

ACTA BIOLOGICA CRACOVENSIA

SERIES BOTANICA

Vol. 63/2

2021



**Polish Academy of Sciences – Cracow Branch
Jagiellonian University, Cracow**

ACTA BIOLOGICA CRACOVIENSIA

Series Botanica

The Official Publication

**of the Biological Commission of the Polish Academy of Sciences – Cracow Branch
and the Jagiellonian University, Cracow**

**DEVOTED TO PLANT ANATOMY, MORPHOLOGY, CYTOLOGY, GENETICS,
KARYOLOGY, EMBRYOLOGY, TISSUE CULTURE, PHYSIOLOGY,
BIOCHEMISTRY, BIOSYSTEMATICS, MOLECULAR PHYLOGENETICS
AND PHYLOGEOGRAPHY, PHYTOCHEMISTRY**

ESTABLISHED 1958

© Polish Academy of Sciences and the Jagiellonian University, Cracow 2021

Polish Academy of Sciences provided partial funding for the publication of this volume

**ACTA BIOLOGICA CRACOVIENSIA Series Botanica is published twice a year
by the Polish Academy of Sciences – Cracow Branch, ul. św. Jana 28, 31-018 Cracow, Poland
and the Jagiellonian University, ul. Gołębia 24, 31-007 Cracow, Poland**

Agencja Wydawniczo-Poligraficzna GIMPO, ul. Transportowców 11, 02-858 Warszawa
tel. +48 501 076 031, e-mail: gimpo@poligrafia.waw.pl

Printed in 100 copies.

Prepress: LogoScript Sp. z o.o., ul. Dembowskiego 4/54, 02-784 Warszawa,
e-mail: logoscript@logoscript.pl, www.logoscript.pl

Managing editor: Monika Tuleja

Copy editor: Maria Czereyska-Kościelniak

ACTA BIOLOGICA CRACOVIENSIA Series Botanica on the Internet

The home page of *Acta Biologica Cracoviensia Series Botanica* can be found at
<https://abcbot.pl/>

Webmaster: Piotr Osyczka

Electronic version of publisher: journals.pan.pl/dlibra/journal/94503

The *Acta Biologica Cracoviensia Series Botanica* is participating in CrossCheck System's users
in order to ensure that the content published is original and trustworthy.

Primary version of the journal is printed version

Indexed in AGRICOLA (*National Agricultural Library*) AGRIS, AGRO, CABI databases (*Agroforestry Abstracts, Botanical Pesticides, CAB Abstracts, Crop Physiology Abstracts, Crop Science Database, Dairy Science Abstracts, Field Crop Abstracts, Forest Products Abstracts, Forestry Abstracts, Grasslands and Forage Abstracts, Horticultural Science Abstracts, Maize Abstracts, Ornamental Horticulture, Plant Breeding Abstracts, Plant Genetic Resources Abstracts, Plant Growth Regulator Abstracts, Potato Abstracts, Rice Abstracts, Seed Abstracts, Soils and Fertilizers Abstracts, Soybean Abstracts, Sugar Industry Abstracts, Wheat, Barley and Triticale Abstracts*), CNPIEC, EBSCO Discovery Service, Elsevier – SCOPUS, Foodline Science, FSTA - Food Science & Technology Abstracts, Google Scholar, Index Copernicus, J-Gate, Microsoft Academic Search, Naviga (Softweco), Polish Scientific Journals Contents, Primo Central (ExLibris), Summon (Serials Solutions/ProQuest), TDOne (TDNet), Thomson Reuters - Biological Abstracts, Thomson Reuters - BIOSIS Previews, Thomson Reuters - Current Contents/Agriculture, Biology, and Environmental Sciences, Thomson Reuters - Journal Citation Reports/Science Edition, Thomson Reuters - Science Citation Index Expanded, WorldCat (OCLC)

ACTA BIOLOGICA CRACOVIENSIA

Series Botanica

Editor

ANDRZEJ JOACHIMIAK

*Department of Plant Cytology and Embryology, Jagiellonian University,
Gronostajowa 9, 30-387 Cracow, Poland
Tel.: 48 12 664 6035; Fax: 48 12 664 51 04 e-mail a.joachimiak@uj.edu.pl*

Managing Editor

MONIKA TULEJA

*Department of Plant Cytology and Embryology, Jagiellonian University,
Gronostajowa 9, 30-387 Cracow, Poland
Tel.: 48 12 664 6038; Fax: 48 12 664 51 04 e-mail abc@iphils.uj.edu.pl*

Editorial Board

HARVEY E. BALLARD, Jr. *Department of Environmental and Plant
Biology Ohio University, Porter Hall, Athens, Ohio 45701, USA;
ballardh@ohio.edu*

Molecular approaches in plant systematics, ecology and evolution

BORUT BOHANEČ. *Biotechnical Faculty, University of Ljubljana,
Jamnikarjeva 101, 1000 Ljubljana, Slovenia;
borut.bohanec@bf.uni-lj.si*

Plant biotechnology

MAURO CRESTI. *Dipartimento di Biologia Ambientale, Sezione
Botanica, Università di Siena, Via P. A. Mattioli 4, I-53100 Siena,
Italy; cresti@unisi.it*

Sexual plant reproduction; pollen biology; pollen tube; pollen-stigma-
style-ovule interaction; cytoskeleton

MARTA DOLEŽAL. *Academy of Physical Education, Chair of Hygiene
and Health Protection, Al. Jana Pawła II 78, 81-571 Cracow, Poland;
Fax: +48-12-648 17 07*

General and medical mycology; health promotion; medical
microbiology

FRANCISZEK DUBERT. *Department of Plant Physiology, Polish
Academy of Sciences, ul. Niezapominajek 21, 30-239 Cracow, Poland;
dubert@ifr-pan.krakow.pl*

Physiology of plant growth and development

JOHANN GREILHUBER. *University of Vienna, Institute of Botany,
Rennweg 14, 1030 Vienna, Austria;
johann.greilhuber@univie.ac.at*

Plant karyology

ANNA KOLTUNOW. *CSIRO Plant Industry, PO Box 350, Glen Osmond,
SA 5064, Australia;
anna.koltunow@csiro.au*

Plant reproduction; developmental biology – particularly seed and fruit
(cellular and molecular aspects)

JOLANTA MAŁUSZYŃSKA. *Department of Plant Anatomy and
Cytology, Silesian University, ul. Jagiellońska 28, 40-032 Katowice,
Poland; jolanta.maluszynska@us.edu.pl*

Plant cytology; cytogenetics

KAROL MARHOLD. *Department of Botany, Faculty of Science,
Charles University, Benátská 2, CZ-128 01 Praha 2, Czech Republic;
karol.marhold@savba.sk*

Genome evolution; phylogeny; phylogeography

ALEV ÖNDER. *Department of Pharmacognosy, Ankara University,
06100 Tandogan-Ankara, Turkey; pharmacogalev@gmail.com*

Natural products; phytochemistry; essential oils; biological activity
of plant extracts and isolated compounds

MARIA PAJĄK. *Department of Plant Cytology and Embryology,
Jagiellonian University, Gronostajowa 9, 30-387 Cracow, Poland;
m.pajak@iphils.uj.edu.pl*

Plant embryology; apomixis

JAN J. RYBCZYŃSKI. *Botanical Garden – Center for Biological
Diversity Conservation of the Polish Academy of Sciences,
ul. Prawdziwka 2, 02-973 Warsaw, Poland;
jryb@obpan.pl*

Plant tissue and organ culture; biotechnology; cryopreservation

DAVID TWELL. *Department of Biology, University of Leicester
Leicester LE1 7RH, United Kingdom;
twe@leicester.ac.uk*

Plant Reproductive biology; pollen development, germline and gamete
development; gene regulation including post-transcriptional and small
RNA pathways

HANNA WEISS-SCHNEEWEISS. *Plant Evolutionary Cytogenetics
Group Department of Systematic and Evolutionary Botany,
University of Vienna, Rennweg 14, A-1030 Vienna, Austria;
hanna.schnee weiss@univie.ac.at*

Evolutionary plant cytogenetics

MICHEL T. M. WILLEMSE. *Laboratory of Plant Cell Biology,
Wageningen Agricultural University, Arboretumlaan 4,
6703 BD Wageningen, The Netherlands;*

Sexual plant reproduction; biology of lower plants

Section Editors

Section name: *Plant embryology; plant cell ultrastructure*

JERZY BOHDANOWICZ. Department of Plant Cytology and Embryology, University of Gdańsk, Wita Stwosza 59, 80-308 Gdańsk, Poland
e-mail: jurboh@biotech.univ.gda.pl

Section name: *Plant genetics and cytogenetics*

ROBERT HASTEROK. Department of Plant Anatomy and Cytology, University of Silesia in Katowice, Jagiellońska 28, 40-032 Katowice, Poland
e-mail: robert.hasterok@us.edu.pl

Section name: *Plant cell tissue and organ culture; developmental biology*

ROBERT KONIECZNY. Department of Plant Cytology and Embryology, Jagiellonian University, Gronostajowa 9, 30-387 Cracow, Poland
e-mail: robert.konieczny@uj.edu.pl

Section name: *Phytochemistry; secondary metabolism; pharmacology; bioactivity of plant natural products; biotechnology*

ADAM MATKOWSKI. Chair and Department of Pharmaceutical Biology and Botany, Silesian Piasts University of Medicine in Wrocław, al. Jana Kochanowskiego 10, 51-601 Wrocław, Poland
e-mail: pharmaceutical.biology@wp.eu

Section name: *Plant anatomy; cell ultrastructure with particular emphasis on secretory cells; pollination biology*

BARTOSZ PŁACHNO. Department of Plant Cytology and Embryology, Jagiellonian University, Gronostajowa 9, 30-387 Cracow, Poland
e-mail: bartosz.plachno@uj.edu.pl

Section name: *Molecular phylogenetics and phylogeography*

MICHAŁ RONIEMIER. W. Szafer Institute of Botany, Polish Academy of Sciences, Lubicz 46, 31-512, Cracow, Poland
e-mail: m.ronikier@botany.pl

Section name: *Molecular biology; cytometry; biotechnology*

ELWIRA ŚLIWIŃSKA. Laboratory of Molecular Biology and Cytometry, UTP University of Science and Technology, al. Kaliskiego 7, 85-789 Bydgoszcz, Poland
e-mail: elwira@utp.edu.pl

Section name: *Plant physiology - photosynthesis and respiration; biotic and abiotic stresses; inter- and intracellular signalling; plant movements; phytohormones in plant growth and development*

IRENEUSZ ŚLESIAK. Franciszek Górski Institute of Plant Physiology, Polish Academy of Sciences, Niezapominajek 21, 30-239 Cracow, Poland
e-mail: i.slesak@ifr-pan.krakow.pl

Review Board

Vol. 62/2020

The Editor is deeply grateful to those listed below who have generously given their time to review manuscripts submitted to volume 63 of *Acta Biologica Cracoviensia Series Botanica*

BENJAMIN ANDERSON (Stockholm University, Stockholm)

AGNIESZKA BAZYŁKO (Medical University of Warsaw, Warsaw)

ALEXANDER BETEKHTIN (University of Silesia in Katowice, Katowice)

ANNA WAJS-BONIKOWSKA (Lodz University of Technology, Łódź)

KRYSZYNA BORATYŃSKA (Polish Academy of Sciences, Kórnik)

MARIA BOSCH (University of Barcelona, Barcelona)

ATSUSHI EBIHARA (National Museum of Nature and Science, Tokyo)

MAGALI FERRARI GRANDO (The University of Passo Fundo, Passo Fundo)

SHRI MOHAN JAIN (Helsinki University, Helsinki)

ADRIANNA KACZMARCZYK (Polish Academy of Sciences, Kraków)

MALGORZATA KAPUSTA (University of Gdańsk, Gdańsk)

PAWEŁ KASZYCKI (University of Agriculture in Krakow, Kraków)

MALGORZATA MAŚLANKA (University of Agriculture in Krakow, Kraków)

MOHAMMAD HOSSEIN MIRJALILI (Shahid Beheshti University, Tehran)

JÓZEF MITKA (Jagiellonian University in Kraków, Kraków)

KRYSZYNA MUSIAŁ (Jagiellonian University in Kraków, Kraków)

EWA NIEWIADOMSKA (Polish Academy of Sciences, Kraków)

SYLWIA OLESZCZUK (IHAR Radzików, Radzików)

Rodomiro Ortiz (Swedish University of Agricultural Sciences, Uppsala)

DANUTA RAJ (Wrocław Medical University, Wrocław)

RALF RESKI (University of Freiburg, Freiburg)

PIOTR ROZPADEK (Jagiellonian University in Kraków, Kraków)

MARIA SHANAIDA (Medical University of Tarnopol, Tarnopol)

IVAN SALAMON (University of Presov, Presov)

EWA SKAŁA (University of Lodz, Łódź)

EDYTA SKRZYPEK (Polish Academy of Sciences, Kraków)

ANETA SŁOMKA (Jagiellonian University in Kraków, Kraków)

ANKICA KONDIC-SPIKA, (Institute of Field & Vegetable Crops, Novi Sad)

ZBIGNIEW SROKA (Wrocław Medical University, Wrocław)

WOJCIECH STRZAŁKA (Jagiellonian University in Kraków, Kraków)

ANTONI SZUMNY (Wrocław University of Environmental and Life Sciences, Wrocław)

FAZAL ULLAH (University of Chinese Academy of Sciences, Beijing)

PIOTR WALIGÓRSKI (Polish Academy of Sciences, Kraków)

KRYSZYNA WINIARCZYK (UMCS, Lublin)

FILIZ VARDAR (Marmara University, Istanbul)

URSZULA ZAJĄCZKOWSKA (SGGW, Warszawa)

IWONA ŻUR (Polish Academy of Sciences, Kraków)

ACTA BIOLOGICA CRACOVIENSIA
Series Botanica

CONTENTS

Volume 63/2, 2021

Original papers

- IVANA BJEDOV, DRAGICA OBRATOV-PETKOVIĆ, VERA RAKONJAC, DRAGANA SKOČAJIĆ, SRĐAN BOJOVIĆ, MILENA MARKOVIĆ, ZORA DAJIĆ-STEVENOVIĆ. Nontrivial variations of morpho-anatomical leaf traits in natural south-eastern populations of *Vaccinium* species from Central Balkans 7
- GRZEGORZ GÓRALSKI, MAGDALENA DENYSENKO-BENNETT, ANNA BURDA, NATALIA STASZECKA-MOSKAL, DAGMARA KWOLEK. Achievements in horizontal gene transfer studies in parasitic plants 17
- ALEKSANDRA GRABOWSKA-JOACHIMIAK, MAGDALENA ŻYTKOWICZ, DAGMARA KWOLEK, ZBIGNIEW SZELĄG. Chromosome complex of the relict diploid species *Hieracium bracteolatum* 29