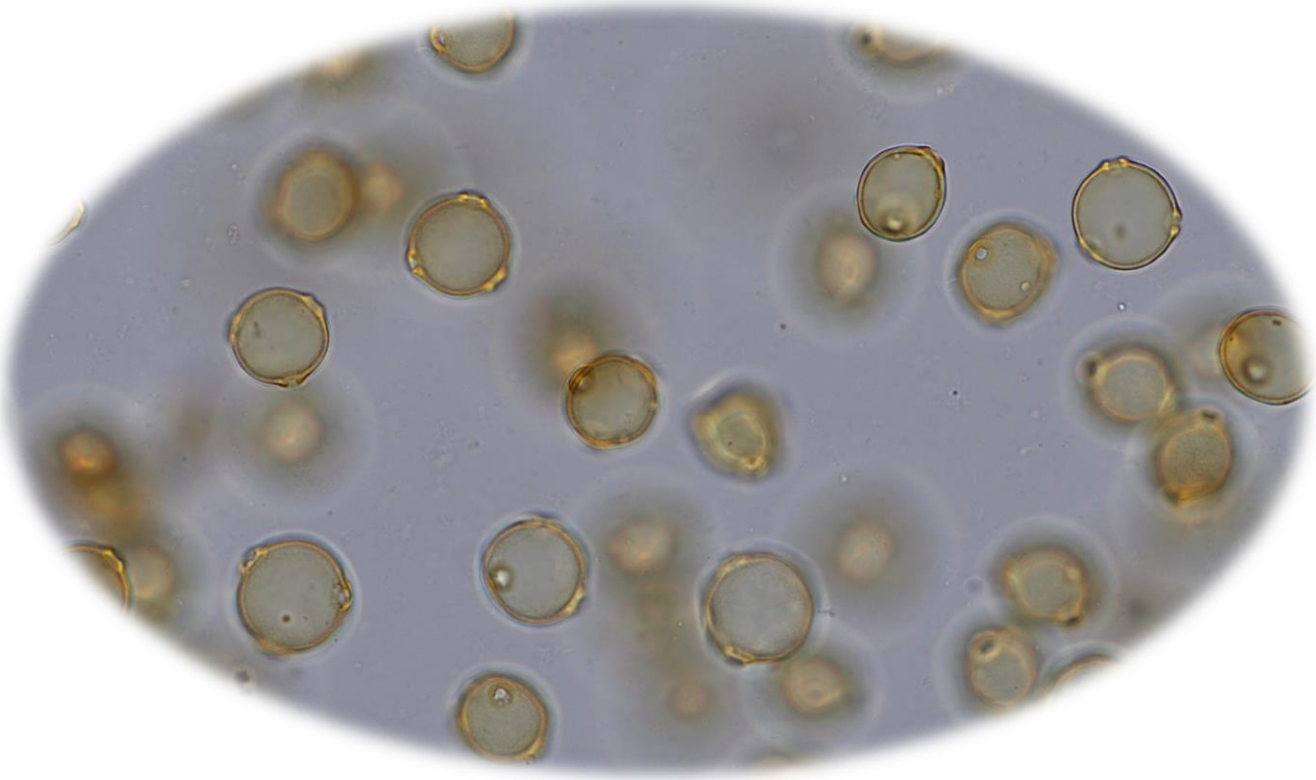
POLLEN MONITORING FOR TYROL

Annual report

2021



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Picture front page: microscopic view of birch pollen

POLLEN MONITORING FOR TYROL (Austria)

Annual report 2021

This annual report summarizes the pollen data obtained throughout the year 2021 for our seven pollen monitoring stations situated in Tyrol. We have five monitoring stations located at low altitudes (490 to 870 m asl) with Innsbruck, Lienz, Reutte, Wörgl and Zams, and two stations at higher altitudes (Galtür: 1580 m asl; Obergurgl: 1940 m asl).

For each site, we graphically present the pollen concentrations for the pollen types that are the most important from an allergological point of view in the region (see pollen profiles), and in tables, list the pollen counts for all types that have been found during the pollen season. Furthermore, we describe the major trends in pollen loads of specific plant taxa that are compared to a 10-year average (2011-2020). The most important pollen types for pollen allergy sufferers and thus, the ones we are focusing on in this report are the following.

- Alder pollen (*Alnus*): moderate to high allergenicity, and frequent cross-reaction to pollen from hazel and birch.
- Hazel pollen (*Corylus*): moderate allergenicity, and frequent cross-reactions to hazelnut (food allergy) and pollen from birch, alder and hornbeam.
- Hornbeam pollen (*Carpinus*): low allergenicity, and possible cross-reactions to pollen from birch, alder and hazel, especially in gardens and parks.
- Hop hornbeam pollen (*Ostrya*): cross-reaction for the birch allergy sufferers, especially in gardens and parks.
- Ash pollen (*Fraxinus*): cross-reaction to pollen from plant family related to olive trees.
- Birch pollen (*Betula*): high allergenicity.
- Grass pollen (Poaceae): high allergenicity.
- Plantain pollen (*Plantago*): moderate allergenicity, and it can affect grass allergy sufferers.
- Mugwort (*Artemisia*): high allergenicity.
- Ragweed (*Ambrosia*): invasive plant and high allergenicity.

All the pollen data presented in the figures are expressed as daily pollen concentration, i.e. number of pollen grains per m^3 of air per day. We further added the class risks to show the allergic burden of each pollen type. The data given in the tables are expressed as monthly pollen counts.

The whole data produced in 2021, bi-hourly and daily pollen counts for each day of the pollen season and each monitoring station, are stored in the Pollen Tyrol and EAN (European Aeroallergen Network) databases where about 40 years of pollen records in Tyrol have already been archived.

Note that we only report the general trends in pollen loads based on pollen traps that are situated at specific locations, and the pollen concentrations and the levels of allergenic burden might differ locally.

This report has been written by the team Pollen Tyrol composed by Laurent Marquer, Sandra Kistl, Werner Kofler and Ugo Bisson. For further information, please send an e-mail to Laurent.Marquer@uibk.ac.at.

Summary of the pollen season 2021 in Tyrol

In 2021, we recorded between 40 and 49 pollen types in our devices located across the region. The pollen concentration in the air of Tyrol has been generally lower than the 10-year average, in particular for trees such as birch and ash. On the contrary, grass and plantain pollen have reached higher allergenic burdens than the 10-year average.

The first pollen from **alder** and **hazel** have been noted on February 9th. For both alder and hazel, the pollen concentrations reached moderate to high allergenic burdens from February to mid-March, in general. The highest values have been observed at the end of February. The second phase of alder pollen season corresponds to the blooming of green alder at mid and high altitudes. This phase has been recorded from the end of May until the start of July with peaks around mid-June. The pollen concentrations were generally low at the bottoms of the valleys when moderate to high allergenic burdens were measured in altitudes.

Hornbeam and **hop hornbeam** pollen were essentially present in the air from the end of March to mid-May. The pollen season for both hornbeam and hop hornbeam was generally lower than the 10-year average, although the concentration of hop hornbeam pollen has been high in Reutte.

Ash pollen were mainly found in our device from the beginning of March until the end of May. From April to mid-May, moderate allergenic burdens were reached. The pollen season for ash was also lower than the 10-year average.

The pollen grains from **birch** have been regularly noted from the beginning of March. The highest allergenic burden has been reached in April. For a few days only, high levels of allergenic burden have been reached. The birch pollen season was rather weak compared to the 10-year average.

The concentration of **grass** pollen increased in April to reach moderate and high allergenic burdens from the end of May until July 24th. Days with moderate burdens were noted until mid-August in Reutte while the highest allergenic burdens were recorded in June. In altitudes, the burden stayed relatively high during most of the summer season. This year, the highest pollen concentrations for grasses have exceeded the 10-year average. Regarding the pollen from **plantain**, it was essentially present in the air from June to August. However, the allergenic burden remained low at many locations and occasionally reached moderate levels.

Mugwort pollen were mainly recorded in August. The allergenic burden remained relatively low, although moderate burdens were reached in mid-August at specific locations. Only single grains of **ragweed** pollen have been observed this year, in particular at the beginning of September. In Lienz, moderate allergenic burdens to ragweed pollen were reached for one day, on September 8th. Based on the 10-year average, the pollen load of ragweed is generally very low in the region.

Contents

1. INNSBRUCK

1.1. Characteristics of the pollen station

Coordinates: 47°16'4.24"N / 11°22'41.92"E

Altitude: 615 m asl

Location: The pollen trap is situated on the roof of the Institute of Botany at about 45 m above the bottom of the valley and around 16 m above the ground.

Environmental context: The direct environment corresponds to the Botanical garden (park) and settlement area. At further distances towards the north, the vegetation cover is characterized by patches of grassland and mixed forests dominated by spruce and beech.

Potential source area of pollen: Innsbruck and the Inntal valley from Telfs to Schwaz.

Duration of the pollen record: The entire year.

Device type: Lanzoni pollen trap.

Information to the public: Weekly newsletters, phone service, radio, newspapers and Internet (Pollen Tyrol webpage).

1.2. Pollen season 2021

In 2021, we recorded 49 pollen types in our device located in Innsbruck (Table 1). The pollen concentration in the air in Innsbruck and the Inntal valley has been generally lower than the 10-year average, in particular for trees such as hazel, birch, ash, hornbeam and hop hornbeam. On the contrary, grass and plantain pollen have reached higher allergenic burdens than the 10-year average.

The first pollen from alder and hazel have been noted on February 9th (Figure 1). If we look at the 10-year average trend, medium pollen concentrations for both alder and hazel can already be seen at the end of January. This year, the pollen concentration for **alder** reached moderate allergenic burden from mid-February to mid-March. The highest concentrations for alder pollen have been observed at the end of February with the highest peak registered on February 25th. The second alder phase (blooming of green alder at higher altitudes) was characterized by a low allergenic burden and took place over a week (June 15th to 23rd) only. Based on the 10-year average, moderate burden for alder can be expected at the end of May. The second phase of alder is recorded owing to the flowering of alder at mid-altitudes and the dispersion of pollen from those altitudes to the bottom of the valleys. Regarding **hazel**, the highest pollen concentrations have also been recorded at the end of February when a high allergenic burden has been reached. The highest hazel pollen concentration was noted on February 25th, as for alder. Levels of moderate burden were present until mid-March. Based on the 10-year average, the pollen concentration for hazel can reach high burdens from the beginning of February to mid-March and a moderate burden can still be present in the air until the start of April.

Hornbeam and **hop hornbeam** pollen were continuously present in the air from the beginning of April to mid-May (Figure 1). Moderate to high allergenic burdens related to hornbeam pollen were recorded between April 10th and 16th. The concentration of hop hornbeam pollen remained low. The pollen season for both hornbeam and hop hornbeam was lower than the 10-year average.

Ash pollen were regularly found in our device from the beginning of March until mid-May (Figure 1). From the start of April to mid-May, moderate allergenic burdens were reached with the highest concentration recorded on May 5th. The pollen season for ash was also lower than the 10-year average.

The first pollen from **birch** have been recorded at the beginning of April (Figure 1). Moderate to high pollen loads were observed throughout April. The highest pollen concentration was registered on April 21st. Only a few days in April have reached high levels of allergenic burden when high levels can be reached regularly over the same period based on the 10-year average. This year, the last pollen grains from birch have been observed mid-May.

The concentration of **grass** pollen increased from the end of April to reach moderate and high allergenic burdens at the end of May to July 10th (Figure 2). The highest allergenic burden was noted on May 26th. No days of high allergenic burden were observed in the 10-year average when six days were recorded in 2021. **Plantain** pollen is also important for grass allergy sufferers. Plantain pollen was mainly recorded from mid-June to mid-August, however, the allergenic burden remained relatively low.

Mugwort pollen were essentially recorded in August, in particular until August 21st. Levels of moderate allergenic burden were reached mid-August. This is in agreement with the 10-year average. Only one **ragweed** pollen has been observed this year. Based on the 10-year average, the pollen load of ragweed is generally very low in the region.

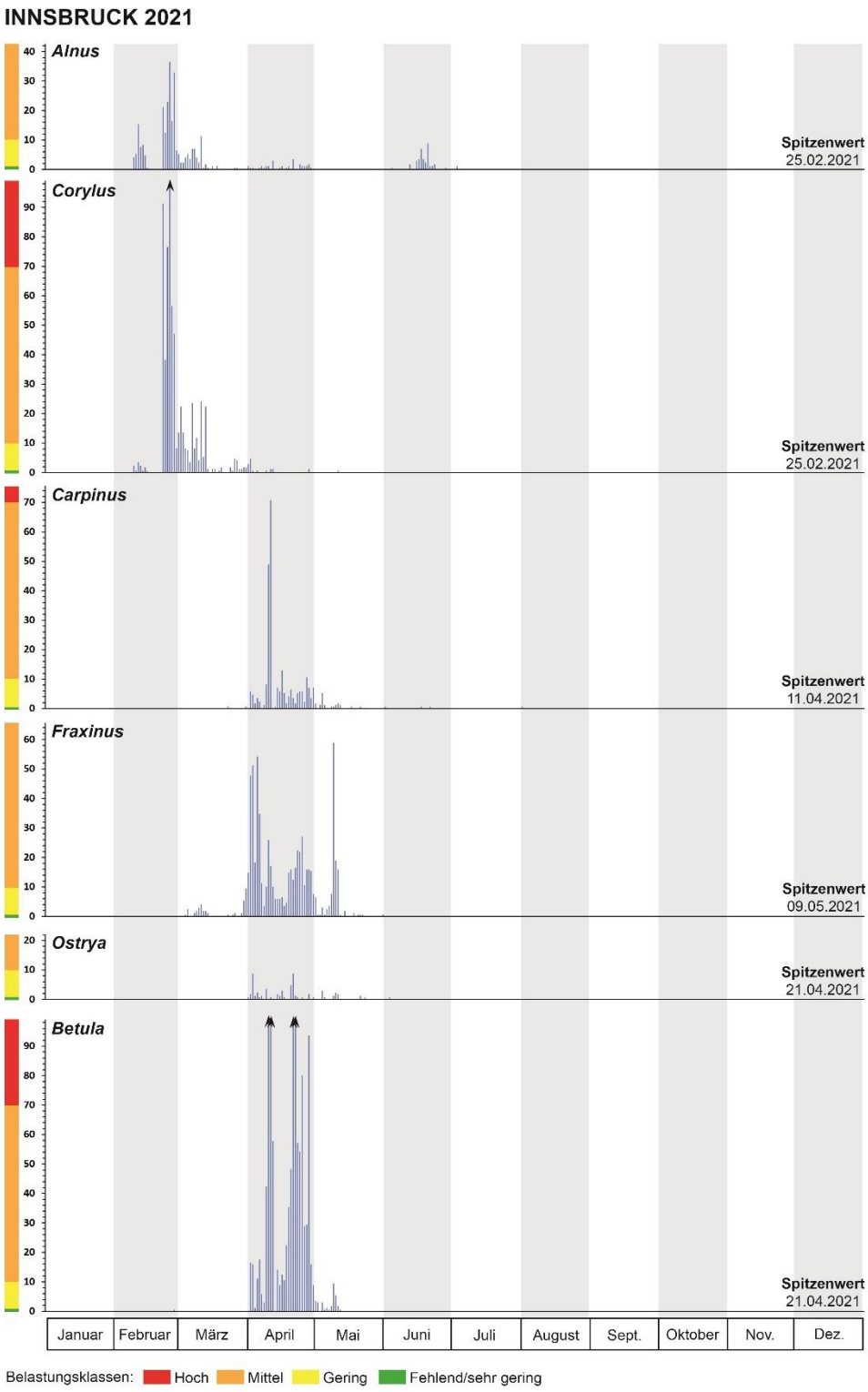

Figure 1. Daily pollen concentration for the major tree pollen of interest for the pollen allergy sufferers. The concentrations are expressed as number of pollen grains per m^3 of air per day. Provided are the class risks which indicates the allergic burden of each pollen type and the date of the highest peak of pollen concentration for 2021. The arrows mark concentrations exceeding the maximum values of the Y-axis.

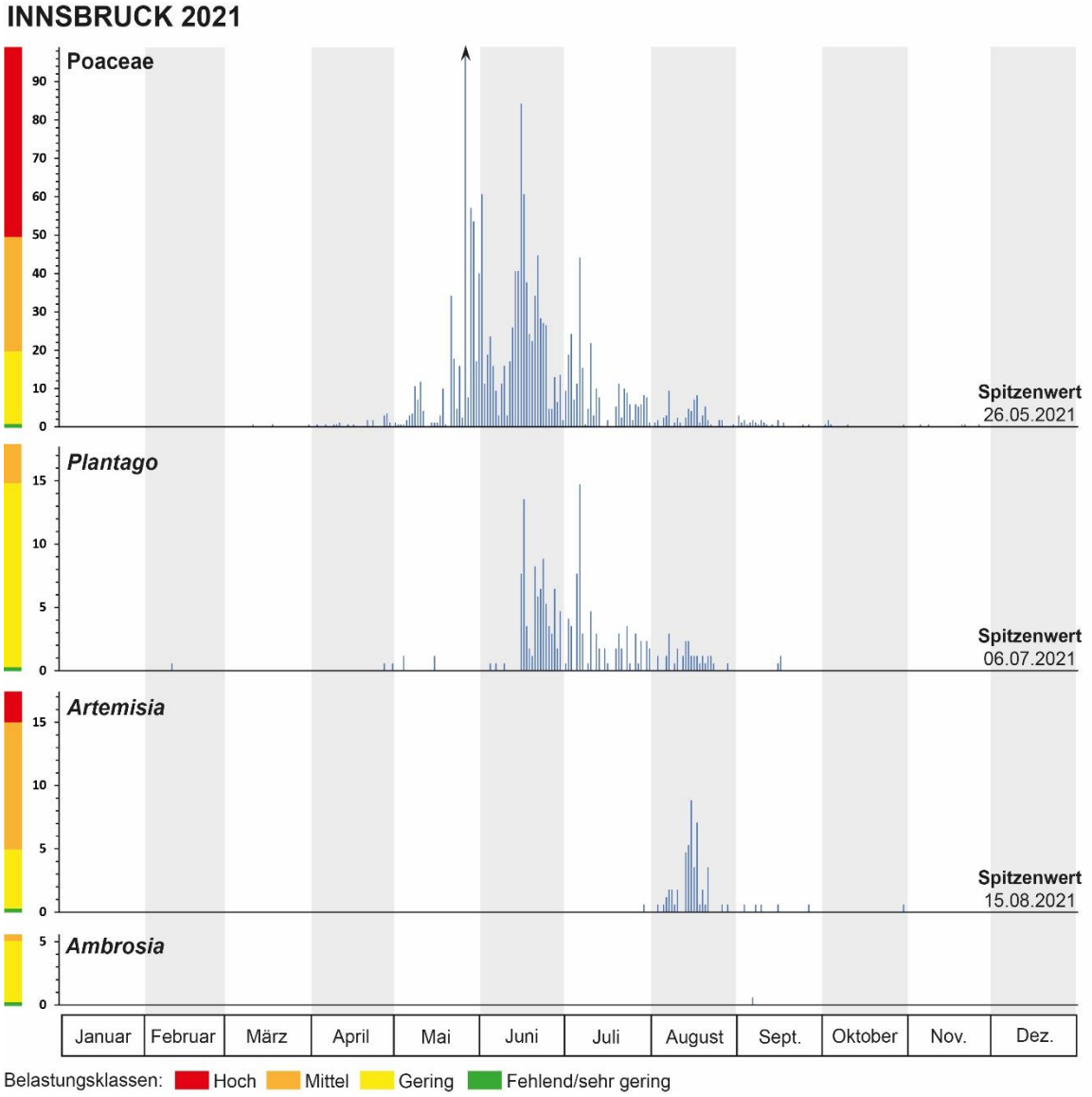

Figure 2. Daily pollen concentration for the major herb pollen of interest for the pollen allergy sufferers. The concentrations are expressed as number of pollen grains per m^3 of air per day. Provided are the class risks which indicates the allergic burden of each pollen type and the date of the highest peak of pollen concentration for 2021. The arrows mark concentrations exceeding the maximum values of the Y-axis.

1.3. Data

Monatssummen am Standort **Innsbruck** im Jahr 2021													
	Januar	Februar	März	April	Mai	Juni	Juli	August	Sept.	Oktober	Nov.	Dez.	Summe
erfasste Tage	31	21	31	30	31	30	31	31	30	31	30	31	
Acer	0	0	3	9	0	0	0	0	0	0	0	0	12
Aesculus	0	0	0	0	29	1	0	0	0	0	0	0	30
Alnus	0	331	104	42	0	60	2	0	0	0	0	0	539
Ambrosia	0	0	0	0	0	0	0	0	1	0	0	0	1
Apiaceae	0	0	0	0	3	5	4	4	0	0	0	0	16
Artemisia	0	0	0	0	0	0	1	77	5	1	0	0	84
Asteraceae	0	0	0	3	14	1	3	4	12	1	0	0	38
Betula	0	1	0	2008	52	0	0	0	0	0	0	0	2061
Brassicaceae	0	0	0	0	3	0	0	0	0	0	0	0	3
Broussonetia	0	0	0	0	292	124	0	0	0	0	0	0	416
Cannabaceae	0	0	0	0	0	2	1	33	1	0	0	0	37
Carpinus	0	0	2	415	27	3	0	1	0	0	0	0	448
Caryophyllaceae	0	0	0	0	1	0	0	2	0	0	0	0	3
Castanea	0	0	0	0	0	131	162	0	0	0	0	0	293
Cedrus	0	0	0	0	0	0	0	0	15	5	0	0	20
Chenopodiaceae	0	0	0	0	2	4	14	17	2	1	0	0	40
Cichoriaceae	0	0	0	0	0	0	1	0	0	0	0	0	1
Corylus	0	802	325	22	1	0	0	0	0	0	0	0	1150
Cupressaceae	0	657	3545	660	154	36	14	2	0	0	0	0	5068
Cyperaceae	0	0	0	15	25	86	10	1	0	0	1	0	138
Ericaceae	0	0	1	5	1	9	11	3	0	0	0	0	30
Fabaceae	0	0	0	0	4	8	14	0	0	0	0	0	26
Fagus	0	0	0	1	3	0	0	0	0	0	0	0	4
Fraxinus	0	0	61	895	211	0	0	0	0	0	0	0	1167
Humulus	0	0	0	0	0	0	0	0	1	0	0	0	1
Impatiens	0	0	0	0	0	0	0	10	13	0	0	0	23
Juglandaceae	0	0	0	70	66	2	0	0	0	0	0	0	138
Juglans	0	0	0	2	128	3	0	0	0	0	0	0	133
Larix	0	0	0	0	2	0	0	0	0	0	0	0	2
Morus	0	0	0	0	26	0	0	0	0	0	0	0	26
Oleaceae	0	0	0	0	0	1	0	0	0	0	0	0	1
Ostrya	0	0	0	77	18	1	0	0	0	0	0	0	96
Picea	0	0	1	3	43	3	1	0	0	0	0	0	51
Pinus	0	2	0	8	6941	1654	485	10	3	0	0	2	9105
Plantago	0	1	0	2	4	142	113	39	3	0	0	0	304
Platanus	0	0	0	1030	331	0	0	0	0	0	0	0	1361
Poaceae	0	0	3	27	705	1241	440	110	33	7	5	0	2571
Populus	0	28	305	9	1	1	0	0	0	0	0	0	344
Quercus	0	0	0	433	1793	8	0	0	0	0	0	0	2234
Ranunculaceae	0	0	0	0	0	11	0	4	0	0	0	0	15
Rosaceae	0	0	0	15	13	0	0	0	0	0	0	0	28
Rubiaceae	0	0	0	0	1	10	0	2	0	0	0	0	13
Rumex	0	0	0	0	17	39	15	2	1	0	0	0	74
Salix	0	1	21	208	129	4	0	0	0	0	0	0	363
Sambucus	0	0	0	0	0	102	0	0	0	0	0	0	102
Tilia	0	0	0	0	0	53	96	3	0	0	2	0	154
Ulmus	0	18	56	22	1	0	0	0	0	0	0	0	97
Urticaceae	0	0	0	2	44	574	1132	897	70	4	0	0	2723
Zea mays	0	0	0	0	0	0	1	1	0	0	0	0	2
Varia	0	3	79	87	231	240	77	30	9	3	2	0	761
Summe	0	1844	4506	6070	11316	4559	2597	1252	169	22	10	2	32347

Table 1. Monthly pollen counts for all pollen grains that have been recorded in the pollen trap situated in Innsbruck.

2. WÖRGL

2.1. Characteristics of the pollen station

Coordinates: 47°30'38.11"N/ 12° 4'40.49"E

Altitude: 491 m asl

Location: The pollen trap is situated on the Tiwag' dam in Kirchbichl at about 30 m from the Inn river bank and 8 m above the ground.

Environmental context: The direct environment corresponds to riparian vegetation (i.e. trees and shrubs) along the Inn river, meadows, pastures, fields and a settlement area. At further distances, about 1 to 3 km from the dam, mixed beech and oak forests are present. Spruce and fir grow at higher altitudes.

Potential source area of pollen: The lower Inn valley, in particular areas of Kufstein, Wörgl and Kundl.

Duration of the pollen record: From February 8th to December 31st.

Device type: Burkard pollen trap.

Information to the public: Weekly newsletters, phone service and Internet (Pollen Tyrol webpage).

2.2. Pollen season 2021

This year, 42 pollen types have been recorded in our device located in Wörgl (Table 2). As for Innsbruck, the pollen concentration in the air of the lower Inn valley and its surrounding areas has generally been lower than the 10-year average for trees, in particular for alder and birch, while grass and plantain pollen have reached higher levels.

Medium to high pollen loads from **alder** and **hazel** have been observed from the end of February (Figure 3). Pollen concentrations of alder and hazel have most likely started to rise earlier sometime between February 15th and 23rd; the pollen trap was out of order for technical issues at that time. Based on the 10-year average, moderate pollen concentrations for alder and hazel can already be noted at the beginning and the end of February, respectively. In 2021, the highest pollen concentrations have been observed at the end of February for both alder and hazel. Moderate allergenic burdens for alder were reached from February 24th (and certainly before, see above the technical issues with the pollen trap) to March 2nd. Regarding hazel, moderate burdens were reached until mid-March. The second phase of alder pollen season (blooming of green alder at higher altitudes) has been registered from the beginning of June until June 23rd, however, the concentrations remained low.

Hornbeam pollen were recorded from the end of March until the end of April (Figure 3) and the overall pollen load was low. Only few pollen concentrations of **hop hornbeam** have been noted at the end of April. Based on the 10-year average, moderate pollen concentrations of hornbeam and hop hornbeam can be observed in April. Note that the pollen trap was out of order from April 8th to 20th, and this might partially explain the low pollen loads recorded this year.

The concentration of **ash** pollen increased from the end of March to reach moderate levels of allergenic burden throughout April (Figure 3). As the pollen trap was out of order from May 1st to 24th, the end of the ash pollen season was not recorded by our device. Based on the 10-year average, the ash pollen season usually ends mid-May.

The first pollen grains from **birch** have been regularly noted from the beginning of March (Figure 3). The highest allergenic burdens have been reached in April, in particular at the end of April when high levels were observed. However, higher allergenic burdens might have been reached earlier; this information is missing because the pollen trap was out of order from April 8th to 20th. Based on the 10-year average, moderate to high pollen concentrations can be observed in April.

The regular presence of **grass** pollen was recorded in April (Figure 4). Moderate to high pollen loads were essentially registered from the end of May (once the pollen trap was repaired) until July 23rd. The highest allergenic burdens were noted from the end of May until June 18th with the highest peak on June 14th. The highest levels of allergenic burden exceeded the 10-year average. Regarding the pollen from **plantain**, it reached moderate allergenic levels from June 17th to July 7th. Plantain pollen were recorded from mid-June to August 22nd. The allergenic burden related to grass was higher in Wörgl than in Innsbruck.

As in Innsbruck, **mugwort** pollen were recorded in the first half of August, however, the allergenic burden remained low (Figure 4). Only very few **ragweed** pollen grains have been observed at the beginning of September.

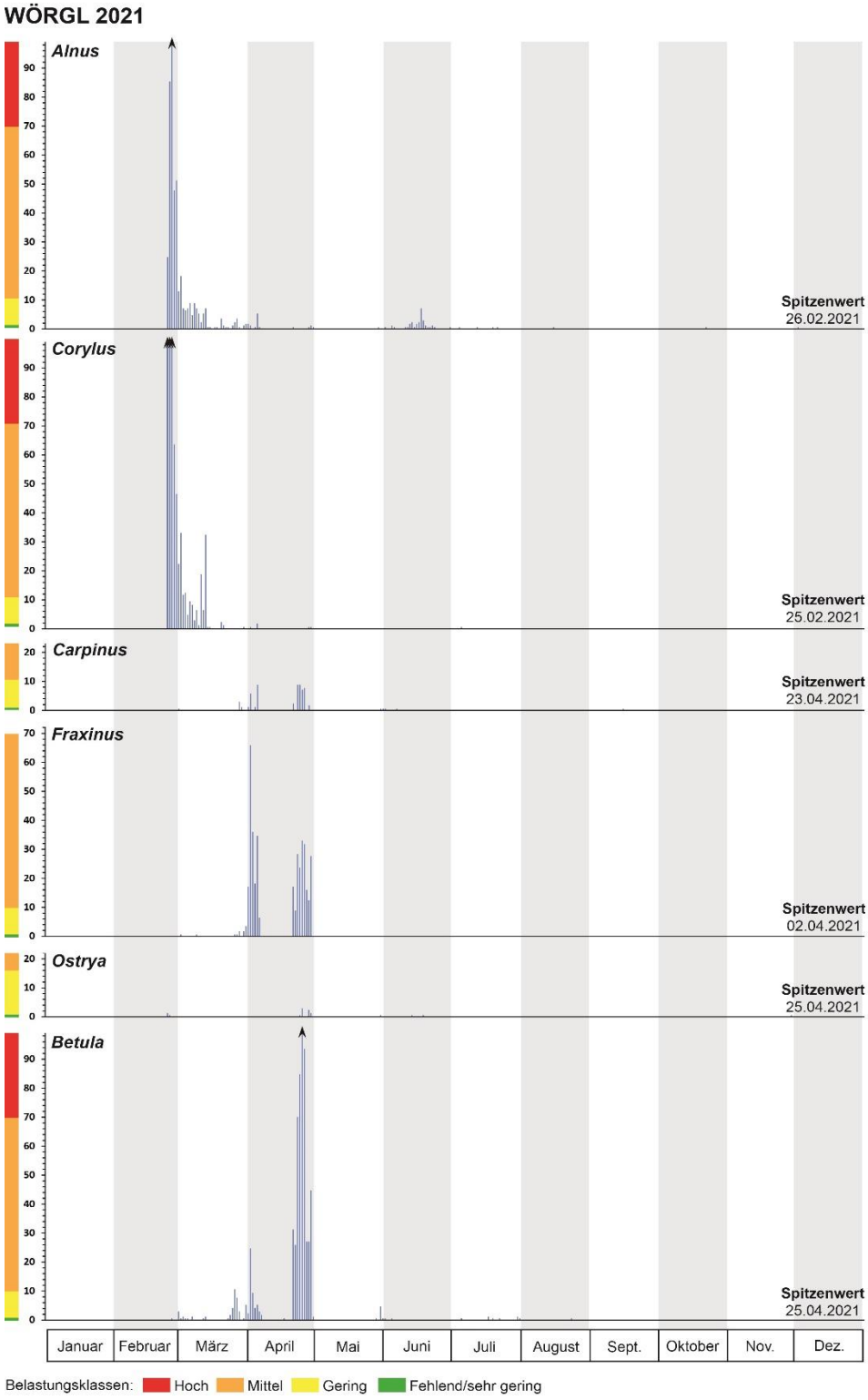

Figure 3. Daily pollen concentration for the major tree pollen of interest for the pollen allergy sufferers. The concentrations are expressed as number of pollen grains per m^3 of air per day. Provided are the class risks which indicates the allergic burden of each pollen type and the date of the highest peak of pollen concentration for 2021. The arrows mark concentrations exceeding the maximum values of the Y-axis.

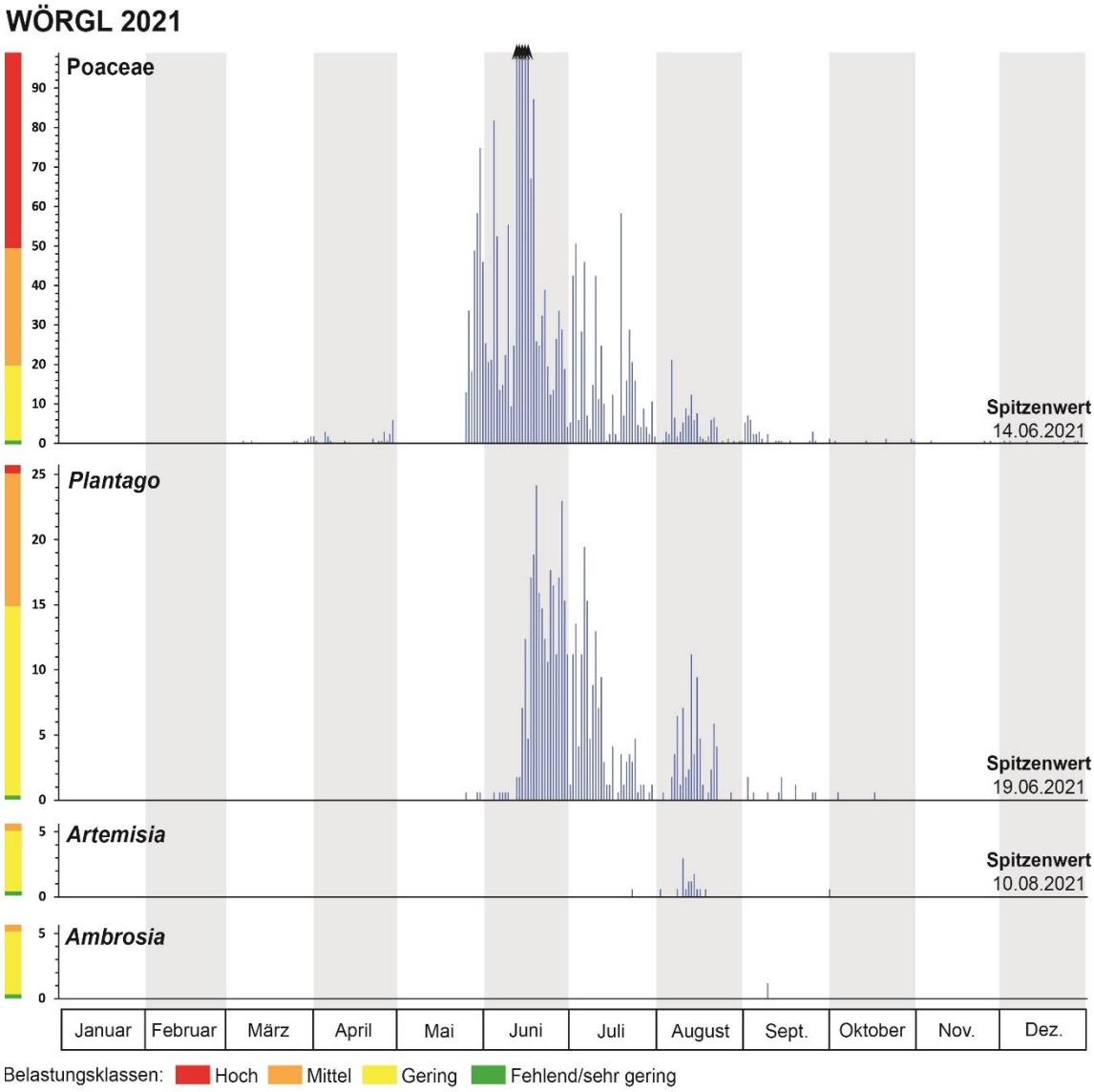

Figure 4. Daily pollen concentration for the major herb pollen of interest for the pollen allergy sufferers. The concentrations are expressed as number of pollen grains per m^3 of air per day. Provided are the class risks which indicates the allergic burden of each pollen type and the date of the highest peak of pollen concentration for 2021. The arrows mark concentrations exceeding the maximum values of the Y-axis.

2.3. Data

Monatssummen am Standort **Wörgl** im Jahr 2021													
	Jänner	Februar	März	April	Mai	Juni	Juli	August	Septemb	Oktober	Novembe	Dezembe	Summe
erfasste Tage	0	12	31	16	6.5	30	31	29	30	30	29	31	
Acer	0	0	0	1	0	0	0	0	0	0	0	0	1
Aesculus	0	0	0	0	1	1	3	0	0	0	0	0	5
Alnus	0	523	204	21	1	46	4	1	0	1	0	1	802
Ambrosia	0	0	0	0	0	0	0	0	2	0	0	0	2
Apiaceae	0	0	0	0	2	16	19	4	0	0	0	1	42
Artemisia	0	0	0	0	0	0	1	18	0	1	0	0	20
Asteraceae	0	0	5	3	0	1	8	13	4	1	0	0	35
Betula	0	1	72	1048	10	2	8	1	0	0	0	0	1142
Cannabaceae	0	0	0	0	0	0	0	4	0	0	0	0	4
Carpinus	0	0	8	91	2	2	0	0	1	0	0	0	104
Caryophyllaceae	0	0	0	0	0	2	0	0	0	0	0	0	2
Castanea	0	0	0	0	0	27	25	1	0	0	0	0	53
Cedrus	0	0	0	0	0	0	0	0	7	4	0	0	11
Chenopodiaceae	0	0	0	0	0	17	9	7	1	0	0	0	34
Cichoriaceae	0	0	0	1	0	2	2	0	0	1	0	0	6
Corylus	0	1618	298	6	0	0	1	0	0	0	0	0	1923
Cupressaceae	0	31	1269	152	12	45	2	1	0	1	0	0	1513
Cyperaceae	0	0	7	15	12	51	4	0	0	0	0	0	89
Ericaceae	0	1	1	13	2	3	5	1	3	0	0	0	29
Fabaceae	0	0	0	0	0	1	3	3	0	0	0	0	7
Fraxinus	0	0	16	640	0	0	0	0	0	0	0	0	656
Humulus	0	0	0	0	0	0	1	4	0	0	0	0	5
Impatiens	0	0	0	0	0	0	9	60	69	2	0	3	143
Juglans	0	0	0	1	2	0	0	0	0	0	0	0	3
Larix	0	0	1	0	0	0	0	0	0	0	0	0	1
Ostrya	0	3	0	12	1	2	0	0	0	0	1	0	19
Picea	0	0	5	3	4	8	2	2	0	0	0	0	24
Pinus	0	1	1	4	404	599	173	6	2	3	3	8	1204
Plantago	0	0	0	0	3	435	259	116	13	2	0	0	828
Poaceae	0	0	10	37	497	2563	838	188	61	9	3	6	4212
Populus	0	47	56	0	1	0	0	0	0	0	0	0	104
Quercus	0	0	1	2	15	1	0	0	0	0	0	0	19
Ranunculaceae	0	0	0	0	2	3	6	2	0	0	0	0	13
Rosaceae	0	0	0	0	0	3	0	0	0	0	0	0	3
Rubiaceae	0	0	0	0	0	7	1	1	0	0	0	0	9
Rumex	0	0	0	0	10	30	18	5	3	0	0	0	66
Salix	0	1	132	45	3	2	0	0	0	0	0	0	183
Sambucus	0	0	0	0	0	46	0	0	0	0	0	0	46
Secale	0	0	0	0	0	3	1	1	0	0	0	0	5
Tilia	0	0	0	0	1	3	10	1	1	0	0	0	16
Urticaceae	0	0	0	1	1	1000	1006	652	84	0	0	0	2744
Zea mays	0	0	0	0	0	0	1	0	0	0	0	0	1
Varia	0	0	52	33	30	116	72	23	8	6	2	2	344
Summe	0	2226	2138	2129	1016	5037	2491	1115	259	31	9	21	16472

Table 2. Monthly pollen counts for all pollen grains that have been recorded in the pollen trap situated in Wörgl.

3. LIENZ

3.1. Characteristics of the pollen station

Coordinates: 46°50'6.60"N / 12°45'51.96"E

Altitude: 692 m asl

Location: The pollen trap is situated on the roof of the hospital at about 20 m above the ground.

Environmental context: The direct environment corresponds to parks, private gardens and a settlement area. Lienz is located at the bottom of a valley that is characterized by arable land, orchards, grasslands and the river banks of the Isel and Drau rivers with alder and willow as the major plant taxa. Conifers grow at higher altitudes.

Potential source area of pollen: Lienz and the surrounding valleys.

Duration of the pollen record: From February 16th to October 18th.

Device type: Burkard pollen trap.

Information to the public: Weekly newsletters, phone service and Internet (Pollen Tyrol webpage).

3.2. Pollen season 2021

In 2021, we recorded 48 pollen types in our device located in Lienz (Table 3). The pollen concentration in the air of Lienz and the surrounding valleys has been lower than the 10-year average for ash, hop hornbeam and birch, in particular. On the contrary, concentrations of hazel, grass and plantain pollen have reached higher levels than the 10-year average.

Pollen from **alder** and **hazel** have been recorded from February 19th (Figure 5). Concentrations regularly reached moderate allergenic burdens between February 22nd and March 14th. High burden was noted for hazel pollen on February 27th and March 5th, and moderate burdens related to hazel pollen were still registered until the end of March. Higher pollen concentrations for hazel than the 10-year average have been observed in 2021. The blooming of green alder at higher altitudes has been recorded from the end of May to June 25th with the highest concentrations that reached moderate allergenic burdens around mid-June.

The concentrations of **hornbeam** and **hop hornbeam** pollen were low throughout the pollen season, and the highest concentrations were observed around May 10th (Figure 5).

Ash pollen has been regularly found in our device from mid-March (Figure 5). The highest concentrations were recorded from the end of March until mid-May. Based on the 10-year average, high pollen concentrations can be recorded in March and April, which were never reached in 2021.

Birch pollen has also been recorded from mid-March (Figure 5). Moderate pollen loads were present in the air between April 18th and May 10th. The highest values were observed at the end of April and at the beginning of May when continuous moderate allergenic burdens were present in the air, however, the burden never reached high levels. Based on the 10-year average, high allergenic burdens can be recorded from the end of March to mid-May. Again, such high concentrations were never obtained in 2021.

The first regular presence of **grass** pollen was noted from the end of April (Figure 6). The allergenic burden increased to moderate levels at the end of May, reached high levels between June 4th and 17th, then varied between moderate and low levels until July 24th. The highest allergenic burden was noted on June 12th. The general timing of change in grass pollen concentrations follows the 10-year average, however, the highest values exceeded the 10-year average. **Plantain** pollen was mainly recorded from the end of May to mid-September, however, the allergenic burden remained relatively low and only one day (July 13th) reached a moderate burden.

Mugwort pollen were recorded in significant numbers from the beginning of August until August 27st (Figure 6). Moderate allergenic burdens were reached in mid-August. This generally is in accordance with the 10-year average trend. **Ragweed** pollen were recorded during the first half of September. Moderate allergenic burdens were reached for one day on September 8th.

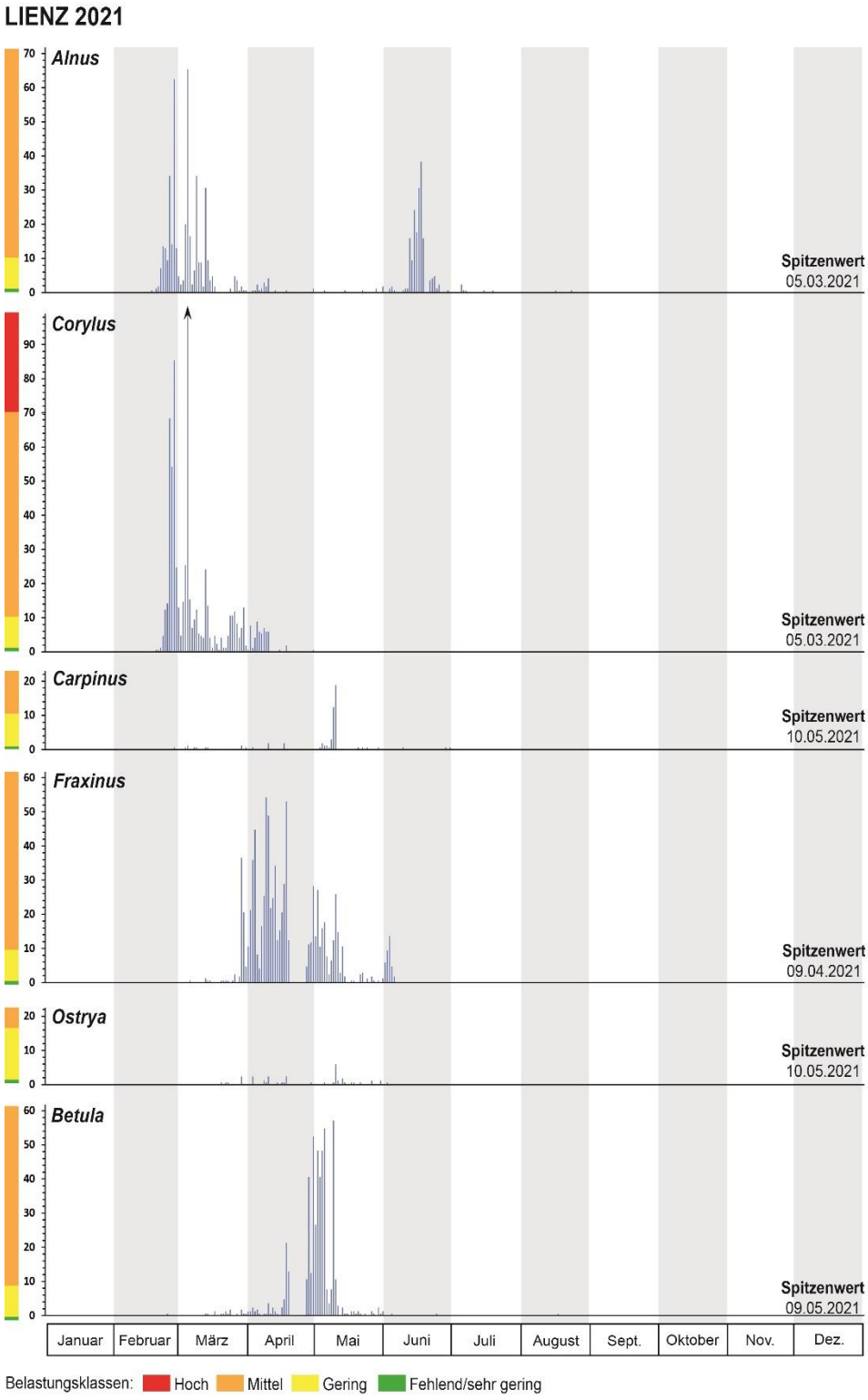

Figure 5. Daily pollen concentration for the major tree pollen of interest for the pollen allergy sufferers. The concentrations are expressed as number of pollen grains per m^3 of air per day. Provided are the class risks which indicates the allergic burden of each pollen type and the date of the highest peak of pollen concentration for 2021. The arrows mark concentrations exceeding the maximum values of the Y-axis.

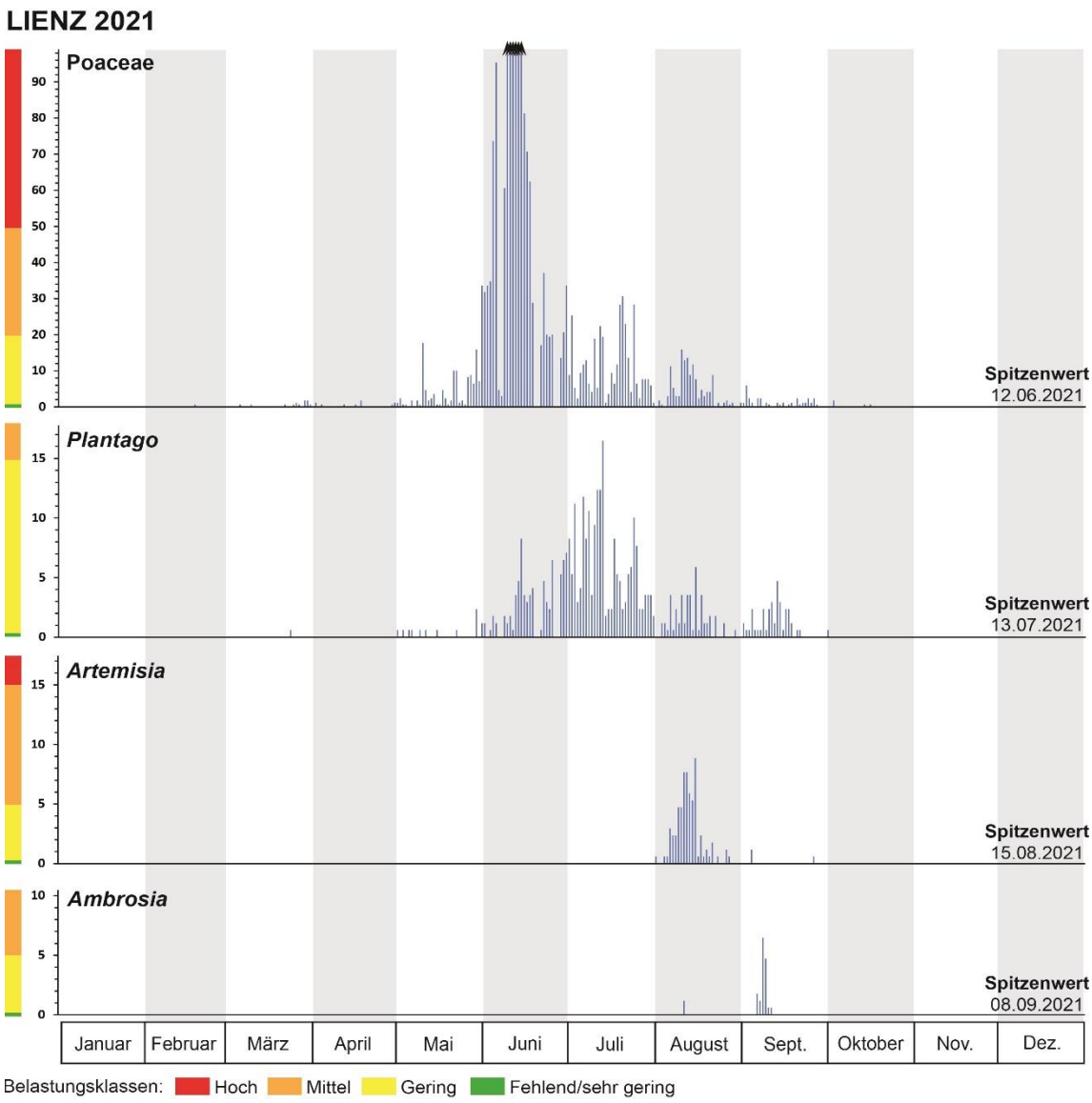

Figure 6. Daily pollen concentration for the major herb pollen of interest for the pollen allergy sufferers. The concentrations are expressed as number of pollen grains per m^3 of air per day. Provided are the class risks which indicates the allergic burden of each pollen type and the date of the highest peak of pollen concentration for 2021. The arrows mark concentrations exceeding the maximum values of the Y-axis.

3.3. Data

Monatssummen am Standort **Lienz** im Jahr 2021													
	Januar	Februar	März	April	Mai	Juni	Juli	August	Sept.	Oktober	Nov.	Dez.	Summe
erfasste Tage	0	12.5	31	22	31	25	31	30	26.5	8	0	0	
Acer	0	0	0	0	1	0	1	1	0	0	0	0	3
Aesculus	0	0	0	0	15	4	0	0	0	0	0	0	19
Alnus	0	289	404	28	8	297	8	2	0	0	0	0	1036
Ambrosia	0	0	0	0	0	0	0	2	26	0	0	0	28
Apiaceae	0	0	1	1	21	32	23	6	0	0	0	0	84
Artemisia	0	0	0	0	0	0	0	108	3	0	0	0	111
Asteraceae	0	4	0	1	4	16	26	28	26	0	0	0	105
Betula	0	1	18	297	548	2	0	1	0	0	0	0	867
Broussonetia	0	0	0	3	24	0	0	0	0	0	0	0	27
Cannabaceae	0	0	0	0	0	0	7	19	2	0	0	0	28
Carpinus	0	1	10	7	71	3	0	0	0	0	0	0	92
Caryophyllaceae	0	0	0	0	0	1	1	0	0	0	0	0	2
Castanea	0	0	1	0	0	67	98	1	0	0	0	0	167
Cedrus	0	0	0	0	0	0	0	0	10	0	0	0	10
Chenopodiaceae	0	0	1	0	0	5	33	18	3	1	0	0	61
Cichoriaceae	0	1	0	0	3	2	4	3	0	0	0	0	13
Corylus	0	452	614	94	0	0	0	0	0	0	0	0	1160
Cupressaceae	0	4	1264	1765	68	40	20	0	1	0	0	0	3162
Cyperaceae	0	0	8	27	66	75	11	0	0	0	0	0	187
Ericaceae	0	0	1	2	10	21	25	2	2	0	0	0	63
Fabaceae	0	0	0	1	0	3	7	1	0	0	0	0	12
Filipendula	0	0	0	0	0	12	1	0	0	0	0	0	13
Fraxinus	0	0	122	932	308	60	0	0	0	0	0	0	1422
Impatiens	0	0	0	0	0	0	3	26	58	0	0	0	87
Juglandaceae	0	0	0	1	15	0	0	0	1	0	0	0	17
Juglans	0	0	0	0	83	6	0	0	0	0	0	0	89
Juncaceae	0	0	0	0	1	0	0	0	0	0	0	0	1
Larix	0	0	1	2	0	0	0	0	0	0	0	0	3
Oleaceae	0	0	0	0	1	1	0	0	0	0	0	0	2
Ostrya	0	0	7	19	25	1	0	0	0	0	0	0	52
Picea	0	3	9	10	34	10	4	2	1	0	0	0	73
Pinus	0	0	3	1	1695	1344	314	7	1	1	0	0	3366
Plantago	0	0	1	0	14	130	327	69	53	1	0	0	595
Platanus	0	0	6	3	67	0	0	0	0	0	0	0	76
Poaceae	0	1	14	11	260	2661	597	225	57	5	0	0	3831
Populus	0	2	97	40	2	0	0	0	0	0	0	0	141
Quercus	0	0	2	21	323	0	0	0	0	0	0	0	346
Ranunculaceae	0	0	0	0	5	9	5	0	0	0	0	0	19
Robinia	0	0	0	0	1	0	0	0	0	0	0	0	1
Rosaceae	0	0	0	0	1	0	1	0	0	0	0	0	2
Rubiaceae	0	0	0	0	1	5	4	0	0	1	0	0	11
Rumex	0	0	2	3	97	95	36	6	2	0	0	0	241
Salix	0	1	143	180	264	0	1	0	0	0	0	0	589
Sambucus	0	0	0	0	0	196	0	0	0	0	0	0	196
Secale	0	0	0	0	0	0	1	3	0	0	0	0	4
Tilia	0	0	0	0	0	50	38	0	0	0	0	0	88
Ulmus	0	0	7	2	0	0	0	0	0	0	0	0	9
Urticaceae	0	0	0	1	21	792	1544	828	129	0	0	0	3315
Varia	0	5	24	34	149	190	82	87	14	1	0	0	586
Summe	0	764	2760	3486	4206	6130	3222	1445	389	10	0	0	22412

Table 3. Monthly pollen counts for all pollen grains that have been recorded in the pollen trap situated in Lienz.

4. ZAMS

4.1. Characteristics of the pollen station

Coordinates: 47°9'41.26"N / 10°35'37.98"E

Altitude: 783 m asl

Location: The pollen trap is situated on the roof of the Hospital St. Vincent at about 25 m above the ground.

Environmental context: The direct environment corresponds to a settlement area and conifer forests with pine as a dominant plant taxon. Alder and willow are also present along the river banks of the Inn river. Note that fields are observed at further distances.

Potential source area of pollen: Zams' valley from Imst to Landeck.

Duration of the pollen record: From February 10th to October 18th.

Device type: Burkard pollen trap.

Information to the public: Weekly newsletters, phone service and Internet (Pollen Tyrol webpage).

4.2. Pollen season 2021

This year, 44 pollen types have been recorded in the device located in Zams (Table 4). The pollen concentration in the air of Zams and its surrounding areas has been lower than the 10-year average for birch and ash, in particular. Grass and plantain pollen have reached higher levels than the 10-year average.

The first pollen grains from **alder** and **hazel** were recorded in our pollen trap on February 10th and 12th (Figure 7), respectively. The concentration of alder pollen reached moderate to high allergenic burdens from February 17th to 28th with highest values on February 19th and 20th. The allergenic burden of hazel pollen reached high levels from February 21st to 27th, then decreased to vary between low and moderate burdens until mid-March. Based on the 10-year average, moderate to high pollen concentrations for alder and hazel can still be recorded until mid-March. The blooming of green alder at higher altitudes has been recorded between June 12th to 27th with a moderate allergenic burden reached for the period June 12th to 18th.

The concentrations of **hornbeam** and **hop hornbeam** pollen were continuously low throughout the pollen season (Figure 7). Based on the 10-year average, one can see that this is generally the case, although the concentrations can increase to moderate levels depending on the years.

Ash pollen has been regularly found in our device from March 23rd to May 10th (Figure 7). Moderate allergenic burdens were recorded from the end of March until the end of April.

The concentrations of **birch** pollen increased from March 22nd, and reached high concentrations at the start of April (Figure 7). A high allergenic burden has been noted on April 1st whereas the remainder of April was characterized by a continuous moderate burden. During the first half of May, the concentrations of birch pollen decreased to low levels. The birch pollen season was relatively weak compared to the 10-year average when high allergenic burdens can be registered from March 24th until the end of April.

The concentration of **grass** pollen increased in May to reach moderate allergenic burdens at the end of the month, and high burdens around mid-June (Figure 8). Then, the concentrations decreased to low levels for the remainder of the summer season, although a higher pollen concentration has been observed on September 14th. Based on the 10-year average, moderate burdens are commonly registered from the end of May until mid-June. Five days of high allergenic burden have been observed in 2021 when no days of high burden are observed in the 10-year average. **Plantain** pollen was continuously recorded from the beginning of June and was present in the air during most of the summer season, however, the allergenic burden remained relatively low.

Mugwort pollen were recorded throughout August, but the concentrations never reached levels of a moderate allergenic burden (Figure 8). This concurs with the 10-year average trend. Only single grains of **ragweed** pollen have been observed this year in September.

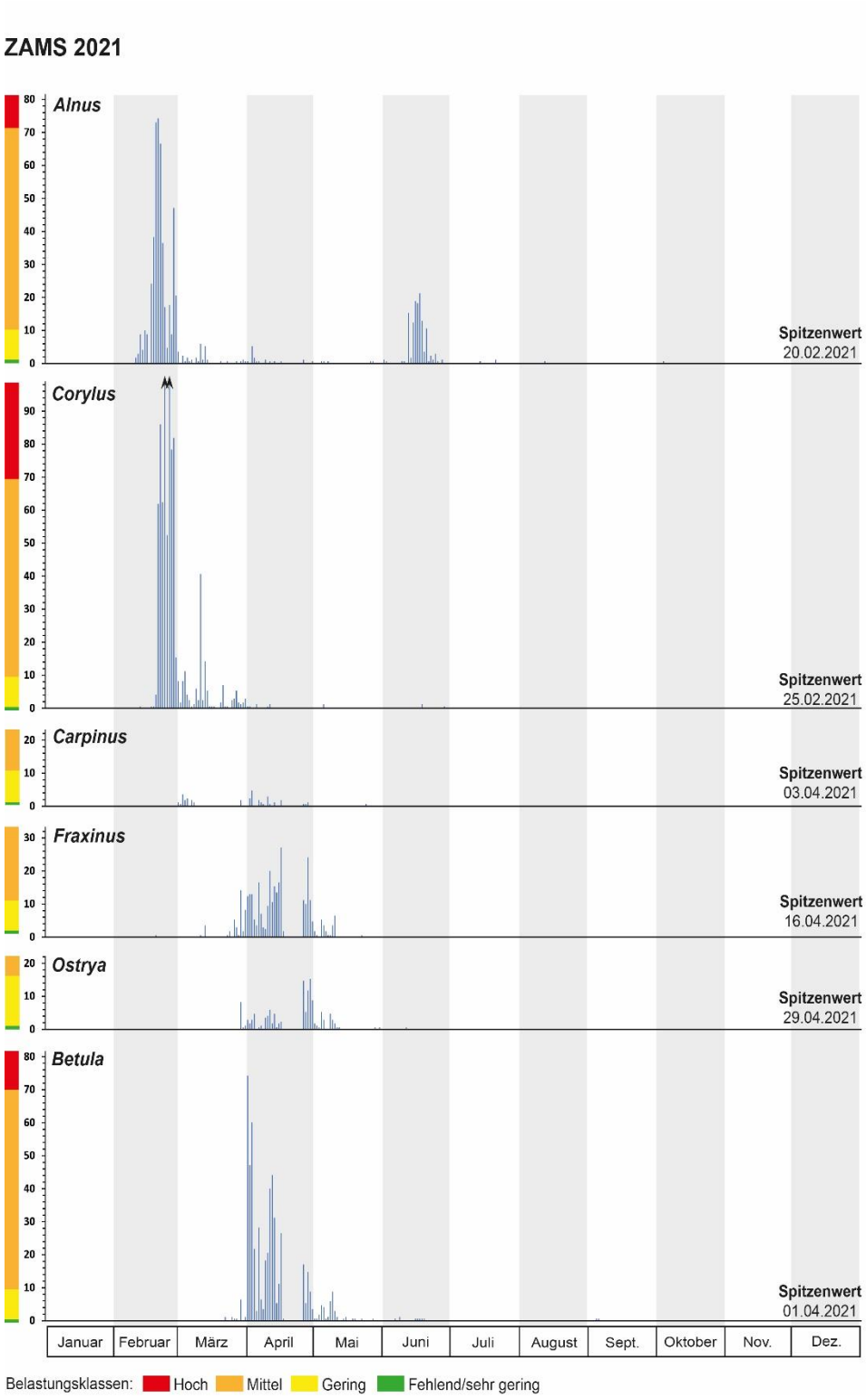

Figure 7. Daily pollen concentration for the major tree pollen of interest for the pollen allergy sufferers. The concentrations are expressed as number of pollen grains per m^3 of air per day. Provided are the class risks which indicates the allergic burden of each pollen type and the date of the highest peak of pollen concentration for 2021. The arrows mark concentrations exceeding the maximum values of the Y-axis.

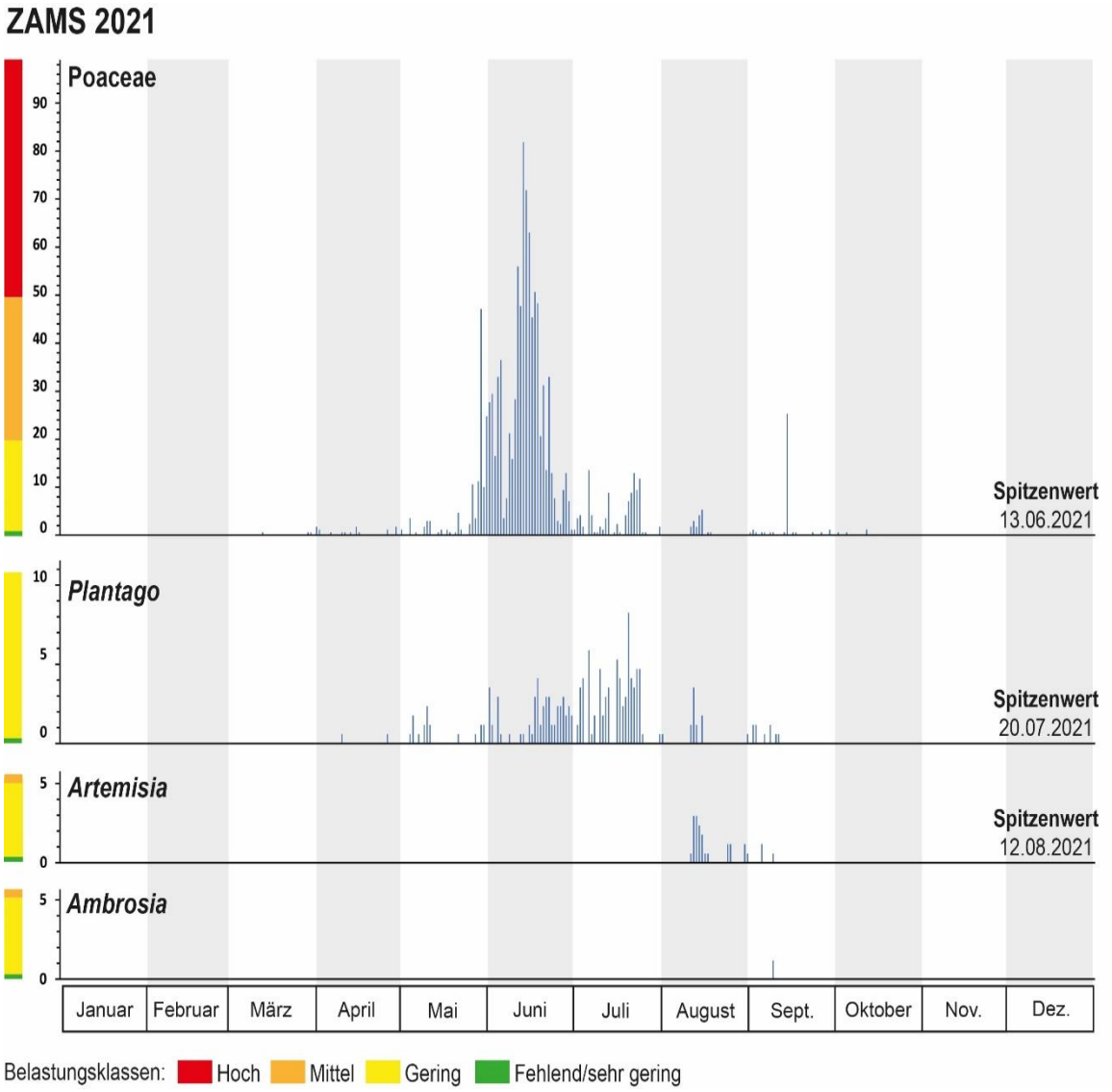

Figure 8. Daily pollen concentration for the major herb pollen of interest for the pollen allergy sufferers. The concentrations are expressed as number of pollen grains per m^3 of air per day. Provided are the class risks which indicates the allergic burden of each pollen type and the date of the highest peak of pollen concentration for 2021. The arrows mark concentrations exceeding the maximum values of the Y-axis.

4.3. Data

Monatssummen am Standort **Zams** im Jahr 2021													
	Januar	Februar	März	April	Mai	Juni	Juli	August	Sept.	Oktober	Nov.	Dez.	Summe
erfasste Tage	0	18.5	31	20	30	30	27	13	30	17.5	0	0	
Abies	0	4	0	0	0	0	0	0	0	0	0	0	4
Aesculus	0	0	0	0	3	0	0	0	0	0	0	0	3
Alnus	0	790	51	23	5	215	3	1	0	1	0	0	1089
Ambrosia	0	0	0	0	0	0	0	0	2	0	0	0	2
Apiaceae	0	0	0	0	7	21	16	1	0	0	0	0	45
Artemisia	0	0	0	0	0	0	0	27	3	0	0	0	30
Asteraceae	0	0	1	3	4	5	10	2	6	0	0	0	31
Betula	0	0	19	835	62	8	0	0	2	0	0	0	926
Brassicaceae	0	0	0	1	0	0	0	0	0	0	0	0	1
Broussonetia	0	0	0	0	3	0	0	0	0	0	0	0	3
Carpinus	0	0	24	33	1	0	0	0	0	0	0	0	58
Caryophyllaceae	0	0	0	0	0	1	0	0	0	0	0	0	1
Castanea	0	0	0	2	0	38	36	0	0	0	0	0	76
Cedrus	0	0	0	0	0	0	0	0	30	0	0	0	30
Chenopodiaceae	0	0	0	0	1	1	10	2	0	1	0	0	15
Cichoriaceae	0	0	0	0	2	2	0	0	1	0	0	0	5
Corylus	0	1198	235	7	2	3	0	0	0	0	0	0	1445
Cupressaceae	0	22	340	140	218	146	22	2	0	0	0	0	890
Cyperaceae	0	0	9	23	27	159	4	0	0	0	0	0	222
Ericaceae	0	1	0	3	4	9	6	0	0	0	0	0	23
Fabaceae	0	0	0	0	1	1	2	0	0	0	0	0	4
Fraxinus	0	1	67	427	42	0	0	0	0	0	0	0	537
Impatiens	0	0	0	0	0	0	0	0	2	0	0	0	2
Juglans	0	0	0	1	24	2	0	0	0	0	0	0	27
Larix	0	0	1	0	0	0	0	0	0	0	0	0	1
Oleaceae	0	0	0	0	1	0	0	0	0	0	0	0	1
Ostrya	0	0	17	161	40	1	0	0	0	0	0	0	219
Picea	0	2	1	5	2	3	0	0	1	0	0	0	14
Pinus	0	6	7	4	2128	2482	478	10	2	1	0	0	5118
Plantago	0	0	0	2	19	75	121	15	9	0	0	0	241
Platanus	0	0	0	276	405	0	0	0	0	0	0	0	681
Poaceae	0	0	3	18	225	1425	179	29	58	4	0	0	1941
Populus	0	6	148	98	0	1	0	0	0	0	0	0	253
Quercus	0	0	1	5	38	1	0	0	0	0	0	0	45
Ranunculaceae	0	0	0	0	4	7	13	0	0	0	0	0	24
Rosaceae	0	0	0	1	5	0	0	0	0	0	0	0	6
Rubiaceae	0	0	0	0	15	25	3	0	0	0	0	0	43
Rumex	0	0	0	0	38	47	7	2	0	0	0	0	94
Salix	0	0	40	153	180	0	0	1	0	0	0	0	374
Sambucus	0	0	0	0	0	156	12	0	0	0	0	0	168
Secale	0	0	0	0	0	2	0	0	0	0	0	0	2
Tilia	0	0	0	0	0	25	3	0	0	0	0	0	28
Ulmus	0	0	12	1	1	0	0	0	0	0	0	0	14
Urticaceae	0	0	0	0	1	401	682	227	40	0	0	0	1351
Varia	0	0	20	25	89	72	92	12	5	2	0	0	317
Summe	0	2030	996	2247	3597	5334	1699	331	161	9	0	0	16404

Table 4. Monthly pollen counts for all pollen grains that have been recorded in the pollen trap situated in Zams.

5. REUTTE

5.1. Characteristics of the pollen station

Coordinates: 47°28'24.21"N/ 10°42'44.96"E

Altitude: 867 m asl

Location: The pollen trap is situated on the roof of the hospital at about 20 m above the ground.

Environmental context: The direct environment corresponds to a mixed forest of conifers (fir and spruce) and deciduous trees (beech), and mown meadows. At further distances towards the north-east, a pine forest is present. Along the streams, alder and willow are abundant.

Potential source area of pollen: Reutte and its surrounding areas.

Duration of the pollen record: From February 03rd to October 11th.

Device type: Burkard pollen trap.

Information to the public: Weekly newsletters, phone service and Internet (Pollen Tyrol webpage).

5.2. Pollen season 2021

In 2021, 42 pollen types have been recorded in our device located in Reutte (Table 5). The pollen concentration in the air of Reutte and its surrounding areas has been lower than the 10-year average for alder and birch and higher for grass, plantain, hazel and hop hornbeam.

The concentration of **alder** pollen increased from February 9th to reach moderate allergenic burdens from February 18th (Figure 9). Daily moderate burdens were observed until March 3rd, then the concentration decreased to low levels. The blooming of green alder at higher altitudes has been recorded over 10 days (June 11th to 21st) and reached moderate allergenic burdens for one day only (June 20th). The 10-year average shows that high burdens can be expected during the first alder phase in February and that the concentration of alder this year was generally lower than the 10-year average.

The first pollen grains from **hazel** were recorded on February 11th (Figure 9). The highest pollen concentrations have been observed between February 22nd and March 5th with the highest peak on February 25th. The concentration reached high allergenic burdens over three days (February 24-26th). The last pollen grains were noted at the end of March. The concentrations of hazel pollen reached high levels this year compared to the 10-year average.

The concentration of **hornbeam** pollen has been the highest from mid-April to the beginning of May (Figure 9). The allergenic burden was relatively low, and reached moderate levels for one day only (April 25th). Regarding **hop hornbeam**, the pollen concentration has been high this year if we consider the 10-year average. Regular moderate burdens have been observed at the end of April in 2021.

Ash pollen has been regularly found in our device from the end of March until the end of May (Figure 9). The highest concentrations were recorded at the end of April, which reached moderate allergenic burdens.

The regular presence of **birch** pollen in our records started mid-April (Figure 9), although medium values were noted for two days in March (26-27th). The highest pollen concentrations have been observed at the end of April, in particular on April 28th, when the highest allergenic burden has been reached. The birch pollen season ended at the end of May.

The concentrations of **grass** pollen increased from the end of April and reached moderate allergenic burdens at the end of May (Figure 10). A period with high allergenic burdens was observed over almost 10 consecutive days, from June 11th to the 22nd. Days with moderate burdens were noted until mid-August, and then only low concentrations were recorded. The grass pollen season appears to have been long and intense this year compared to the 10-year average. **Plantain** pollen was mainly recorded from mid-May until the start of September, however, the allergenic burden remained relatively low. The highest concentrations were noted between June 21st to 24th when moderate burdens were reached.

Only single pollen grains of **mugwort** and **ragweed** were recorded this year (Figure 10), between July 21st and September 6th, and between August 7th and September 14th, respectively.

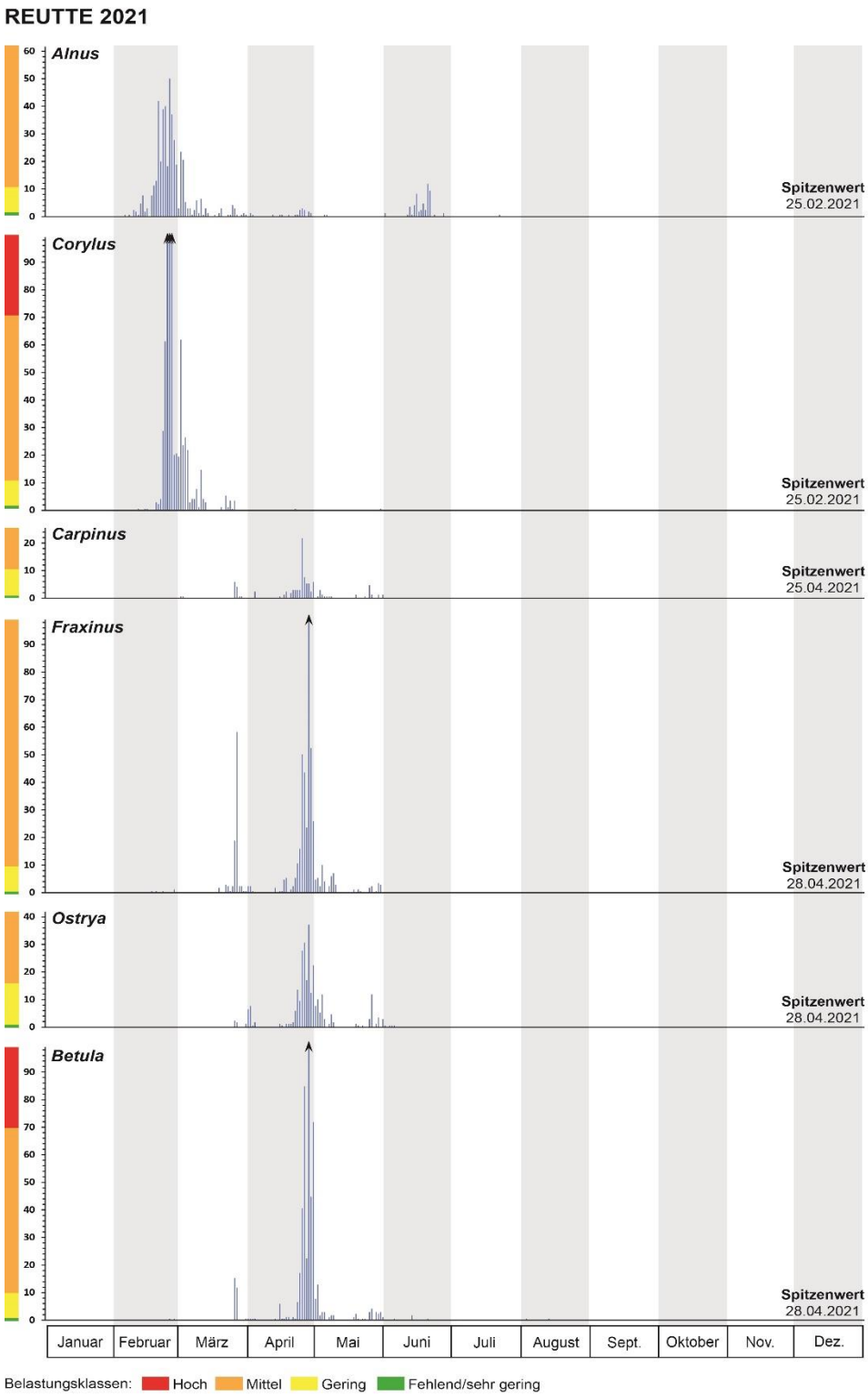

Figure 9. Daily pollen concentration for the major tree pollen of interest for the pollen allergy sufferers. The concentrations are expressed as number of pollen grains per m^3 of air per day. Provided are the class risks which indicates the allergic burden of each pollen type and the date of the highest peak of pollen concentration for 2021. The arrows mark concentrations exceeding the maximum values of the Y-axis.

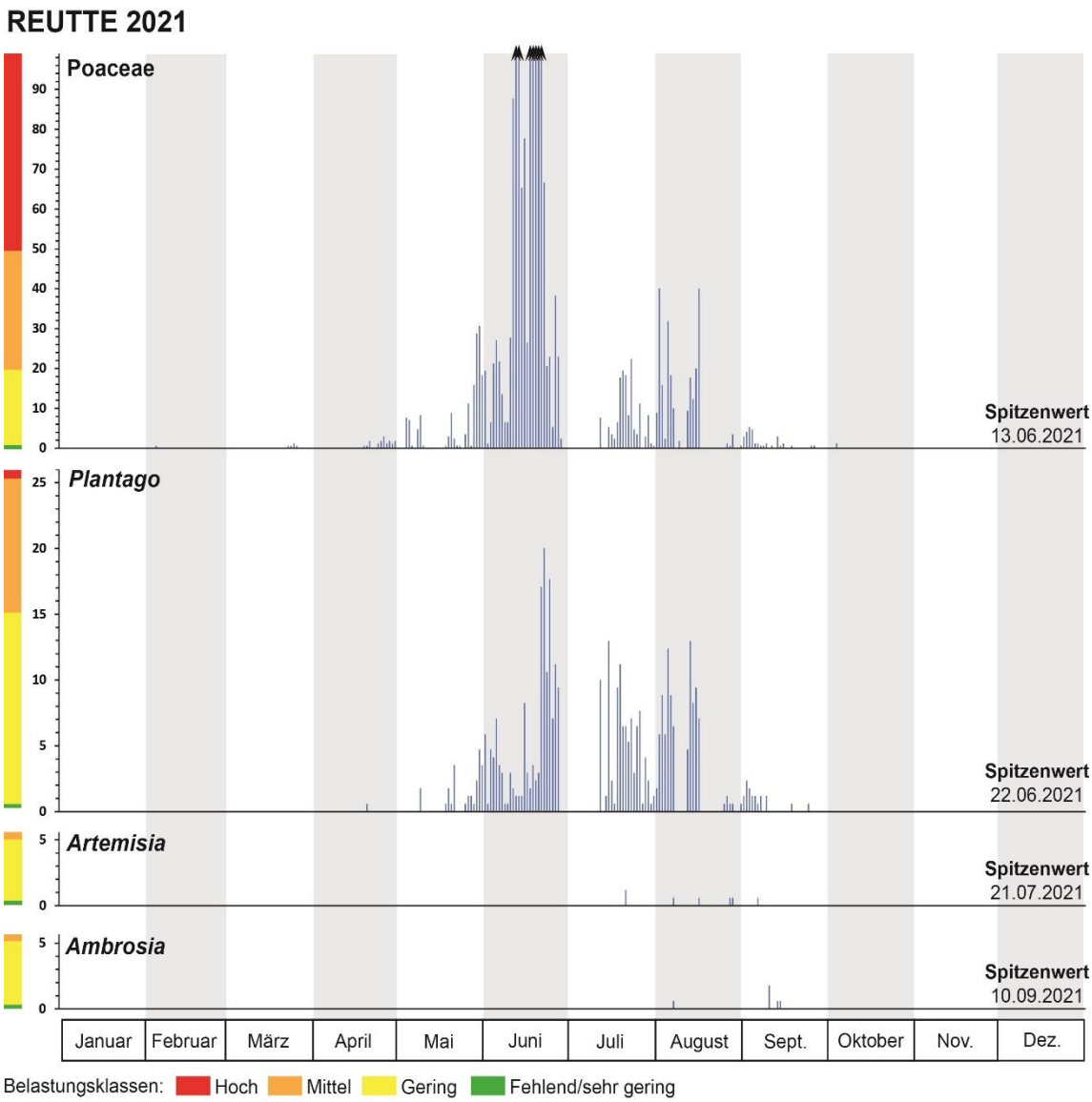

Figure 10. Daily pollen concentration for the major herb pollen of interest for the pollen allergy sufferers. The concentrations are expressed as number of pollen grains per m^3 of air per day. Provided are the class risks which indicates the allergic burden of each pollen type and the date of the highest peak of pollen concentration for 2021. The arrows mark concentrations exceeding the maximum values of the Y-axis.

5.3. Data

Monatssummen am Standort **Reutte** im Jahr 2021													
	Januar	Februar	März	April	Mai	Juni	Juli	August	Sept.	Oktober	Nov.	Dez.	Summe
erfasste Tage	0	26	31	23	22.5	27.5	19.5	21.5	28.5	10.5	0	0	
Acer	0	0	0	0	0	0	1	0	0	0	0	0	1
Aesculus	0	0	0	0	0	6	0	0	0	0	0	0	6
Alnus	0	590	162	27	2	89	1	0	0	0	0	0	871
Ambrosia	0	0	0	0	0	0	0	1	5	0	0	0	6
Apiaceae	0	0	0	0	1	16	35	34	1	0	0	0	87
Artemisia	0	0	0	0	0	0	2	4	1	0	0	0	7
Asteraceae	0	0	0	0	4	6	0	0	0	0	0	0	10
Betula	0	2	47	700	93	5	0	2	0	0	0	0	849
Carpinus	0	0	21	116	29	0	0	0	0	0	0	0	166
Caryophyllaceae	0	0	0	0	0	1	0	0	0	0	0	0	1
Castanea	0	0	0	0	0	22	7	21	0	0	0	0	50
Cedrus	0	0	0	0	0	0	0	0	2	1	0	0	3
Chenopodiaceae	0	0	0	0	0	0	2	1	0	0	0	0	3
Cichoriaceae	0	0	0	1	5	0	0	0	1	0	0	0	7
Corylus	0	1171	357	1	1	0	0	0	0	0	0	0	1530
Cupressaceae	0	28	145	149	59	31	9	2	0	0	0	0	423
Cyperaceae	0	0	7	56	86	73	1	3	0	0	0	0	226
Ericaceae	0	0	1	9	6	3	0	0	2	0	0	0	21
Fabaceae	0	0	0	0	0	1	0	0	0	0	0	0	1
Fagus	0	0	0	0	0	1	0	0	0	0	0	0	1
Fraxinus	0	5	158	592	100	0	0	0	0	0	0	0	855
Impatiens	0	0	0	0	0	0	1	1	12	0	0	0	14
Juglans	0	0	0	0	14	0	0	0	0	0	0	0	14
Juncaceae	0	0	0	0	0	0	0	1	0	0	0	0	1
Ostrya	0	0	9	339	119	4	0	0	0	0	0	0	471
Picea	0	0	4	9	5	3	0	0	1	0	0	0	22
Pinus	0	0	1	3	625	1829	78	230	2	0	0	0	2768
Plantago	0	0	0	1	38	260	168	163	20	0	0	0	650
Platanus	0	0	1	9	3	3	0	0	0	0	0	0	16
Poaceae	0	1	5	25	261	2965	244	398	49	2	0	0	3950
Populus	0	3	47	32	1	0	0	0	0	0	0	0	83
Quercus	0	0	0	8	162	23	0	0	0	0	0	0	193
Ranunculaceae	0	0	0	0	11	46	1	1	0	0	0	0	59
Rosaceae	0	1	0	0	0	7	0	0	0	0	0	0	8
Rubiaceae	0	0	0	0	0	53	0	3	0	0	0	0	56
Rumex	0	0	0	1	24	52	9	4	0	0	0	0	90
Salix	0	1	82	135	210	0	0	0	0	0	0	0	428
Sambucus	0	0	0	0	0	19	1	16	0	0	0	0	36
Secale	0	0	0	0	1	2	0	0	0	0	0	0	3
Tilia	0	0	0	0	0	0	4	10	1	0	0	0	15
Ulmus	0	1	3	0	0	2	0	0	0	0	0	0	6
Urticaceae	0	0	0	0	0	565	782	481	51	1	0	0	1880
Varia	0	4	8	14	42	80	30	45	3	3	0	0	229
Summe	0	1807	1058	2227	1902	6167	1376	1421	151	7	0	0	16116

Table 5. Monthly pollen counts for all pollen grains that have been recorded in the pollen trap situated in Reutte.

6. GALTÜR

6.1. Characteristics of the pollen station

Coordinates: 46°58'7.80"N / 10°11'21.21"E

Altitude: 1579 m asl

Location: The pollen trap is situated opposite the entrance of the Alpenhotel Tirol, in Galtür, at about 4 m above the ground.

Environmental context: The direct environment corresponds to a settlement area and meadows. Conifer forests are present at further distances.

Potential source area of pollen: Galtür and the Paznaun valley.

Duration of the pollen record: From April 27th to October 18th.

Device type: Lanzoni pollen trap.

Information to the public: Weekly newsletters, weekly reports, phone service and Internet (Pollen Tyrol webpage).

6.2. Pollen season 2021

In 2021, 40 pollen types have been recorded in Galtür (Table 6). There are no data to calculate the 10-year average trend for Galtür. From 2022, we will be able to make comparisons for one year to another.

In Galtür, the first phase of **alder** blooming is not recorded as the pollen season begins late at such elevations and we started our pollen recording at the end of April (Figure 11). The second phase with the blooming of green alder was mainly recorded from June 1st to 27th. The concentrations have been the highest around mid-June when a high allergenic burden was noted on June 14th; moderate burdens have been observed from June 4th to 20th.

Only single pollen grains from **hornbeam** and **hop hornbeam** were registered for the period April 29th – June 18th and April 29th – May 21st (Figure 11).

Ash pollen have been mainly found in our device from the end of April until mid-May (Figure 11). However, the pollen concentrations were low.

The concentrations of **birch** pollen were low and never reached levels of moderate allergenic burden (Figure 11). Pollen from birch were recorded between April 27th and June 15th. The pollen season for birch was rather weak with low allergenic burdens.

Grass pollen was the main threat in Galtür and the Paznaun valley for pollen allergy sufferers (Figure 12). The first pollen grains from **grass** were recorded at the start of May. However, it is only from May 21st that the concentrations increased to reach moderate allergenic burdens, which was highest on May 28th – 29th. The period May 30th to June 10th was characterized by relatively low allergenic burdens. The burden rose again to moderate levels from June 11th and reached high levels at the end of June. The burden stayed relatively high until July 24th, although this depended on the days. The highest concentrations were recorded on June 27th. From the end of July and August the burden remained low. **Plantain** pollen that is also important for grass allergy sufferers were recorded from mid-June until the end of July, however, the pollen concentrations were low.

Only single pollen grains from **mugwort** were detected at the end of July (Figure 12). No **ragweed** pollen has been observed.

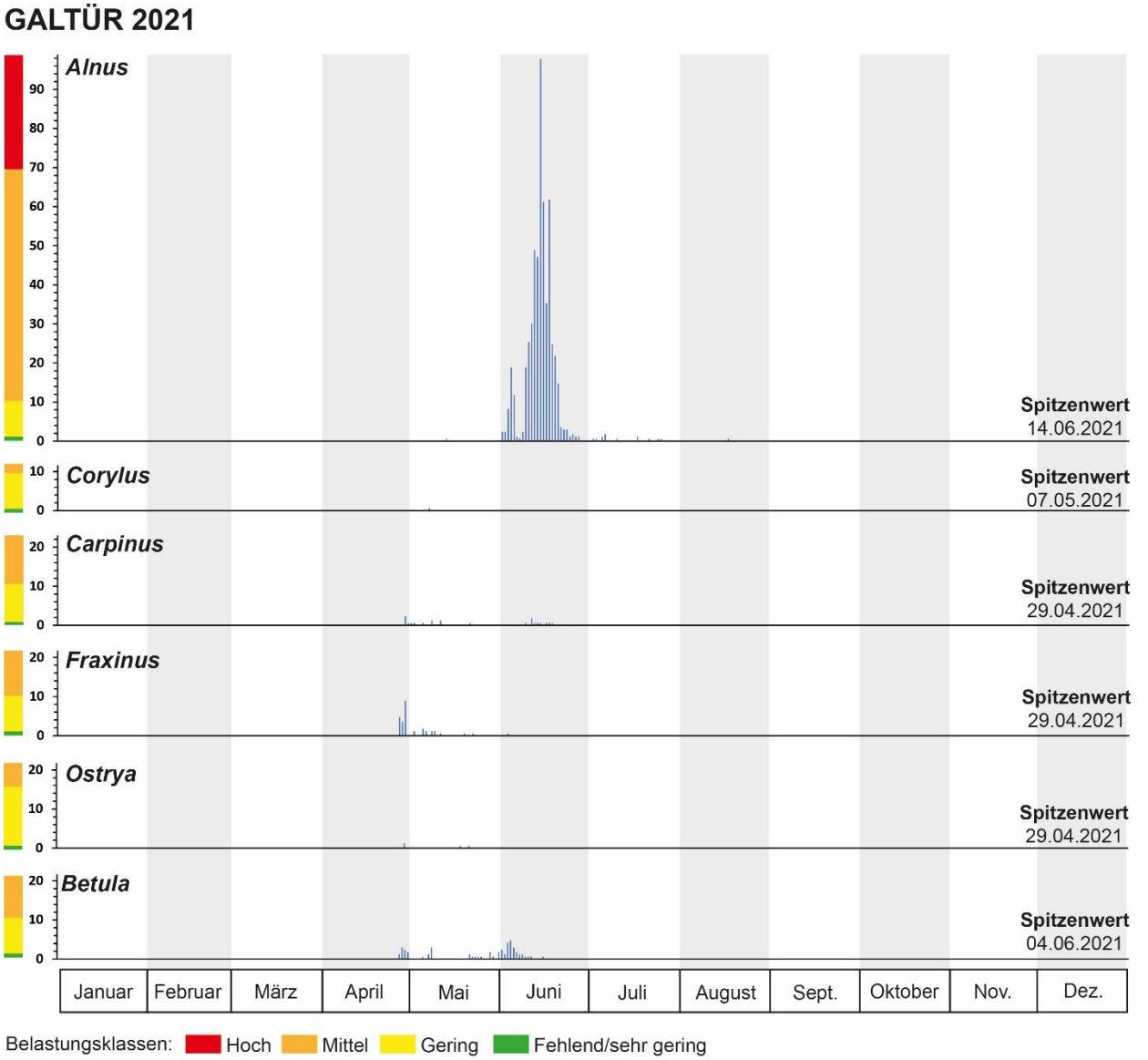

Figure 11. Daily pollen concentration for the major tree pollen of interest for the pollen allergy sufferers. The concentrations are expressed as number of pollen grains per m^3 of air per day. Provided are the class risks which indicates the allergic burden of each pollen type and the date of the highest peak of pollen concentration for 2021. The arrows mark concentrations exceeding the maximum values of the Y-axis.

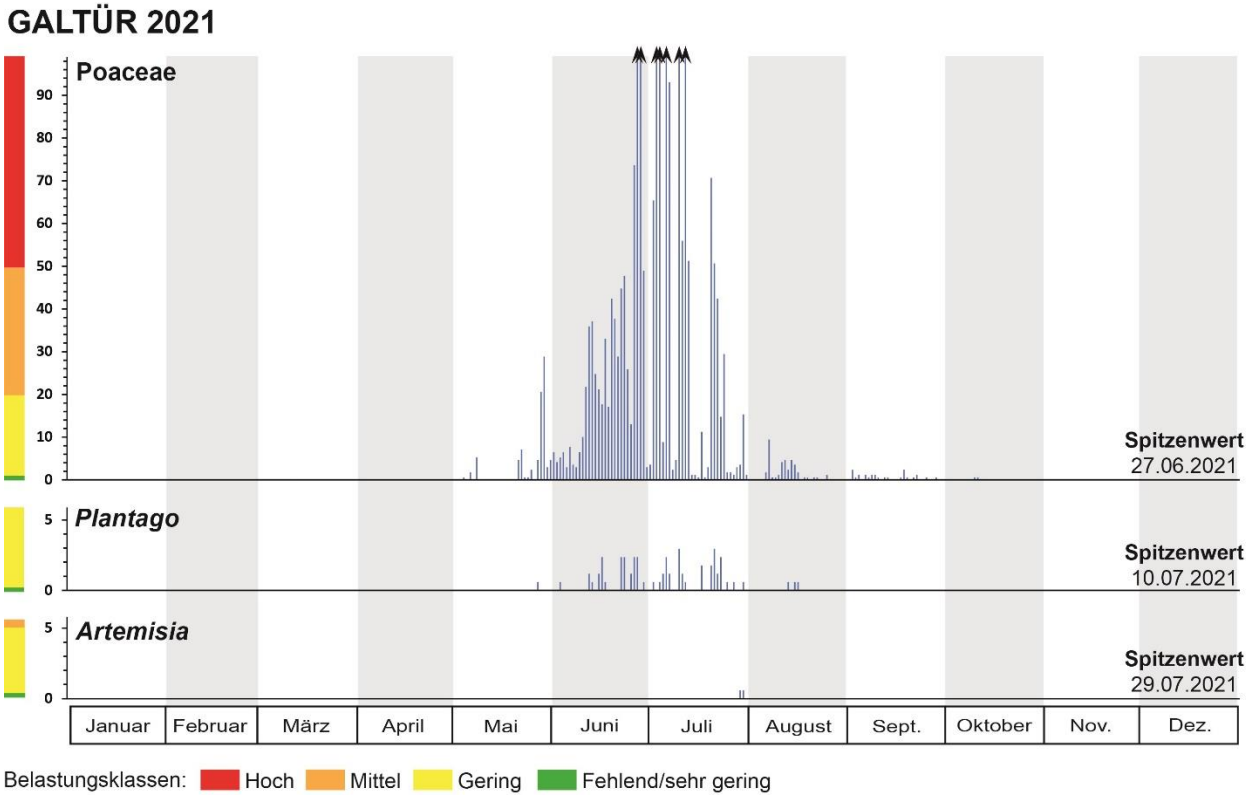

Figure 12. Daily pollen concentration for the major herb pollen of interest for the pollen allergy sufferers. The concentrations are expressed as number of pollen grains per m^3 of air per day. Provided are the class risks which indicates the allergic burden of each pollen type and the date of the highest peak of pollen concentration for 2021. The arrows mark concentrations exceeding the maximum values of the Y-axis.

6.3. Data

Monatssummen am Standort **Galtür** im Jahr 2021													
	Januar	Februar	März	April	Mai	Juni	Juli	August	Sept.	Oktober	Nov.	Dez.	Summe
erfasste Tage	0	0	0	3.5	31	30	31	29.5	29.5	17.5	0	0	
Alnus	0	0	0	0	1	934	13	1	0	0	0	0	949
Apiaceae	0	0	0	0	0	104	42	2	1	0	0	0	149
Artemisia	0	0	0	0	0	0	2	0	0	0	0	0	2
Asteraceae	0	0	0	0	3	3	0	1	1	0	0	0	8
Betula	0	0	0	14	21	37	0	0	0	0	0	0	72
Brassicaceae	0	0	0	0	0	0	0	2	0	0	0	0	2
Broussonetia	0	0	0	0	6	1	0	0	0	0	0	0	7
Cannabaceae	0	0	0	0	0	0	0	4	0	0	0	0	4
Carpinus	0	0	0	5	8	10	0	0	0	0	0	0	23
Caryophyllaceae	0	0	0	0	1	0	0	0	2	0	0	0	3
Castanea	0	0	0	0	0	56	23	0	0	0	0	0	79
Chenopodiaceae	0	0	0	0	0	8	4	7	4	0	0	0	23
Cichoriaceae	0	0	0	0	0	9	3	0	2	0	0	0	14
Corylus	0	0	0	0	1	0	0	0	0	0	0	0	1
Cupressaceae	0	0	0	2	19	275	108	1	0	0	0	0	405
Cyperaceae	0	0	0	0	4	149	22	0	0	0	0	0	175
Ericaceae	0	0	0	2	4	8	54	1	2	0	0	0	71
Fabaceae	0	0	0	0	1	1	0	0	0	0	0	0	2
Fraxinus	0	0	0	29	14	1	0	0	0	0	0	0	44
Impatiens	0	0	0	0	0	0	0	1	0	0	0	0	1
Juglandaceae	0	0	0	0	0	2	0	0	0	0	0	0	2
Juglans	0	0	0	0	0	1	0	0	0	0	0	0	1
Larix	0	0	0	0	0	1	0	0	0	0	0	0	1
Oleaceae	0	0	0	0	0	0	0	1	0	0	0	0	1
Ostrya	0	0	0	2	2	0	0	0	0	0	0	0	4
Picea	0	0	0	0	0	10	0	0	0	0	0	0	10
Pinus	0	0	0	0	105	653	520	3	0	0	0	0	1281
Plantago	0	0	0	0	1	30	38	3	0	0	0	0	72
Poaceae	0	0	0	0	144	1776	2250	65	28	2	0	0	4265
Populus	0	0	0	0	3	0	1	0	0	0	0	0	4
Quercus	0	0	0	1	24	3	1	2	0	0	0	0	31
Ranunculaceae	0	0	0	0	0	19	8	2	0	0	0	0	29
Rosaceae	0	0	0	0	0	0	1	0	0	0	0	0	1
Rubiaceae	0	0	0	0	0	1	1	0	0	0	0	0	2
Rumex	0	0	0	0	5	390	88	1	0	0	0	0	484
Salix	0	0	0	5	17	1	0	0	0	0	0	0	23
Sambucus	0	0	0	0	0	4	0	0	0	0	0	0	4
Secale	0	0	0	0	0	0	1	0	0	0	0	0	1
Tilia	0	0	0	0	0	0	8	0	0	0	0	0	8
Urticaceae	0	0	0	1	9	144	512	191	24	0	0	0	881
Varia	0	0	0	10	26	76	21	7	3	1	0	0	144
Summe	0	0	0	71	419	4707	3721	295	67	3	0	0	9283

Table 6. Monthly pollen counts for all pollen grains that have been recorded in the pollen trap situated in Galtür.

7. OBERGURGL

7.1. Characteristics of the pollen station

Coordinates: 46°52'0.41"N / 11° 1'28.40"E

Altitude: 1940 m asl

Location: The pollen trap is situated at the entrance of the Alpine Research Centre Obergurgl, next to the meteorological station at 4 m above the ground.

Environmental context: The direct environment corresponds to a settlement area, alpine meadows and trees such as Swiss stone pine and green alder.

Potential source area of pollen: Obergurgl and the Ötztal valley. Due to south-westerly winds and foehn, the pollen record can be influenced by a pollen component coming from valleys in South Tyrol.

Duration of the pollen record: From April 9th to October 27th.

Device type: Burkard pollen trap.

Information to the public: Weekly newsletters, weekly reports, phone service and Internet (Pollen Tyrol webpage).

7.2. Pollen season 2021

This year, 41 pollen types have been recorded in our device located in Obergurgl (Table 7). The pollen concentration in the air of Obergurgl and the Ötztal valley was lower than the 10-year average for alder and birch, in particular. Grass pollen have reached higher levels than the 10-year average.

In Obergurgl, only the second **alder** phase (blooming of green alder) is recorded which lasted over a month, from June 3rd to July 3rd (Figure 13). The concentrations have been highest around mid-June when moderate to high allergenic burdens were observed. The highest peak is noted on June 15th. Based on the 10-year average, the pollen concentrations of green alder can increase earlier in May and reach high burdens in mid-June. Only very few pollen grains of **hazel** were recorded during the first half of March, and the related allergenic burden was therefore low; these pollen grains result from long-distance pollen dispersal.

The concentrations of **hornbeam** and **hop hornbeam** pollen were low, in particular for hornbeam (Figure 13). Hop hornbeam has been recorded from mid-April until mid-May.

Ash pollen have been mainly found in our device from the end of April until the beginning of June (Figure 13). However, the pollen concentrations were low.

The first pollen grains from **birch** have been recorded on April 9th (Figure 13). The pollen season for birch was rather weak with low allergenic burdens except for one day (April 25th) when the burden increased to a moderate level. Low pollen concentrations have been observed until the end of May. The 10-year average trend shows that pollen concentrations were lower than the average.

As for Galtür, **grass** pollen was the main risk in Obergurgl and the Ötztal valley for pollen allergy sufferers (Figure 14). The consistent presence of grass pollen was recorded at the beginning of May. The allergenic burdens were low until moderate to high burdens were registered over four days between June 12th and 16th. The highest allergenic burden was noted on June 13th. For the rest of the summer period, the allergenic burden was rather low until mid-July, except three days when the burden reached moderate levels. From mid-July to mid-August, the allergenic burdens were low to moderate, depending on the weather conditions. It was only after mid-August that the concentrations of grass pollen generally decreased to low and even very low levels. Compared to the 10-year average, the highest levels of allergenic burdens have been reached early (mid-June) when these levels can be reached in mid-July. **Plantain** pollen were mainly recorded from mid-June to mid-August, however, the pollen concentrations were low.

Mugwort pollen were notably recorded in August, however the pollen concentrations were very low (Figure 14). This is in agreement with the 10-year average. Only one **ragweed** pollen has been observed over the entire pollen season.

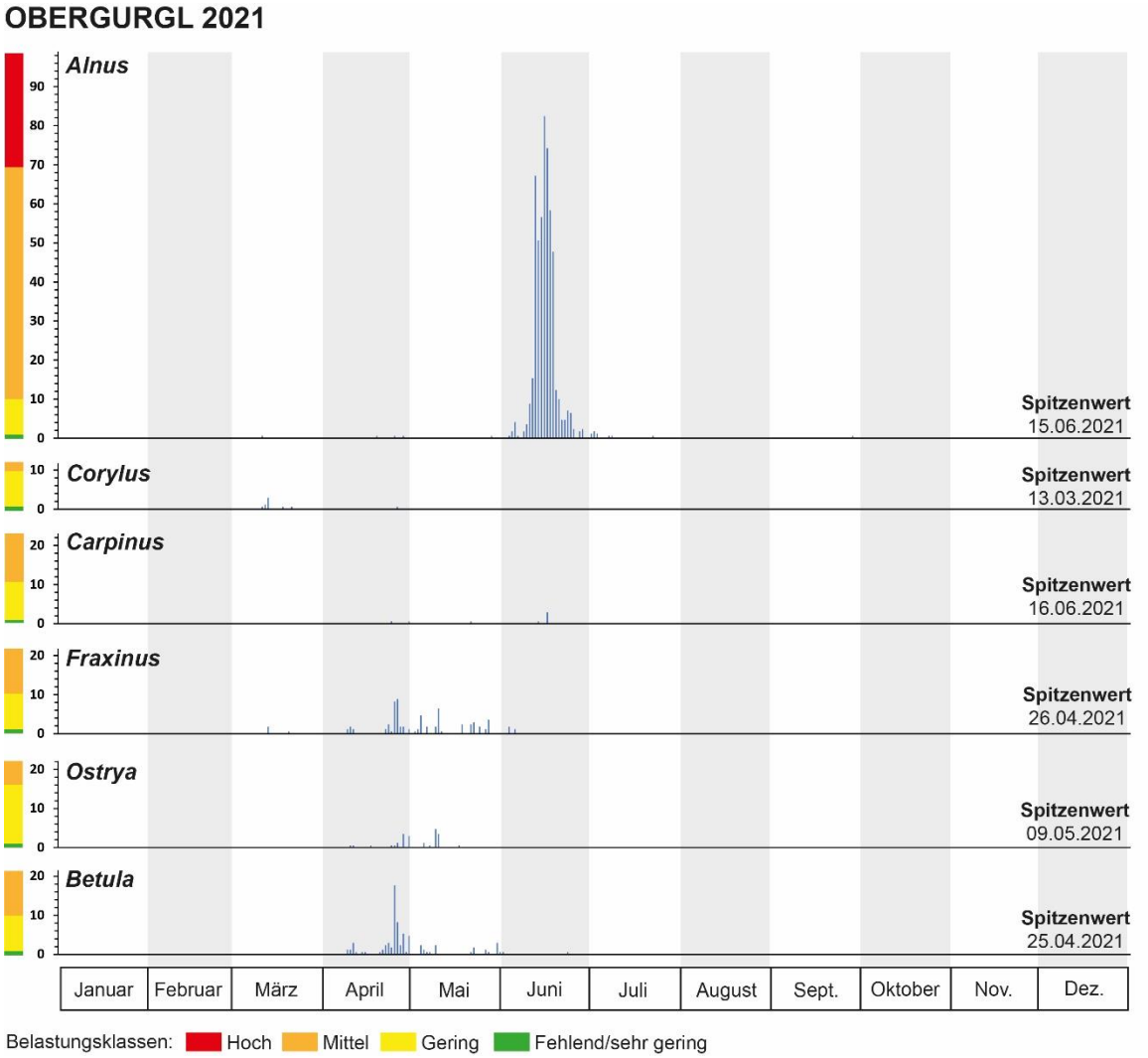

Figure 13. Daily pollen concentration for the major tree pollen of interest for the pollen allergy sufferers. The concentrations are expressed as number of pollen grains per m^3 of air per day. Provided are the class risks which indicates the allergic burden of each pollen type and the date of the highest peak of pollen concentration for 2021. The arrows mark concentrations exceeding the maximum values of the Y-axis.

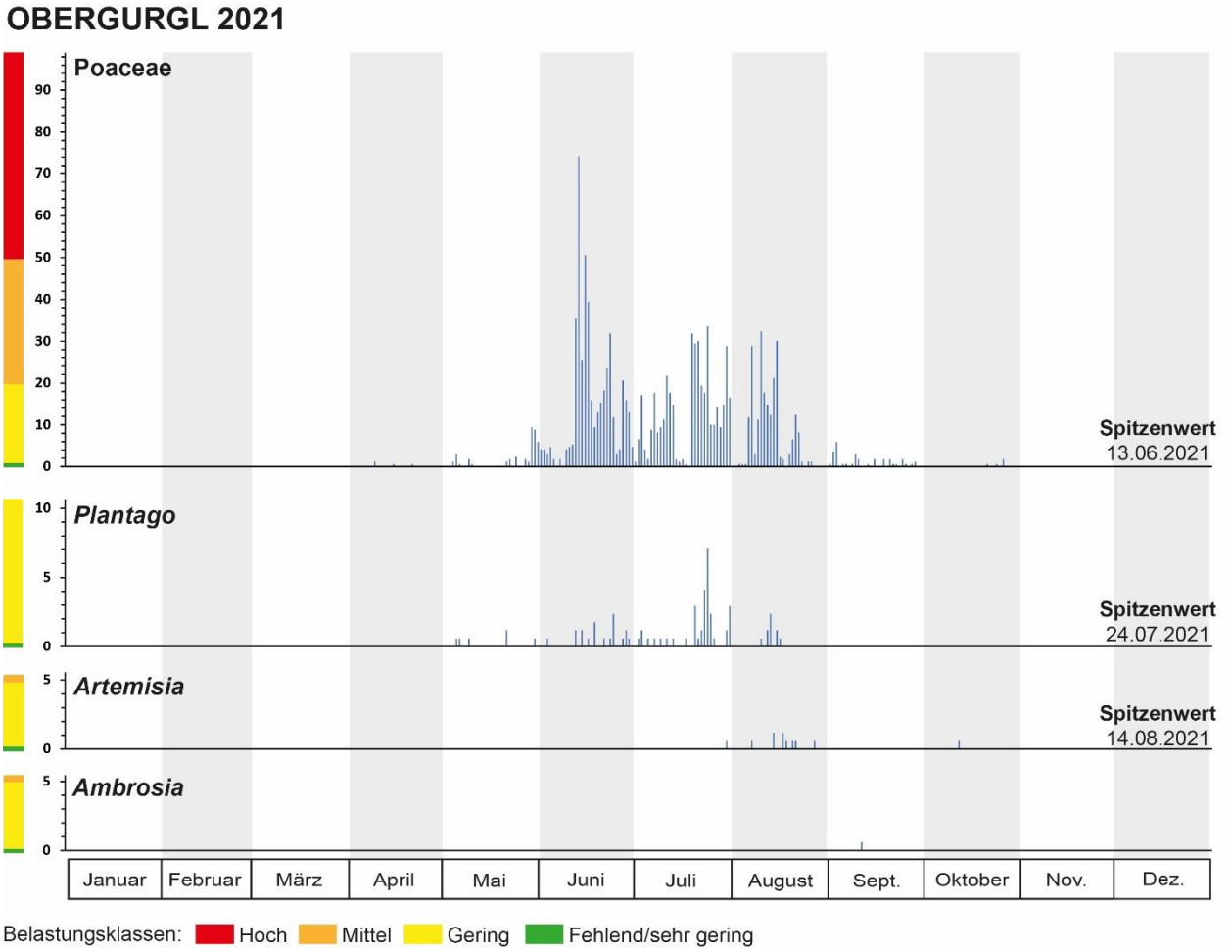

Figure 14. Daily pollen concentration for the major herb pollen of interest for the pollen allergy sufferers. The concentrations are expressed as number of pollen grains per m^3 of air per day. Provided are the class risks which indicates the allergic burden of each pollen type and the date of the highest peak of pollen concentration for 2021. The arrows mark concentrations exceeding the maximum values of the Y-axis.

7.3. Data

Monatssummen am Standort **Obergurgl** im Jahr 2021													
	Januar	Februar	März	April	Mai	Juni	Juli	August	Sept.	Oktober	Nov.	Dez.	Summe
erfasste Tage	0	0	14	22	31	30	31	31	29	26.5	0	0	
Abies	0	0	2	0	0	0	0	0	0	0	0	0	2
Alnus	0	0	1	3	1	892	10	0	1	0	0	0	908
Ambrosia	0	0	0	0	0	0	0	0	1	0	0	0	1
Apiaceae	0	0	0	0	2	7	36	10	1	0	0	0	56
Artemisia	0	0	0	0	0	0	1	9	0	1	0	0	11
Asteraceae	0	0	0	1	3	0	3	3	4	0	0	0	14
Betula	0	0	0	93	25	2	0	0	0	0	0	0	120
Brassicaceae	0	0	0	0	3	0	0	0	0	0	0	0	3
Broussonetia	0	0	0	0	18	7	0	0	0	0	0	0	25
Cannabaceae	0	0	0	0	0	0	0	10	1	0	0	0	11
Carpinus	0	0	0	2	1	6	0	0	0	0	0	0	9
Caryophyllaceae	0	0	0	0	0	0	2	0	0	0	0	0	2
Castanea	0	0	0	0	0	146	52	3	0	0	0	0	201
Chenopodiaceae	0	0	0	0	0	16	8	2	1	0	0	0	27
Cichoriaceae	0	0	0	0	1	4	0	1	0	0	0	0	6
Corylus	0	0	10	1	0	0	0	0	0	0	0	0	11
Cupressaceae	0	0	18	27	74	362	270	0	0	0	0	0	751
Cyperaceae	0	0	0	6	16	167	22	0	0	0	0	0	211
Ericaceae	0	0	0	1	2	19	41	6	1	0	0	0	70
Fabaceae	0	0	0	0	0	1	4	0	0	0	0	0	5
Fraxinus	0	0	4	51	53	5	0	0	0	0	0	0	113
Impatiens	0	0	0	0	0	0	0	0	2	0	0	0	2
Juglans	0	0	0	0	1	0	0	0	0	0	0	0	1
Larix	0	0	0	0	1	0	0	0	0	0	0	0	1
Oleaceae	0	0	0	0	0	5	0	0	0	0	0	0	5
Ostrya	0	0	0	18	18	0	0	0	0	0	0	0	36
Picea	0	0	3	0	1	3	0	1	0	0	0	0	8
Pinus	0	0	9	6	268	1136	3136	20	1	1	0	0	4577
Plantago	0	0	0	0	6	19	48	10	0	0	0	0	83
Poaceae	0	0	0	4	67	779	698	378	47	5	0	0	1978
Populus	0	0	5	2	0	0	2	0	0	0	0	0	9
Quercus	0	0	0	8	35	4	1	0	0	0	0	0	48
Ranunculaceae	0	0	0	0	0	4	6	4	0	0	0	0	14
Rosaceae	0	0	0	0	0	0	1	0	0	0	0	0	1
Rubiaceae	0	0	0	0	0	6	2	1	0	0	0	0	9
Rumex	0	0	0	0	6	353	268	5	1	0	0	0	633
Salix	0	0	6	6	4	6	0	0	0	0	0	0	22
Tilia	0	0	0	0	0	5	1	0	0	0	0	0	6
Ulmus	0	0	1	0	0	0	0	0	0	0	0	0	1
Urticaceae	0	0	0	0	6	241	706	301	45	0	0	0	1299
Xanthium	0	0	0	0	1	0	0	0	0	0	0	0	1
Varia	0	0	1	20	64	110	32	17	4	0	0	0	248
Summe	0	0	60	249	677	4305	5350	781	110	7	0	0	11539

Table 7. Monthly pollen counts for all pollen grains that have been recorded in the pollen trap situated in Obergurgl.

8. ACKNOWLEDGEMENTS

The pollen monitoring service for Tyrol was financially supported by *Amt der Tiroler Landesregierung, Landesdirektion für Gesundheit, Abteilung Landessanitätsdirektion*. We are grateful to their support which allows to run our service under the best conditions, gather high quality pollen data across the region of Tyrol and finally inform the pollen allergy sufferers about pollen concentrations in the air and the allergenic exposure in the region. Without this financial support, we would not be able to provide pollen allergy sufferers with up-to-date pollen information via our newsletters and the webpage.

We would also like to thank to the Galtür municipality, the Tourismusverband Paznaun – Ischgl, the Ötztal Tourismus and the Alpine Research Centre Obergurgl (in particular Dr. Nikolaus Schallhart) for their financial supports and/or help for the maintenance of the pollen traps at high altitudes (Obergurgl and Galtür) and their interests in communicating our pollen information to the public.

Special thanks are also given to the district hospitals in Lienz and Reutte and the hospital St. Vinzenz in Zams for their continuous collaborations over the years regarding the maintenance of the pollen traps and the weekly changes of drums. We are grateful to all the technicians involved in these tasks.

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Finally, we thank the Austrian pollen monitoring service and all members of its team for their collaborations in term of dataset management.