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EFFECTS OF METEOROLOGICAL FACTORS ON POLLEN FLORA IN THE ATMOSPHERE OF SINOP (TURKEY)

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Abstract

This study was conducted for determining the plant taxa of the pollen grain in the atmosphere of the city center of Sinop (Turkey) and investigating the effects of meteorological factors on pollen concentration, by analyzing daily, weekly and monthly changes in the atmosphere. The types and amounts of pollen grain in the atmosphere were determined using Burkard trap. On the basis of the average of 2 years (2016 - 2017), the dominant trees taxa in the atmosphere were Cupressaceae/Taxaceae (32.67%), Pinaceae (15.51%), *Morus* sp. (5.50%), *Quercus* sp. (2.76%), *Alnus* sp. (2.24%), *Corylus* sp. (1.48%), *Carpinus* sp. (1.43%), *Juglans* sp. (1.43%), *Fraxinus* sp. (1.33%), *Olea europaea* (1.05%) and Poaceae (Grass) (5.29%), whereas the dominant weed taxa were Urticaceae (11.16%), *Ambrosia* sp. (4.31%), Amaranthaceae (3.21%), and *Mercurialis* sp. (2.05%). Temperature and wind speed had a positive effect on the increased amount of pollen, whereas precipitation had a negative effect on it. On the basis of the data obtained, a pollen calendar was prepared for the area.

Introduction

Turkey is located in the intersection of Euro-Siberian (Circumboreal), Irano-Turanian and Mediterranean phytogeographical regions, leading to very rich vegetation due to its climate character and physiographical structure. Climate and geographic factors mostly control the natural vegetation and distribution areas of plants. Therefore, pollen types and pollinosis vary in yearly basis. The meteorological factors have an impact on the amount of pollen grain produced by plants in the air (Malyer 2011). Owing to the effect of air currents, pollen grain can be transported to very long distances (D'Amato *et al.* 2007). Performing aeropalynological studies for each region and preparing a pollen calendar provide a temporal and economical advantage for the vegetation and climate in the region as well as the afforestation projects, monitoring air pollution and the treatment of pollen-related allergic diseases. For this purpose, aeropalynological studies have been conducted for numerous years in Turkey as in other countries; on the basis of the gravimetric and volumetric methods pollen calendars have been prepared by different workers (Yavru 2007, Ceter *et al.* 2012, 2014, Türkmen *et al.* 2018).

This study was conducted for determining the plant taxa of the pollen grain in the atmosphere of the city center of Sinop and investigating the effects of meteorological factors on pollen concentration, by analyzing daily, weekly, and monthly changes in the atmosphere. The results of this study will contribute to the palynological database of Turkey and provide useful information on the other branches of botany, such as apiculture, silviculture, and ecology and the periods when individuals with particular pollen allergy should be cautious in Sinop.

Materials and Methods

Five vegetation types have been defined in the Sinop peninsula as follows: Forest, degraded forest, maquis, frigana, and dune. Of these plants, floristically 19.1% belong to the Mediterranean,

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18.5% to the Euro-Siberian (Circumboreal), 1.5% to the Irano-Turanian floristic elements, 3.1% to the common plants, and 57.8% to those with unidentified floristic region. The presence of humid and warm Mediterranean climate in the city center of Sinop contributes to the plant biodiversity. The characteristic and dominant forest vegetation types are *Fagus orientalis*, *Carpinus betulus*, *C. orientalis*, *Quercus cerris* subsp. *cerris*, *Q. hartwisiana*, *Fraxinus angustifolius* subsp. *oxycarpa*, *Ulmus minor* subsp. *canescens*, *Acer trauvetteri*, *A. campestre*, and *Castanea sativa*. Floristic composition includes shrubs such as *Rhododendron luteum*, *Ilex colchica*, *Rubus canascens*, *Daphne pontica*, and *Crataegus monogyna*. The characteristic tree and shrub species of the maquis vegetation formed due to the deterioration of *Pinus brutia* forests by biotic factors, namely *Quercus ilex*, *Arbutus unedo*, *Phillyrea latifolia*, *Laurus nobilis*, *Myrtus communis* subsp. *communis*, *Spartium junceum*, and *Olea europaea* var. *sylvestris*. The plants in the frigana vegetation under the pressure of the the city in the north are *Sarcopoterium spinosum* and *Quercus ilex*, *Laurus nobilis*, *Phillyrea latifolia*, *P. terebinthus*, *Arbutus unedo*, *Vitis sylvestris*, *Carpinus orientalis*, *Crataegus monogyna* subsp. *monogyna*, *Cistus creticus*, *Cistus salviifolius* and *Corylus avellana* (Karaer and Kılınç 1993, Kılınç and Karaer 1995).

The plants mostly used for landscaping in the parks and gardens are *Platanus orientalis*, *Washingtonia robusta*, *Magnolia grandiflora*, *Fraxinus excelsior*, *Acer palmatum*, *Casuarina equisetifolia*, *Pinus pinea*, *Salix babylonica*, *Populus alba*, *Phoenix canariensis*, *Cupressus leylandii*, *Picea pungens*, *Aesculus hippocastanum*, *Cersis siliquastrum*, *Eleagnus angustifolia*, *Eucalyptus globulus*, *Magnolia* x *soulangeana* and *Magnolia stellate*.

The types and amounts of pollen grain in the atmosphere were determined using Burkard trap. The device was placed in 3.5 m high building in the city center of Sinop (Fig. 1). The data of the study were recorded between January 01, 2016 and December 31, 2017. The location of the device was at an altitude of 81m above the sea level and in 42°01´30.09´´N and 35°09´36.49´´E (Anon. 2017).

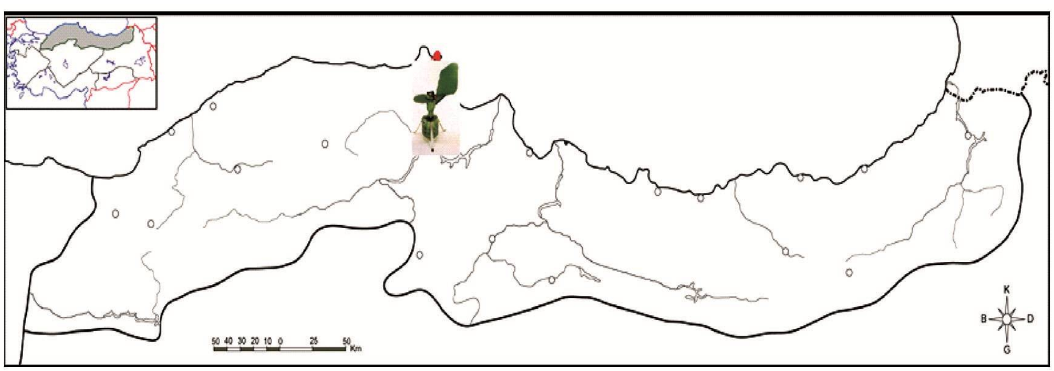


Fig. 1. The location of Burkard sampler at Sinop, Turkey.

The melinex tape used to collect the pollen data was fastened on the disc in the Burkard device with a double-sided adhesive tape coated with safranine glycerin gelatin (Pınar *et al*. 2003). The tape was replaced every 7 days intervals, divided into equal parts at a length of 48 mm and placed on the glass slide. The glass slides were coated with basic fuchsin glycerin gelatin, and the pollen count was performed using x400 magnification. The Spanish Aerobiological Network (REA: Red Española de Aerobiología) procedures were followed for airborne sampling and pollen analysis in this survey (Galán *et al*. 2007). The recorded pollen counts were converted to m^3

(Lacey and West 2006). Reference preparations of the local flora plants, palynological atlas, and books were utilized for the identification of pollens (Aytug 1971, Lewis 1983, Pehlivan 1995).

The data required for the comparison of the detected pollen grain in the atmosphere with the meteorological factors (temperature, precipitation, relative humidity, wind speed, and wind blowing) were obtained from the Ministry of Agriculture and Forestry, Sinop Meteorology Station (Table 1).

Table 1. Mean montly meteorological data for Sinop (2016 - 2017).

Year	Meteorological data	I	II	III	IV	V	VI	VII	VIII	XI	X	XI	XII
2016	Mean temp. (0ºC)	4.4	5.6	7.7	9.5	13.8	19.8	22.9	24.2	21.8	13.5	12.1	10.8
	Total precipitation (mm)	81	42.4	28.2	30.8	104.6	29.8	43.7	37.1	94.8	54	121.8	177.6
	Mean relative humidity (%)	80.1	76.8	86.8	85.7	86.5	88.7	88.5	89.8	79.4	89.7	80.4	81.7
	Mean wind velocity (m/s)	3.1	3.0	2.9	3.2	2.5	2.6	2.7	2.5	2.2	2.8	2.7	2.8
2017	Mean temp. (0ºC)	4.4	5.6	7.7	9.5	13.8	19.8	22.9	24.2	21.8	15.3	12.1	10.8
	Total precipitation (mm)	46.0	15.6	46.0	43.0	66.6	59.0	1.6	39.6	24.6	36.4	74.8	132.8
	Mean relative humidity (%)	82.2	77.4	91.7	84.3	85.7	83.0	79.0	79.5	77.3	79.5	80.1	71.1
	Mean wind velocity (m/s)	3.4	3.4	2.8	3.1	2.6	2.5	2.4	2.6	2.4	2.4	2.4	2.5

Spearman's correlation analysis was used for demonstrating the correlation between meteorological factors (daily average temperature, average rainfall, average relative humidity, average wind speed) and *Alnus* sp., Amaranthaceae, *Ambrosia* sp., *Carpinus* sp., *Corylus* sp., Cupressaceae/Taxaceae, *Fraxinus* sp., *Juglans* sp., *Mercurialis* sp., *Morus* sp., *Olea europaea*, Pinaceae, Poaceae, *Quercus* sp. and Urticaceae, which were detected to have the highest daily average pollen amounts in the atmosphere of Sinop. For the correlation analysis, the main pollen seasons (MPS) of taxa were determined on the basis of the 98% method (Emberlin *et al.* 1993, Galán *et al.* 1995). The data were statistically analyzed using SPSS version 21.0 (Table 2).

Results and Discussion

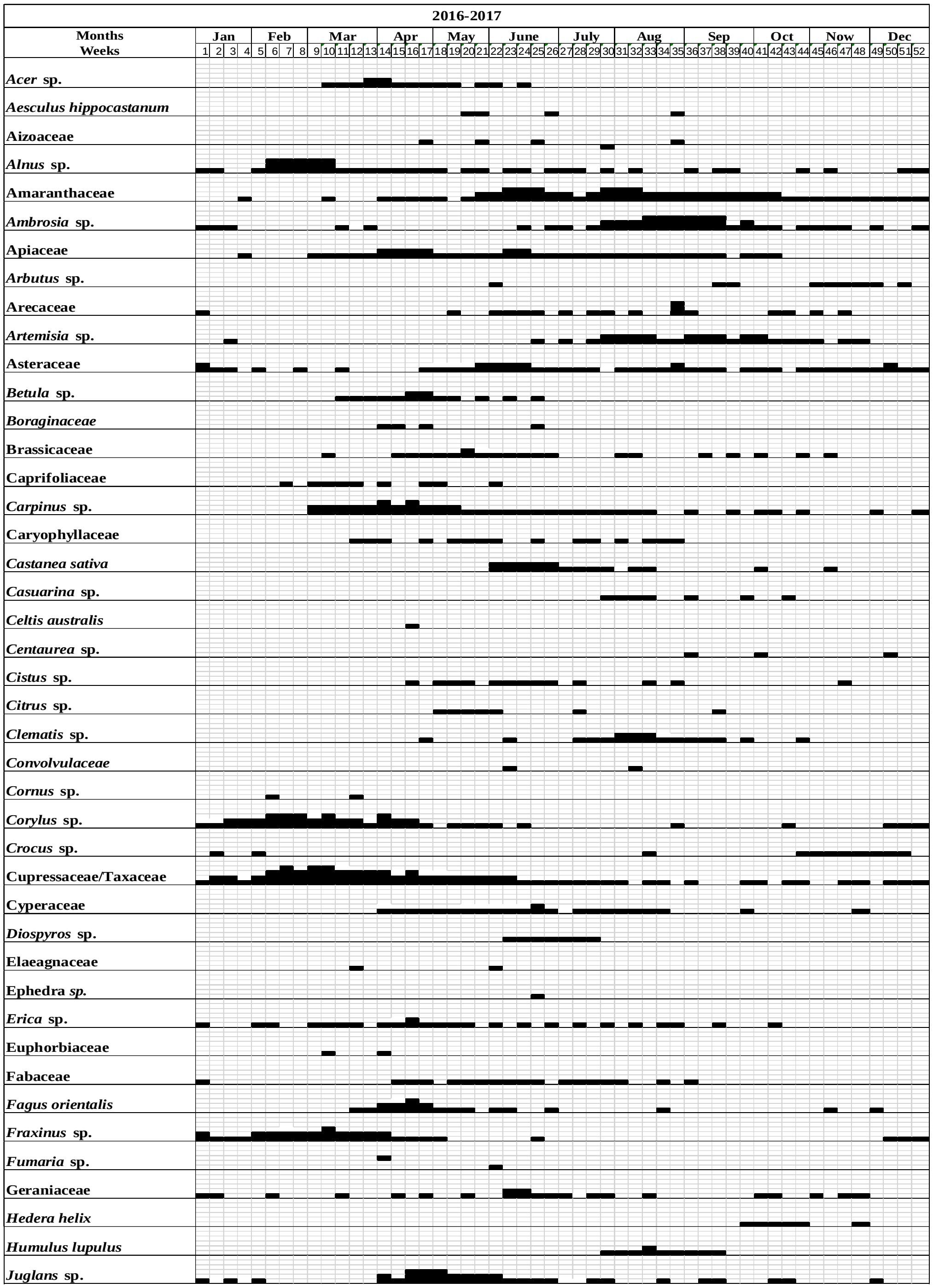
On the basis of the examination of pollen studies, the number of taxa detected in the city of Sinop was found to be higher than that conducted in the same region of Turkey a few years back (Ceter *et al.* 2012, 2014). Unlike the present study, the yearly total 93414 pollen grain were detected by Ceter *et al.* (2014) in the city of Sinop (Korucuk village) between 2010 and 2012. Of these pollen taxa 69. 5% were trees, 13.4% were weeds and 17.1% were Poaceae (Grass) types. As it was observed, the pollen grain of trees (71.12%) **was** lower and the rate of Poaceae pollen grain (5.29%) was higher compared with that found in the present study (Table 4). The different number of taxa and pollen grain detected may be because the meteorological factors during the study period and the location and altitude where the device was placed were different. There are reports in which the amount and types of pollen vary at different altitudinal heights (Chakraborty *et al.* 2001).

Table 2. The results of Spearman's correlation analysis between daily pollen count of 15 dominant taxa and meteorological data for Sinop.

Dominant pollen taxa	Mean daily temp.	Mean total rainfall	Mean daily humidity	Mean daily wind speed
Alnus sp.	0.503**	0.044	0.154	0.024
Amaranthaceae	–0.470**	–0.284	–0.274	–0.183
Ambrosia sp.	0.155	–0.142	0.056	–0.027
Carpinus sp.	0.139	–0.048	0.302	0.078
Corylus sp.	0.650**	–0.274	0.012	0.327
Cupressaceae/Taxaceae	0.553**	0.153	0.577**	–0.124
Fraxinus sp.	0.557**	0.130	–0.006	0.183
Juglans sp.	0.183	–0.054	0.197	0.395*
Mercurialis sp.	0.203	0.127	–0.044	–0.219
Morus sp.	–0.226	0.038	–0.477**	–0.030
Olea europaea	–0.092	–0.105	–0.195	–0.259
Pinaceae	0.315	–0.223	–0.073	0.578**
Poaceae	0.193	0.056	–0.146	0. 172
Quercus sp.	0.308	0.002	0.082	0.356*
Urticaceae	–0.161	–0.060	0.169	–0.143

The amount of pollen grain detected in the atmosphere of Sinop in 2016 and 2017 was 74,692 and 44,669, respectively. There was a marked decrease in the amount of pollen grain in the second year of the study. The amount of pollen in the atmosphere was associated with vegetation as well as meteorological factors such as temperature, precipitation, relative humidity, and wind speed. Temperature, duration of sunshine, and moderate winds increased the amount of pollen in the atmosphere, whereas light winds and strong winds, precipitation and relative humidity have a negative effect on the pollen concentration. Rain caused pollen to fall onto the ground without spreading into the atmosphere. Atmospheric events such as fog and dew also have a negative impact on the amount of pollen. In addition, mild winter months result in an early onset of pollinosis period, whereas cold winters result in a delayed pollinosis (Gemici 2011). The examination of meteorological data revealed that the average temperature in 2016 (14.5°C) was similar to that in 2017 (14.0°C) and the average wind speed in 2016 and 2017 was 2.8 and 2.7 m/s, respectively (Table 1). The comparison of precipitation parameters revealed that total precipitation in 2016 (846 mm) was slightly higher than that of 2017 (586 mm). The relative humidity in 2016 and 2017 were 84.5 and 80.9%, respectively. The decreased amount of pollen in 2017 is due to the low temperature, high precipitation and high humidity (the highest level in March, 91.7%) in the spring season in which trees and woody taxa with a high potential of producing pollen are blossomed. The average wind speed in 2017 was lower than that of 2016 (Table 1).

Table 3. Pollen calendar prepared for Sinop atmosphere in 2016 - 2017 (mean).



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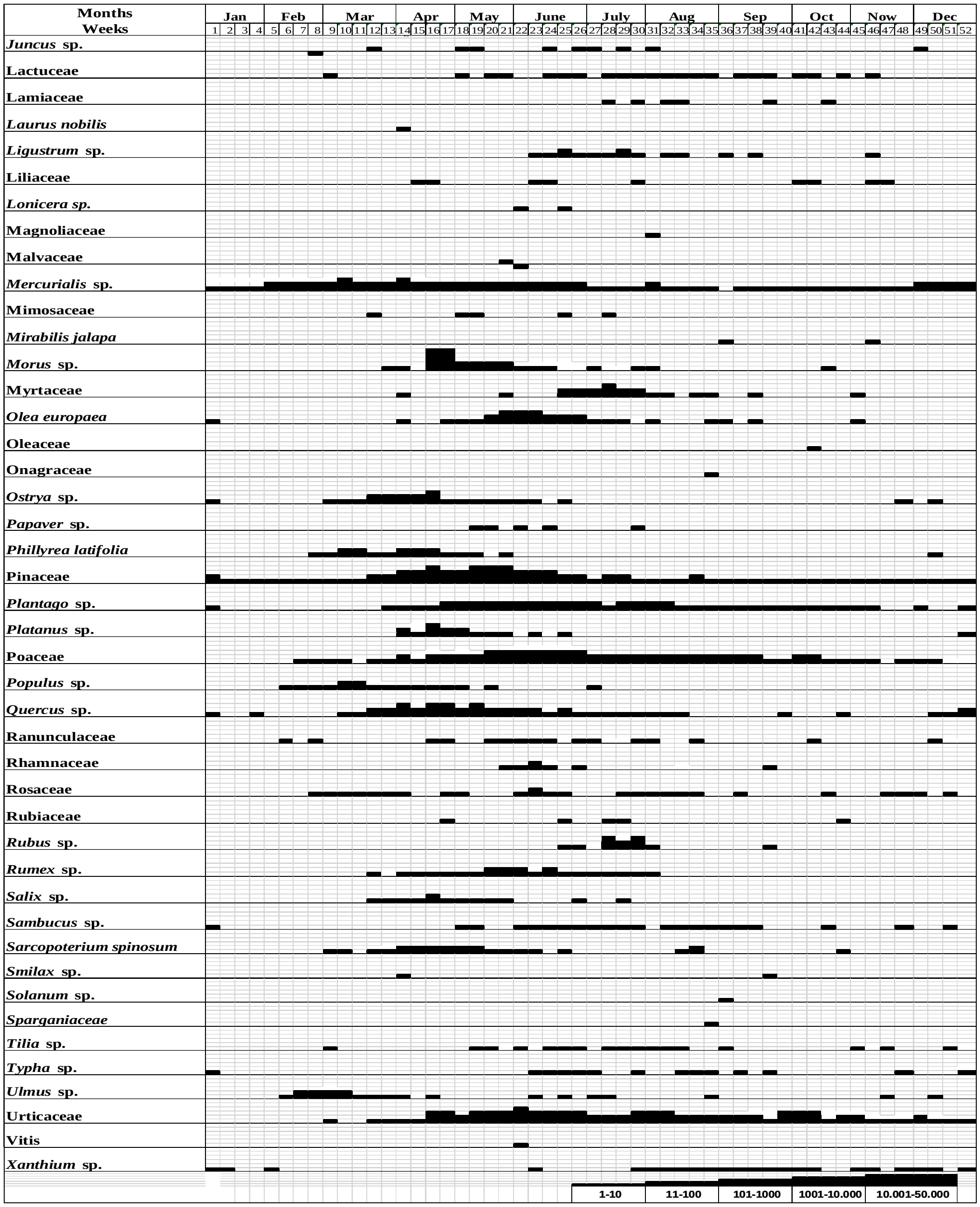

The average amount of Cupressaceae/Taxaceae pollen grain, which was the dominant pollen in the atmosphere during the 2-year study period, was 19,496 pollen (32.67%). This amount constitutes a major part of all pollen (32.67%). The highest concentration of Cupressaceae/ Taxaceae pollen grain was observed in February and March, and they reached the maximum level at the 10th week. The MPS was between February 5 and May 13 (79 days) (Tables 3 and 4). In the aeropalynological studies conducted in Turkey, Cupressaceae/Taxaceae pollen grain is commonly observed in all regions (Bicakci *et al*. 2010). In studies conducted by many researchers, it has been stated that the Cupressaceae/Taxaceae pollen grain has allergenic effects at low or moderate levels (D'Amato *et al*. 2007). This taxon, which commonly grows in the city's parks and gardens and cemeteries, is important in terms of being an allergenic source for the city of Sinop.

Pinaceae which is one of the dominant taxa in the atmosphere of Sinop, was grown both naturally and in parks and gardens. Pollen grain of Pinaceae (15.51%) was determined intensely in the atmosphere between the 13th and 27th weeks. Pinaceae pollen grain peaked at the 16th and 21st weeks. The MPS was between April 5 and June 20 (76 days) (Tables 3 and 4). It is emphasized that pollen grain of this taxon had low allergenic effects (D'Amato *et al*. 2007).

The pollination of Urticaceae family (11.16%), is the dominant pollen grain in the atmosphere of Sinop, began by spring, and the pollen density increased in June. The pollen count peaked at the 22th week. The MPS was between April 18 and November 22 (207 days) (Tables 3 and 4). The pollen grain of Urticaceae family is among the most common respiratory allergy symptoms in word wide (Docampo *et al*. 2007).

The proportion of *Morus* sp. pollen grain which are cultivated in the gardens of houses, in total pollen rate was 5.49%. Most of the pollen recorded belong to the year of 2016. The highest concentration of *Morus* sp. pollen grain was detected in April in the first year and in May in the second year of the study. It may be concluded that the amount of *Morus* sp. pollen grain in 2016 was relatively higher than that of 2017 because the mulberry trees, which were very close to the area where the device was placed, were cut downed in the year of 2017. The MPS was between April 17 and May 20 (33 days in average) (Tables 3 and 4). It was reported that the pollen grain of *Morus* sp. was modaretely or highly allergenic (Çeter *et al.* 2012). Ongoing pollen studies will show whether pollen grain of *Morus* sp. will be included in the list of dominant pollen in the atmosphere of Sinop in future.

Poaceae (Grass), which has the high number of species in the flora of Turkey and produces high allergen pollen grain, is among the taxa with dominant pollen grain in the atmosphere of Sinop (5.29%). Although it exhibits continuity in the air in the February - December period, the highest concentration level was observed in June and May, respectively. The pollen grain peaked at the 21st week. The MPS was between April 5 and October 19 (171 days) (Tables 3 and 4). Poaceae pollen has been emphasized to be high allergenic in numerous studies (D'amato *et al*. 2007). The pollen count results of this taxon in Bursa, Ankara and Konya are announced to the public in the form of a weekly calendar (Bıçakçı *et al.* 2009).

Ambrosia sp. pollen grain constitutes 4.34% of the pollen grain**,** recorded in the atmosphere of Sinop for two years. These pollen grain reached the maximum level at the 36th week. The highest amount levels in 2016 and 2017 were detected on September 2 and August 28, respectively. The MPS is between July 27 and October 29 (70 days) (Tables 3 and 4). However, *Ambrosia* spp. are not found in the flora of Sinop, *A. artemisiifolia* is an invasive taxon that spreads all over the central and eastern Black Sea region (Önen *et al*. 2015). Additionally, *Ambrosia* pollen grain caught by the trap, with the north or northeastern winds may have come from Ukraine and Russia around the Azov Sea (Celenk and Malyer 2017). Pollen grain of *Ambrosia* (*A. artemisiifolia, A. trifida)* is recognized as a significant cause of allergic rhinits (D'Amato *et al.* 2007).

During the study period pollen grain of Amaranthaceae (4.71%) and *Mercurialis* sp. (2.14%) the dominant weeds taxa in the atmosphere of Sinop was detected to be highest in June

Table 4. Annual pollen concentration and percentage of pollen taxa recorded at Sinop (2016 - 2017).

Year	2016		2017		Total	
Taxa	Pollen count	%	Pollen count	%	Pollen count	%
Acer sp.	45	0.06	65	0.15	110	0.09
Aesculus hippocastanum	2	0.00	2	0.00	4	0.00
Alnus sp.	1007	1.35	1663	3.72	2670	2.24
Arbutus sp.	20	0.03	5	0.01	25	0.02
Arecaceae	239	0.32	30	0.07	269	0.23
Betula sp.	108	0.14	44	0.10	152	0.13
Caprifoliaceae	22	0.03	7	0.02	29	0.02
Carpinus sp.	832	1.11	878	1.97	1710	1.43
Castanea sativa	333	0.45	70	0.16	403	0.34
Casuarina sp.	20	0.03	5	0.01	25	0.02
Celtis australis	0	0.00	1	0.00	1	0.00
Cistus sp.	46	0.06	4	0.01	50	0.04
Citrus sp.	5	0.01	7	0.02	12	0.01
Clematis sp.	168	0.22	7	0.02	175	0.15
Cornus sp.	2	0.00	2	0.00	4	0.00
Corylus sp.	901	1.21	866	1.94	1767	1.48
Cupressaceae/Taxaceae	15529	20.79	23463	52.53	38992	32.67
Diospyros sp.	11	0.01	6	0.01	17	0.01
Elaeagnaceae	0	0.00	10	0.02	10	0.01
Ephedra sp.	1	0.00	0	0.00	1	0.00
Erica sp.	68	0.09	49	0.11	117	0.10
Fagus orientalis	353	0.47	188	0.42	541	0.45
Fraxinus sp.	1135	1.52	455	1.02	1590	1.33
Hedera helix	7	0.01	24	0.05	31	0.03
Juglans sp.	1206	1.61	500	1.12	1706	1.43
Laurus nobilis	2	0.00	0	0.00	2	0.00
Ligustrum sp.	131	0.18	10	0.02	141	0.12
Lonicera sp.	1	0.00	3	0.01	4	0.00
Magnoliaceae	0	0.00	2	0.00	2	0.00
Mimosaceae	2	0.00	22	0.05	24	0.02
Morus sp.	6451	8.64	112	0.25	6563	5.50
Myrtaceae	702	0.94	29	0.06	731	0.61
Olea europaea	1039	1.39	216	0.48	1255	1.05
Oleaceae	0	0.00	1	0.00	1	0.00
Ostrya carpinifolia	203	0.27	207	0.46	410	0.34
Phillyrea latifolia	89	0.12	104	0.23	193	0.16
Pinaceae	13427	17.98	5081	11.37	18508	15.51
Platanus sp.	218	0.29	243	0.54	461	0.39
Populus sp.	108	0.14	151	0.34	259	0.22
Quercus sp.	2359	3.16	932	2.09	3291	2.76
Rhamnaceae	10	0.01	31	0.07	41	0.03
Rosaceae	39	0.05	190	0.43	229	0.19
Rubus sp.	1173	1.57	10	0.02	1183	0.99
Salix sp.	37	0.05	33	0.07	70	0.06
Sarcopoterium spinosum	294	0.39	377	0.84	671	0.56
Smilax sp.	1	0.00	1	0.00	2	0.00
Tilia sp.	16	0.32	11	0.02	27	0.02
Ulmus sp.	360	0.48	56	0.13	416	0.35
Vitis sp.	4	0.01	0	0.00	4	0.00
Trees	48724	65.23	36168	80.97	84892	71.12
Grass (Poaceae)	4311	5.77	2008	4.50	6319	5.29

(Contd.)

Year	2016		2017		Total	
Taxa	Pollen count	%	Pollen count	%	Pollen count	%
Aizoaceae	2	0.00	2	0.00	4	0.00
Amaranthaceae	3517	4.71	320	0.72	3837	3.21
Ambrosia sp.	4871	6.52	279	0.62	5150	4.31
Apiaceae	367	0.49	77	0.17	444	0.37
Artemisia sp.	305	0.41	97	0.22	402	0.34
Asteraceae	318	0.43	197	0.44	515	0.43
Boraginaceae	1	0.00	4	0.01	5	0.00
Brassicaceae	91	0.12	31	0.07	122	0.10
Caryophyllaceae	9	0.01	17	0.04	26	0.02
Centaurea sp.	3	0.00	0	0.00	3	0.00
Convolvulaceae	3	0.00	0	0.00	3	0.00
Crocus sp.	25	0.03	5	0.01	30	0.03
Cyperaceae	28	0.04	78	0.17	106	0.09
Euphorbiaceae	6	0.01	0	0.00	6	0.01
Fabaceae	22	0.03	22	0.05	44	0.04
Fumaria sp.	0	0.00	1	0.00	1	0.00
Geraniaceae	12	0.02	119	0.27	131	0.11
Humulus lupulus	55	0.07	12	0.03	67	0.06
Juncus sp.	6	0.01	7	0.02	13	0.01
Lactucaceae	40	0.05	21	0.05	61	0.05
Lamiaceae	7	0.01	2	0.00	9	0.01
Liliaceae	1	0.00	14	0.03	15	0.01
Malvaceae	1	0.00	0	0.00	1	0.00
Mercurialis sp.	1599	2.14	849	1.90	2448	2.05
Mirabilis jalapa	1	0.00	1	0.00	2	0.00
Onagraceae	1	0.00	0	0.00	1	0.00
Papaver sp.	5	0.01	2	0.00	7	0.01
Plantago sp.	656	0.88	208	0.47	864	0.72
Ranunculaceae	32	0.04	8	0.02	40	0.03
Rubiaceae	2	0.00	4	0.01	6	0.01
Rumex sp.	136	0.18	39	0.09	175	0.15
Sambucus sp.	99	0.13	22	0.05	121	0.10
Solanum sp.	0	0.00	1	0.00	1	0.00
Sparganiaceae	13	0.02	0	0.00	13	0.01
Typha sp.	49	0.07	15	0.03	64	0.05
Urticaceae	9308	12.46	4018	9.00	13326	11.16
Xanthium sp.	66	0.09	21	0.05	87	0.07
Weeds	21657	29.00	6493	14.54	28150	23.58
Total	74692	100.00	44669	100.00	119361	100.00

(24th and 32nd week) and April (10th week), respectively. The MPS of Amaranthaceae was between April 20 and November 22 (171 days). The main pollination season of *Mercurialis* sp. was between January 10 and November 14 (286 days) (Tables 3 and 4). Reportedly, pollen grain of Amaranthaceae was Grade A (highly) and B (moderately) type allergenic, whereas *Mercurialis perennis* pollen grain was Grade B (moderately) type allergenic (Aytuğ *et al*. 1990).

Even if their percentage **is** low among trees taxa, *Quercus* sp. (3.16%), *Alnus* sp. (1.35%), *Fraxinus* sp. (1.52%), *Carpinus* sp. (1.43%), *Juglans* sp. (1.43%), *Olea europae**a*** (1.39%), and *Corylus* sp. (1.21%) pollen grain, is significant in terms of being allergenic, is among the dominant pollen observed in the atmosphere of Sinop. The MPS were between March 23 and June 27 (82 days in average) for *Quercus* sp., February 8 and April 10 (60 days in average) for *Alnus* sp., January 3 and April 18 (96 days in average) for *Fraxinus* sp., March 3 and June 5 (85 days in average) for *Carpinus* sp., April 5 and June 12 (57 days in average) for *Juglans* sp., April 6 and July 18 (78 days) for *Olea europae**a*** and January 18 and April 20 (86 days) for *Corylus* sp. (Tables 3 and 4). In a study conducted in the Thrace region in Turkey, it was stated that *Fraxinus excelsior*, *Fraxinus americana* and *Quercus* sp. pollen grain was Grade A (highly) type allergenic, and *Juglans regia* L., *Juglans nigra* L., *Carpinus betulus, Corylus* sp. and *Alnus* sp. pollen grain was Grade B (moderately) type allergenic (Aytuğ *et al*.1990).

Spearman's correlation analysis was used for demonstrating the correlation between the effect of meteorological factors and the daily average amount of 15 taxa, which were dominant in the atmosphere of Sinop during the 2-year study period. There was a significant positive correlation (99% probability) between the amounts of *Alnus* sp., *Corylus* sp. and *Fraxinus* sp. pollen grain**s** and the daily average temperature, whereas a significant negative correlation (99% probability) was noted between Amaranthaceae pollen grain and the temperature. A significant positive correlation (99% probability) was noted between the daily average pollen grain of Cupressaceae/Taxaceae, daily average temperature and relative humidity. A significant positive correlation was noted between the daily average pollen grain of *Juglans* sp., *Quercus* sp. (95% probability), and Pinaceae (99% probability) and the daily average wind speed. A significant negative correlation (99% probability) was noted between the daily average pollen of *Morus* sp. and the relative humidity. No positive or negative correlation was observed between the daily average pollen grain of *Ambrosia* sp., *Carpinus* sp., *Mercurialis* sp., *Olea europaea*, Poaceae and Urticaceae and the meteorological factors (Table 2).

In conclusion, pollen grain of *Alnus* sp., *Carpinus* sp., Cupressaceae/Taxaceae, *Fraxinus* sp., Pinaceae and *Quercus* sp. which was all detected in the atmosphere of Sinop between 2016 and 2017, reflect the characteristic plants that constitute the forest vegetation, whereas a large part of the other pollen taxa reflects the plants which are commonly found in the natural flora of the city center and nearby environment of Sinop. Dominant pollen taxa detected during the study periods in the atmosphere of Sinop generally had allergenic effects at moderate and high levels. The pollen calendar prepared on the basis of the results of the study reflects the weekly and monthly concentrations and periods of the pollen from the plant taxa in the vegetation and will contribute to the treatment of patients with allergy who live or will live in Sinop. In addition, the continuation of the studies in the following years will contribute to the determination of the effect of climate change on the region vegetation.

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