

Review Article

**Scandix pecten-veneris L.: A wild green leafy vegetable**

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**Abstract**

Shepherd's needle (*Scandix pecten-veneris* L.) is an edible wild green leafy vegetable widely used in the Mediterranean diet. It is an archaeophyte, native of Eurasia, dicot, annual scapose herb. *S. pecten-veneris* is a species which grows in arable land and waste places and prospers in sandy, loam, clay soils. It is grown from seeds, mainly during autumn and early winter, although a few seeds germinate in spring in cultivated fields. The leaves are the main edible parts of the plant and are either consumed boiled by just adding olive oil, or in pies. *S. pecten-veneris* has minerals, fatty acids and fibres, phenols and alpha-tocopherol. It can be used as a model species for the extensive study of climate changes since it was once widespread and often abundant in the lowlands, but its growth has considerably declined lately due to the introduction of chemical herbicides, fertilizers and the destruction of field margins. The aim of this review is to provide all the disseminated information regarding the rare or even extinct plant *S. pecten veneris*, in order to orientate future research.

**Keywords:** climate changes; culinary uses; edible; proximate composition; *Scandix pecten-veneris*; weeds.

**Abbreviations:** DW\_Dry weight, GC (FID)\_Gas Chromatograph (Flame Ionization Detector), GC/MS\_Gas chromatography/mass spectrometry, N-WFP\_North-West Frontier Province, SPECIES\_Spatial Estimator of the Climate Impacts on the Envelope of Species.

**Introduction**

Edible wild plants have an important role in indigenous peoples' nutrition around the world. There are several exhaustive global catalogues of edible wild plants from around the world, including root vegetables, fleshy fruits, grains, seeds, nuts and edible greens (leaves, stems, shoots, including marine algae). Many of these wild plants are common, high-yielding and also highly nutritious, palatable and easily harvested (Hadjichambis et al., 2008; Turner et al., 2011). In the Mediterranean in particular, traditional gathering of wild edible greens persists in many rural communities (FAO, 1999). One such wild weed plant is *Scandix pecten-veneris* L., commonly known as Shepherd's needle, which has the potential to be used in the Mediterranean diet since it is an edible plant (Horwood, 1919). According to Dodonoëus, writing in 1578, "*Scandix eaten is good and wholesome, and in times past hath bene a common herb amongst the Greeks, but of small estimation and value, and taken but only for a wild wurt or herb*" (Hulme, 1902). *S. pecten-veneris* is an archaeophyte, native of Eurasia, a dicot, an annual scapose herb belonging to the family Apiaceae (Umbelliferae) (Plunkett et al., 1996; Terpo et al., 1999; Eskin et al., 2012; Kougioumoutzis et al., 2012). There is limited information concerning the use of *S. pecten-veneris*. The aim of this study was to compile and review the current available data on *S. pecten-veneris*. Most of this information is scattered and difficult for the international scientific community to access.

**History of *S. pecten-veneris***

The Latin word *Scandix* comes from the Greek names *skandix* or *skandikos* which was used by Aristophanes and Theophrastus to chervil. *S. pecten-veneris* appeared as

*Scandix Pecten*, or *Scandix*, the generic name being suppressed and *Pecten* adopted as generic, the binomial as we call it became *Pecten- Veneris* (Nieuwland, 1911), while the standard author abbreviation L. is used to indicate Carl Linnaeus (1707 – 1778). The consumption of wild plants such as *S. pecten-veneris* in Greece has been documented for more than two thousand years. *Scandix* is mentioned as a pot-herb by Theophrastus and Pliny, and Dioscorides describes the greens as being eaten raw or cooked. Euripides's mother was supposed to have sold wild chervil on the Athenian market. The wild plants that our ancestors used to collect (there are reports by Theophrastus, and by Dioscorides) and use in separate dishes are present even today in meals, mostly in villages (Dalby, 2003; Psaroudaki et al., 2012).

**Scientific classification**

Taxa	Name
Kingdom	Plantae
Subkingdom	Viridaeplantae
Phylum	Tracheophyta
Subphylum	Euphylllophytina
Infraphylum	Angiospermae
Class	Magnoliopsida
Subclass	Asteridae
Order	Apiales
Family	Umbelliferae
Subfamily	Apiodeae
Tribe	Scandiceae
Genus	<i>Scandix</i>
Specific epithet	<i>pecten-veneris</i> -L.
Botanical name:	<i>Scandix pecten-veneris</i> L.

Synonyms for *S. pecten-veneris* include *Chaerophyllum pecten-veneris* Crantz, *Myrrhis pecten-veneris* All., *Pecten veneris* Lam., *Pectenaria vulgaris* Bernh.

### Common names of *S. pecten-veneris*

Common names for *S. pecten-veneris*, except from shepherd's needle, are Venus needle, Venus comb, kampa sarjaputki, acicula comune, pettine di venere.

### Vernacular names of *S. pecten-veneris*

Language	Name
Deutsch:	Echter Venuskamm, Gemeiner Nadelkerbel
English:	Shepherdsneedle, Venus'-comb
Español:	Aguja de pastor, Peine de Venus
Français:	Peigne de Venus, Scandix peigne de Vénus
Italiano:	Acicula, Pettine di Venere, Spillettone
Nederlands:	Naaldekerfel, Venusstraat
Português:	Agulha-de-pastor, Erva-agulheira
Română:	Acul Doamnei
Slovenščina:	navadna češljika
Svenska	Nålkörvel
Türkçe:	Zühre tarağı
Ελληνικά	Μυρόφι
Русский:	Скандикс гребенчатый, Венерин гребень

The genus *Scandix* is dibasic ( $x = 7, 8$ ) in nature with  $x = 8$  being the most common basic number (Jeelani et al., 2012). The genus *Scandix* is in the family *Apiaceae*, including 94 scientific plant names of species rank for the genus *Scandix*. Out of these, only 5 are accepted species names.

- *Scandix australis*
- *Scandix grandiflora* L.
- *Scandix macrorhyncha* C.A. Mey.
- *Scandix pecten-veneris* L.
- *Scandix stellata* Banks & Sol.

The genus *Scandix* contains 20 species with 15 of them mostly confined to the Mediterranean region (Kubeczka, 1982; Zohary, 1972; Downie et al., 2000) and only *Scandix pecten-veneris* widely distributed (Cohen, 2002).

### Geographical distribution

The distribution of *S. pecten-veneris* in Europe is centred on the Mediterranean, extending north to Denmark and westwards to Great Britain, introduced into North and South America, North and South Africa and Australasia (Forbes, 2003; Allen and Hatfield, 2004), while the range of *S. pecten-veneris* beyond Europe extends to North Africa and from South-East Asia to the borders of India (Stewart et al., 1994).

### Crop weed

*S. pecten-veneris* is a species of arable land and waste places, associated with arable cultivation and is extremely abundant in grain fields. Shepherd's needle found in arable crops is annual, able to grow and set seed in the time between the sowing of the crop and post-harvest cultivation. However, *S. pecten-veneris* that has shorter-lived seeds has declined.

*S. pecten-veneris* is dependent on the arable ecosystem, which is characterized by regular soil cultivation (Wilson, 1993). It is listed as a threatened or even extinct weed species in Northern and Central Europe (Pinke et al., 2011; Pal et al.,

2013), but much more frequent in the Southern European study area, which can be regarded as its original (core) area. Shepherd's needle declined markedly during the past century (Sutcliffe and Kay, 2000; Godefroid, 2001), and especially from the mid 1950s (Stewart et al., 1994). Romero et al. (2008) compared weed vegetation occurring in conventional and in organically managed farms in Spain. They documented that *S. pecten-veneris* can be found in big frequency only in organic fields and it was concentrated in the crop edges. Cirujeda et al. (2011) observed that it is a very rare species, found in quite intensive dryland cereal fields.

### Morphological characteristics of the plant

*S. pecten-veneris* is an erect branched annual, growing in height, which develops a bare stem, creating a thick crown up to 50 cm (Storkey et al., 2010).

### Leaves

*S. pecten-veneris* has 2–3-pinnate leaves with linear leaf-segments. They are pinnately decomposed, bright green, deeply divided, with lobes on either side of the stalk and arranged opposite one another (Coulter and Rose, 1889; Horwood, 1919).

### Flowers

The flowers are white, with petals (1–2mm long) blunt at the tip, polygamous, small, and inconspicuous, in small umbels with 1–4 rays. Each ray has a ring of characteristically deeply bifid basal bracteoles and between four and twelve flowers. The staminate flowers are usually in the middle, or absent, but those in the umbels of the third order are male as a rule. The styles vary from 0.5 mm to 2.5 mm (Cohen, 2002).

### Root

*S. pecten-veneris* has a white, small tapering root with slender, secondary rootlets. Its root oil has anlyisobutyrate (42.8%) as its main component (Kubeczka, 1982).

### Fruits

The fruit is rough, flattened on one side, finely furrowed on the other, with hairy edges and it consists of two seeds which remain joined until ripe. The fruits can reach up to 6 cm in length and are long, narrow and pointed.

### Seeds

The seed has a long scabrid needle-like appendage up to 6cm in length, which acts as a spring dispersal mechanism as the seed ripens (Schneider et al., 1994). *S. pecten veneris*, being the short-lived species, germinates mainly in autumn and early winter, although a few seedlings germinate in spring following spring cultivations (Liopa-Tsakalidi, 2010). *S. pecten-veneris* has a very low level of seed dormancy which renders it particularly vulnerable to periods of inappropriate management. The optimum germination depth is 0.5 cm, while the seed number per plant ranged from 50–150. Generally, the mean seed weight of *S. pecten-veneris* is about 0.20 mg and the seed longevity in the soil is 5 years maximum (Kästner et al., 2001). *S. pecten-veneris* is listed as a threatened or even extinct weed species in Central Europe (Schneider et al., 1994; Pinke et al., 2011).

## Physical characteristics of plant

*S. pecten-veneris* is a wild green vegetable, herb and weed. The plant is grown from seeds mainly in autumn and early winter, although a few seeds germinate in spring in cultivated fields. Shepherd's needle has a very low level of seed dormancy which renders it particularly vulnerable to periods of inappropriate management. *S. pecten-veneris* is limited by a mean temperature of less than -4 °C (Jäger, 1990). The flowers bloom in June to July and the seeds ripen by July. The flowers may be male and hermaphrodite and are pollinated by insects. The plant is self-fertile. (Horwood, 1919; Koul and Bhargava, 1983; Cohen, 2004). It prefers all soils except chalk, though it can be occasionally seen on chalky loam soil and may also be planted growing freely on lime soil on calcareous rock soils (Brenchley, 1913; Horwood, 1919).

## Cultivation and collection of the plant

**Habitat:** *S. pecten-veneris* inhabits arable fields, wasteland and coastal sites subject to disturbance. It is found in dry, sunny, most frequently on heavy calcareous clay loam soils. It cannot grow in the shade and it requires moist soil. It has suffered a severe decline in Central Europe due to large agricultural intensification and the low level of the plants' seed dormancy.

## Soil

It grows in sandy, loam, clay nutrient-rich soils. It can be successfully grown in soils with a neutral and alkaline pH, while it prefers moist soil.

## Climate

It is a plant which thrives in hot, dry summers and winters with variously alternating snowy, wet, fine, warm and cold periods (Turrill, 1918).

## Propagation

Available information for propagation of *S. pecten-veneris* is conspicuously lacking. It can be propagated only through seeds. *S. pecten-veneris* seeds are sowed in autumn to early winter and in spring at a 0.5cm depth. The seed germination percentage in potting soil at a temperature of 15°C in the greenhouse was 94%, while at 18°C it was higher (97%). At 15°C in the greenhouse a reduction of the germination percentage in all concentrations of 40, 60 and 80 mM of NaCl was shown at 84-80% and at 18°C at 93-92% respectively. At 15°C the height of *S. pecten-veneris* was less than the corresponding height at 18°C. At 18°C the length of the *S. pecten-veneris* root, hypocotyls and the first appearing leaf was increasing as were the NaCl concentrations and at 15°C in the greenhouse the root and the first appearing leaf length was reduced, compared to the control (Liopa-Tsakalidi, 2010).

## Manure and fertilizers

*S. pecten-veneris* appeared in organic fields and also only in the crop edges of conventional field ones (Romero et al., 2008; Armengot et al., 2011). However, it declined as nitrogen fertilizer applications increased to arable habitats (Storkey et al., 2010); the steepest decline corresponds to the

postwar increases in fertilizer applied to winter wheat (Chalmers et al., 1990). The low seed dormancy of *S. pecten-veneris* (Thompson et al., 1993) leads to a faster depletion of the seed bank by repeated herbicide applications (Storkey et al., 2010).

## Culinary uses

Wild green leafy vegetables have played an important role in complementing staple foods to provide a balanced diet. Their consumption is a world-wide phenomenon that is noted as having an important role on human nutrition (Cruz-Garcia and Price, 2012). In Mediterranean countries the wild green leafy vegetables, such as *S. pecten-veneris*, are traditionally and regularly collected for home consumption to be used in cooking (FAO, 1999). They are often sold around the Mediterranean (Łuczaj et al., 2012), where *S. pecten-veneris* is traditionally used in various local cuisines (Hadjichambis et al., 2008). Although this culinary tradition has decreased due to economic changes in nutrition and agriculture, its contemporary use has been documented in Italy (Guarrera, 2003), Greece (Hadjichambis et al., 2008) and Turkey (Dogan, 2012). *S. pecten-veneris* is sold widely in the Mediterranean and is present in every weekly vegetable market, as its selling has a long, continuous tradition. Shepherd's needle is collected in the wild by local farmers who not only consume it themselves, but also bring it to the market for sale, to supplement their income. The aerial part of *S. pecten-veneris* is mainly consumed, in many different ways, according to local traditions. It is consumed either boiled cooked with olive oil, or in pies. Wild green plants are attracting attention from the health standpoint, because they are rich sources of antioxidants and  $\omega$ -3 fatty acids (Simopoulos and Salem, 1986; Simopoulos et al., 1992; 1995). The conservation of the use of *S. pecten-veneris* has gained interest in this context.

## Proximate, carbohydrate and fatty acid composition

Studying local plant foods is of particular interest, as they often contain higher amounts of bioactive compounds than highly cultivated food plants (Trichopoulou et al., 2000), especially ones which have been under cultivation for many generations. Moreover, wild gathered leafy vegetables can be nutritionally important by supplying minerals, fatty acids, omega-3 fatty acids, antioxidants, and fibres. *Scandix pecten-veneris* contains sufficient quantities of moisture (81.31%), ash (3.10%), proteins (3.82%), total lipids (0.63%), crude fibre (3.82%), total sugar (0.76%), total carbohydrate (7.32%), reducing sugar (0.64%), and of the fatty acids total saturated fatty acids (31.83%), total monounsaturated fatty acids (12.02) and total polyunsaturated fatty acids (31.29) (Imran et al., 2007). Its leaves also contain sufficient quantities of anti-nutritional components, oxalic acid (0.225±0.02% DW), phytic acid (0.025±0.00% DW) (Khan et al., 2012) and minerals with the computed energy of 417.42±15.53 kcal/100g dry weight (DW) (Table 1).

## Minerals composition

Minerals composition of *S. pecten-veneris*, reported on dry weight basis, is given in Table 1. *S. pecten-veneris* contained sodium 381 in Pakistan and 662mg/100g in Greece, potassium 2206 and 4450mg/100g, magnesium 370 and 228mg/100g, calcium 3200 and 2790mg/100g iron 200 and

**Table 1.** Proximate, carbohydrate, lipid, mineral composition and fatty acids of *Scandix pecten-veneris*.

Proximate, carbohydrate and lipid composition (%)		Mineral composition (mg/100g)		Fatty acids (%)		
		Pakistan (N-WFP*)	Greece (Crete)	Pakistan (N-WFP)		
Moisture (%)	81.31	Na	381	662	Total saturated	31.83
Crude protein	3.82	K	2206	4450	Total monounsaturated	12.02
Total carbohydrate	7.32	Mg	370	228	Total polyunsaturated	31.29
Ash	3.10	Ca	3200	2790		
Crude fibre	3.82	Fe	200	44.3		
Total lipids	0.63	Cu	54	1.71		
Energy (Kcal/100g)	50.23	Zn	16	2.15		
Total sugar	0.76	Mn	9	5.67		
Reducing sugar	0.64	Cr	0.40			
Non-reducing sugar	0.12	Ni	2.40			
		P		518		
Pectin	0.11					
Saponifiable lipid	0.43					
Non-saponifiable lipid	0.20					

N-WFP\* North-West Frontier Province

44.3mg/100g, copper 54 and 1.71 mg/100g, zinc 16 and 2.15mg/100g, magnesium 9 and 5.67mg/100 g respectively (Imran et al., 2007; Zeghichi et al., 2003). Furthermore, in Greece it also contained nickel 2.40mg/100g, chromium 0.40 mg/100g (Imran et al., 2007) and phosphorus 518mg/100g (Zeghichi et al., 2003).

#### Antioxidant content

Studying *S. pecten-veneris* is of particular interest as it often contains high amounts of polyphenols (130.7mg g<sup>-1</sup> ethanolic extract) (Consortium LFN, 2005). It contained alpha-tocopherol (1.133 mg/100g wet weight) and its total phenol contents were (46.51±1.13 mg/100g wet weight), antioxidant activity (EC<sub>50</sub>) (2.477±0.11 mg dry extract/mg DPPH), antiradical power ARP (0.404±0.018, 1/EC<sub>50</sub>) (Simopoulos, 2004) and the amount of nitrates being 0.0076 ±0.003 g/100g wet weight (Zeghichi, 2004) (Table 1). Studies show that the nutrient contents in plants depend on climate type, agronomic practices, soil type, plant cultivars, rainfall, temperature and are probably major causes for differences in nutrient levels (Imran et al., 2007). The results are too variable to make any definitive conclusion. Mineral composition has been studied in *S. pecten veneris* and even the data differ. This difference might be due to the way it is harvested, geographical variations, or analytical procedures. Radulović and Mladenović (2012) identified by GC (FID) and GC/MS, in the aerial parts and roots essential oil of *S. pecten-veneris* from South-eastern Serbia, the constituents tridecane (8.5-52.8%), pentadecane (1.3-23.5%) and β-caryophyllene (0.1-18.5 %).

#### Edible and medicinal uses

*S. pecten-veneris* is used as food, and then as medicine. Young leaves can be cooked as greens with olive oil, in pies or used in salads (Tabernaemontanus, 1731; Zeghichi et al., 2003; Simopoulos 2004). Tabernaemontanus (1731) reported that *S. pecten-veneris* has a pungent taste with bitterness. Shepherd's needle is a medicinal plant (Grace, 2010), which can be prepared as tea and is used against for the getter (Akyol and Altan, 2013). It is also used to help blood coagulation, body pains and palpitation (Mosaddegha et al., 2012). The root contains a bitter principle, giving the plant an antiphlogistic, astringent and eupeptic action, therefore its

decoction was used in dyspepsia, gastroenteritis, cystitis, nephritis and pyelitis (Guarino et al., 2008). Moreover, *S. pecten-veneris* has been used for toothaches (Allen and Hatfield, 2004).

#### Other uses

Climate change has the potential to have a significant impact on the distribution of species. The SPECIES (Spatial Estimator of the Climate Impacts on the Envelope of Species) model uses neural networks to integrate biophysical variables for characterising habitat. This model identifies the potential changes in the future. *S. pecten-veneris* is a simulated species because it was once widespread and often abundant in the lowlands of Great Britain, but has declined considerably due to the introduction of chemical herbicides and fertilizers and the destruction of field margin habitats (Berry et al., 2001; 2002). Probably in the future, except from this model, it would be useful to create an ex-situ reserve population, in order to protect its genetic diversity.

Documenting and recovering the indigenous knowledge on wild green leafy vegetables as *S. pecten-veneris*, is thus urgently needed to maintain and promote nutritional health and to preserve genetic and cultural diversity. Shepherd's needle may offer good opportunities for commercialization if properly exploited.

#### Conclusion

*S. pecten-veneris* is an edible wild green leafy vegetable in the Mediterranean diet and a species of arable land and waste places. It was used as food and then as medicine. The consumption of wild plants as Shepherd's needle in Greece has been documented for more than two thousand years; *Scandix* is mentioned as a pot-herb by Theophrastus and Pliny, and Dioscorides. It is an erect branched annual, growing in height, and develops a bare stem, creating a thick crown up to 50 cm. This plant is grown from seeds mainly in autumn and early winter, although a few seeds germinate in the spring in cultivated fields. *S. pecten-veneris* is sold widely around the Mediterranean and is present in every weekly vegetable market. The selling of Shepherd's needle has a long, continuous tradition. *S. pecten-veneris* is rich in minerals, fatty acids, fibres, alpha-tocopherol and phenols. However, there has been a dramatic decline of this species

throughout much of its range in the last 60 years. Moreover, it is a model species for climate change because it was once widespread and often abundant in the lowlands, but has declined considerably due to the introduction of chemical herbicides and fertilizers and the destruction of field margin habitats.

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