Culinary Concept

Introducing Dittany of Crete (Origanum dictamnus L.) to gastronomy:
A new culinary concept for a traditionally used medicinal plant☆

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Abstract

A new culinary concept has been developed to praise ancient and modern uses of exclusive Mediterranean ingredients, focusing the world’s attention in a region: Crete, Greece. We reviewed the vernacular names, medicinal properties and traditional uses of the Dittany of Crete (local endemic of the island of Crete, Greece) and we explored the possibility of cooking different dishes. We developed a novel concept which resulted in the culinary use of the infusion, the leaves and/or inflorescences of this perennial herb in modern sweet and savoury dishes of Mediterranean cuisine (five case-studies are described and illustrated). Our study expands the use of a unique and beneficial herb (Origanum dictamnus) rendering it as a new spicy ingredient suitable for gastronomic experimentation. The promotion of new uses for this traditionally used medicinal plant (currently cultivated only at small scale on the island of Crete) (i) offers new ingredients to international gastronomy, (ii) may prove to be beneficial for local economies, and (iii) supports sustainable plant exploitation.

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Introduction

International gastronomy and food science are in search for appealing ingredients, new food products or new technology and methods for dish preparation. Different algae (blue, green, red algae) and super-foods (Morris, 2012) have entered the international cuisine due to their nutritional value and have found many applications which reflect an expanding market for related products (e.g. moleculargastronomynetwork.com, algaecompetition.com). Apart from delivering new original flavours and sensations, this new trend is often triggered by or associated with ethnobotanical background, health claims and beneficial properties of new ingredients (e.g. Atala, 2012 and Renna and Gonnella, 2012). Furthermore, flavouring of foods using natural herbs and spices is a preferred approach to reduce salt use in dish preparation and to increase consumer acceptability and appreciation (Ghawi et al., 2014).

Dittany of Crete (Origanum dictamnus L.) is a unique aromatic cushion-forming perennial plant of Lamiaceae family (Mint family) which is a local endemic to the Island of Crete, Greece (Fig. 1). In the wild it grows exclusively as a rock-dweller in crevices and rocky habitats, generally from 300 m or more commonly from 500 m to 1800 m above sea level (Turland, 1995). Its above ground parts (non-woody parts) have been traditionally used in Greece as a comminuted herbal substance for preparation of an infusion (locally called ‘vrastari’ in Crete, Greece, from the verb vrasto = to boil) or tincture by decoction for cutaneous use; in its native range, it is occasionally chewed crude against gingivitis cough and cold (Skoula and Kamenopoulos, 1997). Concerning its culinary...
use, inflorescences and leaves have been added sometimes to sauces, salads and vermouth. Dried leaves and extracts have also been reportedly used in bitters, liqueurs and fish sauces, salads and vermouth. Dried leaves and extracts have use, in

However, its culinary use is limited (The Herb Society of America, 2005 and Chishti et al., 2013). In our study we review current literature for the Dittany of Crete (O. dictamnus) from an ethnobotanical point of view and we explore its potential for culinary use in the Mediterranean cuisine, in an attempt to exploit the traditionally known beneficial effects of this plant (EMA/HMPC, 2013). Our study expands the use of a unique and beneficial herb (O. dictamnus) rendering it as a new spicy ingredient suitable for gastronomic experimentation and study.

Material and methods

We explored the vernacular names of the Dittany of Crete in the Greek language in an attempt to document its long-standing traditional use and to explore its long-standing traditional use in respect to safety rules for human consumption as a food.

We conducted extensive searches in the Scopus and Google Scholar bibliographic databases to find previously published studies indicating uses for the Dittany of Crete. We consulted the scientific literature to find the medicinal properties which are attributed to the Dittany of Crete and to document whether consolidated indications exist according to the requirements of the European Medicines Agency (http://www.ema.europa.eu/ema/).

We reviewed literature sources (Phitos et al., 1995, 2009 and Bilz et al., 2011) to define whether there is some protection status designated for the exploitation of wild populations and if an extinction risk is assigned to the wild populations of this local endemic plant of Crete (Greece). We also reviewed the history of its commercial cultivation in Greece.

By testing several ingredients, we explored the possibility of cooking different dishes (appetisers, salads, main dishes, desserts) with Dittany of Crete, using fresh or dried material in different quantities and their infusions; this procedure resulted in the culinary concept presented in this study.

To assess initially the quality, odour, taste and the overall sensory properties of the case-studies developed using different quantities of plant material, we formulated a non-official tasting panel. This first round sensory evaluation panel included a local chef, a food-editor, two everyday cooks and two adults with no previous gustative training (in total, 2 men and 4 women). The non-formal assessors were asked to taste freely from the samples presented (as much as or as often as they wanted) and to provide us with their comments during a long discussion with the authors. The first assessment included tasting of crude and chopped plant material, the second round included samples of infused plant material (for 10 persons, 30 g of plant material infused in 1.5 L of hot water for 4–5 min), while the third, fourth and fifth rounds were targeted to the prepared dishes using different quantities of Dittany of Crete during preparation (case-studies developed). All samples (crude plant material, infused plant material and prepared dishes), were presented to the panellists at room temperature under normal lighting conditions and the evaluation session was held in the foyer of the Laboratory of Conservation and Evaluation of Native and Floricultural Species (Thessaloniki, Greece). The case-studies developed were prepared before the session and were served to the panellists in the afternoon of the same day.

Results and discussion

Vernacular names suggesting ancient use

There is strong ancient mythological and historical context about the Dittany of Crete, resulting to several vernacular Greek names which reflect its long-standing traditional use by humans. In total, we detected at least 10 vernacular names related to the Dittany of Crete.

Archaebotanical evidence (seeds) of O. dictamnus were found during excavations in the Knossos palace near Heraklion, Crete; these date back to Minoan times (27th–15th century B.C.), suggesting a really ancient use of this plant (Diapoulis, 1949).

Originally, the plant was dedicated to the ancient Cretan goddess Diktynna, thus elucidating its ancient common name Dittany (Dictamos in Greek). However, Dictamos may also derive from Dicti, the name of the Cretan mountain where Zeus (Jupiter) was raised up by the goat Amalthia and the Greek word thannos = shrub (Skrubis, 1979 and Skoula and Kamenopoulos, 1997).

The power of this plant has been praised by numerous writers from antiquity up to the fourth century A.D. (EMA/ HMPC, 2013). Hippocrates (5th–4th century B.C.) used it to cure gastric complaints, tuberculosis and in poultices on wounds. Aristotle (Historia Animalia 9.16.1), and later Theophrastus (4th–3rd century B.C.) (Thanos, 1994), Dioscorides (1st century A.D.) (Berendes, 1902), Galen and Plutarch (1st–2nd century A.D.) (Liolios et al., 2010), all state that wild goats of Mount Ida (Crete) when struck by poisoned arrows used to eat shoots of O. dictamnus to heal their wounds. This tradition passed to Romans and famous Latin writers such as
Cicero (2nd–1st century B.C.) and Virgil (1st century B.C.) attributed the healing of the wounds of the Trojan hero Aeneas to the Dittany of Crete (Virgil, Aeneid 12.412) (Hunt, 2005). Some ancient vernacular names of Cretan Dittany like veloulko or velotoko (velos=arrow) probably elucidate the plant's ability to heal arrow wounds (Gennadios, 1914). Other vernacular Greek names include stomachohorto (from Greek stomachos=stomach, referring to its healing properties to cure stomach ache, and horto=herb, Plimakis, 1997; Skoula and Kamenopoulos, 1997), kephalohorto (from Greek kephali=head), stamatochorto [literally meaning in Greek stomach ache, and horto=herb], Plimakis, 1997; Skoula and Kamenopoulos, 1997), kephalohorto (from Greek kephali=head), stamatochorto [literally meaning in Greek 'stopping something herb', originating from the Greek verb stamato (= to stop)], livanohorto (from Greek livanis=incent), maliarohorto (from Greek maliaros=hairy), and gerondas (=old man); the latter two, evidently refer to the plant's morphology, as its leaves are covered by dense white hairs (Skoula and Kamenopoulos, 1997; Liolios et al., 2010; see also Fig. 1).

Due to difficulties in reaching the plant's wild habitats, it was traditionally believed that someone has to be truly in love in order to climb and gather the Dittany shoots to be offered (Plimakis, 1997 and Fragaki, 1969); this reflects another vernacular name i.e. Erontas (from the ancient Greek God Eros=love).

According to EMA/HMPC (2013), this plant has also common names in English (Dittany of Crete, Dictamna hops, Dictamus, Winter Sweet, Dittany, Hop Marjoram, Hop Plant), Turkish (Mangırotu), German (Diptamdosten, Kreta-diptam, Dictamno, Kreta-Majoran), Italian (Oriogano di Creta, Dittamno di Candia, Dittamo Cretico) and French (Dictame de Crète).

**Dittany of Crete: a traditional herbal medicinal product and a possible functional food**

Dittany of Crete is a famous medicinal plant since ancient times. It was considered as ‘panacea’ (universal remedy) and it was thoroughly used for stomach disorders, gastric ulcers, generally for the peptic system, spleen, against rheumatism, to facilitate childbirth and against gynaecological disorders (EMA/HMPC, 2013). It was also widely used in medieval monasteries, in the famous liqueurs Benedictine and Trappistine of the Benedictines and Trappistines monks, respectively (EMA/HMPC, 2013). Even in our days, it is used in distilleries, as vermouth for example is flavoured with extracts of this aromatic plant (Baumann, 1996 and Skrubis, 1979). During the middle ages, the plant is recorded to the code of Carolmagnus (742–814 A.D.) (EMA/HMPC, 2013).

The non-woody above ground parts of the plant contain essential oils rich in volatile compounds (1.5–2.5%) such as carvacrol, γ-terpinene, thymol and p-cymene (Sivropoulou et al., 1996; Skoula et al., 1999; Daferera et al., 2000; Chorianopoulos et al., 2004 and Liolios et al., 2010) (Fig. 2). Dittany of Crete also contains high concentration of polyphenolic compounds, mainly depsides (Fig. 3) (Chatzopoulou et al., 2010; Exarchou et al., 2013; Kaliara et al., 2014; Lagouri and Alexandri, 2013; Skotti et al., 2014 and Tair et al., 2014), coumarins, triterpenes (e.g. the rare 21αOH oleanolic acid), tocopherols (e.g. Lagouri and Boskou, 1996), sterols (e.g. Komaitis et al., 1988) and fatty acids (e.g. palmitic, oleic, linoleic acids, Revinthi-Moraiti et al., 1985).

Dittany of Crete has been associated with several medicinal properties: it is orexigenic (triggers appetite), antioxidant (e.g. Couladis et al., 2003, Kaliora et al., 2014; Kouri et al., 2007; Lagouri and Alexandri, 2013; Lions et al., 1998; Møller et al., 1999; Skotti et al., 2014 and Tair et al., 2014), diuretic and digestive (e.g. Bazaios, 1982), emmenagogue (e.g. Bazaios, 1982), antispasmodic (e.g. Skoula and Kamenopoulos, 1997), astringent, soothing the nervous system (e.g. Bazaios, 1986). Additionally, it has antibacterial (Sivropoulou et al., 1996 and Economakis et al., 2002), antifungal (Vokou, et al. 1993, Daferera et al., 2000 and Karanika et al., 2001) and anthelmintic properties (e.g. Skoula and Kamenopoulos, 1997).

There is an evidence on traditional medicinal use in Greece for ‘at least 30 years’ (literature references in accordance for 40 years, actual use for > 50 years), as requested by EU Directive 2004/24/EC and its uses are confirmed by a large number of publications providing consistent information (EMA/HMPC, 2013 and references therein). In this respect this plant is considered safe for consumption as a spice. Dittany of Crete and its infusion preparation is regarded to date as traditional herbal medicinal product in the following indications (EMA/HMPC, 2013): (i) for the relief of cough associated with cold, (ii) for the relief of minor skin inflammations and bruises and (iii) for the relief of mild gastrointestinal disorders. The latter indication could be exploited in gastronomy; cooking ingredients prepared with Dittany of Crete may prove to offer additional functions to
food, thus rendering Dittany as a possible fortifying functional element to be studied further.

**Expanding current uses of Dittany of Crete**

The main use of Dittany of Crete is currently restricted to the preparation of herbal teas (infusion, decoction) for oral use, tinctures or for cutaneous use (Chishti et al., 2013, Liolios et al., 2010; EMA/HMPC, 2013). According to current knowledge, the culinary use of Dittany of Crete is too limited or not recommended. None of *Origanum* experts recommend this species for culinary use, claiming that the scent is too medicinal (therefore not attractive and savoury) and the flavor is too strong for cooking (The Herb Society of America, 2005 and Chishti et al., 2013). Although Dittany of Crete is considered as orexigenic, antioxidant, digestive, with considerable antimicrobial properties, and despite the fact that it is assessed as a safe and effective traditional herbal medicinal product especially for gastrointestinal disorders (EMA/HMPC, 2013 and references therein), it has not actually been used as a spice in dish preparations. The densely hairy leaves of Dittany, its medicinal scent and strong flavour (The Herb Society of America, 2005 and Chishti et al., 2013) have probably restricted its culinary use to date. However, when used in certain quantities, its culinary use becomes challenging and attractive (see case-studies developed below).

**Threatened wild growing populations and commercial interest**

To date Dittany of Crete is a plant with significant commercial interest since it is widely used for herbal teas in Crete and mainland Greece. In the past, the demand for plant material was covered exclusively by harvesting wild populations. Local people associated with collections of Dittany of Crete from the wild are called in Greek ‘Erontades’, ‘Atitano-logi’ or ‘Mazoctades’, indicating harvesting pressure since ancient times. This probably led to rapid decrease of wild populations and some local extinction events from several areas on the island of Crete where it is endemic.

Nationally it has been designated as threatened with extinction (Vulnerable, according to Turland, 1995) and it was recently assessed at the European scale as Near Threatened (Bilz et al., 2011). Dittany of Crete is considered as a protected plant due to its inclusion in the Presidential Decree 67/1981 at the national level (this regulates any access to its wild populations). It is also covered by the Bern Convention at the international level. In addition, *O. dictamnus* is included as a Priority Species in Annexes II and IV of the European Directive 92/43/EEC (Habitats Directive); for this plant, EU (European Union) member states (for Dittany i.e. Greece) are entirely responsible for its long-term conservation globally.

The plant’s relative rarity, the climbing accidents occurred during quests for the plant and the increasing commercial demand for plant material, probably induced its cultivation since 1920s (in Embaros, South Crete). After 1935, there was a rapid increase in its cultivation in other places of Crete reaching a peak production of 10 t per year. Right after 1945, the production reached 50 tonnes per year and to date almost 85% of the product is exported (mainly to Italy, France, Germany and Japan), while 15% of the total production is absorbed by the Greek market (Skoula and Harborne, 2002). The plant material can be purchased in traditional or modern shops with local products and open-air market stalls (Hanlidou et al. 2004; Liolios et al., 2010 and Skoula and Kamenopoulos, 1997). Although the plant is known in several countries, no marketed products seem to be available outside Greece (EMA/HMPC, 2013).

**Dittany of Crete as a new ingredient in gastronomy: culinary concept, reasoning, process and quantities**

The aim of the proposed culinary concept was the integration of the flavours of the Dittany of Crete into the Mediterranean cuisine and the exploitation of its beneficial properties in dish preparation; this represents a new trend in international gastronomy and food science (Atala, 2012). Our reasoning was triggered by the fact that Dittany’s oral use as herbal tea is widespread in Greece with well-established indications (EMA/HMPC, 2013). Hence, we reasoned that if the plant’s aromatic infusion is so much praised for well-being (especially for the peptic system), to incorporate its flavour into food preparation should be equally savoury and beneficial. In this way, we explored possible uses of Dittany of Crete in dish preparation.

Fig. 4. Fresh shoots of Dittany of Crete (local Greek endemic plant) collected in early summer from sustainable cultivation of propagated plants in the Balkan Botanic Garden of Kroussia (Greece) and colour of its traditionally made infusion (3 g of plant material in 150 ml of hot water, after 4–5 min).
The inflorescences and the leaves (fresh or dried) of Dittany of Crete can be a novel and an interesting ingredient in cooking which can be exploited in a wide range of different dishes, offering additionally significant medicinal properties (Figs. 5–7). Inflorescences and leaves can be consumed crude and a traditional simple technique i.e. infusion can be used to collect this new flavour, thus providing new perceptions in gastronomy (Figs. 5–7). The basic flavour of Dittany of Crete is strong, sharp and slightly bitter balancing between oregano-like (mainly due to carvacrol, Fig. 2) or thyme-like (due to thymol, Liolios et al., 2010) nuance.

**Cuisine applications**

We developed the following case-studies combining infusion, leaves and/or inflorescences of Dittany of Crete (Figs. 5–7):

**Fig. 5.** Case-studies of cuisine applications prepared with *Origanum dictamnus* infusion, leaves and/or inflorescences: Left: Cherry pie with dark chocolate and syrup from Dittany of Crete; the aromatic effect of Dittany is hidden in the dough and the sweet syrup. Right: Beef meatballs with marinated oven leeks and béchamel sauce with Dittany of Crete; in this complex case with many ingredients, the Dittany marinates the leeks in the oven and offers original aroma to the béchamel sauce.

**Fig. 6.** Case-studies of cuisine applications prepared with *Origanum dictamnus* infusion, leaves and/or inflorescences: Left: Fish egg salad with Dittany of Crete; in this case the Dittany's scent is perfectly blended with the flavours of the rest of the ingredients. Right: Marinated rabbit with pearl onions and sweet potato; in this case, the rabbit is marinated with wine, Dittany and laurel overnight and the oregano-like or thyme-like savoury effect is contrasted with the pungent and bland tastes of onions and sweet potatoes, respectively.

**Fig. 7.** Fresh salad of climbing French beans boiled with Dittany of Crete, served with Greek yogurt sauce and topped with Sun flower seeds; a case-study prepared with *Origanum dictamnus* infusion of leaves and/or inflorescences; boiled Dittany leaves and/or inflorescences for 15 min provide the intriguing aftertaste (the floral decorative of inflorescence bracts may also be eaten crude for stronger flavour).
- Cherry pie with dark chocolate and syrup from Dittany of Crete [dough: cereal flour, water, egg, yeast, chopped Dittany leaves, brown sugar, olive oil, ginger, salt; filling: dark chocolate, cherries; syrup: brown sugar, one cup with infusion of Dittany, Fig. 5].
- Beef meatballs with marinated oven leeks and béchamel sauce with Dittany of Crete [meatballs: no-crust bread, beef mince, milk, salt, pepper; leeks: marinated with salt, olive oil, red wine and chopped Dittany leaves and inflorescences, then baked in the oven; béchamel: olive oil, cereal flour, milk, one cup of Dittany infusion, eggs, grated hard goat and sheep’s cheese, salt and black pepper, Fig. 5].
- Fish-egg salad with Dittany of Crete [leavened bread, fish roe ‘white tarama’, olive oil, one cup with Dittany infusion, chopped fresh Dittany leaves and inflorescences, lemon juice, Fig. 6].
- Marinated rabbit with pearl onions and sweet potato [marinade: red wine, laurel, one cup with infusion of Dittany of Crete; cooked in Dutch oven, Fig. 6].
- Fresh salad of climbing French beans boiled with Dittany of Crete, with Greek yogurt sauce, topped with Sun flower seeds [climbing French beans boiled with chopped Dittany leaves and inflorescences; cow yogurt with olive oil, vinegar, lemon juice, salt, black pepper, Fig. 7].

Given that the scent of Dittany of Crete has been considered as too medicinal or too strong for cooking (The Herb Society of America, 2005 and Chishti et al., 2013), for the case-studies developed (see Figs. 5–7) we first used rather small quantities of Dittany i.e. for 4 persons 2 g of plant material and 3 g infused in 150 ml of hot water for 4 min; these attempts resulted in interesting and original mild flavours according to the first round assessors. Although flavour in some dishes may be complex due to several ingredients used (e.g. dishes in Fig. 5), the aromatic intensity of Dittany is still distinctive in the quantities mentioned above. We then doubled and tripled the quantities used for the case-studies in pursuit for stronger flavours. When the quantity used was doubled, the interaction of flavours delivered an intense mouth feel sensation with sudden fresh explosions of aromas by the chewing of chopped Dittany, which easily travels up from mouth to nose according to the opinion of the first round assessors. When the quantity used was tripled, the flavours became rather intense and aggressive and the sensorial perception obtained a strong and lingering aftertaste; some of the panellists tasting these samples found them too strong for their tastes.

All the case-applications developed in this study were prepared using smaller quantities of Dittany of Crete than the single daily doses (4.5–21 g) proposed by EMA/HMPC (2013). Although no overdose case or drug abuse has been recovered in the scientific literature, it is important to note that the safety of Dittany of Crete for children and adolescents or during pregnancy and lactation has not been established yet (no specific studies exist in literature). EMA/HMPC (2013), in accordance with general medical practice, suggests that “the herbal medicinal products (herbal teas and other finished products) should not be used during pregnancy and lactation without medical advice”.

Conclusions

The culinary concept presented in this study provides new sensations to different food products which may contribute at the same time to human well-being. Second, but not less important, a rational and sustainable exploitation of this plant in a wider scale may be promoted through gastronomy, offering important socio-economic benefits to the local population of Crete. This has recently been also attempted for other ingredients originating from biodiversity-rich areas such as Amazonia, Brazil (Atala, 2012). If Cretan Dittany is successfully promoted as a food ingredient (or a possible functional food) to be launched in easily made dishes of everyday life and in nouvelle cuisine preparations, it could soon be considered as a high value-added product which can offer potential to the sustainable development at local scale. This could be quite significant especially in countries severely affected by the deep economic crisis (such as Greece). Being a local endemic of Crete (Greece), if the market demand is increased for this food product, any future commercialisation by international companies will have to adapt to the provisions of the Nagoya Protocol and comply with national rights on access to endemic genetic resources, involving special benefit and sharing mechanisms (Kamau et al., 2010).

To date, the natural products derived from plants show a great appeal for consumers and chefs and as a consequence the introduction of new spices from plants could stimulate new opportunities for gastronomy (Renna and Gonnella, 2012). Dittany of Crete meets all necessary requirements to be introduced as a new, interesting and unique spice for culinary use which is accompanied with important medicinal properties, thus rendering it as a potential functional food. The promotion of new uses for this traditionally used medicinal plant (currently cultivated only at small scale on the island of Crete) (i) offers new ingredients to international gastronomy, (ii) may prove to be beneficial for local economies, and (iii) supports sustainable plant exploitation.

References
