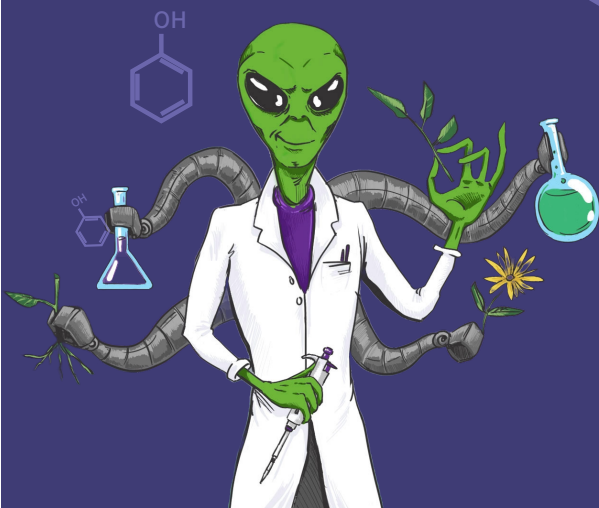


Final Conference

Poreč, 21-22 November 2024

NATURE AS AN ALLY: ALIEN INVASIVE PLANTS AS PHYTOPHARMACEUTICALS

IP-2020-02-6899



Book of Abstracts



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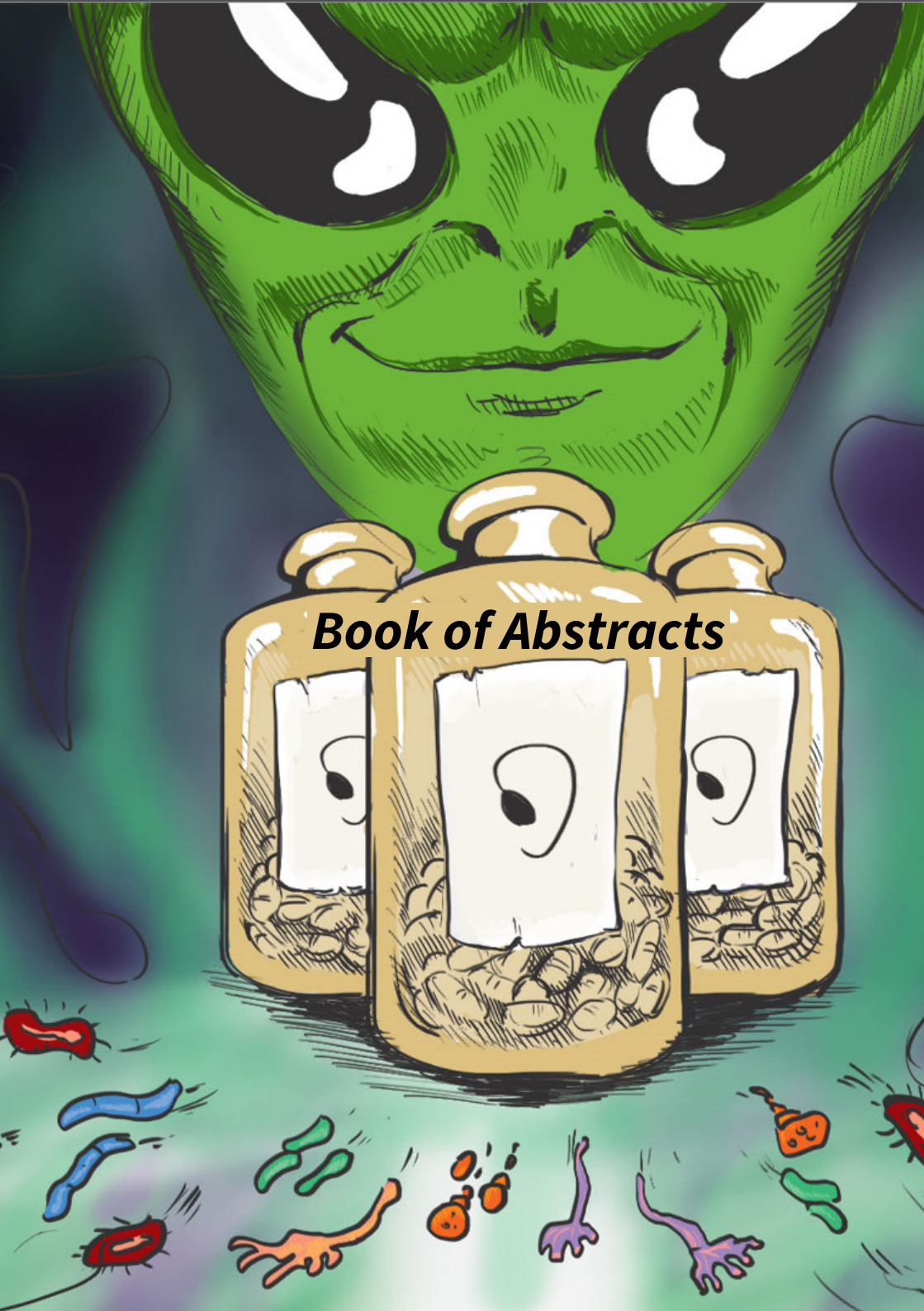
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Pula*



HRZZ
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za znanost





Book of Abstracts



Chair Welcome

Dear Colleagues, Guests, and Friends,

It is with great enthusiasm and pleasure that I welcome you to Poreč, Croatia, for the Final Conference of the NATURALLY Project. Over the past four years, this project has taken us on an incredible journey of exploration, collaboration, and discovery, uncovering the untapped phytopharmaceutical potential of invasive alien plant species. Today, as we gather in this beautiful setting, we celebrate not only the culmination of these efforts but also the vibrant community of scientists and innovators that has grown around this shared mission.

This conference FROM PLANT TO PHARMACY brings together a distinguished group of experts from across the fields of life and biotechnical sciences. With two inspiring plenary lectures and three engaging invited talks, our invited speakers will set the stage for thought-provoking discussions. Beyond that, the program showcases the hard work and achievements of the NATURALLY team and collaborators, highlighting the project's outcomes, partnerships, and the exciting avenues it has opened for future research.

As we reflect on the milestones we've achieved, let us also embrace the questions that remain unanswered and the challenges yet to be tackled. Together, we can transform these into opportunities for innovation and new collaborations, building on the foundation we've established over these four transformative years.

On behalf of the entire NATURALLY team, I extend my heartfelt gratitude to all participants, speakers, and contributors for joining us in this celebration of science and discovery. Your presence and active engagement are what make this conference a vibrant and fruitful exchange of ideas.

Welcome to Poreč, and let's make this event not only a showcase of what we've accomplished but a starting point for even greater achievements in the future!

Danijela Poljuha
Conference Chair

NATURE as an ALLY: Alien Invasive Plants as Phytopharmaceuticals - NATURALLY

Final Meeting and Conference "FROM PLANT TO PHARMACY"

Institute of Agriculture and Tourism (IPTPO)

21-22 November 2024

PROGRAM

21 November 2024 (Thursday)

PROJECT PARTNERS MEETING

Official languages – English / Croatian

Venue: IPTPO / virtual

10:30 - 11:00 **Gathering**

11:00 - 11:10 **Opening**

Welcome speech by **Danijela Poljuha**, Project Lead (IPTPO)

11:10 - 11:30 **Overview of project activities and results – Danijela Poljuha (IPTPO)**

PROJECT RESULTS FROM THE EXPERTS' PERSPECTIVE

11:30 - 12:30 **Overview and Discussion of project partners and collaborators**

*Institute of Agriculture and Tourism, Croatia - **Barbara Sladonja**,
Ivana Pavičić*

*Faculty of Veterinary Science, University of Pretoria, RSA - **Jacobus N. Eloff**,
Lyndy McGaw, **Ibukun Michael Famuyide***

*Biotechnical Faculty, University of Ljubljana, Slovenia - **Maja Mikulič Petkovšek***

*Polytechnic of Rijeka, Croatia - **Slavica Dudaš***

*Faculty of Pharmacy and Biochemistry, University of Zagreb, Croatia - **Roberta Petlevski***

*Istrian University of Applied Sciences, Croatia - **Josipa Bilić***

*Faculty of Science, University of Zagreb, Croatia - **Ivana Šola***

*University of North, Croatia - **Dunja Šamec***

*University of Cambridge, UK - **Ljiljana Fruk***

12:30 - 13:30 **Lunch Break**

13:30 - 14:00 **Conclusions & Future Collaboration (All)**

14:00 - 14:15 **Closing remarks – Barbara Sladonja (IPTPO)**

Study Visit

NATURE as an ALLY: Alien Invasive Plants as Phytopharmaceuticals - NATURALLY

Final Meeting and Conference "FROM PLANT TO PHARMACY"

Institute of Agriculture and Tourism (IPTPO)

21-22 November 2024

PROGRAM

22 November 2024 (Friday)

CONFERENCE "FROM PLANT TO PHARMACY"

Official languages – English / Croatian

Venue: Hotel Diamant, Lavanda I Hall, Poreč / virtual

8:30 - 9:00 Registration

9:00 - 9:15

Opening

Welcome speeches

9:15 - 9:30

NATURALLY Project Overview

Danijela Poljuha, Project Lead (Institute of Agriculture and Tourism, Croatia)

PLENARY LECTURES

9:30 – 10:15

Research and developing products from invasive plant species

Jacobus N. Eloff (University of Pretoria, Republic of South Africa)

10:15 – 11:00

Nature-inspired: flavins and flavonoids for catalysis and fashion

Ljiljana Fruk (University of Cambridge, UK)

11:00 – 11:30

Coffee break

COLLABORATION – A KEY TO SUCCESS

11:30 – 12:00

Plants as a source of bioactive compounds: Natural defenses against pests in agriculture

Dragana Šunjka (University of Novi Sad, Republic of Serbia)

12:00 – 12:30

Project TEMPHYS: How relevant is growing temperature for a plant's phytochemical composition and its health benefits?

Ivana Šola (University of Zagreb, Faculty of Science, Croatia)

12:30 – 13:00

Project GinkoBiFlav: Biflavonoids: New insights into long-known molecules

Dunja Šamec (University of North, Croatia)

13:00 – 13:15

Closing remarks

13:15- 14:00

Lunch

INTRODUCTORY LECTURE

Invasive alien plants as phytopharmaceuticals: An overview of the NATURALLY project

Danijela Poljuha

Institute of Agriculture and Tourism, Poreč, Croatia

Climate change has accelerated the spread of invasive plant species, posing significant challenges to maintaining ecological balance in emerging ecosystems. Could invasive species hold the key to preserving ecosystem balance and biodiversity? Might they serve as sources of valuable bioactive phytochemicals? How can we use invasive species to provide new ecosystem services? The research project "NATURE as an ALLY: Alien invasive plants as phytopharmaceuticals – NATURALLY" (IP-2020-02-6899), funded by the Croatian Science Foundation, explores these questions. Focusing on four invasive alien plant species—*Ailanthus altissima* (Mill.) Swingle, *Robinia pseudoacacia* L., *Helianthus tuberosus* L., and *Solidago canadensis* L.—in Istria region (Croatia), the project investigates their potential as sources of phytopharmaceuticals. This presentation will showcase the key project's findings, including the evaluation of species' impact on the environment, phytochemical screening of leaf and flower extracts, and assessments of their biological activity.

This research was funded by the Croatian Science Foundation under the project "NATURE as an ALLY: Alien Invasive Plants as Phytopharmaceuticals—NATURALLY" (IP-2020-02-6899).

PLENARY LECTURE

Research and developing products from invasive plant species

Kobus (JN) Eloff

Phytomedicine Programme, University of Pretoria, Republic of South Africa

In developing useful products from plants one of the parameters to consider is the availability of plant material. Weeds and invasive plant species are normally available in large quantities. Another motivation is that if fungal attack is a limiting factor in the distribution of plant species, invasive species may have good antifungal activity. The methods used in extracting the plants, determining the antifungal activity and in isolating the active compound in the extracts on more than ten invasive plant species that we have worked on, will be discussed. By increasing the antifungal activity of the extract we could develop a low cost product that had much better activity against a field fungal infection at a lower dose than the commercial product. Complications in registering a product as a herbicide will also be briefly discussed.

PLENARY LECTURE

Nature-inspired: flavins and flavonoids for catalysis and fashion***Ljiljana Fruk****Department of Chemical Engineering and Biotechnology,
University of Cambridge, United Kingdom*

Flavin and flavonoids are important organic compounds widely recognised for their role in enzyme function, medicine and as vibrant plant pigments. In this talk, we will delve into their applications in catalysis and textile dyeing. Specifically, we will explore strategies for designing more efficient enzyme mimics and reducing the environmental footprint of fabric dyeing process.

INVITED LECTURE

Plants as a Source of Bioactive Compounds: Natural Defenses Against Pests in Agriculture

Dragana Šunjka

Faculty of Agriculture, University of Novi Sad, Serbia

Identifying alternative sources of compounds with pesticide activity is one of the biggest challenges in plant protection. In the development of new biopesticides, natural products derived from plants can be crucial. They contain various types of metabolites (alkaloids, phenols, terpenoids) developed by plants to help them in the protection from pests, providing a renewable source of bioactive agents with unique modes of action. Research has identified numerous bioactive compounds that act as biopesticides, some of which can be synthesized into chemical analogs, benefiting the agrochemical industry. Benefits of these products, in terms of agriculture, include rapid degradation, reduced residue risks in food, and complex bioactive structures, even within just one extract, that slow the development of pest resistance. Selectivity towards non-target and beneficial organisms also enhances safety for human and animal health and the environment. Besides, some compounds produced by plants in conditions of abiotic (ultraviolet radiation, ozone, chemical treatments, mechanical damages) or biotic (infections caused by various pathogens) stress play an important role in their immune response and are crucial in many aspects. These plant-derived products with the potential to become a new generation of biopesticides, represent a promising path in sustainable agriculture.

INVITED LECTURE

How relevant is growing temperature for a plant's phytochemical composition and its health benefits?

Ivana Šola

Faculty of Science, University of Zagreb, Croatia

Global air temperatures are expected to increase by 0.2 °C per decade, potentially reaching 1.8–4.0 °C by 2100. Plants respond to temperature changes through complex signaling networks involving transcription factors and hormones, which regulate stress-responsive genes and metabolite biosynthesis. This allows plants to adapt to heat stress by modifying gene expression related to osmoprotectants, detoxification, and ion transport, affecting their nutrient relationships. In contrast, low-temperature stress can rigidify biological membranes, compromising cellular integrity and leading to cell death by disrupting electron transport chains and generating reactive oxygen species (ROS). This reduces photosynthetic activity, limiting energy production and carbon assimilation, negatively impacting plant growth. The aim of our work was to evaluate how low (LT) and high (HT) growing temperatures affect the phytochemical profile of broccoli microgreens (*Brassica oleracea* L. convar. *botrytis* var. *cymosa*) and the biological effects of their extracts. We wanted to identify which phytochemical parameters are sensitive or resistant to temperature stress, potentially serving as markers for LT/HT stress.

~~In this lecture, our findings will be discussed.~~

This research was funded by the Croatian Science Foundation under the project “Indirect effect of global warming on mammals physiological parameters via high temperature-stressed plant diet - TEMPHYS ” (IP-2020-02-7585).

INVITED LECTURE

Biflavonoids: New Insights into Long-Known Molecules

Dunja Šamec

University of North, Koprivnica, Croatia

Biflavonoids are a type of flavonoid dimer. The first of these compounds, ginkgetin, was extracted from the yellow leaves of the *Ginkgo biloba* L. tree during the early 1900s. Researchers have now cataloged almost 600 varieties of dimeric flavonoids, commonly referred to as biflavonoids, yet they continue to receive significantly less research attention compared to their monomeric counterparts. The ginkgo tree, being the initial source of biflavonoids, provides a rich diversity of these compounds and serves as an important model organism for exploring their roles in plants. We have developed a reliable method for simultaneously identifying and quantifying the five most prevalent biflavonoids: amentoflavone, bilobetin, ginkgetin, isoginkgetin, and sciadopitysin which belong to the group of 3'-8"-biflavones. Furthermore, we have conducted an in-depth analysis of these compounds across various plant tissues and developmental stages. Our research suggests that the specific distribution and increased levels of biflavonoids could indicate their functional roles in plant biology, a topic we will explore further in the presentation.

This research was funded by the Croatian Science Foundation under the project "Biflavonoids role in plants: Ginkgo biloba L. as a model system - GinkoBiFlav" (UIP-2019-04-1018).

Project in Brief

NATURALLY is a research project funded by the Croatian Science Foundation aimed at exploring the phytopharmaceutical potential of extracts from four invasive alien plant species: black locust, Jerusalem artichoke, Canada goldenrod, and tree of heaven.

Key questions posed in the project:

How to make the best use of invasive species as providers of new ecosystem services?

Can invasive species be a source of valuable bioactive phytochemicals?

Can the key to ecosystem balance and biodiversity conservation be found in the use of invasive species?

Objectives & Methods

To perform chemical characterization of extracts from invasive alien plant species by liquid chromatography-mass spectrometry (LC-MS) method;

To determine antioxidative, antimicrobial, cytotoxic, and genotoxic properties of invasive alien plant species extracts;

To estimate the potential of invasive alien plant species for the application in phytopharmacy;

To propose the model for utilizing new ecosystem services of invasive alien plant species in a pilot territory of Istria (Croatia) to mitigate their negative environmental impacts.



Results & Selected Publications

All tested invasive species are rich in bioactive phenolic compounds.

A total of 116 different specialized metabolites were detected in the leaf and flower extracts.

The extracts showed an antioxidant effect in *in vitro* tests.

At concentrations below 1 mg/mL, the extracts did not have a cytotoxic or genotoxic effect on human liver cells.

The leaf and flower extracts demonstrated antibacterial and antifungal effects, some in the range of standard antibiotics and antimycotics.

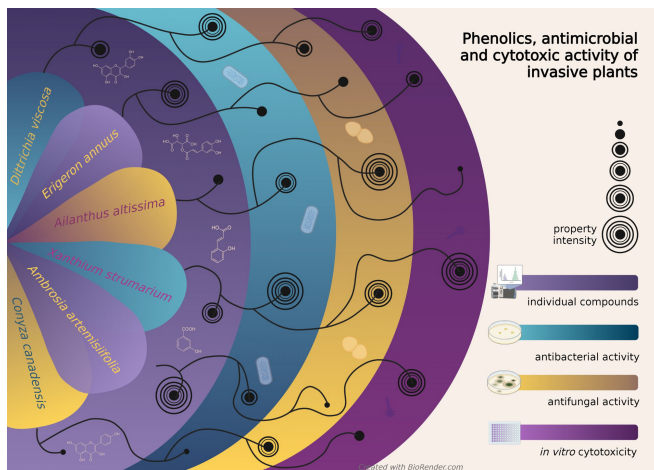
At concentrations of 1 mg/mL, the extracts demonstrated antitumor properties.

All results are available in the project's publications



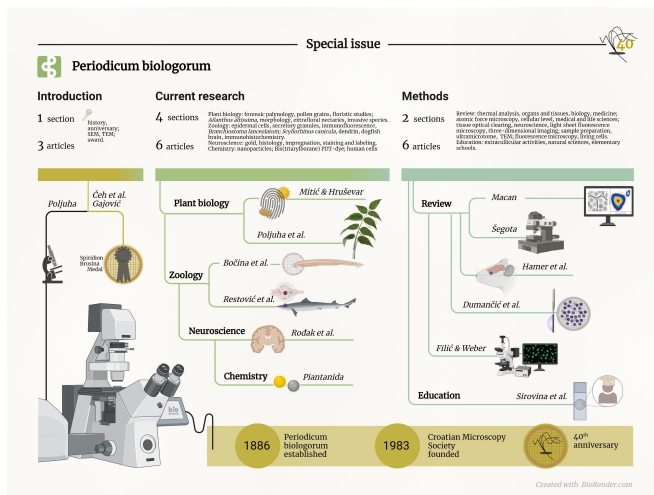
ARTICLE TITLE

LC-DAD-MS Phenolic Characterisation of Six Invasive Plant Species in Croatia and Determination of Their Antimicrobial and Cytotoxic Activity



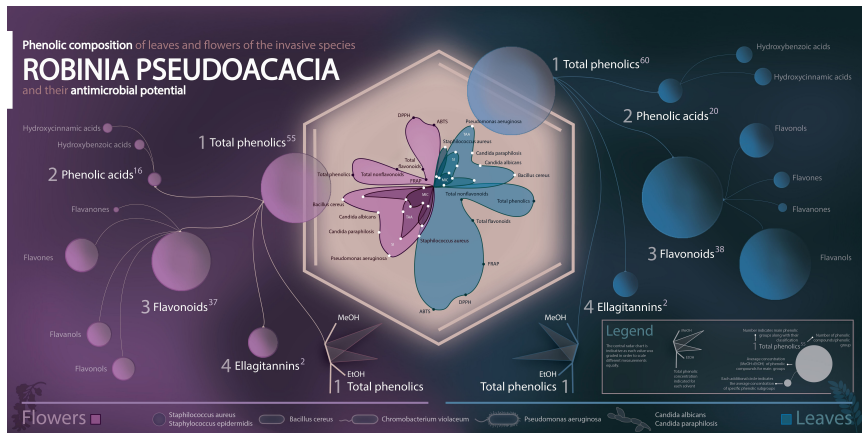
ARTICLE TITLE

Morphology of extrafloral nectaries of *Ailanthus altissima* (Mill.) Swingle (Simaroubaceae)



ARTICLE TITLE

Invasive Alien Species as a Potential Source of Phytopharmaceuticals: Phenolic Composition and Antimicrobial and Cytotoxic Activity of *Robinia pseudoacacia* L. Leaf and Flower Extracts



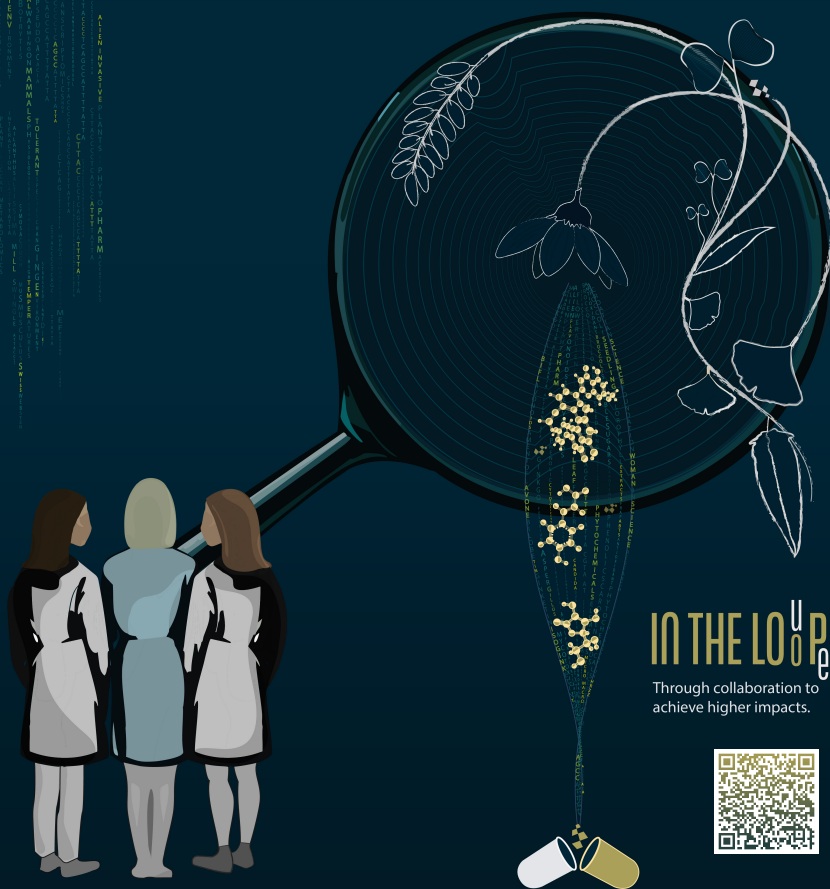
ARTICLE TITLE

The Invasive Alien Plant *Solidago canadensis*: Phytochemical Composition, Ecosystem Service Potential, and Application in Bioeconomy



Collaboration

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IN THE LOOP

Through collaboration to
achieve higher impacts.



GINKOBIFLAV

NATURALLY

TEMPHYS

