Mastic: An Aromatic Journey in the Eastern Mediterranean

Dorene Petersen, President and Founder of the American College of Healthcare Sciences

Mastic dripping from trunk
© Dorene Petersen

With a longtime fascination for the powerful antimicrobial mastic gum essential oil, I set sail in the summer of 2009 to the eastern Mediterranean from Marmaris, Turkey. After a week of beating into the howling, northwest *meltemi* wind I was excited to catch sight of the Greek island of Chios on the horizon. Lured by stories of pirates raiding mastic villages to steal the precious aphrodisiac mastic gum, I was on a mission to learn as much as I could about mastic (*Pistacia lentiscus* var Chia).

Fresh diamond-like mastic tears on the trapezi © Dorene Petersen

Chios mastic is the "best" source, I was told. The mastic gum from Chios has been granted protection by the European Union with designations such as Protected Designation of Origin (PDO), Protected Geographical Indication (PGI), and Traditional Specialty Guaranteed (TSG). Only the Chios gum mastic has these designations. Chios is unique for the gum, and on my mastic journey one of my guides said, "You can take the same tree and plant it in Sweden and it will not produce mastic."

Arriving completely unannounced, I had the great fortune of meeting three experts: John Perikos, author of many books including *The Chios Gum Mastic*, and a delightful young couple, Vassilis Ballas and his wife Roula.

Together, Vassilis and Roula escaped from a high-tech, stressed-filled life in Athens to Chios to become mastic farmers. Vassilis's grandfather came from the village of Myrsta. They came to Mesta for the weekend to visit one winter and despite the winter weather they still enjoyed it. They decided to return to live and within two days had moved. They are mastic producers and also provide eco-tours of the mastic fields and have established a company called Mastic culture (see http://www.masticulture.com/english-homepage.php).

John, Vassilis, and Roula kindly spent time with me and shared their knowledge of the mastic gum process. Vassilis drove me around the island, sharing all the secret and fascinating places, which are tourist destinations but are so strangely signposted that I would have missed them. For example, Vassilis took me to the mastic fields to experience the aromatic trees and demonstrated the cutting and gathering process firsthand.

The mastic gum tree, *Pistacia lentiscus* var Chia, needs an alkaline soil and the specific climate of southern Chios. It is an evergreen shrub that grows very slowly, about 2-3 meters high, and can live for 40-50 years. It seems to grow happily interspersed with olive trees; the soft grey-green of the olive and the deep green of the mastic tree give a wonderful patchwork of color to the landscape. The tree is propagated by tip cuttings which are put straight into the field in the fall and watered. For the first 1-2 years it is necessary to irrigate and the tree does better with a nitrogenous fertilizer.

Mastic landscape © Dorene Petersen

In the past, farmers grew nitrogen-fixing broad beans around the trees and dug the roots into the soil after the beans were harvested. Vassilis plans to return to this practice, along with starting an island compost-recycling program.

Chios's summers are hot but are blessed with a morning mist. Vassilis emphasizes how important this is for a plentiful harvest. The morning mist is so important it has its own name, *drongima*. (*Drongima* typically occurs from July through September, but in some years it does not begin until August and so the mastic runs late.)

The global climate change is an unknown. Heat and moisture threaten the tree, stimulating the resin so production is good, but too much moisture can make the bark soft which is not desirable. It is a fine climatic balance; a single rain during the harvest can destroy it. It can wash the gum away or, if the gum is fresh, it mixes with the rainwater and turns black. If this happens, the price drops to 5-6 euros per kilo. The smaller, drier gum, which is of lesser quality, is what is used for distilling mastic gum oil.

Standing in a mastic field is a magical experience. The aromatic mastic gum oozes silently and slowly from the wounds cut into the tree trunk and forms light-radiating droplets. These diamond-like droplets fall to the ground and collect beneath the tree. Sparkling with a clear brilliance when the sun hits them, they lie on the ground protected from the soil and debris by a layer of white clay tamped down and flattened to form a table-like surface until they coagulate, harden, and are gathered. The white clay placed under the tree keeps the gum clean and transparent and is called a *trapezi* or table. One-thousand tons of kaolin is used per year on Chios to make the white tables under the mastic tree. The mastic trees, with their white clay circular undergarment, create a unique visual landscape throughout southern Chios.

A mastic trapezi © Dorene Petersen

Vassilis has spent a lot of time with older mastic farmers learning the process of looking after his mastic trees and exchanging his labor for their wisdom. When I ask him how he knows where to cut the tree, he explains how he feels for the vein. The incisions, or cuts, are then made in the same place each year. It is said the tree is crying and the cutting is called hurting. Each cut is 3-5 centimeters and spaced about 5-10 centimeters apart. They are made vertical to the trunk or branch. The white clay table and cuts are made the same day. You may wonder why mastic produces this wonderful therapeutic gum. The mastic is said to be in the tree to protect it.

Mastic Specifics

- Evergreen shrub; grows very slowly about 2-3 meters high, lives 40-50 years.
- Needs an alkaline soil and the specific climate of southern Chios (it does not grow in the north)
- Propagated by tip cuttings which are put straight into the field in the fall and watered - grows well with olive trees
- For the first 1-2 years it is necessary to irrigate and the tree does better with a nitrogenous fertilizer

Once the mastic gum has coagulated it is collected. There are two major collection dates: one starts about mid-August and the other mid-September. To begin, the area under the tree, which is covered in coagulated gum, leaves, twigs and other small debris, is swept with a regular broom and the entire collection is picked up and put in a sack. The sacks are then taken back to the village. Historically, the sacks were transported by donkey; now they are transported by a strange-looking vehicle that resembles a lawn mower on wheels with a truck-bed addition in the rear. They say you can tell a mastic grower by the vehicle. Sure enough I saw a determined older woman, her head wrapped tightly in a white scarf, driving a bunch of what could have been her grandkids through the town of Prygi, one of the quaint medieval mastic villages, in one of these converted lawn mowers.

The sacks from the mastic harvest contain a lot of soil and debris, as well as the gum, and they are left to sit until October or November when the mastic gum cleaning process begins. The sacks are first emptied into half-barrels full of water. The leaves float to the surface and are collected with a sieve and put aside. The remaining material is left in the water for

three days. Then calcium carbonate is added to the water, changing the density, and the mastic gum floats to the surface. The mastic is skimmed off and sorted.

Vassilis lives in the village of Mesta, a truly charming medieval village, and explains to us that the harvest and cleaning technique is from Mesta. Each mastic village has a slightly different technique. Pyrgi has a special technique of centrifuge to remove the mastic gum from the debris. Pyrgi is only 10 minutes from Mesta, but it has a different dialect, different costumes, and a very unique and intricate style of house adornment.

Houses in Pyrgi
© Dorene Petersen

All Chios mastic is sold to the Mastic Growers' Cooperative (also called The Chios Gum Mastic Growers' Association). If the gum is stored before being delivered to the Cooperative it must be refrigerated. The Cooperative sorts the mastic again. This sorting is done by women wearing pretty pale-blue smocks with matching hair coverings and latex gloves who sit around a large table covered in the coagulated mastic gum known as "mastic tears." With speed and dexterity, using a small sharp-pointed knife blade, they cut away impurities and "pick" through the gum, sorting it by size and color (Perikos, 1993).

Women sorting out mastic gum
© Dorene Petersen

Once sorted, the Cooperative analyzes the gum quality by passing it through a light box that checks for color clarity. It can also give an average size for payment. The Cooperative was started in 1938 after production declined and the value of the gum dropped. Today, even if mastic producers want to make their own product, they must sell the gum to the Cooperative and then buy it back. Over time, the Cooperative has stabilized prices and has done a lot to promote mastic gum; exports of Chios mastic gum and mastic gum products have increased considerably over the years. The launch in 2002 of the chain of Gum Mastica boutiques, one of which opened in New York, is the brainchild of the commercial division of the Cooperative (see http://www.mastihashopny.com.)

The quality of mastic gum is based on color. The clearer the gum, the better the quality. When it becomes yellow, it is oxidized and less desirable. The transparent glass, bead-like gum is the highest quality. As it ages it turns white, then yellow. The gum is given the grade of A, B, or C. Grade A is the highest quality for which the mastic farmer is paid about 80 euros a kilo (based on the 2009 harvest). For grade B the price is 70 euros per kilo, and for grade C the price is 62 euros a kilo. Each tree can yield up to about 200 grams per year, but it does not start to produce until the 5th or 6th year.

Mastic finished product at the Association © Dorene Petersen

Vassilis also shares his concerns about Chios's wild orchids. He believes there is a relationship between the orchids, which flower February through mid-May, and the mastic gum yield. He is worried that farmers are now cultivating more than they should and that this will affect the delicate balance.

Vassilis and Roula aim for 200-300 kilos of mastic production per year; the European Union has helped fund their return to the village through a program called Young Farmers. They started with 25-30 trees and by the end of the first year had 500 trees. Eventually they aim to have 2,000 trees. (Their farm has about 32 stremas. One strema equals ¼-acre and 8 acres will support 2,000 trees). About 10-50 grams can be expected from one tree, although a top producer can yield as much as 200 grams.

When we wandered through the mastic grove and inhaled the therapeutic but sweet aroma, I was tempted to pick up the gum droplets on the ground to chew. I resisted the temptation because each droplet is worth a lot of money and is someone's livelihood. Instead I asked, "Do you think there is much mastic poaching?"

Later that evening I spent some time reading Periko's book, *Chios Gum Mastic*. He explains that during the rule of the Genoans (1346-1566) there were penalties as harsh as having your ears and nose cut off for stealing as little as 7 kilos. Between 25-50 kilos, the thief lost an eye and a hand or leg. For the theft of more than 50 kilos, the thief was hung. The same penalty was imposed on the receiver and rewards were given to informers.

The Ottoman Turks occupied Chios in 1566. The rebellion against the occupation in 1822 led to a terrible massacre of 30,000 people. The mastic villages were spared from the massacre as mastic gum was such a source of revenue for Turkey. The women in the harem were said to be major users, as the gum had the reputation of being an aphrodisiac, and the sultan is said to have ordered bread baked with mastic gum powder in anticipation of a particularly vigorous harem visit.

The Turks were so taken with the benefits of gum mastic that a decade after the invasion and massacre, which left thousands of people dead or sold into slavery, they protected the mastic villages and gave them special privileges, such as exemption from taxes.

Happy with my decision not to pillage the mastic harvest, I visit the Mastica Shop and see the gum being used in many culinary, cosmetic, and medicinal products. As a sweet or chewing gum, it is mixed with inulin or maltodextrin and has a reputation for being very healing to the gums, including preventing and healing gingivitis and other gum diseases. It is in many toothpastes and mouthwashes.

Current Uses and Potential for Mastic

- Seasoning in Mediterranean cuisine
- Chewing gum
- Perfumery
- Dentistry
- Cosmetics and skincare products
- Wellness protocol for prostate cancer (Paraschos et al, 2012)
- Relief of gastralgia and protection against peptic ulcer (Paraschos et al, 2007)
- Immunity regulation (Kaliora et al, 2007)

Despite the strong flavor, there are some great recipes for including the powdered gum in cooking. When I ask Vassilis what he and his wife use it for, he explains there is not a tradition on Chios of using the gum as it is such a valuable commodity. They do occasionally grind the gum into a fine powder and mix it into their drinks or add it to cakes and ice cream. In addition, Souma, the local distilled liquor from figs, often has mastic added to it. Diane Kochilas in *Mastiha Cuisine* says about mastic: "The spice with its unique, musky, woody, slightly piney, incense-like, exotic flavor can be paired with almost anything, from tomatoes in a hearty sauce, to white wine and lemon in more delicate sauces to chocolate, with which it goes divinely."

The national drink of Greece is ouzo, typically flavored with anise. On Chios there are five ouzo factories making mastic-flavored ouzo. The flavor is sweet yet medicinal.

The medicinal value of the gum and essential oil is also not well-known on Chios, but in other parts of the Mediterranean and Europe it is a well-known traditional remedy for stomach upsets and oral health, and it has a reputation as being a safeguard against various cancers. A search of PubMed reveals a number of recent and previous studies that show a range of interesting biological activity, many that support the traditional wisdom.

The mastic gum yields anywhere from a 1-3% of essential oil. The essential oil is complex and unique, containing over 70 constituents including a range of acids and hydrocarbons and a new triterpenoid acid and masticadienonic acid (Bezirtzoglou, 1993) which has aroused a lot of research interest. Two of the major components of the oil are α-pinene and myrcene. It also has trace amounts of β-pinene, limonene, p-cymene, perillene, trans-perillyl alcohol, alpha-terpineol, trans anethole, linalool, beta carophyllene, trans-methyl-isoeugenol, and the ester bornyl acetate (Chios Gum Mastiha Growers Association). With this array of constituents, it is not surprising the oil is considered antiseptic (Aksoy et al, 2006), antibacterial (Aksoy et al, 2006), antimicrobial (Paraschos et al, 2012; Triantafyllou et al, 2011; Kottakis et al, 2009), antioxidant (Paraschos et al, 2012), anti-inflammatory (Triantafyllou et al, 2011), and hepatoprotective (Giaginis and Theocharis, 2011; Triantafyllou et al, 2007). It is also known as an aphrodisiac, and as an anticancer agent.

Its traditional reputation as a powerful aphrodisiac was tested in a 2010 study to review the zinc levels in Chios mastic gum compared to other sources. According to the results, mastic gum sourced from Chios does contain higher levels of zinc (Sawidis et al, 2010). Zinc can enhance prostate function, so it looks like the sultan was on to something! Chios mastic gum is alongside nutmeg, pepper, clove, and other spices and gums that significantly impacted the course of history.

A 2012 study showed the gum and the oil have other notable and promising medicinal potential including the suppression of bacteria and fungi that can cause peptic ulcers, reduction in tooth plaque and mouth odor, improvement of symptoms of autoimmune diseases such as Crohn's disease, reduction of inflammatory proteins that can trigger an asthma attack, lowering of levels of total serum cholesterol thus protecting the cardiovascular system, triggering of cell death of human cancer cells *in vitro*, inhibition of growth of human tumors grafted into immunodeficient mice, and improvement of symptoms in patients with functional dyspepsia (Dimas et al, 2012).

Its reputation of being a powerful anticancer agent is supported by a number of studies. A 2009 study looked at the ability of mastic oil to inhibit lung cancer cells and concluded that the results provided novel molecular evidence of tumor growth inhibition mediated by mastic oil (Moulos et al, 2009).

A 2011 study published in the *Journal of Natural Products* showed a triterpenoid isolated from *P. lentiscus* resin triggered cell death in chemoresistant, androgen-independent human prostate cancer cells *in vitro* and *in vivo* (Samy et al, 2011). This study was done on the isolated constituent of the resin not the whole mastic gum oil. Mastic oil, however, may be an effective preventative and a potential aid in a wellness protocol for preventing androgen-insensitive prostate cancers.

Another 2011 study, conducted by the University of Athens, also identified the triterpenoids as the active constituents responsible for the anticancer potential of the Chios mastic. The study recommended the isolation and synthetic reproduction of the constituent (Giaginis and Theocharis, 2011). As we have seen in other natural materials, this is not always successful and the holistic healing synergy of the complete plant or essential oil is compromised.

In a 2007 study, 133 subjects were randomly assigned into two groups that were given daily doses over a period of 12-18 months; the first was given 5 grams of mastic powder and the second a Chios mastic solution (low-dose group). Checkups were performed monthly. The group that took a daily dose of 5 grams of powder showed a lowered serum total cholesterol, LDL, and total cholesterol/HDL ratio. The study concluded the Chios mastic powder could have a hepatoprotective/cardioprotective role *in vivo* in humans (Triantafyllou et al, 2007).

An additional 2011 study published in the *Nutrition Journal* showed the molecular action that provides strong evidence that mastic is a free-radical scavenger and viable antioxidant (Triantafyllou et al, 2011).

The above study would explain the anti-inflammatory action. This action alone would be enough reason, but coupled with the antimicrobial, anticancer, liver-protecting power this gum shows we have powerful indicators that mastic essential oil and/or the whole gum (which can be powdered fresh) should be in everyone's culinary tool box as a great example of "Let food be thy medicine."

Formulas using Mastic essential oil

Chios Mastica Oil Toothpaste
(*Chios Mastica Guide to Beauty Care*)

1 Tbl./13.8 gm sodium bicarbonate (baking soda)

1 Tbl./15 ml vegetable glycerine

10 drops Chios Mastica oil

Mix the baking soda and vegetable glycerine well and add the essential oil. Put the mixture in a tight-fitting jar and brush your teeth with it twice a day. It will freshen your breath, strengthen your gums, and protect teeth from decay.

Chios Mastica Oil Mouthwash
(*Chios Mastica Guide to Beauty Care*)

50 ml Green tea

2 drops Chios Mastica oil

Mix the ingredients well and use to rinse your mouth after meals or after brushing your teeth. Do not swallow. The fluoride in the green tea, combined with the Chios Mastica essential oil's antibacterial action, will strengthen the gums, help prevent tooth decay and leave your breath fresh and fragrant.

References

Aksoy A, Duran N, Koksal F. (2006). In vitro and in vivo antimicrobial effects of mastic chewing gum against *Streptococcus mutans* and *mutans streptococci*. *Arch Oral Biol.* 51 (6), p476-81. Epub 2005 Dec 15.

Bezirtzoglou C. (1993). *Mastica Island*. G N Merousis Publishers.

Chios Gum Mastiha Growers Association. *Chios Mastiha Historic and Folkloric Reference* and *Chios Mastiha Guide to Beauty Care*. Available: http://www.gummastic.gr/index.php?contentid=5&langflag=_en. Last accessed 9 December 2013.

Dimas K S, Pantazis P, Ramanujam R. (2012). Review: Chios mastic gum: a plant-produced resin exhibiting numerous diverse pharmaceutical and biomedical properties. *In Vivo*. 26 (5), p777-85.

Giaginis C and Theocharis S. (2011). Current evidence on the anticancer potential of Chios mastic gum. *Nutr Cancer.* 63 (8), p1174-84.

Kaliora A C, Stathopoulou M G, Triantafillidis J K, Dedoussis G, Andrikopoulos N K. (2007). Alterations in the function of circulating mononuclear cells derived from patients with Crohn's disease treated with mastic. *World J Gastroenterol.* 13 (45), p6031-603.

Kochilas D. (2008). *Mastiha Cuisine*. Greece: Mastihashop/Mastic Producers Cooperative of Chios.

Kottakis F, Kouzi-Koliakou K, Pendas S, Kountouras J, Choli-Papadopoulou T. (2009). Effects of mastic gum *Pistacia lentiscus* var. Chia on innate cellular immune effectors. *Eur J Gastroenterol Hepatol.* 21 (2), p143-9.

Moulos P, Papadodima O, Chatziioannou A, Loutrari H, Roussos C, Kolisis F N. (2009). A transcriptomic computational analysis of mastic soil-treated Lewis lung carcinomas reveals molecular mechanisms targeting tumor cell growth and survival. *BMC Med Genomics.* 15 (2), p68.

Paraschos S, Mitakou S, Skaltsounis A L. (2012). Chios gum mastic: A review of its biological activities. *Curr Med Chem.* 19 (14), p2292-302.

Paraschos S, Magiatis P, Mitakou S, Petraki K, Kalliaropoulos A, Maragkoudakis P, et al. (2007). In Vitro and In Vivo Activities of Chios Mastic Gum Extracts and Constituents against Helicobacter pylori. Antimicrobial Agents and Chemotherapy. *American Society for Microbiology.* 51 (2), p551-559.

Perikos J. (1993). *The Chios Gum Mastic*. Greece: John Perikos Publisher.

Samy A F, et al. (2011). (8R)-3β,8-Dihydroxypolypoda-13E,17E,21-triene Induces Cell Cycle Arrest and Apoptosis in Treatment-Resistant Prostate Cancer Cells. *J. Nat. Prod.* 74 (8), p1731-6.

Sawidis T, Yurukova L, Askitis T. (2010). Chios mastic, a natural supplement for zinc to enhance male sexuality and prostate function. *Pharm Biol.* 48 (1), p48-54.

Triantafyllou A, Bikineyeva A, Dikalova A, Nazarewicz R, Lerakis S, Dikalov S. (2011). Anti-inflammatory activity of Chios mastic gum is associated with inhibition of TNF-alpha induced oxidative stress. *Nutr J.* 6 (10), p64.

Triantafyllou A, Chaviaras N, Sergentanis T N, Protopapa E, Tsaknis J. (2007). Chios mastic gum modulates serum biochemical parameters in a human population. *J Ethnopharmacol.* 111 (1), p43-9.

Dorene Petersen is President and Founder of the American College of Healthcare Sciences (ACHS). ACHS offers accredited, online programs in Aromatherapy at the certificate, diploma, undergraduate and graduate levels. She currently serves as Chair of the Aromatherapy Registration Council (ARC), an independent, nonprofit organization that administers a directory of Registered Aromatherapists (RAs) who have passed a national examination in aromatherapy to ensure standards of training and essential oil safety knowledge. She is the author of the *Aromatherapy Materia Medica Essential Oil Monographs* textbook used in the ACHS AAS and MS in Aromatherapy programs. www.achs.edu