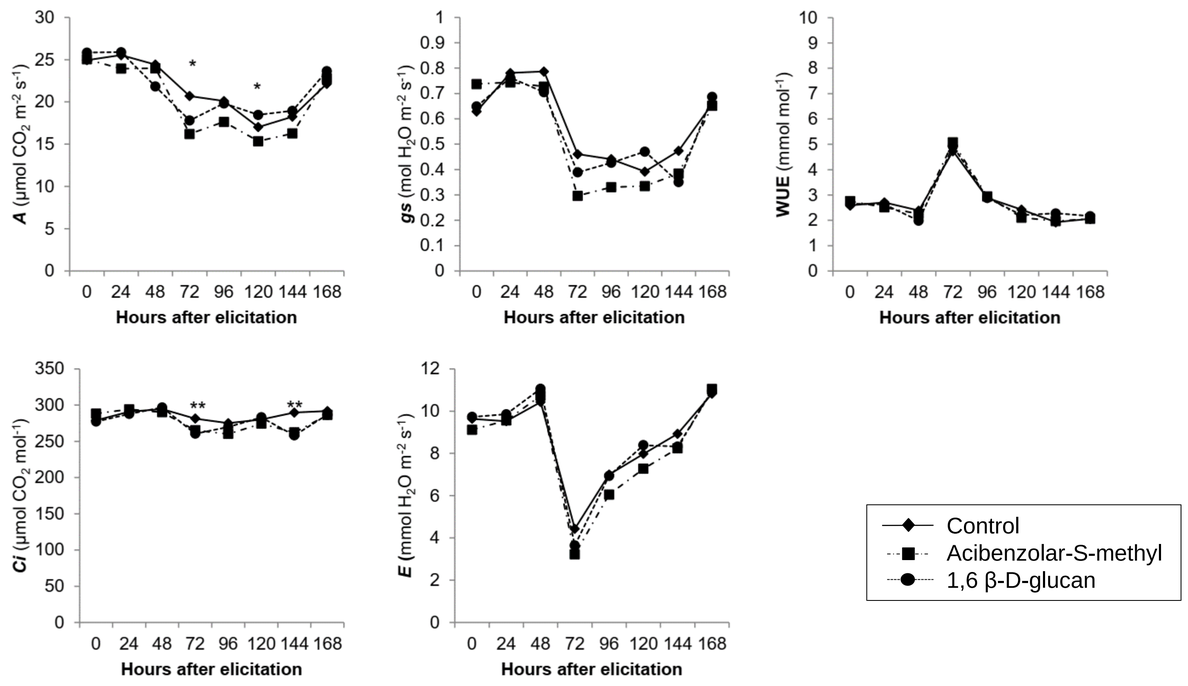
PAL, SOD and CAT activity had no significant difference by statical test When was elicitated with ASM and GLUCAN. The activity of POX was stimulated by the use of elicitors after 24 hours of application for ASM and GLUCAN application.

**Figure 2** – Guaiacol peroxidase (POX) acitivity (μm $min^{-1}$ mg $protein^{-1}$) in *Varronia curassavica* leaf tissues submitted to elicitation with distilled water (control), acibenzolar-S-methyl (ASM) and 1,6 β-D-glucan (GLUCAN) at 0, 24, 48, 72, 96 and 120 hours after products application.




Only *A* and *Ci* changed significantly with the elicitors application when compared to the control, for *gs, E* and *WUE*, no statical differences were observed between treatments.

**Figure 3** - Net carbon assimilation rate (*A*, μmol $CO_2$ $m^{-2}$ $s^{-1}$), stomatal conductance (*gs*, mol $H_2O$ $m^{-2}$ $s^{-1}$), transpiration rate (*E*, mmol $H_2O$ $m^{-2}$ $s^{-1}$), intercellular $CO_2$ concentration (*Ci*, μmol $CO_2$ $mol^{-1}$) and water use efficiency (*WUE*, mmol $mol^{-1}$) before (0h) and 24, 48, 72, 96, 120, 144 and 168 hours after products application.




For essential oil yield, there was no significant difference between DW, ASM and GLUCAN (0.748, 0.819 and 0.798%, respectively).

With the essential oil chemical analyses was identified 17 substances. The elicitors application did not result in differences in the essential oils compounds.

**Table 1** - Essential oil chemical composition (%) of *Varronia curassavica* leaves submitted to elicitation with distilled water (DW), acibenzolar-S-methyl (ASM) and 1,6 β-D-glucan (GLUCAN) after 7 days of products application.

| SUBSTANCES | TREATMENTS | | | |
|---|---|---|---|---|
| | Control | ASM | GLUCAN | CV (%) |
| α-pinene[MH] | 41.89 ns | 44.94 | 42.76 | 6.97 |
| sabinene[MH] | 0.74 ns | 0.78 | 0.74 | 2.57 |
| β-pinene[MH] | 1.79 ns | 2 | 1.88 | 3.41 |
| myrcene[MH] | 0.54 ns | 0.62 | 0.6 | 1.69 |
| β-phellandrene[MH] | 0.99 ns | 1.1 | 1.06 | 2.19 |
| 1,8-cyneol[OM] | 1.09 ns | 1.05 | 1.02 | 2.39 |
| isobornyl acetate[OM] | 0.55 ns | 0.49 | 0.5 | 3.8 |
| α-cedrene[SH] | 1.82 ns | 1.6 | 1.66 | 3.4 |
| α-cis-bergamotene[SH] | 11.69 ns | 10.77 | 11.34 | 5.39 |
| (E)-β-caryophyllene[SH] | 14.66 ns | 13.99 | 14.26 | 6.37 |
| α-humulene[SH] | 2.2 ns | 2.05 | 2.17 | 3.98 |
| (E)-β-farnesene[SH] | 2.53 ns | 2.36 | 2.42 | 5.24 |
| β-santalene[SH] | 0.66 ns | 0.61 | 0.66 | 2.34 |
| β-bisabolene[SH] | 2.8 ns | 2.6 | 2.79 | 3.25 |
| β-sesquifelandrene[SH] | 0.83 ns | 0.66 | 0.7 | 4.14 |
| (E)-γ-bisabolene[SH] | 1 ns | 0.92 | 0.99 | 3.25 |
| Neryl isobutyrate[OS] | 1.25 ns | 1.12 | 1.16 | 3.8 |
| [MH]Monoterpenic hydrocarbons | 45.95 | 49.43 | 47.04 | |
| [OM]Oxygenated monoterpenes | 1.64 | 1.54 | 1.52 | |
| [SH]Sesquiterpenic hydrocarbons | 38.19 | 35.56 | 36.99 | |
| [OS]Oxygenated sesquiterpenes | 1.25 | 1.12 | 1.16 | |
| Total identified | 87.03 | 87.66 | 86.72 | |

ns - not significant at 5% probability by Tukey test

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CAPES
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