

# PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY

(<https://ikpress.org/index.php/PCBMB/index>)



## About the Journal

PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY (ISSN: 0972-2025) journal is published by I. K. Press from Volume 14. PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY is the official journal of Society for Biology and Biotechnology, Kannankurichi-P.O Salem-636 008, Tamil Nadu State, India.

### The Scope of Plant Cell Biotechnology and Molecular Biology (PCBMB) (ISSN: 0972-2025) includes

1. Plant Science related research (including all branches of Plant Science like Agronomy, Algology and Phycology, Bacteriology, Bryology, Mycology, Paleobotany, Plant Anatomy and Physiology, Pteridology, etc)
2. Cell Biology (including all branches of Cell Biology)
3. Biotechnology related research (including all branches of Biotechnology like Animal Biotechnology, Medical Biotechnology, Industrial Biotechnology, Environmental Biotechnology, Plant Biotechnology, etc.)
4. Molecular Biology related research (including all branches of Molecular Biology)

This international English-language journal includes papers exploring both basic and applied aspects of the above-mentioned areas.

Read More (<https://ikpress.org/index.php/PCBMB/about>)

## Latest Articles

THE GOOD, BETTER AND BEST ABOUT SELECTIVE ESTROGEN RECEPTOR MODULATORS AS NOVEL GUARDIANS AGAINST OSTEOPOROSIS  
(<https://ikpress.org/index.php/PCBMB/article/view/7510>)

GROWTH, DEVELOPMENT AND BIOCHEMICAL RESPONSE OF APPLE AS INFLUENCED BY LIQUID FERTILIZERS (BIOFERT) APPLICATION  
(<https://ikpress.org/index.php/PCBMB/article/view/7502>)

RESPONSE OF THREE CYCLES OF S1 RECURRENT SELECTION FOR GRAIN YIELD IN MAIZE POPULATION SAKHA 14 (<https://ikpress.org/index.php/PCBMB/article/view/7503>)

Carica papaya THERAPEUTIC PROPERTIES IN DISEASE MANAGEMENT: A REVIEW  
(<https://ikpress.org/index.php/PCBMB/article/view/7504>)

PATHOPHYSIOLOGY OF SARS -nCoV-2: STRUCTURE, MODE OF INFECTION AND POSSIBLE TREATMENTS (<https://ikpress.org/index.php/PCBMB/article/view/7494>)

## Most Viewed

ANTIFUNGAL ACTIVITY OF CLOVE AND CINNAMON MEDIATED SELENIUM NANOPARTICLES: AN In vitro STUDY  
(<https://ikpress.org/index.php/PCBMB/article/view/5289>)

STUDY ON THE ANATOMICAL MORPHOLOGY OF LOTUS VARIETIES (*Nelumbo nucifera* Gaertn.) IN VIETNAM (<https://ikpress.org/index.php/PCBMB/article/view/4562>)

TISSUE CULTURE STUDIES ON SARACA ASOCA (ROXB.) DE WILDE: A VULNERABLE MEDICINAL PLANT FROM WESTERN GHATS  
(<https://ikpress.org/index.php/PCBMB/article/view/1227>)

FUNGI ASSOCIATED WITH SAFFRON (*Crocus sativus*) IN MOROCCO  
(<https://ikpress.org/index.php/PCBMB/article/view/4840>)

THE ADVENT OF CRISPR Cas9 – NEW GENERATION OF GENOME EDITING TOOLS (A REVIEW) (<https://ikpress.org/index.php/PCBMB/article/view/4941>)

## Most Read

---

AGING AND FERTILIZATION AFFECT NUTRIENT CONTENT IN LEAVES OF *Acacia mangium* TREE (<https://ikpress.org/index.php/PCBMB/article/view/4802>)

---

APPLICATIONS OF *Moringa oleifera* Lam., *Urtica dioica* L., *Malva sylvestris* L. AND *Plantago major* L. CONTAINING POTASSIUM FOR RECOVERY (<https://ikpress.org/index.php/PCBMB/article/view/5938>)

---


EFFICIENT In vitro DIRECT REGENERATION FROM NODAL EXPLANTS OF *Simmondsia chinensis* (Link) SCHNEIDER-A POTENTIAL MULTIPURPOSE PLANT (<https://ikpress.org/index.php/PCBMB/article/view/1358>)


---

Biotechnology of Rice: Present Limitations and Future Prospects (<https://ikpress.org/index.php/PCBMB/article/view/1608>)

---

INDUCTION OF POTATOES (*Solanum tuberosum* L.) MICRO TUBER AT SOME COUMARIN CONCENTRATIONS AND INCUBATION TEMPERATURES (<https://ikpress.org/index.php/PCBMB/article/view/6259>)

 [For Readers](#)

 [For Authors](#)

 [For Librarians](#)

We encourage readers to sign up for the publishing notification service for this journal. Use the Register (<http://www.journalmanuscript.com/user/register>) link at the top of the home page for the journal. This registration will result in the reader receiving the Table of Contents by email for each new issue of the journal. This list also allows the journal to claim a certain level of support or readership. See the journal's Privacy Statement (</index.php/PCBMB/about/submissions#privacyStatement>), which assures readers that their name and email address will not be used for other purposes.

---

[Terms & Condition \(/index.php\)](/index.php) | [Privacy Policy \(/index.php\)](/index.php) | [Help \(/index.php/index/faqs-help\)](/index.php/index/faqs-help) | [Team \(/index.php/index/our-team\)](/index.php/index/our-team) | [Advertising Policy \(/index.php/index/ikp-advertising-policy\)](/index.php/index/ikp-advertising-policy)  
Copyright © 2000-2022 I.K. Press. All rights reserved.

# PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY

(<https://ikpress.org/index.php/PCBMB/index>)

[Home \(https://ikpress.org/index.php/PCBMB/index\)](https://ikpress.org/index.php/PCBMB/index) / [Editorial Team](#)

## Editorial Team

### Chief Editors

#### Dr. P. Balasubramanian

Centre for Plant Molecular Biology, Tamil Nadu Agricultural University, India

Email: [balasubrap@hotmail.com](mailto:balasubrap@hotmail.com)

Profile link: NA

#### Dr. Afroz Alam

Professor,

Department of Bioscience & Biotechnology, Banasthali University (Rajasthan), India

email: [aaafroj@banasthali.in](mailto:aaafroj@banasthali.in), [afrozalamsafvi@gmail.com](mailto:afrozalamsafvi@gmail.com)

ProfileLink: <https://goo.gl/QftpHV> (<https://goo.gl/QftpHV>)

#### Dr. Ahmed Medhat Mohamed Al-Naggar

Professor of Plant Breeding,

Department of Agronomy, Faculty of Agriculture, Cairo University, Egypt

Email: [medhatalnaggar@agr.cu.edu.eg](mailto:medhatalnaggar@agr.cu.edu.eg), [medhatalnaggar@gmail.com](mailto:medhatalnaggar@gmail.com),

[ahmedmedhatalnaggar@gmail.com](mailto:ahmedmedhatalnaggar@gmail.com)

Profile Link: NA

### Founding Editor (Life Time)

#### Dr. P. Venkatachalam

Department of Biotechnology, Periyar University, Tamil Nadu, India

Email: [chalampv@yahoo.co.in](mailto:chalampv@yahoo.co.in)

Profile link: NA

### Academic Editors

#### Dr. T. Pullaiah

Department of Botany, Sri Krishnadevaraya University, Anantapur, India

Email: [tpullaiah@usa.com](mailto:tpullaiah@usa.com), [Pullaiah.thammineni@gmail.com](mailto:Pullaiah.thammineni@gmail.com)

Profile link: NA

#### Dr. Milan Stankovic

University of Kragujevc, Serbia

Email: [mstankovic@kg.ac.rs](mailto:mstankovic@kg.ac.rs)

Profile link: [http://www.kg.ac.rs/sve2novi.php?fakultet\\_je=8&nast\\_je=96](http://www.kg.ac.rs/sve2novi.php?fakultet_je=8&nast_je=96) ([http://www.kg.ac.rs/sve2novi.php?fakultet\\_je=8&nast\\_je=96](http://www.kg.ac.rs/sve2novi.php?fakultet_je=8&nast_je=96))

#### Dr. Sunil Kumar Singh

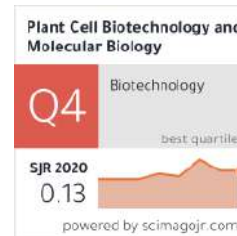
Shanghai Center for Plant Stress Biology, Chinese Academy of Sciences, China

Email: [agrilsunshine@yahoo.com](mailto:agrilsunshine@yahoo.com)

Profile Link: NA

#### Dr. Rajarshi Kumar Gaur

<https://ikpress.org/index.php/PCBMB/about/editorialTeam>



(<https://www.scimagojr.com/journalsearch.php?q=71491&tip=sid&exact=no>)

Make a Submission  
(<https://ikpress.org/index.php/PCBMB/about/submissions>)

### Information

For Readers  
(<https://ikpress.org/index.php/PCBMB/information/readers>)  
For Authors  
(<https://ikpress.org/index.php/PCBMB/information/authors>)  
For Librarians  
(<https://ikpress.org/index.php/PCBMB/information/librarians>)

Professor

Department of Biotechnology, D.D.U. Gorakhpur University, India

E-mail: gaurrajjarshi@hotmail.com, gaurrajjarshi@gmail.com

Profile link: [http://ddugu.ac.in/Faculty\\_profile\\_.aspx](http://ddugu.ac.in/Faculty_profile_.aspx)  
([http://ddugu.ac.in/Faculty\\_profile\\_.aspx](http://ddugu.ac.in/Faculty_profile_.aspx)) or [http://182.18.165.51/VWTeacher\\_Data.aspx?uid=571](http://182.18.165.51/VWTeacher_Data.aspx?uid=571)  
([http://182.18.165.51/VWTeacher\\_Data.aspx?uid=571](http://182.18.165.51/VWTeacher_Data.aspx?uid=571))

**Dr. Rama Bhat P.**

PG Biotechnology, Alva's College, Moodbidri, Karnataka, India

Email: bhat\_pr@rediffmail.com

Profile Link: NA

**Dr. Ömer Kiliç**

Associate Professor,

Bingol University, Turkey

Email: omerkilic77@gmail.com

Profile Link: NA

**Dr. Fatma Aykut Tonk**

Associate Professor,

Department of Field Crops, Faculty of Agriculture, Ege University, Turkey

Email: fatma.aykut@ege.edu.tr

Profile Link: NA

**Dr. Manasi Dash**

AICRP on Sesame, OUAT, Bhubaneswar, India

Email: manasi\_dash@yahoo.com

Profile Link: NA

**Dr. Duc Thanh Nguyen**

Institute of Biology (present - Institute of Biotechnology), National Center for Scientific Research of Vietnam

(present - Vietnam Academy of Science and Technology), Hanoi, Vietnam

Email: nguyenducthanh\_pcg@ibt.ac.vn

Profile Link: NA

**Dr. Asif Mohammad Iqbal Qureshi**

Assistant Professor,

Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, India

Email: asifquresh@gmail.com

Profile Link: NA

**Dr. Wellington Ferreira do Nascimento**

Professor,

Agrarian and Environmental Sciences Center, Federal University of Maranhao, Brazil

Email: nascimentowf@yahoo.com.br

Profile Link: NA

**Dr. Sylwia Okon**

Institute of Plant Genetics, Breeding and Biotechnology, University of Life Sciences, Lublin, Poland

Email: Sylwia.okon82@gmail.com, sylwia.okon@up.lublin.pl

Profile Link: NA

**Dr. Elena Rakosy Tican**

Professor,

Plant Biotechnology, Babe-Bolyai University, Romania

Email: elena.rakosy@ubbcluj.ro

Profile Link: NA

**Dr. Tran Dang Khanh**

Head of Genetic Engineering,

Agricultural Genetics Institute, Hanoi, Vietnam

Email: tdkhanh@vaas.vn, khanhkonkuk@gmail.com

Profile Link: NA

**Dr. Liang Yan**

Professor,

College of Horticulture, South Campus, Northwest A&F University Yangling, P.R.China

Email: liangyan@nwafu.edu.cn

Profile Link: <https://goo.gl/M6yQqh> (<https://goo.gl/M6yQqh>)

**Dr. Sandra Perez Alvarez**

Professor,

Department of Biotechnology, CIIDIR,

unit Sinaloa of Instituto Politécnico Nacional, México

Email: perezalvarezsandra2015@gmail.com; jefaturaba2015@gmail.com

Profile Link: <https://goo.gl/kE6iqv> (<https://goo.gl/kE6iqv>)

**Dr. Ujjal Kumar Nath**

Professor,

Department of Horticulture, Suncheon National University, Korea

And

Department of Genetics and Plant Breeding,

Bangladesh Agricultural University, Bangladesh

Email: ujjalnath@gmail.com

Profile Link: [https://www.bau.edu.bd/pages/faculty\\_list/GPB](https://www.bau.edu.bd/pages/faculty_list/GPB) ([https://www.bau.edu.bd/pages/faculty\\_list/GPB](https://www.bau.edu.bd/pages/faculty_list/GPB))

**Dr. Rishie K. Kalaria**

Assistant Professor,

Department of Plant Biotechnology, Bioinformatics Section,

Navsari Agricultural University, Surat, India

Email: risheekal@nau.in

Profile Link: NA

**Dr. Al-kazafy Hassan Sabry**

Professor,

Department of Pests and Plant Protection,

National Research Centre, Cairo, Egypt

Email: kazafysabry@yahoo.com, alkazafyhassan@yahoo.com

Profile link: NA

**Dr. Seema Akbar**

Drug Standardisation Research Unit,

Regional Research Institute of Unani Medicine (CCRUM),

University of Kashmir, Kashmir, India

Email: seemaakbar@hotmail.com

Profile link: NA

**Fatemeh Nejat-zadeh**

Department of Horticulture,

Faculty of Agriculture, Khoy Branch,

Islamic Azad University,

Khoy, P.O. Box 58168-44799 West Azarbayjan, Iran

EMAIL: fnejatzadeh@yahoo.com

Profile link: NA

**Prof. Antar El-Banna**

Department of Genetics, Faculty of

Agriculture, Kafrelsheikh University .Egypt.

Email: antarsalem@yahoo.com , antar.elbana@agr.kfs.edu.eg

Profile Link:NA

**Dr. Mohammad Reza Naroui Rad**

Horticultural Crops Research Department,

Agriculture and Natural Resources Research and Education Center of Sistan,

AREEO. Zabol. Iran.

Email: narouirad@gmail.com

Profile Link: NA

**Dr. Bishun Deo Prasad**

Associate Professor,

Department of Molecular Biology & Genetic Engineering,

Dr. Rajendra Prasad Central Agricultural University, Pusa, India

Email: bdprasadbau@gmail.com; bdprasadbau1@gmail.com

Profile Link: <https://goo.gl/aefnCc> (<https://goo.gl/aefnCc>)

**Prof. Dr. Wafaa Haggag**

culture and Biology Research Division,

El-Threer Street, National Research Centre, Dokki,Egypt.

Tel: 00202/ 33371362; 33371499 (Work); 01224269551 (Mobil).

EMAIL: wafaa\_haggag@yahoo.com

Profile link: NA

**Dr. Rasmia Sayed Sayed Darwesh**

Professor,

Central Laboratory for Date Palm Research and Development,

Agriculture Research Center, Giza, Egypt

Email: darweshsrasmia@gmail.com

Profile Link: NA

**Dr. SANTOSH KUMAR**

Christopher S Bond Life Science Centre

University of Missouri, Columbia

Email: kumarsant@missouri.edu

Profile Link: NA

**Dr. Md. Abdulla Al MAMUN**

Department of Biotechnology

Graduate school of Agricultural and Life Science,

The University of Tokyo, Tokyo, Japan

E-mail: mamungeb26@gmail.com, Abdullamamun30@g.ecc.u-tokyo.ac.jp

Profile Link: NA

**Dr. Ravi Kant Chaturvedi**

Centre for Integrative Conservation, Xishuangbanna Tropical Botanical Garden,

Chinese Academy of Sciences,P.R. China

Email: ravikantchaturvedi10@gmail.com, ravi@xtbg.ac.cn

Profile Link: <https://goo.gl/XrBV53> (<https://goo.gl/XrBV53>)

**Dr. S. Prabhu**

Department of Biotechnology,

Sri Venkateswara College of Engineering, Sriperumbudur, India

Email: sprabhu@svce.ac.in, prabhussb2008@gmail.com

Profile Link: <https://www.svce.ac.in/departments/newbio/profile/fac.php?id=BIO1392007>

(<https://www.ikprress.org/index.php/PCBMB/about/%20https://www.svce.ac.in/departments/newbio/profile/fac.php?id=BIO1392007>)

**Dr. Pankaj Kumar**

Assistant Professor

Department of Microbiology

Dolphin (PG) Institute of Biomedical and Natural Sciences

H.N.B.Garhwal Central University, Srinagar, Uttarakhand, India

Dehradun-248007

Email: guptapankaj23@gmail.com

**Dr. Jehad M. H. Ighbareyeh**

Professor

Department of plant production and protection,

Faculty of Agriculture, Al-Quds Open University,

Hebron Branch, Abu ktellah St., Hebron, Hebron, Palestine

Email: jehadighbareyeh@hotmail.com

Profile Link: NA

**Dr. Ahmed KARMAOUI**

Department of Biology,

Southern Center for Culture and Sciences,

Zagora, Morocco

E-Mail: karmaoui.ahmed@gmail.com

Profile Link: <https://publons.com/author/1286285/> (<https://publons.com/author/1286285/>)<http://livedna.org/212.24612> (<http://livedna.org/212.24612>)<http://www.flickr.com/photos/akarmaoui/> (<https://www.flickr.com/photos/akarmaoui/>)**Dr. Nesreen Houssien Abou- Baker**

Associate Professor,

Department of Soil and Water Use,

Division of Agricultural and Biological Research,

National Research Centre, Giza, Egypt

Email: nh.abou-baker@nrc.sci.eg, nesreenhaa@yahoo.com

Profile Link: [http://www.nrc.sci.eg/?page\\_id=1427](http://www.nrc.sci.eg/?page_id=1427) ([http://www.nrc.sci.eg/?page\\_id=1427](http://www.nrc.sci.eg/?page_id=1427))**Dr. Vineet Kaswan**

Assistant Professor,

Department of Biotechnology,

College of Basic Science and Humanities,

Sardarkrushinagar Dantiwada Agricultural University, Gujarat , India

Email: vineetkaswan@gmail.com

Profile Link: NA

**Dr. Farjana Sultana**

Professor,

College of Agricultural Sciences,

International University of Business Agriculture and Technology (IUBAT University), Bangladesh

Email: farjana1s@iubat.edu, farjana1s@gmail.com

Profile link: <https://iubat.edu/web1/index.php/team-details/dr-farjana-sultana/>(<https://iubat.edu/web1/index.php/team-details/dr-farjana-sultana/>)**Dr. Vinayaka K.S**

Assistant Professor,

Dept of Botany, Kumadvathi First Grade College, India

Email: ks.vinayaka@gmail.com

Profile Link: NA

**Dr. Frédéric Ngezahayo**

Associate Professor

Département des Sciences Naturelles, Ecole Normale Supérieure,

Burundi

Email: ngezafre@yahoo.fr , gezahayo.frederic@ens.bingezahayo.frederic@ens.bi

Profile Link: NA

**Dr. Awadhesh Kumar Pal**

Assistant Professor,

Department of Biochemistry and Crop Physiology,

Bihar Agricultural University, India

Email: awapal@gmail.com

Profile Link: NA

**Dr. Muhammad Abdul Rehman Rashid**

Assistant professor,

Department of Plant Breeding and Genetics at

“University of Agriculture Faisalabad”, Pakistan

Email: rashidpbg1620@gmail.com, rashidpbg@uaf.edu.pk

Profile Link: NA

**Dr. Tsygankova Victoria Anatolyivna**

Department for Chemistry of Bioactive Nitrogen-Containing Heterocyclic Compounds,

Institute of Bioorganic Chemistry and Petrochemistry of National Academy of Sciences of Ukraine, Ukraine

Email: vtsygankova@ukr.net

Profile Link: NA

**Dr. Francisco Cruz-Sosa**

Professor

Biotechnology Department

Metropolitan Autonomous University Iztapalapa Campus

Av. San Rafael Atlixco 186 México City 09340 México

EMAIL : cuhp@xanum.uam.mx

**Dr. Mahmoud HozaynDr.**

Department of Field Crops Research,

Division of Agricultural and Biological Research,

National Research Centre, Cairo, Egypt

Email: m\_hozien4@yahoo.com Profile Link: NA

**Dr. Moaed Al Meselmani**

Department of Molecular Biology and Biotechnology, The University of Sheffield

Firth Court, Western Bank, Sheffield

South Yorkshire

Email: m.almeselmani@sheffield.ac.uk; moaedalmeselmani@yahoo.com

Profile Link: NA

**Dr. Ogonna, Abigail Ifemelunma**

Lecturer,

Department of Plant Science and Technology,

Faculty of Natural Sciences,

University of Jos. P.M.B.2084 Jos, Nigeria

Email: ogbonabi@yahoo.co.uk, ogbonnai@unijos.edu.ng

Profile Link: NA

**Dr. Gulzar S Sanghera**

Plant Breeding and Genetics, Punjab agricultural University, Ludhiana, India

Email ID: sangheragulzar@gmail.com

Profile link: NA

**Dr. Essien Archibong Okon**

Associate Professor,



Department of Plant Science & Biotechnology, Faculty of Science,  
Cross River University of Technology (CRUTECH), Calabar, Nigeria.  
Email ID: essyokon@yahoo.com  
Profile link: NA

**Dr. Vikas Sharma**

Assistant Professor  
Department of Molecular Biology & Genetic Engg.  
Lovely Professional University, Jalandhar, India  
Email ID: biotech\_vikas@rediffmail.com; vikas25269@lpu.co.in  
Profile Link: NA

**Dr. Jaydip Mandal**

Professor  
Department of Botany & Formerly, Head DESM  
Regional Institute of Education  
Shyamla Hills, Bhopal, Pin Code: 462013, Madhya Pradesh, India  
Email: jaydipmandal07@yahoo.com  
Profile Link: NA

**Dr. T. Pullaiah**

Department of Botany,  
Sri Krishnadevaraya University, India  
Email: Pullaiah.thammineni@gmail.com  
Profile Link: NA

**Dr. K. Lekha**

Assistant Professor, PSG College of Arts & Science, Coimbatore, Tamilnadu, India  
Email : Lekha\_152@yahoo.com  
Profile Link: NA

**Dr. Md. Anwar Hossain**

Professor  
Plant Molecular Biotechnology Lab  
Department of Biochemistry and Molecular Biology  
University of Rajshahi, Bangladesh  
E-mail: mahossain95@hotmail.com Or mahossain.biochem@ru.ac.bd  
Profile Link: NA

**Dr. Mokhtar M. Abdel-Kader**

Professor  
Plant Pathology Department,  
National Research Centre, El-Beheos St., Dokki, Giza, Egypt  
Email ID: mokh\_nrc@yahoo.com  
Profile Link: NA

**Dr. Azman Bin Abd Samad**

Department of Biosciences  
Faculty of Science (FS)  
Universiti Teknologi Malaysia, Malaysia  
Email ID: azmansamad@utm.my  
Profile Link: NA

**Dr. B Fakrudin**

Professor  
Biotechnology Crop Improvement, University of Horticultural Sciences, Bagalkot, GKVK post, Bengaluru, INDIA  
Email: bfakrudin@gmail.com , bfakrudin@uhsbagalkot.edu.in  
Profile Link: NA

**Dr. Deepmala Katiyar**

Department of Plant Physiology,  
Institute of Agricultural Sciences,  
Banaras Hindu University, Varanasi, India  
Email: deepmala.katiyar@gmail.com  
Profile Link: NA

**Dr. Florin Sala**

Professor  
Faculty of Agriculture  
Banat University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" Timisoara,  
Romania  
Email: florin\_sala@usab-tm.ro , florin\_sala@yahoo.com  
Profile Link: NA

**Dr. Nehal S. El-mougy**

Department of Plant Pathology , National Research Centre, Giza, Egypt.  
Email: nehal\_nrc@yahoo.com  
Profile Link: NA

**Dr. Asma Hanif**

Assistant Professor  
Department of Botany, University of Karachi, Pakistan  
Email: asmahanif4@gmail.com , asma.hanif@uok.edu.pk  
Profile LINK: NA

**Dr. Joaquin Guillermo Ramírez Gil**

Assistant Professor  
Facultad de Ciencias Agrarias, Departamento de Ciencias Agronómicas,  
Universidad Nacional de Colombia, USA  
Email: jgramireg@unal.edu.co, j457r015@ku.edu  
Profile Link: NA

**Dr. Thayamini H Seran**

Professor  
Department of Crop Science, Faculty of Agriculture,  
Eastern University, Sri Lanka  
Email: thayaseran@yahoo.com  
Profile Link: NA

**Dr. Tinatin Doolotkeldieva**

Professor  
Head of Plant Protection Department  
Turkmen Manas University, Kyrgyzstan  
Email: tdoolotkeldieva@gmail.com  
Profile Link: NA

**Dr. Zhong-Guang Li**

Professor  
School of Life Sciences,  
Yunnan Normal University, Yunnan, People's Republic of China  
Email: zhongguang\_li@163.com  
Profile Link: NA

**Dr. Eduardo Osorio Hernández**

Professor  
Faculty of Engineering and Sciences

Autonomous University of Tamaulipas, Mexico

e-mail: eosorio@docentes.uat.edu.mx

Profile Link: NA

**Dr. Rafiul Amin Laskar**

Assistant Professor

Department of Botany,

Bahona College, Jorhat, Assam, India

Email: rafihkd@gmail.com , rafihkd@outlook.com

Profile Link: NA

**Dr. Mervat Shamooun Sadak**

Department of Botany,

Agricultural and Biological Research Division,

National Research Centre, Giza, Egypt

Email: mervat\_sh24@yahoo.com

Profile Link: NA

**Dr. Rajiv Dutta**

Dean and Sr. Professor,

School of Biological Engineering and Life Sciences (SBE&LS)

Shobhit Institute of Engineering & Technology (Deemed-to-be-University), Meerut, India

Email: director.sbt@gmail.com , profrajivdutta.2019@gmail.com

Profile Link: <http://rdutta.50megs.com> (<http://rdutta.50megs.com>)

**Dr. P. B. Kavi Kishor**

Department of Genetics, Osmania University, Hyderabad, India

Email: pbkavi@yahoo.com

Profile link: NA

**Dr. C. Nirmala**

Professor, Department of Botany, Punjab University, Chandigarh, India

Email: cnirmala10@gmail.com

Profile link: NA

**Dr. K. Veluthambi**

Department of Plant Biotechnology, Madurai Kamaraj University, India

Email: veluthambi@mrna.tn.nic.in

Profile link: NA

**Dr. C. Jayabaskaran**

Department of Biochemistry, Indian Institute of Science, Bangalore, India

Email: cjb@biochem.iisc.ernet.in

Profile link: <http://biochem.iisc.ernet.in/cjayabaskaran.php> (<http://biochem.iisc.ernet.in/cjayabaskaran.php>)

**Dr. P. K. Jaiwal**

Department of Biosciences, M.D. University, Rohtak, India

Email: pkjaiwal@yahoo.com

Profile link: NA

**Dr. M. V. Rajam**

Department of Genetics, University of Delhi-South Campus, New Delhi, India

Email: rajam@bol.net.in

Profile link: NA

**Dr. N. Geetha**

Department of Biotechnology, Mother Teresa Women's University, Kodaikanal, India

Email: geethadrbio@gmail.com

Profile link: NA

**Dr. P. A. Kumar**

NRC on Plant Biotechnology, Indian Agricultural Research Institute, New Delhi, India

Email: polumetla@hotmail.com

Profile link: NA

**Dr. P. K. Saha**

Department of Botany, Bose Institute, APC Road, Kolkata, India

Email: pksaha@bosemain.boseinst.ac.in

Profile link: <http://www.boseinst.ernet.in/psaha/> (<http://www.boseinst.ernet.in/psaha/>)

**Dr. S. A. Ranade**

Plant Molecular Biology Division, National Botanical Research Institute, Lucknow, India

Email: shirubhau@rediffmail.com

Profile link: NA

**Dr. Peter A. Roussos**

Agricultural University of Athens, Greece

Email: roussosp@aua.gr, carb4rop@aua.gr

Profile link: NA

**Dr. Idress Hamad Attitalla**

Omar Al-Mukhatr University, Libya

Email: idressattitalla2004@yahoo.com, dr.d.rs.idress@arc.ly

Profile link: NA

**Dr. Susmita Shukla**

Amity Institute of Biotechnology, Amity University, India

Email: shuklasusmita@yahoo.co.in

Profile link: NA

**Dr. Pradeep Kumar**

Department of Forestry,

North Eastern Regional Institute of Science and Technology,

Nirjuli (Itanagar)-791109 Arunachal Pradesh, India

Email: pkbiotech@gmail.com, pradeep@post.bgu.ac.il

Profile link: NA

**Dr. Sharad Tiwari**

Biotechnology Centre, Jawaharlal Nehru Agricultural University, India

Email: stiwari@lycos.com

Profile link: NA

**Dr. Hon H. Ho**

Professor,

Department of Biology, State University of New York, New Paltz, U.S

Email: hoh@newpaltz.edu

Profile Link: <http://www.newpaltz.edu/ugc/science/biology/faculty.php>  
(<http://www.newpaltz.edu/ugc/science/biology/faculty.php>)

**Prof. Mohamed Fawzy Ramadan Hasssanien**

Deanship of Scientific Research,

Umm Al-Qura University, Makkah, KSA.

Email: mhasssanien@uqu.edu.sa, hasssanienmohamed@yahoo.com

Profile Link: NA

**Disclaimer:** 'PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY' journal is published by International Knowledge Press from Volume 14. 'PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY' is the official journal of Society for Biology and Biotechnology.

**Society Address:**

Society for Biology and Biotechnology, Kannankurichi-P.O Salem-636 008, Tamil Nadu State, India,  
website: <http://pcbmb.org>

---

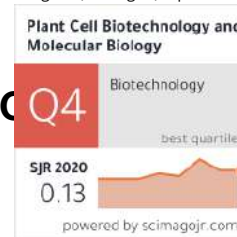
[Terms & Condition \(/index.php\)](#) | [Privacy Policy \(/index.php\)](#) | [Help \(/index.php/index/faqs-help\)](#) | [Team \(/index.php/index/our-team\)](#) | [Advertising Policy \(/index.php/index/ikp-advertising-policy\)](#)  
Copyright © 2000-2022 I.K. Press. All rights reserved.

# PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY

(<https://ikprress.org/index.php/PCBMB/index>)

Home (<https://ikprress.org/index.php/PCBMB/index>)

/ Archives (<https://ikprress.org/index.php/PCBMB/issue/archive>) / 2021 - Volume 22 [Issue 71-72]



(<https://www.scimagojr.com/journalsearch.php?q=71491&tip=sid&exact=no>)

Original Research Article

## IN VITRO EVALUATION OF ANTIARTHRITIC POTENTIAL OF SOME TRADITIONAL MEDICINAL PLANTS AND THEIR PHYTOCHEMICAL ANALYSIS

(<https://ikprress.org/index.php/PCBMB/article/view/7231>)

GHAZALA SHAHEEN, HAJIB MAJEED, HAFIZ MUHAMMAD ASIF, SHAFIA ARSHAD, FARAH ZAFAR, SEHRISH RANA RAJPOOT, MUHAMMAD WASIM TASLEEM

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 1-11

Published: 11 December 2021

Abstract (0) View Article (<https://ikprress.org/index.php/PCBMB/article/view/7231>)

Make a Submission  
(<https://ikprress.org/index.php/PCBMB/about/submissions>)

Information

For Readers  
(<https://ikprress.org/index.php/PCBMB/information/readers>)  
For Authors  
(<https://ikprress.org/index.php/PCBMB/information/authors>)  
For Librarians  
(<https://ikprress.org/index.php/PCBMB/information/librarians>)

Original Research Article

## HEPATO-CURATIVE POTENTIALS OF *Morus alba* FRUIT EXTRACT AGAINST LEAD (Pb) TOXICITY IN ALBINO MICE

(<https://ikprress.org/index.php/PCBMB/article/view/7232>)

IRAM INAYAT, SEHRISH RASHEED, MUHAMMAD ALI KANWAL, KHAWAJA RAEES AHMAD, SYEDA NADIA AHMAD, SADIA SULEMAN, RABIYAH ALI, ASMA YOUNIS, SAIRA SIDDIQUE, SAIMA MATLOOB, MUHAMMAD ATIF KAMRAN

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 12-18

Published: 11 December 2021

Abstract (0) View Article (<https://ikprress.org/index.php/PCBMB/article/view/7232>)

Original Research Article

## COMPOSTING OF GREEN WASTE AND PHOSPHATE WASHING SLUDGE AND THEIR EFFECT ON THE GROWTH AND DEVELOPMENT OF TOMATOES (*Lycopersicon esculentum* L)

(<https://ikprress.org/index.php/PCBMB/article/view/7234>)

YOUSSEF AIT RAHOU, KHALID FARES, MERIEM MOBALIGH, OMAR SAADANI HASSANI, ABDERRAHIM BOUTASKNIT, ALLAL DOUIRA, RACHID BENKIRANE, ABDELILAH MEDDICH

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 27-44

Published: 13 December 2021

Abstract (0) View Article (<https://ikprress.org/index.php/PCBMB/article/view/7234>)

Original Research Article

## ROLE OF PHOSPHORUS AND ARBUSCULAR MYCORRHIZAL FUNGI IN THE GROWTH PERFORMANCES AND TOLERANCE OF BARLEY TO WATER STRESS

(<https://ikprress.org/index.php/PCBMB/article/view/7235>)

ABDELILAH MEDDICH, REDOUANE OUHADDOU, MOHAMED ANLI, ABDERRAHIM BOUTASKNIT

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 45-67

Published: 13 December 2021

Abstract (0) View Article (<https://ikprress.org/index.php/PCBMB/article/view/7235>)

Original Research Article

## STUDY OF GENETIC PARAMETERS FOR SEED YIELD AND QUALITY INFLUENCING TRAITS IN MUSTARD (*Brassica juncea*, Brassicaceae)

(<https://ikprress.org/index.php/PCBMB/article/view/7236>)

MUHAMMAD AHMAD, ALI HAMZA, AFAQ TARIQ, MUHAMMAD HAMZA, AMMAD U. DIN, MUHAMMAD SAAD, SHABBIR HUSSAIN, MUHAMMAD RIZWAN YOUSAF, MUHAMMAD AQIB, HUMA QAMAR

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 68-76

Published: 13 December 2021

Abstract (0) View Article (<https://ikprress.org/index.php/PCBMB/article/view/7236>)

Original Research Article

## ENHANCEMENT OF THE QUALITY FEATURES, SOME CHEMICAL CONSTITUENTS, THE PURITY OF THE VASE SOLUTION AND SOME


### ANATOMICAL CHARACTERISTICS OF *Lilium orientalis* L. Cv. SANTANDER CUT SPIKES BY USING SOME ESSENTIAL OILS

(<https://ikprress.org/index.php/PCBMB/article/view/7241>)

SAFIA, H. EL-HANAFY, MAGDA, M. KANDIL, MONA, H. MAHGOUB, NAHED, G. ABD EL-AZIZ, AMAL, A. M. NASR, MAYADA, M. EL-SABWAH, SHIMAA, A. SHAABAN

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 77-91

Published: 13 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7241>)

Original Research Article


### IDENTIFICATION OF CLIMATE RESILIENT AND DISEASE TOLERANT (*Ascochyta* blight & wilt) CHICKPEA GENOTYPES AT DIFFERENT DATES OF SOWING

(<https://ikprress.org/index.php/PCBMB/article/view/7243>)

AZIZ ULLAH, TARIQ JAVED, MUHAMMAD ARFAN, MUHAMMAD MAJID, MUHAMMAD AMIN, MUHAMMAD MAZHAR IQBAL, TAYYABA NAZ, SALMAN GHUFFAR, KASHIF RASHID

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 92-100

Published: 13 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7243>)

Original Research Article


### LOCUS DETERMINING ROOT SIZE IN RUSSIAN RICE VARIETIES

(<https://ikprress.org/index.php/PCBMB/article/view/7249>)

Y. K. GONCHAROVA, S. V. GONTCHAROV, V. A. SHELEG, H. A. OCHKAS, V. V. SIMONOVA

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 101-111

Published: 13 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7249>)

Original Research Article


### EFFECT OF COUMARIN AND PHENYLALANINE CONJUGATED WITH CHITOSAN NANOPARTICLES ON SECONDARY METABOLITES SYNTHESIS IN CALLUS OF *Silybium marianum*

(<https://ikprress.org/index.php/PCBMB/article/view/7251>)

SABAH A. HASSANEN, GHADA A. HEGAZI, MOHAMED I. DIAB, ASMAA A. MAHDI, MOHAMED H. HENDAWAY, KHALED Y. FARROH

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 112-130

Published: 14 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7251>)

Original Research Article


### TITANIUM DIOXIDE NANOPARTICLES (NANO-TiO<sub>2</sub>) MITIGATE HEAVY METALS STRESS IN INDIAN MUSTARD (*Brassica juncea* L.) SEEDLINGS

(<https://ikprress.org/index.php/PCBMB/article/view/7254>)

DEEPAK KUMAR SINGH, . RANJANA, SAYAN CHATTERJEE, RAM SINGH PURTY

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 131-140

Published: 14 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7254>)

Original Research Article


### TEMPORAL VARIATION OF THE DUCKWEED EFFICIENCY IN WASTEWATER TREATMENT

(<https://ikprress.org/index.php/PCBMB/article/view/7255>)

HOSSAM F. NASSAR, HADEER E. ELSHERIF, HAMADA M. MAHMUD

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 141-150

Published: 14 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7255>)

Original Research Article


### HEMATOLOGICAL STUDY OF AQUEOUS EXTRACT OF *Sorghum propinquum* LEAVES

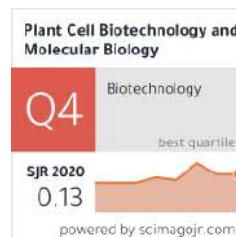
(<https://ikprress.org/index.php/PCBMB/article/view/7256>)

PRAVEEN KUMAR VEMURI, MOHAMMAD ANJUM SHAIK, P. V. HEMANTH SAI, BHAVANA POTLURI, SRI SARVANI VEMURI, GNANASREE BOPANA, KUSUMA NIDAMANURI, SURYANARAYANA VEERAVILLI

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 151-155

Published: 14 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7256>)



(<https://www.scimagojr.com/journalsearch.php?q=71491&tip=sid&exact=no>)

Make a Submission  
(<https://ikprress.org/index.php/PCBMB/about/submissions>)

Information 

For Readers  
(<https://ikprress.org/index.php/PCBMB/information/readers>)  
For Authors  
(<https://ikprress.org/index.php/PCBMB/information/authors>)  
For Librarians  
(<https://ikprress.org/index.php/PCBMB/information/librarians>)

## Original Research Article

**ASSESSMENT OF THE GENETIC DIVERSITY OF GLUTENINS BY SDS-PAGE METHOD REVEALS PRIVATE SUBUNITS IN WHEAT PROGENITORS AND LANDRACES FOR BREEDING PURPOSES**<https://ikprress.org/index.php/PCBMB/article/view/7259>

SAHAR BENNANI, AYMANE BOUZIDI, FATIMA GABOUN, MONA TAGHOUTI

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 166-179

Published: 14 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7259>)

## Original Research Article

**INFLUENCE OF PICLORAM ON CALLI INDUCTION AND SOMATIC EMBRYOS DEVELOPMENT OF DATE PALM CV. HAYANI VIA In vitro**<https://ikprress.org/index.php/PCBMB/article/view/7264>

RASHA, N. ARAFA, GHADA, A. ALI, SAYED, A. A. ELSAYH, SALWA EL-HABASHY

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 180-194

Published: 14 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7264>)


## Original Research Article

**CHARACTERIZATION AND QUALITY IMPROVEMENT OF MNH992 AND VH289 BT COTTON SEED VARIETIES**<https://ikprress.org/index.php/PCBMB/article/view/7266>

SHRINIVASULU KAMMA, KAVYASRI ARUMILLI, SHAIK MOHAMMAD ANJUM, P. V. HEMANTH SAI, MOHITH PARIMI, VENGILI LAXMISAI DIXITHA, B. VIGNESHWARA REDDY, SURYANARAYANA VEERAVILLI

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 195-200

Published: 14 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7266>)

## Original Research Article

**ADSORPTION PROPERTIES OF HEMOSORBENT BASED ON HYDROLYZED NATURAL SILK FIBROIN**<https://ikprress.org/index.php/PCBMB/article/view/7268>

YARMATOV SARDORBEK, SARIMSAKOV ABDUSHKUR, KHEGAY LYUBOV, SHADMANOV ALISHER, ERGASHEVA ZUMRAD

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 201-207

Published: 14 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7268>)

## Original Research Article

**DETERMINING COMBINING ABILITY OF SOME NEWLY DEVELOPED YELLOW MAIZE INBRED LINES USING LINE X TESTER DESIGN**<https://ikprress.org/index.php/PCBMB/article/view/7269>

M. A. A. ABD-ELAZIZ, M. A. A. HASSAN, S. M. ABO EL-HARESS, H. M. EL-SHAHED, NOURA A. HASSAN

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 208-215

Published: 14 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7269>)


## Original Research Article

**THE STUDY OF VARIOUS BODY PARAMETERS AND IMPACT OF CLIMATE CHANGE ON POTENTIAL SWARMING OF *Schistocerca gregaria* FORSKAL (ORTHOPTERA: ACRIDIDAE) IN PUNJAB, PAKISTAN**<https://ikprress.org/index.php/PCBMB/article/view/7270>

MUHAMMAD NAWAB, RIFFAT SULTANA, SANTOSH KUMAR

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 216-223

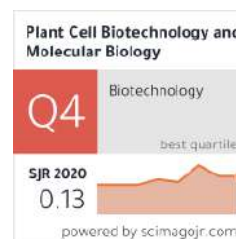
Published: 14 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7270>)

## Original Research Article

**ANTIDIARRHEAL ACTIVITY OF THE ETHANOL EXTRACT OF ANDONG STEM (*Cordyline fruticosa* (L.) A. Cheval) AGAINST *Salmonella typhi***<https://ikprress.org/index.php/PCBMB/article/view/7271>

. ELFITA, . FITRYA, . MARDIYANTO, ELISA NURMAWATI, NYAYU JUWITA LESTARI, KURRATUL AINI



(<https://www.scimagojr.com/journalsearch.php?q=71491&tip=sid&exact=no>)

Make a Submission  
(<https://ikprress.org/index.php/PCBMB/about/submissions>)

Information 

For Readers  
(<https://ikprress.org/index.php/PCBMB/information/readers>)

For Authors  
(<https://ikprress.org/index.php/PCBMB/information/authors>)

For Librarians  
(<https://ikprress.org/index.php/PCBMB/information/librarians>)



*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 224-234

Published: 14 December 2021

Abstract ▼ () View Article (<https://ikpress.org/index.php/PCBMB/article/view/7271>)

Original Research Article

**CONTRIBUTION TO THE ETHNOBOTANICAL STUDY OF MEDICINAL PLANTS USED IN THE TREATMENT OF DIGESTIVE DISORDERS: CASE OF THE MOYEN OUM RBIÁ REGION (MIDDLE ATLANTIC MOROCCO-5)**  
(<https://ikpress.org/index.php/PCBMB/article/view/7272>)

BEN AKKA FATIHA, SALHI SOUAD, EL HILAH FATIMA, BENKHNIGUE OUAFAE, DOUIRA ALLAL, ZIDANE LAHCEN

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 235-245

Published: 14 December 2021

Abstract ▼ () View Article (<https://ikpress.org/index.php/PCBMB/article/view/7272>)

Original Research Article

**SEVERE STRESS OF CUPROL COMPOUND AGAINST LAND SNAIL, *Massylaea vermiculata*, RESPIRATION**

(<https://ikpress.org/index.php/PCBMB/article/view/7273>)

SOHA A. MOBARAK, RANDA A. KANDIL

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 246-253

Published: 14 December 2021

Abstract ▼ () View Article (<https://ikpress.org/index.php/PCBMB/article/view/7273>)

Original Research Article

**MRI IN PRIMARY BONE TUMORS**

(<https://ikpress.org/index.php/PCBMB/article/view/7274>)

H. TEJASWINI, KUMBHAR RAMCHANDRA, BHOITE AMOL, TAMBOLI ASIF, SHAHA PRAMOD, GAUTAM AMOL

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 254-262

Published: 14 December 2021

Abstract ▼ () View Article (<https://ikpress.org/index.php/PCBMB/article/view/7274>)

Original Research Article

**ANTIMICROBIAL ACTIVITY In vitro OF EXTRACTS FROM THE COMBINATIONS OF AFRICAN GERANIUM, BLACK ELDERBERRY AND ST. JOHN'S WORT IN COLLOIDAL NANO SILVER**

(<https://ikpress.org/index.php/PCBMB/article/view/7276>)

TEODORA P. POPOVA, IGNAT IGNATOV

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 272-285

Published: 14 December 2021

Abstract ▼ () View Article (<https://ikpress.org/index.php/PCBMB/article/view/7276>)

Original Research Article

**EFFECT OF BENZYLADENINE, THIDIAZURON AND NANOSILVER ON QUALITY OF *Chrysanthemum morifolium* cv. 'CRYSTAL SUNNY' FLOWERING POT PLANTS**

(<https://ikpress.org/index.php/PCBMB/article/view/7285>)

ASMAA H. AHMED, MONA, A. DARWISH, H. M. ELBAGOURY, WEAAM, R. A. SAKR, SOAD A. M. KHENIZY

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 286-295

Published: 15 December 2021

Abstract ▼ () View Article (<https://ikpress.org/index.php/PCBMB/article/view/7285>)

Original Research Article

**RESPONSE OF THE WHEAT VARIETIES TO DIFFERENT NITROGEN LEVELS, SEEDING RATES AND THEIR COMBINATION: 4- YIELD AND QUALITY**

(<https://ikpress.org/index.php/PCBMB/article/view/7288>)

EL-SAYED M. S. GHEITH, SAYED A. SAFINA, OLA Z. EL-BADRY, MUSA A. A. SABOON

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 296-306

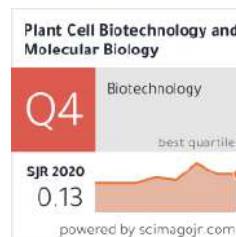
Published: 16 December 2021

Abstract ▼ () View Article (<https://ikpress.org/index.php/PCBMB/article/view/7288>)

Original Research Article

**STATUS OF PLANT DIVERSITY IN DIFFERENT SUB-TROPICAL ECOZONES OF PAKISTAN**

(<https://ikpress.org/index.php/PCBMB/article/view/7291>)



(<https://www.scimagojr.com/journalsearch.php?q=71491&tip=sid&exact=no>)

Make a Submission  
(<https://ikpress.org/index.php/PCBMB/about/submissions>)


Information ^

For Readers  
(<https://ikpress.org/index.php/PCBMB/information/readers>)  
For Authors  
(<https://ikpress.org/index.php/PCBMB/information/authors>)  
For Librarians  
(<https://ikpress.org/index.php/PCBMB/information/librarians>)

IQRA PARVEZ, IFTIKHAR AHMAD, MANSOOR HAMEED

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 307-314

Published: 16 December 2021

Abstract  () View Article (<https://ikprress.org/index.php/PCBMB/article/view/7291>)


Original Research Article

**PHYSICOCHEMICAL CRITERIA, BIOACTIVE COMPOUNDS OF POMEGRANATE PEELS (*Punica granatum* L. SEFRI VARIETY) CULTIVATED IN BENI MELLAL, MOROCCO** (<https://ikprress.org/index.php/PCBMB/article/view/7292>)

LOUBNA CHAFKI, KAOUTAR ELFAZAZI, HANANE AZZOUI, MOUAD ACHCHOUB, SAMIR FAKHOUR, MOHAMED BENBATI, ABDELMAJID HADDIOUI, MOHAMED ELHANSALI

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 315-322

Published: 16 December 2021

Abstract  () View Article (<https://ikprress.org/index.php/PCBMB/article/view/7292>)


Original Research Article

**MOLECULAR STRUCTURE AND VIBRATIONAL SPECTRA OF THYMINE USING Ab-Initio AND DENSITY FUNCTIONAL THEORY**(<https://ikprress.org/index.php/PCBMB/article/view/7295>)

BRIJESH KUMAR SHARMA, ACHCHHE LAL, VIPIN B. SINGH, DEVENDRA K. SINGH

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 323-331

Published: 16 December 2021

Abstract  () View Article (<https://ikprress.org/index.php/PCBMB/article/view/7295>)


Original Research Article

**CLINICAL ANALYSIS AND MANAGEMENT OF RHINO-ORBITO-CEREBRAL MUCORMYCOSIS IN 2ND WAVE OF COVID-19 IN TERTIARY CARE CENTRE** (<https://ikprress.org/index.php/PCBMB/article/view/7299>)

PRAJAKTA PATIL, DEVIKA DAMLE, SUPRIYA BHAVAKE, SANVEDYA KADAM

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 332-336

Published: 16 December 2021

Abstract  () View Article (<https://ikprress.org/index.php/PCBMB/article/view/7299>)


Original Research Article

**EFFECTS OF POTASSIUM FERTILIZER ON GROWTH, CAPSAICIN, AND ASCORBIC ACID CONTENT OF LOCAL AND HYBRID CHILI (*Capsicum annum* L.)** (<https://ikprress.org/index.php/PCBMB/article/view/7302>)

. SLAMETO, LENI NOVIANTI, INDRI FARIROH, RIZA YULI RUSDIANA, KACUNG HARIYONO

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 337-345

Published: 17 December 2021

Abstract  () View Article (<https://ikprress.org/index.php/PCBMB/article/view/7302>)


Original Research Article

**RESPONSE OF *Taxodium disticum* L. SEEDLINGS TO FOLIAR APPLICATION OF FOLIC ACID AND/OR  $\alpha$ -TOCOPHEROL** (<https://ikprress.org/index.php/PCBMB/article/view/7303>)

SAMAH M. EL-SAYED, AZZA A. MAZHAR, MAYADA, M. EL-SABWAH

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 346-357

Published: 17 December 2021

Abstract  () View Article (<https://ikprress.org/index.php/PCBMB/article/view/7303>)


Original Research Article

**A STUDY ON HEALTHCARE AND HOSPITAL PREFERENCES OF YOUTH DURING COVID IN DELHI NCR** (<https://ikprress.org/index.php/PCBMB/article/view/7307>)

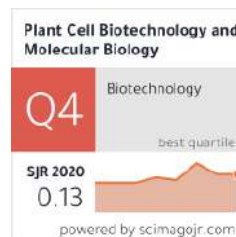
K. MANIVANNAN, SHAILESH KUMARI, CHHAVI DESHWAL, SARANGA PANWAR, BHAWNA SHARMA

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 378-392

Published: 19 December 2021

Abstract  () View Article (<https://ikprress.org/index.php/PCBMB/article/view/7307>)

Original Research Article

**EVALUATION OF DORMANCY DYNAMIC AND CHILLING REQUIREMENTS OF MOROCCAN AND FOREIGN APRICOT (*Prunus armeniaca* L.) CULTIVARS**(<https://www.scimagojr.com/journalsearch.php?q=71491&tip=sid&exact=no>)Make a Submission (<https://ikprress.org/index.php/PCBMB/about/submissions>)Information 

For Readers (<https://ikprress.org/index.php/PCBMB/information/readers>)

For Authors (<https://ikprress.org/index.php/PCBMB/information/authors>)

For Librarians (<https://ikprress.org/index.php/PCBMB/information/librarians>)

(<https://ikprress.org/index.php/PCBMB/article/view/7314>)

MERYEM ERAMI, ALI MAMOUNI, AHMED OUKABLI, ADNANE EL YAACOUBI

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 404-418

Published: 20 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7314>)

Original Research Article

### EFFECT OF LIQUORICE AND *Azadirachta indica* EXTRACTS ON THE EXPRESSION OF VIRULENCE GENES of *Enterococcus faecalis*

(<https://ikprress.org/index.php/PCBMB/article/view/7315>)

EHSAN MANSOOR KADHIM, BUSHRA KAREM AMIN, BASSAM KAREM AMIN

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 419-425

Published: 20 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7315>)

Original Research Article

### GROUNDNUT IMPROVEMENT: INDUCED GENETIC VARIABILITY FOR YIELD AND ITS COMPONENTS IN GROUNDNUT (*Arachis hypogaea* L.) THROUGH GAMMA IRRADIATION

(<https://ikprress.org/index.php/PCBMB/article/view/7322>)

SAIED A. SHRIEF, HASHIM M. ABD EL-LATTIF

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 426-437

Published: 20 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7322>)

Original Research Article

### EFFECTS OF ORGANIC AND INORGANIC FERTILIZER WITH REDUCED NITROGEN LEVEL ON GROWTH, NITROGEN USE EFFICIENCY, SEED YIELD AND QUALITY TRAITS OF *Chenopodium quinoa*

(<https://ikprress.org/index.php/PCBMB/article/view/7323>)

AHMED MEDHAT MOHAMED AL-NAGGAR, MOHAMED MOHAMED ATTA, MAISA LOTFY ABD EL-MONEIM, MARIAM SABRY AL-METWALLY

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 438-453

Published: 20 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7323>)

Original Research Article

### POTENTIAL EFFECT OF MEDICINAL PLANTS AGAINST *Penicillium digitatum* (Sacc.) CAUSING POSTHARVEST DECAY IN CITRUS FRUIT

(<https://ikprress.org/index.php/PCBMB/article/view/7327>)

MUHAMMAD TAHIR MURAD, AMER HABIB, AHMAD HASSAN, FAHEEM RAFIQ, SADIA MURAD, ISHRAT FATIMA, . SIDRA, FAZILA NASEEM, AFRAZ AKBAR, M. MADNI AFZAL

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 454-461

Published: 22 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7327>)

Original Research Article

### AN EFFICIENT DIRECT ORGANOGENESIS PROTOCOL FOR *Hygrophila auriculata* (K. Schum.) – AN IMPORTANT AYURVEDIC PLANT

(<https://ikprress.org/index.php/PCBMB/article/view/7331>)

ROY JOHN

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 462-468

Published: 22 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7331>)

Original Research Article

### QUANTITATIVE EVALUATION OF COMMERCIAL CANOLA CULTIVARS THROUGH G × E ANALYSIS UNDER DIFFERENT AGRO-CLIMATIC CONDITIONS

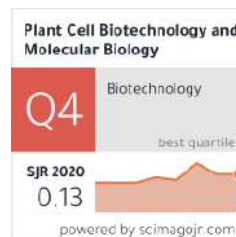
(<https://ikprress.org/index.php/PCBMB/article/view/7332>)

MISBAH ZULFQAR, HAFIZ SAAD BIN MUSTAFA, . EJAZ-UL-HASAN, SHAZIA SAEED, RIZWANA QAMAR, AHMAD NAWAZ GILL, TARIQ MAHMOOD, AHSAN MOHYO UD DIN, MUHAMMAD TANVEER AHMAD KALYAR, SAJID ALI, AMIR HAMEED, JAFAR SALIM, ABDUL WAKEEL

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 469-480

Published: 22 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7332>)



(<https://www.scimagojr.com/journalsearch.php?q=71491&tip=sid&exact=no>)

Make a Submission  
(<https://ikprress.org/index.php/PCBMB/about/submissions>)

Information

For Readers  
(<https://ikprress.org/index.php/PCBMB/information/readers>)  
For Authors  
(<https://ikprress.org/index.php/PCBMB/information/authors>)  
For Librarians  
(<https://ikprress.org/index.php/PCBMB/information/librarians>)

## Original Research Article

**A REVIEW OF PARACETAMOL AND MIRACULOUS ETHNOMEDICINAL HERBS AS SUBSTITUTE FOR PARACETAMOL**  
(<https://ikprress.org/index.php/PCBMB/article/view/7333>)

MEENA JHA, ASITA ELENGOE

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 481-488

Published: 22 December 2021

Abstract ▾ () View Article (<https://ikprress.org/index.php/PCBMB/article/view/7333>)

## Original Research Article

**RESPONSE OF THEE WHEAT VARIETIES TO NITROGEN LEVELS, SEEDING RATES AND THEIR COMBINATION: 3- STRAW YIELD AND ITS COMPONENTS**  
(<https://ikprress.org/index.php/PCBMB/article/view/7342>)

SAYED A. SAFINA, EL-SAYED M. S. GHEITH, MUSA A. A. SABOON, OLA Z. EL-BADRY

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 497-505

Published: 23 December 2021

Abstract ▾ () View Article (<https://ikprress.org/index.php/PCBMB/article/view/7342>)

## Original Research Article

**NEUROPROTECTIVE EFFECTS OF THE POLYPHENOLIC ANTIOXIDANT, CURCUMIN, AGAINST FORMALDEHYDE-INDUCED NEUROTOXICITY IN RATS**  
(<https://ikprress.org/index.php/PCBMB/article/view/7346>)

CHOUBA IBTISSEM, SAMAI IBTISSEM, BOUDIAF FELLA, HAMRI AHLEM

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 506-511

Published: 24 December 2021

Abstract ▾ () View Article (<https://ikprress.org/index.php/PCBMB/article/view/7346>)

## Original Research Article

**PHYSICOCHEMICAL AND MINERAL ANALYSIS OF PECTIN EXTRACTED FROM RIPE AND UNRIPE PINEAPPLE PEELS WITH ORANGE PEELS**  
(<https://ikprress.org/index.php/PCBMB/article/view/7347>)

J. O. OGUNDELE, D. I. OLOWU, E. Y. DADA, T.O. ABE

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 512-520

Published: 25 December 2021

Abstract ▾ () View Article (<https://ikprress.org/index.php/PCBMB/article/view/7347>)

## Original Research Article

**EFFICIENT CALLUS INDUCTION, REGENERATION, AND UNIFORMITY ASSESSMENT OF Citrus macroptera MONTR- AN ENDANGERED MEDICINAL TREE SPECIES OF ECONOMICAL VALUE**  
(<https://ikprress.org/index.php/PCBMB/article/view/7350>)

RITUPRIYA SINGH, SHIV KANT SHUKLA, SUSMITA SHUKLA

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 521-530

Published: 25 December 2021

Abstract ▾ () View Article (<https://ikprress.org/index.php/PCBMB/article/view/7350>)

## Original Research Article

**ACUTE TOXICITY STUDY OF Sinapis alba AQUEOUS EXTRACT IN SWISS ALBINO MICE** (<https://ikprress.org/index.php/PCBMB/article/view/7351>)

MOUNIRA MERGHEM, KHADIDJA DEHIMI, SALIHA DAHAMNA

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 531-536

Published: 25 December 2021

Abstract ▾ () View Article (<https://ikprress.org/index.php/PCBMB/article/view/7351>)

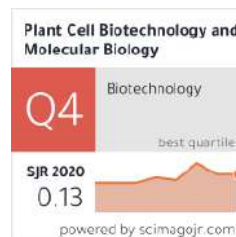
## Original Research Article

**EFFECT OF URANIUM ON PIGMENT, LIPID AND SURFACE CHARACTERIZATION OF IMMOBILIZED ALGAE**  
(<https://ikprress.org/index.php/PCBMB/article/view/7352>)

YASSIN M. EL-AYOUTY, ZEINAB M. NASSAR, HODA A. FATHEY, MOSTAFA M. S. ISMAIEL

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 537-550

Published: 25 December 2021

Abstract ▾ () View Article (<https://ikprress.org/index.php/PCBMB/article/view/7352>)(<https://www.scimagojr.com/journalsearch.php?q=71491&tip=sid&exact=no>)Make a Submission  
(<https://ikprress.org/index.php/PCBMB/about/submissions>)

## Information

For Readers  
(<https://ikprress.org/index.php/PCBMB/information/readers>)

For Authors  
(<https://ikprress.org/index.php/PCBMB/information/authors>)

For Librarians  
(<https://ikprress.org/index.php/PCBMB/information/librarians>)

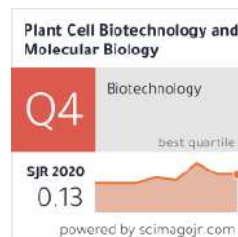
## Original Research Article

**GRAIN YIELD STABILITY OF LENTIL RELEASED VARIETIES IN MOROCCAN CLIMATIC CONTRASTED ENVIRONMENTS USING AMMI-GGE-BIPLLOT ANALYSIS** (<https://ikpress.org/index.php/PCBMB/article/view/7353>)

BENBRAHIM NADIA, TAGHOUTI MONA, BAGGAR ASMAE, MENTAG RACHID, MBASANI MANSI JOSEPH, GABOUN FATIMA

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 551-566

Published: 25 December 2021

Abstract ▾ () View Article (<https://ikpress.org/index.php/PCBMB/article/view/7353>)(<https://www.scimagojr.com/journalsearch.php?q=71491&tip=sid&exact=no>)

## Original Research Article

**WEED MANAGEMENT IN CHICKPEA (*Cicer arietinum* L.) THROUGH IDENTIFICATION OF POST-EMERGENT HERBICIDES AND HERBICIDE TOLERANT GENOTYPES FOR FOOD SECURITY** (<https://ikpress.org/index.php/PCBMB/article/view/7354>)

MUHAMMAD AKHTER, KASHIF RASHID, KAISER LATIF CHEEMA, IRFAN RASOOL, MUHAMMAD AFZAL ZAHID, IFTIKHAR HAIDER, ZEESHAN QADEER, MUHAMMAD JAHANZAIB KHALID

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 567-574

Published: 25 December 2021

Abstract ▾ () View Article (<https://ikpress.org/index.php/PCBMB/article/view/7354>)Make a Submission  
(<https://ikpress.org/index.php/PCBMB/about/submissions>)

## Information ^

For Readers  
(<https://ikpress.org/index.php/PCBMB/information/readers>)  
For Authors  
(<https://ikpress.org/index.php/PCBMB/information/authors>)  
For Librarians  
(<https://ikpress.org/index.php/PCBMB/information/librarians>)

## Original Research Article

**THE EFFECT OF ADDING HUMIC ACID, SPRAYING SOME FOLIAR TREATMENTS, ON CHEMICAL COMPONENTS OF FRUITS OF CHILI PEPPER PLANTS (*Capsicum annum* L.) PLANTED IN UNHEATED PLASTIC HOUSES CONDITIONS** (<https://ikpress.org/index.php/PCBMB/article/view/7358>)

LAILA TURKI FADALA, DHIA AHMED TAAIN, FATIMA ALI HASSAN

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 584-594

Published: 26 December 2021

Abstract ▾ () View Article (<https://ikpress.org/index.php/PCBMB/article/view/7358>)

## Original Research Article

**ASSESSMENT OF COMPOSTS QUALITY PRODUCED FROM PHOSPHATE WASHING SLUDGE AND LEACHATES, BASED ON RADIOACTIVITY, PHYTOTOXICITY AND DIFFERENT PHOSPHORUS FORMS** (<https://ikpress.org/index.php/PCBMB/article/view/7362>)

MERIEM MOBALIGH, ABDELLATIF TALBI, ABDERRAHIM ALAHYANE, MAKRAM BEN EL FAKIR, MOULAY-ALI MISDAQ, KHALID FARES

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 595-609

Published: 26 December 2021

Abstract ▾ () View Article (<https://ikpress.org/index.php/PCBMB/article/view/7362>)

## Original Research Article

**EFFECT OF WATER DEPLETION AND ORGANIC FERTILIZATION ON SOIL PROPERTIES AND BOTH PRODUCTIVITY WATER AND MAIZE YIELD** (<https://ikpress.org/index.php/PCBMB/article/view/7363>)

B. A. EL-GAMAL, H. M. EL SHAHED, A. M. ABU SHOSHA, H. A. ABOYOUSEF

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 610-628

Published: 26 December 2021

Abstract ▾ () View Article (<https://ikpress.org/index.php/PCBMB/article/view/7363>)

## Original Research Article

**In-vitro ANTIOXIDANT ACTIVITY OF *Dianthus caryophyllus* L. ETHANOLIC EXTRACT** (<https://ikpress.org/index.php/PCBMB/article/view/7365>)

MOUNIRA MERGHEM, NAWEL MEROUANI, WAFAR NOUIOUIA

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 629-635

Published: 26 December 2021

Abstract ▾ () View Article (<https://ikpress.org/index.php/PCBMB/article/view/7365>)

## Original Research Article

**THE EFFECTS OF ROW RANGE AND PLANT THICKNESS ON GROWTH, DEVELOPMENT, AND PRODUCTIVITY OF PEAS (*Pisum sativum* L.)**

(<https://ikpress.org/index.php/PCBMB/article/view/7366>)

SOBIR BOLIEVICH MUSTANOV

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 636-641

Published: 26 December 2021

Abstract ▾ () View Article (<https://ikpress.org/index.php/PCBMB/article/view/7366>)

Original Research Article

### MOLECULAR PROFILING OF RICE VARIETIES TO ASSESS GENETIC PURITY AND EXPLORING GENES FOR BACTERIAL LEAF BLIGHT, BLAST RESISTANCE AND PHOSPHORUS UPTAKE

(<https://ikpress.org/index.php/PCBMB/article/view/7367>)

M. GIRIJA RANI, P. VENKATA RAMANA RAO, B. N. V. S. R. RAVIKUMAR, N. CHAMUNDESWARI, P. V. SATYANARAYANA, K. UMA, K. KALPANA

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 642-657

Published: 26 December 2021

Abstract ▾ () View Article (<https://ikpress.org/index.php/PCBMB/article/view/7367>)

Original Research Article

### IDENTIFICATION, CHARACTERIZATION AND ANTIBIOTIC CONTROL OF BACTERIAL CONTAMINATION DURING In-vitro PROPAGATION OF BANANA

(<https://ikpress.org/index.php/PCBMB/article/view/7370>)

SANDEEP SIROHI, NITIKA VATS

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 676-682

Published: 26 December 2021

Abstract ▾ () View Article (<https://ikpress.org/index.php/PCBMB/article/view/7370>)

Original Research Article

### In vitro EMBRYOTOXICITY ASSAY OF MULBERRY (*Morus alba* L.) AND AGARWOOD (*Aquilaria malaccensis* L.) LEAVES EXTRACTS IN ZEBRAFISH (*Danio rerio*)

(<https://ikpress.org/index.php/PCBMB/article/view/7371>)

MAULITA INDRISARI, ASRIL BURHAN, NUR KHAIRI, RENY SYAHRUNI, AGUNG GIRI SAMUDRA, ASRUL ISMAIL, ARNI DAYANTI, SRI WAHYUNI

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 683-690

Published: 26 December 2021

Abstract ▾ () View Article (<https://ikpress.org/index.php/PCBMB/article/view/7371>)

Original Research Article

### QUANTITATIVE EVALUATION OF CHICKPEA (*Cicer arietinum* L.) CULTIVARS IN DRY LAND AGRO-CLIMATIC CONDITIONS

(<https://ikpress.org/index.php/PCBMB/article/view/7380>)

HAFIZ SAAD BIN MUSTAFA, IQTIDAR HUSSAIN, MUHAMMAD ZUBAIR AL- FAISAL, HAFIZ BASHEER AHMAD, MUHAMMAD NAEEM KHAN, JAFAR SALIM, ASRAR HUSSAIN SHAH, ALI AFZAL, MUHAMMAD RASHID, ABDUL WAKEEL, ALLAH NAWAZ, MISBAH ZULFQAR, RIZWAN KHURSHEED, MUHAMMAD ALTAJ, IDREES AHMAD

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 658-667

Published: 26 December 2021

Abstract ▾ () View Article (<https://ikpress.org/index.php/PCBMB/article/view/7380>)

Original Research Article

### ENHANCEMENT OF GREEN BIOMASS YIELD AND NUTRITIONAL QUALITY TRAITS IN FODDER SORGHUM THROUGH ASCORBATE PRIMING

(<https://ikpress.org/index.php/PCBMB/article/view/7418>)

AMIR BIBI, SAIRA AKRAM, MUHAMMAD AWAIS, ZEBA ALI, BILQUEES FATIMA, MUHAMMAD AHSAN IQBAL

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 668-675

Published: 26 December 2021

Abstract ▾ () View Article (<https://ikpress.org/index.php/PCBMB/article/view/7418>)

Short Research Article

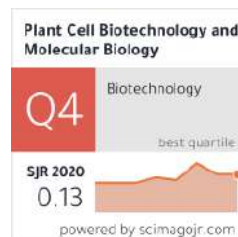
### LACTIC ACID BACTERIA AS BIO-PRESERVATIVE AGENTS: ANTIFUNGAL ACTIVITY OF *Lactiplantibacillus plantarum* AND *Levilactobacillus brevis* AGAINST FUNGI ISOLATED FROM BIOORGANIC FERTILIZER

(<https://ikpress.org/index.php/PCBMB/article/view/7305>)

KHADIIJA ATFAOUI, ABDESSAMAD ETOUIL, ASMAA OUBIHI, ISMAIL LOURAGLI, SOUAD HAMMOUTOU, MOHAMMED OUHSSINE

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 370-377

Published: 17 December 2021




(<https://www.scimagojr.com/journalsearch.php?q=71491&tip=sid&exact=no>)

Make a Submission  
(<https://ikpress.org/index.php/PCBMB/about/submissions>)

Information

For Readers  
(<https://ikpress.org/index.php/PCBMB/information/readers>)  
For Authors  
(<https://ikpress.org/index.php/PCBMB/information/authors>)  
For Librarians  
(<https://ikpress.org/index.php/PCBMB/information/librarians>)

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7305>)

Short Communication


**IDENTIFICATION OF *Dendrobium Sw.* BASED ON STOMATA ANATOMICAL CHARACTERS IN LIWA BOTANICAL GARDEN**

(<https://ikprress.org/index.php/PCBMB/article/view/7334>)

. MAHFUT, SRI WAHYUNINGSIH, TUNDJUNG TRIPENI HANDAYANI, . SUKIMIN

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 489-496

Published: 22 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7334>)

Review Article


**SUGAR BEET CROP IS AN ICON OF NEW CULTIVATION LANDS; A REVIEW**

(<https://ikprress.org/index.php/PCBMB/article/view/7233>)

NOFAL O. A., SAIED EL SAYED, GABALLAH M. S., Mansour H. A.

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 19-26

Published: 13 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7233>)

Review Article


**MODERN APPROACHES TO MITIGATE THE UNAVAILABILITY OF NUTRITIONAL ELEMENTS INCALCAREOUS SOIL OF EGYPT: A REVIEW**

(<https://ikprress.org/index.php/PCBMB/article/view/7257>)

M. M. WAHBA, M. A. AMAL, EBTISAM I. ELDARDIRY, M. ABD EL-HADY

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 156-165

Published: 14 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7257>)

Review Article

**RESPONSE OF WHEAT PLANT TO DROUGHT STRESS: A REVIEW**

(<https://ikprress.org/index.php/PCBMB/article/view/7275>)

KASHIF RASHID, MUHAMMAD ARFAN, SULTAN MAHMOOD, TARIQ JAVAID, MUHAMMAD MAJID, SAJID ALI, SHAKEEL AHMAD ANWAR, MUHAMMAD FARHAN KHAN, MUHAMMAD FARHAN KHAN

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 263-271

Published: 14 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7275>)

Review Article


**QUALITY MANAGEMENT SYSTEM AS AN EFFECTIVE TOOL FOR CATALYZING THE TRANSFORMATION OF PLANT TISSUE CULTURE SECTOR: A PERSPECTIVE OF INDIAN TISSUE CULTURE INDUSTRY**

(<https://ikprress.org/index.php/PCBMB/article/view/7304>)

SHIV KANT SHUKLA, VIDYA GUPTA, KRISH GURUMURTHI

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 358-369

Published: 17 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7304>)

Review Article

**RECENT TRENDS WITH MUTATION BREEDING IN FRUIT CROP IMPROVEMENT**

(<https://ikprress.org/index.php/PCBMB/article/view/7308>)

R. S. AFIYA, S. SENTHIL KUMAR, S. MANIVANNAN

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 393-403

Published: 19 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7308>)

Review Article


**A MYSTICAL PLANT *Azadirachta indica* USED AS PHYTOMEDICINE: STATE-OF-THE-ART**

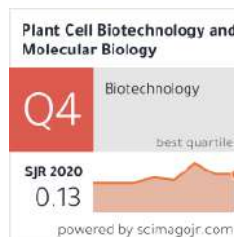
(<https://ikprress.org/index.php/PCBMB/article/view/7356>)

DIVYA PRAKASH, MANSI SAINI, NAMITOSH TYAGI, AYUSH MADAN, RAJIV DUTTA

*PLANT CELL BIOTECHNOLOGY AND MOLECULAR BIOLOGY*, Page 575-583

Published: 26 December 2021

Abstract  View Article (<https://ikprress.org/index.php/PCBMB/article/view/7356>)



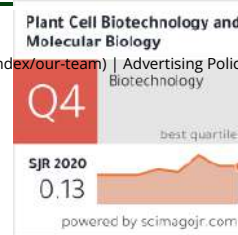
(<https://www.scimagojr.com/journalsearch.php?q=71491&tip=sid&exact=no>)

Make a Submission  
(<https://ikprress.org/index.php/PCBMB/about/submissions>)

Information 

For Readers  
(<https://ikprress.org/index.php/PCBMB/information/readers>)  
For Authors  
(<https://ikprress.org/index.php/PCBMB/information/authors>)  
For Librarians  
(<https://ikprress.org/index.php/PCBMB/information/librarians>)

[Terms & Condition \(/index.php\)](#) | [Privacy Policy \(/index.php\)](#) | [Help \(/index.php/index/faqs-help\)](#) | [Team \(/index.php/index/our-team\)](#) | [Advertising Policy \(/index.php/index/ikp-advertising-policy\)](#)  
Copyright © 2000-2022 I.K. Press. All rights reserved.



(<https://www.scimagojr.com/journalsearch.php?q=71491&tip=sid&exact=no>)

Make a Submission  
(<https://ikpress.org/index.php/PCBMB/about/submissions>)

### Information



- For Readers  
(<https://ikpress.org/index.php/PCBMB/information/readers>)
- For Authors  
(<https://ikpress.org/index.php/PCBMB/information/authors>)
- For Librarians  
(<https://ikpress.org/index.php/PCBMB/information/librarians>)



# EFFECTS OF POTASSIUM FERTILIZER ON GROWTH, CAPSAICIN, AND ASCORBIC ACID CONTENT OF LOCAL AND HYBRID CHILI (*Capsicum annum* L.)

SLAMETO\*, LENI NOVIANTI, INDRI FARIROH, RIZA YULI RUSDIANA  
AND KACUNG HARIYONO

Department of Agronomy, Faculty of Agriculture, University of Jember, Jember, Indonesia [Slameto, LN, IF, RYR, KH].

[\*For Correspondence: E-mail: slametohdsct.faperta@unej.ac.id]

## Article Information

### Editor(s):

(1) Dr. Ahmed Medhat Mohamed Al-Naggar, Professor, Cairo University, Egypt.

### Reviewers:

(1) Amir masoumi, Canada.

(2) Adewoyin Oluayinka Benedicta, University Oye Ekiti, Nigeria.

Received: 06 October 2021

Accepted: 12 December 2021

Published: 17 December 2021

Original Research Article

## ABSTRACT

Potassium plays an important role in plant's physiological processes, such as photosynthesis, plant reproductive development, and physiological maturity which is connected with crop yield and quality. The aim of the experiment is to determine the best varieties and appropriate potassium doses in improving the yield and quality of chili. The experiment used a factorial randomized completely block format with two factors, i.e. chili varieties (Local and Gada) and potassium (KCl) doses (0, 60, 120, 180 kg ha<sup>-1</sup>). The result showed that the Gada variety is taller than the local variety, also produced a higher number of fruits per plant. The local variety produced bigger chili fruit and higher productive branches than Gada variety. Application of 120 kg K ha<sup>-1</sup> was enough to increase the weight of fruit per plant, a number of fruits per plant, and a number of productive branches in chili. Application of 180 kg K ha<sup>-1</sup> in ripe local and Gada fruit resulted from the highest capsaicin content. Unripe fruits of local variety did not produce capsaicin, whereas the highest capsaicin content on unripe Gada fruit was shown in 120 kg K ha<sup>-1</sup>. The highest ascorbic acid content in the Gada variety resulted from 60 kg K ha<sup>-1</sup>, meanwhile in local variety was obtained from 120 kg K ha<sup>-1</sup>.

**Keywords:** Chili hybrids; chili nutrition; growth and yield; postharvest quality.

## INTRODUCTION

Red pepper (*Capsicum annum* L.) is one of the most popular horticultural crops in Indonesia because of its high economic value and people's preferences in using pepper for food preparations.

In Indonesia, pepper consumption has become a part of traditional culture and international identity. In addition, pepper is in high demand for food additives because of its spiciness. Production of shallots, cayenne pepper, potatoes, and red pepper in 2020 has increased when compared to

2019. Pepper become one of the top five seasonal vegetable commodities with the largest production in 2020, i.e. shallots (1.58 million tons), cabbage (1.41 million tons), cayenne pepper (1.37 million tons), potatoes (1.31 million tons), red pepper (1.21 million tons) [1]. The average red pepper national price in markets was increased from Rp 30.063 kg<sup>-1</sup> in July 2020 to Rp 33.763 kg<sup>-1</sup> in July 2021 [2]. Red pepper harvested area had declined (133.729 ha) compared to 2019 (133.434 ha) [1]. Therefore, red pepper production needs to be increased to fulfill the market needs through agronomy cultivation with fertilization application which is appropriate for plant needs and its agroecology.

Red pepper requires mineral fertilization, especially potassium (K) and nitrogen (N) to obtain maximum productivity. The potassium element is one of the essential macronutrients which important to physiological processes in plants, such as photosynthesis and respiration enzyme activation, osmoregulation, and opened/closed stomata regulator. [3] stated that red pepper cv. 'Cyklon' required a large amount of potassium (40%) and nitrogen (31%) if compared to other horticultural crops. Higher levels of nitrogen (350 mg dm<sup>-1</sup> substrate) and potassium fertilization (400 mg dm<sup>-3</sup> substrate) had a positive effect on the analyzed biometric parameters of fruits, except for the fresh weight of a single fruit.

Widyanti and Susila [4] Added that K fertilizer application at 3, 6, and 9 weeks after transplanting increases plant height, leaf number, weight per plant, fruit weight, fruit diameter, fruit length, marketable yield per lot, unmarketable yield per plot, marketable yield per hectare, and unmarketable yield per hectare with linear response pattern. While the addition of potassium did not affect the time of anthesis and fruit ripening. Total yield per plot and total yield per hectare increased with the addition of potassium fertilizer with a quadratic response pattern. In medium K soil content (146.2 ppm), potassium fertilizer recommendation for red chili in inceptisols is 487.5 kg K<sub>2</sub>O ha<sup>-1</sup>.

The effect of potassium (K) is most connected with the quality of seeds and fruits, also it was

required for the early ripening of crops, improved the quality of fruits and vegetables, and prolonged the products for a longer period time [5]. [6] Added that P and K were critical nutrients for vegetative growth parameters, total fruit yield, fruit quality, and chemical composition of sweet chili plants (total acidity, total ascorbic acid, and total capsaicin content). Total acidity in fruit with combinations of 100 P kg/ha and 120 K kg ha<sup>-1</sup> is 169.67 mg g<sup>-1</sup> while application of 120 kg ha<sup>-1</sup> single K fertilizer is 166 mg g<sup>-1</sup>. The highest content of ascorbic acid (176.66 mg 100 g<sup>-1</sup>) and capsaicin content in fruit (129.17 mg 100 g<sup>-1</sup>) was obtained from combinations of 200 P kg ha<sup>-1</sup> and 120 K kg ha<sup>-1</sup>. The aim of the experiment is to determine the best varieties and appropriate potassium fertilization doses to improve the yield and quality of chili.

## MATERIALS AND METHODS

The experiment was conducted in Banjarsari Village, Bangsalsari Subdistrict, from February to August 2018 with an experimental pattern using a factorial randomized completely block format with two factors and 3 replications. The first factor was varieties with 2 levels (local varieties and hybrid varieties (Gada)) and the second factor was potassium fertilizer (KCl) with 4 levels (0 kg ha<sup>-1</sup>, 60 kg ha<sup>-1</sup>, 120 kg ha<sup>-1</sup>, and 180 kg ha<sup>-1</sup>). Potassium content (K<sub>2</sub>O) in the experimental field was reported to be 0.049%, analyzed with wet oxidation method, HNO<sub>3</sub> + HClO<sub>4</sub>, AAS, Flamephotometry.

Combinations of media used in this study were soil, sand, and compost/manure (2:1:1). Furadan 3G was applied in planting media to prevent pests in soil. Mashed planting media then put into polybags. The height of the planting medium is about 5 cm from the lip of the polybag. The fertilizers used were Urea, SP-36, and KCl with a dose of urea (4.5 gr per plant or 150 kg ha<sup>-1</sup>), SP-36 (4.5 gr per plant or 150 kg ha<sup>-1</sup>). Potassium fertilization was done at intervals of 3, 6, and 9 weeks after planting.

Fruit harvesting was done in 70-90 days after planting depending on the variety, which is indicated by 60% of the chilies being red. Harvesting can be done at intervals of 3-7 days

continuously until the plants do not produce fruit. Harvesting was done by picking chilies with the stalks, doing it selectively and carefully so that the flowers did not fall out.

The following parameters were measured: plant height, fruit diameter, fruit weight per plant, number of fruits per plant, number of productive branches, capsaicin content of ripe and unripe fruit, and ascorbic acid content. The observed data were analyzed using analysis of variance (ANOVA). Means were separated using the DUNCAN test with an error rate of 5%.

### Capsaicin Analysis ( $\mu\text{g g}^{-1}$ )

Capsaicin analysis was conducted to determine the content of *capsaicin* chili peppers. Analysis *Capsaicin* using TLC (Thin Layer Chromatography) method. In 1 ml of ethanol the sample was homogenized, sonicated for 1 hour. Post supernatant as much as 25  $\mu\text{l}$  on silica gel 60 F254 plates by including capsaicin standard. Then put into a chamber that already contains the saturated mobile phase toluene – chloroform – acetone (45:25:30). Extend to the limit, lift and dry. Determination of capsaicin levels at a wavelength of 228 nm. Rf. 0.51.

### Determination of Ascorbic Acid

Testing the value of ascorbic acid was measured by redox titration using an iodine solution [7]. A total of 0.1 grams of sample extract was dissolved in 100 ml of distilled water. The sample solution (50 ml) was pipetted into the Erlenmeyer flask and 2 ml of 1% soluble starch solution was added. The sample is titrated with KI solution until the color changes to bluish, ascorbic acid as a standard to determine the value of vitamin C.

## RESULTS AND DISCUSSION

### Yield Parameters of Chili Plant

Chili varieties and potassium dose did not have any interaction on the five observed parameters of chili plant. The difference of the chili varieties (local and Gada) showed significant results on plant height (cm), fruit diameter (cm), fruit weight per plant (g), and numbers of fruit per plant. The numbers of productive branches did not differ between local variety and Gada. Plant height and fruit diameter of chili plants were not significantly different on the application of potassium doses. Meanwhile, the difference in potassium doses was significantly affected fruit weight per plant, number of fruits per plant, and number of productive branches on chili plant (Table 1).

Golcz et al. [3] analyzed the difference effect of potassium sources ( $\text{KCl}$ ,  $\text{K}_2\text{SO}_4$ ,  $\text{KNO}_3$ ) with one level nitrogen-potassium (250 mg N + 300 mg K) during one year on red pepper cv Cyklon plants and resulted in no significant effect on the height of the plant. A significant effect was observed in the total number of red pepper fruits during two years of the experiment with different levels of nitrogen-potassium. [5] stated that there was a significant effect among the different levels of potassium on chili from var hybrid Sitara plant height at first flowering and at final harvest, but not significantly different at first harvest. Combination treatment of nitrogen and potassium had a significant effect on plant height from first flowering to final harvest. [8] also observed the influence of nitrogen and potassium application on chili plants, and showed no difference result on plants height. It can be assumed that plant height was a function of genetic and influenced by chili varieties.

**Table 1. Influence of varieties and potassium doses on growth, yield, and fruit quality of chili**

Variable	P-value		
	Varieties (V)	Potassium doses (K)	Varieties $\times$ Potassium doses (V $\times$ K)
Plant height (cm)	*	ns	ns
Fruit diameter (cm)	*	ns	ns
Fruit weight per plant (g)	*	*	ns
Number of fruits per plant	*	*	ns
Number of productive branches	ns	*	ns

Note: \* = significant, ns= not significant in the Duncan test at alpha 5% level

The enhancement of potassium levels on chili from var hybrid Sitara increased the number of fruits per plant [5]. The previous study about the interactive effect of phosphorus and potassium on the exotic landrace of chili (Padron) also showed the significant result on the number of branches per plant, the number of fruits per plant, and the weight of fruit per plant [6]. [9] added that number of fruits per plant and fruit weight of California type cv Requena pepper on a hydroponic system also influenced by different  $K^+$  concentrations using sodium nitrate ( $NaNO_3$ ) and potassium chloride (KCl). [10] stated that potassium activates at least 60 different enzymes involved in plant growth. The K changes the physical shape of the enzyme molecule, exposing the appropriate chemical active sites for reaction. Furthermore, [11] concluded that potassium plays vital regulatory functions in biochemical and physiological processes that contribute to plant growth and development.

The different potassium doses showed no interaction with chili varieties (Fig. 1). Each variety showed a different response to the different levels of potassium. [12,13] explained that the different responses of chili varieties (Kopay, Bemer, Perintis) on growth and yield parameters were influenced by a variety of different adaptations, both climate and growing media, also the genetic. Gada is a hybrid variety that was produced by East-West Seed Indonesia and it was claimed that produced a high yield. Gada variety is taller ( $\bar{X}$  = 225.3 cm) than local variety ( $\bar{X}$  = 155.8 cm) (Fig. 1A), but fruit size of Gada is smaller ( $\bar{X}$  = 2.65 cm) than local fruit ( $\bar{X}$  = 4.18 cm) (Fig. 1C). [8] stated that plant height was a function of genetic, so the difference of chili varieties played a greater role on plant height than the application of nitrogen and potassium. The weight of fruit per plant (Fig. 1B) and the number of productive branches (Fig. 1E) were not different between Gada and the local variety. Local variety was heavier ( $\bar{X}$  = 43.10 g) than Gada variety ( $\bar{X}$  = 39.96 g). Local variety produced higher productive branches ( $\bar{X}$  = 15.25) than Gada variety ( $\bar{X}$  = 14.75). Gada variety produced the higher number of fruits per plant ( $\bar{X}$  = 68.25 fruits) (Fig. 1D) than local variety did ( $\bar{X}$  = 56.25 fruits). It can be assumed that Gada variety had better genotype characteristics in yield than the local

variety.

Different potassium doses influenced fruit weight per plant (g), the number of fruits per plant, and the number of productive branches on chili (Fig. 2). Potassium doses of 0  $kg\ ha^{-1}$  and 60  $kg\ ha^{-1}$  resulted in no difference in fruit weight per plant, respectively 12.4 g and 12.7 g. The same trend was observed for 120  $kg\ ha^{-1}$  and 180  $kg\ ha^{-1}$  potassium doses which resulted in no significant difference in fruit weight per plant to 14.8 g and 15.4 g, respectively. However, the application of 60  $kg\ K\ ha^{-1}$  showed different fruit weights per plant with 120  $kg\ K\ ha^{-1}$  (Fig. 2A). In other words, the application of 120  $kg\ K\ ha^{-1}$  was enough to increase the weight of fruit per plant in chili. [6] reported that maximum fruit weight per plant (465.5 g) was obtained from the combination of 100  $kg\ P\ ha^{-1}$  and 120  $kg\ K\ ha^{-1}$ . Potassium doses of 0  $kg\ ha^{-1}$  and 200  $kg\ P\ ha^{-1}$  resulted in the lowest weight of fruit per plant 137.1 g. [9] stated that application of compost (1.35 kg per planting hole) + Urea (75  $kg\ ha^{-1}$ ) + SP36 (75  $kg\ ha^{-1}$ ) + KCl (75  $kg\ ha^{-1}$ ) resulted the highest fruit weight in chili var Lado F1 to 253.35 g.

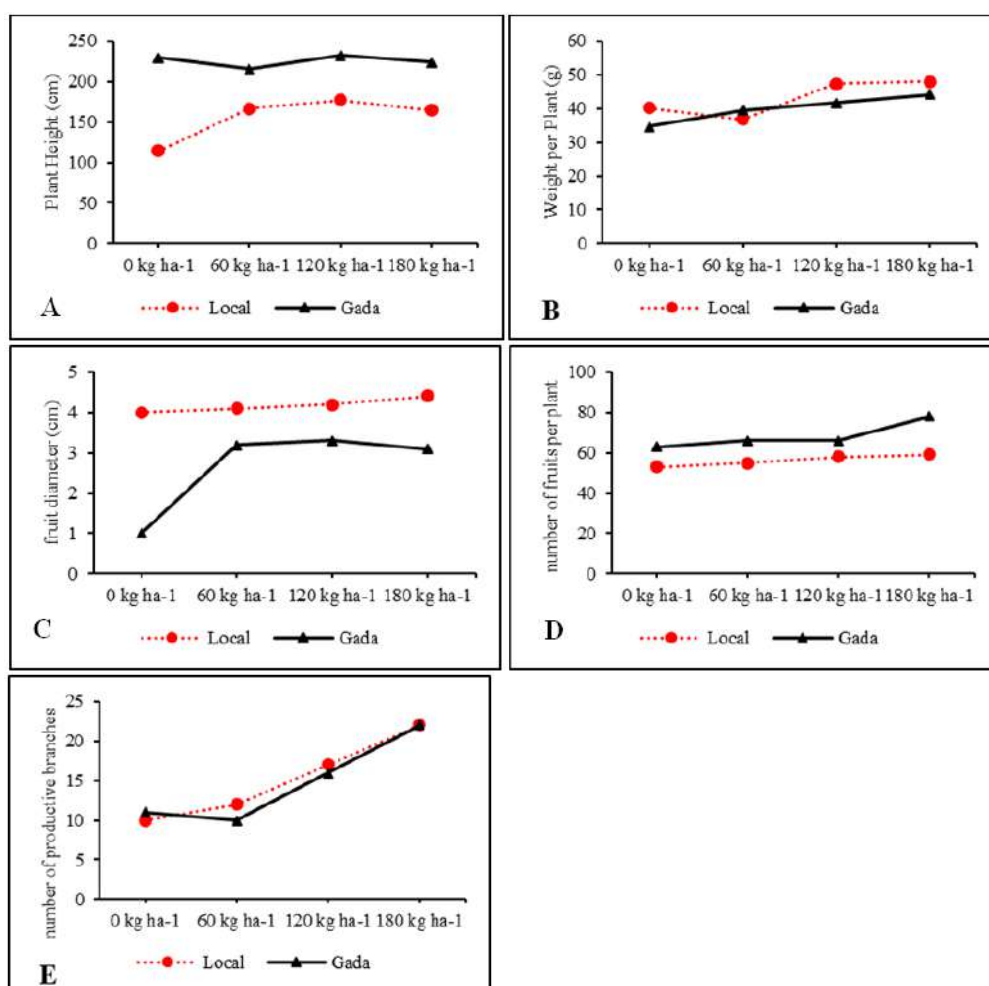
The number of fruits per plant in chili was not significantly different on 0, 60, and 120  $kg\ K\ ha^{-1}$  to 19.3, 20.2, and 20.7 fruits per plant, significantly. Application of 180  $kg\ K\ ha^{-1}$  resulted in the highest number of fruit per plants to 22.8 (Fig. 2B). [5] observed the influence of potassium fertilizer in chili var hybrid Sitara and resulted that the highest number of fruit per plant was found in 60  $kg\ K\ ha^{-1}$  (7.2 fruits). Potassium is most connected with the quality of seeds and fruits, also necessary for the early ripening of crops. [8] found that application of 50  $kg\ K\ ha^{-1}$  resulted in the highest number of fruit per plant to 47.7 fruits, but not different with the application of 40  $kg\ K\ ha^{-1}$  to 47.5 fruits. This highest result on the number of fruit per plant is probably due to the vigor of the chili plant and more number of leaves per plant.

Potassium doses of 120  $kg\ ha^{-1}$  were enough in producing the high number of fruit per plant in chili (Fig. 2B). [6] reported that the combination of 100  $kg\ P\ ha^{-1}$  and 120  $kg\ K\ ha^{-1}$  resulted in the highest number of fruits per plant to 30.17 in the exotic landrace of chili (Padron). This result was

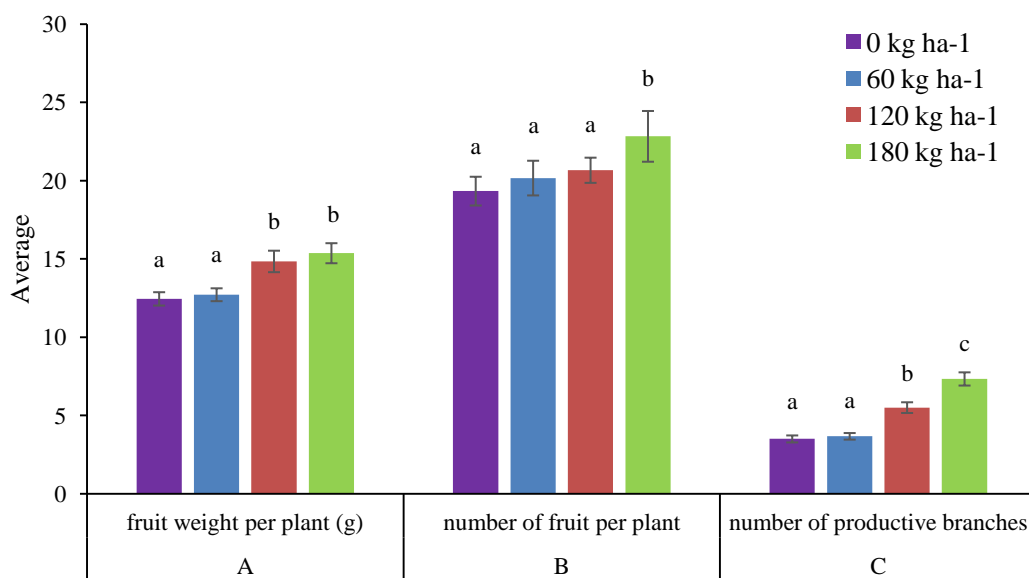
2.4 times higher if compared with plants that were not applied with fertilizer (12.5 fruits). [9] added that California type cv Requena pepper with 7 and (14)-10 mM  $K^+$  produced the highest fruit number to 17.6 and 15.19 fruits per plant respectively. The number of fruits per plant was strongly decreased with low  $K^+$  in nutrient solution (6.1 fruits with 0.5-0 mM  $K^+$  and 10.52 fruits with 0.5 mM  $K^+$ ) and slightly reduced with high  $K^+$  (14 fruits per plant with 14 mM  $K^+$ ).

The number of productive branches in chili was not different in application of 0 and 60 kg  $K\ ha^{-1}$  to 3.5 and 3.7, respectively. Application of 180 kg

$K\ ha^{-1}$  resulted in the highest number of productive branches to 7.3. The number of productive branches which was resulted from the application of 120 kg  $K\ ha^{-1}$  (5.5) was significantly different with 60 (3.7) and 180 (7.3) kg  $K\ ha^{-1}$ ). [8] stated that 50 kg  $K\ ha^{-1}$  resulted in the highest branches per plant to 13.2 in chili, it was not significantly different with 0, 30, and 40 kg  $K\ ha^{-1}$  (13; 12.9; 12.9 respectively). [6] added that a combination of 100 kg  $P\ ha^{-1}$  and 120 kg  $K\ ha^{-1}$  resulted in a maximum number of branches per plant (41.20). The minimum number of branches per plant (15.00) was obtained from a no fertilizer plant.



**Fig. 1.** The influence of different potassium doses and chili varieties on A) plant height, B) weight per plant, C) fruit diameter, D) number of fruits per plant, E) number of productive branches



**Fig. 2. Effect of different potassium doses on fruit weight per plant (A), number of fruits per plant (B), and number of productive branches (C). Error bars show the standard error (SE) of the means of three replicates. The different lower cases represent a significant difference ( $p$ -value < 0.05) among four potassium doses treatments within the same chili variety**

The potassium fertilizer used in this experiment was KCl. [3] found that at a lower nitrogen (250 mg) and potassium (300 mg) fertilization, the highest total yield of fruits in red pepper was obtained from combination with  $\text{KNO}_3$  to  $1.90 \text{ kg m}^{-2}$  and  $2.48 \text{ kg m}^{-2}$ . When nitrogen and potassium doses were increased to 350 mg N and 400 mg K, the highest total yield of fruits was obtained from combination with KCl or  $\text{KNO}_3$  ( $2.25$  and  $2.29 \text{ kg m}^{-2}$ , respectively) in 2005. Meanwhile, in 2006, the highest total yield of fruits was obtained from combination with KCl to  $2.66 \text{ kg m}^{-2}$ . [14] stated that better yield production of chili under KCl than NaCl treatment due to better leaf water status and photosynthesis, more leaf number, and less chlorotic leaves.

In conclusion, the application of  $120 \text{ kg K ha}^{-1}$  was enough to increase the weight of fruit per plant, the number of fruits per plant, and the number of productive branches in chili. [15] reported that maximum plant height (110.2 cm), plant spread (108.2 cm), 100 pod weight (54.5 g), number of fruit per plant (228.4), and maximum yield ( $48.85 \text{ q ha}^{-1}$ ) in chili variety LCA 353 were obtained from the application of  $300 \text{ kg N ha}^{-1}$ ,

was given as 50% urea and remaining 50% as CAN (calcium ammonium nitrate),  $120 \text{ kg K ha}^{-1}$  as 50% MOP (muriate of potash) and 50% as SOP (sulphate of potash). [11] resumed that potassium plays an imperative role in plant photosynthesis process and the subsequent carbohydrate translocation and metabolism which increase the crop yield and grain quality. Potassium also regulates the biosynthesis, conversion, and allocation of metabolites that ultimately increases the yield.

### Capsaicin Content in Fruit

The capsaicin content of ripe local and Gada variety did not differ ( $p$ -value = 0.277) in various treatments of potassium fertilizer. Otherwise, the unripe chilies indicated the statistical difference between local and Gada varieties ( $p$ -value = 0.009) (Fig. 3). The highest capsaicin content on ripe chili fruit was resulted by application of  $180 \text{ kg K ha}^{-1}$ , both in local and Gada variety, respectively  $0.87$  and  $0.9 \text{ mg/100g}$ . Capsaicin content in the ripe local variety was higher than Gada variety, which means the local variety was spicier (Fig. 3A). In the local variety, there was no

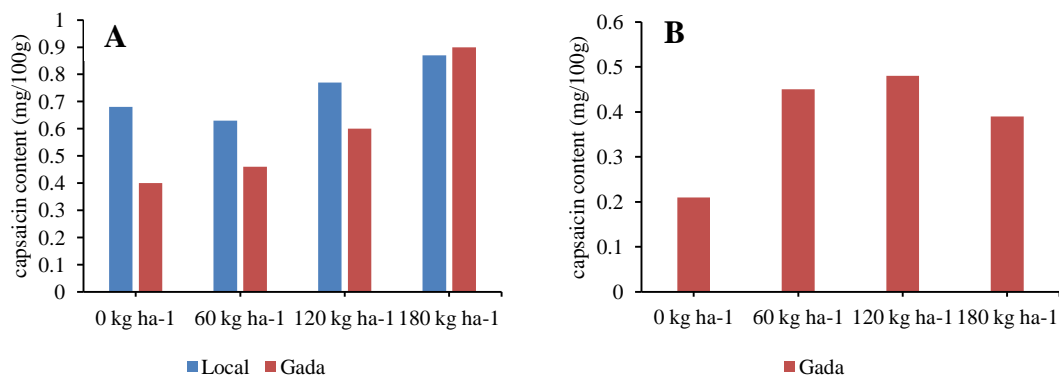
capsaicin content in unripe fruits, but it differed from the unripe Gada variety. The highest capsaicin content on unripe Gada fruit was shown in 120 kg K ha<sup>-1</sup> to 0.48 mg/100g (Fig. 3B). [6] found that a combination of 200 kg P ha<sup>-1</sup> + 120 kg K ha<sup>-1</sup> and 100 kg P ha<sup>-1</sup> resulted in the highest capsaicin content 129.17 mg/100g and 128.17 mg/100 g respectively.

The higher potassium doses were given to the plant, the capsaicin level on ripe fruit also increased (Fig. 3A). [11] resumed that potassium plays role in plant reproductive development, especially in flowering, pollen germination, and physiological maturity. Phenological development was delayed due to the lower application of K. Meanwhile [16] resumed that capsaicin content in plants increases gradually during fruit

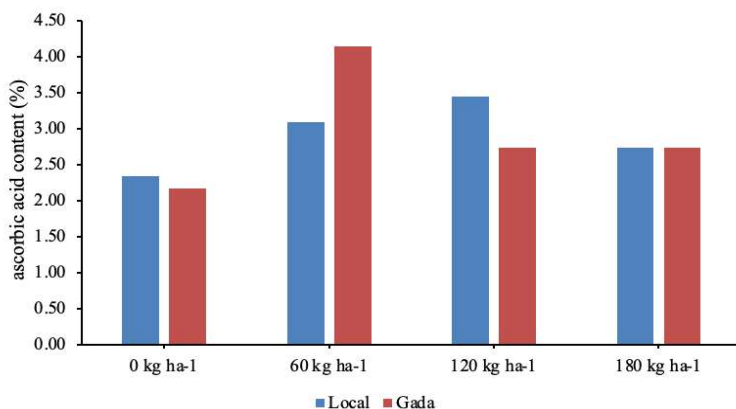
development and reaches maximum levels at 40 to 50 days, then it tends to degrade into secondary compounds due to peroxidase action. This result showed that potassium fertilization triggered the formation of capsaicin during fruit development.

### Ascorbic Acid in Fruit

Ascorbic acid content (%) in chili fruit showed different results on varieties for each potassium dose. Gada variety which was applied with 60 kg K ha<sup>-1</sup> resulted in the highest ascorbic acid content to 4.15%. In contrast with Gada variety, the highest content of ascorbic acid in the local variety was 3.44% when it was applied with 120 kg K ha<sup>-1</sup>. The lowest ascorbic acid content was obtained from the Gada variety without potassium application to 27.17% (Fig. 4).



**Fig. 3. Capsaicin content on different potassium doses and chili variety in ripe fruit (A) and unripe fruit (B)**



**Fig. 4. Ascorbic acid content (%) in different potassium doses and chili variety**

Akram et al. [6] found that application of 200 kg P ha<sup>-1</sup> and 120 kg K ha<sup>-1</sup> produced the highest ascorbic acid content to 176.66 mg/100 g. The lowest ascorbic acid content was recorded in chili plants without fertilizer (148.37 mg/100 g). [9] observed that potassium fertilizer increased ascorbic acid in pepper fruits from 30 days after anthesis until the end of the experiment (60 DAA). The highest ascorbic acid content in pepper fruit was obtained from nutrient solution up to 14-10 mM K<sup>+</sup> to 269 mg/100 g of juice. Meanwhile, the lowest ascorbic acid content was shown by the lowest level of K<sup>+</sup> (0.5-0 mM K<sup>+</sup>), i.e. 122 mg/100 g of juice. Higher potassium nutrient solution to 14 mM, reduced ascorbic acid content in pepper fruit. Ascorbic acid plays an important role as an antioxidant in plants. Ascorbic acid content is affected by the composition of the nutrient solution. Although the mechanisms of ascorbic acid improvement due to the increased plant K<sup>+</sup> status are uncertain, it could be related to increase photosynthesis, sugar production, and photoassimilate transport from leaves to fruit.

## CONCLUSIONS

Chili varieties and potassium doses did not have any interaction with the five observed parameters of the chili plant. Plant height (cm), fruit diameter (cm), fruit weight per plant (g), and the number of fruits per plant were influenced by chili varieties. The number of productive branches did not differ between local variety and Gada. The application of potassium doses did not significantly differ on plant height and fruit diameter. Meanwhile, fruit weight per plant, number of fruits per plant, and number of productive branches were significantly affected by potassium doses. Gada variety is taller than local variety, also produced the higher number of fruits per plant. The local variety produced bigger chili fruit and higher productive branches than the Gada variety. It can be assumed that Gada variety had better genotype characteristics in yield than the local variety.

Application of 120 kg K ha<sup>-1</sup> was enough to increase the weight of fruit per plant, the number of fruits per plant, and the number of productive branches in chili. The highest capsaicin content on ripe chili fruit was resulted by application of 180 kg K ha<sup>-1</sup>, both in local and Gada variety. Unripe

fruits of local variety did not produce capsaicin, whereas the highest capsaicin content on unripe Gada fruit was shown in 120 kg K ha<sup>-1</sup>. The highest ascorbic acid content in Gada variety resulted from 60 kg K ha<sup>-1</sup>, meanwhile in local variety, the highest content of ascorbic acid was obtained from 120 kg K ha<sup>-1</sup>.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. BPS Statistics Indonesia. Statistik Tanaman Sayuran dan Buah-buahan Semusim Indonesia 2020. Jakarta: BPS-Statistics Indonesia; 2021.
2. Ministry of Trade Indonesia. Analisa perkembangan harga bahan pangan pokok di pasar domestik dan internasional. Jakarta: Ministry of Trade Indonesia; 2021.
3. Golcz A, Kujawski P, Markiewicz B. Yielding of red pepper (*Capsicum annuum* L.) under the influence of varied potassium fertilization. Acta Sci Pol Hortorum Cultus. 2012;11(4):3–15.
4. Widyanti SA, Susila AD. Rekomendasi pemupukan kalium pada budi daya cabai merah besar (*Capsicum annuum* L) di inceptisols dramaga. J. Hort Indonesia. 2015;6(2):65-74.
5. Bhuvaneswari G, Sivaranjani R, Reeth S, Ramakrishnan K. Application of nitrogen and potassium efficiency on the growth and yield of chili *Capsicum annuum* L. Int J Curr Microbiol Appl Sci. 2013;2(12):329–337.
6. Akram M, Hussain S, Hamid A, Majeed S, Chaudary S, Shah Z, Yaqoob A, Kayani F, Arif U, Fareed K, et al. Interactive effect of phosphorus and potassium on growth, yield, quality, and seed production of chili (*Capsicum annuum* L.). J Hortic. 2017;04(01):4–8.
7. Bailey DN. The determination of ascorbic acid: A quantitative analysis experiment. J Chem Educ. 1974;51:488–489.
8. Khan A, Shah MNS, Rab A, Sajid M, Ali K, Ahmed A, Faisal S. Influence of



- nitrogen and potassium levels on growth and yield of chilies (*Capsicum annuum* L.). *Int J Farming Allied Sci.* 2014;3(3):260–264.
9. Prajapati K, Modi HA. The importance of potassium in plant growth—a review. *Indian J Plant Sci.* 2012;1:177–186.
  10. Hasanuzzaman M, Bhuyan MHMB, Nahar K, Hossain MS, Al Mahmud J, Hossen MS, Masud AAC, Moumita, Fujita M. Potassium: A vital regulator of plant responses and tolerance to abiotic stresses. *Agronomy.* 2018;8(31):1–29.
  11. Kesumawati E, Apriyatna D, Rahmawati M. The effect of shading levels and varieties on the growth and yield of chili plants (*Capsicum annuum* L.). *IOP Conf Ser Earth Environ Sci.* 2020;425:1–7.
  12. Anggraheni YGD, Nuro F, Paradisa YB. Effect of organic fertilizer on growth and yield of chili peppers. Bogor: Research Center for Plant Conservation and Botanic Gardens LIPI; 2019.
  13. Botella MÁ, Arévalo L, Mestre TC, Rubio F, García-Sánchez F, Rivero RM, Martínez V. Potassium fertilization enhances pepper fruit quality. *J Plant Nutr.* 2017;40(2):145–155.
  14. Ahmadi M, Souri MK. Growth characteristics and fruit quality of chili pepper under higher electrical conductivity of nutrient solution induced by various salts. *Agrivita.* 2020;42(1):143–152.
  15. Suryakumari S, Bharathi S, Jyothi KU, Reddy PV. Effect of nitrogen and potassium sources on yield attributes and yield of chili (*Capsicum annuum* L.). *J Spices Aromat Crop.* 2015;24(2):137–140.
  16. Reyes-Escogido MDL, Gonzalez-Mondragon EG, Vazquez-Tzompantzi E. Chemical and pharmacological aspects of capsaicin. *Molecules.* 2011;16:1253–1270.