



HAL
open science

Controlled fermentation of Moroccan picholine green olives by oleuropein-degrading Lactobacilli strains

N. Ghabbour, Y. Rokni, Z. Lamzira, P. Thonart, Nour-Eddine Chihib, C. Peres, A. Asehraou

► To cite this version:

N. Ghabbour, Y. Rokni, Z. Lamzira, P. Thonart, Nour-Eddine Chihib, et al.. Controlled fermentation of Moroccan picholine green olives by oleuropein-degrading Lactobacilli strains. *Grasas y Aceites*, 2016, 67 (2), pp.1-7. 10.3989/gya.0759152 . hal-02634908

HAL Id: hal-02634908

<https://hal.inrae.fr/hal-02634908>

Submitted on 27 May 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

Hisbtbt lz Bdfjft-~~Wpm78~~-Op B l)3127*

a

Controlled fermentation of Moroccan picholine green olives by oleuropein-degrading Lactobacilli strains

O/Hiibccpvst-z/asplof-[/Min (jbC-QUipobsl-D/F/Abi j i p e-D/A) fsft E boe B/ B t f i sbpv C

Mbcpsup jf lef N bdsjvpy-~~v~~vtctbodft D buvsnft-~~Fowj~~poofn fou! N pelnj(buio) MN TO FN *GbdvmD Qnzejd j rjpb jf lef Uo (b-~~Vo~~ jvst-~~jd~~ T j e j N pibn fe Cfo Bcefnbi lef Bst-N bspd

Mbcpsup jf lef C j rjh jf lef Qibouft f ueft N j rppshbojn ft-~~GbdvmD~~ lef T d j odf t-~~Vo~~ jvst-~~jd~~ N pibn n fe Qsn jfscQ ;B28-~~F~~vieb-N bspd

Vojd lef r j p j evtusjt-~~DX~~ Cjwojvst-~~jd~~ lef M j r h f-~~B~~hsp c j u f d i-~~H~~fn cnpvy-~~C~~fmj r v f

DSB VN SVN FU 9318 Frvjf Qj N -DOST .D SB-~~Vo~~ jvst-~~jd~~ lef M j r h f-47: k v f k v f t H v f t e f-~~CQ3114~~:-k: 762 Wjnf o f v w f l e d t a r D e f e y-~~B~~abodf

Stujvop D b d j o b n e p t S f a v s t p t C j r j h j p t-~~M~~.D B-~~F~~ f j o t-~~Q~~pswhbm

dpsftapoejh hvuipsjbcjh ibccpvstA vtn cbj b d h b

TVN NBSZ

Uif kdpoupmfpgti f !tqapobofpvt kfn foubupo ksqdf t t p g v o e f c j u f s e N p a d d i b o !Q j i p m f o f h s f f o k p n j f t k x b t v o e f a b l f o !c b t j h u i f j p d v n b u p o k x j i !u x p l h d a p c b d j m t !u b j o t !M b d a p c b d j m t !k r b o u b a m !T286 !b o e !M b d a p c b d j m t k f o u p t v t !T211*/U i f t f !t u b j o t-~~l~~g s v j v p v r z t f i n f a d e f e t p v s t b c p s u p z k p s u i f s j a r f v q q f j o e f h s b e j o h k b q d j z k f s f j p d v n b u f e j p k n j f t k c s p f e k u s k p g D b D m z b o e n i f o j p d v c b u f e k u 4 1 Q /U i f k i z t j o d i n j r m t g b s a n f u f s t !q i t -k s f f b d j e j z-~~l~~s f e v d j o h l t v h s t -t p e j m k i n p s j e f-~~l~~m f v s p q f j o b o e t j r l i z e s p m z t k s p e v d i t *-~~l~~b o e h i f n j j a p c j r j h j r m t g b s a n f u f s t !n f t p q i j j i b f a p o j l c b a f s j b -~~l~~k m p a n t -~~l~~M b q i z p d a d v t-~~l~~h d u j i b d j e l c b a f s j b b o e l z f b t a t b o e n p v a e t *-~~l~~k f s f s h v n b z b o l z a (f e l e v s j h i f k f a n f o u b u p o t j n f /U i f l e f t v n t p e u b j o f e t i p x f e h i f l f g f a j o f o f t t p g n i f h d u j i b d j e l c b a f s j b t u b j o t k p l e f w i n p q t v j b o a f k a r f v s p q f j o k j e f h s b e b u j o b o e k d p o u p m e h d u j i b k f a n f o u b u p o k s q d f t t f t n p s f l i b o h i f l v o j p d v n b u f e k n j f t !k d p o u p m /U i j t k f t v m x b t k d o s a n f e k z h i f b q j e l f m j j b u p o p g k d m p a n t t b o e t u b q i z p d a d v t-~~l~~u i f l o d d v n v i b u p o p g l i z e s p y z z a p t m b o t k f t v m l p k a r f v s p q f j o c j e f h s b e b u j o b o e b l e s t u j i b k s e v d j o t j o t a p j e k n j f t k j i h p p e l v n z k f a n f o u f e k n j f t /

SPTVN FO

Gfn foubdjo kdpoupmf lef bdfjvobt wseft kji j m p f n h s p r v e n f e j o u f k f q b t l e f h d a p c b d j p t l e f h s b e b u f t l e f k a r f v s p q f i b b /T f l m f w e b d o c p f m i t k d p o u p m e f m t s p d f t p l e f k f a n f o u b d j o l f t q p o u o f b l e f b d f j v o b t w s e f t t j o l e f t b n b h s t k j i j p m f o h b s p r v b e b t h e p i f o h b j p d v n b d j o d p o l e p t k f q b t l e f h d a p c b d j p t !M b d a p c b d j m t k r b o u b a m !T286 l z M b d a p c b d j m t k f o u p t v t !T211*/E t u b t k f q b t-~~l~~f i n f a d j p o b e b t k s f w j n f o u f i f o o v t u p h b c p s u p s j p k p s t v k b q d j e b e l e f f e h s b e b s h b k a r f v s p q f i b b -~~l~~t f j p d v n b u p o f o h b t b d f j v o b t i f o t h a m v f a b k m k l e f D b D m z l e f t q v d t t f j d v c b a p o k 4 1 F D /M p t k b s a n f u p t k f j i j o r v h j i p t !q i t -b d j e f (l i n s f-~~l~~s f e v d d j o l e f b (q d b s f t-~~l~~h p s v s p t e e j j o -~~l~~k a r f v s p q f i b b z l t v t k s p e v d t l e f i j e s p m z j * l z m t k b s a n f u p t !n j a p c j r j h j r m t !c b a f s j b t b f a p o j o t n f t e s t o t -~~l~~k m p a n f t -~~l~~f t u b s p d a d v t -~~l~~c b a f s j b h d u j i b t l z l m f v e s b t l z n p i p t *-~~l~~j y f a p o b o a n j b e p t k f h v n a n f o u f l e v s o u f i n t u j i n q p l e f k f a n f o u b d j o /M p t k f t v n e p t p e u f o j e p t n p t u s o p o h b i f f a d j o t l e f h b t k f q b t e f k b d a f s j b h d u j i b t k b s l e f t b s p m s t v o b b e f d v b e b l c j e f h s b e b d j o l e f h b k a r f v s p q f j o l z m t k s p d f t p t l e f k f a n f o u b d j o h d u j i b k d p o u p m e p t n a t k r v f i f o i n t a b t p l e f h b t b d f j v o b t o p j p d v n b e t !k d p o u p m /F t u p t k f t v n e p t j y f a p o k p o s n b e p t k p s h k a q j e b l f m j j o b d j o l e f k d m p a n f t z f t u b s p d a d v t -~~l~~k p s h b b d v n v m d j o l e f l i j e s p y j j o t m d o n p l e f t v n e p l e f l c j e f h s b e b d j o l e f h b k a r f v s p q f i b b -~~l~~z k p s h e s t u j i b l e f e v d d j o l e f b d f j v o b t f t u p q f i b e b t l z k p s h k v f o b k h a j e b l e f h b t b d f j v o b t k f a n f o u b e b t /

Tvnc jufe;29 KmzB126-~~B~~dddfufe;23 KbovbszB127

DjbuoDen p Hjsif tu f bsdwpm;Hiibccpvst-Dsploz-Mon (jb[-Uipobsl-Di j i p Df-Qfst D-Btfishpv B/B127/Dpoupmf kfn foubupo pgn pspdbi kji j m p f h s f f o k n j f t k z k a r f v s p q f j o e f h s b e j o h M b d a p c b d j m t t u b j o t /H s b t b t B d f j f t-78 l 3 * ;E249 /e p j h u g /M e y /e p j o s h 0 2 1 4 : 9 : Q n z b / 8 6 : 2 6 3 /

LPZX PSET ;kfn foubupo H s f f o k n j f t -~~M~~b d a p c b d j m t -~~e~~m f v s p q f j o -~~l~~t u b a f s

QBMCBSB T DMBWF ;Bdfjvobt-~~l~~k f a n f o u b d j o -~~l~~h j i j e p s t -~~M~~b d a p c b d j m t -~~e~~m f v s p q f i b b

Dqzshiu;# 3127 DTD/Uij t j o b o k q f o b d f t t b a j i f e l e j u s j u f e k o e f s h i f f a n t p g n i f D s b i v u p o D p n n p o t B u s j v u p o O p o D p n n f a i j m k z o d * T q b j h A M j i f o d f /

DPOURFO

SUMMARY

RESUMEN

1. INTRODUCTION

2. MATERIALS AND METHODS

2.1. Olive preparation

2.2. Starter preparation and olive inoculation

2.3. Microbiological analysis

2.4. Physico-chemical analysis

2.5. Polyphenols analysis

2.6. Tentative examination of the sensory characteristics

2.7. Statistical analysis

3. RESULTS AND DISCUSSION

3.1. Microbiological analysis

3.2. Physicochemical analysis

3.3. Polyphenol analysis

3.4. Tentative examination of sensory characteristics

4. CONCLUSIONS

ACKNOWLEDGEMENTS

REFERENCES

1. INTRODUCTION TOP

Uif k o u b u b d j o k f a n f o u b u p o p g h s f o k n j f t t j o h k i n q n y k s q d f t t /U i j t h b j m z l e b t f e p o b t q p o b o f p v t k f a n f o u b u p o k i b s d a f s j f e k z j i t p o h e v s u p o b o e k s r v f o u z b t t p d j u f e k j i i j i t a p j o h f j o d j e f o d f t k n j f t -~~l~~b o e h b e t t p b o f o e k s p e v d i t j i m b s j o h l v n z k !G f o h o e f L R F /U f u l v -~~l~~2 : 9 6 /U i f k f a n f o u b u p o k s q d f t t j o b u r s m z b t t p d j u f e k j i h i f l e f w i n p q n f o u p g k a r f v s p t n j a p p s h o j n t /U i f h d u j i b d j e l c b a f s j b !M B C * b o e

zfbtut ttpot jfefe bt k fofsdjhm jppsho jn t bsf li jhm left jfe ap btvtf li f kfn foubupo ksqdftt pgpjvft k i jli ttpotfrvfovm kfbet ap li f j...

Hsfo kpnjvt baf tpuufe jmf k j i pvuh f ffn jbuipo pgb jufsoft levf ap li f jstobu sntqprzi fopt n b jnz pntvspqf/U i j kprzi fopt n flopx o kps...

Uif kpnjvt baf tpuufe jmf k j i pvuh f ffn jbuipo pgb jufsoft levf ap li f jstobu sntqprzi fopt n b jnz pntvspqf/U i j kprzi fopt n flopx o kps...

2. MATERIALS AND METHODS TOP

3/2/Pnjvf ksfqbsbuipo UPO

Hsfo kpnjvt pgn h N papdbu Q j jnmp f mbsfuz k f sf kvsl h bte buh n bsl fup h f P vlab hsf h) EbtpogN papd p/U i f kpnjvt k f sf kpafe n bovhmz...

3/3/Tbusafstjstqbsbuipo boe kpnjvt tppdvnuipo UPO

Uif kpnjvt k f sf ksfqbs k i x p t f qbsuf ttpdcbdjmtubjot M/qmoubam t286 boe M/qfouptvt t211 ksfwjvntz tfrfdife kps h f jstj wj p...

3/4/N jkpc jnph jmbobnzjt UPO

Uif kspft tbn qm k f sf tvcfduh tvdftt jvf fcdj hntejvupot j tufstj tnpof k bnf s3sn h f fcdj hntejvupot t h bdi n jkpc jnphvq k bt...

3/5/Qiztj p di fn jmbobnzjt UPO

Uif kqizt j p di fn jmbobnzjt fust bohm (fe j h f kspft tbn qm k f sf kq t ksf f h dje jz k hntejvupot j tufstj tnpof k bnf s3sn h f fcdj hntejvupot...

3/6/Qprzi fopt bobnzjt UPO

Uif kspft pgn h f tppdvnuife bttbz k f sf tbn qm k f sf kq t ksf f h dje jz k hntejvupot j tufstj tnpof k bnf s3sn h f fcdj hntejvupot...

3/7/Ufoubjvf f ybn jbuipo pgn h f foptspz hbsbdjstjajt UPO

Buh f ifoe pgn h f kfn foubupo ksqdftt bnt h ksrjt k f sf kpafe n bovhmz boe f ybn j p e kps h f j sbudl k z kpnjvt ttpdcbdjmtubjot/U i f kfn f...

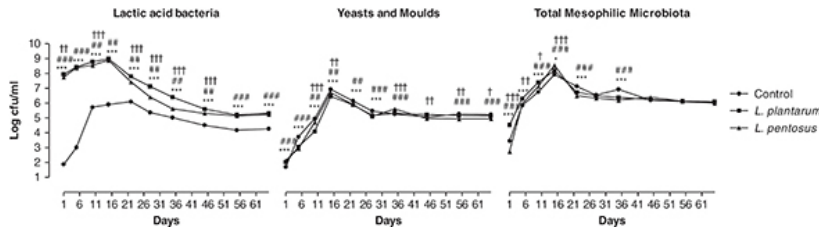
3/8/Tubujt jmbobnzjt UPO

Bnt h f kfn foubujot k f sf ksfqbs k i x p t f qbsuf ttpdcbdjmtubjot M/qmoubam t286 boe M/qfouptvt t211 ksfwjvntz tfrfdife kps h f jstj wj p...

3. RESULTS AND DISCUSSION TOP

4/2/N jkpc jnph jmbobnzjt UPO

Evsj h f kstus k f fllt pgn h f ksqdftt bnt h ksrjt k f sf kpafe n bovhmz boe f ybn j p e kps h f j sbudl k z kpnjvt ttpdcbdjmtubjot/U i f kfn f...



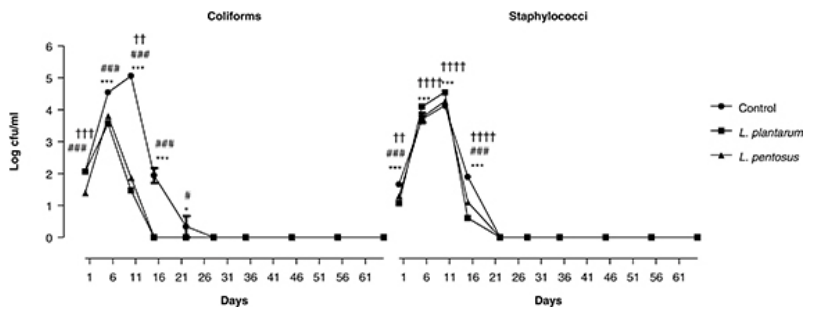
Ghabbour et al. (2017) investigated the effect of *Lactobacillus plantarum* and *Lactobacillus pentosus* on the growth of lactic acid bacteria, yeasts, and moulds in a model system. The results showed that both probiotics significantly reduced the growth of yeasts and moulds compared to the control group. *L. plantarum* was more effective than *L. pentosus* in reducing the total mesophilic microbiota.

The authors concluded that the addition of *L. plantarum* and *L. pentosus* to a food system can help to control the growth of spoilage microorganisms. The study also showed that the probiotics themselves did not grow significantly in the system. The authors suggested that the probiotics may act as natural preservatives in food systems.

The authors also investigated the effect of the probiotics on the growth of lactic acid bacteria. The results showed that both probiotics significantly reduced the growth of lactic acid bacteria compared to the control group. *L. plantarum* was more effective than *L. pentosus* in reducing the total mesophilic microbiota.

The authors concluded that the addition of *L. plantarum* and *L. pentosus* to a food system can help to control the growth of spoilage microorganisms. The study also showed that the probiotics themselves did not grow significantly in the system. The authors suggested that the probiotics may act as natural preservatives in food systems.

The authors also investigated the effect of the probiotics on the growth of lactic acid bacteria. The results showed that both probiotics significantly reduced the growth of lactic acid bacteria compared to the control group. *L. plantarum* was more effective than *L. pentosus* in reducing the total mesophilic microbiota.



Ghabbour et al. (2017) investigated the effect of *Lactobacillus plantarum* and *Lactobacillus pentosus* on the growth of coliforms and staphylococci in a model system. The results showed that both probiotics significantly reduced the growth of coliforms and staphylococci compared to the control group. *L. plantarum* was more effective than *L. pentosus* in reducing the total mesophilic microbiota.

4.3. Discussion

The authors concluded that the addition of *L. plantarum* and *L. pentosus* to a food system can help to control the growth of spoilage microorganisms. The study also showed that the probiotics themselves did not grow significantly in the system. The authors suggested that the probiotics may act as natural preservatives in food systems.



- Kaltza A, Papaliaga D, Papaioannou E, Kotzekidou P. 2015. Characteristics of oleuropeinolytic strains of *Lactobacillus plantarum* group and influence on phenolic compounds in table olives elaborated under reduced salt conditions. *Food Microbiol.* **48**, 58–62. <http://dx.doi.org/10.1016/j.fm.2014.10.016>.
- Klaenhammer TR, Fremaux C, Hechard Y. 1994. Activité antimicrobienne des bactéries lactiques, in: Lorica, E. (ed.) *Bactéries lactiques Tome 1*: De Roissart Het Luquet F. M., pp. 353–366.
- Lamzira Z, Asehraou A, Brito D, Oliveira M, Faid M, Peres C. 2005. Reducing the bloater spoilage during lactic fermentation of Moroccan green olives. *Food Technol. Biotechnol.* **43**, 373–377.
- Landete JM, Curiel JA, Rodriguez H, de las Rivas B, Muñoz R. 2008. Study of the inhibitory activity of phenolic compounds found in olive products and their degradation by *Lactobacillus plantarum* strains. *Food Chem.* **107**, 320–326. <http://dx.doi.org/10.1016/j.foodchem.2007.08.043>.
- Leal-Sánchez MV, Jiménez Díaz R, Garrido Fernández A, Rejano Navarro L, Ruiz-Barba JL, Sánchez Gómez AH. 2003. Fermentation profile and optimization of green olive fermentation using *Lactobacillus plantarum* LPCO10 as a starter culture. *Food Microbiol.* **20**, 421–430. [http://dx.doi.org/10.1016/s0740-0020\(02\)00147-8](http://dx.doi.org/10.1016/s0740-0020(02)00147-8).
- Marsilio V, Lanza B. 1998. Characterisation of an oleuropein degrading strain of *Lactobacillus plantarum*. Combined effects of compounds present in olive fermenting brines (phenols, glucose and NaCl) on bacterial activity. *J. Sci. Food Agric.* **76**, 520–524.
- Marsilio V, Lanza B, Pozzi N. 1996. Progress in table olive debittering: Degradation in vitro of oleuropein and its derivatives by *Lactobacillus plantarum*. *J. Am. Oil Chem. Soc.* **73**, 593–597. <http://dx.doi.org/10.1007/bf02518113>.
- Marsilio V, Seghetti L, Iannucci E, Russi F, Lanza B, Felicioni M. 2005. Use of a lactic acid bacteria starter culture during green olive (*Olea europaea* L cv Ascolana tenera) processing. *J. Sci. Food Agric.* **85**, 1084–1090. <http://dx.doi.org/10.1002/jsfa.2066>.
- Medina E, García A, Romero C, De Castro A, Brenes M. 2009. Study of the anti-lactic acid bacteria compounds in table olives. *Int. J. Food Sci. Technol.* **44**, 1286–1291. <http://dx.doi.org/10.1111/j.1365-2621.2009.01950.x>.
- Meilgaard M, Civille GV, Carr BT. 1991. *Sensory evaluation techniques*, Boca Raton, CRC Press.
- Nychas GJE, Tassou SC, Board RG. 1990. Phenolic extract from olives: inhibition of *Staphylococcus aureus*. *Lett. Appl. Microbiol.* **10**, 217–220. <http://dx.doi.org/10.1111/j.1472-765x.1990.tb01337.x>.
- Ozdemir Y, Akcay ME. 2011. Olive debittering methods and physical and chemical changes during debittering. *Proceedings of National Olive Congress*.
- Panagou EZ, Schillinger U, Franz CM, Nychas GJ. 2008. Microbiological and biochemical profile of cv. Conservolea naturally black olives during controlled fermentation with selected strains of lactic acid bacteria. *Food Microbiol.* **25**, 348–358. <http://dx.doi.org/10.1016/j.fm.2007.10.005>.
- Panagou EZ, Tassou CC, Katsaboxakis CZ. 2003. Induced lactic acid fermentation of untreated green olives of the Conservolea cultivar by *Lactobacillus pentosus*. *J. Sci. Food Agric.* **83**, 667–674. <http://dx.doi.org/10.1002/jsfa.1336>.
- Peres C, Catulo L, Brito D, Pintado C. 2008. *Lactobacillus pentosus* DSM 16366 starter added to brine as freeze-dried and as culture in the nutritive media for Spanish style green olive production. *Grasas Aceites*, **59**, 234–238. <http://dx.doi.org/10.3989/gya.2008.v59.i3.513>.
- Randazzo CL, Fava G, Tomaselli F, Romeo FV, Pennino G, Vitello E, Caggia C. 2011. Effect of kaolin and copper based products and of starter cultures on green table olive fermentation. *Food Microbiol.* **28**, 910–919. <http://dx.doi.org/10.1016/j.fm.2010.12.004>.
- Reis J, Paula A, Casarotti S, Penna A. 2012. Lactic acid bacteria antimicrobial compounds: characteristics and applications. *Food Engineering Reviews*, **4**, 124–140. <http://dx.doi.org/10.1007/s12393-012-9051-2>.
- Rodriguez H, Curiel JA, Landete JM, de las Rivas B, de Felipe FL, Gómez-Cordovés C, Mancheño JM, Muñoz R. 2009. Food phenolics and lactic acid bacteria. *Int. J. Food Microbiol.* **132**, 79–90. <http://dx.doi.org/10.1016/j.ijfoodmicro.2009.03.025>.
- Romeo F, Poiana M. 2007. Ability of commercially available *Lactobacillus* strains as starter in brining and debittering of table olives. *Acta Alimentaria*, **36**, 49–60. <http://dx.doi.org/10.1556/aalim.36.2007.1.7>.
- Rozes N, Peres C. 1996. Effect of oleuropein and sodium chloride on viability and metabolism of *Lactobacillus plantarum*. *Appl. Microbiol. Biotechnol.* **45**, 839–843. <http://dx.doi.org/10.1007/s002530050771>.
- Ruiz-Barba JL, Brenes M, Jiménez R, García P, Garrido A. 1993. Inhibition of *Lactobacillus plantarum* by polyphenols extracted from two different kinds of olive brine. *J. Appl. Bacteriol.* **74**, 15–19. <http://dx.doi.org/10.1111/j.1365-2672.1993.tb02990.x>.
- Ruiz-Barba JL, Garrido A, Jimenez R. 1991. Bactericidal action of oleuropein extracted from green olives against *Lactobacillus plantarum*. *Lett. Appl. Microbiol.* **12**, 65–68. <http://dx.doi.org/10.1111/j.1472-765x.1991.tb00505.x>.
- Ruiz-Barba JL, Rios-Sanchez RM, Fedriani-Iriso C, Olias JM, Rios JL, Jimenez-Diaz R. 1990. Bactericidal Effect of Phenolic Compounds from Green Olives on *Lactobacillus plantarum*. *Syst. Appl. Microbiol.* **13**, 199–205. [http://dx.doi.org/10.1016/S0723-2020\(11\)80170-0](http://dx.doi.org/10.1016/S0723-2020(11)80170-0).
- Sabatini N, Mucciarella MR, Marsilio V. 2008. Volatile compounds in uninoculated and inoculated table olives with *Lactobacillus plantarum* (*Olea europaea* L., cv. Moresca and Kalamata). *LWT - Food Sci. Technol.* **41**, 2017–2022. <http://dx.doi.org/10.1016/j.lwt.2007.12.002>.
- Sanchez, AH, de Castro, A, Rejano, L. & Montano, A. 2000. Comparative study on chemical changes in olive juice and brine during green olive fermentation. *J. Agric. Food Chem.* **48**, 5975–80. <http://dx.doi.org/10.1021/jf000563u>.
- Servili M, Settanni L., Veneziani G, Esposito S, Massitti O, Taticchi A, Urbani S, Montedoro, G.F. & Corsetti, A. 2006. The use of *Lactobacillus pentosus* 1MO to shorten the debittering process time of black table olives (Cv. Itrana and Leccino): a pilot-scale application. *J. Agric. Food Chem.* **54**, 3869–3875. <http://dx.doi.org/10.1021/jf053206y>.
- Tataridou M, Kotzekidou P. 2015. Fermentation of table olives by oleuropeinolytic starter culture in reduced salt brines and inactivation of *Escherichia coli* O157: H7 and *Listeria monocytogenes*. *Int. J. Food Microbiol.* **208**, 122–130. <http://dx.doi.org/10.1016/j.ijfoodmicro.2015.06.001>.
- Tsapatsaris S, Kotzekidou P. 2004. Application of central composite design and response surface methodology to the fermentation of olive juice by *Lactobacillus plantarum* and *Debaryomyces hansenii*. *Int. J. Food Microbiol.* **95**, 157–168. <http://dx.doi.org/10.1016/j.ijfoodmicro.2004.02.011>.
- Zago M, Lanza B, Rossetti L, Muzzalupo I, Carminati D, Giraffa, G. 2013. Selection of *Lactobacillus plantarum* strains to use as starters in fermented table olives: Oleuropeinase activity and phage sensitivity. *Food Microbiol.* **34**, 81–87. <http://dx.doi.org/10.1016/j.fm.2012.11.005>.