

Pollen morphology of *Tussilago farfara* L. pollinated by Honeybees

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ABSTRACT

In this study, pollen morphology of *Tussilago farfara* L. belonging to the genus *Tussilago* (Asteraceae) were examined with light microscopy (LM). According to the investigation by light microscope (LM), pollen grains of the species is monad, radially symmetrical, isopolar, oblate-spheroidal, colporate and echinate. In our opinion, the palynological features of the taxon might be helpful to investigate the taxa various palynological, taxonomical and pharmaceutical researches.

Key words: Asteraceae, *T. farfara*, light microscope, palynological, taxonomical researches.

Introduction

Asteraceae comprises more than 1700 genera and 25000 species, and is considered the largest family among the flowering plants [1]. The tribe Senecioneae is one of the largest tribe of the Asteraceae with c. 3000 species and 150 genera, distributed in central and south America, south eastern Africa, central and east Asia but not common in Mediterranean type areas [2-3].

Tussilago farfara L. is a perennial plant widespread in Giresun on embankments (soil banks), wet shores, screes, sewers and abandoned places on clay (loamy) soils. Its english name is “Coltsfoot”. It is known in Germany as “Huflattich/horse-hoof”, in France “coughwort/ feuilles de tussilage”, in Bulgaria as “podbel”, in Chinese “Kuan Dong Hua”, in Turkey ““kabalak/öksürük otu” [4-7]. *Tussilago farfara* L., starting its blooming in early spring, supplies colonies

of wild Apoidea and honeybees with pollen and nectar flow under good weather conditions. Under laboratory conditions at 20°C and relative humidity 60%, full opening of 7 tagged inflorescences of *T. farfara* was completed after one and half hour. Therefore, it is considered as a honey plant with importance in Europe [8].

Ethnobotany provided data for *T. farfara* as a valuable medicinal plant that has been used in folk remedies as herbal tea for a wide range of disorders, such as throat, catarrh, bronchitis, laryngitis, pulmonary emphysema, silicosis and tubercular coughs [9].

There is no enough literature on pollen morphology of *T. farfara* in Turkey. Therefore, the present study aims to fill this gap in literature by palynologically analyzing the *T. farfara*. Consequently, it provides information that help

mellisopaygnological and aeropalynological analyses.

Material and Methods

Locality

Materials of this study were collected in February 2016 from Giresun-Güre-

Batlama River. Giresun is located in the eastern part of the Black sea region (40°54'K and 38°25'D). According to the grid system applied by Davis [10], Gure (Giresun) is located in the A7 frame (Fig. 1).

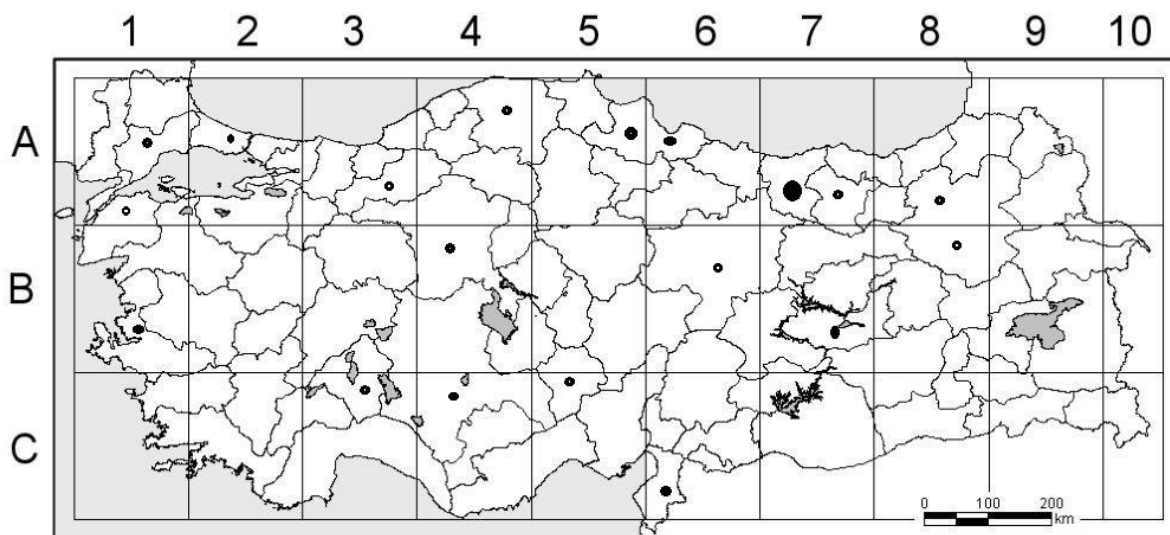


Figure 1. Geographical distribution of *T. farfara* in Turkey

Pollen Sample

The light microscopy (LM) observations with their measurements were made on pollen from mature anthers, which have been prepared according to the Wodehouse method [11]. The measurements of the pollen grains of *T. farfara* were taken on 30 pollen grains from the species. P: polar axis, E: equatorial diameter, Amb: diameter of pollen at the polar view, t: distance between colpi ends, were measured from 30 fully developed grains per sample under the Nikon Eclipse Ci microscope (1000×). Additionally, 12 measurements of Clg: length of colpus, Clt: latitude of colpus, Spin length, base of length, Plg: length of porus, Plt: latitude of porus. Results are provided as minimum, maximum and mean±standard deviations. P/E ratios were also calculated. In addition, the ornamentation were established. All the

statistical analyses of the palynological characters were made by the SPSS package program. The arithmetic mean, standard deviation and variation were calculated for sample. The statistical results are shown in tables. The terminology used is of Erdtman [12], Kremp [13] and Punt et al. [14].

Result and Discussion

Palynological description of *T. Farfara* (Fig. 2) was made based on the quantitative and qualitative morphologic results. It is monad, radially symmetric, isopolar, 3-colporate, medium-sized, oblate-spheroidal (P/E 0.99) (Fig. 3). Polar axis (P) is $33.63 \pm 1.60 \mu\text{m}$, equatorial axis (E) is $33.96 \pm 2.09 \mu\text{m}$. Amb is circular. Exine is $2.45 \pm 0.52 \mu\text{m}$ thick; nexine is thinner than or as thick as sexine. Exine ornamentation is echinate: length of spine

4.27±0.78 µm, spin base 2.45±0.52 µm, spines acute, concave-conic, distance between colpi ends 20.20±1.47 µm. Apertural system 3-colporate: three colpus 17.93 ±1.34µm long, 10.25±1.48 µm wide,

pore 10.61 ± 1.19 µm long, 10.25 ± 1.48 wide; distinct margin and terminal edges acute, the pori situated at midpoint of colpus, are circular and with distinct margin. (Fig. 3, Table 1).



Figure 2. *Tussilago farfara*'nın genel görüntüsü

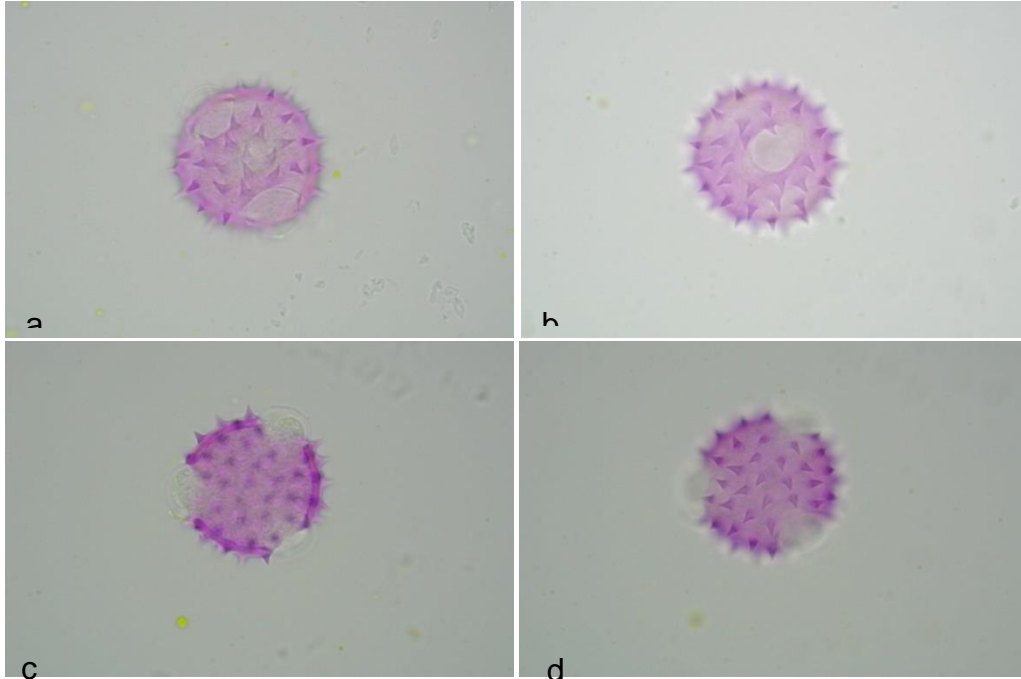


Figure 3. *T. farfara* a-b: equatorial view; c-d: polar view (10x100)

Table 1. The palynological measurements of *T. farfara* (M: median, Var.: variation, S: standart deviation).

P/E	Oblate spheroidal	0.99	Exine (μm)	M	2.45
				S	0.52
				Var.	2-3
P(μm)	M	33.63	Sexine (μm)	M	1.45
	S	1.6		S	0.52
	Var.	31-236		Var.	1-2
E (μm)	M	33.96	Nexine (μm)	M	1
	S	2.09		S	0
	Var.	30-37		Var.	1
Cl _t (μm)	M	10.25	Length of spine (μm)	M	4.27
	S	1.48		S	0.78
	Var.	8-13		Var.	3-5
Cl _g (μm)	M	17.93	Spine base (μm)	M	2.45
	S	1.34		S	0.52
	Var.	15-20		Var.	2-3
Pl _t (μm)	M	10.25	Amb (μm)	M	31.13
	S	1.48		S	1.45
	Var.	8-13		Var.	28-34
Pl _g (μm)	M	10.61	t (μm)	M	20.20
	S	1.19		S	1.47
	Var.	9-13		Var.	17-24

İnceoğlu and Karamustafa [15] claimed that pollen grains of senecioneae are tricolporate, oblate-spheroidal, spheroidal, Amb circular, spines conic or concav-conic. Pollen grains of *T. farfara*, heteromorphous pollen grains nonaperturate and spheroidal, 13-50 μm (E) in diameters, Exine is 3,1 μm thick, echinate. Some spines are conic shape with

acicular or rounded ends, others dome-shaped. Spines 2,6 μm in length with base diameter of 4,3 μm .

Warakomska and Kolasa [8] put forward the idea that *T. farfara* (Coltsfoot) pollen grains were isodiametric, trizonocolporate and echinate. Their diameters are without echinate, ranged from 28.5 μm to 29.5 μm .

The grains covered with pollen kit easily adhered to insect's body.

In MediaWiki [16], *T.farfara* pollens are 36 (33.4-39.8) μm (Medium), Tricolporatae and echinate, Senecio-Typ, spheroidal, isopolar, pore width 11 μm , spin 4 μm lang, plentiful pollenkit

In Pal dat [17], *T.farfara* pollens are monad, medium-sized (26-50 μm), isopolar, spheroidal, outline in polar view: circular, shape (dry pollen): prolate, outline in polar view (dry pollen): triangular, aperture 3 colporate, ornamentation LM: echinate, SEM: echinate, perforate, TEM tectum: eutectate.

Our palynological results are concordant to previous research about *Tussilago* and *T. farfara* pollen investigations. Pollen grains of *T. farfara* are radially symmetric, isopolar, 3-colporate, oblate-spheroidal, echinate (LM)

Conclusion

In Turkey, *T. farfara* has a common name "öksürük otu" and has been traditionally used as medicine all over the World. Pollen morphology of *T. farfara* is determined. The remarkable property of

this species is colpus as wide as porus and porus big.

Acknowledgements

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Bal arısı ile Tozlaşan *Tussilago farfara*'nın Polen Morfolojisi

Öz: Bu çalışmada, *Tussilago* L. (Asteraceae) cinsine ait *T. farfara* L. polen morfolojisi ışık mikroskobu (LM) ile incelenmiştir. Yapılan incelemelere göre, bu taksona ait polenler tek, radyal simetrik, izopolar, oblat-siferoid, kolporat, ekinat özellik göstermektedir.

Bu taksonlara ait palinolojik özelliklerin çeşitli palinolojik, taksonomik ve farmasötik botanik çalışmalarında taksonların daha doğru teşhis edilmesine yardımcı olacağını düşünmekteyiz.

Anahtar kelimeler: Asteraceae, *T. farfara*, ışık mikroskobu, palinolojik, taksonomik araştırmalar.

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Appendix

Pollen morphology of *Tussilago farfara* L.

Leaves petiolate, lamina 10-20(-30) cm diam., with rather acute lobes, margin irregularly toothed, at first white-floccose on both sides, becoming glabrous above. Scapes 4-15 cm (lengthening in fruit to c. 30 cm), with numerous purplish scale-leaves, floccose, erect in bud, nodding after anthesis. Capitula 1.5-2.5 cm broad. Phyllaries linear, obtuse, often purplish and white-hairy, sometimes with black glandular hairs. Achenes 3-4 mm. Pappus 10-15 mm. Fl. 3-4. Waste and sandy places, damp ground, s.l.-2400 m.

Described from Europe (Hb. Linn. 995/10, photo!).

Widespread except in E. Anatolia; commonest in N. Turkey

Europe except extreme N., N. & W. Asia, N. Africa. Euro-Sib. element.

Introduced in N. America. The leaves of this species are medicinal [10].