

**POLLEN AND ACHENE MORPHOLOGY OF TARAXACUM F.H. WIGG.
(ASTERACEAE) SPECIES DISTRIBUTED AROUND BURSA**

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ARTICLE INFO	ABSTRACT
<p>Article History: Received: 24April 2018 Accepted: 30 April 2018</p>	<p>In this study, we extensively examined the pollen morphology and some important morphological characteristics of <i>Taraxacum</i> F.H. Wigg. (Asteraceae) species which have a wide distribution in and around Bursa. There are 7 <i>Taraxacum</i> species distributed in Bursa and its vicinity, 2 of which are endemic. Taxons are <i>Taraxacum serotinum</i> Poir., <i>Taraxacum hyberniforme</i> Soest, <i>Taraxacum minimum</i> Heldr. ex Nyman, <i>Taraxacum aznavourii</i> Soest, <i>Taraxacum buttléri</i> Soest, <i>Taraxacum pseudobrachyglossum</i> Soest and <i>Taraxacum turcicum</i> Soest. According to the palynological studies, <i>T. turcicum</i> pollens are moderate monad, their pollen type is three-zonocolporate rarely tetra-zonocolporate, pollen shape is subprolate, prolate-spheroidal, oblat-spheroidal and exine ornamentation is defined as spinulate. <i>T. pseudobrachyglossum</i> pollens are medium sized monad, pollen type is three-zonocolporate, pollen shape is subprolate, prolate-spheroidal, oblat-spheroidal; exine ornamentation is spinulate; spine and spinule. <i>T. serotinum</i> pollens are medium sized monad, pollen type is three-zonocolporate rarely tetra-zonocolporate, pollen shape is prolate-spheroidal, oblat-spheroidal; exine ornamentation is spinulate; spine and spinule. <i>T. minimum</i> pollens are medium sized monad, pollen type is three-zonocolporate, pollen shape is suboblate, prolate-spheroidal, oblat-spheroidal; exine ornamentation is spinulate; spine and spinule. <i>T. hyberniforme</i> pollens are medium sized monad, pollen type is three-zonocolporate, pollen shape is prolate-spheroidal, oblat-spheroidal; exine ornamentation is spinulate; spine and spinule. <i>T. aznavourii</i> pollens are medium sized monad, pollen type is three-zonocolporate, pollen shape is prolate-spheroidal, oblat-spheroidal; exine ornamentation is spinulate; spine and spinule. <i>T. buttléri</i> pollens are medium sized monad, pollen type is three-zonocolporate, pollen shape is suboblate, prolate-spheroidal, oblat-spheroidal, subprolate; exine ornamentation is spinulate; spine and spinule. <i>T. turcicum</i>, <i>T. pseudobrachyglossum</i>, <i>T. aznavourii</i> its achene has a straw coloured, 2,5-4mm achene length, <i>T. minimum</i> its achene has a yellowish or straw coloured, 3-4mm achene length, <i>T. hyberniforme</i> its achene has a red-brown, 4-5,5mm achene length, <i>T. buttléri</i> its achene has a brown-red, 2,5-4,5mm achene length, <i>T. serotinum</i> its achene has a straw-brown, 2,5-3mm achene length. The aim of this study is to examine the morphological characteristics of the detailed pollen morphology and important characters of <i>Taraxacum</i> taxa belonging to the Asteraceae family of Bursa.</p>
<p>Keywords: Asteraceae, <i>Taraxacum</i>, Pollen morphology, Achene morphology, Bursa, Turkey.</p>	
<p>DOI: 10.26900/jsp.2018.15</p>	

1. INTRODUCTION

The Asteraceae (Compositae) family is in the first place in terms of diversity having more than 1.100 genera and 20.000 species in the world. Family flora in Turkey has 134 genera and 1209 species (Davis et al 1988, Özhatay and Kültür 2006, Doğan 2007). It is found especially in tropical and subtropical semi-arid regions like the Mediterranean Region, Mexico and South Africa; in tropical forests of Africa, South America and Australia and in the stony and shrubland areas (Heywood 1978). They are less common in humid tropical forests (Kadereit and Jeffrey, 2007).

Asteraceae are entomophilous plants containing an annual, biennial or perennial herbaceous plants or shrubs and sometimes laticifers. Leaves alternate or sometimes opposite, exstipulate (rarely stipuloid), entire, toothed, lobed or variously dissected. Individual flowers usually numerous (rarely only), sessile and aggregated into a capitulum surrounded by a protective involucre of 1-many series of phyllaries (involucral bracts), rarely fused; capitula sometimes aggregated into a secondary capitulum-like head (pseudocephalium). Receptacle naked or bearing paleae (scales), long hairs or bristles. Flowers epigynous, either all hermaphrodite and protandrous, or female, male (at least functionally so), or neuter (sterile) (Davis et al.1975, Yıldız and Aktoklu, 2010).

One of the most important members of family is the *Taraxacum* F.H. Wigg. The *Taraxacum* F.H. Wigg. is represented by approximately 2500 species and 43 sections worldwide. The total number of species of *Taraxacum* (Compositae = Asteraceae) in our country is 54 taxons. It has a wide distribution in the hot regions of the northern hemisphere. Although it is a cosmopolitan species, it distributes especially in Europe, Central Asia, Turkey, Iran, Afghanistan, Pakistan and India. A number of studies have been conducted worldwide on this apomixis species whose taxonomy is problematic (Richards., John, 1968).

Taraxacum is a perennial plant which is glabrous or arachnoid. Distinguishing characteristics is to have a leafless stem that carries hollow, latex rising from the leaf on the bottom and carrying flowers at the top. The crown board is bare; achene is usually long-beaked rarely beakless. Pappus pluriseriate, finely scabrous, persistent (Davis et al.1975).

Bednorz & Maciejewska-Rutkowska (2010) have carried out a research on pollen morphology, exine structure, ornamentation shape and morphological characteristics of the species using light microscope and scanning electron microscope (SEM) in their study of *Taraxacum pieninicum*. In addition, they investigated the outer surface of achene, spins, pappus and beak structure with scanning electron microscope (SEM).

Marciniuk et al. (2009) conducted a study on *Taraxacum scanicum* that shows the morphology of important characters such as pollen morphology, achene, outer bracts and flower. They studied showing the differences among the significant morphological characteristics of *Taraxacum scanicum*, *Taraxacum prunicolor* and *Taraxacum cristatum* species.

Marciniuk and Rudzińska-Langwald (2008) studied the diversity of pollen morphology of *Taraxacum* species in the ones which were selected according to chromosome level. They noted that there is a relationship between pollen morphology and reproduction pathways. In conclusion, the pollen of compulsory apomixis triploidal species shows variability and has characteristics of high rated deformed pollen grains. The optional apomixis tetraploids have relatively equal size and regular pollens. In the pentaploidal *Taraxacum mendax* and in species with unknown chromosome numbers (*Taraxacum portentosum* and *T. platyglossum*), these taxa have been shown as being optional apomixtis.

Jafari & Assadi (2007) investigated the morphological and anatomical features of *Taraxacum aurantacum* (ASTERACEAE) in the Iranian flora.

Gedik et al. (2014) studied two endemic species belonging to the *Taraxacum* species from the caryological perspective. There have been no previous studies on the karyology of *T. bellidiforme* and *T. revertens*; and the number of chromosomes and karyotype analysis of species have been presented for the first time in the science world.

The purpose of this study is to examine the morphological characteristics of the detailed pollen morphology and important characters of *Taraxacum* taxa belonging to the Asteraceae family of Bursa.

2. MATERIAL AND METHODS

Specimens belonging to *T. serotinum*, *T. hyberniforme*, *T. minimum*, *T. aznavourii*, *T. buttleri*, *T. pseudobrachyglossum* and *T. turcicum* were collected from different locations in Bursa in the months of April, May and June in 2017 during flowering and fruiting periods (Table 1). Plant samples taken from stations were pressed and dried in accordance with the herbarium rules and made ready for laboratory studies (Erdoğan et al. 2011, Günay. 2001). The samples are stored in the Uludağ University, Faculty of Sciences and Art, Department of Biology (BULU) herbarium.

For morphological studies, plant samples taken from 7 different stations were examined morphologically. Measurements were made for the individuals collected from each population using the criteria of plant height, achene length and width, cone, beak, pappus measurements, achene, measurements and positions of external bract. 10 to 30 measurements were made for each measurable character. OLYMPUS SZ 51 stereo microscope was especially used to be able to measure fruit parts and some micro characters in millimetric ocular.

Pollens from herbarium specimens were used for Palynological studies. Pollen slides prepared to examine in light microscope were prepared according to the methodology of Wodehouse (1935). The measurement and examination of pollens was conducted by using a microscope with Nikon Eclipse E100 including x40 and x100 lenses. Properties such as pollen diameter (AB), exine (E), intine (I), pore number, distance between pores, pore length (Plg), pore width (Plt) and spine length were taken into consideration in the microscopic measurement (Table2).

Table 1. Plant samples collected from different localities of Bursa province.

Taxa	Localities	The date collected	Collected by	Identified by
<i>T.turcicum</i>	Bursa: Görükle; Around the lodgement	15.04.2017	Narmin ABDULLAYEVA	Gül KUŞAKSIZ
<i>T.pseudobrachyglossum</i>	Bursa: Uludağ University Campus; Around the Faculty of Agriculture	16.04.2017	Narmin ABDULLAYEVA	Gül KUŞAKSIZ
<i>T.serotinum</i>	Bursa: Subsection of Merinos, road sides	26.04.2017	Narmin ABDULLAYEVA	Gül KUŞAKSIZ
<i>T. minimum</i>	Bursa: Kumla; Şahintepe stony area and meadow	03.05.2017	Narmin ABDULLAYEVA Gül KUŞAKSIZ Betül UĞUR	Gül KUŞAKSIZ
<i>T.hyberniforme</i>	Bursa: Demirtaş the south parts of the Grass Skiing Facility	10.10.2017	Narmin ABDULLAYEVA Gül KUŞAKSIZ	Gül KUŞAKSIZ
<i>T. aznavourii</i>	Bursa: Gürsu exit-Dışkaya village	10.10.2017	Narmin ABDULLAYEVA Gül KUŞAKSIZ	Gül KUŞAKSIZ
<i>T. butleri</i>	Bursa: Uludağ Wolfram mine upper regions	07.08.2003	R.GÜNAY Ö.YILMAZ	R.GÜNAY Ö.YILMAZ

3. RESULT

3.1. Pollen Morphology

The data obtained after the palynological studies carried out by the Wodehouse method for *T. turcicum* shows that pollen is medium sized monad, pollen type is three-zonocolporate rarely tetra-zonocolporate, pollen shape is subprolate, prolate-spheroidal, oblat-spheroidal; pollen diameter is A: 21,75-35,55 μ m, B: 21,5-33,83 μ m, A / B ratio 0.88-1.2; pore number is 5-(6) -7, distance between pores (mezoporium) is 15,03-24,53 μ m, pore length (Plg) is 4,43-7,02 μ m, pore width is (Plt) 3,07-6,16 μ m, Plg / Plt ratio is 1.18, subprolate, exine (E) is 0.91-2.25 μ m, intine (I) is 1.1-2.19 μ m; exine ornamentation is spinulate; spine length is 1,63-2,7 μ m (Fig 1. 1-3).

According to the obtained data for *T. pseudobrachyglossum*, pollens are medium sized monad, pollen type is three-zonocolporate, pollen shape is subprolate, prolate-spheroidal, oblat-spheroidal; pollen diameter is A: 23.5-39.52 μ m, B: 20.04-38.45 μ m, A / B ratio is 0.9-1.2; pore number is 5- (6) -8, distance between pores (mezoporium) is 12,6-28,08 m, pore length (Plg) is 3,71-6,91 m, pore width (Plt) is 3,986,9 m, Plg / Plt ratio is 1.02, prolate-spheroidal, exine (E) is 1,14-2,39 μ m, intine (I) is 1,14-2,64 μ m; exine ornamentation is spinulate; spine and spinule length is 1,46-3,46 μ m (Fig 1. 4-6).

According to the data obtained for *T. serotinum*, pollens are medium sized monad, pollen type is three-zonocolporate rarely tetra-zonocolporate, pollen shape is prolate-spheroidal, oblat-spheroidal; pollen diameter is A: 25,8937,27 μ m, B: 24,73-36,82 μ m, A / B ratio is 0.9-1,1; pore number is 6-(7)-8; distance between pores (mezoporium) is 15,9-24,48 μ m, pore length (Plg) is 3,79-7.06 μ m, pore width (Plt) is 3,37-5,64 μ m Plg / Plt ratio is 1.22, subprolate, exine (E) is 1.14-2.07 μ m, intine (I) is 1.3-2.23 μ m; exine ornamentation is spinulate; spin and spinule length is 1,63-3,27 μ m (Fig 1. 7-9).

According to the data obtained for *T. minimum*, pollens are medium sized monad, pollen type is three-zonocolporate, pollen shape is suboblate, prolate-spheroidal, oblat-spheroidal; pollen diameter is A: 21,03-35,84 μ m, B: 23,32-37,18 μ m, A / B ratio is 0.8-1.09; pore number is 5 - (7) -9, distance between pores (mesoporium) is 2,89-23,98 μ m, pore length (Plt) is 3,78-8,22 μ m, pore width (Plt) is 2,6 - 5,12 μ m, Plg / Plt ratio is 1.36, prolate, exine (E) is 0.9-1.74 μ m, intine(I) is 1.18-2.43 μ m; exine ornamentation is spinulate; spine and spinule length is 1,47-3,16 μ m (Fig 1. 10-11).

According to the data obtained for *T. hyberniforme*, pollens are medium sized monod, pollen type is three-zonocolporate, pollen shape is prolate-spheroidal, oblat-spheroidal; pollen diameter is A: 23,6731,38 μ m, B: 24,52-34,43 μ m, A / B ratio 0.9-1,1; pore number is 6- (7) -8, distance between pores (mezoporium) is 14,95-22,22 μ m, pore length (Plg) is 4,06-6,94 μ m, pore width (Plt) is 3,94-5,31 μ m, Plg /Plt ratio is 1.2, subprolate, exine (E) is 0.86-1.63 μ m, intine (I) is 1.09-2.09 μ m; exine ornamentationis spinulate; spine and spinule length 1,99-3,61 μ m (Fig 1. 12-13).

According to the data obtained for *T. aznavourii*, pollens are medium sized monad, pollen type is three-zonocolporate, pollen shape is prolate-spheroidal, oblat-spheroidal; pollen diameter is A: 24,8130,24 μ m, B: 20,09-31,52 μ m, A / B ratio is 0.8-1,3; pore number is 5-(6)-7; distance between pores (mezoporium) is 18,14-22,92 μ m, pore length (Plg) is 3,67-6,71 μ m, pore width (Plt) is 2,94-5,1 μ m, Plg / Plt ratio is 1.14, subprolate, exine (E) is 0.83-1.62 μ m, intine (I) is 1.01-2.54 μ m; exine ornamentation is spinulate; spine and spinule length 1,72-3,7 μ m (Fig 1. 14-15).

Table 2. A comparison of pollen structures about *Taraxacum* taxa

Taxa	No. of Pores	A	B	A/B	Plg	Plt	Plg/Plt	Mesopodium	E	I	Spinulate
<i>T.turcicum</i>	6	30,55	29,3	1,04	5,36	4,55	1,18	20,19	1,52	1,7	2,15
<i>T.pseudobrachyglossum</i>	6	29,73	28,64	1,04	5,2	5,1	1,02	19,86	1,5	1,85	2,38
<i>T.serotinum</i>	7	30,14	29,9	1	5,38	4,42	1,22	19,99	1,51	1,73	2,43
<i>T. minimum</i>	7	27,61	26,51	1,04	5,18	3,81	1,36	17,73	1,27	1,71	2,21
<i>T.hyberniforme</i>	7	27,53	27,09	1	5,34	4,45	1,2	18,6	1,22	1,55	2,6
<i>T.aznavourii</i>	6	28,58	27,9	1,02	4,94	4,33	1,14	20,8	1,18	1,55	2,43
<i>T.butleri</i>	6	26,47	25,77	1,03	4,34	4,12	1,05	20,11	1,18	1,43	2,33

A-pollen diameter (Long axis); B-pollen diameter (Short axis); Plg- pore length; Plt-pore width; E-exine; I-intine.

According to the data obtained for *T.butleri*, pollens are medium sized monad, pollen type is three-zonocolporate, pollen shape is suboblate, prolate-spheroidal, oblat-spheroidal, subprolate; pollen diameter is A: 22,98-22,54 μ m, B: 20,86-29,55 μ m, A / B ratio is 0.8-1,2; pore number is 6- (7) -8, distance between pores (mesopodium) is 17,63-25,8 μ m, pore length (Plg) is 2,95-5,61 μ m, pore width (Plt) is 2,886,1 μ m, Plg / Plt ratio is 1.05, prolate-spheroidal, exine (E) is 0.73-1.63 μ m, intine (I) is 1.01-2.19 μ m; exine ornamentation is spinulate; spine and spinule length is 1,63-3,49 μ m (Fig 1. 16-17).

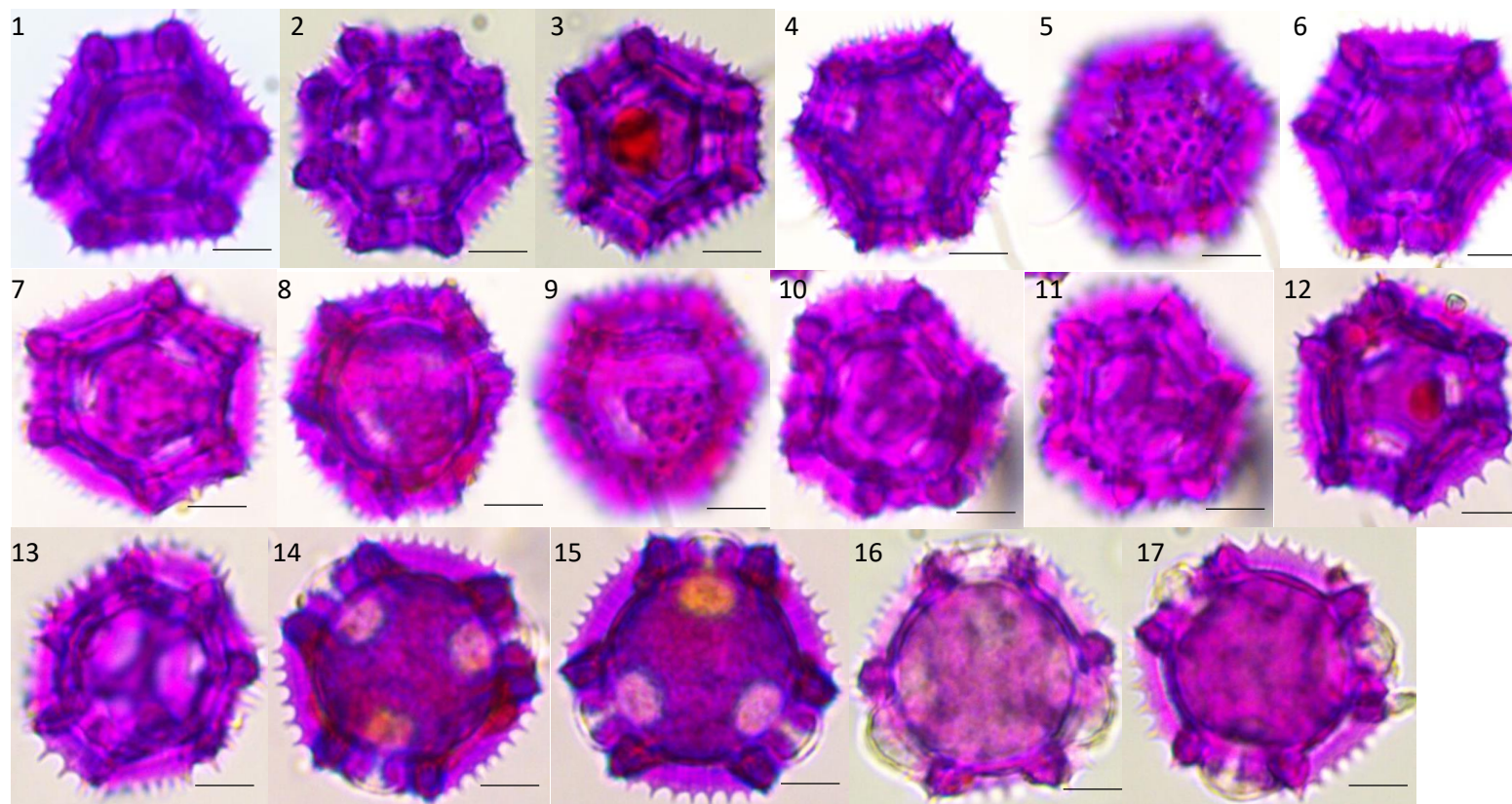


Figure 1. Pollen grains by light microscopy of *Taraxacum*. 1-3 *T.turcicum*; 4-6 *T.pseudobrachyglossum*; 7-9 *T.serotinum*; 10-11 *T.minimum*; 12-13 *T.hyberniforme*; 14-15 *T.aznavourii*; 16-17 *T.butleri* Scale bar 25 μ m.

Table 3. Comparison of *Taraxacum* F.H. Wigg. morphological characters.

	<i>T.turcicum</i>	<i>T.pseudobrachyglossum</i>	<i>T.serotinum</i>	<i>T. minimum</i>	<i>T.hyberniforme</i>	<i>T.aznavourii</i>	<i>T.butleri</i>
Achene color	strow coloured	strow coloured	strow brown	yellowish or strow coloured	red-brown	strow coloured	brown-red
Achene lenght	2,6-4,8mm	2,6-3mm	2,5-3mm	3-4mm	4-5,5mm	3-4mm	2,5-4,5mm
Achene width	0,8-1mm	1mm	0,5-1mm	1mm	1-1,5mm	1mm	0,5-1mm
Cone lenght	0,1-1mm	0-1mm	0,5-1mm	1-1,5mm	1-2mm	1mm	0,5-1mm
Beak lenght	5-12,6mm	7,5-11mm	5-10mm	8-11mm	4-8,5mm	3-6mm	2,5-5,5mm
Pappus lenght	6-8,2mm	5-8mm	6-7mm	5-6mm	5-7mm	3,5-5mm	3-5,5mm
The lenght of outer bracts	1-1,5cm	7-14mm	1,1-1,3cm	5-1,1cm	3,5-6mm	4-6mm	2-6mm
Position of outer bracts	spreading	recurved	recurved	spreading	spreading	recurved	recurved
Involucre lenght	1,3-1,9cm	1,1-1,8cm	1,1-1,9cm	1,1-1,8cm	1,2-1,6cm	1,1-1,3cm	7-12mm
Involucre hyaline margin	0,7-1,5mm	0,2-1mm	0,2-1mm	0,2-1mm	0,5-1mm	0,5-1mm	0,2-0,5mm
Height of the plant	11,5-25,3cm	12-32cm	17-36,5cm	12-19cm	5,5-15cm	8-19cm	5-13cm

3.2. Morphology and Achene Morphology

As a result of the researches, we saw similarities in the morphological characters among the species studied. However some characters show sharp differences from each other. The distinguishing characters are different in terms of achene colors, achene lengths, the position of the outer bracts and the edge width of the outer bracts. The differences between the examined morphological characters are shown in Table 3.

T. turcicum is a perennial herbaceous plant with a length of 11,5-25 cm. The plant floor is thick, its achene has a straw coloured and 4-6 mm in length (0,8-1 mm cone). The beak is 5 to 12 mm, it has off white pappus 6-8 mm. Outer bracts is ovate with 1-1,5 cm length, spreading. Involucre is 1,3 - 1,9 cm; it has hyaline margin of 0,7-1.5 mm.

T.pseudobrachyglossum is a perennial herbaceous plant with a length of 12-32 cm. Its achene has a straw coloured and it is 3,6-4,6 mm in length (1 mm cone); the beak is 7,5-11 mm long; it has off white pappus 5-8 mm. Outer bracts is 1-1,5 cm recurved. Involucre is 1,2-1,8 cm and it has a hyaline margin of 0,2-1 mm.

T. serotinum is a perennial herbaceous plant with a length of 17-36,5 cm. Plant is intensive arachnoid. Involucre is 1,1-1,9 cm in length, sometimes less or much. Outer bracts is brownish-reddish on the outside, linear or narrowly spandler, up to 1,1-1,3cm, recurved. Achene is pastel brown and has pedicellaria near the top. It is 3-4 mm in length with cone (0,5-1 mm). The beak is 5-10 mm; pappus is pastel brown and 6-7 mm long. Ligula is straw yellow and stigma is dirty yellow or greenish.

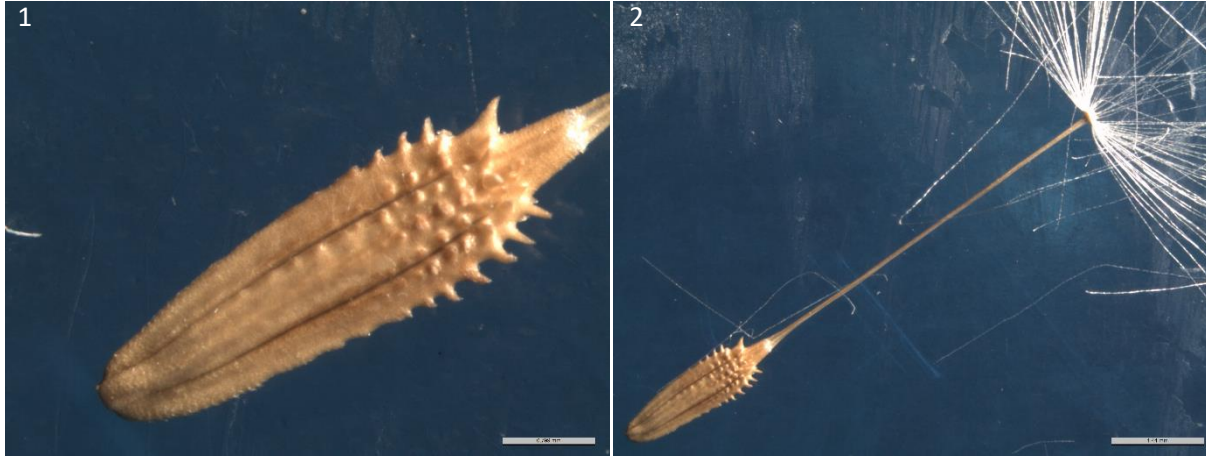
T. minimum is a perennial herbaceous plant with a length of 12-19 cm. Involucre is 1,1-1,8 cm; hyaline margin is 0,2-1 mm; ovate. Outer bracts is 0,5-1,1 mm \pm spreading. Achene is 4-5 mm (1-1,5 mm cone included) in yellowish or straw colour. Beak is 8-11 mm in length, pappus is 5-6 mm. Stigma is greenish.

T.hyberniforme is a perennial herbaceous plant with a length of 5,5-15 cm. Outer bracts is 3,5-6 mm \pm spreading, ovate, usually broad-edged, dark green with usually blackish median vein and dark humped. Involucre is 1,2-1,6 cm; it has a hyaline margin in 0,5-1 mm length. Ligula is gray-violet and externally striped. Achene is 5-7 mm (1-2 mm cone included in length), has red-brown coarse pedicellaria and thorny. The beak is 4-8,5 mm in length; pappus is 5-7mm long.

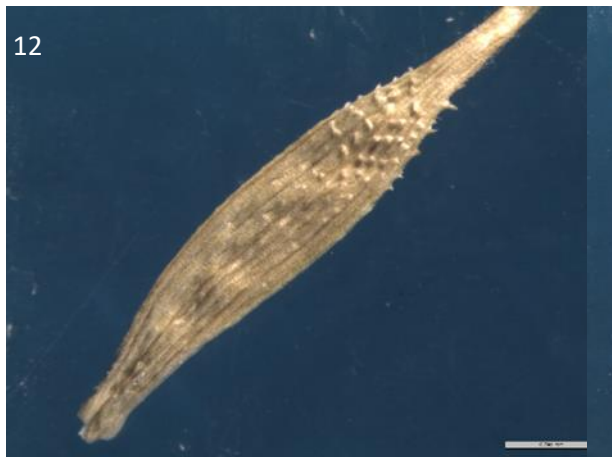
Taraxacum aznavourii is a perennial herbaceous plant with a length of 8-19 cm. Its achene has a straw coloured and it is small by having 3-5 mm length (1 mm cone). The beak is 3,5 to 5 mm, it has off-white pappus feathers of 3,5-5 mm. Outer bracts is 1-1,5 cm, lanceolate and its points are back-convoluted, humpless. Involucre is 1,1-1,3 cm and it has a hyaline margin of 0.5-1 mm.

Taraxacum buttleri is a perennial herbaceous plant with a length of 5-13 cm. The plant is small. Its achene has a dark brown-red color and 3-5,5 mm long (0,5-1 mm cone). The beak is 2,5 to 5,5 mm and it has off-white pappus feathers with 3,5-5 mm length. Outer bractea has 2-6 mm width and it is strictly back-convoluted. Involucre is 0,7-1.2 cm. It has hyaline margin of 0,2-0,5 mm. Ligula is straw yellow and stigma is dirty yellow or greenish.

Figure 2. *Taraxacum* F.H. Wigg. Achene; Scale bar: *T. turcicum* 1 (1,44mm),2 (0.79mm) ; *T. pseudobrachyglossum* 3 (1.44mm), 4 (1.13mm); *T. serotinum* 5 (1.44mm),6 (0.707mm); *T. minimum* 7 (1.44mm),8 (0.801mm); *T. hyberniforme* 9 (1.44mm), 10 (0.801mm); *T. aznavourii* 11 (1.44mm),12 (0.895mm); *T. butleri* 13 (1.28mm),14 (0.801mm);







4. Discussion

Palynological and morphological studies on *Taraxacum* taxa have revealed some differences when compared with findings in this study. Bednorz & Maciejewska-Rutkowska (2010) according to the study about *Taraxacum pieninicum* taxon, pollen grains are mainly medium sized isopolar; the polar axis is 24 µm (range between 20-30 µm) and the equatorial axis (E) is 25 µm (range between 20-32 µm), the P / E value is from 0,98 to 1,16, the mean value is 1,06. Pollen shape is prolate spheroids, sometimes oblate spheroid and has circular ambles. Pollen grains are three-zonocolporate. Exine layer is determined having a thickness of 10-13µm (including the spines). The thickness of the exine layer is 4µm at maximum according to the data obtained in this study. Achene was determined as brownish purple and the fruit had an average height of 18 mm (15-20mm). The shape was elliptic. Achene is 5mm, cone is 2mm (in pyramidal shape) and the beak is 10mm. Achene also has ordered spines, ranging from 3 to 4 in each order.

Marciniuk et al (2009) *Taraxacum scanicum* achenes have differently ordered spins of 3,5-4 mm long and they are in red brown color. The outer bractea is green and sprawled. It has narrow edges of 0,1-0,2 mm. Palynological findings show that the average maximum pollen diameters of *Taraxacum scanicum* are 22.48 µm inside (without exine) and 33.83 µm outside. The variability is relatively low. The internal diameter range is 14,3 – 30,8µm. For the 78% of the pollen grains, it is determined as 20,1 - 25µm. In this study, the obtained data shows a difference between 27-30 µm.

Osman (2006) *Taraxacum turcicum* polar axis has been determined as 34 µm (range between 32 and 35 µm). Equatorial axis (E) is 37 µm (range between 35 and 43 µm) and P / E value is 0,92. Pollen shape is oblate-sferoidal and exine ornamentation is spinelate. The pollen grains are three-zonocolpate; rarely tetra-zonocolporate. In the data obtained in this study, *Taraxacum turcicum* pollen type is three-zonocolporate rarely tetra-zonocolporate, pollen diameter is A: 21,75-35,55µm, B: 21,5-33,83µm, A / B ratio 0.88-1.2; pollen shape is subprolate, prolate-spheroidal, oblat-spheroidal; exine ornamentation is spinulate was found to be compatible with the work done.

The micromorphology of the most *Taraxacum* species has not been investigated. There are no information of achene microsculpturing of any dandelion species and there are only data of pollen morphology of a few species of this genus (Jones & Wilson 2001; Weryszko-Chmielewska & Chwil 2005; Osman 2006). That is why we can not entirely compare our results with the data from literature.

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