



VI INTERNATIONAL SYMPOSIUM ON POMEGRANATE

and Minor Mediterranean Fruits

BARI , ITALY 22-25 SEPTEMBER 2025

Book of abstracts





VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

VI INTERNATIONAL SYMPOSIUM ON POMEGRANATE AND MINOR MEDITERRANEAN FRUITS





**VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE**
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

CONVENERS

Giuseppe Ferrara *University of Bari “Aldo Moro”, Italy*

Stefano La Malfa *University of Catania, Italy*

ORGANIZING COMMITTEE

Giuseppe Ferrara *University of Bari “Aldo Moro, Italy*

Ilaria Marcotuli *University of Bari “Aldo Moro”, Italy*

Stefano La Malfa *University of Catania, Italy*

Mario di Guardo *University of Catania, Italy*

Antonio Ippolito *University of Bari “Aldo Moro”, Italy*

Andrea Mazzeo *University of Bari “Aldo Moro”, Italy*

Pasquale Venerito *CRSFA, Italy*

Salem Alhajj Ali *University of Bari “Aldo Moro”, Italy*

Ferdinando Cossio *Plant breeder and consultant, Italy*

Giovanni Carbonara *Agridatalog, Italy*

Luigi Grasso *Agridatalog, Italy*

Maria De Angelis *University of Bari “Aldo Moro”, Italy*

Pasqualina Colasuonno *University of Bari “Aldo Moro”, Italy*

Alessandro Pesole *University of Bari “Aldo Moro”, Italy*

Ambrogio Agostino Chiriaco *University of Bari “Aldo Moro”, Italy*





**VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE**
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

SCIENTIFIC COMMITTEE

Giuseppe Ferrara *University of Bari “Aldo Moro”, Italy*

Maria Luisa Amodio *University of Foggia, Italy*

Stefano La Malfa *University of Catania, Italy*

Salvatore D’Aquino *CNR, Italy*

Doron Holland *Agricultural Research Organization, Israel*

Zhaohe Yuan *Nanjing Forestry University China*

Olaniyi A. Fawole *University of Johannesburg, South Africa*

Umezuruike Linus Opara *Stellenbosch University South Africa*

Julià Bartual *Agricultural Experiment Station of Elche, Spain*

Pablo Melgarejo *Universidad Miguel Hernández de Elche, Spain*

Ali Sarkhosh *University of Florida, USA*

Messaoud Mars *Higher Agronomic Institute of Chott-Mariem,
University of Sousse, Tunisia*

George Manganaris *Cyprus University of Technology, Cyprus*

Ibrahim Kahramanoglu *European University of Lefke, Northern
Cyprus*

Ahsen Işık Özgüven *Cyprus International University Northern Cyprus*

Maria Bernardita Pérez-Gago *Instituto Valenciano de Investigaciones
Agrarias (IVIA)*

Lluís Palou *Instituto Valenciano de Investigaciones Agrarias (IVIA)*





**VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE**
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

PREFACE

The VI International Symposium on Pomegranate and Minor Mediterranean Fruits will be held in Bari, Puglia, Italy, from September 22 to 25, 2025. This symposium is jointly organised by the University of Bari ‘Aldo Moro’ (UNIBA), University of Catania (UNICT) and Agridatalog, under the aegis of the International Society for Horticultural Science (ISHS), and the patronage of Società Ortoflorofruitticoltura Italiana (SOI). Bari and Catania are located in Southern Italy, in two regions, Puglia and Sicily, respectively, very important for fruit production, including pomegranate and other minor fruits (carob, fig, prickly pear, azarole, jujube, mulberry, strawberry tree, quince, rowberry). The Puglia region is the major commercial producing and processing area of pomegranate in Italy. Pomegranate cultivation in Puglia dates back IV century B.C. The symposium points on pomegranate and other minor fruits research topics, addressing, among others, the following areas: archaeology and history, botany and physiology, germplasm and breeding, orchard management, harvest and post-harvest, diseases and disorders, processing, health properties, food industry.

On behalf of the Organising Committee of the VI International Symposium on Pomegranate and Minor Mediterranean Fruits, we welcome you in Bari, Italy.





**VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE**
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

INDEX

VI INTERNATIONAL SYMPOSIUM ON POMEGRANATE AND MINOR MEDITERRANEAN FRUITS	2
PART 1: ORAL PRESENTATIONS.....	14
SESSION I: “GERMPLASM EVALUATION”	15
QUALITY, FLAVOUR, AND RIPENING INDICES OF 'NETA' FRUIT: A NEW EARLY-SEASON POMEGRANATE VARIETY	16
<i>O. Elimelech¹, R. Porat¹, K. Hatib², I. Bar-Ya'akov², R. Harel-Beja², T. Trainin², D. Holland², T. Azoulay-Shemer²</i>	16
MACHINE LEARNING-BASED CLASSIFICATION OF POMEGRANATE CULTIVARS USING THEIR MULTIDIMENSIONAL QUALITY TRAITS	17
<i>O. Fawole¹, Y. Silue¹, T. Fadji²</i>	17
FIRST DESCRIPTIONS OF 20 PRICKLY PEAR GENOTYPES SELECTED FROM THE EASTERN MEDITERRANEAN REGION OF TÜRKIYE	18
<i>C. Yilmaz¹, C. Türkyay², H. Kelebek³, S. Sell⁴</i>	18
MORPHOLOGICAL AND SENSORIAL CHARACTERISATION OF POMEGRANATE (<i>PUNICA GRANATUM</i> L.) FROM TWO EUROPEAN COLLECTIONS	19
<i>F. Cossio¹, J. Bartual², M.J. Navarro-Canovas²</i>	19
IN VITRO BIOTECHNOLOGY FOR PROPAGATION AND CONSERVATION OF MINOR MEDITERRANEAN FRUIT SPECIES: CURRENT STATUS AND FUTURE PERSPECTIVES	20
<i>W. Tarraf, R. Petruccelli, C. Benelli</i>	20
FRUIT AND JUICE QUALITY OF TWENTY POMEGRANATE ACCESSIONS FROM THE USDA NATIONAL CLONAL GERMPLASM REPOSITORY	21
<i>J. Chater¹, G. Lana², C. Heinitz³</i>	21
SESSION II: “POSTHARVEST AND PRODUCT QUALITY”	22
POMEGRANATE SKIN DEVELOPMENT AND FRUIT CRACKING INCIDENCE – OMICS AND SENSING APPROACHES	23
<i>I. Ginzberg, Y. Kaplan, E. Manasherova, A. Faigenboim, M. Morozov, Y. Yoktan, N. Alon, H. Cohen, A. Sadka, V. Alchanati</i>	23
CHEMICAL AND BIOLOGICAL EVALUATION OF TWO COMMERCIAL POMEGRANATE JUICES AFTER DIFFERENT INDUSTRIAL PROCESSING	24
<i>S. Carradori</i>	24
EFFECTS OF MELATONIN, CARNATION OIL AND SO ₂ ON POSTHARVEST STORAGE OF POMEGRANATE UNDER MODIFIED ATMOSPHERE CONDITIONS	25
<i>O. Konut, S. Usanmaz, İ. Kahramanoğlu</i>	25



**VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE**
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

COMPARATIVE ANALYSIS OF MORPHOLOGICAL, TEXTURAL AND CUTICULAR TRAITS IN THREE POMEGRANATE CULTIVARS:
IMPLICATIONS FOR SUSCEPTIBILITY TO FRUIT CRACKING26

M. Di Guardo, P. La Spada, M. Milia, E. Liotta, G. Modica, A. Continella, A. Gentile, S. La Malfa26

EFFECTS OF ENVIRONMENTAL CONDITIONS AND RIPENESS OF THE FRUIT AT HARVEST ON THE PHYSICOCHEMICAL QUALITY AND
INTERNAL SKIN BROWNING OF COLD-STORED ‘MOLLAR DE ÉLCHE’ POMEGRANATE27

*M.B. Pérez-Gago¹, L. Palou¹, V. Taberner¹, J. Morales¹, A. Quiñones¹, J.E. Lluch², M.J. Navarro-Cánovas², J.
Bartual²27*

POMEGRANATE FERMENTATION WITH HANSENIASPORA VALBYENSIS: A NEW APPROACH TO VALORIZE AND ENHANCE NUTRITIONAL
AND SENSORY QUALITY28

R. Limongelli, C. Porfido, C.A. Apa, G. Celano, C.E. Gattullo, R. Terzano, M De Angelis, F. Minervini28

ANTIFUNGAL EDIBLE COATINGS TO REDUCE POSTHARVEST DECAY AND PRESERVE THE QUALITY OF ‘MOLLAR DE ÉLCHE’
POMEGRANATES29

L. Palou¹, M.V. Alvarez², V. Taberner¹, M.B. Pérez-Gago¹29

CYTOSPORA PUNICAE CAUSES POST-HARVEST DECAY IN POMEGRANATE FRUIT DURING LONG-TERM STORAGE.....30

E. Venter, C.L. Lennox, J.M. Hopkins30

MODIFIED ATMOSPHERE PACKAGING COMBINED WITH HOT WATER DIPS AND FUNGICIDES TO REDUCE DECAY AND ALLEVIATE
POSTHARVEST DISORDERS OF POMEGRANATE.....31

S. D’Aquino¹, S. La Malfa², M.G. Molinu¹, A. Continella², A. Gentile², A. Palma¹31

PERFORMANCE OF POMEGRANATE CULTIVARS AT DIFFERENT ELEVATIONS IN THE SOUTHWESTERN UNITED STATES.....32

U.K. Schuch¹, G. Wright².....32

NON-DESTRUCTIVE METHODS FOR THE PREDICTION OF THE NUMBER AND WEIGHT OF POMEGRANATE ARILS33

BABY KIWI OR KIWINO (*ACTINIDIA ARGUTA*): A KIWI IN ONE BITE – CONSUMER IMPRESSIONS AND SHELF LIFE34

C. Besada, M. Castillo, C. Albert, J. Malagón.....34

SUSCEPTIBILITY OF POMEGRANATE CULTIVARS TO THE KEY PATHOGEN *CONIELLA GRANATI*35

D. Gerin¹, A. Agnusdei¹, V. Montilon¹, A. Bolzonello², R. Musetti², S. Tundo², F. Faretra¹, S. Pollastro¹35

ECO-FRIENDLY CONTROL OF POSTHARVEST GRAY MOLD IN POMEGRANATES USING SATUREJA MONTANA ESSENTIAL OIL.....36

A. Firoozi¹, M. Ahmadzade¹, A. Sardo², F. Salehi³, A. Omrani Sabbaghi².....36

CHARACTERISATION AND POSTHARVEST BEHAVIOUR OF MULBERRY (*MORUS NIGRA* L.) DURING RIPENING37

A. Najafabadi, D. Fatchurrahman, N. Castillejo, M.L. Amodio, G. Colelli37



**VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE**
and Minor Mediterranean Fruits
BARI, ITALY 22-25 SEPTEMBER 2025

SESSION III: "GENETICS"	38
IMPROVING POMEGRANATE RESISTANCE TO COLLETOTRICHUM GLOEOSPORIOIDES: IDENTIFICATION OF SOURCES OF RESISTANCE, DISSECTION OF MODE OF INHERITANCE, AND DEVELOPMENT OF GENOMIC RESOURCES	39
<i>Z. Deng¹, A. Schaller¹, G. Vallad¹, J. Chater², Z. Jia³</i>	39
A NEW HORIZON FOR POMEGRANATES: RED COLORATION AND IN-MOUTH PROPERTIES OF MOLLAR MERGED IN A NEW HYBRID	40
<i>J. Bartual¹, M. Castellano², M.J. Navarro¹, C. Besada³</i>	40
DEVELOPING 'PEPPY LE POM' AS A MODEL FOR POMEGRANATE GENETIC AND GENOMIC RESEARCH: CHARACTERIZATION OF ITS SHORT JUVENILITY, GENOME, AND FLOWERING TIME GENES	41
<i>Z. Deng¹, A. Schaller¹, J. Chater², Z. Jia³</i>	41
GENETIC STRUCTURE AND GWAS IN AN INTERNATIONAL POMEGRANATE COLLECTION INCLUDING SARDINIAN GERMPLOSM.....	42
<i>D. Rau¹, M. Santona¹, F. Cossio², L. De Pau³, D. Satta³, G. Schirru³, G. Tacconi⁴, C.M. Posanidu¹, D. Fois¹, A. Porceddu¹</i>	42
EXPLOITING THE GENETIC VARIATION IN FIG TREES TO IDENTIFY MOLECULAR MARKERS LINKED TO ABIOTIC STRESS RESPONSES.....	43
<i>T. Giordani¹, M. Castellacci¹, A. Cavallini¹, L. Natali¹, G. Usai¹, A. Vagelisti¹, F. Mascagni¹, S. Simoni¹, M. Lopez-Corrales², M. Guadalupe Dominguez², G. Baraket³, S. Haffar³, A. Kuden⁴, S. Comlekcioglu⁴, J. Inaki Hormaza⁵</i>	43
SESSION IV: "FIELD MANAGEMENT"	44
CANOPY POSITION AND FRUIT QUALITY ATTRIBUTES AFFECT ARIL BROWNING DISORDER IN POMEGRANATE (<i>PUNICA GRANATUM</i> L.)	45
<i>J. Bartual, M.J. Navarro-Canovas, E. Lluch, L. Natali, G. Usai, A. Vagelisti, F. Mascagni</i>	45
CLIMATIC AND CANOPY FACTORS INFLUENCING TRANSPIRATION OF YOUNG AND FULL-BEARING POMEGRANATE ORCHARDS UNDER SEMI-ARID CONDITIONS	46
<i>M. Ravuluma¹, R. Kgaphola², P. Tharaga³, S. Dzikit⁴, T. Volschenk⁵, S. Walker³</i>	46
SESSION V:	47
"MISCELLANEOUS"	47
ELCHE AND BARI POMEGRANATE COLLECTIONS: CONSERVING LOCAL VARIETIES AND INTERNATIONAL GERMPLOSM FOR FUTURE CHALLENGES	48
<i>J. Bartual¹, A. Lozano², A. Gadaleta³, I. Marcotuli³, G. Ferrara³, E. Zuriaga²</i>	48
COMPARISON OF CHILLING REQUIREMENTS AMONG POMEGRANATE CULTIVARS	49
<i>G. Ferrara, A. Chiriaco, S. Pitardi, A. Pesole, A. Mazzeo, M. Palasciano</i>	49



**VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE**
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

MALUM PUNICUM RECTE SERITUR. POMEGRANATE IN PLINY THE ELDER’S NATURALIS HISTORIA AND COLUMELLA’S DE RE RUSTICA	50
<i>M. Helbig</i>	50
GELLAN GUM-BASED HYDROGEL LOADED WITH POMEGRANATE PEEL EXTRACT FOR CARTILAGE TISSUE REGENERATION.....	51
<i>F. Busto¹, A.C. Scalia², P. Gentile³, S. Toniolo², S. Cometa⁴, A. Cochis², E. De Giglio¹</i>	51
RECOVERY, CHARACTERISATION AND VALORISATION OF APULIAN MINOR FRUIT SPECIES AND VARIETIES.....	52
<i>P. Venerito¹, C. Montemurro², F. Loperfido¹, G. Ferrara², V. Fanelli², F. Caponio², A. Turco¹, D. Perrelli¹, G. Maggi¹, P. La Notte¹</i>	52
COMPARISON OF <i>PUNICA GRANATUM</i> L. LEAF AREA INDEX DETERMINED USING IN SITU AND REMOTE SENSING TECHNIQUES	53
<i>R. Kgaphola¹, T. Volschenk², P. Tharaga³, S. Dziki⁴, M. Ravuluma²</i>	53
THE EFFECT OF WEATHER ON THE QUALITY, PRODUCTIVITY, AND GROWTH OF POMEGRANATES IN THE MEDITERRANEAN CLIMATE OF THE WESTERN CAPE IN SOUTH AFRICA	54
<i>P. Tharaga¹, M. Ravuluma², R. Kgaphola³</i>	54
FRUIT EXTRACTS FROM IMMATURE POMEGRANATES, A VALUABLE BYPRODUCT AND RESOURCE: AN OVERVIEW OF OUR PAST, ONGOING, AND FUTURE STUDIES ON THIS UNEXPECTED SOURCE OF BIOLOGICALLY SIGNIFICATIVE COMPOUNDS	55
<i>L. Siracusa¹, L. Pulvirenti¹, L. Parafati², G. Modica², C. Drago¹, A. Continella², C. Restuccia²</i>	55
BIO-AGRONOMICAL EVALUATION OF A NEW HERMAPHRODITIC CAROB CULTIVAR IN THE BALEARIC ISLANDS	56
<i>F. Maldera¹, A. Gallotta¹, F. Nicolì¹, S. Camposeo¹, J. Paul², L. Tortella², J. Miquel², M. Garau²</i>	56
SOME PROMISING FIG CULTIVARS IN THE PUGLIA REGION FOR BREBA PRODUCTION.....	57
<i>G. Ferrara, A. Mazzeo</i>	57
DETECTION AND CONTROL OF ALTERNARIA BLACK SPOT OF TOMATOES IN THE WESTERN CAPE OF SOUTH AFRICA	58
<i>J. Meitz-Hopkins¹, C. Daniel-Swartland¹, F. Vries², C.L. Lennox¹</i>	58
PART 2 POSTER PRESENTATIONS	59
CHARACTERIZATION OF ANTHOCYANIN BIOSYNTHESIS PATHWAY GENES IN EUROPEAN ELDER (<i>SAMBUCUS NIGRA</i> L.)	60
<i>V. Fanelli¹, I. Mascio¹, M.A. Savoia¹, P. Venerito², C. Montemurro¹</i>	60
ISOLATION OF THE GENES INVOLVED IN THE PHENYLPROPANOID AND FLAVONOID PATHWAYS IN QUINCE (<i>CYDONIA OBLONGA</i> MILL.)	61
<i>V. Fanelli¹, N. Sgaramella¹, M.A. Savoia¹, P. Venerito², C. Montemurro¹</i>	61



**VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE**
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

IDENTIFICATION AND CHARACTERISATION OF FUNGAL PATHOGENS ASSOCIATED WITH TOMATOES (<i>SOLANUM LYCOPERSICUM</i>) IN THE WESTERN CAPE PROVINCE	62
<i>J. Meitz-Hopkins¹, S.A. Malueke², Z.A. Belay³, A.A. Tsige², O.J. Caleb⁴</i>	62
PREHARVEST EFFICACY OF ALTERNATIVES USED IN CONJUNCTION WITH REGISTERED FUNGICIDES IN CONTROLLING HEART ROT IN POMEGRANATES	63
<i>J. Meitz-Hopkins, E. Van Rooyen, E. Venter, C. Lennox</i>	63
MORPHO-ANATOMICAL CHARACTERISTICS OF POMEGRANATE FRUIT THAT PREDISPOSE THEM TO FUNGAL INFECTIONS	64
<i>E. Venter, C. Lennox, J. Meitz-Hopkins</i>	64
PLUM DEFENCE-RESPONSE MODULATION BY NANO-ENCAPSULATED ESSENTIAL OILS INHIBITING BOTRYTIS CINEREA	65
<i>J. Meitz-Hopkins¹, N.J. Njombolwana-Swartz², R. Pfukwa³, S. Monteiro⁴, C.L. Lennox¹</i>	65
'AMELE DI BARI': AN AUTOCHTHONOUS CAROB APULIAN GENOTYPE	66
<i>F. Maldera, R.C. Caroppo, F. Polignano, A. De Rosa, A. Gallotta, S. Camposeo</i>	66
PRELIMINARY EVALUATION OF WATER STRESS RESISTANCE IN CAROB TREE (<i>CERATONIA SILIQUA</i> L.) CULTIVARS UNDER MEDITERRANEAN CONDITIONS: IMPLICATIONS FOR SUSTAINABLE AGRICULTURE	67
<i>J. Pou, L. Tortella, J. Miquel, B. Pisà, M. Garau</i>	67
BIODIVERSITY AND AGRONOMIC TRAITS OF CAROB CULTIVARS IN THE MEDITERRANEAN	68
<i>J. Pou, J. Miquel, L. Tortella, B. Pisà, M. Garau</i>	68
NEW MICROSATELLITE MARKERS FOR ASSESSMENT OF GENETIC DIVERSITY IN POMEGRANATE AND CONSTRUCTION OF MOLECULAR DATABASE	69
<i>A. Akkak¹, A.C. Khouane², F. Cossio³, K. Khelifi⁴, M. Petricione⁵, P. Venerito⁶</i>	69
OPTIMISATION OF NEWLY DEVELOPED MICROSATELLITE MARKERS FOR GENETIC EVALUATION OF JUJUBE (<i>ZYZIPHUS JUJUBE</i> MILL.) GERMPLASM	70
<i>A. Akkak¹, F. Cossio², P. Venerito³</i>	70
PRELIMINARY STUDY ON THE BIOLOGICAL ACTIVITY OF DIFFERENT TRICHODERMA ISOLATES AGAINST FUNGI CAUSING POMEGRANATE	71
<i>D. Gerin, A. Agnusdei, F. Dalena, D. Cornacchia, D. Salamone, G. Incampo, F. Faretra, S. Pollastro</i>	71
CHARACTERISATION OF PHYSICO-CHEMICAL AND PHYTO-CHEMICAL PROPERTIES OF ITALIAN POMEGRANATE (<i>PUNICA GRANATUM</i> L.) ACCESSIONS	72
<i>W. Tarraf¹, L. Calani², D. Beghè³, M. Cirlini², C. Dall'Asta², E. Beneventi², A. Bonetti¹, R. Petruccelli¹</i>	72
GENOTYPE- AND SEASON-DEPENDENT EXPRESSION OF FLORAL REGULATORS IN FIG (<i>FICUS CARICA</i> L.) BY RNA-SEQ ANALYSIS.....	73



**VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE**
and Minor Mediterranean Fruits
BARI, ITALY 22-25 SEPTEMBER 2025

<i>P. Colasuonno, I. Marcotuli, L. Giove, A. Gadaleta, G. Ferrara</i>	73
ASSESSMENT OF GENETIC VARIABILITY IN <i>FICUS CARICA</i> USING SSR MARKERS: A CASE STUDY FROM THE 'GIARDINI DI POMONA'	74
<i>P. Colasuonno¹, I. Marcotuli¹, L. Giove¹, A. Pesole¹, A. Mazzeo¹, P. Belloni², G. Ferrara¹, A. Gadaleta¹</i>	74
DEFENCE RESPONSE MODULATION BY NANO-ENCAPSULATED ESSENTIAL OILS INHIBITING GREY MOULD OF PLUMS	75
<i>C.L. Lennox</i>	75
STOMATAL TRAITS IN PECAN [<i>CARYA ILLINOINENSIS</i> (WANGENH.) K. KOCH]: VARIETAL DIFFERENCES AND SEASONAL ADAPTATIONS UNDER MEDITERRANEAN CONDITIONS	76
<i>A. Pesole, A. Chiriaco, S. Pitardi, G. Ferrara</i>	76
STOMATAL TRAITS IN POMEGRANATE (<i>PUNICA GRANATUM</i> L.): VARIETAL AND SEASONAL VARIABILITY IN RELATION TO CLIMATIC ADAPTATION.....	77
<i>A. Chiriaco, S. Pitardi, A. Pesole, A. Mazzeo, G. Ferrara</i>	77
POMEGRANATE DIVERSITY IN CYPRUS: A RESOURCE FOR SELECTION AND CONSERVATION	78
<i>S. Ioannidou¹, M.C. Kyriacou¹, N. Nikoloudakis², N. Seraphides¹, L.C. Papayiannis¹, A.C. Kyratzis¹</i>	78
PRODUCTION OF QUINCE CIDER (<i>CYDONIA OBLONGA</i> MILL.) FROM APULIAN VARIETIES USING NON-SACCHAROMYCES MICROBIAL STARTERS ISOLATED FROM THE FRUIT'S EPIPHYTIC MICROBIOTA.....	79
<i>F. Loperfido¹, V. Petrelli¹, A. Galeotti¹, S. Pupillo¹, A. Turco², G. Maggi¹, P. Venerito², G. Romano³, F. Tedesco⁴, C. Gerardi³, M. Tufariello³, F. Grieco³</i>	79
PRODUCTION OF "FIG VINEGAR" FROM THE PRODUCTION WASTE OF "COTTO DI FICHI" OF APULIAN <i>FICUS CARICA</i> L. VARIETIES USING YEASTS AND BACTERIA ISOLATED FROM THE EPIPHYTIC MICROBIOTA OF THE FRUITS AS MICROBIAL STARTERS.....	80
<i>F. Loperfido¹, A. Galeotti¹, V. Petrelli¹, S. Pupillo¹, A. Turco², G. Maggi¹, P. Venerito²</i>	80
FERMENTED POMEGRANATE JUICE (<i>PUNICA GRANATUM</i> L.) OF AN INDIGENOUS APULIAN VARIETY, ENRICHED WITH POMEGRANATE PEEL EXTRACT BY MEANS OF AN ULTRASOUND TECHNIQUE: A POSSIBLE NEW FUNCTIONAL PRODUCT	81
<i>F. Loperfido¹, V. Petrelli¹, A. Galeotti¹, S. Pupillo¹, A. Turco², G. Maggi¹, P. Venerito²</i>	81
UNVEILING LEAF SPOT AETIOLOGY AND RESISTANCE CLUES IN THE NEGLECTED MULBERRIES OF APULIA: A FIRST STEP TOWARD GERMPLASM VALORISATION	82
<i>F. Nigro¹, E. Chiaromonte¹, P. Nigro¹, G. Pompe Lucchese¹, P. Venerito²</i>	82
POMOLOGICAL CHARACTERS OF 54 HYBRID POMEGRANATE GENOTYPES IN MERSIN ECOLOGICAL CONDITIONS	83
<i>C. Yilmaz¹, M. Yilmaz², I. Canan³, O. Gülsen⁴, A. Uzun⁴, H. Pinar⁴, A.I. Özgüven⁵, V. Aras⁶</i>	83
IMMATURE PRICKLY PEAR FRUITS, FROM WASTE PRODUCT TO VALUABLE RESOURCE: COMPOSITIONAL FEATURES AND BIOPROSPECTING	84



**VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE**
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

<i>L. Siracusa¹, L. Pulvirenti¹, I. Natelova¹, F. Zappalà¹, B. Tomasello², G. Modica², A. Continella², A. Marrazzo², F. Attanasio¹</i>	84
PHENOLIC COMPOUNDS IN LEAVES, FLOWERS, AND FRUITS OF POMEGRANATES FROM MEXICO.....	85
<i>Y.L. Contreras-Ornelas¹, M.C. Castañeda-Saucedo¹, E. Tapia-Campos², J.P. Ramírez-Anaya¹, E.H Valdez-Miramontes¹, M.K. Amezcua-Lujan¹</i>	85
POMEGRANATE COCKTAIL OF WONDERFUL VARIETY: PHENOLIC CONTENT, ANTIOXIDANT CAPACITY, MICROBIAL SAFETY AND QUALITY EVALUATION OF PASTEURIZED AND TURBID BEVERAGES.	86
<i>J.P. Ramírez-Anaya¹, G. Jazo-Ochoa², M.C. Castañeda-Saucedo², E.H. Valdez-Miramontes², E. Tapia-Campos³, A. Sepúlveda-Montes², R.A. Mojica-Conteras⁴</i>	86
MORPHOLOGICAL DIVERSITY OF CAROB GERMPASM IN CROATIA	87
<i>M. Radunic¹, D.I. Zeravica², J. Rosin¹</i>	87
FIG GERMPASM COLLECTION AT THE INSTITUTE FOR ADRIATIC CROPS SPLIT, CROATIA.....	88
<i>M. Radunic, M. Carija, K. Hancevic, E. Gasi, T. Radic, J. Rosin</i>	88
FROM SWEET TO SOUR: A COLOURFUL JOURNEY THROUGH POMEGRANATE JUICE CHEMISTRY	89
<i>M. Radunic¹, M.V. Bratinčević¹, I.G. Mekinac², M. Popovic¹</i>	89
POMEGRANATE FOOTPRINTS: MYTH AND HISTORY OF AN ICONIC FRUIT IN THE MEDITERRANEAN AREA	90
<i>S. La Malfa, D. Romano</i>	90
PHYSIOLOGICAL RESPONSES OF FOUR POMEGRANATE CULTIVARS (<i>PUNICA GRANATUM</i> L.) UNDER WATER STRESS.....	91
<i>M. Di Guardo¹, G. Modica¹, F. Arcidiacono¹, D. Costantino², S. La Malfa¹, A. Continella¹</i>	91
POSTHARVEST STRATEGIES TO EXTEND THE COMMERCIAL LIFE OF 'WONDERFUL' POMEGRANATE FRUIT THROUGH CHILLING INJURY ALLEVIATION AND MODIFIED ATMOSPHERE PACKAGING	92
<i>A.F. Najafabadi¹, L. Russo¹, D. Fatchurrahman¹, D. Cortés Montaña², M.L. Amodio¹, G. Colelli¹</i>	92
CARBON SEQUESTRATION IN TRADITIONAL, HIGH-DENSITY, AND SUPER HIGH-DENSITY FIG (<i>FICUS CARICA</i> L.) PRODUCTION SYSTEMS IN EXTREMADURA (SPAIN).....	93
<i>A.J. Galán Jiménez¹, J.R. Marqués da Silva², M. Lopez-Corrales¹</i>	93
IMPACT OF PRUNING INTENSITY ON AGRONOMIC PERFORMANCE AND FRUIT QUALITY OF 'DE REY' FIG TREES IN EXTREMADURA ...	94
<i>M. Lopez-Corrales¹, A.J. Galan Jiménez¹, M.G. Domínguez Yagüe¹, M.C. Parra², A.M. Montero de Espinosa Pérez¹, F. Pérez Gragera¹</i>	94
EXOGENOUS APPLICATION OF ABSCISIC ACID BY FOLIAR SPRAYING ON <i>FICUS CARICA</i> L.: ON-TREE RIPENING MONITORING UNTIL COMMERCIAL HARVEST	95



**VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE**
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

M.J. Serradilla¹, C. Moraga-Lozano¹, M. Palomino-Vasco¹, A.M. Fernández-León¹, B. Velardo-Micharet¹, M. López-Corrales¹, A. Rodríguez²95



**VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE**
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

PART 1: ORAL PRESENTATIONS





**VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE**
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

SESSION I: “GERMPLASM EVALUATION”



Università
di Catania



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Quality, flavour, and ripening indices of 'Neta' fruit: a new early-season pomegranate variety

O. Elimelech¹, R. Porat¹, K. Hatib², I. Bar-Ya'akov², R. Harel-Beja², T. Trainin², D. Holland², T. Azoulay-Shemer²

¹*Dept. of Postharvest Science, Agricultural Research Organization - Volcani Institute, Rishon LeZion, Israel*

²*Dept. of Fruit Tree Sciences, Neve Ya'ar Research Center, Agricultural Research Organization – Volcani Institute, Ramat Yishay, Israel*

³*The Robert H. Smith Faculty of Agricultural, Food and Environmental Sciences, Hebrew University of Jerusalem, Rehovot, Israel*

Abstract

'Neta' is a new early-season pomegranate variety developed by the pomegranate-breeding program in Neve Ya'ar Research Centre, Agricultural Research Organisation – Volcani Institute, Israel. 'Neta' fruits have a deep red colour, are sweet and tasty, and have soft seeds. Preliminary evaluations indicated that 'Neta' fruit ripens nearly two weeks before 'Emek', which is the major early-season pomegranate variety in Israel. In the current research, we examined fruit quality traits and the flavour of 'Neta' fruit grown in a commercial orchard in the Southern part of Israel during nine weekly intervals from July 2, 2024, until August 26, 2024. Quality evaluations included fruit and aril weight, fruit diameter, peel colour, juice TSS and acidity, consumer flavour acceptance, and descriptive sensory evaluation tests. In this study, we found that 'Neta' fruit ripened and became suitable for harvest at the end of July, much before any other pomegranate variety in Israel. The recommended ripening indices for 'Neta' pomegranates are fruit weight ≥ 250 g, fruit diameter ≥ 80 mm, aril weight ≥ 0.25 g, and TSS $\geq 13.0\%$. 'Neta' fruits achieve their deep red colour much before harvest and have low acidity levels; therefore, peel colour and juice acidity levels are not good ripening indicators. Overall, 'Neta' is a new, very early ripening pomegranate variety with good quality and flavour.

Keywords: Breeding; ripening; flavour





VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Machine Learning-based classification of pomegranate cultivars using their multidimensional quality traits

O. Fawole¹, Y. Silue¹, T. Fadiji²

¹Postharvest & Agroprocessing Research Centre, Department of Botany & Plant Biotechnology, University of Johannesburg, APK Campus, South Africa

²Food and Markets Department, Natural Resources Institute, University of Greenwich, Chatham, United Kingdom

Abstract

Pomegranate cultivars present significant variability in physical, biochemical, textural, phytochemical, and antioxidant properties, hindering their suitability for fresh market and industrial applications. Hence, classifying these cultivars is crucial for commercial use, optimising production, postharvest management, and processing. In a previous study, we used traditional statistical methods to explore the variability in fruit quality attributes of eight commercially grown pomegranate cultivars cultivated in South Africa. However, machine learning (ML) provides a more robust, data-driven approach for distinguishing cultivars. Therefore, this study aims to classify eight pomegranate cultivars (“Arakta”, “Bhagwa”, “Ruby”, “Acco”, “Ganesh”, “Herskawitz”, “Molla de Elche” and “Wonderful”) using their multidimensional quality attributes (derived from our previously published research) as input data for the ML models. Several supervised learning models, including Artificial Neural Networks (ANNs), Tree-based models (Random Forest, Decision Tree, Gradient Boosting Machines (XGBoost, CatBoost), Support Vector Machines (SVMs), were trained and evaluated to identify the best-performing model(s) for cultivar classification. Preliminary results suggest that the ML models can effectively differentiate pomegranate cultivars, providing an accurate method for classification based on quality traits. This study highlights the potential of ML-driven approaches as precise and efficient tools for cultivar selection (targeted breeding), postharvest management, processing, and marketing strategies.

Keywords: Classification; Cultivars; Machine Learning; Physico-chemical properties; Pomegranate; Texture



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

First Descriptions of 20 Prickly Pear Genotypes Selected from the Eastern Mediterranean Region of Türkiye

C. Yilmaz¹, C. Türkay², H. Kelebek³, S. Selli⁴

¹Eskisehir Osmangazi University, Agricultural Faculty, Horticultural Department, 26160, Eskisehir, Turkey

²Alata Horticultural Research Institute, Mersin Erdemli, Turkey

³Adana Alparslan Türkeş Science and Technology University, Adana, Turkey

⁴University of Cukurova, Faculty of Engineering, Department of Food, Adana, Turkey

Abstract

The prickly pear (*Opuntia ficus-indica* L.), a cactus plant, is a fruit that is widely grown in the Mediterranean and Aegean regions, especially in the coastal zone of Türkiye and is especially popular and consumed in southern coastal areas. Although the number of regular orchards in Türkiye is small today, it is mostly found as a hedge plant, on the edge, or outside of the main agricultural areas as scattered or collective plantations. These plants and plantations are generally owned, and their fruits are consumed or marketed by them. This experiment aims to determine the yield, phenological, morphological, and pomological characteristics of 20 superior prickly pears (*Opuntia ficus-indica* L.) genotypes selected from the Eastern Mediterranean Region within the scope of project 111O135, previously supported by TUBITAK, and to determine the best prickly pear genotypes to be registered in Türkiye first. For this purpose, the phenology, yield, morphological, and pomological characteristics of 20 prickly pear genotypes under Mersin - Erdemli ecological conditions were examined in 2023.

Keywords: Prickly pear; Opuntia, new varieties; adaptation; Mersin



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Morphological and sensorial characterisation of pomegranate (*Punica granatum* L.) from two European collections

F. Cossio¹, J. Bartual², M.J. Navarro-Canovas²

¹*Plant breeder and consultant, Via Arturo Giusto 6, 37010 San Zeno di Montagna VR, Italy*

²*Estación Experimental Agraria, Ctra Dolores Km.1, 03290 Elche, Alicante, Spain*

Abstract

Pomegranates are widely grown in the Mediterranean Basin countries as Spain, which is the first producer and exporter in Europe, and Italy (5,327 and 1,958 ha cultivation covered an area; 79,183 and 30,239 t production, respectively), mainly located in the central and southern regions of these countries. Data obtained from autochthonous and imported pomegranate genotypes belonging to germplasm collections have a strong potential for future commercial exploitation of these accessions as a resource for fresh consumption, processing, and nutraceutical uses. Agronomic traits are key components in cultivar development, and they depend on agroecological characteristics of the area where they are cultivated. Fruit colour, fruit weight, aril size, aril colour, flavour, hardness, yield, ripening and physiological disorders have been defined and compared for 120 homonymies and 40 uncommon accessions from the Agricultural Experiment Station of Elche (Spain) and from a private collection located in central Italy. The collected data showed variability in ten cultivars (earliness, fruit size, colour, softness or flavour) that implies different agronomical behaviour or genotypes. In addition, these data could help promote pomegranate production in these and other countries since more information is needed on the morphological, chemical, and sensorial characteristics of the different local and adapted genotypes, which will help in identifying those cultivars that align with consumer preferences, allowing for selecting, cultivating, harvesting, and marketing fruits with desirable attributes. An extended offer with varieties originating from other countries and selected autochthonous cultivars could affect the consumption of pomegranates with different tastes in the future.

Keywords: Genotypes; Acidity; Hardness; Sweetness



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

In Vitro Biotechnology for Propagation and Conservation of Minor Mediterranean Fruit Species: Current Status and Future Perspectives

W. Tarraf, R. Petruccelli, C. Benelli

CNR-IBE, Via Madonna del Piano n. 10, 50019 Sesto Fiorentino, Florence, Italy

Abstract

The Mediterranean basin is known as a rich area for plant genetic resources, particularly for many underutilised fruit species that are valuable for biological diversity and represent an essential source for human well-being. Due to their ecological, nutritional, and economic value, their maintenance represents a fundamental step to avoid genetic erosion. This important plant germplasm is also threatened by natural hazards and climate change. Some of these risks can be overcome by adopting biotechnological techniques and genetic improvement programs to achieve sustainable agricultural production and enhance food security. Advances in plant biotechnology, particularly in vitro culture, have provided a powerful tool to support and improve the propagation and maintenance of plant diversity. For safe and secure conservation, both in situ and ex-situ strategies are needed. While in situ conservation safeguards plant species within their natural habitats with minimal human interference, ex-situ conservation preserves plant materials outside their original location. In vitro culture has emerged as a promising approach to maintain the plant germplasm under controlled conditions, making it an effective method for ex-situ conservation. The in vitro propagation offers a rapid and efficient method for the large-scale production of economically important plants in a short time and limited space, while in vitro conservation is particularly interesting for the storage of plant germplasm of rare and endangered species, recalcitrant seeds, and vegetatively propagated species. Therefore, the in vitro propagation is an appropriate technique for mass production and short-term conservation of minor fruit species. Additionally, other methods, such as in vitro slow-growth storage (minimal growth) and cryopreservation, can provide safeguard strategies for medium- to long-term conservation. This research will discuss the role of in vitro biotechnology in propagation and protection of pomegranate and minor Mediterranean fruits, reviewing the methods and current status of conservation efforts for various underutilised fruit species.

Keywords: Underutilized species; ex-situ conservation; micropropagation; slow-growth storage; cryopreservation





**VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE**
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

**Fruit and juice quality of twenty pomegranate accessions from the USDA
National Clonal Germplasm Repository**

J. Chater¹, G. Lana², C. Heinitz³

¹CREC - University of Florida/IFAS, 700 Experiment Station Rd., Lake Alfred, FL 33850, United States of America

²Horticultural Sciences Department, Citrus Research and Education Center, University of Florida, Lake Alfred Florida, 33850, United States of America

³National Clonal Germplasm Repository, USDA, Davis CA 95616, United States of America

Abstract

Pomegranate is an ancient tree fruit crop that has been used for food, beverages, medicines, dyes, and other purposes for thousands of years. The industry standard in the United States and several other countries is ‘Wonderful’, which is believed to originate in Florida, later to be propagated in California for commercial production. The United States Department of Agriculture National Clonal Germplasm Repository - Tree Fruit and Nut Crops and Grapes conserves hundreds of pomegranate accessions for breeding, research and conservation. Despite the repository’s long history of conserving mature germplasm, there still exists a limited understanding of diverse phenotypic variation in the collection. Little to nothing is known about the fruit and juice properties of most of these accessions when grown in California, USA. The present investigation includes the evaluation of 20 pomegranate cultivars of diverse international origin for juice and juice quality over two years. This work represents 11.1% of the currently available 179 USDA accessions. The fruit traits evaluated included fruit mass, diameter, length, 100-seed mass, total seed mass, mean number of seeds per fruit, and peel colour. The juice traits evaluated included titratable acidity, total soluble solids, sugar:acid ratio, and colour. For every trait evaluated, there was evidence for significant differences among accessions. Some accessions had much lower acid; these accessions included ‘Eversweet’, ‘Lou Lou’, ‘Azadi’, ‘Utah Sweet’ and ‘Rosamia’. The cultivar with the highest titratable acidity was ‘Chandyr’, which was significantly higher than all other accessions included in this investigation. ‘Afganski’ had the highest TSS compared to most other accessions during year 1. More research is needed to properly characterise the USDA pomegranate collection for breeders, growers, packers and processors.

Keywords: Berry; Breeding; Gene bank; Punica granatum; Wonderful





**VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE**
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

SESSION II: “POSTHARVEST AND PRODUCT QUALITY”





VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Pomegranate skin development and fruit cracking incidence – omics and sensing approaches

I. Ginzberg, Y. Kaplan, E. Manasherova, A. Faigenboim, M. Morozov, Y. Yoktan, N. Alon, H. Cohen, A. Sadka, V. Alchanati

Agricultural Research Organization, Volcani Institute, Rishon LeZion, Israel

Abstract

The peel of pomegranate fruit consists of an inner thick spongy white tissue and an outer smooth skin layer that accumulates anthocyanins in red cultivars when ripe. The skin is comprised of epidermis cells covered by a cuticle and is the first target of cracking incidence. We analysed the skin transcriptome of cv. Wonderful at distinct developmental time points to characterise the processes that occur in the skin during fruit ripening and that may be involved in its resistance to internal pressure due to fruit expansion and cracking. The data suggested a ripening mechanism that combines ethylene, polyamine, and jasmonic acid pathways, differing from the model for non-climacteric fruit, where abscisic acid is the growth regulator that drives the ripening. Interestingly, cuticle- and cell-wall-related genes that showed differential expression between the developmental stages were mainly upregulated in the skin of early fruit, with lower expression at mid-growth and ripening stages. A metabolomic study on the effect of Israel's hot and dry climate on the accumulation and composition of fruit skin cutin was then conducted in three orchards located in different regions of the country, each with a different typical microclimate. Data indicated distinct metabolic profiles at different stages of fruit development and variations between the orchards. In accordance with the transcriptomic data, cutin was mainly accumulated at an early stage of skin development. Interestingly, gallic acid, the precursor of the pomegranate's important hydrolyzable tannins, was detected as a component of the fruit's cutin. Recently, within the frame of the European 'Crack Sense' HORIZON project, we have focused on understanding the variables that influence pomegranate fruit cracking. This includes collecting data from tree and fruit sensors. Results indicated that irrigation with varying amounts of water, plus 20% down to minus 30% compared to the control, had no effect on pomegranate cracking incidence.

Keywords: Fruit cutin; Fruit cracking; Gallic acid; Growth sensors; Non-climacteric fruit; Plant growth regulators; Pomegranate skin; *Punica granatum* L.



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Chemical and biological evaluation of two commercial pomegranate juices after different industrial processing

S. Carradori

Università degli Studi "G. d'Annunzio", Via dei Vestini 31, Chieti, Italy

Abstract

Pomegranate is considered an important functional food, whose peels, arils and seeds have a specific composition of bioactive compounds. Among these, ellagitannins and anthocyanins have been investigated for their positive influence on health. In this study, we focused on two different commercial pomegranate juices provided by "Masseria FruttiRossi s.r.l." (Castellaneta, Taranto, Italy) in 2024. The effects of industrial pasteurisation and high-pressure processing were studied by different techniques (CIEL*a*b* colourimetry, HPLC-DAD, DI-ESI-MS, and NMR) to understand the impact on healthy and chemical properties. More in detail, the two pomegranate juices were monitored in terms of vitamin C content, total phenolic and flavonoid contents (TPC and TFC), antioxidant and antiradical, and chelating activities (*in vitro* and in animal models). Finally, their ability to inhibit crucial enzymes involved in diabetes (amylase, glucosidase) and degenerative processes (cholinesterases, tyrosinase), their prebiotic effect, their allelopathy in *in vivo* systems, and their biocompatibility *in vitro* (human normal cell lines) and toxicity *in vivo* (brine shrimp assay, mice) were also assessed. The two industrial processes demonstrated to have an influence on the bioactive compounds, preserving or modifying the phytochemical composition quantitatively and qualitatively. Thus, organoleptic qualities and bioecotoxicological potential can be changed. These experimental data can be important in selecting the best industrial and agricultural conditions to enhance the quality of functional foods and ensure a better correlation between food production and healthy properties.

Keywords: pomegranate, pasteurization; high-pressure process; ellagitannins; anthocyanins; vitamin C; biocompatibility; functional food; NMR



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Effects of Melatonin, Carnation Oil and SO₂ on Postharvest Storage of Pomegranate under Modified Atmosphere Conditions

O. Konut, S. Usanmaz, İ. Kahramanoğlu

Department of Horticulture, Faculty of Agricultural Sciences and Technologies, European University of Lefke, Gemikonağı, Northern Cyprus, via Mersin 10 Türkiye

Abstract

This study was conducted to test the impacts of different postharvest treatments on the storage quality of pomegranate cv. Wonderful during 150 days of storage. Six different treatments were applied: Control (no treatment), Modified Atmosphere Packaging (MAP), MAP combined with Carnation oil (MAP+Car), MAP combined with Melatonin (MAP+Mel), standalone 500 µM Melatonin treatment (Melatonin), and SO₂ pad application. Fruits were stored at 6-7 °C and 90-95% relative humidity for 150 days. Quality assessments were performed at 30-day intervals, including weight loss, ascorbic acid content, soluble solids concentration, titratable acidity, decay incidence, and chilling injury. Results showed that MAP-based treatments significantly reduced weight loss and decay compared to the control. Among all treatments, MAP+Mel demonstrated the best preservation of ascorbic acid and overall fruit quality, with minimal chilling injury and decay. SO₂ pads were effective in reducing decay but were not effective in reducing chilling injury and maintaining other quality parameters. The standalone melatonin treatment provided moderate protection but was less effective than when combined with MAP. Overall, the combination of MAP and melatonin emerged as the most promising postharvest strategy for maintaining pomegranate fruit quality during extended cold storage.

Keywords: Chilling injury; decay control; pomegranate fruit; postharvest storage; essential oil



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Comparative analysis of morphological, textural and cuticular traits in three pomegranate cultivars: implications for susceptibility to fruit cracking

M. Di Guardo, P. La Spada, M. Milia, E. Liotta, G. Modica, A. Continella, A. Gentile, S. La Malfa

Università di Catania, Via Santa Sofia 100, Catania, Italy

Abstract

Pomegranate is one of the oldest fruits to be domesticated; its cultivation is widespread thanks to its great adaptability to semi-arid areas of cultivation and to the fruit quality (especially the nutraceutical value and the organoleptic characteristics). Nevertheless, the quality and quantity of pomegranate production are often negatively influenced by the occurrence of fruit cracking. In this context, the morphological, textural, and cuticular characteristics of the cultivar 'Wonderful' (selected for its wide employment worldwide), coupled with two Sicilian varieties ('Etna' and 'Primosole'), were investigated. The three genotypes were evaluated by combining pomological assessments (e.g., diameter and weight of the fruits) with textural analysis on both the arils and the tegmen using a texture analyser. 'Wonderful' fruits exhibited both significantly larger fruit size and firmness of the arils and tegmen compared to 'Etna' and 'Primosole'. Furthermore, the cuticle thickness and structure were evaluated in three portions of the fruits using an optical microscope. The thickness of the cuticle did not show a significant correlation with the cracking attitude of the three accessions. On the other side, the invaginations of the cuticle inside the epicarp seem to be associated with greater resistance to the stresses to which the fruit is subjected during the growth phases. Our results showed larger invaginations for 'Wonderful' and 'Etna', which increase the fruit's ability to withstand abiotic stress. Conversely, 'Primosole', which has a cuticle with a lower degree of invagination, was the most susceptible to cracking. The findings highlight the importance of cuticle morphology in determining fruit response to physical stresses likely involved in triggering cuticle lesions.

Keywords: *Punica granatum* L.; fruit quality; microscopy; cuticle; local varieties



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Effects of environmental conditions and ripeness of the fruit at harvest on the physicochemical quality and internal skin browning of cold-stored ‘Mollar de Elche’ pomegranate

M.B. Pérez-Gago¹, L. Palou¹, V. Taberner¹, J. Morales¹, A. Quiñones¹, J.E. Lluch², M.J. Navarro-Cánovas², J. Bartual²

¹*Instituto Valenciano de Investigaciones Agr, IVIA, Ctra Moncada-Naquera Km 5, 46113 Moncada, Spain*

²*Estación Experimental Agraria de Elche, EEA ElxSTT, CV-855, Km 1, 03290 Alicante Elche, Spain*

Abstract

Pomegranate is a cold-sensitive fruit, prone to developing chilling injury (CI), which manifests as external pitting and internal browning. In the case of ‘Mollar de Elche’ pomegranates, storage at 5 °C and >90% relative humidity (RH) is recommended to minimise CI, weight loss, and fungal diseases. However, in recent seasons, increased internal skin browning has been observed in the absence of typical external CI symptoms. Furthermore, this disorder becomes apparent after a few weeks of storage under optimal conditions. The objective of this work was to study the effects of environmental conditions at harvest (early in the morning (E) with mild temperatures and late in the morning (L) with maximum solar radiation) and harvest date (at the beginning (H1) and the end (H2) of the growing season 2022) on the physicochemical quality and internal tissue browning of ‘Mollar de Elche’ pomegranates stored for 8 and 12 weeks at 6 °C and 90-95% RH, followed by 7 days at 20 °C and 85% RH. Differences in solar radiation, ambient temperature and RH at harvest time resulted in fruit temperatures of 15.7 ± 1.8 and 28.1 ± 0.4 °C for E and L, respectively. No significant differences in internal browning were observed between E and L harvest time, whereas H2 fruit was less susceptible than H1 fruit. Furthermore, fruit with higher internal browning incidence showed higher respiration, weight loss, and electrolyte leakage, indicating damage to the cell membrane. Fruit firmness was greater in H1 than in H2 at harvest and after 8 weeks of cold storage plus shelf life, but no differences were observed between treatments at the end of storage. Overall, late-harvest fruit was less susceptible to internal browning. Future work should explore the origin of this physiological disorder and feasible postharvest management to minimise it.

Keywords: *Punica granatum* L.; overall fruit quality; fruit respiration; electrolyte leakage



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Pomegranate fermentation with *Hanseniaspora valbyensis*: a new approach to valorize and enhance nutritional and sensory quality

R. Limongelli, C. Porfido, C.A. Apa, G. Celano, C.E. Gattullo, R. Terzano, M De Angelis, F. Minervini

Dipartimento Di Scienze Del Suolo, Della Pianta E Degli Alimenti (Di.S.S.P.A.), via Giovanni Amendola 165/a, 70126 Bari (BA), Italy

Abstract

The microbiota of pomegranate arils is primarily composed of yeasts, likely originating from environmental sources and typically colonising the fruit's surface. We identified *Hanseniaspora valbyensis* as the only yeast species present in both pomegranate juice (PJ) and seeds (PS), obtained from fruits (cv. Wonderful) collected in the Apulia region. *H. valbyensis* was able to ferment pomegranate matrices, altering their chemical composition, in terms of minerals or organic acids. The most promising results were observed in PS fermented by *H. valbyensis* strain S-L1 and in PJ fermented by *H. valbyensis* strain J-L6 (isolated from spontaneously fermented PS and PJ, respectively). Then, pomegranate seeds fermented by *H. valbyensis* S-L1 were processed into flour (PSF) to obtain a granola snack. In addition, a cider-like beverage was produced starting from commercial PJ, fermented by either commercial *Saccharomyces cerevisiae* or *H. valbyensis* J-L6. Three types of granola snacks were compared: fermented PSF (G-FS), unprocessed PSF (G-US), and conventional granola (G-C). The inclusion of PSF improved the antioxidant activity of granola, with G-FS exhibiting 60% DPPH· scavenging activity, compared to 40% in G-C. Additionally, both G-FS and G-C showed higher mineral content compared to G-US, whereas the fortified snacks had lower energy values. Sensory evaluation showed that G-FS was more accepted, scoring 6.3 on a 1–9 scale, compared to G-US (score: 4.9). Upon fermentation of PJ to cider-like beverage, *H. valbyensis* J-L6 reached higher cell densities more quickly compared to the commercial starter, leading to faster monosaccharides consumption, higher acetic acid production, and a more complex profile of volatile organic compounds. These findings underline the potential of yeast fermentation to enlarge the range of pomegranate-based food and beverages with enhanced nutritional and sensory quality.

Keywords: *Hanseniaspora valbyensis*; by-products; cider-like; minerals; volatile organic compounds



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Antifungal edible coatings to reduce postharvest decay and preserve the quality of ‘Mollar de Elche’ pomegranates

L. Palou¹, M.V. Alvarez², V. Taberner¹, M.B. Pérez-Gago¹

¹Centre de Tecnologia Postcollita (CTP), Institut Valencià d'Investigacions Agràries (IVIA), Montcada, València, Spain

²Grupo Investigación en Ingeniería en Alimentos, Facultad de Ingeniería, Universidad Nacional de Mar del Plata, Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET, CCT Mar del Plata), Argentina.

Abstract

Pomegranate exhibits important postharvest quality losses that limit its storage potential, caused mainly by weight loss, chilling injury, and fungal diseases. In this work, the effect of antifungal edible coatings (AECs) formulated with different biopolymers (citrus pectin (PEC), λ -carrageenan (CARG), and their combination PEC-CARG), beeswax (BW) as hydrophobic component, and 0.5% essential oils [EOs, cinnamon (CN) or lemongrass (LG)] as antifungal ingredients were evaluated to control weight loss and natural fungal decay of ‘Mollar de Elche’ pomegranates during storage at ambient temperatures (20 °C). Results showed that PEC-based AECs were the most effective in reducing pomegranate decay caused by latent infections by *Botrytis cinerea* and wound infections by *Penicillium* spp. During 8 weeks of storage, with no significant differences between coatings formulated with CN or LG EOs. Furthermore, PEC-based coatings also reduced weight loss without causing visible phytotoxicity, while CARG-based coatings were slightly detrimental to the fruit rind. Afterwards, selected AECs were assayed to control natural decay and preserve the fruit quality of pomegranates stored at 5 °C for 12 weeks, plus 1 week of shelf life at 20 °C. PEC-based coatings were confirmed as an effective means to reduce weight loss and prevent fruit shrivelling of cold-stored pomegranates without negatively affecting the fruit's physicochemical and sensory quality. However, no significant differences in latent and wound external decay were found between control and coated fruits after cold storage and shelf life. In conclusion, PEC-based coatings containing CN or LG EOs at 0.5% could be a promising treatment to extend the postharvest life of ‘Mollar de Elche’ pomegranates, although further studies are required to improve their antifungal effect during cold storage.

Keywords: *Punica granatum* L.; essential oil; postharvest disease management; overall fruit



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Cytospora punicae causes post-harvest decay in pomegranate fruit during long-term storage

E. Venter, C.L. Lennox, J.M. Hopkins

Stellenbosch University, Department of Plant Pathology, Private Bag XI, Matieland, Stellenbosch, 7602, South Africa

Abstract

Post-harvest fungal decay in pomegranate fruit contributes to economic losses in most commercial pomegranate-producing countries. Although *Penicillium* spp., *Coniella granati*, *Botrytis cinerea*, *Aspergillus flavus*, *Alternaria alternata* and *Colletotrichum gloeosporioides* are amongst the most reported decay-causing fungal pathogens, recent findings confirmed *Cytospora punicae*, a typical trunk pathogen, also as a post-harvest pomegranate fruit pathogen. This study aimed to determine the pathogenicity, etiology and incidence of *C. punicae* in South African pomegranates. *Cytospora punicae* cultures isolated from decaying stored fruit caused infection in inoculated nursery tree stems. A pathogenic response following fruit surface and detached fruit stem scar inoculations verified the mechanical transferability of this pathogen. In orchard conditions (in vivo), peduncle inoculations resulted in latent infections that remained quiescent during long-term fruit storage, eventually leading to fruit decay. These findings provide insights into the behaviour and pathogenic potential of *C. punicae*, which could inform future disease management strategies.

Keywords: Cytospora; Fruit rot; post-harvest; pomegranate storage



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Modified atmosphere packaging combined with hot water dips and fungicides to reduce decay and alleviate postharvest disorders of pomegranate

S. D'Aquino¹, S. La Malfa², M.G. Molinu¹, A. Continella², A. Gentile², A. Palma¹

¹ CO ISPA-CNR, Traversa La Crucca 3, 07100 Sassari (SS), Italy

² Università di Catania, Via S. Sofia, 100, Catania, Italy

Abstract

Pomegranate cv Primosole was dipped in water (20 °C or 50 °C) or water emulsions of Imazalil or Fludioxonil at 20 °C or 50 °C for 3 min prior to individual wrapping with a polyolefin heat shrinkable films. Fruits were then stored at 2 °C or 8 °C for 4 or 8 weeks, followed by 7 days at 20 °C and 60-65 % RH to simulate the marketing conditions (SMC). Imazalil, and to a lesser extent Fludioxonil, especially when applied as heated emulsions, increased husk browning at both storage temperatures. Hot water dip at 50 °C mitigated both husk scald and chilling-induced injuries in fruit stored at 8 °C as well as in those stored at 2 °C, especially during the first 4 weeks of storage and the subsequent 7 days of SMC at 20 °C. Decay incidence increased with storage and was higher in fruit stored at 2 °C after 7 days of SMC. Most of the decay was caused by *Botrytis cinerea* and to a lesser extent by *Penicillium* spp. And *Aspergillus* ssp. Both fungicides (despite the negative effect on peel appearance) and, to a lesser extent, hot water dip were effective in reducing decay symptoms. Film wrapping improved overall appearance in control fruit (water dip at 20 °C or 50 °C), with no substantial difference between the two treatment temperatures, alleviated husk browning of Imazalil and Fludioxonil treated fruit and markedly reduced weight loss. A gradual decline in juice chemical compounds occurred over the storage time, while the effect of the other experimental factors was negligible. Overall results show that combining hot water dips with film wrapping can effectively preserve the overall quality of 'Primosole' pomegranates for 8 weeks at 2 °C or 8 °C plus 1 week of SMC.

Keywords: Cold storage; film wrapping; fungicides; heat treatments; postharvest disorders; microbiological spoilage



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Performance of pomegranate cultivars at different elevations in the southwestern United States

U.K. Schuch¹, G. Wright²

¹ *School of Plant Sciences, University of Arizona, Tucson, AZ 85721-0036, United States of America*

² *Yuma Agric. Center, University of Arizona, Yuma AZ 85364, United States of America*

Abstract

Pomegranates are well adapted to the semi-arid climate in the southwestern United States, requiring less water and labour input than other crops. Two experiments were conducted to determine the growth and development of 15 cultivars at different elevations in Arizona. The first study evaluated cultivars growing at three elevations, 50 m, 716 m, and 1124 m in USDA zones 10a, 9b, and 8b. The second study evaluated these cultivars at four sites ranging from 716 m to 1,310 m elevation in USDA climate zones 9b, 8b, and 8a. Plant growth, survival, phenology, and harvest differed between years, sites, and cultivars. Bud break was strongly correlated with site location and started between early February to late March. Bud break varied between cultivars, and up to 30 days elapsed between the first and last plant to break bud in each location. The onset of flowering began 35 to 45 days after budbreak. Canopy size was strongly correlated with maximum temperatures and other site-specific attributes. Extreme low temperatures were the primary cause of plant mortality. Fruit yield differed between sites and cultivars. Aril colours ranged from white, light to dark pink, and light to dark red and differed between sites and cultivars. The taste ranged from sweet, semi-sweet, to tart and differed between cultivars and sites.

Keywords: phenology; elevation; fruit characteristics



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Non-destructive Methods for the Prediction of the Number and Weight of Pomegranate Arils

E. Caglar, I. Kahramanoglu

European University of Lefke, 99780 via Mersin 10 Gemikonagi, Northern Cyprus, Turkey

Abstract

This study aimed to non-destructively model the number and weight of the pomegranate arils. In this study, ‘Wonderful’ cultivar pomegranate fruits were used as materials, and the prediction of the outputs (number of arils and aril weight) was done with five inputs, namely fruit weight (gr), fruit width (mm), fruit height (mm), fruit crown diameter (mm) and stem end diameter (mm). Predictions of the outputs were done with four different methods, including multiple linear regression (MLR), principal component analysis (PCA), artificial neural network (ANN) and support vector machines (SVM). The findings of this study provide evidence for the ability of non-destructive prediction methodologies, namely ANN and SVM, to determine number and weight measurements in pomegranate arils based on physical attributes. ANN had the highest rate of accuracy for aril weight among models, and both ANN and SVM were able to work well with non-linear relationships, hence producing reliable predictions. Results of PCA analysis also revealed that fruit weight, stem end diameter and crown diameter were the most important predictors of the model. Our results suggest that machine learning has the power to enhance pomegranate quality assessment, grading and postharvest management, thus supporting its application in precision horticulture.

Keywords: Modelling, multiple linear regression (MLR); principal component analyses (PCA); artificial neural network (ANN); support vector machines (SVM)



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Baby Kiwi or Kiwiño (*Actinidia arguta*): A Kiwi in One Bite – Consumer Impressions and Shelf Life

C. Besada, M. Castillo, C. Albert, J. Malagón

Valencian Inst. for Agricultural Resear, Crta Moncada-Náquera km 4.5, Valencia, Spain

Abstract

The baby kiwi, or ‘kiwiño’, belongs to the *Actinidia* genus, just like the common kiwi. However, it’s much smaller (10-20 g) and can be eaten with its skin, making it more convenient. This study analysed consumer impressions when baby kiwis are presented to them for the first time, and fruits post-harvest behaviour at different temperatures. The study was performed with baby kiwis grown in the Valencia Community (Spain). A panel of 100 regular fruit consumers participated in a word association test, listing the first five words that came to mind when seeing the baby kiwi: (1) whole, (2) cut open, and (3) after tasting it. Acceptance was measured on a 9-point hedonic scale, and purchase intent on a 5-point scale. Additionally, we studied postharvest evolution of baby kiwis at 20 °C and during storage at 1 °C up to one month plus a shelf-life period; the main physicochemical properties were evaluated: skin and flesh colour, firmness, total soluble solids, acidity, maturity index, weight loss and external appearance. Results from the sensory study showed excellent consumer acceptance. The fruit was described as soft, pleasantly flavoured, sweeter than acidic, and flavour reminiscent. It scored 7.1 out of 9 in liking, with 90% of participants expressing purchase intent. Notably, the word association test revealed that including an image of the cut fruit on the packaging is essential, as its external appearance didn’t clearly reveal its nature, potentially deterring first-time buyers. Regarding postharvest behaviour, baby kiwis softened and gradually ripened over 8 days at 20 °C. After 12 days, firmness dropped sharply as the ripeness index increased significantly. Under cold storage at 1 °C, fruit maintained commercial quality for a month plus the shelf-life period. At both temperatures, skin dehydration and excessive softening were key factors limiting a longer shelf life or storage.

Keywords: baby kiwi; consumer; acceptance; storage; purchase intention



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Susceptibility of pomegranate cultivars to the key pathogen *Coniella granati*

D. Gerin¹, A. Agnusdei¹, V. Montilon¹, A. Bolzonello², R. Musetti², S. Tundo², F. Faretra¹, S. Pollastro¹

¹Università degli Studi di Bari - Dipartimento di Scienze del Suolo, della Pianta e degli Alimenti (Di.S.S.P.A.), via Giovanni Amendola 165/a, 70125, Bari (BA)

²Università degli Studi di Padova, viale dell'Università 16, Legnaro, Italy

Abstract

Pomegranate cultivation was recently industrialised due to its adaptability to diverse environmental conditions as well as the release of cultivars with improved agronomic and organoleptic characteristics. One of the most important fungal pathogens of pomegranate is the ascomycete *Coniella granati* (Sacc.), causing crown rot, leaf spot and dry fruit rot. To ensure more sustainability in the agricultural processes, disease management of pomegranate must be conducted using control strategies alternative to chemicals. To date, control means suitable to manage the diseases are scanty, being pomegranate a minor crop. In this context, the aim of this study was to evaluate the susceptibility of 10 autochthonous and 7 commercial pomegranate cultivars using an *in vitro* leaf assay. Preliminary evaluations on the pomegranate response to *C. granati* wood infection were also performed by artificial inoculations on the 'Wonderful' cultivar. In both experiments, the strain *C. granati* CBS 144 846 was used. For the susceptibility test based on lesion diameters on leaves, recorded at 5 days after inoculation (DAI), among the commercial cultivars, 'Parfianca' (13 mm) and 'G2' (18 mm) were the least susceptible, while 'Wonderful' and 'Mollar de Elche' were the most susceptible (both, 30 mm). Smaller differences were observed for autochthonous cultivars, with the lesion diameters ranging from 21 ('Principalli') to 29 ('Dente Mulo') mm. The validation of the results through assays on detached canes is in progress. The microscopic observation of 'Wonderful' pomegranate wood inoculated with *C. granati* revealed that the pathogen was able to advance from the point of inoculation through the xylem parenchyma to the xylem vessels, whereas the occurrence of tylosis, as a plant defence response, was limited. In summary, we report the different susceptibility of pomegranate genotypes to *C. granati*, highlighting the importance of understanding the mechanisms underlying plant defence responses to improve sustainable crop management.

Keywords: crown rot; susceptibility; genotypes; pathogenicity





VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Eco-Friendly Control of Postharvest Gray Mold in Pomegranates Using *Satureja montana* Essential Oil

A. Firoozi¹, M. Ahmadzade¹, A. Sardo², F. Salehi³, A. Omrani Sabbaghi²

¹ Dept. of Plant Protection, Faculty of Agriculture, College of Agriculture Natural Resources, University of Tehran, Tehran, Karaj 31587-77871, Iran.

² XEDA Fruits Science Research Centre, Saint Andiol, FRANCE.

³ R&D Dep. of Middle East Fruit Science Company, Tehran 1968634349, Iran

Abstract

Botrytis cinerea (gray mold) is a major postharvest disease in pomegranates, causing 30–50% losses during cold storage. With increasing restrictions on synthetic fungicides and rising consumer demand for residue-free produce, this study evaluated the antifungal efficacy of *Satureja montana* essential oil—rich in carvacrol and other bioactive compounds—as a sustainable alternative. The research was conducted in 2024 at the Postharvest Physiology Laboratory of the Middle East Fruit Science Company, using two application methods: hot water brushing (HWB) with a 5000-ppm solution (at 55 °C for 45 seconds) and electro fogging at concentrations of 5 and 10 cc/m³. Fruits were inoculated with *B. cinerea* and treated at 12-, 24-, and 48-hours post-inoculation in a completely randomised design with three replications. Treatment dosages were selected based on prior in vitro efficacy screening. Electro fogging at 10 cc/m³ achieved 81.5% and 75.3% disease control at 24- and 48-hours post-inoculation, respectively. HWB showed comparable results, with 79.7% and 72.6% control at the same time points. These findings highlight the strong antifungal activity of *S. montana* essential oil and its effectiveness when applied using modern delivery techniques. This plant-based solution offers a high-performing, eco-friendly strategy for controlling postharvest gray mold, supporting sustainability and food safety objectives. The formulation is currently under registration as an organic fungicide with the Iran Plant Protection Organisation.

Keywords: Postharvest disease; Essential oils; *Satureja montana*; *Botrytis cinerea*; Pomegranates





VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Characterisation and postharvest behaviour of mulberry (*Morus nigra* L.) during ripening

A. Najafabadi, D. Fatchurrahman, N. Castillejo, M.L. Amodio, G. Colelli

Dipartimento di Scienze Agrarie, Alimenti, Risorse Naturali e Ingegneria DAFNE, Università di Foggia, Foggia, Italy

Abstract

Mulberry (*Morus nigra* L.) is a highly appreciated but very perishable fruit, especially when harvested mature. Limited understanding of its postharvest physiology hinders shelf-life extension. This study aimed to characterise the metabolic behaviour and physicochemical evolution of mulberries across 9 distinct maturity stages, both at harvest and during a subsequent 3-day storage period at room temperature. At harvest, fruits across these stages varied significantly in weight (0.52-5.7 g), firmness (23.3 down to 2.4 N), and colour (Hue° 137°-328°). Key parameters, including pH, total soluble solids (TSS), titratable acidity (TA), and ethylene production, were monitored. Mulberries exhibited climacteric-like behaviour, particularly pronounced in intermediate maturity stages (4, 5, and 6), which displayed distinct ethylene peaks (maxima: 83, 132, and 138 $\mu\text{L}/\text{kg}\cdot\text{h}$, respectively) and continued ripening during storage. After 3 days, these stages (4-6) showed significant increases in TSS (e.g., 10.5% in stage 5) and pH (e.g., 32.7% in stage 5), and marked decreases in TA (e.g., 52% in stage 5), accompanied by colour changes. In contrast, earlier stages failed to ripen properly, and later stages exhibited senescence. This study confirms the possible mulberry's climacteric nature and, by characterising a wide range of maturities, provides valuable data for optimising harvest and postharvest handling.

Keywords: ripening; climacteric; pH; TSS; acidity



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

SESSION III: “GENETICS”



Università
di Catania



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

**Improving pomegranate resistance to *Colletotrichum gloeosporioides*:
Identification of sources of resistance, dissection of mode of inheritance, and
development of genomic resources**

Z. Deng¹, A. Schaller¹, G. Vallad¹, J. Chater², Z. Jia³

¹*Gulf Coast Research and Education Center, University of Florida IFAS, 14625 County Road 672, Wimauma, FL 33598, United States of America*

²*Citrus Research and Education Center, University of Florida IFAS, 700 Experiment Station Road, Lake Alfred, Florida 33850, United States of America*

³*Department of Botany and Plant Sciences, University of California, Riverside, 900 University Avenue, Riverside, California 92521, United States of America*

Abstract

Pomegranate, an emerging crop in the southeastern USA, faces a formidable challenge from the fungal pathogen *Colletotrichum gloeosporioides*, which causes anthracnose fruit rot and leaf spots in this region. To improve pomegranate resistance to these diseases, we screened pomegranate germplasm to identify resistant genotypes, assessed phenotypic distribution of leaf spot severity in segregating families to understand the inheritance of leaf spot resistance, and developed genomic sources for transferring the resistance traits to new varieties. Toward this goal, 35 pomegranate varieties with diverse origins were planted in central Florida, and their flowers and young fruit were exposed to natural anthracnose rot disease pressure or inoculated with *C. gloeosporioides* spores. Six varieties ('Azadi', 'Arakta', 'Chistina', 'Eversweet', 'Fleishman', and 'Jimmy Roppe') exhibited much less fruit rot, suggesting stronger resistance to anthracnose fruit rot. Rooted cuttings of 10 varieties and open-pollinated seedlings from 30 varieties and four selections were inoculated with *C. gloeosporioides* spores, followed by evaluating leaf spots on inoculated leaves. After these inoculations, seven varieties ('Azadi', 'Boris #2', 'Desertnyi', 'Don Sumner South', 'Eversweet', 'Molla-Nepes', and 'Parfianka') exhibited varying degrees of resistance to leaf spots. Nearly 1,500 seedlings from 26 families were artificially inoculated with *C. gloeosporioides* spores, followed by examining the phenotypic distribution of leaf spot severity in these families. The broad-sense heritability of leaf spot resistance was determined to be low with $H^2 = 0.207$. Intrigued by the fact that a variety originating from Turkmenistan has evolved resistance to both anthracnose fruit rot and leaf spot diseases in Florida, we used HiFi and Hi-C sequencing technologies and assembled the first chromosome-scale, haplotype-resolved genome of 'Azadi'. Compared to six previously published pomegranate genomes, the 'Azadi' genome carries a total of 67 unique disease resistance gene analogs (RGAs) from the two haplotypes.

Keywords: Pomegranate; disease; fruit rot; leaf spot; resistant variety; sources of resistance; heritability; Azadi, genome sequencing; resistance gene analogs





VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

A new horizon for pomegranates: red coloration and in-mouth properties of Mollar merged in a new hybrid

J. Bartual¹, M. Castellano², M.J. Navarro¹, C. Besada³

¹*Elche Agricultural Experiment Station, Elche, Spain*

²*IVIA. Carretera CV-315, Km 10,7, 46113 Valencia MONCADA 46113, Spain*

³*Valencian Inst. for Agricultural Resear, Crta Moncada-Náquera km 4.5, Valencia, Spain*

Abstract

This study evaluates consumer acceptance of two new pomegranate hybrids (*Punica granatum* L.) obtained at the Elche Agricultural Experiment Station (Spain) and provisionally named ‘H327’ and ‘D2712’, in comparison to their parentals, ‘Mollar’ and ‘Wonderful’. A panel of 94 consumers tasted the four varieties, rated acceptance (scale from 1-I disliked very much, to 9-I liked very much), and described their organoleptic properties by means of the Check-All-That-Apply test; the main physicochemical properties were also evaluated. The two new hybrids, ‘H327’ and ‘D2712’, inherited the low acidity and sweetness of ‘Mollar’ and the red skin and aril colour of ‘Wonderful’. The seed of ‘H327’ was quite noticeable and firm, similar to that of ‘Wonderful’, while ‘D2712’ featured a soft and less noticeable seed, like ‘Mollar’. Sensory evaluation revealed that the red colour gave the two hybrids an aesthetic advantage over ‘Mollar,’ as they were more appealing to consumers. When tasting arils, three distinct consumer preference profiles were identified: 20% preferred the commercial variety ‘Wonderful’, associating it with its acidic character; 48% rejected ‘Wonderful’ and favoured ‘Mollar’, ‘H327’ and ‘D2712’ for their sweetness and low acidity; 34% showed a marked preference for ‘Mollar’ and ‘D2712’, appreciating their low acidity and soft seed, while rejecting ‘Wonderful’ and ‘H327’, the two varieties with the firmest and noticeable seeds. Thus, ‘D2712’ proved to be the most promising of the two hybrids. It combines an attractive red colour with the in-mouth characteristics of ‘Mollar,’ such as low acidity, sweetness, juiciness, mild wood flavour, and a barely noticeable seed. In the following season, its postharvest behaviour was evaluated during storage at 5 °C for up to three months, plus shelf life. A panel of 80 consumers corroborated its excellent quality, rating appearance and taste with scores of 8 and 7, respectively, with no decline during the evaluated storage period.

Keywords: pomegranate; consumers; acceptance; storage



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Developing ‘Peppy Le Pom’ as a model for pomegranate genetic and genomic research: Characterization of its short juvenility, genome, and flowering time genes

Z. Deng¹, A. Schaller¹, J. Chater², Z. Jia³

¹University of Florida, IFAS, Gulf Coast Research and Education Center, 14625 County Road 672, Wimauma, FL 33598, United States of America

²Citrus Research and Education Center, University of Florida IFAS, 700 Experiment Station Road, Lake Alfred Florida 33850, United States of America

³Department of Botany and Plant Sciences, University of California, Riverside, 900 University Avenue, Riverside California 92521, United States of America

Abstract

Unlike typical pomegranate varieties that can have a juvenility period over several years, the dwarf cultivar 'Peppy Le Pom' can mature and flower within six months, making it highly valuable for research and breeding. This study aimed to characterise 'Peppy Le Pom' as a potential model for pomegranate genetic research and breeding, focusing on segregation of the short juvenility trait in its progeny, assembly and annotation of its genome, and identification of potential flowering time genes. Phenotypic evaluations of seedlings from selfed 'Peppy Le Pom' confirmed a short juvenile phase with an average flowering time of 148 days. However, this early flowering was not observed in F1 hybrids with two other varieties, indicating a recessive nature. Subsequent self-pollinated F2 generations from these hybrids again demonstrated early flowering, supporting the hypothesis of recessive gene control. A comprehensive genomic assembly for 'Peppy Le Pom' was achieved using PacBio HiFi and Hi-C sequencing. The assembly included two haplotypes, each with 8 contigs, and exhibited high N50 values (40.6 Mb and 40.9 Mb, respectively) and high BUSCO scores (90.3% and 92.4%, respectively). Annotation revealed 52.8% of the genome comprised repetitive elements and identified a total of 59,052 gene models for the two haplotypes, with 97% functionally annotated. Comparative analyses with Arabidopsis revealed 1,166 homologous genes that are potentially associated with flowering time, some of which are known to cause early flowering and dwarfing stature in Arabidopsis. These results signify that 'Peppy Le Pom'’s rapid flowering is advantageous for genetic studies, yet its recessive inheritance may limit its application in traditional breeding. The high-quality genome assembly and the identification of candidate flowering time genes provide a foundation for advanced genomics and molecular breeding. This study positions 'Peppy Le Pom' as a promising model for pomegranate genetics, enabling rapid crossing cycles and faster genetic and genomic research.

Keywords: Pomegranate; Peppy Le Pom; short juvenility; inheritance; genome sequencing; flowering time gene





VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Genetic structure and GWAS in an international pomegranate collection including Sardinian germplasm

D. Rau¹, M. Santona¹, F. Cossio², L. De Pau³, D. Satta³, G. Schirru³, G. Tacconi⁴, C.M. Posanidu¹, D. Fois¹, A. Porceddu¹

¹Dipartimento di AGRARIA, Università degli Studi di Sassari, 07100, Sassari, Italy

²Plant breeder and consultant, Via Arturo Giusto 6, 37010 San Zeno di Montagna VR, Italy³Agricultural Research Agency of Sardinia, Service for Research in Arboriculture, 07100 Sassari, Italy

⁴CREA, Research centre Genomics and Bioinformatics, I-29017 Fiorenzuola d'Arda PC, Italy

Abstract

The pomegranate (*Punica granatum* L.) is a strategic crop for sustainable agriculture and healthy diets in Mediterranean and Mediterranean-like environments. Conservation and use of its genetic resources are essential to support breeding programs and valorise local germplasm. This study integrated two pomegranate collections: an international collection of 109 accessions from various countries, and a Sardinian collection of 54 accessions. Whole-genome resequencing of all 163 accessions at 20× coverage produced a high-quality dataset comprising 21,906 SNPs across eight chromosomes. Population structure was assessed using multivariate, model-based, and network methods to identify 11 genetic clusters. The international accessions spanned ten clusters, five of which were exclusive. The Sardinian accessions spanned six clusters, one of which was exclusive and comprised 34 accessions showing genetic signatures of clonality. The genetic divergence between clusters was moderate (mean $F_{ST} = 0.15$; range 0.045–0.174). Highly differentiated genomic windows (1 Mbp) were identified on chromosomes 1, 2 and 6, with F_{ST} values of 0.55–0.75 and individual SNPs reaching fixation ($F_{ST} = 1$), suggesting signatures of divergent selection during pomegranate diversification and improvement. Phenotypic data were available for 127 accessions and included fruit and aril colour, seed hardness and flavour. All traits showed significant differentiation across genetic groups ($p < 10^{-2}$ to $p < 10^{-21}$), with seed hardness showing the strongest association. GWAS using multi-locus models (FARMCPU and BLINK) identified several significant associations that explained a relevant portion of the phenotypic variance, particularly for seed hardness (chromosomes 1, 2, 5 and 7), flavour (chromosomes 3, 6 and 7), and aril colour (chromosome 7). These findings emphasise the importance of integrated collections for describing intraspecific diversity and identifying the genetic basis of key traits. A representative subset of these accessions has been established in a common garden trial in Sardinia, enabling long-term investigations of productive, biochemical and nutraceutical traits.

Keywords: population genetics; GWAS; genetic diversity; germplasm valorisation; *Punica granatum* L.



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Exploiting the genetic variation in fig trees to identify molecular markers linked to abiotic stress responses

T. Giordani¹, M. Castellacci¹, A. Cavallini¹, L. Natali¹, G. Usai¹, A. Vagelisti¹, F. Mascagni¹, S. Simoni¹, M. Lopez-Corrales², M. Guadalupe Dominguez², G. Baraket³, S. Haffar³, A. Kuden⁴, S. Comlekcioglu⁴, J. Inaki Hormaza⁵

¹University of Pisa, Dept. Agricultural food and environment, Via del Borghetto 80, 56124 Pisa, Italy

²CICYTEX, Ctra. A-V, Km372, 06187 Guadajira, Badajoz, 06187 Guadajira, Badajoz, Spain

³Université de Tunis El Manar, Tunis, Tunisia

⁴Çukurova Üniversitesi Rektörlüğü, Balcalı, 01330 Sarıçam/Adana, Turkey

⁵CSIC, Malaga, Spain

Abstract

In the face of climate change significantly affecting the Mediterranean region, breeding efforts are essential to enhance crop tolerance to multiple abiotic stresses, thereby improving agricultural productivity, efficiency, and sustainability. The fig tree (*Ficus carica* L.), a traditional crop of the Mediterranean basin, holds great potential for commercial expansion due to its nutritional and nutraceutical benefits and its ability to thrive in marginal soils and challenging environments. However, understanding the genetic basis of traits like drought and salt stress tolerance remains a key challenge. This research aims to explore and characterise the biodiversity of fig trees in the Mediterranean and identify genes involved in stress adaptation. A total of 286 fig varieties from Spain, Tunisia, and Turkey were genotyped using a reference genome, revealing over 1.3 million SNPs. Principal component analysis and population analysis showed three distinct genetic clusters aligned with geographic origin. Interestingly, certain genotypes showed genetic relatedness across different clusters and countries, indicating potential synonymies or cryptic relatedness. Genome-wide association studies (GWAS) identified significant markers linked to traits related to drought and salt stress response, such as leaf temperature, water content, and plant height. Candidate genes involved in these responses include BTB/POZ, BON1, GALT6, GDP-L-fucose, PEX7, LEA protein, Serine/Threonine Protein Kinases, and cysteine synthase. These findings provide valuable insights into fig stress adaptation mechanisms and offer essential resources for future breeding programs aimed at developing more resilient fig varieties suited to changing climatic conditions.

Keywords: genetic variability, genome-wide association studies, abiotic stress response, climate change



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

SESSION IV: “FIELD MANAGEMENT”



Università
di Catania



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Canopy position and fruit quality attributes affect aril browning disorder in pomegranate (*Punica granatum* L.)

J. Bartual, M.J. Navarro-Canovas, E. Lluch, L. Natali, G. Usai, A. Vagelisti, F. Mascagni

Estación Experimental Agraria, Ctra Dolores Km.1, 03290 Elche, Alicante, Spain

Abstract

The pomegranate is a fruit species native to arid and semi-arid agricultural regions, highly valued for its fruit composition and organoleptic characteristics. However, in the recent climate scenario, fruit quality is being affected by a physiological alteration called aril browning (AB) in the main Mediterranean producing countries. The affected arils become soft, deformed, develop an unacceptable off-flavour and light creamy to dark brown in colour. This disorder has become a serious concern for producers, having a negative impact on consumers, as these fruits are not commercially suitable. The causes considered to be associated with AB are stress produced heat shock, high light stress or drought, which affects metabolic processes during fruit development. Abiotic stress in plants causes an increase in the content of reactive oxygen species (ROS), which increases the oxidation reactions of polyphenols contained in the juice and the membrane degradation. This study studies the relationship between the position of the fruit within the tree (orientation and part of the tree canopy) and the physicochemical characteristics (fruit size, rind thickness, peel colour, aril colour, titratable acidity, pH, and total soluble solids (TSS) associated with AB disorder. The AB incidence index (ranging from 1 = no damage to 5 = severe damage) was evaluated inside the pomegranate fruit in 80 pomegranate accessions belonging to the Agricultural Experiment Station of Elche, at harvest and after 4 weeks of storage at 5 °C. About 36.2% of the studied genotypes showed resistance to AB, while the rest (63.8%) showed moderate to severe susceptibility. Symptom intensity increased in more exposed sunlight fruits (south- and west-facing) and decreased in the inner canopy. Among the pomegranate genotypes, fruits with thicker rind were more affected, and a negative correlation was found between AB intensity and titratable acidity (TA), highlighting the importance of genotypes in this physiological disorder.

Keywords: Colour; Titratable Acidity; Genotypes; TSS



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Climatic and canopy factors influencing transpiration of young and full-bearing pomegranate orchards under semi-arid conditions

M. Ravuluma¹, R. Kgaphola², P. Tharaga³, S. Dzikiti⁴, T. Volschenk⁵, S. Walker³

¹R44 Hoogstede Road, 7609 Western Cape, Stellenbosch, South Africa

²205 Nelson Mandela Dr, Park West, 9301 Bloemfontein, South Africa

³600 Belvedere St, Arcadia, 0084 Pretoria, South Africa

⁴Corner of Victoria and University Streets, 7599 Stellenbosch, South Africa

⁵Corner of Helshoogte Road and the R44, Idasvallei, 7609 Stellenbosch, South Africa

Abstract

Quantifying tree transpiration and relating it to canopy characteristics and climatic processes is important knowledge that can be applied to improve irrigation management practices. The Western Cape of South Africa has a semi-arid Mediterranean climate with erratic rainfall during the winter season. The pomegranate production industry depends on rainwater harvesting during the winter to ensure enough water reserves during the growing season (summer). Currently, there is not adequate information in South Africa on the influence of canopy-related variables on transpiration and how the climate influences the transpiration of pomegranate trees. The study explores the influence of canopy characteristics on the daily transpiration and climatic factors on the hourly transpiration of pomegranate trees. The study was conducted in the Western Cape Province of South Africa on commercial farms in the Porterville and Drakenstein districts. Transpiration was measured using the Heat Ratio Method (HRM). The fractional interception and leaf area index (LAI) were measured using a ceptometer. Weather data was recorded using an automatic weather station. Sap flow measurements were conducted for six months (November to April) during the 2023/2024 growing season for eight trees that varied in stem diameter. The fractional interception related better to transpiration than LAI. The correlation analysis between the diurnal sap flow, net radiation, air temperature and wind speed showed a strong positive relationship with a p-value < 0.0001; however, a negative relationship was observed with the relative humidity. The air temperature was the most important variable responsible for over 70% of the variation for the young orchard, and the net radiation contributed to 86.5% of the variation for the full-bearing orchard. Based on the stepwise regression, it can be concluded that the air temperature and the net radiation are the main drivers of hourly transpiration for the young and full-bearing orchards, respectively.

Keywords: Daily transpiration; Leaf area index; Fractional light interception



**VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE**
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

SESSION V: “MISCELLANEOUS”





VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Elche and Bari Pomegranate Collections: Conserving Local Varieties and International Germplasm for Future Challenges

J. Bartual¹, A. Lozano², A. Gadaleta³, I. Marcotuli³, G. Ferrara³, E. Zuriaga²

¹*Estación Experimental Agraria, Ctra Dolores Km.1, 03290 Elche, Alicante, Spain;*

²*IVIA, CV-315, Km. 10.7, 461113 Valencia Moncada, Spain;*

³*University of Bari 'Aldo Moro', Via Amendola 165A, 70126 Bari (BA), Italy*

Abstract

The pomegranate (*Punica granatum* L.) is one of the oldest domesticated fruit species, resulting in a wide range of local cultivars worldwide. Spain and Italy are the leading producers and exporters in the European Mediterranean region, but developing new, well-adapted varieties is essential to maintaining competitiveness. Germplasm banks are key to conserving and improving this species, with the collections in Elche (Spain) and Bari (Italy) serving as strategic resources for the characterisation and use of pomegranate diversity in Europe. However, to maximise their value, comprehensive studies of the genetic diversity contained within these collections are necessary. This study evaluates the genetic diversity of both collections using 16 microsatellite markers and pomological data, providing an integrated overview of their genetic resources. Genetic redundancy between the two collections was assessed with the aim of improving collection management and identifying genotypes with the highest potential for breeding programs. A total of 185 pomegranate accessions were analysed — 94 from the Elche collection and 91 from Bari. The number of alleles per marker ranged from 3 to 13, with an average of 5.75 alleles per locus. Polymorphic Information Content (PIC) values ranged from 0.179 (PGCT022) to 0.654 (PGCT111), indicating substantial genetic variability across both collections. Phenotypic differences were also noted, especially in harvest time and fruit quality traits such as aril and peel colour, seed hardness, titratable acidity, and soluble solids. Both collections hold high genetic and phenotypic diversity, making them valuable for pomegranate conservation and breeding. Some genetically identical accessions showed phenotypic variation, underscoring the importance of combining molecular and morphological data. This study enhances our understanding of European pomegranate diversity and supports future breeding efforts by optimising germplasm management and selection.

Keywords: genetic diversity; microsatellites; accessions; pomological data





VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Comparison of chilling requirements among pomegranate cultivars

G. Ferrara, A. Chiriaco, S. Pitardi, A. Pesole, A. Mazzeo, M. Palasciano

University of Bari 'Aldo Moro', Via Amendola 165A, 70126 Bari (BA), Italy

Abstract

Pomegranate (*Punica granatum* L.) is a deciduous fruit tree species that requires a certain amount of winter chilling to enter and overcome the period of dormancy. Pomegranate cultivars exhibit variable chilling and heat requirements for dormancy release, budbreak, and flowering. Understanding these thermal requirements is essential for both agronomic management and the selection of suitable cultivars for specific regions to prevent potential economic losses due to inappropriate cultivar choice. To date, limited information is available on the chilling/heat requirements of several pomegranate cultivars. In the 2024–2025 winter season, the chilling and heat requirements of four pomegranate cultivars were evaluated: two international (Wonderful and Fleischman's) and two of Puglia origin and distribution (Dente Molfetta and Acido Torrelonga). Chilling requirements were estimated under controlled temperature in the laboratory using the Weinberger model ($\sum \text{hours} \leq 7.2 \text{ }^\circ\text{C}$), while heat requirements were calculated in Growing Degree Hours (GDH) according to the linear Richardson model. The number of chilling hours required for dormancy release varied significantly among cultivars, ranging from 100 to 500 hours ($< 7.2 \text{ }^\circ\text{C}$), while heat requirements for budbreak ranged from 1624 to 4408 GDH. The cultivar with the lowest chilling requirement under controlled conditions was Fleischman's (100 hours), followed by Acido Torrelonga (200 hours), and both Dente Molfetta and Wonderful (300–400 hours). Different chilling treatments significantly influenced budbreak rates: the 400- and 300-hour chilling treatments yielded the highest budbreak percentages (23.4% and 16.43%, respectively), while the control (no chilling) and 600-hour treatments resulted in lower values (4.1% and 5.6%, respectively). Fleischman's responded positively to all six chilling treatments, unlike Wonderful, Dente Molfetta, and Acido Torrelonga. These findings contribute to a better understanding of the thermal requirements of pomegranate and provide useful insights into the behaviour of different cultivars, which may be of interest for future cultivation in the Puglia region and other areas with similar climatic conditions.

Keywords: dormancy; Wonderful; bud-break; GDH



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Malum Punicum recte seritur. Pomegranate in Pliny the Elder's *Naturalis Historia* and Columella's *De re rustica*

M. Helbig

Independent researcher, PhD in Classics, Katowice, Poland

Abstract

The pomegranate (*Punica granatum* L.), known in Antiquity as malum Punicum, pomum granatum or granata, held significant agricultural, medicinal, and symbolic value in the Ancient Roman world. This paper examines its cultivation and botanical characterisation through the lens of the two fundamental Latin texts: the encyclopaedic Pliny the Elder's *Naturalis Historia* and agronomic Columella's *De re rustica libri duodecim*. While both authors provide instructions on pomegranate propagation, pruning and varietal differentiation, their approaches reflect distinct perspectives – Pliny's encyclopaedic compilation of empirical knowledge contrasts with Columella's practical, hands-on agricultural expertise. Pliny catalogues diverse pomegranate cultivars, distinguishing them by flavour, rind thickness, and climatic adaptability, while also documenting medicinal applications of its bark, rind and flowers. Columella, conversely, emphasises optimal planting techniques, soil preferences, and grafting methods to maximise yield – a testament to Roman horticultural innovation. Intriguingly, both authors note the pomegranate's role in the Mediterranean agroecology. For contemporary botanists, these ancient texts offer not only a historical record of *Punica granatum*'s diversity but also insights into pre-modern arboriculture practices.

Keywords: *Punica granatum*; Roman botany; ancient agronomy; horticultural history; Mediterranean fruits



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Gellan gum-based hydrogel loaded with pomegranate peel extract for cartilage tissue regeneration

F. Busto¹, A.C. Scalia², P. Gentile³, S. Toniolo², S. Cometa⁴, A. Cochis², E. De Giglio¹

¹*Department of Chemistry, University of Bari, 70126, Bari, Italy*

²*CAAD, Department of Health Sciences, University of Piemonte Orientale, 28100 Novara, Ital;*

³*C. for Biomaterials and Tissue engineering, Universitat Politècnica de València, 46022 Valencia, Spain*

⁴*Jaber Innovation s.r.l., Via Calcutta 8, 00144 Rome, Italy*

Abstract

Punica granatum peels, relevant to the pericarp and mesocarp fruit, are known for their high content of bioactive molecules. Several studies demonstrated the excellent antioxidant and anti-inflammatory properties of numerous metabolites, including catechins, flavonoids, tannins and gallic acids. One of the most abundant polyphenols is punicalagin, well known for its anti-inflammatory properties, which inhibits the production of proinflammatory cytokines, including tumour factor α (TNF- α), interleukin-1 beta (IL-1 β) and interleukin-6 (IL-6) [2,3]. In this study, we report, for the first time, a new hydrogel based on a blend of high and low acyl content Gellan gum loaded with a punicalagin-rich pomegranate peel extract for in situ cartilage tissue repair and prevention of inflammatory disease. Gellan gum is an anionic carbohydrate showing excellent gelling, low cytotoxicity, mucoadhesive, and biodegradable properties, even if its low mechanical strength limits its employment for cartilage applications. In this respect, to overcome the carbohydrate-poor mechanical properties, the introduction of a polyphenol-rich matrix, like the extract of *Punica granatum* peels, was exploited. The obtained hydrogels were characterised by XPS, FT-IR/ATR, TGA and SS-NMR. Antioxidant assays and total polyphenol content (TPC) have also been carried out. RP-HPLC has been used to monitor the punicalagin release kinetics. Mechanical and rheological characterisations showed good results that made the investigated hydrogel an ideal system for damaged cartilage repair. Chondrogenesis and anti-inflammatory studies using mesenchymal stem cells demonstrated that the hydrogel shows anti-inflammatory and antibacterial activities, crucial properties for a biomaterial. In summary, this research highlights the possibility of exploiting the multiple advantages deriving from the use of this natural extract in the development of a bioactive hydrogel for application in cartilage tissue engineering.

Keywords: *Punica granatum* L.; Punicalagin; Gellan gum; Hydrogel; Tissue engineering



**VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE**
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Recovery, Characterisation and Valorisation of Apulian Minor Fruit Species and Varieties

P. Venerito¹, C. Montemurro², F. Loperfido¹, G. Ferrara², V. Fanelli², F. Caponio², A. Turco¹, D. Perrelli¹, G. Maggi¹, P. La Notte¹

¹CRSEFA, via Cisternino 281, 70010 Locorotondo (BA), Italy

²University of Bari 'Aldo Moro', Via Amendola 165A, 70126 Bari (BA), Italy

Abstract

The launch of an organic and widespread program for the recovery of the vast heritage of minor fruit varieties in the Puglia Region was made possible by the implementation of integrated projects for biodiversity financed by the Puglia Region with the Rural Development Program. The projects allowed the discovery and the introduction of hundreds of minor varieties in the Regional Centre for the ex situ Conservation of native fruit, vine and olive in Locorotondo and others, such as the centre for ex situ conservation of the University of Bari in Valenzano (Ba). Through these it was created a sensible improvement in the study of regional genetic resources, important investments in new collection fields, equipment, and laboratories, functional to the conservation, characterisation, and evaluation of the health status and sanitation of the recovered germplasm. A total of 92 genotypes of minor fruit trees were recovered (azareole 5, carob 3, chestnut 5, cornelian cherry 2, strawberry tree 3, quince 6, prickly pear 3, mulberry 6, jujube 3, persimmon 2, pomegranate 21, European medlar 7, Japanese medlar 1, walnut 7, hazelnut 4, pistachio 1, elderberry 2 and rowan 3). For each accession, various carpometric and photographic surveys were carried out to create pomological sheets. The description and comparison between the different accessions identified allowed the varietal identity to be verified. Genetic characterisation also allowed the identification of cases of synonymy and homonymy, as well as the construction of a database with the profiles of all the accessions tested and the obtaining of various phylogenetic trees. Furthermore, on a selection of fruit varieties worthy of valorisation, agronomic, productive, chemical and technological characterisation actions are carried out for their valorisation.

Keywords: agrobiodiversity; minor fruits; recovery; valorisation



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Comparison of *Punica granatum* L. leaf area index determined using in situ and remote sensing techniques

R. Kgaphola¹, T. Volschenk², P. Tharaga³, S. Dziki⁴, M. Ravuluma²

¹1719 Springwater ave, Wenatchee, 98801, United States of America

²ARC Infruitec Helshoogte Road, Stellenbosch, ARC Nietvoorbij Corner of Helshoogte Road, 7599 7599 Stellenbosch, South Africa

³600 Belvedere St, Arcadia, 0084, Pretoria, 0001, South Africa

⁴Stellenbosch University Private Bag XI, 7602 7602 Stellenbosch, South Africa

Abstract

Leaf Area Index (LAI) is a crucial parameter for assessing vegetation health and canopy structure, and it relates to evapotranspiration in a mature pomegranate (*Punica granatum* L.) orchard. This study related LAI using remote sensing data processed through the PySEBAL model, and LAI modelled from *in-situ* fractional interception measurements from the AccuPAR LP-80 ceptometer in Wellington, Western Cape province of South Africa. The datasets of AccuPAR LP-80 and PySEBAL estimations were categorized on canopy development stages (ranging between 1.1m² m⁻² to 1.8m² m⁻² in September 2022, 1.1m² m⁻² to 2.8m² m⁻² in November 2022, 0.8m² m⁻² to 1.1m² m⁻² in August 2023, and 1.4m² m⁻² to 1.7m² m⁻² in October 2023) and full canopy-leaf fall (ranging between 1.2m² m⁻² to 2.9m² m⁻² in December 2022 and 1.0m² m⁻² to 1.4m² m⁻² in May 2023). The seasonal trend in remote sensing-derived LAI and AccuPAR LP-80 modelled LA was compared with each other and was validated during three different periods (September 2022 to March 2023, April to May 2023, and July to October 2023) to assess model accuracy and reliability. Results indicated that during the September 2022 to March 2023 period, a non-linear relationship with a weaker correlation ($R^2 = 0.4632$, $p = 0.1133$) was observed. However, a linear trend during the same period was observed, indicating a stronger correlation ($R^2 = 0.7878$, $p = 0.3048$). In contrast, during April–May 2023, the relationship weakened ($R^2 = 0.3608$, $p = 0.3993$), suggesting reduced alignment between PySEBAL and *in-situ* LAI measurements. The statistical analysis revealed that none of the models were significant (p -values > 0.05) in determining the seasonal variability of LAI. The findings also revealed that variations in LAI significantly influence seasonal changes in evapotranspiration rates, with higher LAI values observed during full canopy stages leading to increased rates of evapotranspiration, which were detected from the remote sensing Model PySEBAL algorithm.

Keywords: AccuPAR LP-80, leaf area index, PySEBAL, remote sensing



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

The effect of weather on the quality, productivity, and growth of pomegranates in the Mediterranean climate of the Western Cape in South Africa

P. Tharaga¹, M. Ravuluma², R. Kgaphola³

¹Office 1.220 Agriculture Building, University of the Free State, 205 Nelson Mandela Drive, 9300 FS Bloemfontein, South Africa

²47 Huegenot Road, Western Cape Stellenbosch, South Africa

³600 Belvedere St, Arcadia, 0084, Pretoria, 0001, South Africa

Abstract

Pomegranate trees have a unique phenological character concerning flowering as compared to other deciduous fruit trees. The flowering occurs three times, with the first flush, second, and third flush of the flowering period. The three flowering periods are driven by weather variables such as temperature, Relative humidity, Radiation, and Wind. The harvesting is also dependent on the flowering timing, and this is also driven by the amount of chill units accumulated and the amount of heat units accumulated during the blooming period. The Fruit development is mainly dependent on radiation and temperature. The fruits are more subjected to sunburn and therefore the fruits are more sensitive to radiation. The individual tree growth was determined based on the growth rates of new shoots on the trees over the 2022/23 and 2023/24 growing seasons for both young and full-bearing orchards. The correlation between the daily tree individual growth rate and the most important weather variables was conducted on weekly campaigns. The daily growth rates of shoots increased with increasing Rn, Tmax, Tmin, and VPD. A non-linear trend described the relationship between leaf transpiration and VPD. The coefficient of determination for the non-linear trend was 7.9% and 6.5% better compared to the linear trend for the young and full bearing orchard, respectively. Growth rate for both orchards initially increased at a fast rate up to VPD of 1 kPa, after which it gradually decreased and tends to level off even more when the VPD becomes 3 kPa. Detailed quality evaluation of fruit from the first and second flush harvests during 2023 for the young and full-bearing pomegranate orchards at Avontuur and Welgemoed, respectively, shows significant differences in terms of Fruit weight, length, diameter, skin colour lightness, red colour, Chroma, Hue°, aril, total soluble solids, total titratable acidity and pH are indicated. Fruits on young trees were highly affected by the sun, as most of the fruits are barely covered or hidden by the leaves, as compared to the mature orchard. It is recommended that pomegranate fruits be harvested for the export market mainly from full-bearing trees.

Keywords: Quality; Weather; Productivity; Pomegranates; Full Bearing





VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Fruit extracts from immature pomegranates, a valuable byproduct and resource: an overview of our past, ongoing, and future studies on this unexpected source of biologically significant compounds

L. Siracusa¹, L. Pulvirenti¹, L. Parafati², G. Modica², C. Drago¹, A. Continella², C. Restuccia²

¹CNR, Via Paolo Gaifami, 18, 95126 Catania (Catania), Italy

²Università di Catania, Via S. Sofia, 100, Catania, Italy

Abstract

Pomegranate (*Punica granatum* L.) thinning, a common agricultural practice involving the removal of immature fruits (ca. 30 to 60 days after fruit bloom, DAFB), generates a substantial, often neglected, byproduct with high disposal costs for producers. In order to reduce the costs of waste disposal and apply a virtuous scheme of circular economy, the valorisation and exploitation of these byproducts would be desirable. The aim of our work, started in 2019, was therefore to study this unexploited resource by assessing the compositional features of environmentally friendly extracts obtained from immature pomegranate fruits cv. “Wonderful” at two different maturation stages using ripe pomegranates of the same cultivar as reference. Comprehensive *in vitro* and *ex vivo* studies, primarily targeting antimicrobial activities, were performed to assess their bioprospecting potential. Results coming from detailed compositional analyses showed that immature fruits slightly differ from their ripe counterparts in terms of polyphenolic profile, due to the degree of metabolite accumulation at different maturation stages. Noteworthy, when considering quantitative data, differences became significant, as immature fruits peels at both maturation stages exhibit a total polyphenol content of 87.54 mg/g fresh material (stage 1) and 151.25 mg/g fresh material (stage 2), that is, three and five times compared to ripe fruit peels (31.26 mg/g fresh material), respectively. Preliminary antimicrobial test showed that all the extracts revealed good antibacterial activity, in particular against *St. aureus*, *St. haemolyticus*, *B. cereus*, *B. subtilis*, and *Ps. fluorescens*, with different efficacy depending on extract and target strain. In particular, the extracts obtained from pomegranate peel of ripening stages 1 and 2 showed the overall best antimicrobial efficacy, in line with compositional findings. An overview of our journey in the study of “baby” pomegranates will be given, together with auspicious future developments and prospects.

Keywords: "baby" pomegranates; fruit thinning; ellagitannins; bioprospecting





VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Bio-agronomical evaluation of a new hermaphroditic carob cultivar in the Balearic Islands

F. Maldera¹, A. Gallotta¹, F. Nicolì¹, S. Camposeo¹, J. Paul², L. Tortella², J. Miquel², M. Garau²

¹Università degli Studi di Bari, via Amendola 165A, 70126 Bari (Bari), Italy

²CEusebi Estada, 145, 07009 Palma, Spain

Abstract

Carob (*Ceratonia siliqua* L.) cultivation is gaining increasing interest due to its high climate change resilience and economic potential. Traditional orchards mainly rely on female cultivars, requiring pollinisers, leading to high company tare. To overcome this, the development of hermaphroditic cultivars could enhance productivity and simplify orchard management. This field study aimed to evaluate the performance of the new hermaphroditic cultivar ‘e-13P’ in a Spanish traditional growing area. The trial was conducted in an experimental orchard in Son Mulet (Mallorca, 39°27'57.6" N 2°56'13.2" E, Spain, 118 m a.s.l.) planted in 2014 under rainfed conditions. Cultivar ‘e-13P’ was compared to ‘Duraió’, an autochthonous female cultivar. Phenology and flower abortion were monitored from 2022 to 2024. Cumulative yield per tree, trunk cross-section, canopy volume, and yield efficiencies were evaluated at the 11th YAP. For both cultivars, flower abortion rate tended to decrease significantly, with lower values in ‘Duraió’ ($3.5 \pm 0.1\%$) than ‘e-13P’ (from 75 to 5%). In terms of cumulative yield, ‘e-13P’ consistently outperformed ‘Duraió’ (89 ± 4.8 and 56.5 ± 4.98 kg tree⁻¹ for ‘e-13P’ and ‘Duraió’, respectively). However, no significant differences were observed for trunk section (159 ± 24 and 161 ± 16 cm², respectively), canopy volume (31 ± 3.3 and 32 ± 4.3 m³, respectively) or production efficiencies, on section (136 ± 41 and 142 ± 7.7 g cm⁻², respectively) and volume (0.6 ± 0.06 and 0.7 ± 0.04 kg m⁻³, respectively), suggesting comparable growth and resource allocation. These findings highlighted the potential of ‘e-13P’ to improve carob production. Future research will focus on optimising irrigation strategies and assessing long-term yield stability to enhance carob cultivation in Mediterranean environments.

Keywords: cumulative yield; ‘Duraió’; ‘e-13P’; production efficiency; phenology



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Some promising fig cultivars in the Puglia region for breba production

G. Ferrara, A. Mazzeo

University of Bari 'Aldo Moro', Via Amendola 165A, 70126 Bari (BA), Italy

Abstract

The fig (*Ficus carica* L.) is one of the oldest species present in the Mediterranean basin and is currently cultivated in many important countries such as Turkey, Egypt, Morocco, as well as Spain and Italy. In the Puglia region, the presence of several cultivars intended for the production of brebas could complement the already known Petrelli (white-skinned) and Tauro (dark-skinned) cultivars, currently used for both the local and international market. In fact, the Puglia brebas market is characterised by a rather short production calendar based on a very few cultivars and a strong demand from international markets (Germany, UK), which often exceeds product availability. The presence of other cultivars could overcome these difficulties, while providing a product with different organoleptic characteristics. Several surveys to characterise native fig cultivars carried out by the Department of Soil, Plant and Food Science (DiSSPA) – University of Bari have led to the identification and description of some interesting cultivars for breba production. Some of the most promising cultivars are: Fiorone bianco, with light-skinned fruit, high weight (80-90 g) and medium ripeness. Texture is good, and resistance to handling is medium, and the pulp has good acidity and sugars (18.8 °Brix). Among the coloured-skinned accessions, Fiorone della regina has oblong (black-purple) fruit, with high weight (90-100 g), and good sugar content (18.1 °Brix). Because of its low resistance to handling and thin skin with slight cracks, it is recommended for a local market. Troiano Nero produces purple-coloured brebas, high weight (90-110 g), thin pulp and small drupelets. Rosso Triggiano has reddish-purple syconia, not very heavy (60-70 g), no cracks, with medium ripening time, light and sweet pulp (18.0 °Brix), and it has good organoleptic and productive characteristics. Rosso comune is an accession that could instead be used for international markets because of its low susceptibility to handling and absence of fruit cracks. Good quality aspects, fine, juicy and sweet pulp (20.0 °Brix) and medium ripening time.

Keywords: Tauro; biodiversity; accessions; skin



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Detection and control of *Alternaria* black spot of tomatoes in the Western Cape of South Africa

J. Meitz-Hopkins¹, C. Daniel-Swartland¹, F. Vries², C.L. Lennox¹

¹Department of Plant Pathology, Stellenbosch University, Private Bag XI, Matieland, 7602 Stellenbosch, South Africa

²Tessara Pty Ltd, 35 Kinghall Ave., Epping 2, Cape Town, South Africa

Abstract

The essential oil extracted from cloves (clove oil) and SO₂ (in the form of sulphur-generating salts) were evaluated for efficacy to inhibit *Alternaria alternata* *in vitro* and tomato fruit. *Alternaria* spp. (either *A. alternata* or *A. arborescens*) are latent pathogens frequently isolated from tomatoes in the Western Cape of South Africa, with a mean *Alternaria* spp. prevalence 17.6% amongst isolates collected from postharvest decay symptomatic tomatoes. Postharvest decay symptoms presented in the form of black spot. Mycelial growth of the pathogen was partially inhibited (up to 67% reduced mycelial growth diameter) by clove oil volatiles (50% v/v concentration applied on filter paper inside a punnet containing petri dishes) or completely inhibited by SO₂ (1g SO₂-generating salts in a sheet fixed to the lid of a punnet). Other tested sulphur-generating salts (sodium sulphate) were not found to inhibit mycelial growth of *Alternaria* spp. *in vitro*. Fruit trials on cultivar 'Roma' resulted in variable results depending on the *Alternaria* sp. isolate tested (complete inhibition of two out of three isolates at either 25 or 50% v/v), while SO₂ from potassium metabisulphite or sodium metabisulphite salts (SO₂-generating sheets) completely inhibited all *Alternaria* sp. infection (0% incidence). This study has demonstrated that the tomato pathogen *Alternaria alternata* and *A. arborescens* are sensitive to both clove oil and SO₂ in the form of sulphur-generating salts (either potassium metabisulphite or sodium metabisulphite) incorporated in SO₂ sheets with complete inhibition of mycelial growth.

Keywords: Antifungal; In vitro; Packaging; SO₂; Tomato (*Solanum lycopersicum* L.)



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

PART 2

POSTER PRESENTATIONS





VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Characterization of anthocyanin biosynthesis pathway genes in European elder (*Sambucus nigra* L.)

V. Fanelli¹, I. Mascio¹, M.A. Savoia¹, P. Venerito², C. Montemurro¹

¹University of Bari, via Amendola 165/A, 70126 Bari, Italy

²CRSFA, via Cisternino, 281, Locorotondo, Italy

Abstract

Elder (*Sambucus nigra* L.) is a small tree of European origin and popularly known as European elder and elderberry. Elder is grown mainly for its fruit and flowers, which are used to produce juices, beverages, infusions, and liqueurs. The fruit extract can also be employed as a medicinal as well as a functional ingredient in many food products. Elderberry is rich in components with high biological activity, primarily polyphenols, such as anthocyanins, which give the fruit its characteristic black-purple colour. The anthocyanin biosynthesis pathway is well-known in different berry species, such as blueberry, while no information is available in elder. The aim of this work was the in-silico isolation of the genes involved in the production of anthocyanins in elder and the evaluation of their expression level in three plant tissues: leaf, flower and fruit. Leaves, fruits and flowers of two Apulian accessions of European elder were sampled between May and September 2024. The RNA was isolated using a commercial kit. The gene sequences were isolated through tblastn using the protein sequences of anthocyanin genes previously isolated in high-bush blueberry (*Vaccinium corymbosum* L.) and publicly available on NCBI. The functional classification of identified genes was performed through a phylogenetic analysis using the amino acid sequences of previously characterised eudicot anthocyanin genes obtained from GenBank. For each gene, two primer couples were designed using Primer3Plus. The in-silico analysis allowed the isolation of 3 housekeeping genes (*Actin*, *GADPH* and *eEF2*) and 10 genes putatively involved in the anthocyanin biosynthesis. The function of these genes was confirmed by the phylogenetic tree analysis. All the genes were successfully amplified through qualitative PCR using the designed primers. The next steps will be the evaluation of the gene expression levels through qPCR in the three selected elder tissues.

Keywords: in silico gene isolation; elderberry; functional classification; gene expression



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

**Isolation of the genes involved in the phenylpropanoid and flavonoid pathways
in quince (*Cydonia oblonga* Mill.)**

V. Fanelli¹, N. Sgaramella¹, M.A. Savoia¹, P. Venerito², C. Montemurro¹

¹University of Bari, via Amendola 165/A, 70126 Bari, Italy

²CRSFA, via Cisternino, 281, Locorotondo, Italy

Abstract

Quince (*Cydonia oblonga* Mill.) is a deciduous tree spread in the Mediterranean area. It belongs to the Rosaceae family and is closely related to apples and pears. Quince is a highly nutritious species since it has low fat content and is a rich source of carbohydrates, fiber, protein, vitamins and phenolic compounds. Thanks to its nutritional components, the positive effects of quince on human health were demonstrated. Despite the importance that this species could play in the agronomical scenario, no information is available about the pathways involved in the production of the bioactive compounds of quince. The aim of our work was to identify and study the genes involved in the phenylpropanoid and flavonoid pathways in quince and compare their expression levels in 5 different accessions. Leaves and mature fruits (peel and pulp) of five Apulian quince accessions were sampled between May and November 2024. The RNA was extracted using a commercial kit, following the manufacturer's instructions. The quantity and quality of isolated RNA were checked through 1% (w/v) agarose gel electrophoresis and Nanodrop ND-1000 spectrophotometer. RNA was converted to cDNA using the iScript cDNA Synthesis Kit (BioRad). Primers designed using apple (*Malus domestica* Borkh) C4H, 4CL, CHS and CHI genes were used to amplify the quince cDNA through RT-qPCR. RNA was isolated from the selected tissues, and it showed good quality and quantity. All the primers are now being tested in qualitative PCR. The next steps will be the evaluation of the gene expression levels through RT-qPCR in the three quince tissues and their comparison in the five accessions.

Keywords: in silico gene isolation; gene expression; Apulian accessions; RNA



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Identification and characterisation of fungal pathogens associated with Tomatoes (*Solanum lycopersicum*) in the Western Cape province

J. Meitz-Hopkins¹, S.A. Malueke², Z.A. Belay³, A.A. Tsige², O.J. Caleb⁴

¹*Plant Pathology Dept., Private Bag XI, 7602 Stellenbosch, South Africa*

²*Department of Horticultural Sciences, Faculty of AgriSciences, Stellenbosch University, 7602 Stellenbosch, South Africa;*

³*Post-Harvest and Agro-Processing Techn., Agricultural Research Council, Infruitec-Nietvoorbij, Stellenbosch, South Africa*

⁴*Department of Food Sciences, Faculty of AgriSciences, Stellenbosch University, 7602 Stellenbosch, South Africa*

Abstract

High volumes of fresh produce are lost to microbial decay between harvest and the consumer. Tomato varieties Mackenzie and Star 9011, tunnel (F1) and open field (F2), produced from two regions 300 km apart in the Western Cape province, South Africa, were subjected to two treatment types: 1% NAOCL and untreated, and allowed to naturally decay postharvest in a moisture chamber, allowing disease development and progression. Daily inspection was carried out, and fruit exhibiting symptoms was isolated onto potato dextrose agar. The percentage of decayed tomatoes over time and pathogen occurrence frequency among the total isolates were recorded. The decay progression for the one region (F1) for both treatments started very low compared to the other region (F2). The first region's samples overall disease incidence comprised less than 2% total decay after one week of storage and rapidly progressed to 46-71% by the end of week two to four. Meanwhile, the second region's disease incidence expressed a rapid increase after the first week at 45% and progressed to more than 80% by the end of week four. The cultivar type, climatic variations and production system employed most likely contributed to these variations. Morphological characterisation was carried out by inspecting spores microscopically and measuring spore length and width to determine the genus identity of the fungal pathogens. Molecular verification of species identity was carried out using species-specific primers or PCR-RFLP of the internal transcribed spacer region followed by phylogenetic analysis of barcoding gene regions. The pathogen species identified were *Alternaria* sp., *Rhizopus* sp., and others. In one region, *Rhizopus* sp. was the most prevalent pathogen at 45%, followed by *Alternaria* sp. at 30%. In contrast, *Alternaria* sp. were more prevalent in the second region compared to *Rhizopus* sp. at 36% and 25%, respectively. Similar pathogens were detected in both regions despite differences in production systems, climate, and cultivar.

Keywords: Decay; Disease incidence; Fungal pathogens; Tomato



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

**Preharvest efficacy of alternatives used in conjunction with registered fungicides
in controlling heart rot in pomegranates**

J. Meitz-Hopkins, E. Van Rooyen, E. Venter, C. Lennox

Plant Pathology Dept., Private Bag XI, 7602 Stellenbosch, South Africa

Abstract

High volumes of fresh produce are lost to microbial decay between harvest and the consumer. Tomato varieties Mackenzie and Star 9011, tunnel (F1) and open field (F2), produced from two regions 300 km apart in the Western Cape province, South Africa, were subjected to two treatment types: 1% NAOCL and untreated, and allowed to naturally decay postharvest in a moisture chamber, allowing disease development and progression. Daily inspection was carried out, and fruit exhibiting symptoms was isolated onto potato dextrose agar. The percentage of decayed tomatoes over time and pathogen occurrence frequency among the total isolates were recorded. The decay progression for the one region (F1) for both treatments started very low compared to the other region (F2). The first region's samples overall disease incidence comprised less than 2% total decay after one week of storage and rapidly progressed to 46-71% by the end of week two to four. Meanwhile, the second region's disease incidence expressed a rapid increase after the first week at 45% and progressed to more than 80% by the end of week four. The cultivar type, climatic variations and production system employed most likely contributed to these variations. Morphological characterisation was carried out by inspecting spores microscopically and measuring spore length and width to determine the genus identity of the fungal pathogens. Molecular verification of species identity was carried out using species-specific primers or PCR-RFLP of the internal transcribed spacer region, followed by phylogenetic analysis of barcoding gene regions. The pathogen species identified were *Alternaria* sp., *Rhizopus* sp., and others. In one region, *Rhizopus* sp. was the most prevalent pathogen at 45%, followed by *Alternaria* sp. at 30%. In contrast, *Alternaria* sp. were more prevalent in the second region compared to *Rhizopus* sp. at 36% and 25%, respectively. Similar pathogens were detected in both regions despite differences in production systems, climate, and cultivar.

Keywords: Alternative fungicide; *Alternaria* spp.; *Aspergillus* sp.



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Morpho-anatomical characteristics of pomegranate fruit that predispose them to fungal infections

E. Venter, C. Lennox, J. Meitz-Hopkins

Plant Pathology Dept., Private Bag XI, 7602 Stellenbosch, South Africa

Abstract

Various pomegranate fruit diseases have been identified and reported; however, their initial infection processes and etiology are often not fully understood. In etiological studies, the role of the fruit's morpho-anatomical characteristics—as the susceptible host—is frequently overlooked. Post-harvest fungal pathogens can penetrate host tissue through three primary mechanisms: wounds – caused by biotic and/or abiotic factors at any stage from orchard to storage (e.g., *Penicillium* spp., *Botrytis* spp.), natural openings – such as stomata, lenticels, stem ends, and pedicel–fruit interfaces and thirdly direct cuticle penetration – where pathogens breach the host's cuticle. This review aims to provide a comprehensive perspective on the structural traits of pomegranate fruit concerning these infection pathways. This presentation highlights the role of morpho-anatomical characteristics in infection initiation, offering insights that could support future integrated pest management (IPM)-based disease control strategies.

Keywords: Morpho-anatomy, pomegranate fruit, post-harvest decay



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Plum defence-response modulation by nano-encapsulated essential oils inhibiting *Botrytis cinerea*

J. Meitz-Hopkins¹, N.J. Njombolwana-Swartz², R. Pfukwa³, S. Monteiro⁴, C.L. Lennox¹

¹Plant Pathology Dept., Private Bag XI, 7602 Stellenbosch, South Africa

²Rovensa SA Pty Ltd, 1 Henry Vos Close, Asla Park, Strand, Cape Town, South Africa

³Department of Chemistry and Polymer Science, Stellenbosch University, 7602 Stellenbosch, South Africa

⁴Rovensa Europe, Estrada Municipal 533, Zona de Biscaia, Estr. Do Lau, 2950-401, Palmela, Portugal

Abstract

Necrotrophic fungi, such as *Botrytis cinerea*, are challenged by plant host defence responses activated through jasmonic acid, ethylene and salicylic acid signalling. Essential oils can either directly affect fungal cells, acting as natural fungicides, or indirectly influence the plant's defence mechanism by modulating the expression of defence response genes. The objective of this study was to investigate the effect of orange and thyme oil nanoparticles, generated through a nanoprecipitation method, on gene expression of plums artificially inoculated with *B. cinerea*. Gene expression was analysed in plum tissue (both wounded and non-wounded) after 3 h, 6 h and 24 h or in plums inoculated with *B. cinerea*, followed by thyme oil or orange oil loaded nanoparticle application and sampled at various intervals post inoculation (6 h, 24 h and 48 h). A reverse transcriptase qPCR technique was used to analyse the expression of pathogenesis-related genes in wounded, non-wounded, treated and untreated (control) plums. The results showed that PR genes showed early and late responses to wounding, and down-regulation of PR gene expression in plums after orange oil nano-particle exposure. Application of thyme oil, on the other hand, resulted in up-regulation of the PR gene expression. This study confirmed the effect of thyme oil on plant host defence responses and demonstrated the indirect mode of action of orange- and thyme oil in harvested plums.

Keywords: Antifungal; Essential oil; Host defense response; RTqPCR



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

‘Amele di Bari’: an autochthonous carob Apulian genotype

F. Maldera, R.C. Caroppo, F. Polignano, A. De Rosa, A. Gallotta, S. Camposeo

University of Bari, via Amendola 165A, 70126 Bari (Bari), Italy

Abstract

Carob (*Ceratonia siliqua* L.) cultivation is already spreading all over the Mediterranean Basin, mainly in a few countries like Spain and Morocco, due to high adaptation to biotic and abiotic stresses. In Italy, its cultivation is mainly concentrated in Sicily; nonetheless, Apulia, with more than 270,000 ha suitable, could increase its production. ‘Amele di Bari’ is the most important Apulian genotype, but the lack of a varietal national registry limits the spread of the cultivars. The aim of this research was to identify carob morphological markers and describe the behaviour of ‘Amele di Bari’. The experiment was conducted near Brindisi (Southern Italy). A list of TOT morphological markers was used to identify the ‘Amele di Bari’. 57 trees were screened to recognise it. This genotype, resulted as female, was characterised by shoots with reddish brown/whitish grey colour and medium lenticel density. The leaf had a long rachis (> 14 cm), leathery, ovate leaflets with an entire margin and a flat leaflet appearance. ‘Amele’ showed short inflorescences (< 6 cm) with a red rachis. Pod presented a straight shape with dark chocolate colouring, rough surface appearance and low lenticel density, medium length (15.8 cm) and high width (23.5 mm). Carobs presented a high weight (30.6 g) and a medium seed number (9-13). The seeds were obovoid in shape, reddish brown in colour, with a medium length/width ratio (1.2-1.4) and average weight (0.19 g). ‘Amele di Bari’ showed promising characteristics for human consumption, considering its high percentage of pulp on total weight (92%). Moreover, the use of a morphological markers list could lead to the establishment of a national register, pushing Italian and Apulian carob cultivation. Future insights will focus on molecular markers analysis and agronomic traits assessment.

Keywords: carob pod; morphological markers; seeds percentage; varietal card



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Preliminary evaluation of water stress resistance in carob tree (*Ceratonia siliqua* L.) cultivars under Mediterranean conditions: implications for sustainable agriculture

J. Pou, L. Tortella, J. Miquel, B. Pisà, M. Garau

C/d'Eusebi Estada, 145, 07009 Illes Balears Palma, Spain

Abstract

Carob tree (*Ceratonia siliqua* L.), native to the Mediterranean region, is increasingly recognised as a resilient crop due to its ability to thrive in nutrient-poor soils and harsh climatic conditions. Its adaptability to marginal lands and tolerance to adverse environments make it a promising candidate for sustainable agriculture, particularly in the face of climate change. This study aims to evaluate the response of ten carob cultivars to water stress under uniform drought conditions. The trial was conducted in an experimental orchard in Sa Granja (Mallorca, Spain), planted in 2021. All cultivars were subjected to identical deficit irrigation conditions (500 m³ha⁻¹year⁻¹). Key water stress parameters, including stem water potential (Ψ), stomatal conductance (g_s) and leaf chlorophyll concentration (SPAD), were measured between June and September. The cultivars included local varieties ('Duraió', 'Pau', 'Bugadera', 'Mestre', 'Roja d'Eivissa'), commercial varieties ('Rojal', 'Turis', '8-P'), and proprietary open-pollinated selections ('e-13P' and 'Granja'). A correlation analysis was performed to evaluate the relationship between water stress indices and ambient temperature variations. 'Pau' cultivar consistently outperformed a higher water potential during the peak evaporative demand period (218 JD, August) with -1.15 MPa, followed by '8-P' (-1.45 MPa) and 'e-13P' (-1.59 MPa). In contrast, 'Turis' (-2.47 MPa), 'Rojal' (-2.59 MPa), and 'Bugadera' (-2.65 MPa) exhibited greater sensitivity to water stress. 'Duraió' showed the highest g_s (604.7 mmol m⁻²s⁻¹), associated with enhanced gas exchange capacity and temperature regulation, while 'Bugadera' displayed the lowest (167.9 mmol m⁻²s⁻¹). 'Mestre' (60.09 SPAD) and 'Pau' (58.32 SPAD) retained the highest chlorophyll levels, suggesting superior photosynthetic capacity under stress conditions. A significant correlation ($p < 0.05$) was observed among water stress parameters and temperatures ranging from 25 to 36 °C. These findings highlight 'Pau', '8-P', and 'e-13P' as resilient cultivars for sustainable agriculture in water-limited environments. The insights gained from this study contribute to future crop adaptation strategies in the face of climate change.

Keywords: carob; water stress; stem water potential; stomatal conductance; chlorophyll concentration



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Biodiversity and Agronomic Traits of Carob Cultivars in the Mediterranean

J. Pou, J. Miquel, L. Tortella, B. Pisà, M. Garau

C/d'Eusebi Estada, 145, 07009 Illes Balears Palma, Spain

Abstract

The Mediterranean region has a long tradition of cultivating carob (*Ceratonia siliqua* L.), a resilient species well adapted to drought, calcareous soils, and salinity. Its current status as a non-listed host species for *Xylella fastidiosa*, combined with its adaptability to warm climates, positions it as a promising crop for climate change adaptation. Germplasm banks play a critical role in genetic diversity and assessing cultivar adaptability to emerging challenges. This study aims to evaluate the agronomic traits, flowering phenology, and physical characteristics of twelve carob cultivars from the Balearic Islands and two commercial Spanish cultivars. The evaluation was conducted at the germplasm bank located in Son Real (Mallorca, Spain), established in 2014, during the 8th to 10th years after plantation. The study included nine female genotypes ('Bajoca', 'Bauçana', 'Bugadera', 'Duraió', 'Fina d'Eivissa', 'Granja*', 'Matalafera', 'D'en Pau', 'Rojal') and five hermaphroditic genotypes ('E13P*', 'Sa Llebre', 'Lloseta', 'Des Mestre', and 'Roja d'Eivissa'). Agronomic parameters such as cumulative production, seed yield and flowering phenology were evaluated, along with the physical characteristics of pods and seeds. A Principal Component Analysis (PCA) was conducted to identify patterns among the different cultivars. Over the last three seasons, the 'E13P' cultivar exhibited the highest cumulative pod yield (78.16 kg per tree) with statistically significant differences compared to the other cultivars. Although 'Granja' did not achieve the highest carob production (57.26 kg per tree), it stands out for its high seed yield (20.67%). Both 'Granja' and 'E13P' also recorded notable cumulative seed production (16.91 and 12.99 kg per tree, respectively), with significant differences from the rest. Regarding flowering phenology, the hermaphroditic cultivars exhibited a significantly extended blooming period ($p < 0.001$), especially during peak fertility stages (stages 3-4), with 'Roja d'Eivissa' being particularly prominent. The first two components of the PCA explained more than 63% of the observed variability among cultivars. This comprehensive evaluation provides valuable insights into the diversity and agronomic potential of carob cultivars, supporting their adaptation to future environmental and economic challenges.

Keywords: Carob, cultivars, hermaphroditic, phenology, production, seed yield





**VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE**
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

New Microsatellite Markers for Assessment of Genetic Diversity in Pomegranate and Construction of Molecular Database

A. Akkak¹, A.C. Khouane², F. Cossio³, K. Khelifi⁴, M. Petricione⁵, P. Venerito⁶

¹*Dipartimento di Scienze Agrarie, Alimenti Risorse Naturali e Ingegneria , DAFNE. Via Napoli 25, 71121 Foggia, Italy*

²*Centre de Recherche en Biotechnologie CRBt, E73 UV N 03 Constantine Nouvelle ville, Ali Mendjelli, Algeria*

³*Plant breeder, Verona, Italy*

⁴*Institut d'Arboriculture Fruitière, et de la Vigne- ITAFV, Boufarik, Algeria*

⁵*CREA-Centre for Olive, Fruit Citrus Crops, Via Torrino 3, 81100 Caserta, Italy*

⁶*Centro di Ricerca, Sperimentazione e Formazione in Agricoltura Basile Caramia, Via Cisternino 28, 70010 Locorotondo (Bari), Italy*

Abstract

A set of 12 newly selected powerful simple sequence repeat (SSR) markers was used to evaluate the genetic diversity of 133 accessions of pomegranate (*Punica granatum* L.) collected from 5 ex-situ germplasm conservation fields and maintained at Apulia Regional ex-situ Conservation Center for fruit growing crops (CRSFA Basile Caramia, Locorotondo), Research Unit for fruit growing (CREA-FRC, Caserta), Exoticplant nursery (Cisterna Latina, Roma), National Plant Germplasm System, USA, and Institut d'Arboriculture Fruitière et de la vigne (ITAFV, Algeria). All the UFPg loci were informative, especially UFPg18 and UFPg20. The average content of the polymorphic information index was 0,416. In this study, 14 synonymy groups were also detected among 110 uniquely distinguished accessions. These data have enabled the construction of the first electronic database for minor fruits, denominated "VALTIFRU."

Keywords: SSR, Genetic Diversity, *Punica granatum*, Germplasm, Minor Fruits





VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Optimisation of Newly Developed Microsatellite Markers for Genetic Evaluation of Jujube (*Zyziphus jujube* Mill.) Germplasm

A. Akkak¹, F. Cossio², P. Venerito³

¹Dipartimento di Scienze Agrarie, Alimenti Risorse Naturali e Ingegneria , DAFNE. Via Napoli 25, 71121 Foggia, Italy

²Plant breeder, Verona, Italy

³Centro di Ricerca, Sperimentazione e Formazione in Agricoltura Basile Caramia, Via Cisternino 28, 70010 Locorotondo (Bari), Italy

Abstract

Among many underutilised fruit species, jujube (*Zyziphus jujube* Mill.) has recently attracted agronomic, commercial, and scientific interest. Native to China, it has been cultivated and naturalised throughout the Mediterranean region since ancient times. Its fruit is well known for its nutritional and health-promoting compounds, underlying its potential use, especially in traditional Chinese medicine. It is reported to be the existence of at least 400 different Chinese genotypes exist, with some local varieties also spread in the Mediterranean area. Few studies were undertaken on the genetic evaluation of *Zyziphus* spp. in Italy. Over the last decade, a multi-institutional funding program was initiated at the University of Foggia to develop genetic markers for the 12 most important alternative fruit species present in the territory, aiming to overcome the lack of genetic information. In this context, this study aimed to optimise the newly developed microsatellite markers for the jujube cultivar identification tool and assess the genetic variability of local germplasm with recently introduced Chinese genotypes. Twenty selected SSR (Simple Sequence Repeats) loci were screened for amplification and polymorphism. Seven loci were used to fingerprint all the accessions collected in Italy and Algeria. All these SSR markers proved to be an effective tool for evaluating genetic diversity in jujube germplasm. The generated data was used to complete the construction of the newly electronic minor fruit database, “VALTIFRU”.

Keywords: SSR, Genetic Markers; Under-utilised Fruits; Germplasm Selection; Characterization



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Preliminary study on the biological activity of different *Trichoderma* isolates against fungi causing pomegranate

D. Gerin, A. Agnusdei, F. Dalena, D. Cornacchia, D. Salamone, G. Incampo, F. Faretra, S. Pollastro

University of Bari, via Amendola 165A, 70126 Bari (Bari), Italy

Abstract

Pomegranate is widely cultivated in the Mediterranean basin, and different fungal pathogens are reported to be associated with pomegranate fruit rot. The development of sustainable control schedules is increasingly required to reduce the application of synthetic fungicides. This work was aimed at studying the biocontrol potential of 35 *Trichoderma* isolates against *Alternaria alternata*, *Aspergillus carbonarius*, *Botrytis cinerea* and *Coniella granati* by *in vitro*-dual-culture assay. Principal component analysis revealed specific interactions between each *Trichoderma* isolate and each fungal pathogen. Against *A. alternata*, two isolates of *T. erinaceum* (Tch13 and Tch14) and one belonging to the *T. harzianum* species complex (Tch23) resulted more effective than the others (colony growth inhibition 63-65%). *Trichoderma erinaceum* Tch14 was also the best antagonist against *A. carbonarius* (inhibition=64%) and *B. cinerea* (inhibition=72%). *Coniella granati* was inhibited by a high number of *Trichoderma* isolates, with *T. atroviridae* Tch8, *T. erinaceum* Tch13 and Tch14 and two isolates of the *Trichoderma harzianum* species complex (Tch19 and Tch20) resulting as the most effective (inhibition: 76-92%). In the co-culture plates with *A. carbonarius*, the ochratoxin A (OTA) amount was quantified by high-performance liquid chromatography in plugs collected from *A. carbonarius* colonies. Twenty out of 35 *Trichoderma* isolates significantly reduced ($p \leq 0.05$) the OTA produced by the fungus as compared to the control plate (*A. carbonarius* grown singly). In conclusion, with this study, we report the effectiveness of *Trichoderma* isolates against fungal pomegranate fruit rot causal agents, representing promising tools for improving integrated and sustainable fruit rot management.

Keywords: pomegranate rot pathogens; biocontrol agents; competition; dual culture



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Characterisation of Physicochemical and Phytochemical Properties of Italian Pomegranate (*Punica granatum* L.) Accessions

W. Tarraf¹, L. Calani², D. Beghè³, M. Cirlini², C. Dall'Asta², E. Beneventi², A. Bonetti¹, R. Petruccielli¹

¹CNR-IBE, Via Madonna del Piano n. 10, 50019 Sesto Fiorentino (FI), Italy

²Food and Drug Department, Parma University, Parco Area Delle Scienze, 27a, 43124 Parma, Italy

³Economics and Management Department, Via J.F. Kennedy 6, 43125 Parma, Italy

Abstract

Pomegranate (*Punica granatum* L.) is widely cultivated in Mediterranean countries. Its fruits are consumed fresh, as minimally processed arils, or used in processed forms. In recent years, pomegranates have gained increasing attention not only for their taste, colour, and nutritional value, but especially for their health-promoting effects. Italy hosts several local pomegranate accessions, but their effective valorisation remains a challenge. Thus, characterising these genotypes is essential to identify those with desirable traits. This study investigated the physicochemical characteristics (total soluble solids, pH, titratable acidity, and colour), antioxidant capacity (DPPH test), and chemical composition, focusing on polyphenols profiling via ultra-high performance liquid chromatography coupled with multiple-stage mass spectrometry, in juices from 12 ancient Italian pomegranate accessions. The commercial cultivar 'Wonderful' was used as a reference. Total soluble solids ranged from 12.95 to 17.79 °Brix, pH from 3.29 to 4.53, and titratable acidity from 0.50 to 4.40%. Total phenolic content varied between 575.78 mg L⁻¹ and 4994 mg L⁻¹, while antioxidant activity ranged from 0.10 to 7.24 mg L⁻¹. Four sugars were identified in the juices—fructose, glucose, mannitol, and galactose—in decreasing order of concentration. The total sugar content ranged from 78.33 to 133.62 mg mL⁻¹. Over one hundred (poly)phenolic compounds were quantified, showing distinct phytochemical profiles among the accessions. These findings highlight the wide variability among Italian pomegranate genotypes and suggest the presence of promising candidates for breeding, functional food production, and local valorisation strategies.

Keywords: *Punica granatum* L.; HPLC; polyphenol; physicochemical characteristics



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Genotype- and season-dependent expression of floral regulators in fig (*Ficus carica* L.) by RNA-SEQ analysis

P. Colasuonno, I. Marcotuli, L. Giove, A. Gadaleta, G. Ferrara

University of Bari 'Aldo Moro', Via Amendola 165A, 70126 Bari (BA), Italy

Abstract

Fig (*Ficus carica* L.) is a fruit tree of high agronomic relevance, widely cultivated in the Mediterranean region. Despite its importance, the molecular mechanisms underlying key developmental processes such as flowering are still not fully elucidated. In this study, in order to investigate the transcriptional dynamics involved in flowering pathways converging on complex gene regulatory mechanisms, we performed RNA-sequencing (RNA-seq) on three fig genotypes: Dottato, Petrelli, and Caprifig, collected at two phenological stages (April and July). Differential expression analysis revealed dynamic and genotype-specific transcriptional changes across developmental stages. Key regulators such as *RANI* (Responsive to ANtagonist1), *AGAMOUS*, *VQ* (*VQ* motif containing) and F-box domain-containing genes exhibited distinct expression profiles. Notably, *RANI* and *AGAMOUS*, both associated with sex determination and floral organ identity, were significantly downregulated in Caprifig (a male genotype) during the July season, suggesting a developmental or seasonal repression of floral identity genes in this variety. Conversely, *F-box* genes displayed increased expression in July, particularly in Caprifig and Petrelli genotypes, indicating a potential role in seasonal floral regulation (fruit maturation) or stress adaptation. These results highlight a complex regulatory network driving floral development in *F. carica*, influenced by both genotype and season. The identification of temporal and variety-specific gene expression patterns provides new insights into fig floral biology and offers a foundation for molecular breeding aimed at improving flowering time, fruiting behaviour, and cultivar selection.

Keywords: *Ficus carica* L.; RNA-seq, seasonal variation; flowering regulation; sex determination



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Assessment of Genetic Variability in *Ficus carica* Using SSR Markers: A Case Study from the ‘Giardini di Pomona’

P. Colasuonno¹, I. Marcotuli¹, L. Giove¹, A. Pesole¹, A. Mazzeo¹, P. Belloni², G. Ferrara¹, A. Gadaleta¹

¹University of Bari ‘Aldo Moro’, Via Amendola 165A, 70126 Bari (BA), Italy

²I giardini di Pomona, contrada Figazzano 114, 72014 Cisternino, Italy

Abstract

Fig (*Ficus carica* L.) is one of the earliest domesticated fruit trees, with a cultivation history spanning over 6,000 years across the Mediterranean basin. Despite its longstanding cultural and nutritional significance, fig remains a relatively understudied "minor fruit crop" in terms of genetic characterisation and conservation. In this study, we investigated the genetic variability and population structure of a fig germplasm collection maintained at the ‘Giardini di Pomona’ in Cisternino (Puglia region, Italy), which includes 235 fig genotypes originating from Italy, France, Albania, and caprifig accessions. The genotypes were characterised through 68 SSR markers previously validated for polymorphism and reproducibility. Genetic diversity parameters such as allele number, heterozygosity, and Shannon’s Information Index were calculated for each regional group. Genetic structure was further assessed using Principal Coordinate Analysis (PCoA), AMOVA, Neighbour-Joining phylogenetic clustering, and Bayesian clustering with the STRUCTURE software. The SSR markers revealed a total of 68 polymorphic alleles, with a moderate to high level of intra-population diversity. Shannon’s index values ranged from 0.25 (Albania) to 0.74 (Italy), and heterozygosity values from 0.12 to 0.43, indicating clear differences in genetic richness among regional groups. AMOVA analysis showed that 39% of total genetic variance was attributable to differences among populations ($F_{st} = 0.386$, $p < 0.001$), suggesting moderate genetic differentiation between geographic origins. The PCoA and phylogenetic tree analyses consistently grouped the genotypes into two major clusters. STRUCTURE analysis supported $K = 2$ as the most probable number of genetic clusters, further confirming the presence of two main subpopulations within the collection. This work highlights the significant genetic variation conserved within the Pomona Gardens fig germplasm and underlines the importance of safeguarding local fig varieties, particularly in light of climate change, agricultural diversification, and increased consumer interest in traditional and nutritionally valuable crops. The study also provides a molecular framework for future breeding efforts and germplasm conservation strategies in *Ficus carica*.

Keywords: Caprifig; germplasm; Puglia; alleles; fruit tree garden.



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Defence response modulation by nano-encapsulated essential oils inhibiting grey mould of plums

C.L. Lennox

Fruit and Postharvest Pathology Research Pr; Department of Plant Pathology, Stellenbosch University, 7602 Western Cape Matieland, South Africa

Abstract

Necrotrophic fungi, such as *Botrytis cinerea*, are challenged by plant host defence responses activated through jasmonic acid, ethylene and salicylic acid signalling. Essential oils can either directly affect fungal cells, acting as natural fungicides, or indirectly influence the plant's defence mechanism by modulating the expression of defence response genes. The objective of this study was to investigate the effect of orange and thyme oil nanoparticles, generated through a nanoprecipitation method, on gene expression of plums artificially inoculated with *B. cinerea*. Gene expression was analysed in plum tissue (both wounded and non-wounded) after 3 h, 6 h and 24 h or in plums inoculated with *B. cinerea*, followed by thyme oil or orange oil loaded nanoparticle application and sampled at various intervals post inoculation (6 h, 24 h and 48 h). A reverse transcriptase qPCR technique was used to analyse the expression of pathogenesis-related genes in wounded, non-wounded, treated and untreated (control) plums. The results showed that PR genes showed early and late responses to wounding, and downregulation of PR gene expression in plums after orange oil nano-particle exposure. Application of thyme oil, on the other hand, resulted in upregulation of the PR gene expression. This study confirmed the effect of thyme oil on plant host defence responses and demonstrated the indirect mode of action of orange- and thyme oil in harvested plums.

Keywords: Antifungal; Essential oil; Host defence response; RTqPCR



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Stomatal Traits in Pecan [*Carya illinoensis* (Wangenh.) K. Koch]: Varietal Differences and Seasonal Adaptations under Mediterranean Conditions

A. Pesole, A. Chiriaco, S. Pitardi, G. Ferrara

University of Bari 'Aldo Moro', Via Amendola 165A, 70126 Bari (BA), Italy

Abstract

In recent years, interest in non-traditional fruit species has grown, particularly as a strategy to diversify agricultural production in areas increasingly affected by extreme climatic conditions. In this context, pecan [*Carya illinoensis* (Wangenh.) K. Koch], a fruit tree native to North America, represents a promising option for Mediterranean orchards due to its productive potential and nutritional value. However, the agronomic and commercial success of this species also depends on a deeper understanding of its morphological and physiological traits, which remain poorly studied under Italian growing conditions. In the seasons 2019 and 2020, a study was conducted on 10 pecan cultivars grown at the repository of the Department of Soil, Plant and Food Sciences, University of Bari 'Aldo Moro' located at the 'Martucci' experimental and educational centre in Valenzano (Bari province), Puglia region (Italy). Two leaf parameters were analysed: stomatal density (SD) and leaf area (LA). Data were statistically evaluated using ANOVA followed by the REGWQ post hoc test. The cultivars Cherokee and Choctaw exhibited the largest leaf areas (454.13 mm²), while Cape Fear showed the smallest (215.56 mm²). Regarding stomatal density, Stuart and Cape Fear had the highest values (589.58 and 566.66 stomata/mm², respectively), whereas Peruque and Cherokee recorded the lowest (427.08 and 444.79 stomata/mm²). The combined analysis of these parameters suggests the existence of differentiated morphological strategies among pecan cultivars, potentially linked to variations in photosynthetic efficiency and water stress response. These findings provide valuable insights for selecting pecan cultivars best suited to sustainable cultivation under Mediterranean conditions, thus contributing to more efficient and climate-resilient orchard management. Further studies will be conducted to better understand the relationship between SD and physiological, yield and quality parameters.

Keywords: Leaf area; stomata; selection; Puglia.



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Stomatal Traits in Pomegranate (*Punica granatum* L.): Varietal and Seasonal Variability in Relation to Climatic Adaptation

A. Chiriaco, S. Pitardi, A. Pesole, A. Mazzeo, G. Ferrara

University of Bari 'Aldo Moro', Via Amendola 165A, 70126 Bari (BA), Italy

Abstract

This study, conducted in the Puglia region over the 2019–2020 period, investigated the variability of stomatal traits in 77 pomegranate (*Punica granatum* L.) varieties, including both local and internationally cultivated varieties. All varieties were grown in the germplasm repository of the Department of Soil, Plant and Food Sciences (DiSSPA), located at the 'Martucci' experimental station in Valenzano (Bari, Italy). The aim of the study was to identify stomatal traits, specifically stomatal density (SD) and stomatal size (SS), to be used for further studies. Leaf samples were collected in summer from three plants per variety. To obtain epidermal impressions, a layer of clear nail polish was applied to the abaxial leaf surface, allowed to dry, and then peeled off using transparent adhesive tape. The imprint was transferred to a microscope slide and observed under a light microscope. No stomata were detected on the adaxial surface of the leaf. The results revealed significant differences among varieties, with SD ranging from 384 stomata/mm² in 'De Marco' to 756 stomata/mm² in 'Reddito Dolce'. SS ranged from 120 μm² (in 'A Dente San Giorgio' and 'Capurso Acido Surico') up to 273 μm² (in 'Perek Ischkjily'). The analysis also revealed significant differences in the two seasons, with consistently lower SD and SS values recorded in 2019 compared to 2020. The considerable variability observed among varieties, such as the high SD in 'Reddito Dolce' and the large SS in 'Perek Ischkjily', suggests the potential for selecting genotypes best suited to different climatic conditions. These findings provide valuable insights for selecting/breeding strategies aimed at enhancing pomegranate resilience under conditions of limited water availability and high temperatures. Further studies will be conducted to better understand the relationship between stomata traits and physiological, yield and quality parameters of pomegranate varieties.

Keywords: Stomata; size; Puglia; abaxial



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Pomegranate Diversity in Cyprus: A Resource for Selection and Conservation

S. Ioannidou¹, M.C. Kyriacou¹, N. Nikoloudakis², N. Seraphides¹, L.C. Papayiannis¹, A.C. Kyratzis¹

¹Agricultural Research Institute, P.O.Box 22016, 1516 Nicosia, Cyprus

²Cyprus University of Technology, 30 Arch. Kyprianos Str., 3036 Limassol, Cyprus

Abstract

Pomegranate (*Punica granatum* L.) is increasingly recognised not only for its economic importance, but also for its health-promoting properties. As demand grows for high-quality, functional fruit, understanding the variation in key quality traits becomes essential. Cyprus, located near the species' centre of origin, holds a unique and underexplored reservoir of pomegranate diversity due to its long cultivation history and relative geographic isolation. This study explores the diversity and stability of fruit quality traits across a collection of 29 locally selected pomegranate accessions, cultivated under uniform conditions in an ex-situ collection. Over multiple growing seasons, key physical and chemical attributes—such as sweetness, acidity, and antioxidant potential—were measured to assess trait expression and stability. In addition to evaluating fruit characteristics, genetic analysis was performed to assess genetic diversity and relationships among the accessions. The results demonstrated significant variability across accessions in both morphological and biochemical traits. Notably, several traits such as titratable acidity and organic acid composition showed remarkable consistency across years, indicating their potential value as reliable selection markers. A distinct subset of genetically and phenotypically similar accessions was identified, representing a local landrace with shared features like light-coloured juice, low in acidity and high juiciness. These findings provide valuable insights into the genetic and phenotypic structure of Cypriot pomegranate germplasm and underscore its potential for use in breeding programs, conservation strategies, and industry applications. By integrating phenotypic and molecular data, this work supports the strategic use and preservation of Mediterranean pomegranate resources and contributes to the development of improved cultivars tailored to both consumer preferences and production needs.

Keywords: Pomegranate; *Punica granatum* L.; Cyprus; Mediterranean germplasm; Genetic polymorphism; Fruit quality; Trait stability; Conservation





VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Production of Quince cider (*Cydonia oblonga* Mill.) from Apulian varieties using non-Saccharomyces microbial starters isolated from the fruit's epiphytic microbiota

F. Loperfido¹, V. Petrelli¹, A. Galeotti¹, S. Pupillo¹, A. Turco², G. Maggi¹, P. Venerito², G. Romano³, F. Tedesco⁴, C. Gerardi³, M. Tufariello³, F. Grieco³

¹Fondazione ITS Academy AgriPuglia, 70010 Locorotondo Ba, Italy;

²CRSFA Basile-Caramia, 70010 Locorotondo, Italy;

³CNR - Institute of Sciences of Food Prod., 73100 Lecce, Italy;

⁴Università del Salento, 73100 Locorotondo, Italy

Abstract

The quince (*Cydonia oblonga* Mill.) represents one of the hardest arboreal fruit species among the varieties at risk of genetic erosion preserved in the territories of Puglia. It belongs to the *Rosaceae* family, *Pomoideae* subfamily. It was already cultivated in 2000 BC by the Babylonians and in Greek and Roman times. The name *Cydonia* originates from the ancient name of the Cretan city of Chania. The distinct aromatic characteristics of its fruits can be utilised for the valorisation of this species. The juice of quince fruits can be used as a fermentative substrate for the production of a new food product like "Quince Cider" by using yeasts isolated from the study of the fruit's epiphytic microbiota as microbial starters for fermentation. The Apulian quince variety for the juice (extracted with a hydraulic press) is the "*Cotogno Gigante*" variety. From the study on the epiphytic microbiota conducted on different varieties of Apulian Quince, it was possible to isolate two non-Saccharomyces yeasts from the "*Quince Acreste*" variety and the "*Quince Gigante*" variety. The yeasts were subjected to a preliminary study to determine their fermentation capacity, which was optimal from the observation of fermentation curves, and sequenced for molecular identification by the ISPA (Institute of Food Production Sciences) of the CNR (National Research Centre) in Lecce. Subsequently, the yeasts, purified on Sabouraud Agar culture maintenance medium, were used individually as fermentation starters for the fermentation of "*Quince Gigante*" juice in order to obtain "Quince Cider". The transformed products were subjected to low-field 80 MHz NMR and GC-FID E-nose analyses to comprehensively evaluate the composition of the liquid component and VOCs, comparing the results obtained with data from the sensory analysis of the ciders.

Keywords: Cider, biodiversity; new product; fermentation



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Production of “Fig Vinegar” from the Production Waste of “Cotto di Fichi” of Apulian *Ficus carica* L. varieties using yeasts and bacteria isolated from the Epiphytic Microbiota of the Fruits as Microbial Starters

F. Loperfido¹, A. Galeotti¹, V. Petrelli¹, S. Pupillo¹, A. Turco², G. Maggi¹, P. Venerito²

¹Fondazione ITS Academy AgriPuglia, 70010 Locorotondo Ba, Italy

²CRSFA Basile-Caramia, 70010 Locorotondo, Italy

Abstract

An ancient story, that of vinegar, is at least as old as that of other foods and beverages born from a fermentation process, such as wine, bread, and beer. Besides having a fundamental organoleptic role in some dressings and culinary preparations, vinegar is important for its preservative function to keep many foods over time. It was also used as a remedy in some medical practices of the past. This work proposes to develop a new food product from a waste product derived from the production process of “Cotto di Fichi”, a traditional product of Southern Italy, as a virtuous example of productive development in the circular economy, valorising Apulian *Ficus carica* L. varieties subject to genetic erosion. The cooking phase of the figs, for the production of “Cotto di fichi”, produces a sugary water with peculiar organoleptic characteristics, derived from the raw material used, which is usually discarded. In the proposed work, the “cooking waters” of two varieties of Apulian figs, *Ficus carica* L. var. “Del Vescovo” and var. “Reale Nero del Gargano” were recovered. At the same time, technological fermentation trials were conducted on an unknown yeast isolated from the microbiota of *Ficus carica* L. var. “Del Vescovo” and on an unknown acetic bacterium, a catalase-positive diplobacillus, isolated from the microbiota of *Prunus cerasus* L. var. “Visciola”. The yeast was subsequently used as a starter for the alcoholic fermentation of the “cooking waters.” At the end, acetic fermentation was initiated using the acetic bacterium from the *Visciola* as the starter. The two obtained products were subjected to preliminary basic chemical analyses (pH, Brix degree, and total acidity expressed in g/l of acetic acid), evaluation of the aromatic VOC profile with GC FID E-Nose, analysis of the metabolic component through low-field 80 MHz NMR, and sensory evaluation through panel testing.

Keywords: Figs; vinegar; valorization; biodiversity; germoplasm



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Fermented pomegranate juice (*Punica granatum* L.) of an indigenous Apulian variety, enriched with pomegranate peel extract by means of an ultrasound technique: a possible new functional product

F. Loperfido¹, V. Petrelli¹, A. Galeotti¹, S. Pupillo¹, A. Turco², G. Maggi¹, P. Venerito²

¹Fondazione ITS Academy AgriPuglia, 70010 Locorotondo Ba, Italy

²CRSFA Basile-Caramia, 70010 Locorotondo, Italy

Abstract

The pomegranate, since antiquity associated with fertility, prosperity, and cyclically renewing life, is one of the most popular fruits in the food industry, especially for its high content of molecules with antioxidant properties, vitamins and mineral salts. A lesser-used part but rich in components with high nutritional and health value is the pomegranate skin. Several scientific studies have shown positive effects for the treatment of ulcers and gastric inflammation, antimicrobial power in particular against *Staphylococcus aureus* and *Salmonella* spp. strains, cardioprotective and anti-tumour actions, and inhibitory activity against the SARS virus spike protein COV2. The aim of this work is to obtain a fermented food product with high functional properties, using a native Apulia pomegranate variety, in particular the “Capitolo” variety, as raw material. This work involved, as a first step, the optimisation of an extraction process of the functional components present in the pomegranate peel using ultrasound technology and the subsequent control of the metabolic components, especially the polyphenolic component. At the same time, a process of transforming the pomegranate juice was initiated, which involved the use of a commercial microbial starter (lactic bacterium *Oenococcus oeni* B7 Direct Lactoenos) for malo-lactic fermentation, transforming the malic acid present into lactic acid in favour of a softer, less acidic product. Subsequently, using an unknown elliptic yeast isolated from the spontaneous fermentation of the same juice as a microbial starter, an alcoholic fermentation was initiated in order to obtain a minimal amount of ethanol (3-4% v/v EtOH) as a stability agent. At the end of the fermentation process, the extract of functional components from the pomegranate peel itself was added to improve the nutritional value and shelf-life of the new food product obtained. The new food product was subjected to sensory analysis of panel tests.

Keywords: pomegranate; biodiversity; functional product



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Unveiling leaf spot aetiology and resistance clues in the neglected mulberries of Apulia: a first step toward germplasm valorisation

F. Nigro¹, E. Chiaromonte¹, P. Nigro¹, G. Pompe Lucchese¹, P. Venerito²

¹University of Bari, via Amendola 165A, 70126 Bari (Bari), Italy

²CRSFA Basile-Caramia, 70010 Locorotondo, Italy

Abstract

Mulberry (*Morus alba* L.) has long held an important place in the cultural and agricultural heritage of Apulia, southern Italy, where it once supported widespread silkworm farming and contributed to the structure of rural landscapes. Today, its presence is limited to a few scattered, mature trees -largely abandoned and of unknown varietal origin-remnants of an agricultural past now almost forgotten. During recent field surveys in the Itria Valley and surrounding areas, these surviving trees were identified and assessed for foliar health, with particular attention to the appearance of leaf spot symptoms. Leaf spot disease can be attributed to several microorganisms, primarily fungi and bacteria, and understanding the agents involved is critical for developing effective management strategies. Disease severity was assessed, revealing significant differences in symptom expression among individual trees, although grown in the same field. To investigate the causes, symptomatic leaves were collected and analysed in the laboratory by isolating pathogens on agar media. Molecular identification was carried out by sequencing fragments of the internal transcribed spacer (ITS), β -tubulin (TUB2) genes or 16S regions. The analyses consistently identified *Neophloeospora maculans* (syn. *Mycosphaerella mori*) as the principal causal agent, although other fungi (*Colletotrichum* sp., *Cercospora* sp.) and bacteria (*Pseudomonas* spp.) were also found. Variability in disease incidence among trees suggests a degree of differential susceptibility, possibly linked to genetic differences, even though the exact cultivar identity of each specimen remains uncertain due to their origin from historical, unregistered local selections. These findings provide new insight into the phytosanitary status of the remaining mulberry population in Apulia and raise important questions about the genetic diversity and potential resilience of these neglected genotypes. Further research is needed to better characterise the aetiological agents, assess resistance mechanisms, and explore the reintroduction of mulberry into multifunctional farming systems. Preserving this residual germplasm could support the broader conservation of an underutilised yet valuable tree species.

Keywords: *Morus alba* L.; *Neophloeospora maculans*; Pathogen isolation; Phytosanitary assessment



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Pomological Characters of 54 Hybrid Pomegranate Genotypes in Mersin Ecological Conditions

C. Yilmaz¹, M. Yilmaz², I. Canan³, O. Gülsen⁴, A. Uzun⁴, H. Pinar⁴, A.I. Özgüven⁵, V. Aras⁶

¹*Eskisehir Osmangazi University, Agricultural Faculty, Horticultural Department, 26160, Eskisehir, Turkey*

²*Ordu University, Agricultural Faculty, Horticultural Department, Ordu, Turkey*

³*Bolu Abant izzet Baysal University, Agricultural Faculty, Horticultural Department, Bolu, Turkey*

⁴*Erciyes University, Agricultural Faculty, Horticultural Department, Kayseri, Turkey*

⁵*Cyprus International University, Faculty of Agricultural Sciences and Tech., Nicosia, Cyprus*

⁶*Alata Horticultural Research Institute, Mersin Erdemli, Turkey*

Abstract

In this study, pomological characteristics of 54 pomegranate types obtained and selected as a result of selfing and crossbreeding of Hicaznar, Fellahyemez and Ernar varieties were determined in Mersin-Erdemli ecological conditions. The study was carried out in the Alata Horticultural Research Institute, Erdemli, Mersin. The trees in the experimental plot were planted at a 5×3 m distance and irrigated and fertilised with a drip irrigation system. The trees were shaped as 2-3 trunks. In the experiment, fruit weight, fruit width and length, calyx diameter and length, 100-aril weight, aril yield, juice yield, rind and seed colour, rind thickness, seed hardness, taste, TSS and acidity values of pomegranate types were measured. Fruit characteristics of hybrid types in Mersin ecology showed great variation. According to the obtained data, the heaviest fruits were determined in Onurnar 5 type, the widest fruits in Antalyanar 17 type, the longest fruits in Canernar 6 type, the highest rind thickness in Hicranar 4 type, the highest fruit aril and juice yield in 20/138 type and the highest 100 aril weight in 19/147 pomegranate type.

Keywords: Pomegranate; genotypes; hybrid; mersin



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

**Immature prickly pear fruits, from waste product to valuable resource:
compositional features and bioprospecting**

L. Siracusa¹, L. Pulvirenti¹, I. Natelova¹, F. Zappalà¹, B. Tomasello², G. Modica², A. Continella², A. Marrazzo², F. Attanasio¹

¹CNR, Via Paolo Gaifami, 18, 95126 Catania (Catania), Italy

²University of Catania, Via Valdisavoia, 5, 95123 Catania (Catania), Italy

Abstract

Opuntia ficus-indica, commonly known as prickly pear, is a succulent plant belonging to the Cactaceae family, native to Mexico but widely cultivated in Mediterranean regions, including Sicily. The plant is characterised by flattened cladodes covered with spines and edible fruits, known for their juicy pulp and health-promoting properties. The agronomic practice of "scozzolamento" (removal of some fruits at early ripening stages) generates significant quantities of immature fruits, which are considered agro-industrial residues and are typically disposed of in landfills. As a part of our research on the up-cycling of fruit thinning products as pre-harvest waste, this study focuses on the valorisation of this underexplored and previously uninvestigated waste through its compositional characterisation and biological validation (bioprospecting). The main objectives include the identification of specialised metabolites present in the peel and pulp of the immature "sanguigna" (red) variety fruits, a preliminary study of their oligo- and polysaccharide profiles, and the evaluation of their bioactive potential as antioxidants and in promoting wound healing. The cladodes (pads) of the same plant, a more extensively studied matrix, were used as a reference. The results revealed a diverse and rich composition of secondary metabolites and moderate molecular weight polysaccharides, as well as promising biological activities, supporting the hypothesis that these agricultural by-products represent a valuable source of innovative natural ingredients for the cosmetic and pharmaceutical industries. This approach is further enhanced by the integration of circular economy principles.

Keywords: *Opuntia ficus indica*; fruit thinning; specialized metabolites; biological activities



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Phenolic compounds in leaves, flowers, and fruits of pomegranates from Mexico

Y.L. Contreras-Ornelas¹, M.C. Castañeda-Saucedo¹, E. Tapia-Campos², J.P. Ramírez-Anaya¹, E.H. Valdez-Miramontes¹, M.K. Amezcua-Lujan¹

¹Centro Universitario del Sur, Universidad de Guadalajara, Ciudad Guzmán, Jalisco, México

²Centro de Investigación y Asistencia en Tecnología y Diseño del Estado de Jalisco (CIATEJ) A.C, Guadalajara, México

Abstract

Pomegranate (*Punica granatum* L.) is recognised for its remarkable biological activity and is considered a superfruit due to its organoleptic and nutraceutical attributes. These properties are primarily associated with its high content of bio-functional compounds, which confer antioxidant activity with pharmacological potential. This study aimed to evaluate antioxidant capacity (AC) using ABTS, DPPH, and FRAP assays, as well as total anthocyanin content (TAC, expressed as cyanidin-3-glucoside equivalents, C3GE mg/100 g) and total phenolic content (TPC) in flowers and leaves of five pomegranate varieties [Apaseo (sweet), Chichona (sour), Tecozautla (sweet), Verde (sour), and Wonderful (sweet–sour)]. Combined analysis of flowers and leaves showed that the Apaseo variety exhibited significantly higher TPC (512.30 mg GAE/g), AC by ABTS (232.51 mM ET/kg), and DPPH (192.59 mM ET/kg). In contrast, Tecozautla recorded the highest FRAP value (24.32 mM ET/kg). TAC ranged from 22.061 to 106.444 mg C3GE/100 g in Tecozautla and Wonderful, respectively. When organs were analysed independently, flowers consistently displayed higher TPC (433.96 mg GAE/g vs. 268.04 mg GAE/g), TAC (114.534 vs. 5.354 mg C3GE/100 g), ABTS (203.72 vs. 94.43 mM ET/kg), and DPPH (146.898 vs. 85.419 mM ET/kg) than leaves. The Apaseo flowers had the highest TPC (779.69 mg GAE/g) and AC by ABTS (361.33 mM ET/kg) and DPPH (290.71 mM ET/kg). In terms of anthocyanins, Wonderful flowers presented the maximum value (204.190 mg C3GE/100 g). In conclusion, the Apaseo variety stands out for its high levels of bio-functional compounds, while flowers generally provide superior phenolic, anthocyanin, and antioxidant profiles compared with leaves.

Keywords: phenolics, ABTS, FRAP, DPPH, anthocyanins



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Pomegranate cocktail of Wonderful variety: Phenolic content, antioxidant capacity, microbial safety and quality evaluation of pasteurized and turbid beverages.

J.P. Ramírez-Anaya¹, G. Jazo-Ochoa², M.C. Castañeda-Saucedo², E.H. Valdez-Miramontes², E. Tapia-Campos³, A. Sepúlveda-Montes², R.A. Mojica-Conteras⁴

¹*Departamento de Ciencias Computacionales e Innovación Tecnológica, Centro Universitario del Sur, Universidad de Guadalajara, Ciudad Guzmán, Jalisco, Mexico*

²*Departamento de Ciencias de la Naturaleza, Centro Universitario del Sur, Universidad de Guadalajara, Ciudad Guzmán, Jalisco, Mexico*

³*Centro de Investigación y Asistencia en Tecnología y Diseño del Estado de Jalisco, Guadalajara, Jalisco, Mexico*

⁴*Instituto Tecnológico Superior de Tamazula de Gordiano, Tamazula de Gordiano, Jalisco, Mexico*

Abstract

“Ponche de granada” is a beverage made with the juice of the variety Wonderful pomegranate. It is a highly valued Mexican cocktail with growing international demand, highlighting the need to enhance its stability and consumer appeal based on visual appearance and biofunctional properties. This study addressed the effect of shelf days (SD), pasteurization (P), and turbidity and sediment removal through filtration (F), on some biofunctional parameters, microbial safety, physicochemical properties, and sensorial quality of “Ponche de granada” in five dates (0, 30, 60, 90, and 120 SD) at ambient conditions. No growth of aerobic mesophilic bacteria, total coliforms, moulds, and yeasts was observed. The titratable acidity (1.44 ± 0.09 g CA/100 mL) and pH (3.06 ± 0.05) remained unchanged according to the SD, pasteurization or filtration treatments, while the alcohol content decreased from 16 to 13% Alc. Vol. without surpassing normative limits (12% Alc. Vol.); contrary, total soluble solids increased (33.68 ± 0.48 to 36.4 ± 0.5 °Bx) over time ($p < 0.05$), being the pasteurized and filtered beverage the most concentrated. Along SD, L^* , a^* , and chroma parameters decreased concurrently with an increase in b^* and hue, with lower values observed when filtration was applied ($p < 0.05$). Filtered beverages were yellowish-red while non-filtered were violet-red. According to SD, the phenolic content increased from 90 SD ($p < 0.05$) and the antioxidant capacity (ABTS) from 0 SD, while the DPPH values decreased continuously until the end. A reduction effect of filtration was observed in the TPC and antioxidant capacity. For non-filtered beverages, the frequency of “Like” responses decreased from 90 SD and 60 SD in pasteurized and non-pasteurized samples, respectively. In the filtered beverages, a decline from 30 SD was observed. Although filtration avoided turbidity and sediment formation, it reduced the functional and sensory quality, resulting in the pasteurized and non-filtered drink being the recommended option.

Keywords: cocktail; *Punic-granatum*; shelf life; antioxidants; alcoholic drink; CIELab





VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Morphological diversity of carob germplasm in Croatia

M. Radunic¹, D.I. Zeravica², J. Rosin¹

¹Institute for Adriatic Crops, Put Duilova 11, 21 000 Split, Croatia

²University of Dubrovnik, Department for Mediterranean Plants, Marka Marojice 4, 20000 Dubrovnik, Croatia

Abstract

Carob (*Ceratonia siliqua* L.), along with olive, grape, fig and almond, is a recognisable part of the landscape in the southern part of the Republic of Croatia. The carob pod became very popular and used in fresh form and as an industrial crop, but no local carob cultivar was selected for cultivation. On the islands of central and southern Dalmatia, the 16 most interesting accessions were selected based on visual observations. The leaves, inflorescences and pods were collected and described according to IPGRI descriptors. Significant variability in morphological characteristics was determined. The length of the leaf stalk varied from 9.7 to 18.9 cm, with 7-9 leaflets. Leaflets' length and width varied from 4.08 to 7.31 cm and from 2.88 to 4.54 cm, respectively. In all accessions, the inflorescences were female, but they differed in length and number of pistils (from 3.64 to 11.95 cm and from 18 to 58, respectively). Pod weight varied too, from 13.33 to 57.72 g with 9-15 seeds per pod; pod length varied from 13.11 to 25.09 cm; width from 1.12 to 3.3 cm, while pod thickness varied from 0.75 to 1.26 cm. Research should be continued on determining the chemical parameters of carob flour quality, and genetic research should be conducted. Representative accessions will be grafted and planted in the carob collection orchard at the Institute for Adriatic Crops and Karst Reclamation Split, and will represent the national carob gene pool as a base for future research.

Keywords: *Ceratonia siliqua* L.; indigenous; genetics resources; morphology



**VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE**
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Fig germplasm collection at the Institute for Adriatic Crops Split, Croatia

M. Radunic, M. Carija, K. Hancevic, E. Gasi, T. Radic, J. Rosin

Inst. for Adriatic Crops, Put Duilova 11, 21 000 Split, Croatia

Abstract

The fig tree is a fruit species widely distributed throughout the Adriatic coast of Croatia. Despite its importance in the Mediterranean diet, the Croatian fig cultivars have not yet been thoroughly investigated. Within the National Program “Plant Genetic Resources for Food and Agriculture in Croatia” plant material from the Middle and South Dalmatia region of Croatia was collected, rooted and planted in a collection orchard at the Institute for Adriatic Crops, Split. Molecular characterisation of 75 fig accessions was conducted to assess genotype-specific molecular profiles and genetic diversity using seven Simple Sequence Repeat (SSR) markers, while morphological characteristics were described according to IPGRI fig descriptors. Additionally, viral sanitary status was molecularly assayed following five viruses (fig mosaic virus-FMV, fig leaf mottle-associated virus-FLMaV-2, fig fleck-associated virus-FFkaV, fig mild mottle-associated virus-FMMaV and fig badnavirus-FBV-1). The aim of this research was to catalogue cultivars and clarify cases of synonymy and homonymy, and to determine the incidence of viral infection. The analysis revealed moderate to high genetic diversity with 4 to 9 unique alleles per marker. A total of 27 unique genotypes were identified with frequent cases of synonymy, and 13 accessions with unknown nomenclature. Morphological characteristics of fruit also showed great differences between genotypes. Only two genotypes have two crops during the year. Differences were found in fruit size and shape, skin and flesh colour, ostiole size, peeling and cracking of the fruit skin, and fruit taste. No virus-free samples were detected. The most abundant virus was FBV-1, present in every fig tree, followed by FMV (present in 55%) and FLMaV-2 (45%). All trees older than 8 years showed leaf variegation symptoms or chlorosis, and in severe cases, poor leaf and fruit development. Younger trees, although also infected, were without symptoms. Molecular profiles, morphological properties and viral status provide a foundation for more effective management of fig cultivars.

Keywords: *Ficus carica* L., genetics resources, morphology, SSR markers, virus infections



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

From sweet to sour: a colourful journey through pomegranate juice chemistry

M. Radunic¹, M.V. Bratincevic¹, I.G. Mekinic², M. Popovic¹

¹*Inst. for Adriatic Crops, Put Duilova 11, 21 000 Split, Croatia*

²*University of Split, Faculty of Chemistry and Technology, Rudera Boskovicica 35, 21000 Split, Croatia*

Abstract

Pomegranate juice, valued for its health-promoting phytochemicals and vibrant red colour, appeals to a wide range of consumer tastes, from sweet to sour. This study compares sweet, sour, and sweet-sour blend pomegranate juices, focusing on their physicochemical and phytochemical characteristics. Total phenolics, anthocyanins, and tannins were determined spectrophotometrically. Individual phenolic acids and anthocyanins were analysed by HPLC-UV/VIS, while volatile compounds were detected using SPME-GC/MS. The sweet juice had the highest TSS/TA ratio (20.15), indicating pronounced sweetness (17.57 °Brix; TA = 0.87%), with the lowest tannin concentration (6.8 mg CE/L), resulting in a milder taste. The sour juice exhibited the highest total acidity (2.28%) and significantly higher tannin content (38.8 mg CE/L), contributing to greater astringency but lower consumer acceptability. It also had a darker colour ($L^* = 21.42$) and lower red ($a^* = 6.503$) values. The sweet-sour sample, with the best balance of sugars and acids (TSS/TA = 10.50), had the highest brightness ($L^* = 21.97$) and more pronounced red ($a^* = 7.723$) and yellow ($b^* = 4.240$) components. It stood out due to the highest bioactive compounds: total phenolics (363.4 mg GAE/L), total anthocyanins (343.1 mg C-3-g/L), and key anthocyanins like cyanidin 3,5-diglucoside (44.75 mg/L). Additionally, the sweet-sour juice contained the highest levels of phenolic acids, such as gallic acid (11.55 mg/L), chlorogenic acid (6.49 mg/L), and caffeic acid (11.75 mg/L), along with (*Z*)-3-Hexen-1-ol (25.66%) and 1-hexanol (47.56%), contributing to its fresh, fruity aroma. The sweet-sour juice is the most balanced in chemical composition, visual appeal, and aroma, making it ideal for functional product development. These findings offer insights for creating functional pomegranate beverages that appeal to a wide consumer base and support the pomegranate juice valorisation in various industries.

Keywords: pomegranate juice; bioactive compounds; physico-chemical properties; anthocyanins; phenolic acids; volatiles



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Pomegranate footprints: Myth and History of an iconic fruit in the Mediterranean area

S. La Malfa, D. Romano

University of Catania, Via S. Sofia 100, 95123 Catania, Italy

Abstract

The paper aims to explore some of the most important myths and symbols associated with the pomegranate in the Mediterranean region. Throughout antiquity, this fruit has been considered as a divine gift, for its numerous evocative characteristics: its squat shape, often with a pointed or crowned tip, symbolises power; the bright red colour of its juice is renowned for its healing properties; and the countless seeds signify fertility. The use of the pomegranate in the Mediterranean can be traced back to ancient cultures, predating both the Greeks and Romans. In Egypt, Cyprus, and Palestine, the pomegranate appears in various textual and iconographic sources. The oldest reference to the pomegranate in the Bible is found in the Book of Exodus, where it is mentioned as a decorative motif in ministerial robes. Additionally, pomegranate is listed among the fruit-bearing plants of the Promised Land in the Book of Deuteronomy. It is also hypothesised that the pomegranate could be the "forbidden fruit" of Eden. In the 2nd millennium BC, the pomegranate was valued as an exotic fruit, traded as a luxury item. Simultaneously, it held significant symbolic meaning in sacred contexts. This symbolism was transmitted to Greek culture at the beginning of the 1st millennium BC. In the garden of the palace of Alcinous, king of the Phaeacians, the pomegranate was one of the continuous-bearing fruit trees. Pomegranate was regarded as a divine fruit of the Underworld in the myth of Demeter and Persephone/Kore. The Phoenicians and Carthaginians contributed to its dissemination and conveyed the traditional Eastern symbolic meanings and uses to the West. They also integrated Eastern themes with meanings from the Aegean and Greek worlds. Consequently, the pomegranate became a symbol of prosperity and power, a significance still relevant. Pomegranate is also featured in Christian iconography, as evidenced in Botticelli's painting "Madonna della Melagrana".

Keywords: Punicaceae; symbolism; heritage; religion; fruit



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

**Physiological responses of four pomegranate cultivars (*Punica granatum* L.)
under water stress**

M. Di Guardo¹, G. Modica¹, F. Arcidiacono¹, D. Costantino², S. La Malfa¹, A. Continella¹

¹University of Catania, Via S. Sofia 100, 95123 Catania, Italy

²Corso Savoia 100, Acireale, Italy

Abstract

The Mediterranean basin is one of the regions most affected by water scarcity. Plants adapt to drought conditions through physiological, biochemical and morphological strategies. Pomegranate (*Punica granatum* L.) is considered an alternative crop for farmers transitioning from traditional options due to its adaptability to a wide range of soil and climate conditions. However, its tolerance to water stress is highly genotype-dependent. For this reason, the aim of this study was to investigate the response of different pomegranate cultivars cultivated in pots subjected to 70% and 50% of field capacity (FC) for 50 days compared to the control. The genotypes under study were: a Sicilian selection named Etna, Acco, originally from Israel, Mollar de Elche and Valenciana, appreciated Spanish cultivars for their intense sweetness. Etna and Valenciana exhibited their sensitivity to water stress as 30% and 29% of the plants, respectively, died at 50% FC; the latter showed the highest decrease in leaf potential compared to the control. Acco maintained plant water status and leaf gas exchange values similar to the control. Additionally, Etna plants showed an increase in transpiration rate (E) at T50, while Mollar and Valenciana reduced E values.

Keywords: Drought stress; gas exchanges; leaf water potential



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Postharvest strategies to extend the commercial life of 'Wonderful' pomegranate fruit through chilling injury alleviation and modified atmosphere packaging

A.F. Najafabadi¹, L. Russo¹, D. Fatchurrahman¹, D. Cortés Montaña², M.L. Amodio¹, G. Colelli¹

¹*Dipartimento di Scienze Agrarie, Università di Foggia, Via Napoli 25, Foggia, Italy*

²*Centro de investigación científica, y tecnológica de Extremadura, Badajoz, Spain*

Abstract

The long-term storage of pomegranate cv. Wonderful is largely constrained by its susceptibility to chilling injury (CI). This study aimed to optimize postharvest handling strategies by reducing CI sensitivity and improving storage conditions to extend the fruit's commercial shelf life (SL). Two experimental lines were conducted during the study. Line 1 investigated the effectiveness of various postharvest elicitors such as methyl jasmonate (5 mM), salicylic acid (2 mM), oxalic acid (2 mM), and putrescine (6 mM) on fruit stored under chilling temperature (2 °C) for 30, 60, 90, and 120 days. After each storage period, the fruit was transferred to room temperature for a 3-day SL simulation. Line 2 evaluated a commercial-scale storage solution using active Modified Atmosphere Packaging (MAP) at 4 °C with polyethylene bags, combined with the most effective elicitor identified in line 1. Results from line 1 showed that fruit treated with oxalic acid exhibited the lowest CI throughout cold storage (0%) and SL periods (0% after 30, 60, and 90 days; <5% after 120 days). These fruits also had the lowest electrolyte leakage (<17%) after 30, 60, 90, and 120 days of storage, followed by a 3-day SL. In line 2, oxalic acid-treated pomegranates stored in MAP showed minimal CI during storage. In conclusion, 2 mM oxalic acid combined with MAP may contribute to reduce CI and preserves pomegranate fruit quality during extended cold storage, securing better quality of fresh fruit for commercial application.

Keywords: quality; damage; electrolyte leakage; cold storage; elicitors



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

**Carbon sequestration in traditional, high-density, and super high-density fig
(*Ficus carica* L.) production systems in Extremadura (Spain)**

A.J. Galán Jiménez¹, J.R. Marqués da Silva², M. Lopez-Corrales¹

¹Fruticultura, Finca la Orden - Valdesequera CICYTEX , Autovía Madrid-Lisboa, sn, 06187, Guadajira, Badajoz

²Department of Rural Engineering, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

Abstract

In the current context of climate change and greenhouse gas emissions, the fig tree (*Ficus carica* L.) plantations can remove CO₂ from the atmosphere and store it stably in their biomass (trunk, branches, roots). This study was carried out in the Autonomous Community of Extremadura (Southwestern Spain), one of the main fig production areas in the European Union, to evaluate the carbon storage potential of different orchard management systems: traditional (rainfed, 204 trees/ha), high density (irrigated, 400 trees/ha) and super-high density (irrigated, 1,200 trees/ha). In each plot, three areas were sampled depending on the vigour of the fig trees (optimal, medium and low development). Biomass estimation was carried out by calculating the volume (m³) of the fig trees and determining wood density (kg/m³) in each plantation. The volume of the aboveground biomass was estimated by measuring the length and perimeter of the trunk and branches, modelling them as cylindrical sections. Belowground biomass was estimated proportionally, based on established root-to-shoot ratios derived from previous studies. Wood density was determined by oven-drying the samples, weighing them, and calculating their volume via water displacement. Total carbon content (g/100 g) in fig wood was analysed using a Thermo Finnigan 1112 EA elemental analyser. Results showed variability within each plot depending on tree vigour. At the system level, the high-density orchard stored the most CO₂, with an average annual rate of 2.89 ton CO₂eq/ha, followed by the super high-density system with 2.55 ton CO₂eq/ha, and the traditional system with 1.74 ton CO₂eq/ha. The data will contribute to carbon footprint assessments and support the calibration of remote sensing tools for large-scale, non-destructive estimation of carbon stocks. Including carbon sequestration rates of fig plantations may enhance the environmental value of Mediterranean fruit crops and improve the accuracy of sustainability metrics and eco-labelling for agricultural products.

Keywords: Fig tree; carbon stocks; biomass estimation; orchard management



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Impact of pruning intensity on agronomic performance and fruit quality of 'De Rey' fig trees in Extremadura

M. Lopez-Corrales¹, A.J. Galan Jiménez¹, M.G. Domínguez Yagüe¹, M.C. Parra², A.M. Montero de Espinosa Pérez¹, F. Pérez Gragera¹

¹Area de Fruticultura, Finca La Orden - Valdesequera CICYTEX, A5 km 372 , 06187 Badajoz Guadajira, Spai

²Cultivos Extensivos, Finca La Orden - Valdesequera CICYTEX, A5 km 372 , 06187 Badajoz Guadajira, Spain

Abstract

In recent years, the market for fresh figs has experienced remarkable growth, driven by the increasing demand for healthy and nutritious fruits. Spain is the leading producer in the European Union, with the region of Extremadura concentrating more than 55% of the cultivated area with 12,800 ha. Many fig varieties are produced in this area, among which 'De Rey' stands out for its fresh consumption due to the organoleptic quality of its fruit. Fig trees of this variety, characterised by their vigour and limited branching, generally have low productivity. This study evaluated the agronomic and fruit quality performance of fig trees of the variety De Rey pruned with different intensities. For this purpose, from 2018 to 2020, three different pruning treatments were carried out on fig trees arranged in an intensive (5×4 m) system with irrigation, leaving 9, 6 and 3 buds per cane. The agronomic parameters determined were annual yield, trunk cross-sectional area (TCSA), and yield efficiency. The pruning treatment with 9 buds per branch showed a higher average production yield than the treatment with 3 buds per branch, with 11.6 kg/tree values and 5.8 kg/tree, respectively, in 2020. Furthermore, the fruits from the 9-bud treatment exhibited the highest average weight among the three treatments, reaching 37.3 g, and had the highest average size at 38.5 mm. These results highlight the importance of pruning intensity in enhancing yield and fruit quality, offering valuable insights for optimising 'De Rey' fig production.

Keywords: *Ficus carica* L.; pruning intensity; intensive cultivation; Mediterranean fruit crops; fresh figs



VI INTERNATIONAL SYMPOSIUM
ON POMEGRANATE
and Minor Mediterranean Fruits
BARI , ITALY 22-25 SEPTEMBER 2025

Exogenous application of abscisic acid by foliar spraying on *Ficus carica* L.: on-tree ripening monitoring until commercial harvest

M.J. Serradilla¹, C. Moraga-Lozano¹, M. Palomino-Vasco¹, A.M. Fernández-León¹, B. Velardo-Micharet¹, M. López-Corrales¹, A. Rodríguez²

¹CICYTEX, Avd. Adolfo Suárez sn, 06007 Badajoz , Spain

²UEX, Avda. Adolfo Suárez sn, 06007 Badajoz, Spain

Abstract

Figs are an infructescence called a syconium, known for their appetising taste and high nutritional value. Their development and growth are divided into three phases, and ripening is a dual mechanism depending on abscisic acid (ABA) (non-climacteric part) and ethylene (climacteric part). In addition, figs have the disadvantage of not ripening simultaneously on the same shoot, which makes harvesting difficult. ABA has been extensively documented to affect ethylene production, ripening, and senescence processes. Moreover, it can stimulate adaptive responses to abiotic stress. On-tree ABA application in figs via the ostiole has been shown to stimulate growth and homogenise fruit ripening, thus facilitating harvesting. Therefore, this work aimed to study the effect of exogenous applications of ABA on fig ripening. For this purpose, during the 2024 season, under super-intensive conditions, two and three ABA applications (one per week) in two concentrations (2.27 and 2.84 mM) were carried out via foliar application on the 'Calabacita' cultivar once most fruits had physiological maturity. Fruits were monitored for colour, size, and chlorophyll index as they ripened on the tree. It was observed that ABA treatments improved colour, obtaining tones more associated with ripe fruit. In addition, fruit size increased with both treatments, especially ABA 2.27 mM. Fruits were also analysed after treatment with 2 or 3 applications at commercial harvest. In general, fruits that received two applications of ABA were less ripe, greener in colour, firmer, and had higher moisture content and titratable acidity. On the other hand, fruits with three applications showed a higher ripening index. Treatment-related variations in colour characteristics were noted in comparison to the control batch. Treated fruits also had lower firmness but a higher weight, size, and chlorophyll index. Consequently, ABA exhibits promising results as a preharvest treatment to modulate fig fruit ripening.

Keywords: Preharvest treatment; on-tree monitoring; fruit maturity; DA-meter; fruit quality



VI INTERNATIONAL SYMPOSIUM ON POMEGRANATE

and Minor Mediterranean Fruits

BARI , ITALY 22-25 SEPTEMBER 2025



www.pomsym2025.com

info@pomsym2025.com

+39 080 4035496

