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Flowering Biology of *Syringa* L. Species and Hybrids

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Abstract

The results of the study of flowering of 6 species and 2 interspecific hybrids of subgenus *Syringa* are described in this article, which include the following: sections *Villosae* C. K. Schneid.: *S. josikaea* J. Jacq. ex Rchb., *S. emodi* Wall. ex Royle, *S. wolfii* C. K. Schneid., *S. sweginzowii* Koehne & Lingelsh., *S. villosa* Vahl, *S.* × *prestoniae* McKelvey (*S. komarowii* subsp. *reflexa* × *S. villosa*), and *S.* × *henryi* C. K. Schneid. (*S. josikaea* × *S. villosa*); and section *Syringa*: *S. vulgaris* L., obtained from the collection of siringarium at the Professor A. G. Genkel Botanical Gardens of the Perm State National Research University. Each of the studied *Syringa* species and cultivars differs with some aspects of the inflorescence structure: the number of flowers and their arrangement in the partial inflorescence and the number of partial inflorescences and their arrangement on the main axis. The beginning and the duration of the partial inflorescences' flowering depend on their arrangement on the main axis and the number of flowers in the partial inflorescence. The clustering of partial inflorescences into three categories, basal, lateral, and apical, was implemented. The inflorescence flowers are characterized by acropetal type of blooming. The duration of bush flowering of the studied species and cultivars varies from 8 to 19 days, and the duration of inflorescence flowering—from 6 to 13 days. The peculiarities of diurnal variation of flowering are discovered: the majority of species and interspecific hybrids of *Syringa* are characterized by morning anthesis, which continues till 12 noon. Anthesis of *S.* × *henryi* species essentially begins at about 8 a.m., and also between 2 p.m. and 4 p.m. *S. wolfii* flowers have the diurnal type of anthesis, and the majority of flowers begin to open at noon till 2 p.m. Despite entomophility of the lilac flowers, only occasional attendance of plants by insects is recorded, among which are pollinators (*Apis mellifera* L., *Bombus hortorum* L.) and a visitor (*Cetonia aurata* L.).

Keywords

Syringa L.; Inflorescences; Flowering

Introduction

Insufficient attention is paid in the literature to the problems of flowering biology of *Syringa* species and cultivars. Diurnal variation of the flowering, type of the inflorescence flowers' opening, effects of microclimate on the process of flowering, and attendance of plants by insects are not investigated. The available data on *Syringa* flowering are not numerous and deal with investigation of the inflorescence structure [1-4], identification and classification of cultivars based on peculiarities of the corolla structure [5], phenology, and rhythm of flowering [6-9].

At the present time, *Syringa* has attracted great interest in selection, whereas plant breeders use different species of the genus. The results obtained in our study on the *Syringa* flowering in Perm may be taken into account while breeding new forms and cultivars with the extra ornamental appeal combining different time and duration of flowering.

The goal of our research is to investigate the process of flowering of some *Syringa* L. species and hybrids.

The research objectives are the following:

1. To investigate the seasonal and diurnal variation of flowering
2. To determine the inflorescence flowering pattern and the sequence of blooming of its flowers
3. To investigate the effects of microclimate on the process of flowering
4. To discover the species composition and the visiting activity of insects for the lilac flowers

Materials and Methods

The subject of the research included 6 species and 2 interspecific hybrids from the collection of siringarium at the Professor A. G. Genkel Botanical Gardens of the Perm State National Research University. According to the system accepted by the International Lilac Society [10], they belong to subgenus *Syringa*: section *Villosae* C. K. Schneid.: *S. josikaea* J. Jacq. ex Rchb., *S. emodi* Wall. ex Royle, *S. wolfii* C. K. Schneid., *S. sweginzowii* Koehne & Lingelsh., *S. villosa* Vahl, *S.* × *prestoniae* McKelvey (*S. komarowii* subsp. *reflexa* × *S. villosa*), and *S.* × *henryi* C. K. Schneid. (*S. josikaea* × *S. villosa*); and section *Syringa*: *S. vulgaris* L. The average age of the lilac collection was 15 years. All plants were characterized by good growth, development, and flowering. Further, 1-2 bushes for each species and hybrid with 21-545 inflorescences were placed under observation.

The research was conducted from May 2012 till July 2014. The bloom sequence of flowers and duration of flowering of compound and partial inflorescences and also the seasonal and diurnal variation of flowering were studied.

A compound inflorescence consists of the main axis and lateral axes (paracladium). Partial inflorescences are viewed as individual inflorescences, i.e., as the lateral axes of a compound inflorescence [11]. For better observation of plants, the partial inflorescences of compound inflorescences of each species and hybrid were labeled at the point of the bud stage, and they registered the following stages of flower opening: a bud, bud burst (a bud with a slip-shaped gap), half-opened flower (a flower with the half-opened petals), open flower (a flower with the fully-opened petals), and withered flower (a flower with the signs of corolla drying).

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Observations were made from 6 a.m. till 8 p.m. every 2 h. At the same time, the activity of insects visiting *Syringa* flowers was registered [12]. To define the life expectancy of flowers, the buds (no less than 30 buds in each compound inflorescence) were marked shortly before the bloom. Also, during the flowering, stationary observations over the microclimatic conditions (air temperature (°C), air humidity (%), insolation (W/m^2), precipitation (mm), and wind velocity (m/s)) were carried out using the Davis Vontage Pro-2 weather station. A total of 21,371 flowers was under observation to investigate the seasonal variation of flowering, and 2,039 flowers—to investigate the diurnal variation of flowering.

Observations of the flowering process were summarized in a Microsoft Excel table. For the following statistical manipulation and accomplishment of the predetermined objectives, two software programs were developed—"Siren'. Sotsvetija" ("Lilac. Inflorescences") and "Siren'. Tsvetki" ("Lilac. Flowers") in *Visual Basic*. For each species and hybrid, the program allows to get the date list of the beginning of flowering and mass flowering of each partial inflorescence; define the type of anthesis of compound inflorescence using the Jonckheere trend test; construct the dependency graphs showing the dependencies between the flowers' proportions at different stages of the flower opening, point of time, and ecological factors; and define the duration of different stages of the flower opening. The construction of the required graphs and calculations was also made using *Microsoft Excel* and *Statistica 10* software. Testing for the homogeneity of the statistical data was made using the χ^2 test, cross tables, and Jonckheere test tables [13]. The investigation of the inflorescence structure was made using the elements of cluster analysis. The investigation of the dependence of flowering on microclimatic conditions was made using multiple regression analysis.

Results and Discussion

The time of flowering of *Syringa* species and hybrids varied over the years of observations (2012-2014). The flowering proceeded within a month: in 2012—from May 17 until June 14, in 2013—from May 28 until June 25, and in 2014—from May 21 until June 17 (Figure 1).

S. vulgaris (not cultivar/control) was characterized by the earliest blooming; in 2012 its blooming had a lead of 11 days among other species and hybrids, in 2013—7 days, and in 2014—6 days. *S. villosa* and *S. wolfii* were also characterized by early blooming and began to bloom a bit earlier than other species and hybrids. *S. sweginzowii* and *S. × prestoniae* were the last to bloom. Difference in the time of blooming between species was 1-2 days in 2012 and 1-3 days in 2013 and 2014. In general, it may be noted that the bloom sequence of species and hybrids did not change during the years of observation and corresponded to their sequential arrangement in the collection at the Professor A. G. Genkel Botanical Gardens considering the time of blooming.

The observed species and hybrids are characterized by a varied and, to some extent, unique structure of inflorescences (Figure 2). The duration and the flowering pattern of inflorescence flowers have important morphological and ornamental value.

The number of partial inflorescences of species and hybrids varies from 12 (*S. × henryi, S. sweginzowii*) to 26 (*S. emodi*) (Table 1).

The average value is more constant and varies from 15.3 ± 2.5 to 22.8 ± 2.4. The minimum number of flowers per one partial inflorescence is 1-3. The maximum number of flowers per one partial inflorescence is

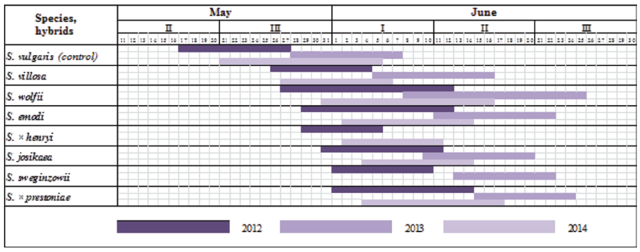


Figure 1: Flowering calendar of *Syringa* species and hybrids (2012-2014)

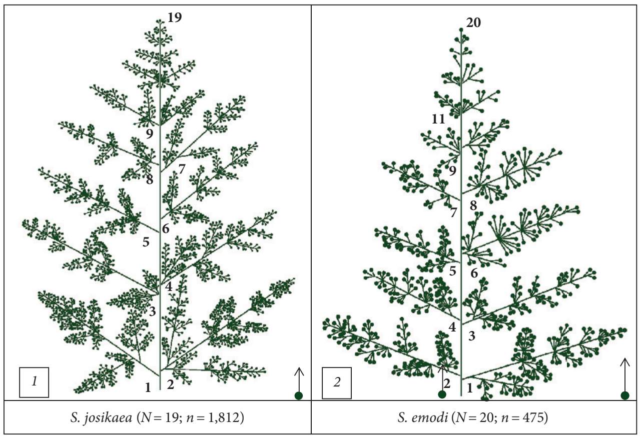


Figure 2: Structure and type of blooming of *S. Josikaea* and *S. Emodi* inflorescences. *N*—number of partial inflorescences in compound inflorescence, pcs.; *n*—number of flowers in compound inflorescence, pcs.; acropetal type of blooming

Species, hybrid	Number of partial inflorescences in compound inflorescence, pcs.			Number of flowers in partial inflorescence, pcs.		Number of flowers in compound inflorescence, pcs.		
	Min	Max	M ± tm (p = 0.05)	Min	Max	Min	Max	M ± tm (p = 0.05)
S. × henryi	12	17	15.3 ± 2.5	3	230	778	922	859 ± 71
S. sweginzowii	12	18	15.7 ± 1.6	2	56	201	300	242 ± 31
S. villosa	15	19	16.8 ± 1.5	1	17	87	125	115 ± 22
S. josikaea	16	24	18.7 ± 6.3	1	549	1,368	2,571	1,816 ± 894
S. × prestoniae	19	21	20.0 ± 1.4	1	154	237	682	438 ± 306
S. vulgaris	17	20	18.8 ± 0.9	1	36	214	274	235 ± 23
S. wolfii	20	23	21.0 ± 1.5	1	270	1,269	1,552	1,419 ± 138
S. emodi	20	26	22.8 ± 2.4	1	71	354	476	436 ± 44

Table 1: Characteristics of inflorescences of *Syringa* species and hybrids

markedly different. *S. villosa* has the least number of flowers, which is 17. The greatest number of flowers in partial inflorescence was recorded in *S. wolfii* (270) and *S. josikaea* (549). The number of flowers in compound inflorescence varies considerably as well. The average value ranges from 115 ± 21 (*S. villosa*) to 1,815 ± 894 (*S. josikaea*). The large number of flowers in compound inflorescence was recorded in *S. josikaea* (1,816 ± 894), *S. wolfii* (1,419 ± 138), and *S. × henryi* (859 ± 71).

The Jonckheere trend test, which was used in the "Siren" program to define the type of blooming, confirmed the acropetal type of blooming for all species and hybrids, i.e., the flowering begins from the bottom of the main axis of compound inflorescence (1 and 2 partial inflorescence) and expands toward the apex (Figure 2).

The beginning and duration of the partial inflorescences' flowering varies in compound inflorescence and depends on their arrangement on the main axis and the number of flowers in each partial inflorescence. For each compound inflorescence of the studied species and hybrids, the cluster analysis of partial inflorescences on the number of flowers was made. As a result, all partial inflorescences were divided into three categories. The category of "basal" inflorescences includes partial inflorescences with a larger number of flowers as compared with others, and their arrangement is mainly at the bottom of the main axis of inflorescence. The category of "lateral" inflorescences includes partial inflorescences with the lesser number of flowers as compared with basal inflorescences, and their arrangement is mainly in the middle of compound inflorescence. The category of "apical" inflorescences includes partial inflorescences with the least number of flowers as compared with other categories, and their arrangement is mainly at the top of compound inflorescence.

Table 2 represents the time of partial inflorescences' flowering by category. The beginning and the end of flowering of the basal and lateral partial inflorescences for *S. villosa*, *S. vulgaris* (not cultivar), and *S.* × *prestoniae* matches. The flowering of basal inflorescences in *S. josikaea*, *S. wolfii*, and *S. sweginzowii* starts one day earlier than lateral inflorescences. The lateral and apical inflorescences of *S. josikaea* begin to bloom on the same day, and *S.* × *henryi* is characterized by the simultaneous onset of the partial inflorescences' flowering in all categories. The flowering of apical inflorescences in *S. villosa* and *S. vulgaris* (not cultivar) starts on one day later than lateral, the difference between *S. emodi* and *S. sweginzowii* flowering is two days, and between *S.* × *prestoniae* and *S. wolfii*—3-4 days. The difference in the duration of partial inflorescences' flowering is 1-2 days.

Testing for the homogeneity of the flowering process by category using the χ^2 test with the significance level of 0.05 showed the homogeneity of lateral inflorescences for *S. villosa* and apical inflorescences for *S. wolfii*, *S. sweginzowii*, and *S.* × *prestoniae*. The homogeneity of lateral inflorescences in other species and hybrids is missing.

The mass flower opening for the inflorescences of most species falls on the mid-flowering; the smaller proportion of open flowers in *S. josikaea* and *S. vulgaris* (not cultivar) was registered in the first days of flowering. The mass flowering lasted for an average of 2-3 days, except for *S.* × *prestoniae*. The maximum number of open flowers was recorded on the 6th day of flowering; the mass flowering lasted for 4 days. The minimum number of open flowers per one inflorescence was recorded at the beginning of *S. josikaea*'s flowering; at the beginning and mid-flowering of *S. emodi*; at the beginning and the end of the flowering of *S. wolfii*, *S. sweginzowii*, *S. villosa*, *S.* × *prestoniae*, and *S.* × *henryi*; and during the mid-flowering of *S. vulgaris* (not cultivar).

It is assumed that the ornamental effect depends on the whole compound inflorescence and is determined not only by the structure and color of flowers but also by the specific proportion of different stages of flower opening in a compound inflorescence. Flowering observations showed different proportion of flowers at different stages of flower opening and their distinct life expectancy. The bud stage in *S. josikaea*, *S. emodi*, *S. villosa*, *S. vulgaris* (not cultivar), and *S.* × *prestoniae* flowers remained intact till the mid-flowering. Their proportion in the total number of inflorescence flowers ranged from 20 to 90%. The buds of *S. wolfii*, *S. sweginzowii*, and *S.* × *henryi* remained intact till the end of flowering and comprised 5-10%. All species and hybrids were characterized by the quick passing through stages prior to the flower opening. The average proportion of flowers in the stage of bud burst and half-opened flower for most species was not larger than 10%, and not larger than 5% in hybrids. For *S. josikaea* and *S. wolfii*, this proportion was lesser than 5%, and some inflorescences had only occasional flowers at these stages of development. High proportion of open inflorescence flowers was recorded only in *S. vulgaris* (not cultivar) (80%) on the 4th and the 5th day of flowering and in *S. villosa* (70%)—on the 4th day. The proportion of open flowers in other species and hybrids comprised 60% for *S.* × *henryi* on the 3rd day, 50% for *S. josikaea* and *S. wolfii* on the 5th day, and for *S.* × *prestoniae*—on the 6th day. The proportion of open flowers in *S. emodi* for all flowering time was not larger than 25 and 35% for *S. sweginzowii*.

All the studied species and hybrids are characterized by the early fall of petals of the open flower or the whole flower without reaching the stage of withered flower, which, to some extent, is one of the factors of poor ornamental quality. The fall of flowers of *S. sweginzowii* starts on the 2nd day of flowering, for *S. villosa* and *S.* × *henryi*—on the 3rd day, for *S. josikaea*, *S. emodi*, *S. wolfii*, and *S.* × *prestoniae*—on the 4th-5th day, and for *S. vulgaris* (not cultivar)—on the 6th day of flowering. The withering of inflorescence flowers was registered in *S. villosa* and *S. josikaea*; their proportion in the total number of inflorescence flowers was not larger than 20 and 30%, respectively. For other species and hybrids, only occasional inflorescence flowers were entirely withered.

Species, hybrid	Beginning of flowering			End of flowering		
	Basal	Lateral	Apical	Basal	Lateral	Apical
S. josikaea	01.06	02.06	02.06	08.06	09.06	10.06
S. emodi	04.06	04.06	06.06	10.06	10.06	11.06
S. wolfii	03.06	04.06	08.06	11.06	12.06	13.06
S. sweginzowii	01.06	02.06	04.06	07.06	07.06	07.06
S. villosa	27.05	27.05	28.05	01.06	01.06	03.06
S. vulgaris	17.05	17.05	18.05	23.05	25.05	25.05
S. × *prestoniae*	02.06	02.06	05.06	09.06	09.06	12.06
S. × *henryi*	30.05	30.05	30.05	04.06	04.06	04.06

Table 2: Time of partial inflorescences' flowering of *Syringa* species and hybrids by category, 2012

Species, hybrid	Number of flowers under observation	Bud burst, h	Half-opened flower, h	Open flower, days
S. josikaea	392	9.6 ± 0.5	5.5 ± 0.5	1.9 ± 0.1
S. emodi	171	8.6 ± 0.7	8.2 ± 0.9	0.95 ± 0.07
S. wolfii	375	12.0 ± 0.5	8.2 ± 0.5	1.6 ± 0.9
S. sweginzowii	289	12.0 ± 0.7	16.8 ± 1.2	1.30 ± 0.07
S. villosa	155	7.2 ± 0.7	7.2 ± 1.2	3.9 ± 0.3
S. vulgaris	177	9.6 ± 1.4	12.0 ± 1.9	6.3 ± 0.3
S. × *prestoniae*	304	10.0 ± 0.5	5.5 ± 0.5	1.10 ± 0.05
S. × *henryi*	176	2.4 ± 0.7	7.2 ± 0.9	1.9 ± 0.1

Table 3: The duration of the flower development stages of *Syringa* species and hybrids, 2013

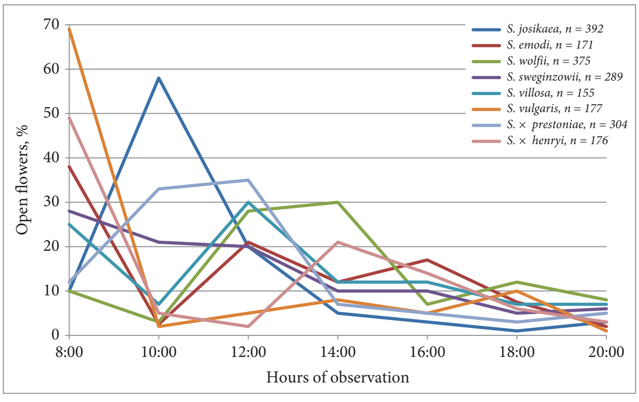
The studied species and hybrids differ with various life expectancy of a single flower both being open and in the stage of bud burst and half-opened flower (Table 3). The highest life expectancy of an open flower was recorded in *S. vulgaris* (not cultivar) (6.3 ± 0.3 days) and *S. villosa* (3.9 ± 0.3 days). The shortest life expectancy of an open flower was recorded in *S. emodi* (0.95 ± 0.07 days) and *S.* × *prestoniae* (1.1 ± 0.05 days). The life expectancy of an open flower in other species and hybrids is not much different and varies from 1.3 to 1.9 days. All species and hybrids are characterized by the quick passing through stages prior to the flower opening. The duration of stages of bud burst varies from 2.4 ± 0.7 to 12.0 ± 0.7 h, and half-opened flower stages—from 5.5 ± 0.5 to 16.8 ± 1.2 h.

The duration of the bud burst stage appeared to be significantly shorter for *S.* × *henryi* (2.4 ± 0.7 h), and the stage of half-opened flower—for *S. josikaea* and *S.* × *prestoniae* (5.5 ± 0.5 h). The duration of the above stages is almost identical for *S. emodi* (8.6 ± 0.7 and 8.2 ± 0.9 h) and *S. villosa* (7.2 ± 0.7 and 7.2 ± 1.2 h).

The duration of flower development stages in *S. emodi*, *S. villosa*, *S.* × *prestoniae*, and *S.* × *henryi* is not much different in relation to partial inflorescences of different categories. The life expectancy of an open flower in the apical inflorescences for *S. josikaea*, *S. wolfii*, and *S. sweginzowii* is shorter as compared with basal and lateral inflorescences. *S. vulgaris* (not cultivar) is characterized by long-term duration of stages of bud burst and half-opened flower for apical inflorescences and short-term duration for basal and lateral inflorescences.

The flower opening starts at 6 a.m. and lasts till 8 p.m. During 8 p.m.-10 p.m., only occasional flowers open. Nocturnal opening of flowers was not registered.

It was found that *S. vulgaris*, *S. emodi*, *S. josikaea*, *S. villosa*, and *S.* × *henryi* are characterized by morning anthesis: the opening of flowers continues till noon (Figure 3). In *S. vulgaris* (not cultivar), the largest proportion of flowers (69%) opens by 8 o'clock in the morning. More than 50% of the open flowers in *S. emodi* and *S. villosa* were registered by 8 a.m. and by noon, and more than 60% of the open flowers in *S. josikaea* and *S.* × *prestoniae*—at 10 a.m. and at noon. *S. sweginzowii* is characterized by a relatively synchronized flower opening by 8 a.m. (28%), by 10 a.m. (21%), and by noon (20%). During the subsequent hours of observation, the flowers were opening with intensity from 1 to 21%. In *S. wolfii* the diurnal anthesis was revealed, and most flowers are opened by noon (28%) and by 2 p.m. (30%). *S.* × *henryi* is characterized by two peaks of flowers opening, and 49% of flowers are opened by 8 a.m.; the rest predominant number of flowers are opened by 2 p.m. and by 4 p.m. (21 and 14%, respectively).



n—Number of flowers under observation

Figure 3: Dynamics of flower opening of *Syringa* species and hybrids for all flowering time, 2013 (%)

Species, hybrid	*Max* number of open flowers at the parameter value		Significant microclimatic parameter	Multiple correlation coefficient, R
	Air temperature, °C	Air humidity, %		
S. josikaea	19.5-23.8	57-68	Temperature, °C	0.71
S. emodi	20.2-27.3	52-66	Temperature, °C; humidity, %	0.86
S. wolfii	27.3-29.4	45-52	Temperature, °C	0.75
S. sweginzowii	14.4-18.9	45-63	Temperature, °C; humidity, %	0.75
S. villosa	13.7-18.5	48-64	Temperature, °C	0.86
S. vulgaris	15.6-22.1	42-67	Humidity, %	0.72
S. × *prestoniae*	18.2-23.2	49-75	Missing	0.71
S. × *henryi*	11.1-16.3	36-61	Temperature, °C	0.89

Table 4: Microclimatic conditions and results of multiple regression analysis of flowering of *Syringa* species and hybrids

Table 4 represents the air temperature and humidity values, during which the mass flower opening was observed, and also the multiple correlation coefficients, R, which demonstrate the degree of dependency of the flower opening on microclimatic data included in the regression model. In the conditions of high air temperature values, the peak of flowering was observed in *S. wolfii* (27.3-29.4°C) and *S. emodi* (20.2-27.3°C) at air humidity values of 45-66%. The maximum number of the open flowers in *S. sweginzowii*, *S. villosa*, and *S.* × *henryi* was recorded at the temperature ranging from 11.1 to 18.9°C. In addition, during the flowering of *S. sweginzowii* and *S. villosa*, the air humidity was ranging from 45 to 64%, and 36-61% during *S.* × *henryi* flowering. The largest number of the open flowers in *S. josikaea* and *S.* × *prestoniae* was recorded at the temperature ranging from 18.2 to 23.8°C and air humidity of 49-75%.

We managed to construct the significant regression model with an R value of not less than 0.7 for all species and hybrids. In addition, the significant dependence on microclimatic conditions was established for all species and hybrids, except for *S.* × *prestoniae*. The dependence of the flowering of *S. vulgaris* (not cultivar) on air humidity was revealed, and the flowering process of *S. josikaea*, *S. wolfii*, *S. villosa*, and *S.* × *henryi* is determined by air temperature. The flower opening of *S. emodi* and *S. sweginzowii* depends on both air temperature and humidity. The dependence of *S.* × *prestoniae* flowering on microclimatic conditions was not registered.

Observations at the time of flowering showed only occasional attendance of plants by insects. Pollinators were *Apis mellifera* L., *Bombus hortorum* L., and *Bombus lucorum* L. *A. mellifera* and *B. hortorum* were rare visitors of plants during daytime. In general, for one day of observations, no more than two species of *A. mellifera* and one of both *B. hortorum* and *B. lucorum* were registered for visiting the studied species and hybrids. The time of the flowering bushes being visited by the given species of insects was mainly from noon till 6 p.m.

The visitor and invader of *Syringa* flowers was *Cetonia aurata* L. During mass flowering, the number of *C. aurata* amounted to 5-7 insects per one bush for one day. The beetles damaged the stamens and petals, which led to the drying of flowers. The most active visiting was registered for *S. villosa* inflorescences. The time of maximum visiting of bushes ranges from noon till 4 p.m.

Thus, despite the entomophility of flowers of the studied *Syringa* species and hybrids, the activity of pollinators is low, which probably may be explained by their absence in the city.

Conclusions

Depending on the growing season conditions in 2012-2014, the flowering of *Syringa* species and hybrids started in the second (2012, 2014) or third decade of May (2013). *S. vulgaris* is characterized by early blooming, and *S. sweginzowii* and *S.× prestoniae* are the last to bloom. The duration of flowering of one inflorescence varies over different years of observations of species and hybrids from 6 to 13 days.

The *Syringa* inflorescence is an open monotelic panicle, which consists of a main axis and lateral axes (partial inflorescences). The number of partial inflorescences varies from 12 (*S. × henryi, S. sweginzowii*) to 26 (*S. emodi*). The minimum number of flowers in one partial inflorescence ranges from 1 to 3. *S. josikaea* is characterized by the maximum number of flowers in a partial inflorescence (549). The number of flowers in a compound inflorescence varies from 115 ± 22 (*S. villosa*) to 1,816 ± 894 (*S. josikaea*). The highest life expectancy of the open flower was observed in *S. vulgaris* (not cultivar) (6.3 ± 0.3 days) and *S. villosa* (3.9 ± 0.3 days).

All species and hybrids are characterized by the quick passing through stages prior to the flower opening. The average proportion of flowers in the stage of bud burst and half-opened flower was 5-10%, and the life expectancy varied from 2.4 to 16.8 h. The highest life expectancy of an open flower was recorded in *S. vulgaris* (not cultivar) (6.3 ± 0.3 days) and *S. villosa* (3.9 ± 0.3 days). The shortest life expectancy of an open flower was recorded in *S. emodi* (0.95 ± 0.07 days) and *S. × prestoniae* (1.1 ± 0.05 days).

The peculiarities of diurnal variation of flowering were discovered: the majority of species and interspecific hybrids of *Syringa* are characterized by morning anthesis, the maximum number of open flowers is recorded at 8 a.m. The opening of the flowers of *S. × henryi* starts predominantly by 8 o'clock in the morning, and also from 2 p.m. till 4 p.m. *S. wolfii* is characterized by diurnal anthesis; the largest proportion of flowers opens from noon till 2 p.m.

The multiple regression analysis of the flowering process upon five microclimatic conditions and moments of time shows the high degree of dependence of flowering on air temperature and/or air humidity for all species and hybrids, except for *S. × prestoniae*.

Despite the entomophility of *Syringa* flowers, only occasional attendance of plants by pollinators and visitors has been recorded. The low activity of pollinators probably may be explained by their low number in the city.

As a result, the flowering data supplement the knowledge on the reproductive biology of *Syringa* species and cultivars and allow for a comparative analysis.

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