

2 February 2016
EMA/HMPC/46757/2015
Committee on Herbal Medicinal Products (HMPC)

List of references supporting the assessment of *Pistacia lentiscus L., resina (mastic)*

Final

The European Medicines Agency acknowledges that copies of the underlying works used to produce this monograph were provided for research only with exclusion of any commercial purpose.

Abdel-Rahman AH Y, Youssef Soad AM. Mastiha as an antioxidant. *J Am Oil chem Soc* 1975, V52(10):423

Aksoy A, Duran N, Koksal F. *In vitro* and *in vivo* antimicrobial effects of mastic chewing gum against *streptococcus mutans* and *mutans streptococci*. *Arch Oral Biol* 2006, 51:476–481

Al-Habbal MJ, Al-Habbal Z, Huwez FU. A double-blind controlled clinical trial of mastic and placebo in the treatment of duodenal ulcer. *Clin Exp Pharmacol Physiol* 1984, 11:541-544

Al-Said MS, Ageel AM, Parmar NS, Tariq M. Evaluation of mastic, a crude drug obtained from *Pistacia lentiscus* for gastric and duodenal ulcer activity. *J Ethnopharmacol* 1986, 15:271-278

Andrikopoulos N, Kaliora A, Assimopoulou A, Papageorgiou V. Biological activity of saliva against *in vitro* LDL oxidation after chewing commercial chewing gums. *Ital J Food Sci* 2002, 3(14):279-290 [Greek]

Andrikopoulos NK, Kaliora AC, Assimopoulou AN, Papageorgiou VP. Biological activity of some naturally occurring resins, gums and pigments against the *in vitro* LDL oxidation. *Phytother Res* 2003, 17:501-507

Assimopoulou AN, Papageorgiou VP. GC-MS analysis of penta-and tetra-cyclic triterpenes from resins of *Pistacia* species. Part I. *Pistacia lentiscus* var. Chia. *Biomed Chromatogr* 2005i, 19(4):285-311

Assimopoulou AN, Papageorgiou VP. GC-MS analysis of penta-and tetra-cyclic triterpenes from resins of *Pistacia* species. Part II. *Pistacia terebinthus* var. Chia. *Biomed Chromatogr* 2005ii, 19(8):586-605

Belles Ch. The island Mastic. Ellinika grammata. Athens Greece 2006

Boelens MH, Jimenez R. Chemical Composition of the Essential Oils from the Gum and from Various Parts of *Pistacia lentiscus* L. (Mastic Gum Tree). *Flavour and Fragrance Journal* 1991, 6:271-275

Official address Domenico Scarlattilaan 6 • 1083 HS Amsterdam • The Netherlands

Address for visits and deliveries Refer to www.ema.europa.eu/how-to-find-us

Send us a question Go to www.ema.europa.eu/contact **Telephone** +31 (0)88 781 6000

An agency of the European Union



Bona SG, Bono L, Daghetta L, Marone P. Bactericidal activity of *Pistacia lentiscus* gum mastic against *Helicobacter pylori*. *The Am J Gastroenterol* 2001, 96(9):S49

Browicz K. *Pistacia lentiscus* L. Plant Systematics and evolution 1987, 155:189-195

Choli-Papadopoulou T, Kottakis F, Papadopoulos G, Pendas S. *Helicobacter pylori* neutrophil activating protein as target for new drugs against *H. pylori* inflammation. *World J Gastroenterol* 2011, 17(21):2585-2591

Dabos KJ, Sfika E, Vlatta LJ, Frantzi D, Amygdalos GI, Giannikopoulos G. Is Chios mastic gum effective in the treatment of functional dyspepsia? A prospective randomised double-blind placebo-controlled trial. *J Ethnopharmacol* 2010i, 217:205-209

Dabos KJ, Sfika E, Vlatta LJ, Giannikopoulos G. The effect of mastic gum on *Helicobacter pylori*: A randomised pilot study. *Phytomedicine* 2010ii, 17(3-4):296-299

Daifas DP, Smit JP, Blanchfield B, Sanders G, Austin JW, Koukoutsis J. Effects of Mastic resin and its essential oil on the growth of proteolytic *Clostridium botulinum*. *Int J Food Microbiol* 2004, 94(3):313-322

Dedoussis GV, Kaliora AC, Psarras S, Chiou A, Mylona A, Papadopoulos NG, et al. Antiatherogenic effect of *Pistacia lentiscus* via GSH restoration and downregulation of CD36 mRNA expression. *Atherosclerosis* 2004, 174:293-303

European Pharmacopoeia. Monograph on Mastic. Council of Europe. 01/2008; 1876

Evans WC. Trease and Evans' Pharmacognosy. 13th ed. Baillière Tindall 1989, 477

Gennadios P. In Paraskeva L, editor. Lexicon Phytologicon, Athens 1914 [Greek]

Giaginis C, Theocharis C. Current Evidence on the Anticancer Potential of Chios Mastic Gum. *Nutr Cancer* 2011, 63(8):1174-1184

Gioxari A, Kaliora C, Papalois A, Agrogiannis G, Triantafyllidis JK, Andrikopoulos NK. *Pistacia Lentiscus* resin regulates intestinal damage and inflammation in trinitrobenzene sulfonic acid-induced colitis. *J Med Food* 2011, 14(11):1403-1411

Gruenwald J, Brendler T, Jaenicke C, LaGow B, editors. PDR for Herbal Medicines. 4th ed. Thomson PDR, Montvale 2007, 571-572

Heo C, Kim SW, Kim KJ, Kim DW, Kim HJ, Do JH, et al. Protective effects of mastic in non-steroidal anti-inflammatory drug induced gut damage and bacterial translocation in a rat model. *Korean J Med* 2006, 71(4):354-361

Huwez FU, Al-Habbal MJ. Mastic in treatment of benign gastric ulcers. *Gastroenterol Jpn* 1986, 21(3):273-274

Huwez F, Thirwell D, Cockayne A, Ala' Aldeen D. Mastiha Gum Kills helicobacter Pylori. *New Engl J Med* 1998, 339(46):1946

Iauk L, Ragusa S, Rapisarda A, Franco S, Nicolosi VM. *In vitro* antimicrobial activity of *Pistacia lentiscus* L. extracts: preliminary report. *J Chemother* 1996, 8(3):207-209

Kaliora AC, Mylona A, Chiou A, Petsios DG, Andrikopoulos NK. Detection and Identification of Simple Phenolics in *Pistacia lentiscus* Resin. *Journal of Liquid Chromatography and Related Technologies*, 2004, 27(2):289-300

Kaliora A, Stathopoulou MG, Triantafyllidis JK, Dedoussis GV, Andrikopoulos NK. Chios mastic treatment of patients with active Crohn's disease. *World J Gastroenterol* 2007i, 13(5):748-753

Kaliora AC, Stathopoulou MG, Triantafyllidis JK, Dedoussis GV, Andrikopoulos NK. Alterations in the function of circulating mononuclear cells derived from patients with Crohn's disease treated with mastic. *World J Gastroenterol* 2007ii, 13(45):6031-6036

Kang JS, Wanibuchi H, Salim EI, Kinoshita A, Fukushima S. Evaluation of the toxicity of mastic gum with 13 weeks dietary administration to F344 rats. *Food Chem Toxicol* 2007, 45(3):494-501

Katsanou ES, Kyriakopoulou K, Emmanouil C, Fokialakis N, Skaltsounis AL, Machera K. Modulation of CYP1A1 and CYP1A2 Hepatic Enzymes after Oral Administration of Chios Mastic Gum to Male Wistar Rats. *PLoS ONE* 2014, 9(6):e100190

Kim HJ, Neophytou C. Natural Anti-Inflammatory Compounds for the Management and Adjuvant Therapy of Inflammatory Bowel Disease and its Drug Delivery System. *Arch Pharm Res* 2009, 32(7):997-1004

Kokolakis AK, Kouravakis AN, Katerinopoulos HE. Effect of hydrodistillation with phosphoric acid in the yield of Chios mastic gum essential oil. *Flavour Fragr J* 2010, 25:48-53

Kottakis F, Kouzi-Koliakou K, Pendasa S, Kountouras J, Choli-Papadopoulou Th. Effects of mastic gum *Pistacia lentiscus* var. *Chia* on innate cellular immune effectors. *Eur J Gastroenterol Hepatol* 2009, 21(2):143-149

Koutsoudaki C, Krsek M, Rodger A. Chemical composition and antibacterial activity of the essential oil and the gum of *Pistacia lentiscus* var. *Chia*. *J Agric Food Chem* 2005, 53:7681-7685

Lemonakis N, Magiatis P, Kostomitsopoulos N, Skaltsounis AL, Tamvakopoulos C. Oral Administration of Chios Mastic Gum or Extracts in Mice: Quantification of Triterpenic Acids by Liquid Chromatography-Tandem Mass Spectrometry. *Planta Med* 2011, 77(17):1916-1923

Lesesne CB. The postoperative use of wound adhesives: gum mastic versus benzoin, USP. *J Dermatol Surg Oncol* 1992, 18(11):990

McDill J.R Medical War manual No 5, in "Lessons from the Enemy- How Germany cares for her war disabled". *Lea & Febiger*, Philadelphia and N.Y, USA 1918, 109-110

Magiatis P, Mellou E, Skaltsounis AL, Chinou IB, Mitaku S. Chemical composition and antimicrobial activity of the essential oils of *pistacia lentiscus* var. *Chia*. *Planta Med* 1999, 65(8):749-752

Marone P, Bono L, Leoane E, Bona S, Carretto E, Perversi L. Bactericidal activity of *Pistacia lentiscus* mastic gum against *Helicobacter pylori*. *J Chemother* 2001, 13(6):611-614

Medicamenta. Guida teorico-pratica per sanitari. 6th ed. *Cooperativa Farmaceutica* Milano. 1965, 4:3994-3995 [Italian]

Meikle A, Vaghadia H, Henderson C. Allergic contact dermatitis at the epidural catheter site due to Mastisol® liquid skin adhesive. *Can J Anaesth* 2012, 59(8):815-816

Mikhail GR, Selak L, Salo S. Reinforcement of surgical adhesive strips. *J Dermatol Surg Oncol* 1986, 12(9):904-905, 908

Mikhail GR, Selak L, Salo S, Balle MR. The efficacy of adhesives in the application of wound dressings. *J Burn Care Rehabil* 1989, 10(3):216-219

Miyamoto T, Okimoto T, Kuwano M. Chemical Composition of the Essential Oil of Mastic Gum and their Antibacterial Activity Against Drug-Resistant *Helicobacter pylori*. *Nat Prod Bioprospect* 2014, 4(4):227-231

Moussaieff A, Fride E, Amar Z, Lev E, Steinberg D, Gallily R, et al. The Jerusalem Balsam: from the Franciscan Monastery in the old city of Jerusalem to Martindale 33. *J Ethnopharmacol.* 2005; 101(1-3):16-26

Papageorgiou VP, Sagredos AN, Moser R. GLC-MS computer analysis of the essential oil of mastic gum. *Chimica Chronika* 1981, 10:119-124

Papageorgiou VP, Bakola-Christianopoulou MN, Apazidou KK, Psarros EE. Gas chromatographic-mass spectroscopic analysis of the acidic triterpenic fraction of mastic gum. *J Chromatography A* 1997, 769:263-273

Papalois A, Gioxari A, Kaliora AC, Lymeropoulou A, Agrogiannis G, Papada E, et al. Chios Mastic fractions in experimental colitis: Implication of the Nuclear Factor κB pathway in cultured HT29 cells. *J Med Food* 2012, 15(11):974-983

Paraschos S, Magiatis P, Mitakou S, Petraki K, Kalliaropoulos A, Maragkoudakis P, et al. *In vitro* and *in vivo* activities of Chios mastic gum extracts and constituents against *Helicobacter pylori*. *Antimicrob Agents Chemother* 2007, 51(2):551-559

Paraschos SP, Mitakou S, Skaltsounis A-L. Chios gum mastic: A review of its Biological activities. *Curr med Chem.* 2012, 19:2292-2302

Perikos I. Mastic the daughter of Chios island. Chios 1986 [Greek]

Rechinger KH. Flora Aegaea-Flora der Inseln und Halbinseln des Ägäischen Meeres. *Springer Verlag*, Wien 1943, 20 [Latin]

Roe IH, Nam SW, Myung NH, Kim JT, Shin JH. The Effect of Mastic Gum on *Helicobacter pylori*-infected Gastritis. *Korean J Gastroenterol* 2003, 41(4):277-283

Sakagami H, Kishino K, Kobayashi M, Hashimoto K, Iida S, Shimetani A, et al. Selective antibacterial and apoptosis-modulating activities of mastic. *In Vivo* 2009, 23:215-223

Savvidis Th. Mastic tree of Chios. *Kiriakidi Brs O.E.*, Thessaloniki 2000 [Greek]

Sharifi MS, Hazell SL. Fractionation of Mastic Gum in Relation to Antimicrobial Activity. *Pharmaceuticals* 2009, 2:2-10

Shaw E. The American Review of reviews, NY 1914, 364

Sollmann T. A Manual of Pharmacology. 8th ed. W.B. Saunders Company Philadelphia – London 1957, 170

Sterer N. Antimicrobial effect of mastic gum methanolic extract against *Porphyromonas gingivalis*. *J Med Food* 2006, 9:290-292

Takahashi K, Fukazawa M, Motohira H, Ochiai K, Nishikawa H, Miyata T. A pilot study on antiplaque effects of mastic chewing gum in the oral cavity. *J Periodontol* 2003, 74:501-505, 511

Tassou CC, Nychas GJE. Antimicrobial Activity of the Essential Oil of Mastiha Gum (*Pistacia lentiscus* var. chia) on Gram-Positive and Gram-Negative Bacteria in Broth and in Model Food System. *International Biodeterioration & Biodegradation* 1995, 36:3-4

The Ayurvedic Pharmacopoeia of India. Mastix monograph part I, volume V. Government of India, Ministry of Health and Family Welfare, Department of Indian System of Medicine & Homoeopathy 615.32. 1st New Delhi: Ministry of Health & Family Welfare (India), 1999

The chemist and Druggist No 1818, Vol LXXXV Nov 1914

The Merck's Annual Report Vol 1912, Vol XXVI, Darmstadt, 1913, 269-271)

The Merck Index 10th ed. Merck & Co, Inc. Rahway, N.J, USA, 1983, 820

The Review of Natural Products. 4th ed. Lippincott Williams & Wilkins, Wolters Kluwer Health Inc. 2005, 761-763

Topitsoglou-Themeli V, Dagalis P, Lambrou D. [A Chios mastic chewing gum and oral hygiene. I. The possibility of reducing or preventing microbial plaque formation]. *Hell Stomatol Chron* 1984, 28:166-170 [Greek]

Topitsoglou-Themeli V, Kolokotronis A, Dagalis P, Lambrou D. Chios Mastiha and oral hygiene. II: Differentiation in microbial plaque formation. *Pedodontia* 1985, 2:56-59 [Greek]

Triantafyllou A, Bikineyeva A, Dikalova A, Nazarewicz R, Lerakis S, Dikalov S. Anti-inflammatory activity of Chios Mastic gum is associated with inhibition of TNF-alpha induced oxidative stress. *Nutr J* 2011, 10:64

Triantafyllou A, Chaviaras N, Sergentanis TN, Protopappa E, Tsaknis J. Chios mastic gum modulates serum biochemical parameters in a human population. *J Ethnopharmacol* 2007, 111:143-149

Turkish Codex-Mastix solute (since 1940-1948) p 405-406 (copy provided by Prof F Dermici) [Turkish]

Van den Berg KJ, van der Horst J, Boon JJ, Sudmeijer OO. The Structure of the Polymeric Fraction of Mastic Resin (*Pistacia lentiscus* L.) Elucidated. *Tetrahedron Letts* 1998, 39:2645-2648

Vlastos D, Mademtzoglou D, Drosopoulou E, Efthimiou I, Chartomatsidou T, Pandelidou, et al. Evaluation of the Genotoxic and Antigenotoxic Effects of Chios Mastic Water by the *In Vitro* Micronucleus Test on Human Lymphocytes and the *In Vivo* Wing Somatic Test on *Drosophila*. *PLoS ONE* 2013, 8(7):e69494

Worsnop F, Affleck A, Varma S, English J. Allergic contact dermatitis from Mastisol mistaken for cellulitis. *Contact Dermatitis* 2007, 56(6):357-358

Yavuzer R, Kelly C, Durrani N, Mittal V, Jackson IT, Remine S. Reinforcement of subcuticular continuous suture closure with surgical adhesive strips and gum Mastic: Is there any additional strength provided? *Am J Surg* 2005, 189(3):315-318

Reference used but not cited in the Assessment Report

Glampedaki P, Dutschk V. Stability studies of cosmetic emulsions prepared from natural products such as wine, grape seed oil and mastic resin *Coll Surf: Physicochem Engin Asp*, 2014, 460, 306-311