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## RESULTS OF TEN-YEAR PHENOLOGICAL OBSERVATIONS PERFORMED ON THE TREES AND SHRUBS OF THE KÓRNIK ARBORETUM

(Wyniki dziesięcioletnich obserwacji fenologicznych nad drzewami i krzewami w Arboretum Kórnickim)

1. Introduction . . . . .	30
2. Methods . . . . .	32
3. Characteristic of Climatic Conditions in the Period 1953–1962 . . . . .	36
4. Analysis of the Phenological Seasons Over a Ten-Year Period, and Their Relations with the Seasonal Rhythm of Vegetation of Trees and Shrubs . . . . .	42
5. Discussion of Results of Phenological Observations . . . . .	118
The Course of the Seasonal Development of Trees and Shrubs and Their Provenience . . . . .	120
Vegetation Rhythm of Trees and Shrubs as an Indicator of Their Sensitivity to Changes in Weather Conditions . . . . .	131
Influence of Temperature, Precipitation and Insolation on the Vegetation Rhythm of Trees and Shrubs . . . . .	133
6. Conclusions . . . . .	137

### 1. Introduction

Long-term observations of the periodical changes which occur every year in the vegetative and generative development of plants are the starting point for methodical investigations on the cultivation of trees and shrubs of foreign origin. Therefore, a knowledge of the seasonal rhythm of vegetation is very important, since it reflects the biological properties of species and the environmental conditions.

The introduction for wider cultivation of ornamental and economically useful trees and shrubs adapted to other climatic conditions requires an exhaustive knowledge of their phenology. For specialists in dendrology it is important to establish the approximate date of such developmental stages or phenophases as leaf bud opening, foliation, change of leaf color, shedding of leaves, flowering and fructification [3]. The phenological observations analyzed in confrontation with the weather conditions in the particular years are one of the methods of determining the



ecological requirements of trees and shrubs as related to the sums of heat, precipitation and light.

Long-term phenological investigations in this country were advocated by Łastowski [19–21] who devoted a number of special publications to methodical problems in this field. Of high merit were also the phenological investigations of Szafer [31–33] who stressed their importance in plant geography and ecology.

Precise phenological observations of introduced trees and shrubs, based on uniform methods coordinated with our studies were performed in the collections of the Botanical Garden of the A. Mickiewicz University in Poznań [4, 22].

In 1966 the elaboration of the observation material accumulated in the Kórnik Arboretum over the ten-year period 1953–1962 was undertaken. This period seems to be sufficiently representative of the variability of the local climate within the range of the climatic station at Kórnik.

The task we set ourselves consisted in:

(1) recognition of the major phenological-developmental groups of trees and shrubs characterized by a specific rhythm of vital manifestations in the annual cycle;

(2) establishment of the relation which may occur between a definite vegetation rhythm, and provenience [28], the history of the geographical spread of the plant [8] and the systematic apurtenance of the trees and shrubs, as well as between the rhythm of their vegetation and various weather conditions and the adaptive ability.

The phenological-developmental tree and shrub groups were established on analysis of the phenological spectra (Fig. 5) and the diagrams presenting a synthesis of the observation results. In the classification, mainly the phenological regularity in trees and shrubs (occurrence of definite phenophases always in the same seasons) and the length of the period of vegetative activity, flowering and fruit development were taken into account.

It is believed that analysis of the results of phenological observations over many years on a large number of trees and shrubs cultivated in the Kórnik Arboretum will throw some light on the course of some developmental phases of these plants, many of which have been transferred to the Arboretum from quite different climatic conditions. It will also allow to study the phenological regularity and plasticity of various plant species.

The present study is also an attempt at explanation of the varying development rhythm of trees and shrubs and their different adaptation ability. Further methodological phenological investigations based on the observations of trees and shrubs originating from the region of the natural range of these plants may contribute to the establishment of a definite trend in further investigations on acclimatization, instead of the so far reigning accidental introduction practices.

The authors would like here to thank Dr. M. Giertych for assistance in the statistical elaboration of the observations. They are also indebted to Mr. L. Hłyń



for preparing part of the phenological spectra and materials for analysis of the results of observation.

## 2. Methods

As material for the study served a profuse material obtained in the course of ten-year phenological observations performed on chosen trees and shrubs of many species, mostly of foreign origin, in the Kórnik Arboretum. The dates of periodical developmental changes in plants, that is phenophases, were recorded according to the scheme of the phenological record card given below. The observations included 295 species of trees and shrubs, 122 of which, mostly originating from various geographical regions of the temperate zone and growing natively in various ecological conditions, were subjected to detailed analysis. Over this ten-year period the findings were recorded by several observers, therefore in some cases certain inexactitudes in the phenological dates are not excluded, caused by the more or less subjective evaluation of the beginning of certain phenophases. It may, however, be assumed that long-term observations ensure a correct final synthesis of the results.

The phenological record is intended for observation of single tree and shrub specimens representing particular species or their varieties. It contains the following lists of the more important phenological events and information on the criteria for establishing the beginning and end (eventually full development) of a given phenophase.

### A. Leaves

(1) Opening of leaf buds (onset of growth), about 5–10 buds show green leaves in the gaps between the opening scales. In trees and shrubs with scaleless buds their marked swelling is visible.

(2) Spreading of leaf blades — about 5–10 young leaves have horizontally spread leaf blades.

(3) Beginning of autumnal change of color — first normal healthy leaves begin to change their color.

(4) Color of leaves completely changed.

(5) Beginning of leaf shedding — first normal healthy leaves either changed in color or not are shed.

(6) End of leaf shedding — most leaves have fallen off.

### B. Flowers

(1) Beginning of florescence — appearance of first 5–10 completely opened female flowers or male pollen-bearing catkins.

(2) End of florescence — appearance of the last female flowers or pollen-shedding male catkins.



### C. Shoots

- (1) Beginning of growth — on several apical shoots leaf buds open (like  $A_1$ ).
- (2) End of growth — majority of shoots have formed apical buds.

### D. Fruits

(1) Beginning of fruit ripening — first fruits (5–10) normally developed and healthy take on a characteristic hue, cease to be hard (loosening of parenchymal tissues) or show other features indicating the beginning of ripening.

(2) End of fruit ripening — last unripe fruits acquire the characteristics of ripening, then the fruits drop or else they dehisce and dispersal of seeds occurs.

Of no small importance for elucidation of the seasonal rhythmicity in plants is the recording of injury caused by precocious and late ground frosts and by frost in winter. The data concerning the hardiness of trees and shrubs of the various species investigated are listed in the publication of W. Bugała and H. Chyla-recki [5].

Phenological observations were recorded the year round at least two to three times weekly.

The observation scheme described above makes possible the collection of materials concerning: the time of foliation, flowering, fruiting and growth of various trees and shrubs, that is floristic phenology. Besides, long-term observations were recorded in the field of bioclimatic phenology. The development of indicator plants chosen according to Łastowski, mostly of native origin, allows the detection of the influence of various weather combinations in the particular years on the course of the vital processes in the trees and shrubs. It is only against the background of the changing rhythm of development of the indicator plants which serve as a kind of measuring instrument for the local climate, that the seasonal development of other plants can be analyzed. The meaning of the appearance of the indicator plants consists mainly in that, under the same environmental conditions, they demonstrate the joint action of numerous climatic factors on plant development [20, 23].

According to the time of florescence, of fruit ripening, change of color and shedding of the leaves of the indicator plants, nine phenological seasons have been distinguished in the year. It was assumed after Łastowski [21] that the following events in the development of the trees and shrubs may be considered as indices (owing to the lack of other observations, only one indicator species served for determination of some of the phenophases).

(1) Early spring — beginning of florescence: *Corylus avellana*, *Tussilago farfara*.

(2) Beginning of spring — beginning of flowering: *Acer platanoides*, *Betula verrucosa*.

(3) Spring — beginning of florescence: *Syringa vulgaris*, *Aesculus hippocastanum*.



- (4) Early summer: beginning of florescence of *Robinia pseudoacacia*.
- (5) Summer: beginning of florescence of *Tilia cordata*.
- (6) Early fall: beginning of fruiting of *Sambucus nigra*.
- (7) "Golden" fall: beginning of yellowing of leaves: *Tilia cordata*, *Acer platanoides*, *Aesculus hippocastanum*.
- (8) Late fall: beginning of leaf shedding: *Tilia cordata*, *Acer platanoides*, *Aesculus hippocastanum*.
- (9) Winter: its beginning is marked by a mean air temperature below 0°C, lasting for several days.

As the duration of the phenological seasons in the course of the period of investigations is assumed the mean value obtained from the dates of the above mentioned events in the development of the indicator plants or, if certain observations are lacking, the date of florescence and fruiting of one indicator species (early summer, summer, early fall).

The tables listing the dates of the phenophases which resulted from observations of many years served for the preparation of a graphical presentation (spectrum) of the phenological record. In the authors' opinion, the seasonal life cycle of the trees and shrubs under study shown in the diagrams will allow to distinguish the most characteristic phenological-developmental groups, and to find relations between the combination of climatic factors and the seasonal changes in the life cycle of the plants.

The phenological spectrum has the shape of an elongated polygon (Fig. 1). The points plotted on the polygon denote the dates of opening of leaf buds (1), of spreading of leaf blades (2), of beginning of leaf color change (3) and full color change (4), beginning (5) of and end (6) of leaf shedding, showing the course of the vegetative cycle. The phase of flowering presented as a segment of the horizontal line and the phenophase of fruiting, the duration of which is marked by a row of black dots represent the generative cycle. The system of plotting the phenological spectrum is a simplification of the method used by Szennikow [34, 35]. This was indispensable, because, in the period 1950–1960, the scheme of phenological observations did not include some detailed observations necessary for presenting exactly the course of vegetation of the plants.

The instruction prepared in 1961 concerning the phenological records for trees and shrubs introduces the missing phenophases. It was elaborated in consultation with the scientists concerned from the Department of Geography and Systematics of Plants, A. Mickiewicz University, Poznań.

The seasonal course of vegetation of plants growing during the ten-year period investigated on the same sites, is largely dependent, beside a number of soil factors described by Kowalkowski and Prusinkiewicz [16], on the varying local climatic conditions. Particularly important here is the sum of heat, the extremal air temperature values, the amount and distribution of precipitation and the length of the



vegetation period. Therefore, much attention is devoted to the characterization of the climate of the area on which the trees were introduced. The general description of the climate was based on the Gausson-Walter climatic diagrams [39] which in the first place supply information on the type of weather, favorable or unfavorable conditions for plant vegetation (hot as well as dry and wet periods), they

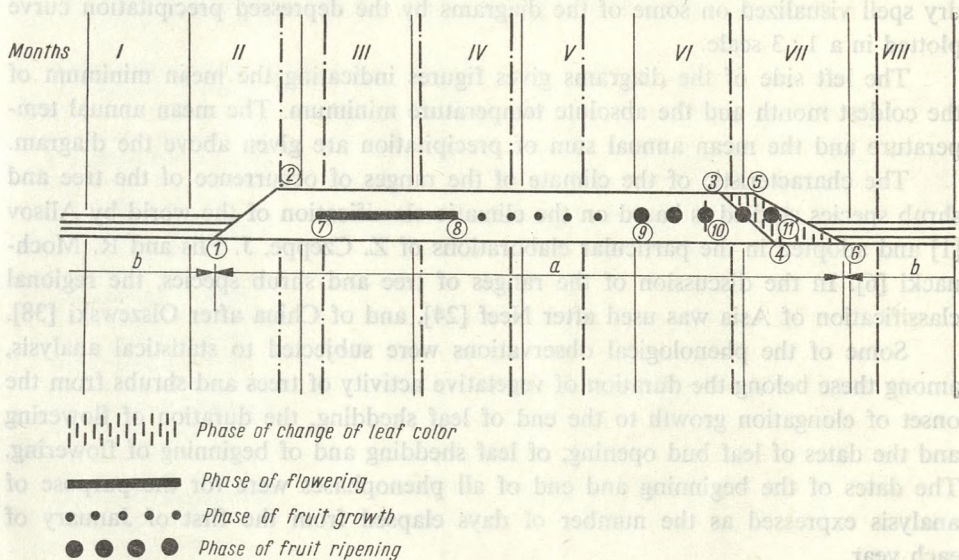


Fig. 1. Pattern of phenological spectrum. 1 — beginning of leaf bud opening, 2 — beginning of leaf blade spreading, 3 — beginning of change of color of leaves, 4 — end of change of color of leaves, 5 — beginning of leaf shedding, 6 — end of leaf shedding, 7 — beginning of flowering, 8 — end of flowering, 9 — beginning of fruit ripening, 10 — full ripeness of fruits, 11 — end of fruit ripening and beginning of their dissemination; *a* — period of vegetative activity, *b* — period of rest. Interrupted vertical lines denote time of duration of phenological seasons.

also give a clear picture of the water balance. The weather conditions arranged according to the successive years (climatogram) show the influence of certain climatic factors in these years on the phenophases.

The method of the Gausson-Walter climatograms consists in plotting in a system of coordinates curves of mean monthly precipitation and of mean monthly temperatures in a 1 : 2 ratio (10°C corresponds to 20 mm precipitation). This ratio results from the limiting values of the hydrothermic coefficient (0.67 and 1.0), which makes possible the distinction between climatic conditions characteristic for steppe, forest-steppe and forest.

According to the authors of this method, the part of the year when the precipitation curve runs above the temperature curve is a moist period, and the part where the precipitation curve is below the temperature curve corresponds to a



period of drought. The vertical dimension of the surface formed between the two curves indicates the degree of moisture (dryness) of the climate, and the horizontal dimension shows the duration of these conditions. The ratio of these surfaces expresses the moisture grade of the climate.

A period of drought as defined by Gaussen, is visible when the diagram represents a steppe or desert region. On the forest-steppe areas there may occur a dry spell visualized on some of the diagrams by the depressed precipitation curve plotted in a 1 : 3 scale.

The left side of the diagrams gives figures indicating the mean minimum of the coldest month and the absolute temperature minimum. The mean annual temperature and the mean annual sum of precipitation are given above the diagram.

The characteristic of the climate of the ranges of occurrence of the tree and shrub species studied is based on the climatic classification of the world by Aliso [1] and adopted in the particular elaborations of Z. Czepe, J. Flis and R. Moch-nacki [6]. In the discussion of the ranges of tree and shrub species, the regional classification of Asia was used after Neef [24], and of China after Olszewski [38].

Some of the phenological observations were subjected to statistical analysis, among these belong the duration of vegetative activity of trees and shrubs from the onset of elongation growth to the end of leaf shedding, the duration of flowering and the dates of leaf bud opening, of leaf shedding and of beginning of flowering. The dates of the beginning and end of all phenophases were for the purpose of analysis expressed as the number of days elapsed from the first of January of each year.

In the diagram in Fig. 2 the arithmetic means of the duration of vegetative activity are plotted for the period 1953-1962 for the particular species together with the extreme values in this period, denoted by the varying length of the horizontal lines. The arithmetic means and extreme values of the duration of florescence are presented similarly (Fig. 4a). On the remaining diagrams (Figs 3a, b, 4b) the dates of leaf bud opening, leaf shedding, and beginning of flowering and the mean dates for the phenophases are separately plotted as segments of various length for the chosen species in the particular years of the ten-year period.

A number of supplementary compilations have been made of the species according to the duration of vegetative activity, flowering and fruit development. They were necessary for the study of the influence of weather conditions on the vegetation rhythm of these plants (Tables 8 and 9).

### 3. Characteristic of Climatic Conditions in the Period 1953-1962

The mean monthly temperature values, sums of precipitation for the particular months (Fig. 5) and the data concerning other more important climatic factors (Tables 1-4) shown in the diagrams underwent distinct variations in the period under study.



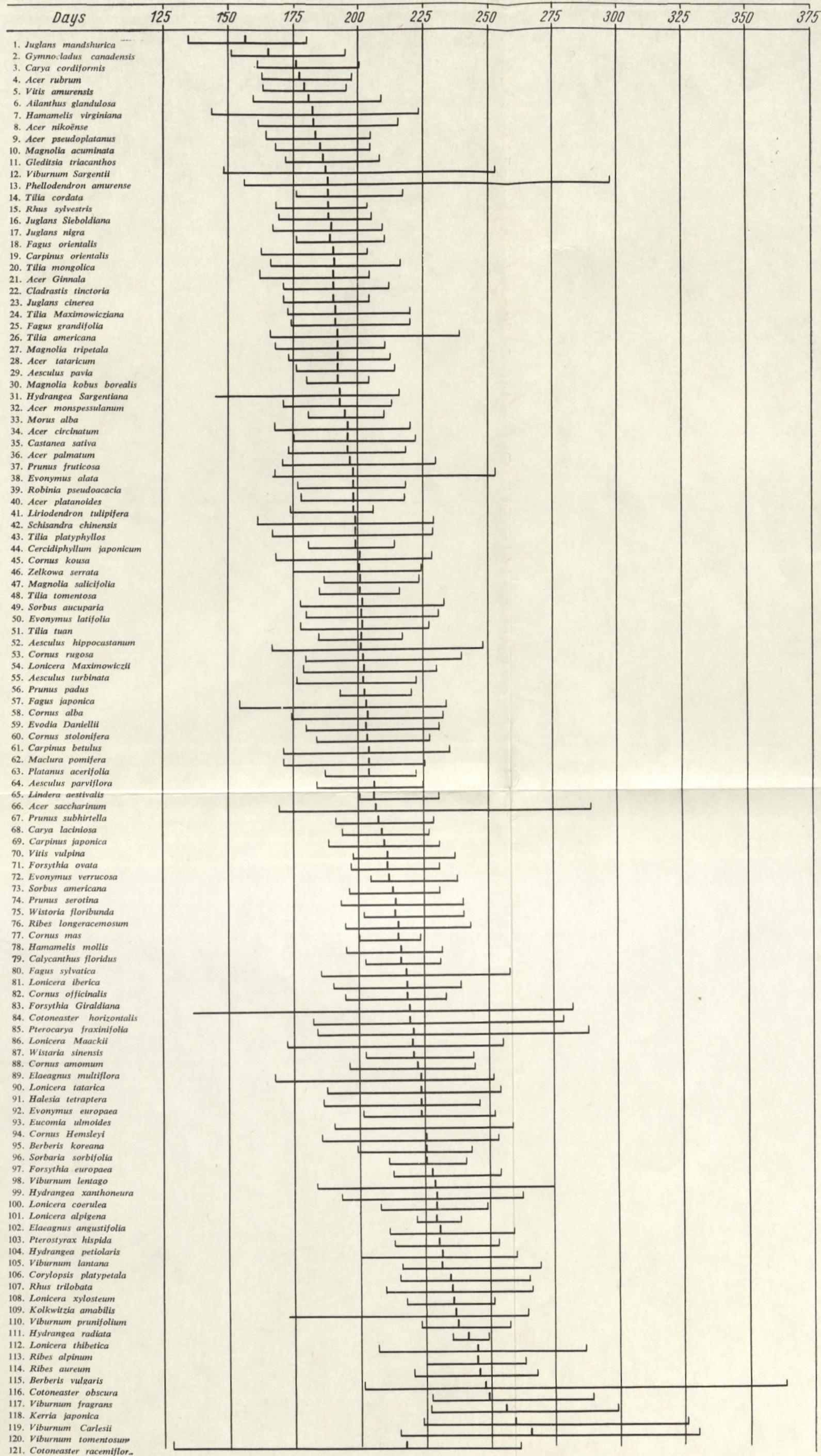
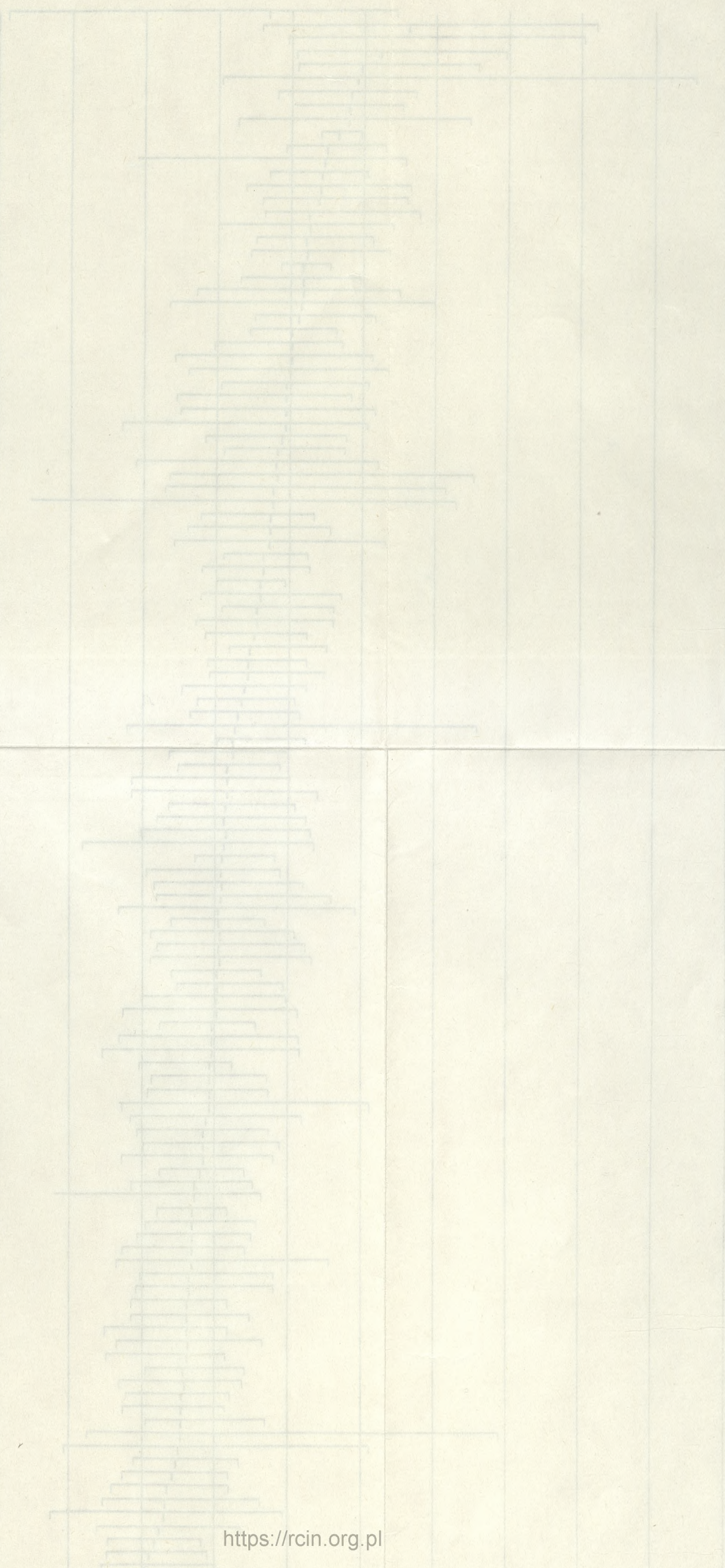


Fig. 2. Period of the vegetative activity of trees and shrubs (means calculated for the years 1953–1962 and extremal values).



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24. Ocena
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Comparison of the weather conditions indicates two severe winters in 1953/1954 and 1955/1956, the latter showing features of a steppe-desert type winter, that is considerable and long lasting temperature falls with little snow and strong winds. The successive mild winters of 1956/1957, 1957/1958 and 1958/1959 were close to the Atlantic type, with low frost, frequent rain or drizzle and a considerable cloudiness. The years 1953 and 1959 with a long vegetation period, a higher than mean average sum of heat, and the cold summers of 1956 and 1958 with relatively short vegetation periods should be noted. Significant for analysis of the seasonal rhythm in plants are the years 1953, 1954 and 1959 with long spells of dry and half-dry weather. For plant development the spring drought of 1959 was most unfavorable. These years had at the same time very long vegetation periods. It should be added that in 1957 ground frosts caused much damage, the last one was recorded as late as May 30 and the first on September 26. The longest period without frost occurred in 1961 when the last ground frost was recorded on April 10 and the first in autumn on November 19.

Table 1  
Distribution of Monthly Means of the Daily Minimal Temperatures over the Years 1953-1962

Years	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Annual mean
1953	-3.8	-4.4	-0.9	2.4	7.0	11.9	13.4	10.6	8.6	5.3	0.1	-1.9	4.0
1954	-9.3	-12.9	-0.5	0.6	6.3	12.0	12.2	11.4	10.0	5.4	-0.7	0.3	2.9
1955	-6.1	-6.7	-4.6	0.9	5.4	8.5	12.7	12.9	9.9	4.2	0.2	-1.0	3.0
1956	-2.7	-15.6	-2.5	1.3	7.0	10.6	11.8	11.0	8.0	4.5	-2.6	-2.0	2.4
1957	-3.2	0.2	-0.3	1.6	4.1	10.1	14.2	11.4	7.4	4.4	1.4	-3.6	4.0
1958	-5.1	-2.8	-4.0	1.1	9.0	9.1	13.1	11.5	8.7	6.0	1.6	-1.5	3.9
1959	-3.3	-5.5	0.7	3.1	5.9	9.8	15.0	13.2	5.9	2.2	-0.6	-2.3	3.7
1960	-4.4	-6.8	-1.1	2.1	7.2	10.9	12.0	12.3	8.0	5.7	1.7	-0.2	4.0
1961	-6.8	0.0	2.3	4.7	6.6	12.0	11.5	12.0	9.5	6.8	1.3	-7.0	4.4
1962	-1.5	-3.2	-3.7	5.6	6.1	9.4	10.1	12.5	8.2	4.1	2.0	-6.3	3.6

Minimal diurnal temperatures for Poznań 3,6°C

Minimal monthly temperatures for Poznań - 16,6°C

A short characteristic of the weather conditions in the particular years of the ten-year period is given below. It may contribute to the elucidation of the influence of certain climatic factors on the rhythm of the seasonal development of trees and shrubs. Only those climatic factors which, in the authors' opinion, are most important for plant vegetation are taken into account here.

#### Year 1953

It was a warm and dry year. Noteworthy is the early spring, temperatures distinctly exceeding the mean in April, June and July, a cool August and long spells of dry weather in spring and in the fall. The drought was severest in October.



Table 2

Distribution of the Monthly Absolute Minimal Temperatures over the Years 1953-1962

Years	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual mean
1953	-11.2	-21.7	-12.5	-5.3	-3.6	4.5	9.4	5.6	2.1	-0.6	-10.0	-9.2	-21.7
1954	-21.6	-25.0	-2.6	-3.4	-1.4	5.7	7.7	6.4	1.2	-1.1	-8.7	-4.6	-25.0
1955	-16.2	-16.7	-15.0	-1.7	-1.0	3.4	9.0	9.5	3.4	0.7	-5.3	-7.7	-16.7
1956	-22.5	-26.8	-7.8	-4.1	1.4	4.9	3.8	7.5	1.5	-6.8	-11.2	-13.6	-26.8
1957	-15.3	-4.9	-5.4	-5.4	-1.3	5.2	9.7	7.1	-0.2	-1.6	-7.2	-15.1	-15.3
1958	-12.6	-12.4	-15.3	-4.4	1.8	0.2	6.9	8.0	1.4	-1.1	-4.1	-8.2	-15.3
1959	-12.7	-16.4	-4.0	-2.0	1.2	3.8	9.4	6.0	-1.5	-3.1	-6.9	-12.8	-16.4
1960	-16.5	-18.0	-9.3	-4.1	0.4	7.8	6.6	7.1	1.5	-0.9	-2.8	-4.4	-18.0
1961	-21.4	-4.0	-5.9	-0.5	2.3	6.0	7.5	8.1	3.2	1.7	-6.7	-23.6	-20.4
1962	-13.1	-12.8	-13.3	-0.4	-2.0	3.5	5.0	7.2	2.2	-1.8	-2.4	-18.4	-13.3

Table 3

Distribution of the Monthly Means of the Air Moisture Deficit in the Years 1954-1962

Years	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov	Dec.	Annual mean
1954	0.8	0.7	1.3	2.3	5.5	7.7	4.1	5.7	5.0	2.9	1.1	0.9	3.2
1955	0.8	1.3	1.3	2.7	5.2	4.9	5.1	6.4	3.7	1.8	0.9	0.9	2.9
1956	1.2	0.5	1.6	1.9	6.0	5.4	7.4	5.2	4.1	2.3	1.0	0.9	3.1
1957	0.8	1.2	2.5	3.7	5.4	8.1	6.3	4.6	2.9	2.1	1.8	1.0	3.4
1958	1.1	1.6	1.5	2.2	4.6	4.4	5.7	4.5	3.6	1.6	0.7	0.9	2.7
1959	1.2	1.0	2.4	4.6	6.7	8.6	8.3	7.0	5.3	4.2	1.1	0.6	4.3
1960	0.6	0.8	1.6	2.8	6.3	6.8	5.1	5.4	4.2	1.7	1.1	0.9	3.1
1961	0.7	0.9	2.4	4.0	3.3	6.8	5.5	4.3	5.1	2.8	2.8	—	3.3
1962	1.2	1.0	1.3	4.4	3.1	7.0	5.5	5.7	3.4	1.8	0.8	0.5	3.0

Table 4

Distribution of Monthly Totals of Insolation in the Years 1954-1962

Years	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov	Dec.	Annual total
1954	63.5	101.2	97.8	136.4	266.5	253.0	140.0	245.9	177.4	131.7	64.5	14.5	1566.4
1955	49.3	86.6	146.2	84.4	207.5	213.6	211.1	240.8	174.5	119.3	46.1	19.0	1598.4
1956	46.1	80.8	152.6	90.7	230.7	182.2	249.4	193.7	210.8	109.4	51.2	55.1	1652.7
1957	42.7	61.6	172.4	174.3	227.7	273.8	187.2	205.8	124.8	99.1	42.1	25.1	1636.6
1958	69.9	76.9	78.9	82.3	202.8	217.1	255.7	204.2	183.3	94.9	26.3	35.7	1528.0
1959	39.5	60.4	159.7	187.3	278.7	250.7	200.8	233.1	225.5	150.3	52.0	9.0	1847.0
1960	33.8	108.8	165.0	143.9	247.4	204.9	120.9	162.4	160.3	66.6	44.7	30.5	1489.2
1961	95.5	60.0	73.7	208.4	110.4	260.4	122.9	135.0	204.0	122.9	27.8	22.7	1443.7
1962	46.7	32.4	132.8	134.9	122.2	245.8	201.7	139.8	138.8	104.1	39.4	21.4	1360.0
1963	72.9	51.9	142.0	162.8	210.7	235.3	252.8	157.8	150.4	78.9	36.4	41.7	1593.6



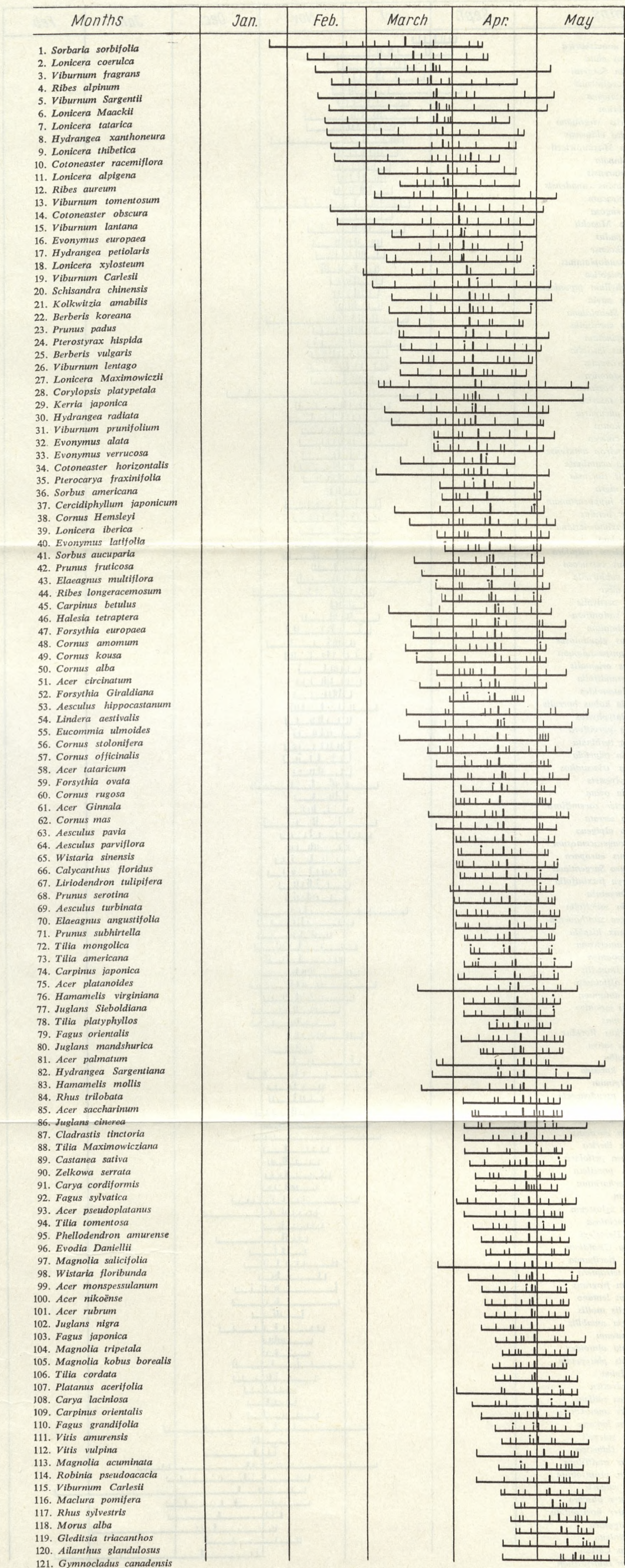


Fig. 3a. Bud opening. Mean dates of this phenological phase in various years from 1953-1962.



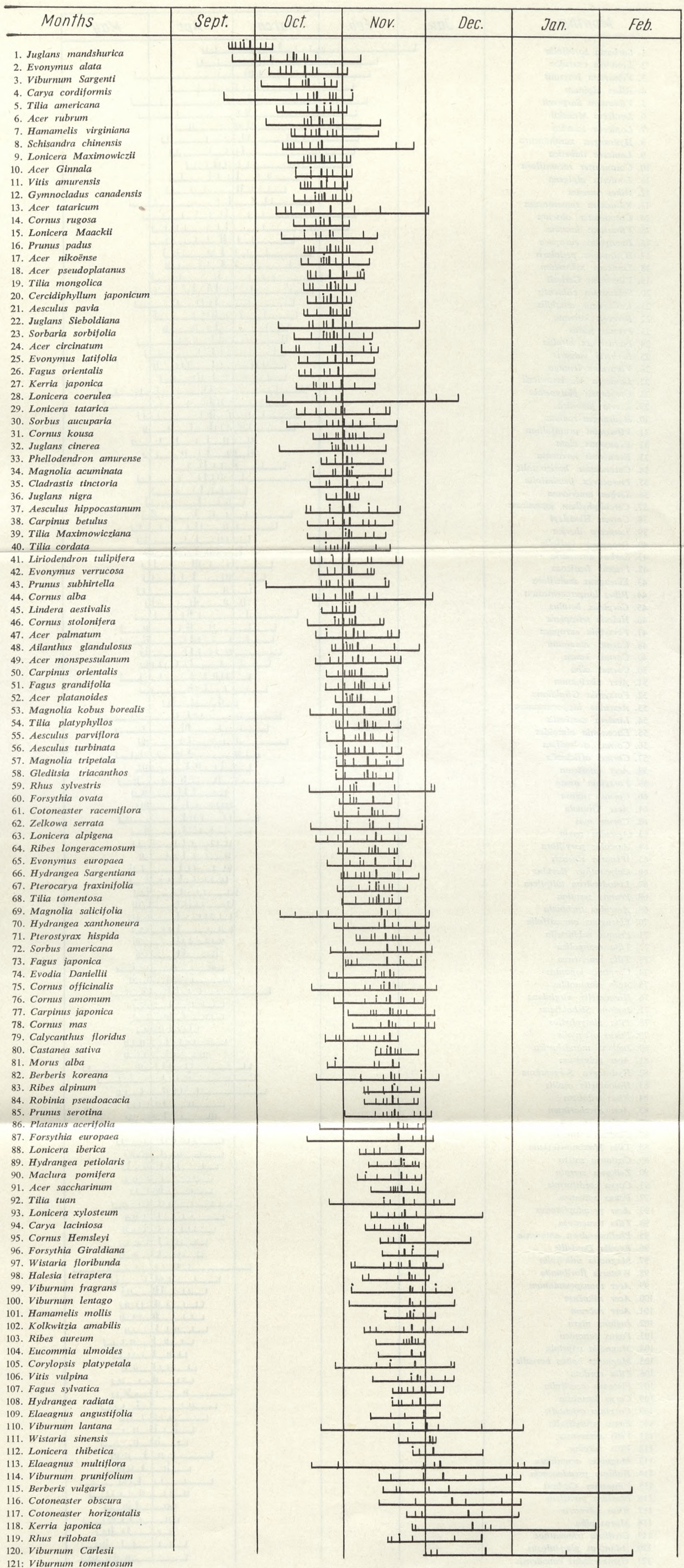


Fig. 3b. Leaf fall. Mean dates of end of leaf fall and dates of this phenological phase for various years from 1953–1962.



Beside the negative water balance (annual sum of precipitation 382.3 mm, i.e. one of the lowest in the 1953–1962 period), and the precipitation distribution unfavorable to plant vegetation (culmination in July), wide diurnal temperature amplitudes were noted, and in April and May severe ground frosts which also disturbed the development of trees and shrubs. In the winter of 1952/1953 frost was not particularly heavy or long lasting.

#### Year 1954

After a very dry and rather cold winter (mean minimal temperature in February  $-12^{\circ}\text{C}$ , absolute minimum  $-25^{\circ}\text{C}$ ), the spring was rather cold, and in April and May recurrence of winter was observed, it did not, however, cause major damage. June was very warm and dry, July was cool and in August and September a long period of drought set in. Its unfavorable influence was somewhat attenuated owing to the preceding profuse rainfall in April and July. A factor unpropitious for many trees and shrubs of foreign origin was in this year the short vegetation period.

#### Year 1955

The weather conditions in this year were characterized by relatively light frost, a long-lying snow cover and a rather uniform distribution of precipitation. Among unfavorable factors long-lasting chills in spring and summer should be noted (mean temperatures in March and June lower than in the remaining years of the 10-year period) and a short vegetation period.

#### Year 1956

As one of the most unpropitious climatic factors should be mentioned in this year the period of heavy frost which started at the end of January and lasted all through February (mean minimum of the coldest month  $-15.6^{\circ}\text{C}$ , absolute minimum  $-26.8^{\circ}\text{C}$ , 10 days with minimal temperature below  $-20^{\circ}\text{C}$ ). The noxious effect was particularly strong since the cold spell occurred after a warm December with abundant precipitation and a warm January, without any snow cover and with strong east winds.

The cold early spring and cool summer with a good deal of precipitation made possible regeneration of the trees and shrubs damaged by frost. In May and July, after much rainfall, spells of dry weather occurred. The vegetation period was one of the shortest in the ten years 1953–1962. Insolation was very high (652.7 hrs).



#### Year 1957

This year was characterized by a very mild winter 1956/1957 of Atlantic type (mean minimal temperature of the coldest month  $-3.6^{\circ}\text{C}$ ). Early spring was very precocious, the mean temperatures of February and March greatly exceeded the average ones. May, August and September were cool. In April and September there occurred spells of dry weather. They were, however, preceded by profuse rainfall, the culmination of which fell to February and July. The annual sum of precipitation (519 mm) shows that this year, besides 1961, may be considered as one of the moistest. Another factor prompting plant development was the long vegetation period and the high annual sum of insolation. On the whole, the weather conditions in 1957 with a mild winter and wet summer were favorable to plant development. Nevertheless, late and severe ground frosts (the last on May 30) and the early ground frosts in the fall (the first on September 26) injured some of the trees and shrubs. The period without frost (118 days) was the shortest in the entire 10-year period.

#### Year 1958

The absence of severe frost in the mild winter 1957/1958 (mean minimal temperature of the coldest month  $-5.1^{\circ}\text{C}$ ) with frequent precipitation, spring without a period of drought and a distribution of precipitation more favorable than in other years prompted vegetation. The diagrams indicate a very cold spring (mean temperatures of March, April and the first half of June much lower than the average) which shortened the vegetation period, nevertheless the very warm month of May with profuse precipitation seems to have somewhat compensated these unfavorable influences. As shown by the dates of the particular events for the indicator plants, the phenological summer period was very short, probably owing to the insufficient precipitation and the maximal amount of insolation (255.7 hrs) in July. The fall was relatively warm and moist. Finally the long period without frost (177 days) contributed to good plant development. Noteworthy were also the small diurnal air temperature amplitudes in March and April.

#### Year 1959

The winter of 1958/1959 like those of 1956/1957 and 1957/1958 was of Atlantic type. Only February was cold and dry, with vehement winds. On the whole, the year 1959 was extremely dry with a higher than average sum of heat and the highest insolation in the period 1953/1962 amounting to 1847 hrs, its maximum falling to July. The spring was dry and warm, March and April had high mean temperatures. Summer was wet and hot with mean temperatures of July and August above the average. The fall was dry and cool. The vegetation period and the period



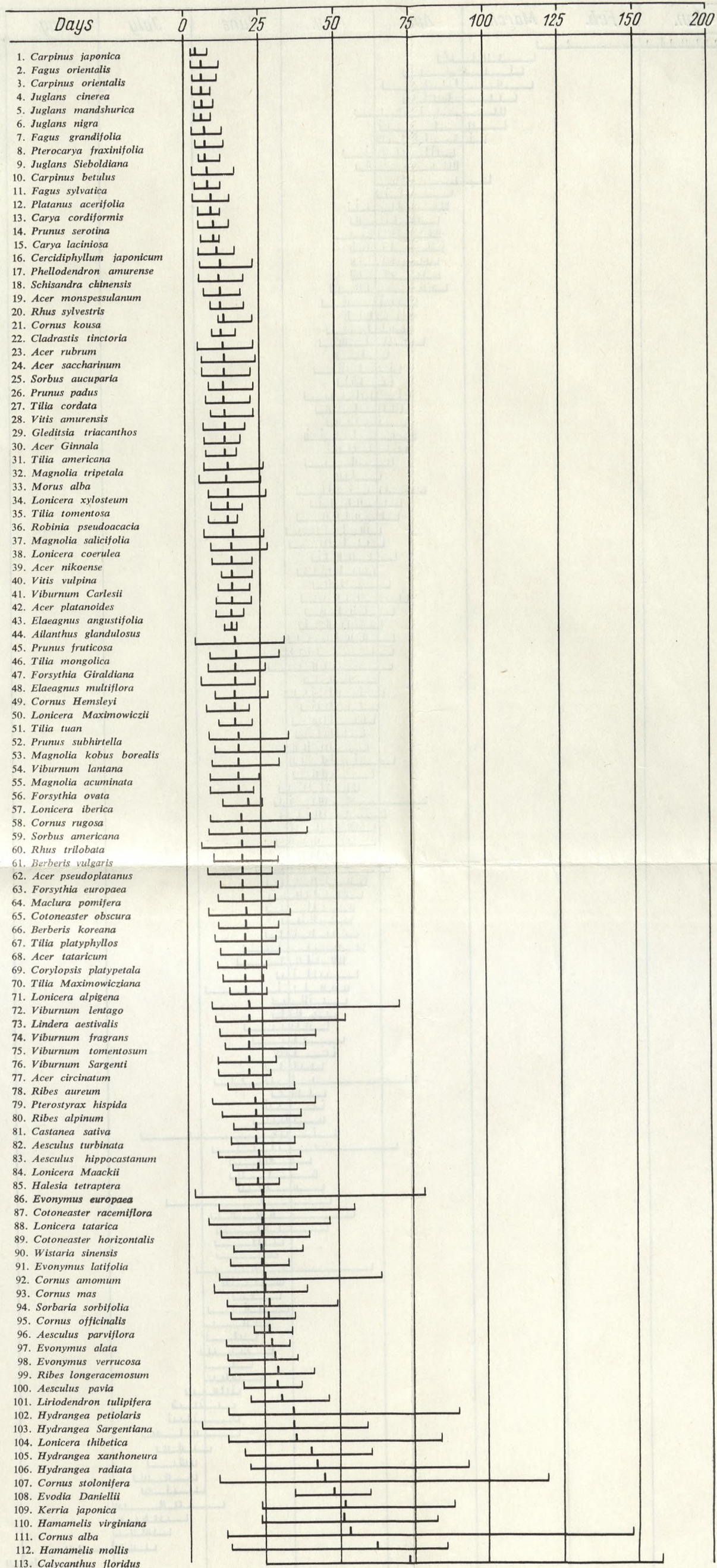


Fig. 4a. Length of flowering period of trees and shrubs. Means calculated for the years 1953–1962 and extremal values.



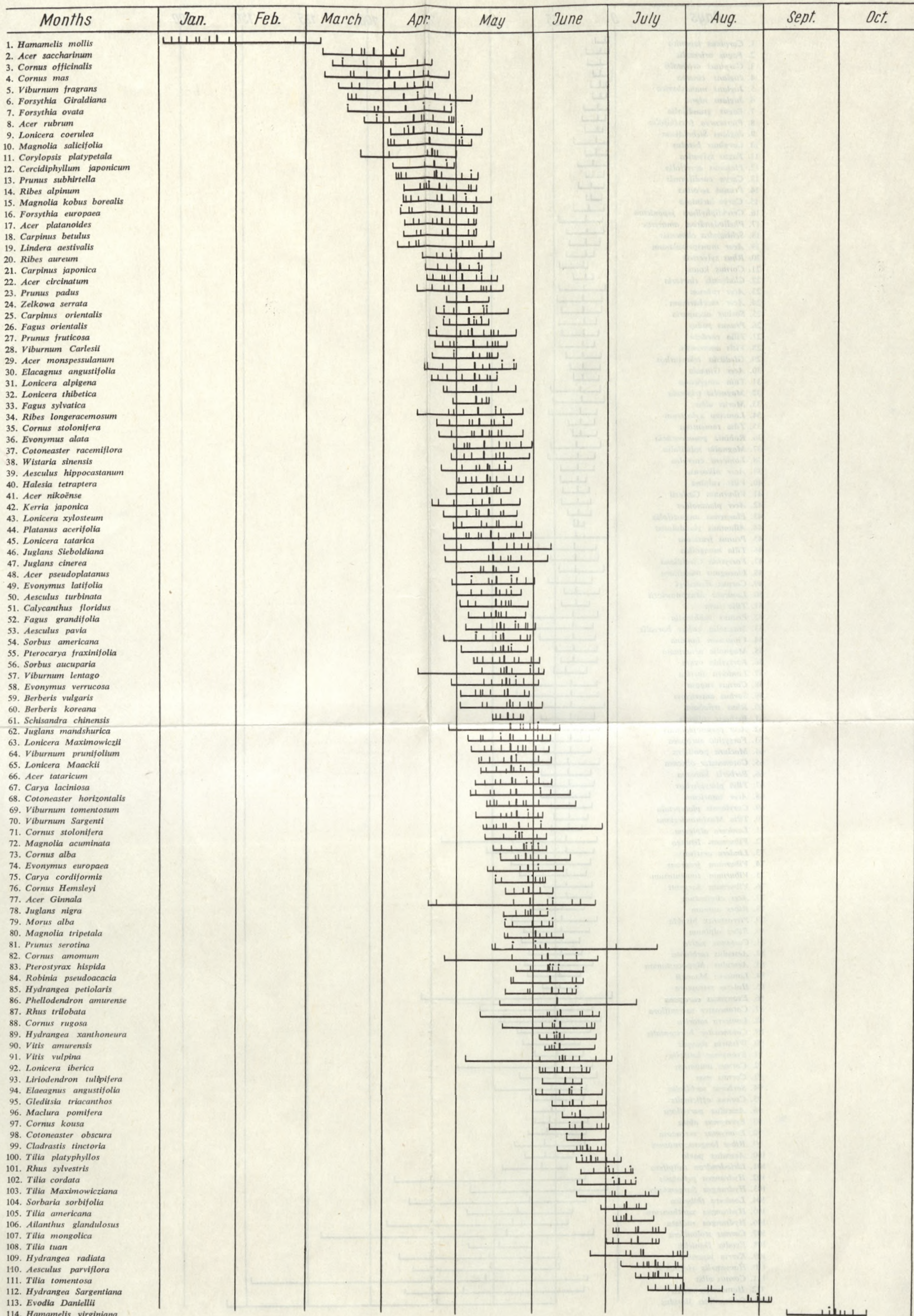


Fig. 4b. Onset of flowering. Mean dates of onset of flowering and dates of this phenological phase in various years from 1953-1962.



without frost were rather long. Most harmful to the vegetation of trees and shrubs was the winter-spring drought lasting from March to June. The abundant precipitation in July and August attenuated in some extent the unfavorable effect of the second period of still greater drought in the fall (Fig. 5).

#### Year 1960

The winter of this year was particularly mild, with moderate frost of short duration (mean minimal temperature of coldest month  $-6.8^{\circ}$ , absolute annual minimum  $-18^{\circ}\text{C}$ ) alternating with warmer periods and profuse snowfall, rain and drizzle. The snow cover lay on the ground from Jan. 20 to Feb. 20. In May a dry spell was unfavorable to the plants. The Atlantic type of weather was most pronounced in the summer months which were cool, cloudy and rainy. With the exception of May and September which were dry, the other months had sufficient rainfall. The mean temperatures of November and December were higher than the average so that the vegetation period was prolonged.

#### Year 1961

This year abounded in precipitation, spring was very early and warm (mean temperature of February, March and April highest in the 10-year period).

In the winter of 1960/1961 severe frost occurred only in mid January (mean minimal temperature of the coldest month  $-6.8^{\circ}\text{C}$ , absolute minimum  $-20.4^{\circ}\text{C}$ ). In December, February and March relatively high air temperatures were noted with frequent snow- and rainfall or drizzle — features of an Atlantic type winter.

Precipitation was very high in this year (694.3 mm), spring was very warm (mean temperatures of February, March and April highest for the 10-year period). May and the summer months were very cool, and the fall warmer than the average. Moreover this year had the longest vegetation period in the years 1953/1962. Plant growth was prompted by the high temperatures and profuse precipitation in the spring months.

The longest time interval without frost amounting to 226 days in the 10-year period (last ground frost on April 10 and first on Nov. 19) was also favorable to the course of the development cycle.

#### Year 1962

A prominent feature of the weather conditions was the long lasting, not very severe but windy winter of 1961/1962. The highest frost was recorded in December, at the turn of January and February and in March. The vegetation period was exceptionally cold. Only April was very warm, whereas the mean temperatures of all the summer and autumn months were lower than the average. Thus, the sum of heat available to the plants in this period was very low. Its amount is shown on



the climatic diagram as approximately the surface area between the temperature curve and the line at 5°C. Precipitation was frequent in winter, and its maximum fell to May and August. In April it was insufficient as well as in June when a spell of dry weather occurred. Another unfavorable factor for plant vegetation was the lowest insolation (1360.0 hrs) in the 10-year period.

#### 4. Analysis of the Phenological Seasons Over a Ten-Year Period and Their Relations with the Seasonal Rhythm of Vegetation of Trees and Shrubs

On the climatic diagrams and phenological spectra of the particular species it is clearly seen that the dates marking the beginning of the nine phenological seasons varied widely in the period 1953–1962 (Fig. 5). The greatest deviations were noted as regards the beginning of spring, and early fall (up to 47 days), early spring (up to 37 days), whereas the dates of the beginning of golden and late fall varied very little (Table 5). The duration of summer and early fall also varied. Most constant proved to be the duration of golden fall (deviations 10–20 days). The date of early spring and beginning of spring depends on the character of the preceding winter, after a mild winter of Atlantic type, the events marking the beginning of early spring (flowering of *Corylus avellana* and *Tussilago farfara*) occurred very early, mostly in the first days of February, and the beginning of spring (flowering of *Acer platanoides* and *Betula verrucosa*) was recorded around mid April (1957, 1958, 1959, 1961, 1962).

The wide differences in the duration of the phenological summer seem to be related to the course of temperature and the sum of precipitation and insolation in the vegetation period. As seen, on the climatic diagrams (Fig. 5), cold and moist spring and summer months with low insolation caused a considerable delay in the occurrence of early fall (1960, 1961, 1962).

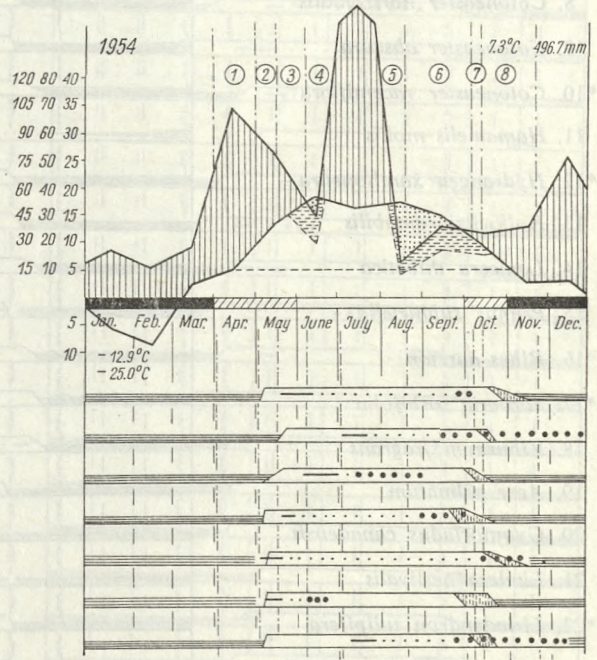
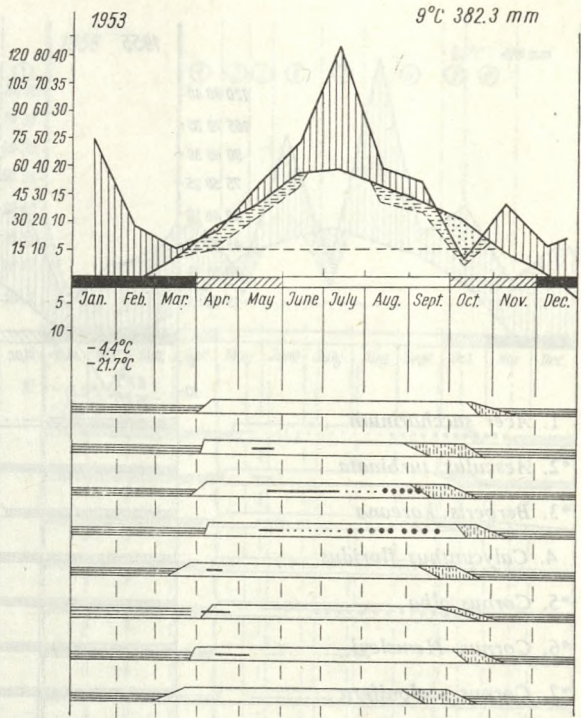
The results of phenological observations of many years (Table 6) prove that the seasonal rhythm of development of trees and shrubs of foreign origin is frequently closely connected with the phenological seasons in this country.

The times of bud opening, foliation, flowering and fruiting and also of change of color and shedding of leaves are determined by the internal rhythmicity of the plants, resulting from their genetic properties and the influence of the environment.

In the following species analysis of the development cycle of the trees and shrubs in the period 1953–1962 demonstrated an almost regular coincidence of the flowering phenophase with the period of early spring: *Acer rubrum*, *Acer saccharinum*, *Cornus mas*, *Viburnum fragrans*, *Cornus officinalis*, *Corylopsis platypetala* (starts flowering), *Forsythia Giraladiana* (starts flowering), *Forsythia ovata*.

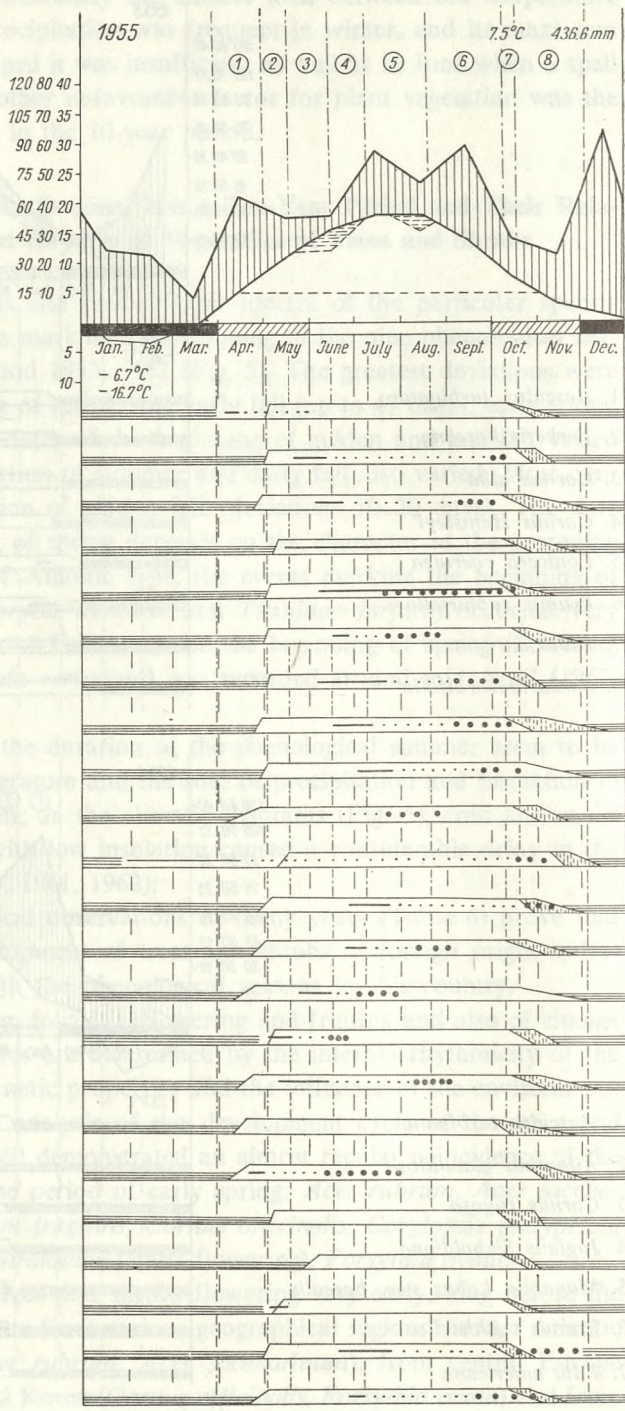
The above enumerated trees and shrubs flowering very early, long before the development of leaves, originate from various geographical regions, i.e. the Atlantic part of North America (*Acer rubrum*, *Acer saccharinum*), from central Europe (*Cornus mas*), from Japan and Korea (*Cornus officinalis*, *Forsythia ovata*) and from





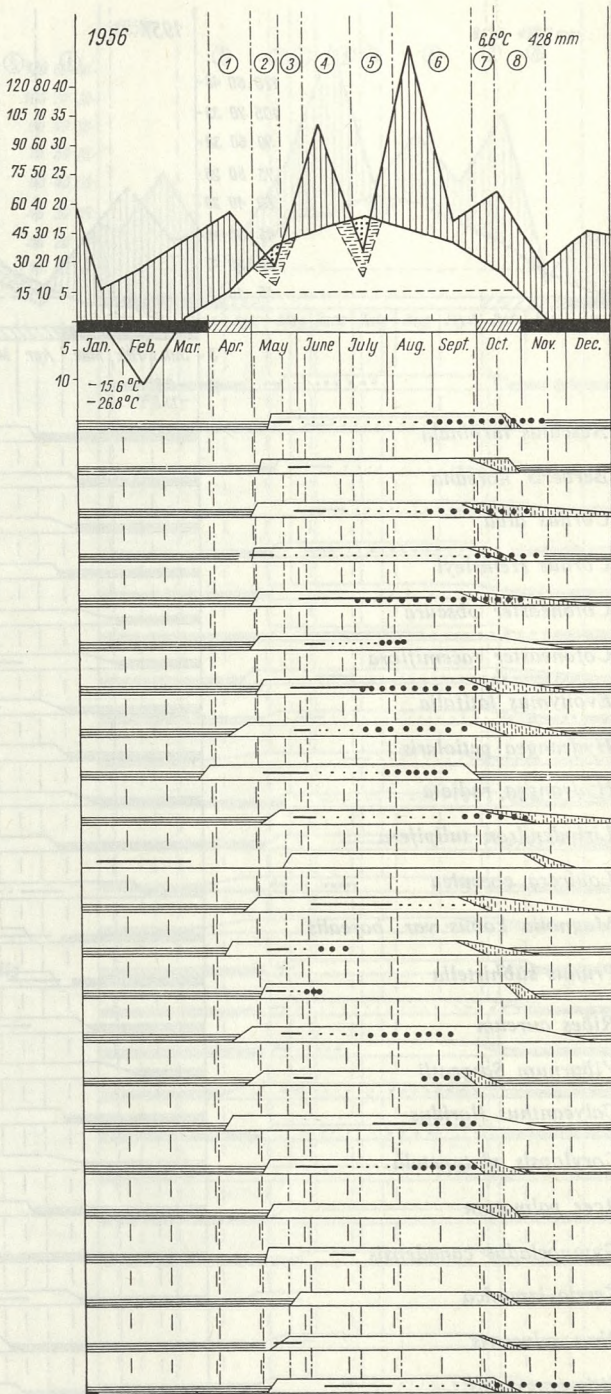


the change in temperature between the curve and the line at 5°C  
 fell to May and August  
 of dry winter  
 between



- 1. *Acer saccharinum*
- \*2. *Aesculus turbinata*
- \*3. *Berberis koreana*
- 4. *Calycanthus floridus*
- \*5. *Cornus alba*
- \*6. *Cornus Hemsleyi*
- \*7. *Cornus stolonifera*
- 8. *Cotoneaster horizontalis*
- \*9. *Cotoneaster obscura*
- \*10. *Cotoneaster racemiflora*
- 11. *Hamamelis mollis*
- \*12. *Hydrangea xanthoneura*
- 13. *Kolkwitzia amabilis*
- 14. *Lonicera thibetica*
- 15. *Prunus subhirtella*
- \*16. *Ribes aureum*
- \*17. *Sorbaria sorbifolia*
- 18. *Viburnum fragrans*
- 19. *Acer palmatum*
- 20. *Gymnocladus canadensis*
- 21. *Lindera aestivalis*
- \*22. *Liriodendron tulipifera*
- 23. *Pterostyrax hispida*







1957

120 80 40  
105 70 35  
90 60 30  
75 50 25  
60 40 20  
45 30 15  
30 20 10  
15 10 5

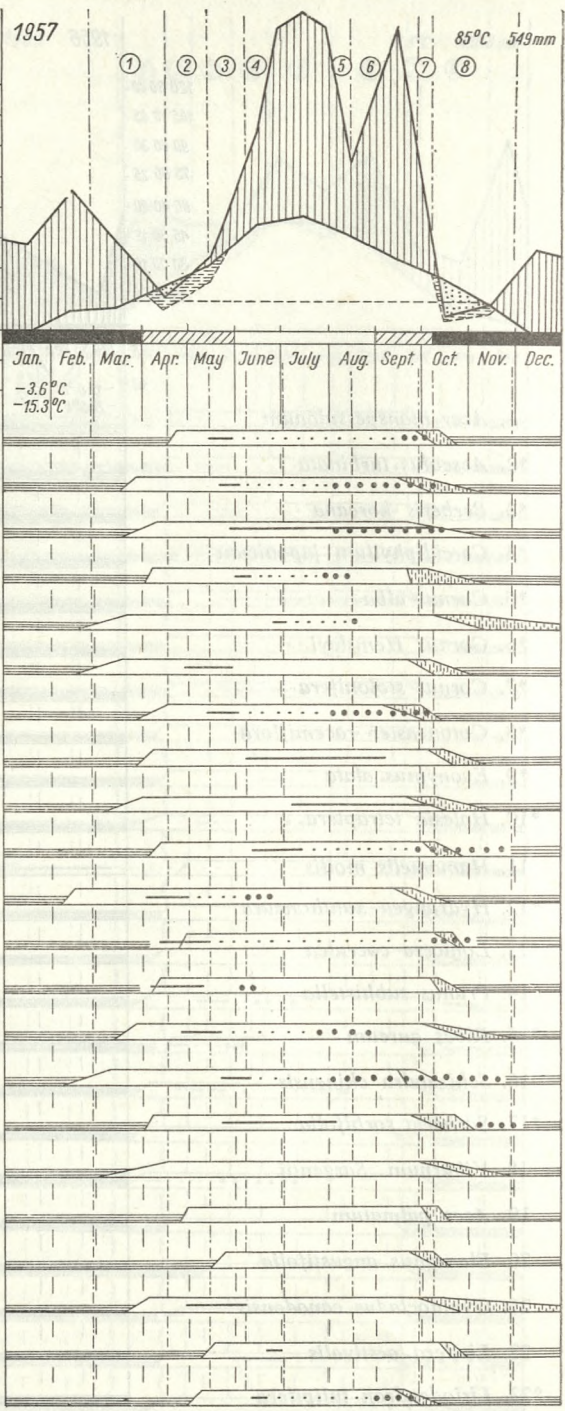
85°C 549mm

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

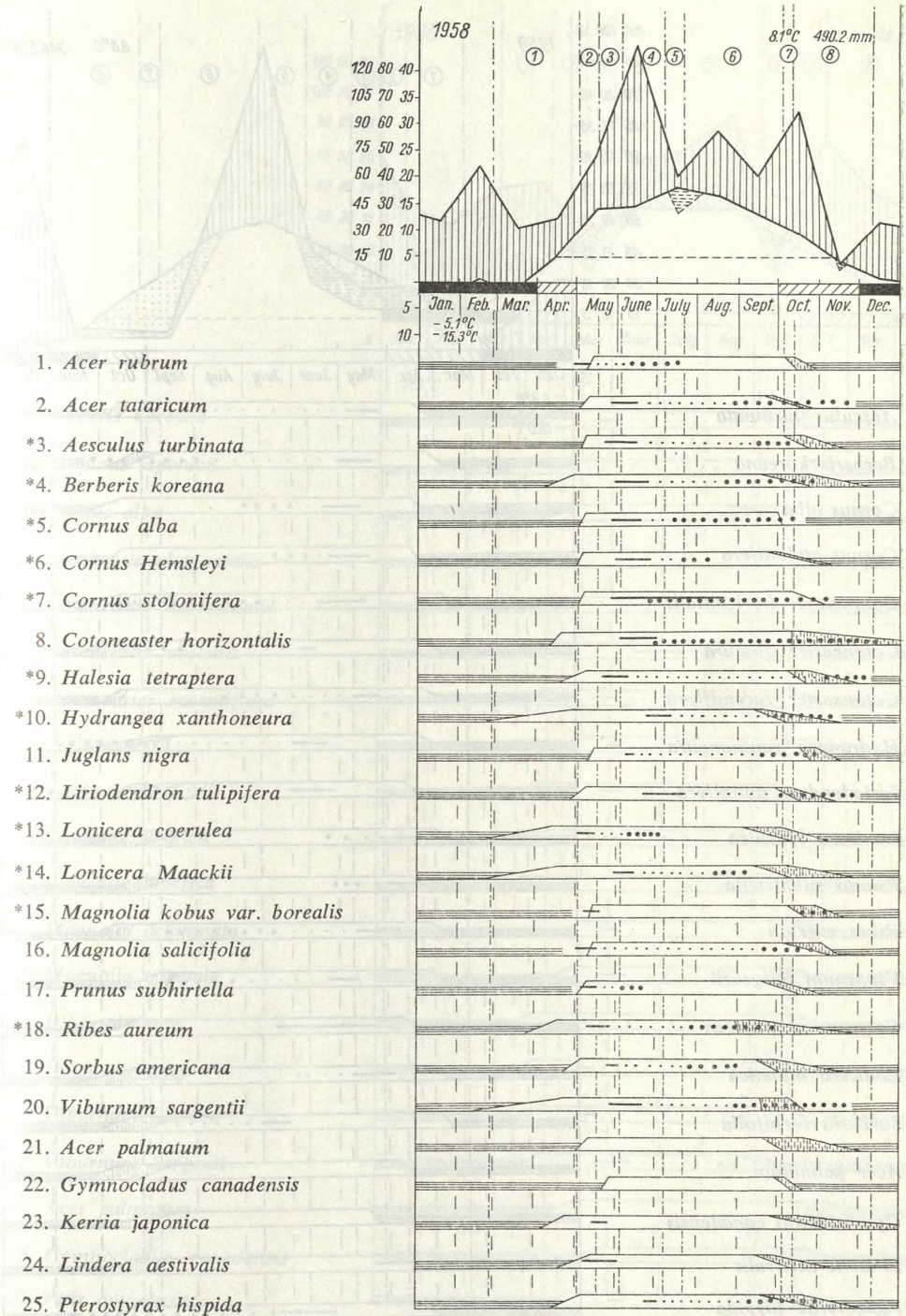
5 Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

10 -3.6°C  
-15.3°C

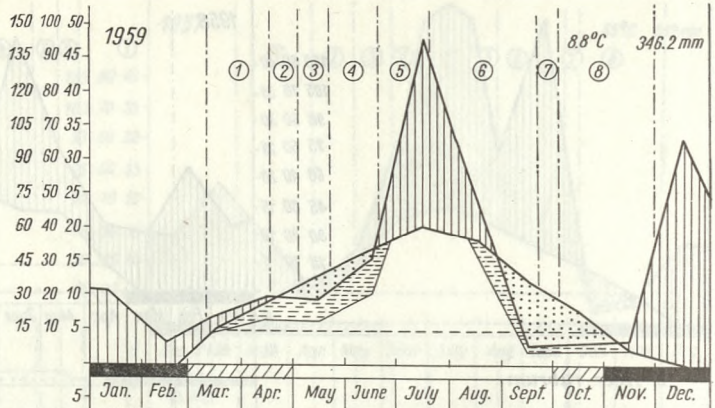
- \*1. *Aesculus turbinata*
- \*2. *Berberis koreana*
- \*3. *Cornus alba*
- \*4. *Cornus Hemsleyi*
- \*5. *Cotoneaster obscura*
- \*6. *Cotoneaster racemiflora*
- \*7. *Evonymus latifolia*
- 8. *Hydrangea petiolaris*
- 9. *Hydrangea radiata*
- \*10. *Liriodendron tulipifera*
- \*11. *Lonicera coerulea*
- \*12. *Magnolia kobus var. borealis*
- 13. *Prunus subhirtella*
- \*14. *Ribes aureum*
- 15. *Viburnum Sargentii*
- 16. *Calycanthus floridus*
- 17. *Corylopsis platypetala*
- 18. *Acer palmatum*
- 19. *Gymnocladus canadensis*
- 20. *Kerria japonica*
- 21. *Rhus sylvestris*
- \*22. *Vitis amurensis*





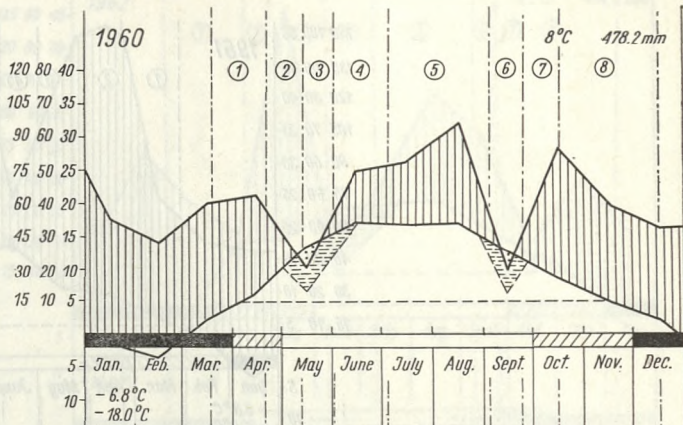




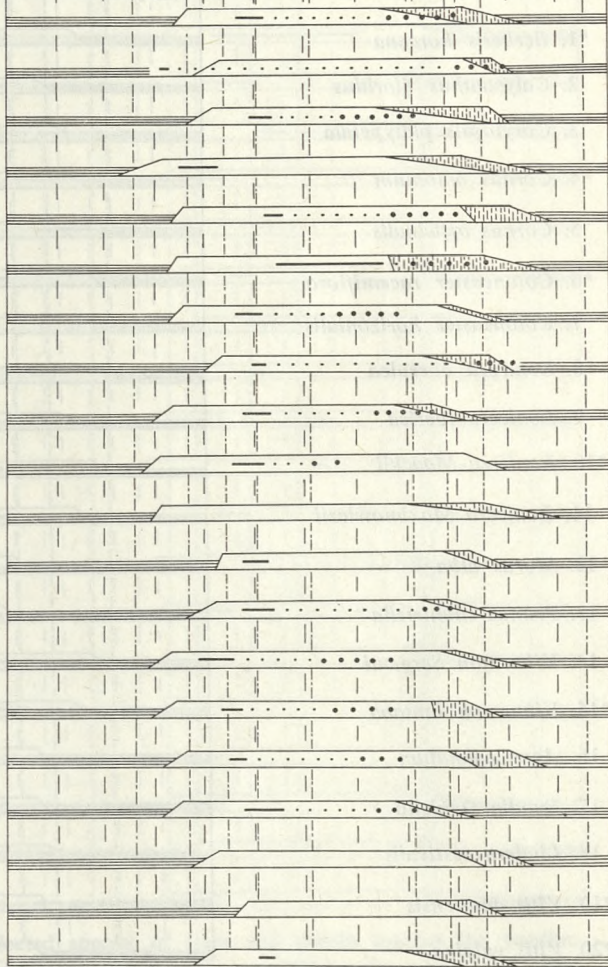


- \*1. *Aesculus turbinata*
- \*2. *Berberis koreana*
- \*3. *Cornus alba*
- \*4. *Cornus stolonifera*
- 5. *Cotoneaster horizontalis*
- \*6. *Cotoneaster obscura*
- \*7. *Cotoneaster racemiflora*
- \*8. *Hydrangea xanthoneura*
- \*9. *Liriodendron tulipifera*
- \*10. *Lonicera coerulea*
- 11. *Prunus subhirtella*
- \*12. *Ribes aureum*
- 13. *Viburnum Sargentii*
- 14. *Calycanthus floridus*
- 15. *Lonicera thibetica*
- \*16. *Sorbaria sorbifolia*
- 17. *Acer palmatum*
- 18. *Gymnocladus canadensis*
- 19. *Lindera aestivalis*
- 20. *Pterostyrax hispida*

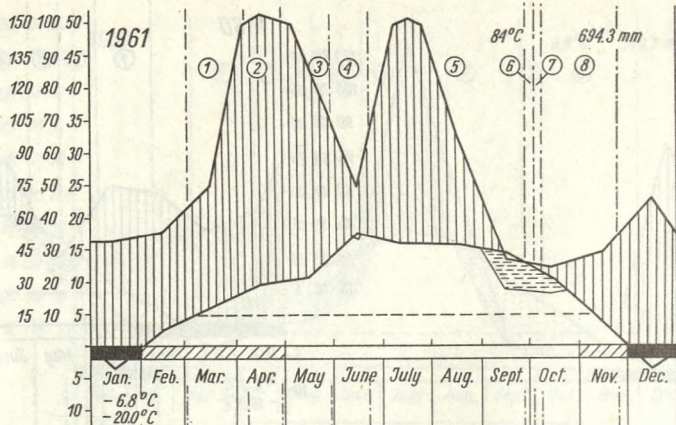




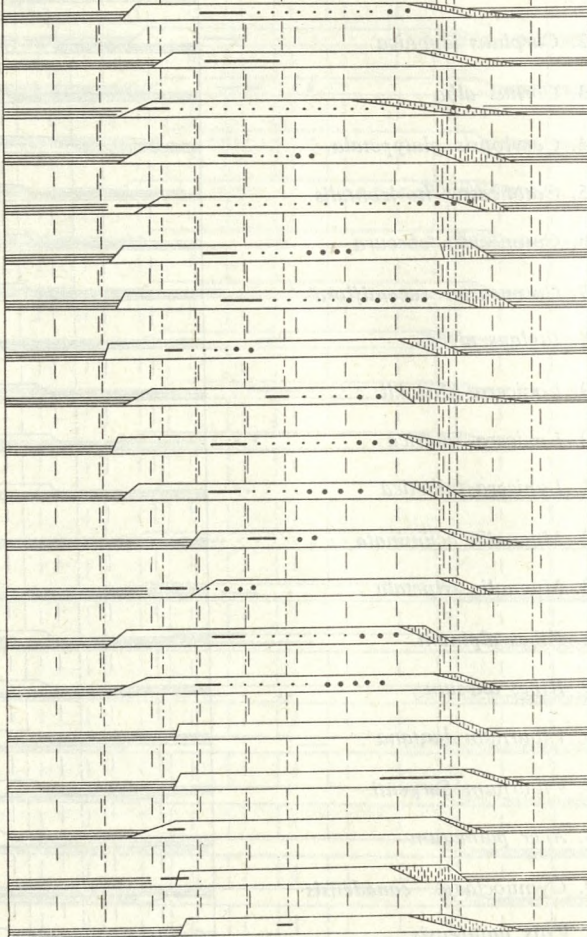
- \*1. *Berberis koreana*
2. *Carpinus japonica*
- \*3. *Cornus alba*
4. *Corylopsis platypetala*
5. *Cotoneaster horizontalis*
- \*6. *Cotoneaster obscura*
- \*7. *Cotoneaster racemiflora*
8. *Juglans nigra*
- \*9. *Lonicera Maackii*
10. *Lonicera tatarica*
11. *Lonicera thibetica*
- \*12. *Magnolia acuminata*
13. *Magnolia tripetala*
14. *Ribes alpinum*
- \*15. *Ribes aureum*
- \*16. *Viburnum lantana*
17. *Viburnum Sargentii*
18. *Acer palmatum*
19. *Gymnocladus canadensis*
- \*20. *Vitis amurensis*







- \*1. *Berberis koreana*
- 2. *Calycanthus floridus*
- 3. *Corylopsis platypetala*
- \*4. *Cornus amomum*
- 5. *Cornus officinalis*
- \*6. *Cotoneaster racemiflora*
- 7. *Cotoneaster horizontalis*
- \*8. *Lonicera coerulea*
- 9. *Lonicera iberica*
- \*10. *Lonicera Maackii*
- 11. *Lonicera Maximowiczii*
- 12. *Morus alba*
- 13. *Prunus subhirtella*
- 14. *Viburnum Sargentii*
- \*15. *Viburnum lantana*
- 16. *Acer palmatum*
- 17. *Evodia Daniellii*
- 18. *Lindera aestivalis*
- \*19. *Vitis amurensis*
- \*20. *Vitis vulpina*





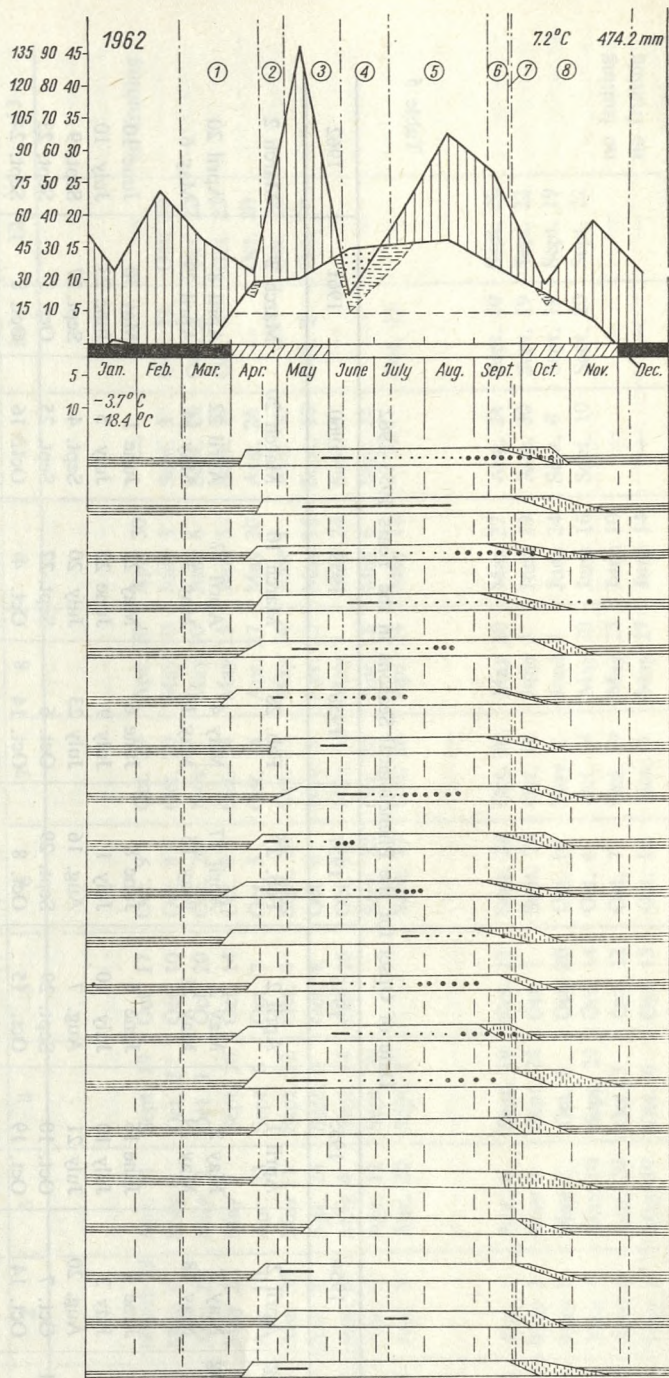


Fig. 5. Phenological spectra for selected species of trees and shrubs against the weather conditions presented by the method of Gausson-Walter diagrams [39] for the period 1953-1962. The species denoted by asterisks are characterized in the Kórnik Arboretum by a high adaptive ability. The phenological seasons are denoted by numbers from 1 to 8. (Explanations to phenological spectra and climate diagram on p. 35).



Table 5

## Date of Onset for the Phenological Seasons in the Years 1953-1962

	1954	1955	1956	1957	1958	1959	1960	1961	1962
1. Early spring	April 2	April 1	April 2	Feb. 27	Feb. 28	March 10	March 20	March 2	March 2
2. Beginning of the spring	May 3	May 2	May 2	April 17	May 4	April 17	April 22	April 8	April 20
3. Spring	May 18	May 19	May 21	May 15	May 19	May 3	May 14	April 29	May 6
4. Early summer	June 8	June 16	June 6	June 8	June 6	May 22	June 1	May 30	June 10
5. Summer	July 3	July 10	July 10	July 1	July 9	June 22	July 5	June 23	July 10
6. Early fall	Aug. 20	July 21	Aug. 7	Aug. 16	July 23	July 20	Sept. 4	Sept. 27	Sept. 9
7. Golden fall	Oct. 7	Oct. 10	Sept. 29	Sept. 29	Oct. 6	Sept. 22	Sept. 25	Oct. 3	Sept. 23
8. Late fall	Oct. 14	Oct. 19	Oct. 15	Oct. 8	Oct. 14	Oct. 4	Oct. 16	Oct. 8	Sept. 24
9. Winter	Nov. 23	Dec. 3	Nov. 18	Dec. 1	Dec. 11	Nov. 29	Dec. 17	Nov. 25	Dec. 6



The Dates of the Phenological Stages for Selected Species

Species	Leaves						Flowers		Fruits			Remarks
	Opening of buds	Opening of blades	Beginning of change of coloration	Maxima change of coloration	Beginning of fall	End of fall	Beginning of flowering	End of flowering	Beginning of ripening	Full ripeness	Beginning of fall	
1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Acer circinatum</i> Pursh.												
1953	March 25	Apr. 11	Sept. 19	Oct. 17	Oct. 9	Oct. 29	Apr. 20	Apr. 30	—	—	—	no fruiting
1954	May 5	May 8	Oct. 2	Oct. 10	Oct. 8	Oct. 20	May 10	June 3	Sept. 3	Oct. 11	Oct. 20	
1955	Apr. 29	May. 2	Oct. 1	Oct. 20	Oct. 20	Nov. 3	May 10	June 6	Sept. 20	Oct. 3	Oct. 22	
1956	May 2	May 9	Sept. 20	Oct. 14	Oct. 8	Oct. 24	May 15	June 5	Sept. 18	Oct. 4	Oct. 23	
1957	Apr. 10	Apr. 23	Sept. 6	Oct. 7	Oct. 5	Oct. 14	Apr. 27	May 20	Aug. 26	—	Oct. 20	
1958	Apr. 30	May 11	Sept. 12	Oct. 4	Sept. 30	Oct. 25	May 14	June 1	Aug. 30	—	Oct. 24	
1959	Apr. 2	Apr. 24	Sept. 4	Oct. 8	Oct. 6	Nov. 8	Apr. 25	May 15	Sept. 10	Oct. 2	Oct. 7*	
1960	Apr. 6	May 4	Sept. 14	Oct. 26	Oct. 18	Nov. 10	May 7	May 24	Sept. 5	—	—	
1961	Apr. 6	Apr. 12	Sept. 20	—	Sept. 28	Oct. 26	Apr. 18	May 6	Sept. 21	—	—	
1962	Apr. 3	Apr. 20	Sept. 1	—	Sept. 17	Oct. 26	Apr. 24	May 18	—	Oct. 15	—	
<i>Acer Ginnala</i> Maxim.												
1953	Apr. 1	Apr. 6	Sept. 19	Oct. 17	Sept. 28	Oct. 20	May 20	May 27	Aug. 24	Sept. 10	Sept. 20	
1954	May 3	May 8	Sept. 24	Oct. 7	Sept. 26	Oct. 12	June 3	June 19	Aug. 30	Sept. 19	Sept. 22	
1955	May 1	May 5	Oct. 8	Oct. 20	Oct. 10	Nov. 2	June 8	June 24	Sept. 8	Sept. 19	Sept. 19	
1956	May 4	May 10	Sept. 29	Oct. 14	Oct. 4	Oct. 24	May 30	June 16	Sept. 10	Sept. 20	Sept. 22	
1957	Apr. 4	Apr. 20	Oct. 5	Oct. 12	Oct. 7	Oct. 19	May 23	June 10	—	—	—	no fruiting
1958	May 2	May 10	Oct. 6	Oct. 15	Oct. 12	Nov. 3	May 27	June 14	—	—	—	no fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1959	Apr. 3	Apr. 10	Sept. 18	Oct. 14	Oct. 12	Oct. 22	—	—	—	—	—	no flowering and fruiting
1960	Apr. 12	May 5	Sept. 18	Oct. 20	Oct. 7	Oct. 28	—	—	—	—	—	no flowering and fruiting
1961	Apr. 6	Apr. 15	Oct. 7	Oct. 22	Oct. 15	Oct. 27	—	—	—	—	—	no flowering and fruiting
1962	Apr. 7	Apr. 23	Sept. 11	Oct. 13	Sept. 19	Oct. 18	—	—	—	—	—	no flowering and fruiting
<i>Acer monspessulanum</i> L.												
1953	Apr. 14	Apr. 20	Oct. 9	Oct. 22	Oct. 20	Nov. 2	Apr. 20	—	—	—	—	no fruiting, flowers froze
1954	May 12	May 18	Sept. 30	Oct. 26	Oct. 5	Nov. 2	May 14	May 26	Sept. 3	Oct. 11	Nov. 4	
1955	May 7	May 10	Oct. 28	Nov. 2	Oct. 28	Nov. 19	May 12	May 28	—	—	—	no fruiting
1956	May 13	May 15	Oct. 18	Oct. 24	Oct. 20	Oct. 31	May 15	May 30	Aug. 28	Oct. 17	Nov. 15	
1957	Apr. 30	May 10	Oct. 7	Oct. 14	Oct. 14	Oct. 29	Apr. 29	May 18	—	—	—	no fruiting
1958	May 12	May 17	Sept. 29	Oct. 18	Oct. 25	Nov. 28	May 13	May 22	—	—	—	no fruiting
1959	Apr. 26	Apr. 30	Oct. 10	Oct. 19	Oct. 19	Oct. 28	Apr. 29	May 6	—	—	—	no fruiting
1960	May 4	May 9	Oct. 18	Oct. 20	Oct. 22	Nov. 3	May 8	May 16	Aug. 12	—	—	
1961	Apr. 14	Apr. 18	Oct. 7	Oct. 25	Oct. 15	Nov. 11	—	—	—	—	—	no flowering and fruiting
1962	Apr. 23	Apr. 25	Sept. 19	Sept. 30	Oct. 10	Nov. 2	—	—	—	—	—	no flowering and fruiting
<i>Acer nikoense</i> Maxim.												
1953	Apr. 16	Apr. 23	Oct. 6	—	Oct. 17	Oct. 29	Apr. 26	May 12	—	—	—	no fruiting
1954	May 8	May 10	Oct. 5	Oct. 15	Oct. 10	Oct. 20	May 12	May 29	Aug. 30	Oct. 11	Nov. 15	
1955	May 7	May 10	Oct. 3	Oct. 20	Oct. 20	Nov. 3	May 15	June 6	Sept. 20	—	Oct. 25	
1956	May 9	May 14	Sept. 20	Oct. 14	Oct. 4	Oct. 17	May 20	June 8	Sept. 18	—	Oct. 28	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1957	Apr. 29	May 3	Sept. 20	Oct. 7	Oct. 5	Oct. 19	May 11	May 25	Aug. 30	—	Oct. 25	
1958	May 10	May 14	Sept. 21	Oct. 20	Oct. 12	Oct. 30	May 17	May 27	Sept. 18	—	Oct. 28	
1959	Apr. 25	May 1	Oct. 4	Oct. 14	Oct. 14	Nov. 2	May 6	May 20	Sept. 16	Oct. 8	Oct. 17*	
1960	May 9	May 13	Oct. 22	Oct. 30	Oct. 26	Nov. 10	May 15	May 24	Sept. 20	—	—	
1961	Apr. 18	Apr. 25	Sept. 26	Oct. 20	Sept. 30	Oct. 26	May 10	May 19	—	Sept. 21	—	
1962	Apr. 25	Apr. 28	Sept. 3	Oct. 13	Oct. 8	Oct. 19	May 16	June 4	—	—	—	
<i>Acer palmatum</i>												
Thunb.												
1953	Apr. 11	Apr. 18	Sept. 19	Oct. 17	Oct. 20	Oct. 29	—	—	—	—	—	no flowering and fruiting
1954	May 8	May 12	Sept. 24	Oct. 5	Oct. 10	Oct. 30	—	—	—	—	—	no flowering and fruiting
1955	May 4	May 7	Oct. 1	Oct. 15	Oct. 28	Nov. 3	—	—	—	—	—	no flowering and fruiting
1956	May 8	May 14	Sept. 20	Oct. 17	Oct. 18	Oct. 28	—	—	—	—	—	no flowering and fruiting
1957	Apr. 25	Apr. 30	Sept. 30	Oct. 7	Oct. 10	Oct. 19	—	—	—	—	—	no flowering and fruiting
1958	May 2	May 11	Sept. 17	Oct. 4	Oct. 18	Dec. 2	—	—	—	—	—	no flowering and fruiting
1959	Apr. 10	Apr. 27	Sept. 16	Oct. 8	Oct. 19	Nov. 14	—	—	—	—	—	no flowering and fruiting
1960	Apr. 20	May 9	Sept. 21	Oct. 16	Oct. 20	Nov. 14	—	—	—	—	—	no flowering and fruiting
1961	Apr. 14	Apr. 17	Oct. 2	Oct. 24	Oct. 11	Nov. 4	—	—	—	—	—	no flowering and fruiting
1962	Apr. 12	Apr. 24	Sept. 17	Oct. 4	Oct. 7	Nov. 1	—	—	—	—	—	no flowering and fruiting



Table 6 (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Acer platano-</i> <i>ides</i> L.													
1953	Apr. 2	Apr. 16	Sept. 19	Oct. 16	Sept. 28	Oct. 30	Apr. 9	Apr. 26	Sept. 10	Sept. 26	Oct. 15		
1954	May 6	May 9	Oct. 5	Oct. 20	Oct. 15	Nov. 12	May 5	May 22	Oct. 5	Oct. 15	Oct. 20		
1955	May 1	May 3	Oct. 12	Nov. 10	Oct. 20	Nov. 17	—	—	—	—	—		no flowering and fruiting
1956	May 6	May 9	Sept. 24	Oct. 25	Oct. 18	Oct. 31	May 6	May 18	Oct. 4	—	Nov. 28		
1957	Apr. 24	Apr. 29	Oct. 5	Oct. 19	Oct. 10	Nov. 5	Apr. 20	May 10	—	—	—		no fruiting
1958	May 6	May 10	Oct. 8	Oct. 30	Oct. 16	Nov. 15	May 8	May 18	Sept. 23	—	Nov. 20		
1959	Apr. 22	Apr. 27	Oct. 8	Oct. 26	Oct. 14	Nov. 6	Apr. 14	Apr. 28	—	—	—		no fruiting
1960	May 3	May 7	Oct. 12	Oct. 28	Oct. 20	Nov. 7	Apr. 26	May 15	Oct. 2	Nov. 7	—		
1961	Apr. 15	Apr. 20	Oct. 7	Oct. 16	Oct. 9	Oct. 26	Apr. 12	Apr. 25	—	—	—		no fruiting
1962	Apr. 15	Apr. 22	Sept. 25	Oct. 17	Sept. 29	Nov. 7	Apr. 22	AMay 4	—	Oct. 27	Nov. 6		
<i>Acer pseudo-</i> <i>platanus</i> L.													
1953	Apr. 1	Apr. 20	Sept. 8	—	Sept. 15	Oct. 17	Apr. 30	May 26	Aug. 24	Sept. 19	Oct. 7		
1954	May 14	May 17	Sept. 15	—	Sept. 28	Oct. 28	May 25	June 5	Aug. 30	Sept. 20	Oct. 22		
1955	May 4	May 9	Sept. 26	—	Sept. 26	Oct. 25	May 16	June 3	—	—	—		no fruiting
1956	May 8	May 13	Sept. 18	—	Sept. 20	Oct. 24	May 20	June 8	Sept. 26	—	Oct. 25		
1957	May 5	May 9	Sept. 26	—	Sept. 26	Oct. 19	May 15	June 12	—	—	—		no fruiting
1958	May 10	May 13	Oct. 8	—	Oct. 12	Nov. 10	May 16	May 30	Sept. 26	—	Oct. 28		
1959	May 1	May 5	Sept. 10	—	Oct. 4	Oct. 26	May 11	May 23	—	—	—		no fruiting
1960	May 7	May 10	Sept. 10	—	Sept. 20	Oct. 28	May 15	June 10	Sept. 28	—	—		
1961	Apr. 14	Apr. 20	Oct. 5	Oct. 13	Oct. 7	Nov. 3	May 16	May 23	—	—	—		no fruiting
1962	Apr. 22	Apr. 23	Sept. 17	Oct. 15	Sept. 21	Oct. 24	May 10	June 6	—	Oct. 27	—		
<i>Acer rubrum</i> L.													
1953	Apr. 11	Apr. 20	Sept. 8	Sept. 19	Sept. 15	Oct. 10	March 28	Apr. 14	May 20	June 3	June 10		
1954	May 9	May 12	Oct. 5	Oct. 15	Oct. 5	Oct. 18	Apr. 20	May 6	May 26	June 11	June 17		
1955	May 3	May 7	Oct. 10	Oct. 25	Oct. 20	Nov. 2	Apr. 29	May 4	June 20	—	Aug. 15		



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1956	May 10	May 14	Oct. 6	Oct. 17	Oct. 14	Oct. 24	Apr. 27	May 10	June 30	—	July 20	
1957	Apr. 27	Apr. 30	Sept. 28	Oct. 7	Oct. 10	Oct. 19	Apr. 2	Apr. 10	—	—	—	no fruiting
1958	May 8	May 13	Oct. 4	Oct. 15	Oct. 12	Oct. 30	Apr. 27	May 10	June 10	—	July 15	
1959	Apr. 24	Apr. 29	Sept. 15	Oct. 2	Sept. 28	Oct. 8	March 28	Apr. 9	—	—	—	no fruiting
1960	May 4	May 9	Sept. 16	Oct. 20	Oct. 12	Oct. 26	Apr. 14	Apr. 20	June 4	—	—	
1961	Apr. 13	Apr. 18	Oct. 5	Oct. 17	Oct. 11	Oct. 27	March 23	Apr. 14	—	—	—	no fruiting
1962	Apr. 18	Apr. 21	Oct. 18	Oct. 23	Oct. 22	Oct. 25	Apr. 16	Apr. 22	May 28	—	—	very poor fruiting
<i>Acer saccharinum</i> L.												
1953	Apr. 4	Apr. 14	Sept. 28	Oct. 17	Oct. 6	Oct. 21	March 23	—	—	—	—	flowers froze
1954	May 8	May 10	Oct. 5	Oct. 27	Oct. 17	Nov. 28	March 31	Apr. 12	May 23	June 10	June 15	
1955	May 1	May 4	Oct. 10	Oct. 30	Oct. 12	Nov. 17	Apr. 3	Apr. 13	June 3	—	June 25	
1956	May 3	May 9	Oct. 8	Oct. 24	Oct. 10	Nov. 22	Apr. 4	Apr. 18	—	—	—	no fruiting
1957	Apr. 25	Apr. 29	Oct. 7	—	Oct. 10	Nov. 12	March 22	Apr. 4	—	—	—	no fruiting
1958	May 6	May 11	Oct. 4	—	Oct. 18	Nov. 26	Apr. 5	Apr. 29	—	—	—	no fruiting
1959	Apr. 22	Apr. 27	Sept. 23	—	Oct. 8	Nov. 8	March 18	March 24	May 10	—	May 30	
1960	Apr. 27	May 6	Aug. 23	Oct. 28	Oct. 22	—	March 26	Apr. 2	—	—	—	no fruiting
1961	Apr. 15	Apr. 20	Oct. 7	Oct. 17	Oct. 11	—	March 7	March 20	—	—	—	no fruiting
1962	Apr. 16	Apr. 22	Oct. 11	Oct. 22	Oct. 17	Nov. 5	Apr. 8	Apr. 22	—	—	—	no fruiting
<i>Acer tataricum</i> L.												
1953	March 25	Apr. 10	Sept. 19	Oct. 17	Sept. 28	Oct. 22	May 12	May 28	Aug. 24	Sept. 10	Nov. 20	
1954	Apr. 30	May 6	Sept. 28	Oct. 23	Oct. 2	Oct. 29	May 26	June 14	Aug. 30	Sept. 15	Nov. 18	
1955	May 1	May 3	Oct. 10	Oct. 17	Oct. 15	Nov. 2	June 2	June 18	Oct. 3	Oct. 23	Nov. 29	
1956	May 2	May 9	Sept. 26	Oct. 16	Oct. 4	Oct. 22	May 30	June 17	Sept. 5	Sept. 24	Nov. 18	no flowering
1957	Apr. 6	Apr. 24	Sept. 26	Oct. 10	Oct. 8	Oct. 14	May 20	June 8	Aug. 20	—	Nov. 20	
1958	May 2	May 10	Sept. 18	Oct. 20	Sept. 27	Oct. 28	May 27	June 16	Aug. 26	—	Nov. 20	
1959	Apr. 4	Apr. 20	Sept. 14	Oct. 10	Oct. 4	Oct. 22	May 10	June 9	—	—	—	no fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1960	Apr. 12	May 4	Sept. 14	Oct. 18	Sept. 26	Nov. 3	May 22	June 12	Aug. 22	Sept. 20	—	no fruiting
1961	Apr. 4	Apr. 8	Sept. 20	Oct. 20	Oct. 2	Oct. 24	May 16	May 27	—	—	—	
1962	Apr. 12	Apr. 22	Sept. 14	Sept. 27	Sept. 24	Oct. 18	May 26	June 16	—	Sept. 15	—	
<i>Aesculus hippocastanum</i> L.												
1953	March 30	Apr. 4	Sept. 15	Oct. 22	Oct. 6	Nov. 2	May 2	May 25	—	—	—	no fruiting
1954	Apr. 30	May 3	Oct. 5	Oct. 10	Oct. 15	Nov. 5	May 19	June 11	Sept. 25	Oct. 10	Oct. 15	
1955	Apr. 28	May 1	Oct. 10	Oct. 27	Oct. 22	Nov. 2	May 17	June 8	Sept. 26	—	Oct. 13	
1956	Apr. 26	May 3	Sept. 28	Oct. 18	Oct. 18	Oct. 28	May 21	June 10	Sept. 24	—	Oct. 6	
1957	Apr. 5	Apr. 10	Oct. 5	Oct. 12	Oct. 10	Oct. 26	May 12	June 5	Sept. 20	—	Oct. 10	
1958	Apr. 26	May 2	Oct. 8	Oct. 18	Oct. 16	Nov. 5	May 19	June 2	Sept. 22	—	Oct. 12	
1959	Apr. 5	Apr. 15	Sept. 16	—	Oct. 4	Nov. 6	May 9	May 23	Sept. 20	—	Oct. 12	
1960	Apr. 12	Apr. 26	Sept. 20	Nov. 7	Oct. 16	—	May 12	June 8	—	—	Oct. 18	
1961	Apr. 4	Apr. 7	Oct. 2	Oct. 13	Oct. 9	Nov. 3	Apr. 24	May 31	Sept. 10	—	Sept. 17	
1962	Apr. 13	Apr. 16	Sept. 22	Oct. 17	Oct. 5	Nov. 5	May 8	June 6	Sept. 25	—	—	
<i>Aesculus parviflora</i> Walt.												
1953	Apr. 1	Apr. 16	Sept. 30	Oct. 26	Oct. 17	Nov. 6	July 6	Aug. 30	—	—	—	no fruiting
1954	May 4	May 9	Oct. 6	Oct. 26	Oct. 18	Nov. 12	July 17	Aug. 10	—	—	—	no fruiting
1955	Apr. 30	May 3	Oct. 20	—	Oct. 25	Nov. 17	July 28	Aug. 22	Oct. 25	—	Nov. 2	
1956	May 5	May 9	Oct. 14	—	Oct. 22	Nov. 8	July 30	Aug. 30	—	—	—	no fruiting
1957	Apr. 3	Apr. 27	Oct. 7	—	Oct. 12	Nov. 11	July 12	Aug. 3	—	—	—	no fruiting
1958	Apr. 29	May 11	Sept. 26	—	Oct. 16	Oct. 21	July 23	Aug. 26	—	—	—	no fruiting
1959	Apr. 8	Apr. 25	Oct. 8	—	Oct. 16	Oct. 30	July 16	Aug. 12	Oct. 4	—	Oct. 25*	
1960	Apr. 20	May 9	Sept. 6	Oct. 28	Oct. 22	Nov. 7	July 20	Aug. 22	—	—	—	fruits not developed
1961	Apr. 6	Apr. 14	Oct. 7	Oct. 25	Oct. 9	Oct. 29	July 15	Aug. 5	—	—	—	fruits not developed
1962	Apr. 15	Apr. 22	Sept. 27	Oct. 23	Oct. 9	Nov. 2	July 29	Aug. 20	—	—	—	no fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Aesculus pavia</i> L.												
1953	Apr. 3	Apr. 9	Sept. 19	Oct. 17	Oct. 2	Oct. 22	May 4	June 10	Sept. 19	Sept. 30	Oct. 6	
1954	May 1	May 4	Sept. 17	Oct. 17	Oct. 6	Oct. 27	May 24	June 19	Sept. 30	Oct. 4	—	
1955	Apr. 30	May 2	Sept. 28	Oct. 25	Oct. 10	Nov. 2	May 25	June 28	Oct. 1	Oct. 10	Oct. 13	
1956	May 6	May 8	Sept. 13	Oct. 14	Sept. 28	Oct. 24	May 31	June 18	Oct. 1	—	Oct. 9	
1957	Apr. 12	Apr. 18	Sept. 4	Oct. 12	Oct. 5	Oct. 19	May 18	June 14	Sept. 24	—	Sept. 30	
1958	May 2	May 7	Oct. 4	Oct. 18	Oct. 10	Oct. 25	May 24	June 18	Sept. 24	—	Oct. 11	
1959	Apr. 8	Apr. 15	Sept. 8	Oct. 16	Oct. 6	Oct. 26	May 10	June 10	Sept. 26	—	Oct. 9	
1960	Apr. 17	Apr. 26	Sept. 15	Oct. 16	Oct. 7	Nov. 3	May 18	June 13	Sept. 28	—	—	
1961	March 25	Apr. 3	Aug. 28	Oct. 9	Sept. 28	Oct. 25	May 4	June 3	Sept. 30	—	—	
1962	Apr. 16	Apr. 18	Aug. 25	Sept. 17	Sept. 11	Oct. 30	May 16	June 20	—	Oct. 8	—	
<i>Aesculus turbinata</i> Bl.												
1953	March 31	Apr. 12	Oct. 12	Oct. 22	Oct. 17	Nov. 16	May 16	—	—	—	—	flowers froze
1954	May 4	May 7	Oct. 12	Oct. 30	Oct. 20	Nov. 18	May 22	June 12	Sept. 24	Sept. 27	Sept. 29	
1955	Apr. 30	May 3	Oct. 15	Oct. 28	Oct. 28	Nov. 12	May 20	June 11	Sept. 29	—	Oct. 5	
1956	May 5	May 7	Sept. 27	Oct. 22	Oct. 22	Oct. 31	May 25	June 8	Sept. 20	—	Oct. 2	
1957	Apr. 17	Apr. 24	Sept. 26	Oct. 12	Oct. 12	Oct. 26	May 16	May 31	Sept. 18	—	Oct. 2	
1958	May 5	May 9	Oct. 2	Oct. 25	Oct. 20	Nov. 18	May 22	June 16	Sept. 15	—	Oct. 5	
1959	Apr. 2	Apr. 16	Oct. 10	Oct. 19	Oct. 19	Oct. 26	May 6	May 26	Sept. 15	—	Sept. 30	
1960	Apr. 19	Apr. 27	Oct. 12	Oct. 28	Oct. 26	Nov. 5	May 16	May 30	Sept. 20	—	—	
1961	Apr. 11	Apr. 13	Oct. 5	Oct. 18	Oct. 9	Nov. 10	Apr. 30	May 30	—	Sept. 26	—	
1962	Apr. 13	Apr. 18	Sept. 13	Oct. 22	Oct. 9	Nov. 5	May 10	June 14	—	Oct. 3	—	
<i>Ailanthus glandulosa</i> Desf.												
1953	May 20	May 26	Oct. 20	—	Oct. 22	Nov. 6	—	—	—	—	—	no flowering and fruiting
1954	May 16	May 24	Oct. 8	Oct. 20	Oct. 15	Oct. 23	July 3	July 20	Sept. 12	Oct. 30	Dec. 18	
1955	May 17	May 25	Oct. 15	—	Oct. 28	Nov. 2	July 7	July 20	Oct. 28	—	Nov. 10	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1956	May 24	May 30	Sept. 28	—	Oct. 26	Oct. 31	—	—	—	—	—	no flowering and fruiting
1957	May 16	May 22	Oct. 12	—	Oct. 17	Oct. 26	—	—	—	—	—	no flowering and fruiting
1958	May 18	May 26	Sept. 24	—	Sept. 30	Nov. 18	July 10	July 25	Oct. 28	—	—	
1959	May 6	May 11	Oct. 8	—	Oct. 10	Oct. 26	July 6	July 22	Sept. 28	Oct. 19	—	
1960	May 16	May 22	Oct. 12	—	Oct. 22	Nov. 7	July 18	Aug. 2	Oct. 20	—	—	
1961	Apr. 23	May 1	Oct. 5	Oct. 23	Oct. 27	Nov. 17	July 4	July 18	Sept. 22	—	—	
1962	Apr. 27	May 16	Sept. 13	—	Sept. 25	Nov. 21	—	—	—	—	—	no flowering and fruiting
<i>Berberis koreana</i>												
Palib.												
1953	Apr. 4	Apr. 7	Aug. 26	Sept. 20	Oct. 11	Oct. 26	May 12	May 26	—	—	—	no fruiting
1954	Apr. 26	May 1	Aug. 30	Oct. 2	Oct. 12	Oct. 28	May 25	June 4	Aug. 14	—	—	
1955	Apr. 22	Apr. 28	Oct. 6	Oct. 28	Oct. 22	Dec. 12	June 3	June 22	Sept. 7	Sept. 20	Sept. 29	
1956	Apr. 30	May 5	Sept. 20	Oct. 17	Oct. 5	Jan. 1	May 30	June 20	Aug. 30	Sept. 14	Nov. 6	
1957	March 16	March 28	Sept. 12	Oct. 3	Sept. 30	Nov. 13	May 20	June 3	Aug. 2	Aug. 29	Oct. 8	
1958	Apr. 4	Apr. 28	Sept. 12	Oct. 25	Oct. 23	Dec. 8	May 29	June 24	Aug. 20	Sept. 22	Oct. 24	
1959	March 25	Apr. 6	Sept. 20	Oct. 19	Oct. 8	Oct. 28	May 10	June 2	Aug. 20	Oct. 4	Nov. 4	
1960	Apr. 11	Apr. 20	Aug. 10	Oct. 10	Oct. 5	Nov. 10	May 21	June 6	Aug. 20	Sept. 28	—	
1961	March 12	March 22	Sept. 3	Oct. 22	Sept. 18	Nov. 20	May 1	May 31	Aug. 27	Sept. 8	—	
1962	Apr. 7	Apr. 11	Sept. 15	Oct. 23	Oct. 19	Oct. 31	May 30	June 17	Aug. 27	—	Oct. 18*	
<i>Berberis vulgaris</i> L.												
1953	Apr. 2	Apr. 7	Aug. 24	Oct. 14	Oct. 12	—	May 10	May 20	Aug. 16	Sept. 10	Oct. 2	
1954	Apr. 28	May 4	Aug. 30	—	—	—	May 14	May 28	July 20	—	—	
1955	Apr. 14	Apr. 28	Oct. 10	—	Nov. 17	Dec. 14	May 30	June 29	Sept. 5	Oct. 5	Oct. 28	fruits unripe
1956	Apr. 27	May 5	Oct. 7	—	Oct. 15	Dec. 28	June 29	July 8	Aug. 23	Sept. 17	—	
1957	March 29	Apr. 8	Oct. 2	Nov. 2	Oct. 6	Nov. 29	May 11	June 5	July 30	Sept. 7	Oct. 8	



Table 6 (continued)

1	2	3	4	5	6	7	7	8	9	10	11	13
1958	Apr. 9	May 4	Sept. 12	—	Oct. 21	Jan. 1	May 28	June 8	Aug. 28	—	Oct. 25	
1959	March 20	Apr. 2	Oct. 19	—	Oct. 26	Nov. 17	May 8	May 24	Aug. 28	Oct. 26	Nov. 20	
1960	Apr. 10	Apr. 17	Sept. 17	—	Oct. 5	Nov. 29	May 19	June 6	Aug. 22	Sept. 27	—	
1961	March 8	March 18	Sept. 21	—	Oct. 14	Nov. 30	May 2	May 25	Aug. 20	—	Oct. 14	
1962	Apr. 7	March 14	Sept. 19	Sept. 2	Sept. 21	Nov. 13	May 21	June 12	Aug. 28	—	—	
<i>Calycanthus floridus</i> L.												
1953	Apr. 7	Apr. 18	Sept. 16	Oct. 12	Oct. 14	—	May 2	May 29	—	—	—	no fruiting
1954	May 7	May 9	Sept. 20	Oct. 20	—	—	May 20	June 14	—	—	—	no fruiting
1955	May 6	May 11	Oct. 7	Oct. 29	Oct. 27	Dec. 3	May 15	Oct. 20	—	—	—	no fruiting
1956	May 6	May 12	Sept. 24	Oct. 18	Oct. 13	Nov. 30	May 28	Aug. 2	—	Nov. 6	Nov. 13	injured by frost
1957	Apr. 2	Apr. 8	Sept. 21	Oct. 16	Oct. 20	Nov. 4	May 22	Aug. 5	—	Oct. 29	Nov. 27	
1958	June 3	May 7	Sept. 29	—	Oct. 4	Nov. 14	May 21	Aug. 26	Oct. 12	—	Nov. 7	
1959	Apr. 3	Apr. 22	Oct. 4	Nov. 3	Oct. 30	Nov. 17	May 8	July 12	—	—	—	no fruiting
1960	Apr. 13	May 5	Aug. 20	Oct. 23	Sept. 27	Nov. 17	May 17	Aug. 2	Aug. 18	—	—	
1961	Apr. 1	Apr. 15	Sept. 12	Oct. 23	Sept. 25	Nov. 19	May 5	June 20	—	—	—	no fruiting
1962	Apr. 16	Apr. 22	Sept. 23	Oct. 26	Oct. 20	Nov. 26	May 16	Aug. 17	—	—	—	no fruiting
<i>Carpinus betulus</i> L.												
1953	March 27	Apr. 8	Sept. 18	Oct. 22	Sept. 26	Oct. 27	Apr. 13	Apr. 20	Aug. 20	Sept. 8	Oct. 6	
1954	Apr. 22	May 4	Oct. 2	Nov. 4	Oct. 8	Nov. 10	May 7	May 13	Oct. 2	Oct. 25	Nov. 8	
1955	Apr. 29	May 3	Oct. 12	Oct. 28	Oct. 20	Nov. 12	—	—	—	—	—	no flowering and fruiting
1956	Apr. 30	May 7	Sept. 24	Oct. 20	Oct. 8	Oct. 31	May 7	May 13	Oct. 8	—	Nov. 25	
1957	Apr. 3	Apr. 18	Sept. 6	Oct. 12	Oct. 5	Oct. 19	Apr. 24	Apr. 27	—	—	—	no fruiting
1958	Apr. 29	Apr. 8	Sept. 20	Oct. 25	Oct. 18	Nov. 3	May 8	May 12	Oct. 8	—	Nov. 20	
1959	Apr. 2	Apr. 15	Sept. 20	Oct. 12	Oct. 4	Oct. 20	Apr. 15	Apr. 24	—	—	—	no fruiting
1960	Apr. 12	Apr. 28	Sept. 8	Oct. 18	Oct. 7	Oct. 26	May 4	May 9	Sept. 20	—	—	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1961	March 28	Apr. 6	Sept. 25	Oct. 15	Oct. 9	Nov. 10	Apr. 8	Apr. 17	—	—	—	no fruiting
1962	Apr. 15	Apr. 18	Sept. 11	Oct. 20	Sept. 21	Nov. 21	—	—	—	—	—	no flowering and fruiting
<i>Carpinus japonica</i> Bl.												
1953	Apr. 4	Apr. 15	Oct. 12	Oct. 22	Oct. 20	Nov. 16	Apr. 17	—	—	—	—	flowers froze
1954	May 6	May 8	Oct. 23	Nov. 3	Oct. 28	Nov. 28	May 9	May 12	Aug. 30	Sept. 28	Oct. 25	
1955	May 1	May 5	Oct. 25	Nov. 12	Nov. 2	Nov. 29	May 9	May 14	Oct. 20	—	Nov. 5	
1956	May 15	May 18	Oct. 24	Oct. 31	Oct. 28	Nov. 25	—	—	—	—	—	no flowering and fruiting
1957	Apr. 7	Apr. 27	Oct. 10	Oct. 29	Oct. 17	Nov. 12	—	—	—	—	—	no flowering and fruiting
1958	May 6	May 14	Sept. 19	Oct. 25	Oct. 2	Nov. 21	May 10	May 14	Oct. 12	—	Nov. 27	
1959	Apr. 9	Apr. 20	Sept. 28	Oct. 19	Oct. 16	Nov. 12	Apr. 26	Apr. 29	Sept. 25	—	Oct. 17*	
1960	Apr. 21	May 9	Oct. 5	Oct. 28	Oct. 22	Nov. 7	May 4	Sept. 30	—	Sept. 30	Oct. 27	
1961	Apr. 9	Apr. 13	Oct. 7	Oct. 20	Oct. 10	Nov. 22	—	—	—	—	—	no flowering and fruiting
1962	Apr. 15	Apr. 21	Sept. 1	Oct. 22	Oct. 14	Oct. 28	Apr. 22	Apr. 30	—	Sept. 29	—	
<i>Carpinus orientalis</i> Mill.												
1953	Apr. 16	May 4	Sept. 15	—	Sept. 26	Oct. 22	Apr. 25	Apr. 30	—	—	—	no fruiting
1954	May 15	May 19	Sept. 27	Oct. 15	Oct. 30	Nov. 18	May 11	May 22	Oct. 13	Oct. 20	Nov. 28	
1955	May 5	May 15	Oct. 10	Nov. 10	Oct. 20	Nov. 12	May 12	May 17	Oct. 20	Nov. 17	Nov. 28	
1956	May 17	May 23	Sept. 27	Oct. 18	Oct. 14	Oct. 26	May 20	May 26	Oct. 12	—	Nov. 25	
1957	May 5	May 14	Oct. 8	—	Oct. 10	Nov. 19	Apr. 29	May 9	Oct. 10	—	Nov. 27	
1958	May 13	May 18	Sept. 12	—	Oct. 18	Nov. 21	May 12	May 17	Oct. 12	—	Nov. 28	
1959	Apr. 19	May 4	Sept. 16	Oct. 22	Oct. 6	Nov. 4	Apr. 25	Apr. 28	Oct. 16	Nov. 4	Nov. 4*	
1960	May 9	May 17	Sept. 20	Oct. 28	Oct. 22	Nov. 7	May 10	May 17	Oct. 22	—	Nov. 7	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	12	11	13	
<i>Carya cordiformis</i> K. Koch	1961	Apr. 7	Apr. 9	Oct. 7	Oct. 24	Oct. 9	Oct. 27	—	—	—	—	—	
	1962	Apr. 15	Apr. 19	Sept. 1	Oct. 22	Oct. 11	Oct. 29	Apr. 22	Apr. 29	—	Sept. 29	—	no flowering and fruiting
	1953	Apr. 14	Apr. 26	Sept. 19	Sept. 27	Sept. 19	Oct. 2	May 15	May 25	—	—	—	
	1954	May 6	May 11	Sept. 29	Oct. 2	Sept. 30	Oct. 19	May 26	June 5	Sept. 30	—	Nov. 22	no fruiting
	1955	May 5	May 15	Oct. 10	Oct. 18	Oct. 12	Oct. 25	—	—	—	—	—	
	1956	May 8	May 17	Sept. 24	Oct. 6	Oct. 4	Oct. 16	June 11	June 16	Oct. 2	—	Nov. 7	no flowering and fruiting
	1957	May 1	May 12	Sept. 26	Oct. 5	Oct. 5	Oct. 12	—	—	—	—	—	no flowering and fruiting
	1958	May 10	May 17	Sept. 30	Oct. 8	Oct. 10	Oct. 18	June 2	June 12	Sept. 30	—	Nov. 22	no flowering and fruiting
	1959	Apr. 16	May 4	Sept. 18	Oct. 10	Oct. 4	Oct. 18	June 2	June 14	Sept. 25	—	Oct. 23	
	1960	Apr. 29	May 12	Sept. 28	Oct. 20	Oct. 18	Oct. 28	June 8	June 16	Oct. 7	—	Nov. 3	
	1961	Apr. 8	Apr. 22	Sept. 28	Oct. 15	Oct. 7	Oct. 25	May 13	May 19	Oct. 26	—	—	
	1962	Apr. 13	Apr. 24	Sept. 17	Sept. 23	Sept. 23	Oct. 17	—	—	—	—	—	no flowering and fruiting
<i>Carya laciniosa</i> Loud.	1953	Apr. 1	Apr. 24	Sept. 28	Oct. 17	Oct. 17	Nov. 16	May 12	May 22	—	—	—	fruits eaten by squirrels
	1954	May 8	May 12	Oct. 6	Oct. 26	Oct. 26	Nov. 22	May 24	June 5	Sept. 30	—	—	fruits eaten by squirrels
	1955	May 8	May 11	Oct. 13	Nov. 2	Nov. 2	Nov. 26	May 23	June 3	Sept. 30	—	Oct. 25	
	1956	May 13	May 16	Oct. 8	Oct. 24	Oct. 26	Nov. 20	June 2	June 8	Oct. 8	—	Oct. 28	
	1957	May 5	May 17	Oct. 8	Oct. 19	Oct. 19	Nov. 30	May 29	June 8	Sept. 30	—	Oct. 23	
	1958	May 12	May 17	Oct. 16	Oct. 28	Nov. 3	Dec. 20	June 8	June 18	Sept. 28	—	Oct. 22	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1959	Apr. 28	May 4	Sept. 28	Oct. 19	Oct. 19	Nov. 18	May 16	May 5	—	—	—	no fruiting
1960	May 8	May 12	Oct. 7	Oct. 28	Oct. 20	—	May 28	June 9	July 11	—	Oct. 28	
1961	Apr. 17	Apr. 21	Oct. 6	Oct. 11	Oct. 15	Nov. 10	May 7	May 12	—	Oct. 3	—	
1962	Apr. 18	Apr. 28	Sept. 22	Oct. 15	Oct. 13	Nov. 11	May 18	May 30	—	Oct. 21	—	
<i>Castanea sativa</i>												
Mill.												
1953	Apr. 4	Apr. 18	Oct. 26	Oct. 26	Oct. 22	Nov. 12	—	—	—	—	—	no flowering and fruiting
1954	May 7	May 10	Oct. 5	—	Oct. 10	—	July 3	July 20	—	—	—	no fruiting
1955	May 1	May 4	Oct. 8	Nov. 12	Oct. 20	Nov. 20	July 10	July 30	Oct. 10	—	Oct. 25	
1956	May 8	May 13	Oct. 14	Oct. 25	Oct. 18	Oct. 30	—	—	—	—	—	no flowering and fruiting
1957	Apr. 30	May 4	Oct. 5	Oct. 19	Oct. 12	Oct. 29	—	—	—	—	—	no flowering and fruiting
1958	May 6	May 10	Oct. 14	Oct. 28	Oct. 18	Nov. 15	July 10	July 25	—	—	—	no fruiting
1959	Apr. 20	Apr. 26	Sept. 15	Oct. 19	Oct. 6	Nov. 10	June 18	July 26	—	—	—	no fruiting
1960	Apr. 29	May 9	Sept. 16	Oct. 20	Oct. 12	Nov. 7	June 28	July 26	—	—	—	no fruiting
1961	Apr. 12	Apr. 18	Oct. 5	Oct. 14	Oct. 7	Oct. 25	June 26	July 18	—	—	—	no fruiting
1962	Apr. 19	Apr. 22	Sept. 17	Oct. 13	Sept. 27	Oct. 30	July 17	—	—	—	—	no fruiting
<i>Cercidiphyllum</i>												
<i>japonicum</i> Sieb.												
1953	Apr. 1	Apr. 8	Sept. 19	Oct. 20	Sept. 26	Oct. 27	—	—	—	—	—	no flowering and fruiting
1954	Apr. 12	Apr. 30	Sept. 28	Oct. 12	Sept. 30	Oct. 18	—	—	—	—	—	no flowering and fruiting
1955	May 1	May 2	Oct. 10	Oct. 28	Oct. 13	Nov. 2	Apr. 26	May 9	Sept. 29	—	Oct. 27	
1956	Apr. 30	May 2	Sept. 24	Oct. 22	Oct. 8	Oct. 28	Apr. 28	May 14	Sept. 30	—	Nov. 9	
1957	March 27	Apr. 9	Sept. 26	Oct. 12	Oct. 10	Oct. 21	Apr. 4	Apr. 9	—	—	—	no fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1958	Apr. 29	May 6	Sept. 12	Oct. 20	Oct. 16	Nov. 5	—	—	—	—	—	no flowering and fruiting
1959	Apr. 2	Apr. 9	Sept. 15	Oct. 14	Oct. 15	Oct. 26	—	—	—	—	—	no flowering and fruiting
1960	Apr. 4	Apr. 20	Sept. 18	—	Oct. 2	Oct. 20	—	—	—	—	—	no flowering and fruiting
1961	Apr. 5	Apr. 8	Oct. 2	Oct. 17	Oct. 12	Oct. 27	Apr. 17	May 4	Oct. 25	—	—	no fruiting
1962	Apr. 5	Apr. 17	Sept. 13	Oct. 18	Sept. 24	Oct. 29	Apr. 27	May 2	—	—	—	
<i>Cladrastis tinctoria</i> Raf.												
1953	May 18	May 23	Sept. 15	Oct. 26	Oct. 17	Nov. 16	—	—	—	—	—	no flowering and fruiting
1954	May 6	May 11	Sept. 18	Oct. 26	Oct. 26	Nov. 18	June 14	June 27	—	—	—	no fruiting
1955	May 3	May 8	Sept. 22	Oct. 25	Oct. 10	Nov. 3	June 30	July 10	—	—	—	no fruiting
1956	May 7	May 11	Sept. 10	Oct. 22	Oct. 4	Oct. 28	June 14	June 30	—	—	—	no fruiting
1957	May 3	May 14	Sept. 6	Oct. 10	Sept. 26	Oct. 21	—	—	—	—	—	no flowering and fruiting
1958	May 6	May 17	Sept. 10	—	Sept. 17	Oct. 28	June 20	June 30	—	—	—	no fruiting
1959	Apr. 10	Apr. 29	Oct. 6	—	Oct. 16	Nov. 4	—	—	—	—	—	no flowering and fruiting
1960	Apr. 12	May 5	Sept. 9	—	Oct. 20	Nov. 3	—	—	—	—	—	no flowering and fruiting
1961	Apr. 4	Apr. 19	Sept. 30	—	—	Sept. 1	—	—	—	—	—	no flowering and fruiting
1962	Apr. 9	Apr. 20	Sept. 6	Oct. 11	Sept. 18	Oct. 21	Oct. 21	—	—	—	—	no flowering and fruiting
<i>Cornus alba</i> L.												
1953	March 28	Apr. 9	Sept. 2	Sept. 18	Oct. 1	Oct. 24	May 22	July 14	Aug. 14	Aug. 26	Sept. 6	
1954	Apr. 26	May 4	Sept. 4	—	Oct. 3	Oct. 26	June 2	June 16	Aug. 18	Aug. 28	—	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1955	Apr. 29	May 3	Oct. 1	Oct. 15	Oct. 5	Nov. 11	June 5	Oct. 6	July 18	—	Oct. 13	
1956	Apr. 30	May 6	Sept. 18	Oct. 12	Sept. 30	Dec. 20	June 1	Sept. 3	July 10	Aug. 28	Nov. 1	
1957	March 18	Apr. 11	Sept. 10	—	Sept. 23	Nov. 11	May 28	Oct. 23	Aug. 3	—	Oct. 23	
1958	May 3	May 8	Sept. 3	—	Sept. 30	Oct. 4	May 28	June 19	July 14	Aug. 6	Oct. 10	
1959	Apr. 4	Apr. 14	Sept. 28	—	Oct. 16	Nov. 12	May 15	June 10	June 30	—	July 30	
1960	Apr. 19	May 6	Aug. 12	Oct. 25	Oct. 21	Nov. 2	May 29	June 10	July 22	Sept. 3	—	
1961	March 18	March 30	Aug. 30	—	Sept. 18	Oct. 27	May 18	June 6	July 3	July 7	—	
1962	Apr. 17	Apr. 19	Sept. 17	Oct. 15	Oct. 9	Oct. 30	May 30	June 13	—	July 26	—	
<i>Cornus amomum</i> Mill.												
1953	Apr. 7	Apr. 9	Sept. 28	Oct. 10	Oct. 16	Nov. 14	—	—	—	—	—	no flowering and fruiting
1954	May 10	May 12	Sept. 30	Oct. 10	Oct. 12	—	May 23	June 2	July 7	—	—	
1955	Apr. 30	May 4	Oct. 5	Nov. 14	Oct. 27	Nov. 19	July 20	Aug. 8	Sept. 18	—	Oct. 6	
1956	Apr. 30	May 5	Sept. 30	—	Oct. 18	Dec. 22	May 31	June 17	Sept. 20	Oct. 3	Oct. 19	
1957	Apr. 1	Apr. 11	Sept. 25	Oct. 18	Oct. 8	Oct. 20	July 4	Aug. 30	Sept. 19	Oct. 12	Oct. 22	
1958	May 2	May 9	Sept. 16	Oct. 24	Oct. 8	Dec. 4	June 3	June 13	Sept. 10	—	Sept. 29*	
1959	March 26	Apr. 18	Sept. 23	—	Oct. 8	Nov. 15	May 16	July 18	Sept. 3	—	Sept. 14*	
1960	Apr. 16	Apr. 21	Sept. 11	—	Sept. 25	Nov. 7	May 31	June 13	July 3	Sept. 17	—	
1961	March 12	March 29	Sept. 17	Oct. 17	Oct. 23	Nov. 10	May 15	June 3	July 1	July 10	—	
1962	Apr. 12	Apr. 17	Sept. 23	Oct. 22	Oct. 3	Nov. 15	May 23	June 12	—	July 26	—	
<i>Cornus Hemsleyi</i> Schn. et Wang.												
1953	Apr. 7	Apr. 10	Oct. 6	Oct. 15	Oct. 20	Nov. 18	May 16	June 2	July 20	Aug. 19	Sept. 21	
1954	Apr. 29	May 3	Oct. 4	—	—	—	June 3	June 14	Aug. 2	—	—	
1955	Apr. 29	May 2	Oct. 12	Oct. 31	Oct. 25	Nov. 29	June 14	June 24	July 20	Aug. 16	Aug. 22	
1956	Apr. 27	May 6	Sept. 25	—	Oct. 8	Dec. 10	June 4	June 18	July 26	Aug. 2	Aug. 8	
1957	Apr. 2	Apr. 7	Sept. 20	Sept. 23	Oct. 5	Nov. 13	May 31	May 10	Aug. 28	Aug. 10	—	
1958	May 2	May 6	Sept. 19	Nov. 5	Oct. 2	Nov. 8	May 31	June 27	Aug. 20	—	Aug. 6*	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1959	March 25	Apr. 10	Oct. 8	—	Oct. 19	Nov. 20	May 18	June 9	July 11	—	July 30*	
1960	—	Apr. 20	Aug. 22	Nov. 2	Sept. 27	Nov. 21	May 31	June 17	June 28	—	—	
1961	Apr. 20	May 9	Sept. 16	Oct. 31	Oct. 23	Nov. 23	May 16	June 6	July 17	—	—	
1962	March 10	March 26	Oct. 5	Oct. 23	Oct. 24	Nov. 11	June 4	June 14	—	July 31	—	
<i>Cornus kousa</i> Hance												
1953	Apr. 8	Apr. 15	Sept. 4	Sept. 20	Oct. 2	Oct. 26	—	—	—	—	—	no flowering and fruiting
1954	May 3	May 8	Sept. 8	Sept. 20	Sept. 30	Oct. 18	—	—	—	—	—	no flowering and fruiting
1955	May 1	May 6	—	Oct. 13	Oct. 10	Nov. 4	—	—	—	—	—	no flowering and fruiting
1956	Apr. 30	May 7	Sept. 18	—	Oct. 10	Nov. 11	—	—	—	—	—	no flowering and fruiting
1957	Apr. 1	Apr. 12	Sept. 10	—	Oct. 4	Oct. 28	June 12	July 3	—	—	—	no fruiting
1958	Apr. 30	May 10	Sept. 12	Oct. 8	Sept. 21	Nov. 12	June 17	July 10	—	—	—	no fruiting
1959	Apr. 6	Apr. 14	Sept. 9	Oct. 16	Oct. 8	Nov. 20	July 16	July 2	—	—	—	no fruiting
1960	Apr. 16	May 5	Aug. 5	Oct. 15	Sept. 23	Oct. 29	June 28	July 11	—	—	—	no fruiting
1961	March 14	March 31	—	Sept. 5	Aug. 31	Oct. 12	—	—	—	—	—	no flowering and fruiting
1962	Apr. 12	Apr. 18	Oct. 3	Oct. 24	Oct. 7	Nov. 7	—	—	—	—	—	no flowering and fruiting
<i>Cornus mas</i> L.												
1953	Apr. 14	Apr. 18	Sept. 28	—	—	Nov. 2	March 24	Apr. 10	—	—	—	
1954	May 11	May 13	Sept. 18	—	—	—	March 31	May 9	Aug. 10	Aug. 26	—	no fruiting
1955	May 7	May 13	Oct. 3	Oct. 16	Oct. 30	Nov. 18	Apr. 27	May 5	Aug. 20	Sept. 5	Sept. 29	no fruiting
1956	May 7	May 16	Oct. 3	Oct. 21	Oct. 6	Dec. 2	Apr. 17	May 7	Aug. 30	Sept. 16	Oct. 28*	
1957	Apr. 1	Apr. 20	Sept. 24	Oct. 28	Oct. 4	Nov. 11	March 19	Apr. 19	—	—	—	no fruiting
1958	Apr. 30	May 10	Sept. 19	—	Oct. 9	Nov. 23	Apr. 16	May 9	Aug. 18	Sept. 20	—	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1959	Apr. 3	Apr. 25	Sept. 22	—	Oct. 26	Nov. 12	March 18	Apr. 20	July 28	—	Aug. 18*	
1960	Apr. 14	May 10	Sept. 17	Oct. 30	Oct. 29	Nov. 9	Apr. 11	May 5	Aug. 15	Sept. 20	—	
1961	March 22	March 26	Sept. 23	—	Sept. 29	Nov. 20	March 8	Apr. 11	Aug. 22	—	—	
1962	Apr. 11	Apr. 21	Oct. 5	—	Oct. 21	Nov. 21	Apr. 6	Apr. 27	Aug. 27	—	Sept. 6	
<i>Cornus officinalis</i> Sieb. et Zucc.												
1953	Apr. 19	Apr. 24	Sept. 2	Sept. 18	Sept. 28	Oct. 26	March 23	Apr. 14	Aug. 4	Sept. 10	—	
1954	May 12	May 14	Oct. 12	Oct. 4	Oct. 12	—	March 30	May 4	Aug. 12	—	—	
1955	Apr. 20	May 9	Oct. 8	Oct. 23	Oct. 22	Nov. 14	Apr. 20	May 4	Sept. 20	Oct. 9	Oct. 13	
1956	May 5	May 16	Sept. 17	Oct. 9	Oct. 10	Dec. 30	Apr. 16	May 7	Sept. 26	Oct. 15	Nov. 6	
1957	March 30	Apr. 25	Oct. 2	Oct. 16	Oct. 8	Oct. 29	March 16	Apr. 18	Sept. 15	Oct. 20	—	
1958	May 3	May 9	Sept. 12	Nov. 4	Oct. 29	Nov. 18	Apr. 14	May 7	Sept. 14	—	Nov. 19	
1959	March 26	Apr. 24	Oct. 8	Oct. 20	Oct. 28	Nov. 15	March 16	Apr. 14	Sept. 10	—	Oct. 7*	
1960	Apr. 26	May 6	Aug. 18	Nov. 4	Oct. 22	Nov. 29	Apr. 4	May 3	Sept. 19	Oct. 22	—	
1961	March 22	Apr. 8	Sept. 25	Nov. 1	Oct. 25	Nov. 12	March 11	Apr. 15	Apr. 15	—	Oct. 16	
1962	March 29	Apr. 21	Oct. 1	—	Oct. 21	Nov. 12	Apr. 5	Apr. 21	—	Oct. 3	Oct. 27	
<i>Cornus rugosa</i> Lam												
1953	Apr. 7	Apr. 9	Sept. 28	Oct. 10	Oct. 28	Oct. 20	—	—	—	—	—	no flowering and fruiting
1954	May 6	May 21	Sept. 30	Oct. 10	Oct. 4	Oct. 20	June 6	June 30	July 12	Aug. 10	Aug. 25	
1955	Apr. 30	May 5	Oct. 3	Oct. 15	Oct. 19	Nov. 14	June 27	July 10	Aug. 18	Aug. 24	Aug. 28	
1956	May 1	May 3	Sept. 19	Oct. 3	Sept. 28	Nov. 30	June 10	June 24	Aug. 18	Aug. 26	Sept. 3	
1957	Apr. 3	Apr. 10	Sept. 14	Oct. 8	Sept. 21	Oct. 18	June 7	June 21	July 29	—	—	
1958	May 1	May 8	Sept. 12	Sept. 20	Sept. 9	Oct. 21	June 20	July 1	Aug. 10	Aug. 22	Aug. 22*	
1959	Apr. 14	Apr. 22	Sept. 8	Oct. 8	Sept. 28	Nov. 5	May 10	June 20	July 27	—	Aug. 6*	
1960	Apr. 18	Apr. 23	Aug. 10	Sept. 24	Sept. 24	Oct. 8	June 18	June 29	Aug. 15	—	—	
1961	March 15	Apr. 9	Aug. 8	Sept. 27	Sept. 23	Oct. 11	June 10	June 18	Aug. 8	—	—	
1962	Apr. 14	Apr. 19	Aug. 29	Sept. 17	Sept. 13	Oct. 13	June 24	—	Aug. 15	Aug. 23	Aug. 30	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Cornus stolonifera</i> Michx.												
1953	Apr. 4	Apr. 16	Sept. 28	Oct. 16	Oct. 18	Nov. 2	May 15	June 4	July 16	July 23	Aug. 2	
1954	May 2	May 7	Oct. 3	Oct. 20	Oct. 16	Nov. 2	May 20	June 9	Aug. 22	—	—	
1955	May 1	May 3	Oct. 6	Oct. 26	Oct. 24	Nov. 5	June 3	Oct. 1	July 20	Sept. 5	Sept. 12	
1956	May 3	May 8	Sept. 22	Oct. 17	Oct. 1	Dec. 11	May 28	July 18	July 12	July 2	Oct. 9	
1957	March 30	Apr. 11	Sept. 17	Oct. 15	Sept. 28	Nov. 3	May 16	Aug. 29	June 26	Sept. 2	—	
1958	May 3	May 8	Sept. 16	—	Oct. 10	Nov. 5	June 28	Aug. 20	June 25	—	Nov. 5	
1959	Apr. 8	Apr. 16	Oct. 8	—	Oct. 16	Oct. 28	May 11	June 6	June 20	—	July 10*	
1960	Apr. 18	May 5	Sept. 19	Oct. 24	Oct. 7	Nov. 2	May 18	June 12	July 22	—	—	
1961	March 12	March 31	Sept. 15	—	Oct. 7	Oct. 29	May 12	June 3	July 3	—	July 8	
1962	Apr. 16	Apr. 19	Oct. 9	Oct. 17	Oct. 11	Oct. 24	June 3	June 13	—	—	July 27	
<i>Corylopsis platypetala</i> Rehd. et Wils.												
1953	May 12	May 28	Sept. 2	Oct. 14	Oct. 10	—	Apr. 2	Apr. 14	—	—	—	
1954	May 18	May 21	Sept. 4	—	—	—	Apr. 21	May 12	—	—	—	no fruiting
1955	May 3	May 6	Oct. 28	Nov. 7	Oct. 30	Feb. 29	Apr. 30	May 16	Sept. 25	—	Oct. 25	
1956	—	—	Sept. 25	—	—	—	—	—	—	—	—	no flowering and fruiting
1957	March 4	Apr. 19	Sept. 23	Nov. 2	Oct. 6	Nov. 29	—	—	—	—	—	no flowering and fruiting
1958	Apr. 28	May 9	Sept. 19	—	Oct. 9	Nov. 30	Apr. 22	May 12	Oct. 6	Oct. 23	—	
1959	March 15	Apr. 20	Oct. 8	—	Oct. 19	Nov. 25	Apr. 1	Apr. 27	—	—	—	no fruiting
1960	March 5	May 4	Aug. 18	Oct. 25	Oct. 4	Nov. 24	Apr. 16	May 10	—	—	—	no fruiting
1961	March 8	Apr. 4	Aug. 5	Oct. 16	Aug. 31	Nov. 28	March 22	Apr. 14	Oct. 6	Oct. 15	—	
1962	Apr. 10	Apr. 20	Sept. 5	—	Oct. 11	Nov. 13	Apr. 18	Apr. 28	—	—	—	very poor fruiting



Table 6 (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Cotoneaster horizontalis</i> Decne													
1953	Apr. 4	Apr. 7	Aug. 29	Oct. 10	—	—	May 6	June 1	June 29	Sept. 14	—	—	
1954	Apr. 16	Apr. 22	—	—	—	—	May 22	June 3	July 12	—	—	—	
1955	Apr. 22	Apr. 28	Oct. 7	Oct. 27	Oct. 30	Dec. 14	June 15	July 10	Sept. 3	Sept. 14	Oct. 18	—	
1956	May 30	June 18	—	—	Oct. 3	Nov. 12	—	—	—	—	—	—	no flowering and fruiting
1957	March 30	Apr. 8	June 25	Nov. 11	Oct. 1	—	June 3	June 21	—	—	—	—	no fruiting
1958	Apr. 12	Apr. 20	Oct. 10	—	Oct. 14	Jan. 2	June 3	July 1	June 29	Sept. 10	Dec. 12	—	
1959	March 20	March 26	Sept. 6	Oct. 19	Oct. 16	Dec. 27	May 14	June 14	July 20	Oct. 8	Nov. 30	—	
1960	Apr. 11	Apr. 19	Oct. 3	Oct. 13	Nov. 2	Nov. 29	June 6	June 17	Aug. 22	Sept. 29	—	—	
1961	March 12	March 17	Sept. 23	Oct. 27	Oct. 30	—	May 15	June 9	Aug. 2	Sept. 19	—	—	
1962	Apr. 7	Apr. 18	Sept. 9	Oct. 22	Sept. 23	Nov. 26	May 8	June 17	Aug. 20	—	Oct. 6	—	
<i>Cotoneaster obscura</i> Rehd. et Wils.													
1953	Apr. 4	Apr. 9	Sept. 14	Oct. 6	—	—	—	—	—	—	—	—	no flowering and fruiting
1954	Apr. 18	Apr. 26	Sept. 16	Oct. 31	Oct. 20	—	—	—	—	—	—	—	no flowering and fruiting
1955	Apr. 26	May 2	Oct. 30	—	Oct. 19	Dec. 10	July 1	July 24	Sept. 22	Oct. 13	Oct. 15	—	no flowering and fruiting
1956	May 1	May 6	—	—	—	Nov. 18	—	—	—	—	—	—	no flowering and fruiting
1957	Feb. 15	March 22	Oct. 2	Nov. 11	Oct. 30	Feb. 12	Apr. 26	Aug. 3	Aug. 15*	—	—	—	leaf shedding in 1958
1958	March 20	May 4	Sept. 20	—	Nov. 10	—	June 28	July 14	Sept. 19	—	Nov. 2	—	
1959	March 25	Apr. 8	Oct. 6	—	Oct. 26	Nov. 15	June 15	June 25	Sept. 10	—	Oct. 16*	—	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	
<i>Cotoneaster racemiflora</i> K. Koch	1960	Apr. 7	Apr. 14	Aug. 22	—	Oct. 17	Nov. 30	June 14	July 18	Sept. 3	Oct. 17	—	
	1961	March 11	March 21	Sept. 23	—	Nov. 7	—	June 7	June 30	Sept. 24	Oct. 26	—	
	1962	Apr. 13	Apr. 17	Oct. 5	Oct. 30	Oct. 11	Nov. 20	June 17	—	—	Oct. 6	—	
	1953	March 25	March 30	Sept. 9	Sept. 26	Oct. 16	—	May 4	May 20	July 4	Aug. 16*	—	
	1954	Apr. 16	Apr. 24	Sept. 12	—	—	—	May 26	June 4	July 12	Aug. 14	—	
	1955	Apr. 4	Apr. 28	Oct. 11	Oct. 31	Oct. 28	Nov. 18	May 20	June 15	July 20	Aug. 5	Aug. 22	
	1956	Apr. 12	Apr. 28	Sept. 24	Oct. 23	Oct. 20	Dec. 12	May 29	June 8	July 15	Sept. 10	Sept. 23	
	1957	Feb. 16	March 19	Sept. 22	Oct. 10	Oct. 5	Nov. 4	Apr. 29	May 31	—	—	—	no fruiting
	1958	March 28	Apr. 16	Oct. 6	Nov. 3	Oct. 18	—	May 17	June 23	July 1	—	Aug. 13*	
	1959	March 23	Apr. 10	Oct. 12	Oct. 20	Oct. 16	Oct. 30	May 5	May 22	June 28	—	Aug. 10	
	1960	Apr. 8	Apr. 18	Sept. 17	Oct. 28	Sept. 25	Nov. 2	May 20	June 3	July 20	Aug. 24	—	
	1961	March 7	March 15	Sept. 30	—	Oct. 17	Nov. 3	May 3	May 24	July 7	Aug. 2	—	
1962	Apr. 2	Apr. 13	Sept. 24	—	Oct. 7	Nov. 5	Apr. 12	June 6	—	Aug. 9	—		
<i>Elaeagnus angustifolia</i> L.	1953	Apr. 1	Apr. 16	—	—	Oct. 26	Nov. 18	—	—	—	—	no flowering and fruiting	
	1954	May 6	May 10	—	—	Oct. 26	Nov. 18	June 16	June 26	—	—	no fruiting	
	1955	May 1	May 2	Sept. 16	—	Sept. 2	Nov. 20	—	—	—	—	no flowering and fruiting	
	1956	May 7	May 9	—	—	Oct. 28	Nov. 24	June 19	July 8	—	—	no fruiting	
	1957	Apr. 8	Apr. 16	—	—	Oct. 19	Nov. 30	—	—	—	—	no flowering and fruiting	
	1958	May 6	May 10	Sept. 23	—	Oct. 28	Dec. 30	—	—	—	—	no flowering and fruiting	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	
<i>Elaeagnus multiflora</i> Thunb.	1959	Apr. 10	Apr. 22	Sept. 20	—	Oct. 28	Nov. 30	June 4	June 20	—	—	—	no fruiting
	1960	Apr. 19	May 4	—	—	Nov. 7	—	—	—	—	—	—	no flowering and fruiting
	1961	Apr. 5	Apr. 11	Oct. 17	Nov. 10	—	Dec. 5	—	—	—	—	—	no flowering and fruiting
	1962	Apr. 12	Apr. 20	Sept. 20	—	Oct. 7	Nov. 21	—	—	—	—	—	no flowering and fruiting
	1953	Apr. 4	Apr. 7	Oct. 6	—	Nov. 6	—	May 4	May 20	—	—	—	no fruiting
	1954	May 2	May 6	Oct. 9	—	—	—	May 28	June 12	—	—	—	no fruiting
	1955	Apr. 29	May 2	Oct. 7	—	Nov. 30	—	June 2	June 19	—	—	—	no fruiting
	1956	—	—	—	—	—	—	June 2	—	—	—	—	very much in- jured by frost
	1957	Apr. 2	Apr. 17	Sept. 22	Nov. 15	Oct. 14	—	May 20	June 4	—	—	—	no fruiting
	1958	Apr. 30	May 3	Sept. 12	Dec. 2	Nov. 13	Dec. 20	May 28	June 2	Aug. 1	—	Aug. 25*	
	1959	Apr. 1	Apr. 3	Sept. 15	—	Oct. 8	Nov. 25	May 7	May 30	July 26	—	Aug. 7*	
	1960	Apr. 15	Apr. 21	Aug. 15	Nov. 4	Sept. 25	Nov. 24	May 22	June 6	—	Aug. 18	—	
1961	March 20	March 27	Sept. 2	—	Sept. 18	—	May 8	May 21	—	—	—	no fruiting	
1962	Apr. 18	Apr. 27	Sept. 15	Nov. 5	Sept. 23	Dec. 26	June 2	June 14	—	—	—	no fruiting	
<i>Eucomia ulmoides</i> Oliv.	1953	Apr. 5	Apr. 18	Oct. 15	—	Oct. 20	—	—	—	—	—	—	no flowering and fruiting
	1954	May 2	May 6	—	—	—	—	—	—	—	—	—	no flowering and fruiting
	1955	Apr. 30	May 11	Oct. 27	—	Nov. 22	Dec. 10	—	—	—	—	—	no flowering and fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1956	May 11	May 22	—	—	Oct. 19	Nov. 23	—	—	—	—	—	no flowering and fruiting
1957	Apr. 18	May 5	Oct. 16	—	Oct. 12	Nov. 27	—	—	—	—	—	no flowering and fruiting
1958	Apr. 16	May 12	Sept. 15	—	Oct. 22	Nov. 24	—	—	—	—	—	no flowering and fruiting
1959	March 28	Apr. 25	Sept. 15	—	Oct. 6	Nov. 6	—	—	—	—	—	no flowering and fruiting
1960	Apr. 17	May 11	Aug. 10	Oct. 29	Sept. 25	Nov. 22	May 14	May 20	—	—	—	no fruiting
1961	March 19	Apr. 15	Sept. 11	Nov. 7	Sept. 17	Nov. 26	—	—	—	—	—	no flowering and fruiting
1962	Apr. 17	Apr. 22	Sept. 3	Oct. 26	Sept. 22	Nov. 21	—	—	—	—	—	no flowering and fruiting
<i>Evodia Danielii</i> Hemsl.												
1953	Apr. 30	May 18	Oct. 2	—	Oct. 16	Nov. 21	—	—	—	—	—	no flowering and fruiting
1954	May 8	May 13	Oct. 18	—	Oct. 25	Nov. 28	Aug. 27	Oct. 16	—	—	—	no fruiting
1955	May 5	May 14	Oct. 15	—	Oct. 28	Nov. 3	Sept. 3	Oct. 28	—	—	—	no fruiting
1956	May 10	May 17	Sept. 29	—	Oct. 16	Nov. 31	Sept. 3	Oct. 21	—	—	—	no fruiting
1957	Apr. 30	May 14	Sept. 8	—	Oct. 10	Nov. 5	Sept. 1	Oct. 12	—	—	—	no fruiting
1958	May 10	May 17	Sept. 18	—	Oct. 28	Nov. 28	Aug. 30	Oct. 12	—	—	—	no fruiting
1959	Apr. 20	Apr. 30	Oct. 8	Oct. 26	Oct. 8	Nov. 2	Aug. 30	Oct. 4	—	—	—	no fruiting
1960	Apr. 30	May 9	Oct. 7	Nov. 7	Oct. 28	Nov. 26	Aug. 9	—	—	—	—	no fruiting
1961	Apr. 14	Apr. 18	Oct. 9	Nov. 7	Oct. 15	Nov. 22	Aug. 20	Oct. 10	—	—	—	no fruiting
1962	Apr. 19	May 4	Oct. 9	—	Oct. 11	Nov. 21	Aug. 20	Oct. 19	—	—	—	no fruiting
<i>Evonymus alata</i> Sieb.												
1953	Apr. 2	Apr. 5	Aug. 28	—	Oct. 16	—	May 2	May 21	Aug. 18	Aug. 26	—	no fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1954	Apr. 26	May 2	Aug. 30	Oct. 12	Oct. 10	Oct. 18	May 14	May 26	—	—	—	no fruiting
1955	Apr. 30	May 4	Sept. 24	Oct. 2	Sept. 26	Oct. 15	May 18	June 15	Sept. 13	Sept. 20	Oct. 16	
1956	May 5	May 9	Sept. 15	Sept. 27	Sept. 23	Oct. 5	May 26	June 28	Aug. 30	Sept. 10	Sept. 14*	
1957	March 24	Apr. 1	Sept. 2	—	Sept. 18	Oct. 2	May 7	June 7	July 30	Aug. 24	Sept. 9	
1958	Apr. 20	May 2	Sept. 10	—	Oct. 6	Oct. 22	May 17	June 16	Aug. 26	Sept. 15	Sept. 19*	
1959	March 23	Apr. 3	Sept. 10	—	Sept. 23	Oct. 19	Apr. 28	May 30	Aug. 20	—	Oct. 4	
1960	Apr. 12	Apr. 27	Aug. 15	—	Oct. 2	Oct. 11	May 12	June 9	Sept. 19	—	Sept. 25	
1961	March 10	March 23	July 25	Aug. 8	Aug. 30	Sept. 21	Apr. 23	—	—	—	Aug. 26	
1962	Apr. 3	Apr. 16	Aug. 28	Sept. 23	Nov. 3	Nov. 11	May 6	June 3	Aug. 9	—	Sept. 6	
<i>Evonymus europaea</i> L.												
1953	March 29	Apr. 3	Sept. 28	Oct. 16	Oct. 10	Oct. 30	May 18	June 4	Aug. 16	Aug. 29	—	
1954	Apr. 30	May 3	Sept. 23	Oct. 26	Oct. 12	Nov. 2	June 2	Aug. 20	Aug. 14	Aug. 26	—	
1955	Apr. 9	May 1	Oct. 27	—	Oct. 31	Nov. 20	June 15	June 29	—	—	—	no fruiting
1956	Apr. 23	May 3	Oct. 3	—	Oct. 8	Dec. 3	June 4	June 20	—	—	—	no fruiting
1957	March 9	Apr. 2	Sept. 25	Oct. 21	Oct. 2	Nov. 10	May 25	June 4	Aug. 3	Sept. 28	Oct. 29	
1958	Apr. 4	May 4	Sept. 19	—	Oct. 24	Nov. 20	May 30	June 2	Aug. 19	Sept. 29	Oct. 11*	
1959	March 24	Apr. 8	Sept. 20	Nov. 4	Oct. 8	Nov. 17	May 18	June 14	Aug. 19	—	Oct. 8*	
1960	Apr. 12	Apr. 21	Aug. 22	Nov. 4	Sept. 25	Nov. 12	May 23	June 15	Sept. 3	—	—	
1961	March 12	March 22	Aug. 27	Oct. 25	Sept. 18	Oct. 30	May 18	June 12	Sept. 2	—	Oct. 5	
1962	Apr. 4	Apr. 15	Sept. 20	—	Oct. 26	Nov. 10	May 30	—	—	—	Oct. 15	
<i>Evonymus latifolia</i> Scop.												
1953	Apr. 5	Apr. 18	Sept. 2	—	—	—	May 6	June 4	July 28	Aug. 19	Sept. 10	
1954	Apr. 28	May 2	Sept. 4	—	—	—	May 22	June 12	—	—	—	no fruiting
1955	May 1	May 6	Sept. 30	Oct. 10	Oct. 2	Oct. 28	May 28	June 18	Aug. 26	Sept. 18	Sept. 27	
1956	May 3	May 8	Sept. 27	Oct. 19	Oct. 16	Nov. 12	May 30	June 13	Sept. 2	Sept. 17	Sept. 19*	
1957	March 28	Apr. 20	Sept. 5	Oct. 4	Sept. 30	Oct. 16	May 13	June 3	Aug. 2	Sept. 10	Oct. 2	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1958	Apr. 17	May 3	Sept. 5	Oct. 30	Sept. 20	Nov. 8	May 22	June 17	Sept. 5	Sept. 16	Sept. 19	
1959	Apr. 4	Apr. 15	Sept. 14	—	Oct. 4	Nov. 10	May 6	June 2	—	—	—	no fruiting
1960	Apr. 12	May 1	Aug. 10	—	Oct. 20	Nov. 10	May 23	June 8	Aug. 18	Sept. 23	—	
1961	March 25	Apr. 9	Aug. 28	Oct. 28	Sept. 24	Nov. 11	Apr. 28	May 25	—	Aug. 24	—	
1962	Apr. 2	Apr. 20	Sept. 3	—	—	Oct. 14	May 14	June 16	Aug. 27	Sept. 12	—	
<i>Evonymus ver-rucosa</i> Scop.												
1953	March 30	Apr. 6	Aug. 26	Sept. 10	Oct. 6	Oct. 28	May 14	June 14	June 24	—	—	
1954	May 2	May 6	Sept. 2	Sept. 30	Oct. 2	—	May 24	June 5	Aug. 17	—	—	
1955	Apr. 27	May 4	Oct. 3	Oct. 18	Oct. 8	Nov. 10	June 2	June 28	Aug. 20	—	Sept. 1	
1956	Apr. 17	May 6	Sept. 19	Oct. 17	Oct. 12	Nov. 21	May 30	June 25	Aug. 29	Sept. 17	Oct. 18	
1957	March 24	Apr. 8	Sept. 2	Oct. 8	Oct. 2	Oct. 24	May 18	June 23	July 28	Aug. 24	Oct. 16	
1958	Apr. 17	May 6	Oct. 2	Oct. 12	Oct. 4	Nov. 20	May 27	June 26	Aug. 26	Sept. 18	Sept. 27	
1959	March 25	Apr. 14	Sept. 10	Oct. 10	Sept. 23	Oct. 22	May 11	June 12	Aug. 20	—	Oct. 9	
1960	Apr. 11	May 1	Aug. 19	Sept. 29	Sept. 25	Oct. 27	May 23	June 18	Aug. 15	Sept. 22	—	
1961	March 25	Apr. 9	Aug. 28	Oct. 18	Sept. 24	Nov. 11	Apr. 28	May 25	—	Aug. 24	—	
1962	Apr. 2	Apr. 17	Aug. 30	Sept. 23	Sept. 29	Oct. 19	May 21	June 25	Aug. 28	Sept. 3	—	no fruiting
<i>Fagus grandifolia</i> Ehrh.												
1953	Apr. 10	May 2	Oct. 6	Oct. 22	Oct. 20	Nov. 16	—	—	—	—	—	no flowering and fruiting
1954	May 10	May 12	Oct. 10	Oct. 27	Oct. 20	Nov. 16	May 14	May 20	—	—	—	no fruiting
1955	May 7	May 12	Oct. 15	—	Oct. 25	Nov. 5	May 28	June 8	Oct. 10	Oct. 20	Oct. 26	
1956	May 10	May 15	Oct. 14	Oct. 24	Oct. 20	Oct. 31	May 17	May 26	Oct. 4	Oct. 12	Oct. 24	
1957	May 3	May 12	Oct. 8	Oct. 17	Oct. 17	Oct. 26	May 20	June 2	—	—	—	no fruiting
1958	May 10	May 15	Sept. 22	Oct. 28	Oct. 25	Dec. 2	May 17	May 21	—	—	—	very poor fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1954	Apr. 26	May 2	Aug. 30	Oct. 12	Oct. 10	Oct. 18	May 14	May 26	—	—	—	no fruiting
1955	Apr. 30	May 4	Sept. 24	Oct. 2	Sept. 26	Oct. 15	May 18	June 15	Sept. 13	Sept. 20	Oct. 16	
1956	May 5	May 9	Sept. 15	Sept. 27	Sept. 23	Oct. 5	May 26	June 28	Aug. 30	Sept. 10	Sept. 14*	
1957	March 24	Apr. 1	Sept. 2	—	Sept. 18	Oct. 2	May 7	June 7	July 30	Aug. 24	Sept. 9	
1958	Apr. 20	May 2	Sept. 10	—	Oct. 6	Oct. 22	May 17	June 16	Aug. 26	Sept. 15	Sept. 19*	
1959	March 23	Apr. 3	Sept. 10	—	Sept. 23	Oct. 19	Apr. 28	May 30	Aug. 20	—	Oct. 4	
1960	Apr. 12	Apr. 27	Aug. 15	—	Oct. 2	Oct. 11	May 12	June 9	Sept. 19	—	Sept. 25	
1961	March 10	March 23	July 25	Aug. 8	Aug. 30	Sept. 21	Apr. 23	—	—	—	Aug. 26	
1962	Apr. 3	Apr. 16	Aug. 28	Sept. 23	Nov. 3	Nov. 11	May 6	June 3	Aug. 9	—	Sept. 6	
<i>Evonymus eu-</i>												
<i>ropaea</i> L.												
1953	March 29	Apr. 3	Sept. 28	Oct. 16	Oct. 10	Oct. 30	May 18	June 4	Aug. 16	Aug. 29	—	
1954	Apr. 30	May 3	Sept. 23	Oct. 26	Oct. 12	Nov. 2	June 2	Aug. 20	Aug. 14	Aug. 26	—	
1955	Apr. 9	May 1	Oct. 27	—	Oct. 31	Nov. 20	June 15	June 29	—	—	—	no fruiting
1956	Apr. 23	May 3	Oct. 3	—	Oct. 8	Dec. 3	June 4	June 20	—	—	—	no fruiting
1957	March 9	Apr. 2	Sept. 25	Oct. 21	Oct. 2	Nov. 10	May 25	June 4	Aug. 3	Sept. 28	Oct. 29	
1958	Apr. 4	May 4	Sept. 19	—	Oct. 24	Nov. 20	May 30	June 2	Aug. 19	Sept. 29	Oct. 11*	
1959	March 24	Apr. 8	Sept. 20	Nov. 4	Oct. 8	Nov. 17	May 18	June 14	Aug. 19	—	Oct. 8*	
1960	Apr. 12	Apr. 21	Aug. 22	Nov. 4	Sept. 25	Nov. 12	May 23	June 15	Sept. 3	—	—	
1961	March 12	March 22	Aug. 27	Oct. 25	Sept. 18	Oct. 30	May 18	June 12	Sept. 2	—	Oct. 5	
1962	Apr. 4	Apr. 15	Sept. 20	—	Oct. 26	Nov. 10	May 30	—	—	—	Oct. 15	
<i>Evonymus la-</i>												
<i>tifolia</i> Scop.												
1953	Apr. 5	Apr. 18	Sept. 2	—	—	—	May 6	June 4	July 28	Aug. 19	Sept. 10	
1954	Apr. 28	May 2	Sept. 4	—	—	—	May 22	June 12	—	—	—	no fruiting
1955	May 1	May 6	Sept. 30	Oct. 10	Oct. 2	Oct. 28	May 28	June 18	Aug. 26	Sept. 18	Sept. 27	
1956	May 3	May 8	Sept. 27	Oct. 19	Oct. 16	Nov. 12	May 30	June 13	Sept. 2	Sept. 17	Sept. 19*	
1957	March 28	Apr. 20	Sept. 5	Oct. 4	Sept. 30	Oct. 16	May 13	June 3	Aug. 2	Sept. 10	Oct. 2	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1958	Apr. 17	May 3	Sept. 5	Oct. 30	Sept. 20	Nov. 8	May 22	June 17	Sept. 5	Sept. 16	Sept. 19	
1959	Apr. 4	Apr. 15	Sept. 14	—	Oct. 4	Nov. 10	May 6	June 2	—	—	—	no fruiting
1960	Apr. 12	May 1	Aug. 10	—	Oct. 20	Nov. 10	May 23	June 8	Aug. 18	Sept. 23	—	
1961	March 25	Apr. 9	Aug. 28	Oct. 28	Sept. 24	Nov. 11	Apr. 28	May 25	—	Aug. 24	—	
1962	Apr. 2	Apr. 20	Sept. 3	—	—	Oct. 14	May 14	June 16	Aug. 27	Sept. 12	—	
<i>Evonymus verucosa</i> Scop.												
1953	March 30	Apr. 6	Aug. 26	Sept. 10	Oct. 6	Oct. 28	May 14	June 14	June 24	—	—	
1954	May 2	May 6	Sept. 2	Sept. 30	Oct. 2	—	May 24	June 5	Aug. 17	—	—	
1955	Apr. 27	May 4	Oct. 3	Oct. 18	Oct. 8	Nov. 10	June 2	June 28	Aug. 20	—	Sept. 1	
1956	Apr. 17	May 6	Sept. 19	Oct. 17	Oct. 12	Nov. 21	May 30	June 25	Aug. 29	Sept. 17	Oct. 18	
1957	March 24	Apr. 8	Sept. 2	Oct. 8	Oct. 2	Oct. 24	May 18	June 23	July 28	Aug. 24	Oct. 16	
1958	Apr. 17	May 6	Oct. 2	Oct. 12	Oct. 4	Nov. 20	May 27	June 26	Aug. 26	Sept. 18	Sept. 27	
1959	March 25	Apr. 14	Sept. 10	Oct. 10	Sept. 23	Oct. 22	May 11	June 12	Aug. 20	—	Oct. 9	
1960	Apr. 11	May 1	Aug. 19	Sept. 29	Sept. 25	Oct. 27	May 23	June 18	Aug. 15	Sept. 22	—	
1961	March 25	Apr. 9	Aug. 28	Oct. 18	Sept. 24	Nov. 11	Apr. 28	May 25	—	Aug. 24	—	
1962	Apr. 2	Apr. 17	Aug. 30	Sept. 23	Sept. 29	Oct. 19	May 21	June 25	Aug. 28	Sept. 3	—	no fruiting
<i>Fagus grandifolia</i> Ehrh.												
1953	Apr. 10	May 2	Oct. 6	Oct. 22	Oct. 20	Nov. 16	—	—	—	—	—	no flowering and fruiting
1954	May 10	May 12	Oct. 10	Oct. 27	Oct. 20	Nov. 16	May 14	May 20	—	—	—	no fruiting
1955	May 7	May 12	Oct. 15	—	Oct. 25	Nov. 5	May 28	June 8	Oct. 10	Oct. 20	Oct. 26	
1956	May 10	May 15	Oct. 14	Oct. 24	Oct. 20	Oct. 31	May 17	May 26	Oct. 4	Oct. 12	Oct. 24	
1957	May 3	May 12	Oct. 8	Oct. 17	Oct. 17	Oct. 26	May 20	June 2	—	—	—	no fruiting
1958	May 10	May 15	Sept. 22	Oct. 28	Oct. 25	Dec. 2	May 17	May 21	—	—	—	very poor fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1959	Apr. 28	May 4	Oct. 8	Oct. 20	Oct. 17	Oct. 30	May 5	May 8	—	—	—	no fruiting
1960	Apr. 25	May 6	Oct. 6	Oct. 25	Oct. 20	Nov. 31	May 10	May 14	Aug. 9	—	—	
1961	Apr. 23	Apr. 29	—	Oct. 25	Oct. 5	Oct. 31	—	—	—	—	—	no flowering and fruiting
1962	Apr. 22	Apr. 26	Sept. 24	Oct. 21	Oct. 14	Nov. 3	—	—	—	—	—	no flowering and fruiting
<i>Fagus japonica</i>												
Maxim.												
1953	Apr. 10	Apr. 18	Oct. 2	Oct. 17	Oct. 6	Nov. 16	—	—	—	—	—	no flowering and fruiting
1954	May 8	May 10	Oct. 10	Oct. 27	Oct. 10	Nov. 22	—	—	—	—	—	no flowering and fruiting
1955	May 6	May 8	Oct. 15	Nov. 3	Oct. 28	Nov. 20	—	—	—	—	—	no flowering and fruiting
1956	May 8	May 13	Oct. 18	Oct. 27	Oct. 24	Nov. 22	—	—	—	—	—	no flowering and fruiting
1957	Apr. 30	May 3	Oct. 7	Oct. 23	Oct. 12	Nov. 30	—	—	—	—	—	no flowering and fruiting
1958	May 8	May 12	Sept. 14	Nov. 3	Oct. 28	Dec. 2	—	—	—	—	—	no flowering and fruiting
1959	Apr. 20	Apr. 27	Sept. 10	Oct. 19	Oct. 8	—	—	—	—	—	—	no flowering and fruiting
1960	Apr. 23	May 6	Sept. 28	Oct. 25	Oct. 18	Nov. 7	—	—	—	—	—	no flowering and fruiting
1961	Apr. 15	Apr. 19	Oct. 6	Oct. 20	—	Oct. 27	—	—	—	—	—	no flowering and fruiting
1962	Apr. 21	Apr. 22	Sept. 17	Oct. 19	Oct. 2	Oct. 31	—	—	—	—	—	no flowering and fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Fagus orientalis</i> Lipsky												
1953	Apr. 16	Apr. 18	Oct. 2	Oct. 10	Oct. 6	Oct. 29	—	—	—	—	—	no flowering and fruiting
1954	Apr. 27	May 4	Oct. 10	Oct. 27	Oct. 10	Oct. 16	May 8	May 15	—	—	—	no fruiting
1955	May 1	May 3	Oct. 8	Oct. 25	Oct. 15	Nov. 2	May 10	May 18	—	—	—	no fruiting
1956	May 4	May 7	Sept. 24	Oct. 17	Oct. 13	Oct. 28	May 12	May 24	—	—	—	no fruiting
1957	Apr. 26	Apr. 29	Sept. 26	Oct. 10	Oct. 5	Oct. 19	May 7	May 12	—	—	—	very poor fruiting
1958	May 2	May 6	Sept. 15	Oct. 18	Oct. 10	Nov. 4	May 10	May 17	—	—	—	very poor fruiting
1959	Apr. 16	Apr. 24	Sept. 10	Oct. 12	Oct. 6	Nov. 12	Apr. 27	Apr. 30	—	—	—	no fruiting
1960	Apr. 19	Apr. 25	Sept. 20	Oct. 14	Oct. 10	Nov. 3	May 6	May 10	—	—	—	no fruiting
1961	Apr. 13	Apr. 17	Sept. 30	Oct. 20	Oct. 8	Oct. 26	Apr. 25	Apr. 28	—	—	—	very poor fruiting
1962	Apr. 18	Apr. 21	Sept. 13	Oct. 13	Sept. 27	Oct. 29	Apr. 25	Apr. 30	—	—	—	very poor fruiting
<i>Fagus sylvatica</i> L.												
1953	Apr. 8	Apr. 23	Oct. 6	Oct. 26	Oct. 17	Nov. 20	Apr. 29	May 8	—	—	—	no fruiting
1954	Apr. 27	May 4	Oct. 4	Nov. 3	Oct. 25	Nov. 28	May 8	May 17	Aug. 28	—	Nov. 4	no fruiting
1955	May 1	May 4	Oct. 8	Nov. 3	Oct. 20	Nov. 25	—	—	—	—	—	no fruiting
1956	May 6	May 8	Oct. 14	Oct. 22	Oct. 18	Nov. 24	May 12	May 24	Aug. 25	—	Nov. 12	no flowering and fruiting
1957	Apr. 28	May 2	Sept. 26	Oct. 17	Oct. 5	Dec. 7	—	—	—	—	—	no flowering and fruiting
1958	May 5	May 8	Oct. 8	Oct. 28	Oct. 12	Dec. 10	May 12	May 18	Aug. 28	—	Oct. 30	no flowering and fruiting
1959	Apr. 26	Apr. 29	Sept. 8	Oct. 30	Oct. 8	Nov. 30	—	—	—	—	—	no flowering and fruiting
1960	Apr. 28	May 4	Sept. 28	Oct. 28	Oct. 12	—	May 9	May 13	Aug. 30	—	Oct. 26	no flowering and fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1961	Apr. 15	Apr. 17	Sept. 29	Oct. 19	Oct. 8	Dec. 2	—	—	—	—	—	no flowering and fruiting
1962	Apr. 22	Apr. 23	Sept. 21	Oct. 24	Sept. 27	Nov. 10	—	—	—	—	—	no flowering and fruiting
<i>Forsythia europaea</i> Deg. et Bald.												
1953	Apr. 16	Apr. 20	Oct. 6	—	Oct. 12	—	Apr. 7	Apr. 21	Aug. 24	—	—	
1954	May 10	May 15	—	—	—	—	May 7	May 18	—	—	—	
1955	May 1	May 3	Oct. 6	Nov. 10	Nov. 8	Dec. 20	May 2	May 18	Oct. 1	Oct. 15	Oct. 31	
1956	May 1	May 6	Oct. 14	—	Oct. 30	Nov. 28	May 7	May 27	—	—	—	no fruiting
1957	Apr. 8	Apr. 12	Oct. 8	Nov. 2	Sept. 28	Nov. 23	Apr. 11	May 11	—	—	—	no fruiting
1958	Apr. 16	May 6	Sept. 16	—	Nov. 4	Nov. 27	May 7	May 20	Sept. 27	—	Nov. 6*	
1959	March 25	Apr. 20	Sept. 23	—	Oct. 16	Nov. 20	Apr. 10	May 6	—	—	—	no fruiting
1960	Apr. 18	May 5	Oct. 24	Nov. 4	Nov. 4	Nov. 21	May 3	May 19	—	—	—	no fruiting
1961	March 16	Apr. 5	—	Oct. 17	Oct. 7	Nov. 23	Apr. 7	Apr. 27	—	—	—	
1962	Apr. 7	Apr. 17	Sept. 24	Oct. 26	Oct. 9	Nov. 16	Apr. 27	—	—	—	Oct. 29	
<i>Forsythia Giraldiana</i> Lingelsh.												
1953	Apr. 13	Apr. 17	—	—	—	—	March 31	Apr. 13	—	—	—	no fruiting
1954	Apr. 10	Apr. 12	—	—	—	—	May 6	May 22	—	—	—	no fruiting
1955	Apr. 29	May 8	Oct. 30	—	Oct. 28	Nov. 18	Apr. 27	May 4	Sept. 26	—	Oct. 22	
1956	May 2	May 8	Oct. 4	—	Oct. 6	Nov. 12	—	—	—	—	—	no flowering and fruiting
1957	March 19	Apr. 8	Oct. 4	Nov. 11	Oct. 14	—	March 20	Apr. 10	—	—	—	no fruiting
1958	Apr. 30	May 5	Sept. 14	—	Oct. 4	Dec. 15	Apr. 21	May 8	—	—	—	no fruiting
1959	Apr. 3	Apr. 10	Sept. 15	—	Oct. 16	Nov. 22	March 18	Apr. 13	—	—	—	no fruiting
1960	Apr. 15	May 2	Aug. 15	—	Oct. 28	Nov. 20	Apr. 13	May 5	—	Aug. 15	—	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1961	March 26	Apr. 6	Sept. 18	Nov. 5	Oct. 28	Nov. 21	March 17	Apr. 8	—	—	—	very poor fruiting
1962	Apr. 10	Apr. 14	Sept. 23	—	Oct. 7	Nov. 15	Apr. 14	Apr. 25	—	—	Oct. 20	very poor fruiting
<i>Forsythia ovata</i> Nakai												
1953	Apr. 7	Apr. 9	Sept. 15	Sept. 28	Oct. 6	Nov. 3	March 29	Apr. 18	—	—	—	no fruiting
1954	May 11	May 14	Sept. 18	—	—	—	Apr. 17	May 9	—	—	—	no fruiting
1955	Apr. 25	May 3	Oct. 10	Oct. 31	Nov. 2	Nov. 19	Apr. 28	May 8	Oct. 6	Oct. 22	Oct. 30	—
1956	May 3	May 7	Oct. 2	Nov. 12	Oct. 27	Dec. 11	Apr. 24	May 8	—	—	—	no fruiting
1957	Apr. 5	Apr. 13	Sept. 25	Oct. 8	Oct. 18	Nov. 5	March 17	Apr. 8	—	—	—	no fruiting
1958	May 5	May 11	Oct. 7	—	Oct. 2	Dec. 3	Apr. 28	May 13	—	—	—	no fruiting
1959	Apr. 4	Apr. 20	Oct. 4	—	Oct. 8	Oct. 19	March 27	Apr. 18	—	—	—	no fruiting
1960	Apr. 17	May 1	Aug. 22	Nov. 4	Nov. 1	Nov. 3	—	—	—	—	—	no flowering and fruiting
1961	March 13	March 23	Sept. 14	Oct. 14	Oct. 25	Nov. 5	March 17	Apr. 5	—	—	—	no fruiting
1962	Apr. 14	Apr. 17	Sept. 17	—	Oct. 9	Oct. 29	Apr. 17	Apr. 25	—	—	Oct. 30*	very poor fruiting
<i>Gleditsia triacanthos</i> L.												
1953	Apr. 27	May 4	Sept. 26	Oct. 20	Sept. 26	Oct. 29	June 2	June 18	Oct. 20	Nov. 21	Feb. 12	leaf shedding in 1954
1954	May 14	May 24	Oct. 15	—	Oct. 15	Nov. 16	June 15	June 26	Oct. 23	Nov. 22	—	—
1955	May 15	May 25	Oct. 15	—	Oct. 25	Nov. 17	June 28	July 12	Oct. 28	—	Feb. 26	leaf shedding in 1956
1956	May 18	May 25	Oct. 8	—	Oct. 16	Oct. 31	June 15	July 5	Oct. 26	—	—	—
1957	May 10	May 18	Oct. 10	Oct. 20	Oct. 12	Oct. 29	June 15	June 26	—	—	—	no fruiting
1958	May 17	May 24	Oct. 18	—	Oct. 20	Nov. 22	June 20	July 8	—	—	—	no fruiting
1959	May 8	May 14	Oct. 8	Oct. 22	Oct. 16	Nov. 4	June 4	June 20	—	—	—	no fruiting
1960	May 13	May 18	Oct. 12	Nov. 3	Oct. 28	—	June 10	June 24	—	—	—	no fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1961	Apr. 23	May 4	Oct. 7	—	Oct. 19	Nov. 12	June 16	June 22	—	—	—	poor fruiting
1962	Apr. 22	May 8	Oct. 5	Oct. 27	Oct. 5	Nov. 16	June 20	June 28	—	—	—	poor fruiting
<i>Gymnocladus canadensis</i> Lam.												
1953	May 12	May 16	Sept. 15	Oct. 10	Sept. 30	Oct. 17	May 16	—	—	—	—	no fruiting
1954	May 20	May 26	Oct. 2	Oct. 15	Oct. 10	Oct. 18	—	—	—	—	—	no flowering and fruiting
1955	May 25	June 7	Oct. 3	Oct. 25	Oct. 20	Nov. 2	—	—	—	—	—	no flowering and fruiting
1956	May 20	May 29	Sept. 27	Oct. 14	Oct. 8	Oct. 24	—	—	—	—	—	no flowering and fruiting
1957	May 15	May 25	Sept. 20	Oct. 10	Oct. 5	Oct. 19	—	—	—	—	—	no flowering and fruiting
1958	May 22	May 28	Sept. 28	Oct. 12	Oct. 6	Oct. 20	—	—	—	—	—	no flowering and fruiting
1959	May 7	May 13	Sept. 14	Oct. 8	Sept. 28	Oct. 26	—	—	—	—	—	no flowering and fruiting
1960	May 16	May 26	Sept. 14	Oct. 12	Oct. 4	Oct. 28	—	—	—	—	—	no flowering and fruiting
1961	Apr. 29	May 9	Sept. 20	—	Sept. 26	Oct. 17	—	—	—	—	—	no flowering and fruiting
1962	May 16	May 24	Sept. 23	Oct. 8	Sept. 29	Oct. 31	—	—	—	—	—	no flowering and fruiting
<i>Halesia tetra- raptera</i> Ellis.												
1953	Apr. 23	Apr. 28	Oct. 6	Oct. 20	Oct. 26	Nov. 4	May 4	May 22	Aug. 12	—	—	
1954	Apr. 30	May 2	Oct. 8	Oct. 18	Oct. 22	Nov. 3	May 16	June 3	Aug. 30	—	—	
1955	Apr. 28	May 9	Oct. 10	Oct. 31	Oct. 10	Dec. 6	May 24	June 17	Oct. 13	—	Nov. 18	
1956	May 4	May 19	Sept. 27	Nov. 12	Sept. 30	Jan. 2	May 26	June 11	Sept. 19	—	Nov. 12	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1957	Apr. 18	Apr. 29	Sept. 24	Oct. 24	Sept. 25	Nov. 29	May 1	June 3	—	—	—	
1958	Apr. 16	May 9	Oct. 6	Oct. 21	Oct. 20	Nov. 30	May 21	June 10	Nov. 4	Dec. 3	—	
1959	March 26	Apr. 18	Oct. 8	—	Oct. 19	Nov. 20	May 6	May 24	Oct. 4	—	—	
1960	Apr. 11	May 9	Sept. 17	Oct. 24	Sept. 27	Nov. 14	May 12	June 4	Aug. 22	Sept. 29	—	
1961	March 8	Apr. 15	Sept. 2	Oct. 18	Sept. 18	Nov. 17	Apr. 30	May 26	—	—	—	
1962	Apr. 16	Apr. 23	Sept. 11	Oct. 24	Sept. 21	Nov. 21	May 8	June 7	—	Dec. 3	—	
<i>Hamamelis mollis</i> Oliv.												
1953	Apr. 16	Apr. 28	Sept. 28	Oct. 12	—	Nov. 2	Feb. 24	March 20	—	—	—	no fruiting
1954	May 11	May 14	—	—	—	—	March 6	Apr. 14	—	—	—	no fruiting
1955	May 7	May 16	Nov. 6	Nov. 17	Nov. 15	Nov. 10	Jan. 28	Apr. 14	Oct. 15	—	Nov. 2	
1956	May 18	May 24	Oct. 29	Nov. 14	Nov. 4	—	Jan. 11	—	—	—	—	most flowers froze
1957	Apr. 16	May 3	Oct. 16	Nov. 11	Oct. 30	—	Jan. 16	March 25	Aug. 24	—	—	
1958	May 7	May 10	Sept. 29	Nov. 20	Oct. 6	—	Jan. 20	March 25	Oct. 6	—	Oct. 24*	
1959	Apr. 20	Apr. 30	Oct. 19	Nov. 3	Oct. 30	Nov. 25	Jan. 2	March 2-9	Oct. 6	—	Oct. 6*	
1960	Apr. 22	May 8	Sept. 19	Nov. 1	Oct. 25	—	Jan. 8	March 3	Aug. 18	Oct. 23	—	
1961	March 23	Apr. 30	Aug. 28	Nov. 7	Sept. 15	—	Jan. 5	March 23	—	Oct. 16	—	
1962	Apr. 17	Apr. 28	Oct. 5	Nov. 11	Nov. 5	Nov. 27	Jan. 15	Apr. 6	—	—	Nov. 8*	
<i>Hamamelis virginiana</i> L.												
1953	Apr. 16	Apr. 18	—	—	—	—	—	Oct. 20	—	—	—	
1954	May 14	May 18	—	—	Sept. 20	Oct. 4	Oct. 2	—	—	—	—	
1955	May 2	May 9	Sept. 19	Oct. 7	Oct. 5	Oct. 28	Oct. 12	Nov. 24	—	—	—	
1956	May 13	May 13	Sept. 16	Sept. 30	Sept. 24	Nov. 13	Sept. 27	Oct. 21	Sept. 29	—	Oct. 18	
1957	Apr. 20	Apr. 29	Nov. 12	Oct. 5	Sept. 17	Oct. 18	Sept. 25	Nov. 2	—	—	—	
1958	May 8	May 12	Sept. 10	—	Sept. 19	Oct. 28	Sept. 12	Dec. 4	—	—	—	no fruiting
1959	Apr. 20	Apr. 26	Sept. 4	—	Sept. 23	Oct. 19	Oct. 4	Dec. 12	—	—	—	no fruiting
1960	—	May 4	Aug. 15	Oct. 3	Sept. 25	Oct. 19	Oct. 6	—	Aug. 22	Sept. 29	—	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	
<i>Hydrangea petiolaris</i> S. et Z.	1961	March 18	Apr. 14	Sept. 8	Sept. 21	Oct. 27	Nov. 6	—	—	—	—	no flowering and fruiting	
	1962	Apr. 12	Apr. 21	Sept. 15	Oct. 11	Sept. 25	Oct. 24	Sept. 30	Nov. 20	—	—	Oct. 29*	
	1953	March 19	Apr. 2	Apr. 2	Sept. 28	Oct. 18	Oct. 22	—	—	—	—	no flowering and fruiting	
	1954	Apr. 20	Apr. 28	Oct. 2	—	—	—	May 22	June 4	Aug. 29	—	—	
	1954	Apr. 20	Apr. 28	Oct. 2	—	—	—	May 22	June 4	Aug. 29	—	—	
	1955	Apr. 25	Apr. 30	Oct. 20	Nov. 5	Nov. 2	Nov. 29	June 20	July 30	Nov. 16	—	Dec. 2	
	1956	Apr. 24	May 3	Oct. 16	Nov. 18	Oct. 26	Dec. 18	—	—	—	—	—	no flowering and fruiting
	1957	March 26	Apr. 7	Oct. 4	Oct. 22	Oct. 14	Nov. 13	June 7	Sept. 5	—	—	—	no flowering no fruiting
	1958	Apr. 9	Apr. 30	Oct. 5	—	Oct. 22	Nov. 30	June 16	June 30	—	—	—	no fruiting
	1959	—	—	—	—	—	—	—	—	—	—	—	no observa- tions
<i>Hydrangea radiata</i> Wald.	1960	Apr. 6	May 25	Sept. 25	Oct. 29	Oct. 20	Nov. 5	June 6	July 28	Aug. 13	—	—	
	1961	March 3	March 27	Sept. 29	Oct. 11	Oct. 25	Nov. 11	May 23	June 5	Oct. 5	—	—	
	1962	March 30	Apr. 16	Oct. 19	—	Oct. 22	Nov. 8	June 17	July 5	—	—	Oct. 23*	
	1953	Apr. 7	Apr. 9	Oct. 2	Oct. 16	Oct. 26	Nov. 20	June 24	July 20	—	—	—	no fruiting
	1954	May 2	May 6	—	—	—	—	June 30	July 20	Aug.	—	—	
	1955	Apr. 27	May 4	Oct. 7	Nov. 5	Nov. 3	Dec. 6	Aug. 30	Oct. 31	Nov. 2	—	Nov. 14	
	1956	May 3	May 7	Sept. 22	—	Oct. 14	Dec. 20	Aug. 1	Aug. 25	Oct. 30	—	Nov. 13*	
	1957	March 6	Apr. 1	Sept. 17	Oct. 20	Oct. 8	Nov. 18	July 8	Oct. 8	—	—	—	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1958	Apr. 11	May 3	Oct. 2	—	Oct. 12	Dec. 3	July 27	July 26	Oct. 20	—	Nov. 8*	
1959	March 25	Apr. 10	Oct. 8	—	Oct. 28	Nov. 28	July 10	Aug. 30	Sept. 25	Oct. 28	Nov. 12	
1960	Apr. 6	Apr. 18	Sept. 17	Oct. 30	Oct. 5	Nov. 24	June 29	July 19	—	Oct. 18	—	
1961	March 10	March 27	Sept. 27	Oct. 23	Oct. 14	Nov. 21	July 14	Aug. 7	Nov. 4	—	—	
1962	Apr. 1	Apr. 17	Oct. 8	Oct. 26	Oct. 26	Nov. 23	July 29	Sept. 3	—	Oct. 26	—	
<i>Hydrangea Sargentiana</i> Rehd.												
1953	May 24	June 16	—	—	Oct. 20	Nov. 7	Aug. 10	Aug. 14	—	—	—	
1954	May 22	May 24	—	—	—	—	Aug. 16	Sept. 20	—	—	—	
1955	May 4	May 9	Oct. 18	—	Oct. 20	Nov. 3	July 30	Aug. 30	Oct. 24	—	Nov. 10	
1956	May 2	May 7	Oct. 14	—	Oct. 11	Nov. 21	July 30	Sept. 4	Oct. 1	—	Nov. 13*	
1957	Apr. 28	May 2	Oct. 5	—	Oct. 8	Nov. 7	July 25	Aug. 20	Sept. 25	—	—	
1958	Apr. 23	May 3	Sept. 18	Oct. 3	Sept. 20	Nov. 19	July 28	Aug. 29	Oct. 12	—	Nov. 20*	
1959	March 25	Apr. 13	—	—	Oct. 18	Nov. 25	July 17	Sept. 6	Oct. 4	Oct. 28	Nov. 8	
1960	Apr. 14	May 4	Oct. 5	—	Oct. 8	Nov. 7	July 23	Sept. 20	—	Oct. 13	—	
1961	March 27	Apr. 10	Oct. 15	—	Oct. 23	Oct. 26	July 20	—	—	—	Nov. 3	
1962	Apr. 17	Apr. 24	Oct. 21	—	Oct. 23	Nov. 19	Aug. 11	—	—	—	—	very poor fruiting
<i>Hydrangea xanthoneura</i> Diels.												
1953	Apr. 2	Apr. 9	Aug. 26	Oct. 14	Oct. 6	—	June 4	July 16	—	—	—	no fruiting
1954	—	—	—	—	—	—	—	—	—	—	—	
1955	Apr. 25	May 5	Oct. 14	Oct. 28	Oct. 25	Nov. 30	June 25	July 22	Oct. 20	—	Nov. 8	
1956	Apr. 22	May 3	Sept. 18	Oct. 10	Sept. 30	Dec. 29	June 8	July 30	Oct. 11	—	Nov. 13	
1957	March 5	Apr. 6	Sept. 12	Oct. 6	Sept. 24	Oct. 22	—	—	—	—	—	no flowering and fruiting
1958	Feb. 14	May 3	Sept. 9	Oct. 6	Sept. 16	Nov. 16	June 24	July 12	Sept. 27	Oct. 11	Nov. 8	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1959	March 25	Apr. 13	Sept. 10	Oct. 28	Sept. 23	Nov. 19	June 9	July 1	Sept. 25	Oct. 30	Nov. 28	
1960	Apr. 8	May 2	Aug. 18	—	Sept. 27	Oct. 8	June 7	July 28	—	Oct. 10	—	
1961	March 11	Apr. 8	Aug. 27	Oct. 2	Aug. 31	Oct. 14	May 19	July 18	—	—	Nov. 3*	
1962	Apr. 2	Apr. 18	Sept. 27	Oct. 3	Oct. 1	Oct. 26	June 22	July 12	—	—	Nov. 7*	
<i>Juglans cinerea</i> L.												
1953	Apr. 8	Apr. 18	Sept. 19	Oct. 17	Oct. 6	Oct. 26	—	—	—	—	—	no flowering and fruiting
1954	May 6	May 10	Oct. 2	Oct. 27	Oct. 25	Nov. 5	May 21	May 30	Sept. 22	Oct. 18	Oct. 24	
1955	May 1	May 9	Oct. 10	Oct. 28	Oct. 25	Nov. 3	May 22	May 29	Sept. 30	—	Oct. 24	
1956	May 8	May 14	Sept. 24	Oct. 18	Oct. 8	Oct. 28	May 30	June 2	Oct. 2	—	Oct. 29	
1957	May 3	May 12	Sept. 8	Oct. 10	Oct. 12	Oct. 21	—	—	—	—	—	no flowering and fruiting
1958	May 7	May 13	Sept. 19	Oct. 27	Oct. 18	Nov. 15	May 26	June 2	Sept. 20	—	Oct. 25	
1959	Apr. 9	Apr. 24	Sept. 15	Oct. 19	Oct. 4	Oct. 30	May 6	May 10	—	—	—	no fruiting
1960	Apr. 28	May 9	Sept. 28	—	Oct. 7	Nov. 3	May 17	May 22	—	—	—	very poor fruiting
1961	Apr. 7	Apr. 14	Sept. 21	Oct. 18	Oct. 11	Oct. 25	Apr. 26	May 3	—	—	—	no fruiting
1962	Apr. 18	Apr. 22	Sept. 15	Oct. 16	Oct. 7	Nov. 7	May 13	May 20	—	—	Oct. 10	
<i>Juglans mandshurica</i> Maxim.												
1953	Apr. 9	Apr. 16	Sept. 8	Sept. 15	Sept. 15	Sept. 22	—	—	—	—	—	no flowering and fruiting
1954	May 6	May 8	Sept. 10	Sept. 20	Sept. 24	Oct. 2	June 2	June 8	Aug. 28	Sept. 18	Sept. 25	
1955	May 2	May 8	Sept. 14	Sept. 30	Sept. 28	Oct. 6	June 2	June 9	—	—	—	no fruiting
1956	May 8	May 14	Aug. 29	Sept. 10	Sept. 3	Sept. 20	—	—	—	—	—	no flowering and fruiting
1957	May 3	May 12	Sept. 4	Sept. 20	Sept. 16	Sept. 26	—	—	—	—	—	no flowering and fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1958	May 8	May 13	Sept. 8	Sept. 21	Sept. 12	Oct. 4	May 30	June 8	—	—	—	no fruiting
1959	Apr. 14	Apr. 24	Sept. 10	Sept. 18	Sept. 15	Sept. 23	May 11	May 15	—	—	—	no fruiting
1960	Apr. 18	May 3	Sept. 9	Sept. 20	Sept. 18	Sept. 24	May 26	May 30	—	—	—	fruits eaten by squirrels
1961	Apr. 3	Apr. 12	Sept. 6	Oct. 20	Sept. 18	Sept. 30	Apr. 27	May 7	—	—	—	no fruiting
1962	Apr. 16	Apr. 22	Sept. 1	—	Sept. 14	Sept. 26	May 26	May 30	—	—	—	no fruiting
<i>Juglans nigra</i> L.												
1953	Apr. 11	Apr. 20	Sept. 19	Oct. 17	Oct. 9	Oct. 27	May 23	May 27	Sept. 17	Sept. 28	Oct. 13	
1954	May 6	May 10	Sept. 18	Sept. 30	Sept. 27	Oct. 20	June 8	June 16	Sept. 22	Oct. 15	Oct. 20	
1955	May 4	May 10	Oct. 10	—	Oct. 20	Nov. 2	June 16	June 20	Sept. 22	—	Oct. 30	
1956	May 10	May 16	Sept. 29	—	Oct. 18	Oct. 30	June 18	June 25	Sept. 22	—	Oct. 28	
1957	Apr. 29	May 12	Sept. 26	Oct. 17	Oct. 7	Oct. 26	June 6	June 10	—	—	—	no fruiting
1958	May 10	May 15	Oct. 16	Oct. 25	Oct. 28	Nov. 15	June 8	June 14	Sept. 17	—	Oct. 28	
1959	Apr. 22	May 4	Oct. 4	Oct. 20	Oct. 16	Nov. 6	May 25	June 3	Oct. 2	—	Oct. 25	
1960	Apr. 29	May 12	Oct. 7	Oct. 26	Oct. 20	Nov. 5	May 30	June 6	Oct. 12	—	Nov. 3	
1961	Apr. 15	Apr. 19	Oct. 3	Oct. 25	Oct. 7	Nov. 10	Apr. 19	May 25	—	—	Nov. 3*	
1962	Apr. 18	Apr. 22	Sept. 13	Oct. 22	Sept. 23	Nov. 5	Apr. 22	—	—	—	—	very poor fruiting
<i>Juglans Sieboldiana</i> Maxim.												
1953	Apr. 11	Apr. 18	Oct. 2	Oct. 17	Oct. 20	Oct. 27	—	—	—	—	—	no flowering and fruiting
1954	May 6	May 8	Sept. 18	Sept. 25	Sept. 28	Oct. 22	May 21	May 28	Aug. 28	Sept. 18	Sept. 25	
1955	May 2	May 8	Oct. 8	Oct. 25	Oct. 20	Nov. 2	May 23	May 30	Aug. 28	—	Sept. 25	
1956	May 7	May 11	Sept. 29	Oct. 24	Oct. 10	Oct. 29	May 28	June 2	Aug. 25	—	Sept. 25	
1957	May 3	May 16	Sept. 6	Oct. 10	Oct. 10	Oct. 19	—	—	—	—	—	no flowering and fruiting
1958	May 6	May 13	Sept. 12	Oct. 16	Oct. 18	Nov. 3	May 26	June 3	—	—	—	very poor fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1959	Apr. 7	Apr. 20	Sept. 28	Oct. 17	Oct. 8	Oct. 28	May 7	May 12	—	—	—	no fruiting
1960	Apr. 14	May 6	Oct. 2	Oct. 20	Oct. 12	Oct. 28	May 19	May 24	—	—	—	very poor fruiting
1960												fruiting
1961	Apr. 4	Apr. 12	Oct. 2	Oct. 2	—	Oct. 18	Apr. 25	May 2	—	—	—	no fruiting
1962	Apr. 16	Apr. 22	Sept. 11	Oct. 23	Sept. 29	Nov. 3	May 2	May 14	—	—	Oct. 9	
<i>Kerria japonica</i>												
D. C.												
1953	Apr. 7	Apr. 15	Oct. 6	Nov. 10	—	—	May 6	June 26	—	—	—	no fruiting
1954	Apr. 26	Apr. 29	Oct. 2	—	—	—	May 18	Aug. 14	—	—	—	no fruiting
1955	Apr. 9	May 2	Oct. 3	—	Nov. 14	Dec. 20	May 10	July 18	—	—	—	no fruiting
1956	May 15	May 20	—	—	—	—	May 24	June 17	—	—	—	
1957	March 18	Apr. 4	Sept. 25	Oct. 28	Oct. 13	Jan. 21	Apr. 29	June 6	—	—	—	leaf shedding in 1958
1958	Apr. 5	Apr. 24	Sept. 16	Nov. 5	Oct. 10	Jan. 2	May 13	June 25	—	—	—	leaf shedding in 1959
1959	March 25	Apr. 16	Sept. 16	—	Oct. 8	Nov. 26	Apr. 22	May 28	—	—	—	no fruiting
1960	Apr. 15	May 6	Aug. 23	Oct. 28	Sept. 24	Nov. 27	May 16	July 1	—	—	—	no fruiting
1961	March 12	Apr. 3	Sept. 15	Oct. 27	Sept. 21	—	Apr. 20	June 7	—	—	—	no fruiting
1962	Apr. 4	Apr. 20	Sept. 7	—	Oct. 11	Nov. 23	May 30	Aug. 2	—	—	—	no fruiting
<i>Kolkwitzia amabilis</i>												
Graebn.												
1953	Apr. 6	Apr. 8	Oct. 26	Nov. 10	Nov. 6	—	—	—	—	—	—	no flowering and fruiting
1954	May 4	May 11	—	—	—	—	—	—	—	—	—	no flowering and fruiting
1955	Apr. 20	May 1	Oct. 5	Nov. 5	Oct. 22	Nov. 23	June 23	July 6	Aug. 10	Aug. 22	Aug. 30	
1956	—	—	—	—	—	—	—	—	—	—	—	strongly frozen



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1957	March 23	March 30	Oct. 4	—	Oct. 30	Nov. 29	—	—	—	—	—	no flowering and fruiting
1958	Apr. 13	Apr. 28	Sept. 8	—	Nov. 4	Dec. 3	—	—	—	—	—	and fruiting
1959	March 25	Apr. 1	Sept. 14	—	Oct. 26	Nov. 25	—	—	—	—	—	no flowering and fruiting
1960	Apr. 10	Apr. 16	Aug. 10	—	Oct. 11	Nov. 24	—	—	—	—	—	no flowering and fruiting
1961	March 9	March 22	Sept. 23	—	—	Nov. 15	—	—	—	—	—	no flowering and fruiting
1962	Apr. 8	Apr. 18	Aug. 23	—	Oct. 5	Nov. 15	—	—	—	—	—	no flowering and fruiting
<i>Lindera aestiva-</i> <i>lis</i> Nees												
1953	Apr. 20	May 4	Sept. 2	Sept. 28	Oct. 2	Oct. 21	Apr. 14	Apr. 24	—	—	—	no fruiting
1954	May 18	May 22	Sept. 16	Oct. 16	Oct. 14	—	May 7	May 28	—	—	—	no fruiting
1955	May 5	May 13	Oct. 7	Nov. 22	Oct. 10	Dec. 3	May 5	May 15	—	—	—	no fruiting
1956	May 5	May 20	Sept. 25	Oct. 18	Sept. 28	Nov. 1	May 11	May 27	—	—	—	no fruiting
1957	March 28	May 5	Sept. 20	Oct. 12	Sept. 25	Oct. 22	Apr. 6	May 28	Aug. 24	—	—	
1958	Apr. 16	May 13	Sept. 10	Oct. 12	Sept. 26	Nov. 13	May 6	June 2	—	—	—	no fruiting
1959	March 29	Apr. 30	Sept. 21	Sept. 28	Oct. 8	Nov. 3	Apr. 13	May 10	—	—	—	no fruiting
1960	Apr. 12	May 12	Aug. 18	—	—	Oct. 28	May 14	May 26	—	—	—	no fruiting
1961	March 14	Apr. 16	Sept. 23	Oct. 16	Sept. 27	Oct. 25	Apr. 10	Apr. 19	—	—	—	no fruiting
1962	Apr. 11	Apr. 23	Sept. 22	Oct. 26	Oct. 3	Nov. 9	May 2	May 19	—	—	—	no fruiting
<i>Liriodendron</i> <i>tulipifera</i> L.												
1953	Apr. 4	Apr. 11	Sept. 15	Oct. 6	Sept. 30	Oct. 22	June 2	June 29	Sept. 10	—	Nov. 3	
1954	May 1	May 6	Sept. 18	Oct. 4	Oct. 6	Nov. 18	June 22	July 17	Sept. 18	—	Oct. 30	
1955	May 1	May 5	Sept. 28	Oct. 17	Oct. 13	Nov. 2	June 20	July 26	Sept. 28	—	Nov. 25	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1956	May 6	May 13	Sept. 24	Oct. 14	Oct. 6	Oct. 27	June 14	July 30	Sept. 28	—	Nov. 28	
1957	Apr. 3	Apr. 12	Sept. 28	Oct. 10	Oct. 5	Oct. 26	June 10	July 12	Sept. 25	—	Nov. 19	
1958	Apr. 26	May 8	Sept. 28	Oct. 18	Oct. 8	Nov. 18	June 20	July 23	Oct. 1	—	Nov. 25	
1959	Apr. 10	Apr. 20	Sept. 4	Oct. 10	Oct. 8	Oct. 26	June 3	June 30	Sept. 23	—	Nov. 30	
1960	Apr. 22	May 7	Sept. 16	Oct. 18	Oct. 12	Nov. 12	June 8	July 12	Oct. 7	—	—	
1961	Apr. 8	Apr. 12	Oct. 2	Oct. 19	Oct. 7	Oct. 28	June 6	June 28	—	—	Nov. 10*	
1962	Apr. 14	Apr. 21	Sept. 3	Oct. 11	Sept. 20	Oct. 30	June 13	July 3	—	—	Nov. 8	
<i>Lonicera alpi-</i>												
<i>gena L.</i>												
1953	March 31	Apr. 2	Sept. 18	Oct. 14	Oct. 12	Nov. 10	Apr. 26	May 14	July 12	—	—	
1954	Apr. 22	May 4	—	—	—	—	May 20	June 4	July 20	July 28	—	
1955	Apr. 8	Apr. 23	Oct. 26	—	—	Nov. 2	May 16	June 11	July 12	July 12	Aug. 2	
1956	Apr. 17	Apr. 29	Oct. 2	—	Oct. 20	Nov. 28	May 13	May 30	Aug. 1	Aug. 22	Aug. 30	
1957	March 18	Apr. 9	Sept. 28	Oct. 18	Oct. 8	Nov. 2	May 2	May 22	July 13	Aug. 18	—	
1958	Apr. 8	Apr. 29	Sept. 14	—	Oct. 19	Nov. 29	May 16	May 30	July 28	Aug. 26	Nov. 2	
1959	March 23	Apr. 3	Sept. 16	Nov. 4	Oct. 8	Nov. 17	Apr. 22	May 18	July 17	—	July 29*	
1960	March 3	Apr. 16	Aug. 23	Oct. 14	Sept. 24	Oct. 19	May 11	May 20	July 17	Aug. 23	—	
1961	March 6	March 21	Sept. 3	—	Sept. 25	Nov. 10	Apr. 20	May 9	July 14	—	—	
1962	Apr. 1	Apr. 20	Oct. 2	Oct. 25	Oct. 23	Nov. 11	May 9	May 24	Aug. 7	Aug. 16	—	
<i>Lonicera coerulea L.</i>												
1953	March 9	March 28	Sept. 6	Sept. 28	Oct. 6	Oct. 28	Apr. 8	Apr. 20	—	—	—	no fruiting
1954	Apr. 12	Apr. 22	Sept. 9	—	—	—	Apr. 20	May 10	July 24	Aug. 17	—	
1955	Apr. 5	Apr. 14	Sept. 28	—	—	Oct. 15	May 2	May 16	June 20	July 5	July 13	
1956	Apr. 10	Apr. 16	Sept. 15	Oct. 6	Sept. 20	Nov. 19	May 9	May 22	June 13	—	July 3	
1957	Feb. 7	Feb. 17	Sept. 12	Oct. 2	Sept. 22	Oct. 22	Apr. 3	Apr. 30	June 8	—	June 25*	
1958	Feb. 13	Apr. 14	Aug. 31	Oct. 9	Oct. 1	Nov. 5	May 2	May 13	June 10	June 20	July 2	
1959	March 20	Apr. 1	Sept. 4	Oct. 8	Oct. 6	Nov. 12	Apr. 10	Apr. 25	May 26	—	June 8*	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	
<i>Lonicera iberica</i> Bieb.	1960	March 23	Apr. 4	Sept. 9	—	Sept. 23	Oct. 24	Apr. 26	May 13	June 11	—	—	
	1961	March 5	March 7	Aug. 30	Oct. 2	Sept. 21	Oct. 19	Apr. 10	Apr. 18	May 23	June 2	—	
	1962	March 27	Apr. 6	Sept. 3	Oct. 18	Sept. 17	Oct. 26	Apr. 22	May 4	June 21	—	July 16*	
	1953	Apr. 2	Apr. 4	—	—	—	—	—	—	—	—	—	
	1954	May 3	May 6	Sept. 12	—	—	—	May 4	May 18	Aug. 17	Sept. 4	Sept. 14	
	1955	Apr. 26	May 2	Nov. 7	—	—	Nov. 25	July 2	July 21	Sept. 1	Sept. 10	Oct. 3	
	1956	May 5	May 9	Nov. 1	—	Nov. 8	Dec. 1	June 25	July 16	Aug. 28	Sept. 20	Oct. 19	fruits fall down rather inefficiently
	1957	March 29	Apr. 4	Sept. 24	—	Oct. 16	—	June 11	July 2	Aug. 2	—	Aug. 24	
	1958	Apr. 23	May 2	Sept. 8	Dec. 4	Nov. 21	—	June 19	July 14	Aug. 20	—	Sept. 19*	
	1959	Apr. 3	Apr. 13	Sept. 23	Nov. 2	Nov. 25	—	June 3	June 23	Aug. 2	—	Sept. 18*	
<i>Lonicera Maackii</i> Maxim.	1960	Apr. 10	May 1	Aug. 18	Nov. 20	Oct. 23	Nov. 29	June 12	June 29	Aug. 10	—	—	
	1961	March 15	Apr. 4	Aug. 31	Sept. 13	Sept. 16	Nov. 28	June 12	June 24	Aug. 8	—	Aug. 21	
	1962	Apr. 16	Apr. 23	—	Sept. 9	—	Oct. 18	June 17	—	—	—	—	no fruiting
	1953	March 26	Apr. 1	Sept. 16	Oct. 6	—	—	—	—	—	—	—	no flowering and fruiting
	1954	Apr. 20	Apr. 26	Sept. 12	—	—	—	May 24	June 18	July 14	—	—	very poor fruiting
	1955	Apr. 8	Apr. 22	Sept. 30	Oct. 12	Oct. 2	Oct. 25	June 7	June 25	Aug. 2	Sept. 15	Oct. 3	
	1956	May 3	May 8	Sept. 22	Oct. 5	Sept. 28	Nov. 2	June 1	June 27	—	—	—	no fruiting
	1957	Feb. 15	March 19	Sept. 18	Oct. 2	Sept. 20	Oct. 14	May 19	June 8	July 29	Aug. 30	—	—
	1958	Feb. 15	Apr. 20	Sept. 12	Oct. 10	Oct. 7	Nov. 30	May 31	June 15	Aug. 14	Sept. 5	—	—
	1959	March 23	Apr. 3	Sept. 10	Oct. 8	Sept. 23	Oct. 22	May 13	June 9	July 29	—	Sept. 7*	—



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	
<i>Lonicera Maximowiczii</i> Reg.	1960	March 28	Apr. 10	Aug. 19	Oct. 3	Sept. 13	Oct. 17	May 23	June 9	Aug. 10	Sept. 13	—	
	1961	March 8	March 12	Aug. 31	Sept. 27	Sept. 2	Oct. 24	May 9	June 1	Aug. 8	Aug. 28	—	
	1962	March 30	Apr. 12	Aug. 27	Sept. 26	Sept. 3	Oct. 18	May 10	June 15	—	—	Aug. 10*	
	1953	Apr. 2	Apr. 4	Sept. 14	Oct. 2	Oct. 6	Oct. 20	May 11	May 27	—	—	—	no fruiting
	1954	Apr. 21	Apr. 26	Sept. 12	—	—	—	May 18	June 3	Aug.	Sept. 2	—	—
	1955	Apr. 14	Apr. 26	Sept. 28	—	Sept. 30	Oct. 12	June 7	June 22	July 26	Aug. 10	Aug. 24	—
	1956	Apr. 25	Apr. 30	Sept. 24	Oct. 14	Oct. 9	Oct. 22	June 3	June 10	Aug. 2	Aug. 24	Sept. 3	—
	1957	March 18	March 29	Sept. 18	—	Sept. 30	Oct. 14	May 18	June 2	July 25	Aug. 2	—	—
	1958	Apr. 22	Apr. 30	Sept. 12	Nov. 9	Oct. 8	Nov. 26	May 28	June 16	July 25	—	Aug. 5*	—
	1959	March 26	Apr. 2	Sept. 20	Oct. 8	Oct. 16	Nov. 20	May 10	May 27	July 8	—	July 15*	—
<i>Lonicera tatarica</i> L.	1960	Apr. 10	Apr. 16	Aug. 20	Oct. 6	Oct. 4	Oct. 16	May 22	June 6	July 27	Aug. 18	—	
	1961	March 12	March 24	Sept. 3	Sept. 27	Sept. 25	May 5	Oct. 13	May 26	July 7	—	Aug. 8	
	1962	Apr. 12	Apr. 16	Aug. 29	—	Sept. 19	Oct. 10	June 2	June 16	—	July 25	—	
	1953	March 28	Apr. 1	Sept. 6	Sept. 14	Sept. 22	Oct. 10	May 4	June 21	—	—	—	no fruiting
	1954	Apr. 20	Apr. 27	Sept. 4	—	Sept. 26	Oct. 4	May 27	June 2	—	—	—	no fruiting
	1955	Apr. 14	Apr. 23	Sept. 28	—	Oct. 13	—	May 23	June 18	July 2	July 14	Aug. 2	—
	1956	Apr. 14	Apr. 28	Sept. 29	—	Oct. 1	Dec. 11	May 29	June 16	July 17	Aug. 22	Aug. 30	—
	1957	Feb. 13	March 16	—	—	Sept. 25	Oct. 22	May 10	May 31	June 26	Aug. 2	—	—
	1958	March 29	Apr. 18	Sept. 16	—	Sept. 19	Dec. 4	May 22	June 11	July 13	Aug. 9	Aug. 11	—
	1959	March 18	Apr. 2	Sept. 14	—	Oct. 8	Oct. 22	May 5	May 26	June 27	—	July 29	—
1960	March 23	Apr. 4	Aug. 22	—	Oct. 3	Oct. 30	May 16	June 3	July 5	—	July 19	—	
1961	Feb. 21	March 4	Sept. 8	Oct. 25	Sept. 25	Oct. 29	Apr. 25	May 27	June 21	—	—	—	
1962	March 30	Apr. 4	Aug. 28	Oct. 9	Sept. 1	Oct. 25	May 9	June 10	—	—	July 31*	—	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Lonicera thibetica</i> Bur. et Franch.												
1953	March 31	Apr. 2	—	—	—	—	—	—	—	—	—	no flowering and fruiting
1954	Apr. 20	Apr. 26	Oct. 4	—	—	—	—	—	—	—	—	no flowering and fruiting
1955	Apr. 8	Apr. 23	—	—	Oct. 16	Dec. 2	May 24	June 14	July 2	July 18	July 26	
1956	Apr. 21	May 1	Oct. 6	—	Nov. 21	Dec. 18	—	—	—	—	—	no flowering and fruiting
1957	—	March 12	Sept. 21	Nov. 15	Sept. 28	—	May 7	July 30	July 3	July 13	—	
1958	Feb. 15	Apr. 14	Sept. 14	Dec. 4	Oct. 23	—	May 17	May 30	July 10	—	July 21*	
1959	March 23	Apr. 1	Sept. 10	—	Oct. 4	Nov. 20	Apr. 26	May 22	June 20	—	June 27*	
1960	March 28	Apr. 4	Aug. 18	Nov. 17	Oct. 12	Dec. 2	—	—	—	—	—	no flowering and fruiting
1961	Feb. 25	March 3	May 27	—	Aug. 30	—	Apr. 25	May 24	—	—	—	no fruiting
1962	Apr. 2	Apr. 8	Aug. 27	—	Sept. 3	Nov. 23	—	—	—	—	—	no flowering and fruiting
<i>Lonicera xylosteum</i> L.												
1953	March 30	Apr. 1	Sept. 10	Sept. 30	Oct. 16	Oct. 26	May 8	May 20	—	—	—	no fruiting
1954	Apr. 24	Apr. 28	Sept. 12	—	—	—	May 18	May 31	—	—	—	no fruiting
1955	Apr. 19	Apr. 26	Oct. 31	—	—	Nov. 15	May 24	June 2	Aug. 10	Aug. 27	Sept. 6	
1956	Apr. 22	Apr. 30	Oct. 2	—	Oct. 11	Dec. 2	May 23	June 5	Aug. 18	Aug. 22	Oct. 10	
1957	March 10	March 17	Sept. 30	Oct. 29	Oct. 12	Nov. 30	May 9	May 25	June 28	July 13	Sept. 25	
1958	Apr. 12	Apr. 29	Sept. 12	Nov. 5	Oct. 7	Dec. 10	May 19	June 2	July 24	Sept. 2	—	
1959	March 23	Apr. 2	Sept. 14	—	Oct. 6	Nov. 26	May 4	May 15	July 5	—	Aug. 2*	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1960	Apr. 8	Apr. 16	Aug. 22	Oct. 28	Sept. 24	Nov. 14	May 21	May 29	July 18	—	—	
1961	March 7	March 15	Sept. 15	Oct. 30	Oct. 23	Nov. 28	Apr. 25	May 14	July 5	July 13	—	
1962	Apr. 3	Apr. 13	Sept. 7	—	Oct. 7	Nov. 16	May 8	June 4	Aug. 7	Aug. 27	—	
<i>Maclura pomifera</i> Schn.												
1953	Apr. 18	May 18	Sept. 30	Oct. 29	Oct. 17	Nov. 16	June 8	June 19	—	—	—	no fruiting
1954	May 16	May 26	Oct. 10	Oct. 26	Oct. 20	Nov. 22	June 12	June 30	—	—	—	no fruiting
1955	May 11	May 31	Oct. 8	—	Oct. 20	Nov. 17	June 26	July 18	Sept. 29	—	Oct. 20*	
1956	May 21	May 30	Sept. 27	—	Oct. 16	Nov. 8	June 15	July 14	—	—	—	no fruiting
1957	May 3	May 19	Oct. 7	—	Oct. 12	Nov. 27	—	—	—	—	—	no flowering and fruiting
1958	May 14	May 25	Sept. 22	—	Oct. 18	Dec. 5	June 20	June 30	—	—	—	no fruiting
1959	Apr. 25	May 9	Sept. 20	—	Oct. 8	Nov. 12	—	—	—	—	—	no flowering and fruiting
1960	May 7	May 17	Sept. 20	—	Oct. 7	Nov. 25	June 14	—	—	—	—	no fruiting
1961	Apr. 17	May 4	Oct. 2	Oct. 29	Oct. 5	Nov. 22	June 12	June 30	—	—	—	no fruiting
1962	Apr. 23	May 17	Sept. 14	Oct. 26	Oct. 2	Nov. 24	June 30	July 18	—	—	Nov. 2*	
<i>Magnolia acuminata</i> L.												
1953	Apr. 8	Apr. 30	Sept. 30	Oct. 17	Oct. 6	Oct. 29	—	—	—	—	—	no flowering and fruiting
1954	May 9	May 12	Sept. 17	Oct. 5	Oct. 8	Nov. 28	May 26	June 14	Sept. 18	Sept. 30	Oct. 18	
1955	May 12	May 16	Oct. 8	Oct. 25	Oct. 15	Nov. 2	June 5	June 18	—	—	—	no fruiting
1956	May 13	May 16	Sept. 24	Oct. 17	Oct. 4	Oct. 28	May 31	June 11	Sept. 18	—	Oct. 23	
1957	May 2	May 12	Sept. 20	Oct. 12	Oct. 10	Oct. 26	May 22	June 15	Sept. 20	—	Oct. 18	
1958	May 13	May 17	Sept. 28	Oct. 22	Oct. 10	Nov. 15	May 26	June 18	—	—	—	very poor fruiting
1959	Apr. 27	May 4	Sept. 15	Oct. 18	Oct. 6	Nov. 2	May 12	June 3	—	—	—	no fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	
	1960	May 7	May 12	Sept. 20	Oct. 20	Oct. 6	Nov. 3	May 23	June 8	—	—	—	no fruiting
	1961	Apr. 22	Apr. 24	Sept. 30	Oct. 17	Oct. 7	Oct. 24	May 19	May 27	Oct. 5	—	—	very poor fruiting
	1962	Apr. 26	Apr. 28	Sept. 3	Oct. 16	Oct. 2	Oct. 31	May 26	June 13	—	—	—	no fruiting
<i>Magnolia kobus borealis</i> Sarg.													
	1953	Apr. 20	Apr. 23	Oct. 6	Oct. 22	Oct. 17	Nov. 6	Apr. 8	—	—	—	—	no fruiting
	1954	May 8	May 10	Oct. 12	Oct. 30	Oct. 17	Nov. 12	May 4	May 20	Oct. 10	Oct. 25	Nov. 4	
	1955	May 6	May 9	Oct. 10	Nov. 3	Oct. 25	Nov. 2	May 4	May 20	Oct. 17	—	Nov. 10	
	1956	May 13	May 16	Oct. 22	Nov. 7	Oct. 20	Nov. 16	May 13	May 28	—	—	—	no fruiting
	1957	Apr. 24	Apr. 29	Oct. 7	Oct. 26	Oct. 21	Oct. 29	Apr. 11	May 14	Oct. 8	—	Oct. 30	
	1958	May 11	May 14	Oct. 7	Oct. 23	Oct. 28	Nov. 18	May 8	May 18	Oct. 17	—	Nov. 3	
	1959	Apr. 18	Apr. 24	Oct. 6	Oct. 19	Oct. 16	Nov. 4	Apr. 14	Apr. 30	Sept. 25	—	Sept. 30*	
	1960	May 2	May 8	Oct. 7	Oct. 26	Oct. 20	Nov. 3	Apr. 28	May 16	Oct. 18	—	—	
	1961	Apr. 13	Apr. 16	Oct. 11	Oct. 22	Oct. 13	Nov. 3	Apr. 9	Apr. 22	Oct. 17	—	—	
	1962	Apr. 22	Apr. 23	Oct. 14	—	Oct. 9	Nov. 2	Apr. 22	May 10	—	Oct. 30	—	
<i>Magnolia salicifolia</i> Maxim.													
	1953	Apr. 13	Apr. 16	Oct. 9	Oct. 26	Oct. 22	Nov. 10	Apr. 2	Apr. 16	—	—	—	no fruiting
	1954	May 6	May 9	Oct. 12	Oct. 30	Oct. 17	Nov. 12	May 1	May 13	Sept. 18	Sept. 25	Oct. 8	
	1955	May 5	May 7	Oct. 28	Nov. 5	Oct. 28	Nov. 17	May 2	May 11	—	—	—	no fruiting
	1956	May 9	May 13	Oct. 22	Nov. 3	Oct. 24	Nov. 14	May 5	May 11	—	—	—	no fruiting
	1957	Apr. 27	Apr. 30	Oct. 12	Oct. 26	Oct. 21	Oct. 31	Apr. 4	Apr. 30	—	—	—	no fruiting
	1958	May 11	May 15	Oct. 30	Nov. 10	Nov. 2	Nov. 18	May 2	May 16	Sept. 20	—	Oct. 25	
	1959	Apr. 18	Apr. 25	Sept. 10	Oct. 22	Oct. 19	Nov. 18	Apr. 3	Apr. 26	—	—	—	no fruiting
	1960	Apr. 26	May 6	Oct. 7	Oct. 18	Oct. 22	Nov. 10	Apr. 18	May 13	Oct. 2	—	—	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	
<i>Magnolia tripe- tala</i> L.	1961	Apr. 12	Apr. 16	Oct. 7	Nov. 3	Oct. 28	Nov. 21	Apr. 10	Apr. 20	—	—	—	no fruiting
	1962	Apr. 20	Apr. 22	Sept. 18	—	Oct. 7	Nov. 5	Apr. 19	Apr. 30	Oct. 14	—	—	
	1953	Apr. 24	May 22	Oct. 2	Oct. 26	Oct. 20	Nov. 16	—	—	—	—	—	no flowering and fruiting
	1954	May 6	May 11	Oct. 2	Oct. 26	Oct. 20	Nov. 18	June 8	June 14	—	—	—	no fruiting
	1955	May 7	May 16	Oct. 12	Oct. 28	Oct. 28	Nov. 2	June 4	June 30	Sept. 27	—	Oct. 21	
	1956	May 16	May 20	Oct. 4	Oct. 24	Oct. 22	Oct. 31	June 6	June 16	—	—	—	no fruiting
	1957	Apr. 29	May 12	Oct. 10	Oct. 27	Oct. 17	Nov. 5	June 8	June 17	—	—	—	no fruiting
	1958	May 10	May 17	Sept. 20	—	Oct. 30	Nov. 21	—	—	—	—	—	no flowering and fruiting
	1959	Apr. 25	May 4	Sept. 28	Oct. 22	Oct. 8	Nov. 6	May 20	June 12	—	—	—	no fruiting
	1960	Apr. 18	May 8	Sept. 9	Oct. 16	Sept. 20	Oct. 28	May 22	June 10	Sept. 9	Sept. 24	—	
<i>Morus alba</i> L.	1961	Apr. 15	Apr. 23	Sept. 30	Nov. 1	Oct. 28	Nov. 11	May 20	May 27	—	—	—	no fruiting
	1962	Apr. 22	Apr. 25	Sept. 29	Oct. 10	Oct. 3	Oct. 29	—	—	—	—	—	no flowering and fruiting
	1953	Apr. 20	May 18	Oct. 22	Nov. 2	Oct. 29	Nov. 16	—	—	—	—	—	no flowering and fruiting
	1954	May 15	May 20	Oct. 22	Nov. 2	Oct. 29	Nov. 16	May 24	May 30	July 3	July 7	July 9	
	1955	May 13	May 22	Oct. 25	—	Nov. 2	Nov. 12	June 3	June 18	July 10	July 22	July 26	
	1956	May 23	May 30	Oct. 18	—	Oct. 14	Nov. 20	June 5	June 10	July 12	July 28	Aug. 10	
	1957	May 10	May 17	Oct. 19	Nov. 4	Oct. 17	Nov. 19	May 30	June 14	July 1	—	July 20	
	1958	May 17	May 23	Oct. 25	—	Nov. 5	Nov. 27	May 28	June 8	July 8	—	July 22	
	1959	May 4	May 8	Oct. 12	—	Oct. 19	Nov. 12	May 19	June 13	June 27	—	July 10*	
	1960	May 13	May 17	Oct. 7	—	Nov. 3	—	May 28	June 13	July 18	Aug. 7	—	
	1961	Apr. 24	May 2	—	Oct. 22	Oct. 4	Nov. 20	May 31	June 15	July 2	July 13	—	
	1962	Apr. 23	May 16	Sept. 24	Oct. 26	Oct. 11	Nov. 14	June 6	June 23	July 18	July 29	Aug. 20	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Phellodendron amurense</i> Rupr.												
1953	May 2	May 18	Oct. 6	Oct. 22	Oct. 20	Nov. 6	—	—	—	—	—	no flowering and fruiting
1954	May 6	May 11	Oct. 12	Oct. 30	Oct. 20	Oct. 9	May 29	June 10	Oct. 20	Nov. 17	Dec. 28	
1955	May 2	May 11	Oct. 20	Oct. 30	Oct. 20	Nov. 2	—	—	—	—	—	no flowering and fruiting
1956	May 8	May 16	Oct. 14	Oct. 26	Oct. 20	Oct. 31	June 15	June 28	Oct. 18	Nov. 12	Nov. 24	
1957	May 2	May 12	Oct. 8	—	Oct. 10	Oct. 29	June 18	June 24	Oct. 12	—	Nov. 19	
1958	May 10	May 17	Sept. 23	—	Sept. 30	Nov. 16	June 18	June 24	Oct. 10	—	Nov. 25	
1959	Apr. 14	Apr. 29	Oct. 12	—	Oct. 16	Nov. 4	May 20	June 3	Oct. 2	Nov. 4	Nov. 20	
1960	Apr. 18	Apr. 27	Oct. 20	—	Oct. 22	Nov. 7	June 10	June 17	—	—	Dec. 12*	
1961	Apr. 7	Apr. 17	Oct. 18	Oct. 25	—	Oct. 28	May 30	June 22	—	—	—	no fruiting
1962	Apr. 16	Apr. 21	Oct. 14	—	Oct. 9	Oct. 30	June 14	June 27	—	—	Oct. 22*	
<i>Platanus acerifolia</i> Willd.												
1953	Apr. 20	Apr. 30	Sept. 28	Oct. 29	Oct. 9	Nov. 16	—	—	—	—	—	no flowering and fruiting
1954	May 10	May 14	Oct. 8	Oct. 30	Oct. 20	Nov. 15	May 24	June 5	Sept. 12	Feb. 18	—	full maturity in 1955
1955	May 4	May 9	Oct. 3	Nov. 12	Oct. 15	Nov. 20	May 26	June 10	Sept. 20	—	Feb. 25	fruit dropped in 1956
1956	May 13	May 17	Sept. 27	Oct. 10	Oct. 6	Oct. 31	—	—	—	—	—	no flowering and fruiting
1957	Apr. 30	May 8	Oct. 5	Oct. 30	Oct. 7	Nov. 12	May 12	May 24	—	—	—	very poor fruiting
1958	May 11	May 16	Sept. 25	Oct. 20	Sept. 29	Dec. 2	May 10	May 18	Sept. 25	—	Feb. 20	fruit dropped in 1959
1959	Apr. 20	Apr. 28	Sept. 23	—	Oct. 8	Nov. 18	Apr. 29	May 3	—	—	—	no fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1960	Apr. 27	May 10	Sept. 20	Nov. 7	Oct. 7	—	May 17	May 22	—	—	—	no fruiting
1961	Apr. 15	Apr. 19	Oct. 3	Oct. 24	Oct. 6	Nov. 26	May 2	May 5	—	—	—	no fruiting
1962	Apr. 18	Apr. 22	Sept. 14	—	Sept. 29	Nov. 28	May 16	May 30	—	—	—	no fruiting
<i>Prunus fruticosa</i>												
G. Woron												
1953	Apr. 8	Apr. 15	Sept. 4	Sept. 28	Oct. 6	Oct. 18	Apr. 19	May 5	—	—	—	no fruiting
1954	Apr. 28	May 4	Sept. 8	Sept. 25	Oct. 4	Oct. 16	May 14	May 24	—	—	—	no fruiting
1955	Apr. 28	May 7	Oct. 1	Oct. 10	Oct. 12	Oct. 31	May 17	June 10	—	—	—	no fruiting
1956	May 1	May 8	Sept. 25	—	Oct. 1	Nov. 11	May 23	May 29	—	—	—	no fruiting
1957	Apr. 2	Apr. 28	—	—	—	—	May 5	June 7	—	—	—	cut down
1958	Apr. 13	May 8	Sept. 20	—	Oct. 11	Nov. 29	May 15	May 26	June 13	July 18	Aug. 2*	
1959	Apr. 12	Apr. 26	Sept. 18	Oct. 12	Oct. 14	Oct. 27	Apr. 22	May 12	June 10	—	July 2*	
1960	Apr. 14	Apr. 27	Oct. 13	—	Oct. 16	—	May 10	May 21	July 2	July 23	—	
1961	March 17	Apr. 9	Sept. 15	—	Sept. 23	Oct. 25	Apr. 22	May 8	June 30	July 12	—	
1962	Apr. 13	Apr. 21	Oct. 3	Oct. 17	Oct. 7	Oct. 20	May 2	—	—	July 23	—	
<i>Prunus padus</i> L.												
1953	March 31	Apr. 3	Oct. 10	Sept. 18	Oct. 10	Oct. 22	Apr. 20	Apr. 30	—	—	—	no fruiting
1954	Apr. 25	May 2	Sept. 22	—	Oct. 8	Oct. 18	May 12	May 20	July 16	—	—	
1955	Apr. 14	May 2	Oct. 3	Oct. 14	Oct. 5	Oct. 24	May 11	June 3	June 21	July 20	July 27	
1956	Apr. 23	May 3	Oct. 5	—	Sept. 30	Nov. 12	May 18	May 28	July 2	July 12	July 20*	
1957	March 11	March 23	Oct. 2	—	Sept. 28	Oct. 10	Apr. 25	May 16	June 26	—	—	fruits dried up
1958	Apr. 9	May 3	Sept. 22	Oct. 29	Oct. 10	Nov. 8	May 14	May 22	July 7	—	July 26*	
1959	—	—	—	—	—	—	—	—	—	—	—	cut down
1960	Apr. 12	Apr. 20	Sept. 17	Oct. 25	Sept. 29	Oct. 30	May 9	May 17	June 25	July 20	—	another specimen taken
1961	March 19	March 31	Sept. 15	Oct. 20	Sept. 19	Oct. 27	Apr. 14	May 6	June 22	July 7	—	
1962	Apr. 5	Apr. 14	Sept. 5	—	Oct. 3	Oct. 28	Apr. 27	May 9	July 5	July 23	—	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Prunus serotina</i>												
Ehr.												
1953	March 30	Apr. 11	Sept. 28	Oct. 26	Oct. 17	Nov. 16	May 21	May 27	—	—	—	no fruiting
1954	May 3	May 7	Oct. 10	Oct. 27	Oct. 15	Nov. 15	June 8	June 13	—	—	—	fruits eaten by birds
1955	May 1	May 4	Oct. 25	Nov. 12	Nov. 2	Nov. 20	June 13	June 24	—	—	—	fruits eaten by birds
1956	May 4	May 9	Oct. 16	Nov. 15	Oct. 22	Nov. 25	June 5	June 16	—	—	—	fruits eaten by birds
1957	Apr. 10	Apr. 23	Oct. 12	Oct. 26	Oct. 19	Nov. 12	May 30	June 14	—	—	—	fruits eaten by birds
1958	May 2	May 12	Sept. 30	Oct. 30	Oct. 22	Nov. 28	June 3	June 16	—	—	—	fruits eaten by birds
1959	Apr. 2	Apr. 27	Sept. 23	Oct. 22	Oct. 6	Nov. 18	May 20	June 2	—	—	—	fruits eaten by birds
1960	Apr. 12	Apr. 26	Oct. 7	Oct. 28	Oct. 18	Nov. 7	May 30	June 8	—	—	—	fruits eaten by birds
1961	—	—	—	—	—	—	—	—	—	—	—	cut down
1962	—	—	—	—	—	—	—	—	—	—	—	
<i>Prunus subhirtella</i> Mig.												
1953	Apr. 4	Apr. 14	Sept. 19	Oct. 26	Oct. 6	Nov. 10	Apr. 5	Apr. 26	—	—	—	no fruiting
1954	May 6	May 8	Sept. 20	Sept. 30	Oct. 15	Oct. 23	May 6	May 19	June 7	June 10	June 18	
1955	May 3	May 7	Oct. 10	Oct. 28	Oct. 28	Nov. 12	May 2	May 17	June 14	June 18	June 22	
1956	May 5	May 9	Oct. 18	Oct. 28	Oct. 25	Nov. 10	May 8	May 22	June 5	June 10	June 15	
1957	Apr. 5	Apr. 11	Oct. 5	Oct. 12	Oct. 10	Oct. 29	Apr. 6	May 10	June 3	—	June 12	
1958	May 2	May 10	Sept. 18	Oct. 18	Oct. 2	Nov. 3	May 6	May 18	June 5	—	June 18	
1959	Apr. 1	Apr. 16	Sept. 15	Oct. 12	Oct. 10	Oct. 26	Apr. 9	Apr. 29	May 18	—	June 2	
1960	Apr. 22	May 5	Sept. 28	Oct. 18	Oct. 23	Nov. 3	Apr. 23	May 13	May 30	—	—	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	
<i>Pterocarya fraxinifolia</i> Spach.	1961	Apr. 25	May 11	Sept. 25	Oct. 23	Oct. 7	Nov. 1	Apr. 7	Apr. 21	May 16	—	June 2	
	1962	Apr. 9	Apr. 21	Sept. 8	Oct. 18	Oct. 13	Nov. 3	Apr. 21	Apr. 29	—	June 6	June 13*	
	1953	March 3	Apr. 11	Sept. 28	Oct. 26	Oct. 17	Nov. 10	—	—	—	—	—	no flowering and fruiting
	1954	Apr. 27	May 3	Oct. 5	Nov. 5	Oct. 10	Nov. 22	May 21	May 29	Oct. 10	Nov. 15	Nov. 18	
	1955	Apr. 30	May 2	Oct. 3	Oct. 31	Oct. 25	Nov. 2	May 22	May 30	Oct. 18	—	Nov. 22	
	1956	May 2	May 6	Sept. 29	Oct. 24	Oct. 18	Oct. 31	May 28	June 10	—	—	—	no fruiting
	1957	March 27	Apr. 5	Oct. 5	Oct. 12	Oct. 10	Nov. 5	—	—	—	—	—	no flowering and fruiting
	1958	Apr. 12	May 2	Sept. 29	Oct. 25	Oct. 20	Nov. 27	May 22	May 27	—	—	—	very poor fruiting
	1959	Apr. 10	Apr. 16	Sept. 16	Nov. 4	Oct. 17	Nov. 18	May 2	May 6	—	—	—	no fruiting
	1960	Apr. 4	Apr. 24	Sept. 20	Oct. 28	Oct. 20	Nov. 7	May 15	May 20	—	—	—	no fruiting
1961	Apr. 4	Apr. 11	Oct. 7	Oct. 24	Oct. 27	Nov. 7	—	—	—	—	—	no flowering and fruiting	
1962	Apr. 7	Apr. 16	Sept. 19	—	Oct. 15	Nov. 19	May 18	—	—	—	—	very poor fruiting	
<i>Pterostyrax hispida</i> Sieb. et Zucc.	1953	Apr. 5	Apr. 9	Sept. 2	—	Oct. 28	—	—	—	—	—	—	no flowering and fruiting
	1954	May 4	May 6	—	—	—	—	—	—	—	—	—	no flowering and fruiting
	1955	Apr. 19	May 4	Oct. 7	Nov. 6	Oct. 24	Nov. 20	June 26	July 6	Sept. 19	Oct. 13	Oct. 27	
	1956	Apr. 29	May 5	Sept. 24	—	Oct. 2	—	June 17	July 5	Sept. 24	Oct. 20	Oct. 27*	
	1957	March 12	Apr. 13	Sept. 25	Oct. 28	Oct. 30	Nov. 26	May 5	June 7	—	—	—	no fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1958	Apr. 13	May 6	Sept. 9	Oct. 26	Oct. 14	Dec. 1	June 23	July 1	Sept. 8	Oct. 19	Nov. 6*	
1959	March 26	Apr. 12	Sept. 13	—	Oct. 6	Oct. 28	June 4	July 16	Sept. 10	Oct. 8	Nov. 4	
1960	—	Apr. 21	Sept. 17	Oct. 25	Sept. 25	Nov. 12	June 11	June 23	Aug. 22	Nov. 4	—	
1961	March 13	March 26	Sept. 29	Oct. 27	Oct. 18	Nov. 18	June 6	June 14	—	Oct. 28	—	
1962	Apr. 5	Apr. 11	Sept. 23	—	Oct. 21	Nov. 2	June 18	June 29	—	Nov. 12	—	
<i>Rhus sylvestris</i>												
Sieb. et Zucc.												
1953	May 4	May 25	Sept. 15	Oct. 26	Oct. 6	Nov. 16	—	—	—	—	—	no flowering and fruiting
1954	May 8	May 19	Sept. 24	Oct. 26	Oct. 10	Nov. 18	June 22	June 30	—	—	—	no fruiting
1955	May 9	May 17	Oct. 15	—	Nov. 2	Nov. 12	June 30	July 20	—	—	—	no fruiting
1956	May 16	May 25	Oct. 20	—	Oct. 20	Oct. 31	July 12	July 12	—	—	—	no fruiting
1957	May 8	May 17	Oct. 10	Oct. 19	Oct. 17	Oct. 29	June 20	June 29	—	—	—	no fruiting
1958	May 15	May 20	Sept. 21	Oct. 25	Sept. 29	Nov. 18	June 26	July 7	—	—	—	no fruiting
1959	Apr. 25	May 6	Oct. 14	—	Oct. 26	Nov. 8	June 18	June 27	—	—	—	no fruiting
1960	May 9	May 17	Sept. 18	Nov. 3	Oct. 28	—	June 19	June 30	—	—	—	no fruiting
1961	Apr. 22	Apr. 25	Oct. 2	Oct. 11	Oct. 8	Nov. 11	June 20	July 8	—	—	—	no fruiting
1962	Apr. 24	May 4	Sept. 15	Oct. 6	Oct. 5	Oct. 29	July 6	July 20	—	—	—	no fruiting
<i>Rhus trilobata</i>												
Nutt.												
1953	Apr. 24	Apr. 30	Oct. 6	Oct. 20	Oct. 6	—	—	—	—	—	—	no flowering and fruiting
1954	May 12	May 14	Oct. 4	Oct. 22	—	—	July 12	Aug. 2	—	—	—	no fruiting
1955	May 3	May 13	Oct. 6	—	Nov. 8	Feb. 29	June 10	June 15	—	—	—	leaf shedding in 1956
1956	May 10	May 22	Sept. 29	—	Oct. 21	Jan. 30	—	—	—	—	—	leaf shedding in 1957
1957	Apr. 13	May 27	Sept. 18	Oct. 15	Oct. 18	Dec. 23	—	—	—	—	—	no flowering and fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1958	May 9	May 16	Sept. 12	Oct. 24	Oct. 18	Dec. 21	—	—	—	—	—	no flowering and fruiting
1959	Apr. 25	May 3	Sept. 15	—	Oct. 19	Nov. 26	—	—	—	—	—	no flowering and fruiting
1960	Apr. 20	May 12	Aug. 19	—	Sept. 25	Nov. 29	May 30	June 14	—	—	—	no fruiting
1961	March 20	Apr. 18	Sept. 5	Oct. 19	Oct. 27	—	May 18	June 16	—	—	—	no fruiting
1962	Apr. 19	Apr. 22	Sept. 5	Oct. 28	Oct. 3	Nov. 25	—	—	—	—	—	no flowering and fruiting
<i>Ribes alpinum</i> L.												
1953	March 22	March 30	Oct. 6	Oct. 16	Oct. 20	—	Apr. 18	May 4	July 15	—	—	
1954	Apr. 23	Apr. 29	—	—	—	—	Apr. 19	May 18	—	—	—	very poor fruiting
1955	Apr. 7	Apr. 23	Oct. 18	Nov. 7	Nov. 3	Nov. 29	May 6	May 17	July 20	Aug. 4	Aug. 20	
1956	Apr. 11	Apr. 19	Oct. 14	—	Oct. 30	Dec. 4	May 7	May 20	July 14	Aug. 2	Aug. 25	
1957	Feb. 16	March 20	Oct. 2	Oct. 16	Oct. 4	Nov. 29	Apr. 9	May 16	July 4	July 25	—	
1958	March 12	Apr. 16	Sept. 17	Sept. 26	Sept. 29	Nov. 21	May 5	May 26	June 29	July 30	Aug. 7*	
1959	March 20	March 25	Sept. 23	Oct. 4	Oct. 10	Oct. 22	Apr. 15	May 10	June 25	July 18	Aug. 30*	
1960	March 26	Apr. 10	Sept. 17	Oct. 27	Sept. 27	Nov. 14	Apr. 25	May 17	July 9	—	Aug. 19	
1961	Feb. 22	March 15	Aug. 5	Oct. 24	Sept. 1	Nov. 19	Apr. 17	May 4	June 25	—	—	
1962	March 19	Apr. 11	Sept. 1	Oct. 15	Sept. 5	Nov. 6	Apr. 19	May 15	July 14	July 23	July 26*	
<i>Ribes aureum</i> Pursh.												
1953	March 28	Apr. 1	Oct. 4	Oct. 16	Oct. 20	Nov. 12	Apr. 16	May 11	—	—	—	no fruiting
1954	Apr. 24	Apr. 28	—	—	—	—	Apr. 28	May 14	—	—	—	no fruiting
1955	Apr. 10	Apr. 22	Oct. 10	Nov. 7	Oct. 29	Dec. 10	May 9	June 13	Aug. 10	Aug. 27	Aug. 31	
1956	Apr. 14	Apr. 28	Oct. 1	—	Oct. 25	Dec. 14	May 17	May 31	July 17	Aug. 30	Sept. 10	
1957	March 12	March 26	Sept. 28	Nov. 2	Oct. 7	Nov. 30	Apr. 24	May 20	July 23	Aug. 24	—	
1958	March 24	Apr. 18	Sept. 1	—	Sept. 14	Dec. 2	May 10	May 27	July 26	July 28	Sept. 26	
1959	March 21	Apr. 3	Oct. 12	—	Oct. 19	Nov. 10	Apr. 22	May 19	July 11	July 20	Sept. 18	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1960	March 28	Apr. 12	Sept. 17	—	Oct. 5	Nov. 28	May 9	May 22	July 16	—	Aug. 19	
1961	March 8	March 18	Sept. 14	Oct. 24	Sept. 25	Nov. 22	Apr. 16	May 7	July 20	—	—	very poor fruiting
1962	March 28	Apr. 9	Aug. 29	—	Oct. 2	Nov. 8	Apr. 28	May 15	July 22	—	—	very poor fruiting
<i>Ribes longerace- mosum</i> Franch.												
1953	Apr. 3	Apr. 8	Sept. 4	Oct. 12	Oct. 6	Oct. 22	Apr. 14	May 4	—	—	—	
1954	Apr. 30	May 4	—	—	—	—	May 16	May 30	—	—	—	no fruiting
1955	May 2	May 5	Oct. 5	—	Oct. 18	Dec. 28	May 18	June 13	—	—	—	no fruiting
1956	May 3	May 7	Oct. 3	—	Oct. 21	Nov. 22	May 26	June 8	—	—	—	no fruiting
1957	Apr. 2	Apr. 7	Sept. 30	Oct. 6	Oct. 11	Oct. 30	May 9	June 14	—	—	—	no fruiting
1958	Apr. 22	Apr. 29	Sept. 18	Oct. 11	Oct. 64	Nov. 14	May 16	June 16	—	—	—	no fruiting
1959	March 25	Apr. 7	Oct. 10	Oct. 18	Oct. 12	Oct. 16	Apr. 29	June 9	—	—	—	no fruiting
1960	Apr. 12	Apr. 28	Sept. 27	—	Oct. 6	Nov. 8	May 12	June 10	—	—	—	no fruiting
1961	March 25	Apr. 3	Sept. 27	Oct. 24	Sept. 27	Nov. 19	Apr. 27	June 4	—	—	—	no fruiting
1962	Apr. 13	Apr. 18	Sept. 7	Oct. 19	Oct. 3	Nov. 3	May 9	June 19	—	—	—	no fruiting
<i>Robinia pseudo- acacia</i> L.												
1953	Apr. 25	May 4	Oct. 9	—	Oct. 26	Nov. 19	—	—	—	—	—	flowers but gives no fruit
1954	May 12	May 17	Oct. 22	—	Oct. 28	Nov. 25	June 8	June 22	Sept. 10	—	Dec. 15	
1955	May 7	May 16	Oct. 20	—	Nov. 2	Nov. 15	June 20	July 6	Sept. 8	—	Dec. 10	
1956	May 15	May 22	Oct. 24	—	Oct. 28	Nov. 8	June 6	June 20	Sept. 24	—	Dec. 28	
1957	May 10	May 18	Oct. 20	—	Oct. 26	Nov. 19	June 8	June 20	—	—	—	very poor fruiting
1958	May 11	May 18	Oct. 25	—	Nov. 3	Nov. 28	June 7	June 25	Sept. 20	—	Dec. 30	
1959	Apr. 24	May 6	Oct. 16	—	Oct. 20	Nov. 8	May 24	June 10	Sept. 15	—	—	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1960	May 7	May 15	Oct. 20	—	Oct. 28	—	June 5	June 18	—	—	—	
1961	Apr. 16	Apr. 21	Oct. 25	—	Oct. 23	Nov. 20	May 30	June 10	—	—	—	
1962	Apr. 24	Apr. 27	Oct. 5	—	Oct. 7	Nov. 18	June 10	June 18	Sept. 12	—	—	
<i>Schisandra chi-</i> <i>nensis</i> Baill.												
1953	Apr. 2	Apr. 4	Sept. 2	Sept. 28	Oct. 6	Oct. 20	—	—	—	—	—	no flowering and fruiting
1954	Apr. 28	May 3	Sept. 4	Oct. 1	Oct. 4	Oct. 18	May 18	June 1	June 20	Aug. 14	—	
1955	Apr. 14	Apr. 30	Oct. 1	Oct. 11	Oct. 2	Oct. 28	May 26	June 15	Aug. 20	Sept. 13	Sept. 18	
1956	Apr. 22	May 6	Sept. 17	Sept. 28	Sept. 21	Oct. 17	May 26	June 8	Aug. 22	—	Sept. 15	
1957	March 2	Apr. 11	Sept. 5	Sept. 17	Sept. 13	Oct. 14	May 16	June 3	—	—	—	no fruiting
1958	Apr. 9	Apr. 30	Sept. 15	Oct. 19	Oct. 12	Oct. 26	May 23	May 28	Aug. 12	Aug. 29	Sept. 3*	
1959	March 24	Apr. 14	Sept. 23	—	Oct. 14	Nov. 8	—	—	—	—	—	no flowering and fruiting
1960	Apr. 8	Apr. 19	Aug. 19	Oct. 7	Oct. 4	Oct. 28	—	—	—	—	—	no flowering and fruiting
1961	March 10	March 26	Sept. 2	Oct. 8	Sept. 14	Oct. 22	—	—	—	—	Aug. 21*	
1962	May 5	June 16	Sept. 3	Sept. 19	Sept. 22	Oct. 13	May 15	May 30	—	—	Sept. 7*	
<i>Sorbus america-</i> <i>na</i> Marsh.												
1953	March 28	Apr. 8	Sept. 28	Oct. 26	Oct. 17	Nov. 10	May 8	May 21	Aug. 10	—	—	
1954	Apr. 14	Apr. 30	Sept. 28	Oct. 6	Oct. 10	Nov. 18	May 26	June 5	July 20	Aug. 30	Sept. 20	
1955	Apr. 29	May 1	Sept. 21	Oct. 25	Oct. 8	Nov. 20	May 30	June 14	—	—	—	no fruiting
1956	Apr. 29	May 2	Oct. 14	Oct. 24	Sept. 24	Nov. 30	May 28	June 28	July 28	Aug. 30	Sept. 24	
1957	Apr. 4	Apr. 13	Oct. 5	Oct. 12	Oct. 12	Nov. 5	May 16	June 3	July 20	—	Sept. 20	
1958	Apr. 20	May 5	Sept. 12	Oct. 4	Sept. 21	Nov. 26	May 25	June 1	July 25	—	Aug. 30*	
1959	Apr. 7	Apr. 19	Sept. 16	Oct. 10	Oct. 19	Nov. 6	May 11	May 18	—	—	—	
1960	Apr. 10	Apr. 27	Sept. 28	Oct. 26	Oct. 20	Nov. 10	May 17	May 28	July 11	—	—	
1961	March 26	Apr. 9	Oct. 2	Oct. 28	Oct. 17	Nov. 19	May 8	May 19	July 18	—	—	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	
<i>Sorbus aucuparia</i> L.	1962	Apr. 7	Apr. 17	Sept. 11	—	Sept. 17	Oct. 5	May 16	May 30	July 22	—	—	
	1953	March 28	Apr. 8	Sept. 19	Oct. 22	Oct. 8	Nov. 16	May 8	May 21	July 10	July 28	Aug. 24	
	1954	Apr. 20	May 1	Sept. 10	Sept. 18	Sept. 18	Oct. 15	May 25	June 4	July 17	Aug. 31	—	fruits eaten by birds
	1955	Apr. 29	May 1	Sept. 20	Oct. 15	Oct. 1	Nov. 17	June 2	June 8	Aug. 4	Aug. 16	Oct. 8	
	1956	Apr. 30	May 5	Sept. 18	Oct. 17	Oct. 4	Oct. 31	May 29	June 7	Aug. 10	—	Sept. 23	
	1957	Apr. 8	Apr. 17	Sept. 22	Oct. 12	Oct. 5	Oct. 29	May 14	June 5	July 26	—	Sept. 20	
	1958	Apr. 20	May 5	Sept. 10	Sept. 12	Sept. 28	Oct. 18	May 23	June 2	July 26	—	Aug. 25*	
	1959	Apr. 5	Apr. 10	Sept. 16	Oct. 8	Oct. 8	Nov. 10	May 10	May 20	July 5	—	Aug. 31*	
	1960	Apr. 8	Apr. 25	Sept. 20	Oct. 18	Oct. 20	—	May 18	June 4	July 11	—	—	
	1961	March 28	Apr. 11	Sept. 20	—	Sept. 30	Oct. 25	May 7	May 24	July 16	—	—	
	1962	Apr. 9	Apr. 18	Sept. 13	Oct. 8	Sept. 25	Oct. 22	May 17	June 6	July 26	Sept. 1	—	
<i>Sorbaria sorbifolia</i> A. Br.													
	1953	Feb. 27	March 24	Aug. 29	Sept. 15	Oct. 2	Oct. 26	—	—	—	—	—	no flowering and fruiting
	1954	Apr. 6	Apr. 13	Sept. 30	Sept. 20	—	—	—	—	—	—	—	no flowering and fruiting
	1955	Apr. 9	Apr. 18	Sept. 28	Oct. 12	Oct. 5	Oct. 25	—	—	—	—	—	no flowering and fruiting
	1956	Apr. 9	Apr. 15	Sept. 17	—	Sept. 29	Nov. 27	July 20	Aug. 17	Aug. 21	—	Sept. 25	
	1957	Feb. 4	Feb. 15	Sept. 14	Oct. 7	Sept. 29	Oct. 20	July 8	Aug. 5	Aug. 30	—	—	
	1958	March 8	Apr. 6	Sept. 12	—	Sept. 26	Nov. 2	July 16	Aug. 1	Sept. 12	—	Oct. 3	
	1959	March 20	March 28	Sept. 8	Oct. 8	Oct. 6	Nov. 4	July 2	Aug. 20	Sept. 10	—	Sept. 30	
	1960	March 2	March 28	Sept. 4	Sept. 30	Sept. 24	Oct. 8	July 2	July 25	Aug. 18	—	—	
	1961	Feb. 21	March 4	Sept. 15	Oct. 5	Oct. 5	Oct. 21	June 18	—	—	—	—	no fruiting
	1962	March 24	Apr. 2	Aug. 27	Oct. 7	Oct. 3	Oct. 26	July 17	July 29	Sept. 17	—	—	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Tilia americana</i>												
L.												
1953	Apr. 7	Apr. 10	Sept. 19	—	Sept. 26	Oct. 26	—	—	—	—	—	no flowering and fruiting
1954	May 5	May 8	Sept. 30	Oct. 10	Oct. 15	Oct. 21	July 7	July 23	Sept. 22	Oct. 26	Dec. 8	
1955	Apr. 30	May 2	Sept. 27	Oct. 13	Oct. 1	Oct. 28	July 16	July 30	Sept. 18	Oct. 3	Nov. 27	
1956	May 5	May 8	Sept. 28	Oct. 20	Sept. 30	Oct. 28	—	—	—	—	—	
1957	Apr. 6	Apr. 12	Sept. 12	Oct. 5	Sept. 26	Oct. 15	July 3	July 20	—	—	—	
1958	May 6	May 10	Oct. 6	Oct. 22	Oct. 10	Nov. 4	—	—	—	—	—	no flowering and fruiting
1959	Apr. 9	Apr. 15	Sept. 14	Oct. 12	Sept. 26	Oct. 19	June 28	July 13	Sept. 10	Oct. 19	Nov. 20	
1960	Apr. 17	Apr. 26	Aug. 22	Oct. 26	Oct. 10	Nov. 3	July 11	July 20	Sept. 26	—	—	
1961	Apr. 6	Apr. 8	Sept. 22	Oct. 13	Oct. 7	Sept. 19	July 13	July 20	Oct. 17	—	—	
1962	Apr. 18	Apr. 22	Aug. 25	—	Sept. 25	Oct. 27	—	—	—	—	—	no flowering and fruiting
<i>Tilia cordata</i>												
Mill.												
1953	Apr. 13	Apr. 20	Sept. 28	Oct. 26	Sept. 26	Nov. 16	—	—	—	—	—	no flowering and fruiting
1954	May 10	May 12	Oct. 10	Oct. 25	Oct. 10	Nov. 2	July 3	July 23	Oct. 2	Oct. 30	Nov. 28	
1955	May 5	May 7	Oct. 8	Oct. 30	Oct. 13	Nov. 12	July 10	Aug. 1	Sept. 30	Oct. 15	Dec. 5	
1956	May 8	May 11	Sept. 29	Oct. 25	Oct. 12	Nov. 8	July 10	July 23	Oct. 12	—	Dec. 10	
1957	Apr. 27	Apr. 30	Sept. 26	Oct. 17	Oct. 5	Oct. 26	July 1	July 15	Sept. 26	—	Nov. 25	
1958	May 10	May 13	Sept. 30	Oct. 18	Oct. 10	Nov. 3	July 8	July 19	—	—	—	very poor fruiting
1959	Apr. 24	Apr. 28	Sept. 15	Oct. 26	Oct. 21	Nov. 2	June 20	July 10	Sept. 4	Sept. 30	Nov. 25	
1960	May 5	May 9	Sept. 20	Oct. 28	Oct. 12	Nov. 3	June 30	July 15	Sept. 16	—	—	
1961	Apr. 16	Apr. 18	Sept. 30	Oct. 13	Oct. 5	Oct. 19	June 25	July 2	Oct. 2	—	—	
1962	Apr. 22	Apr. 23	Aug. 25	—	Sept. 3	Nov. 2	July 10	July 28	Oct. 7	—	—	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Tilia Maximowicziana</i> Shiras												
1953	Apr. 4	Apr. 17	Oct. 22	Nov. 2	Oct. 26	Nov. 10	—	—	—	—	—	no flowering and fruiting
1954	May 6	May 10	Oct. 8	Oct. 15	Oct. 10	Oct. 26	July 3	July 23	Sept. 30	Oct. 15	Oct. 25	
1955	May 2	May 5	Sept. 28	Oct. 25	Oct. 25	Nov. 12	July 12	July 30	Oct. 1	Oct. 15	Oct. 25	
1956	May 11	May 15	Sept. 28	Oct. 24	Oct. 22	Oct. 31	July 9	July 30	Sept. 28	—	Nov. 12	
1957	Apr. 24	Apr. 29	Sept. 26	Oct. 12	Oct. 10	Oct. 19	July 3	July 16	Sept. 30	—	Oct. 30	
1958	May 10	May 13	Oct. 20	Nov. 3	Oct. 28	Nov. 18	July 8	July 28	Oct. 8	—	Nov. 26	
1959	Apr. 16	Apr. 24	Sept. 14	Oct. 18	Oct. 12	Oct. 28	June 23	July 11	Sept. 10	Oct. 7	Nov. 12	
1960	Apr. 29	May 9	Sept. 20	Oct. 28	Oct. 26	Nov. 7	July 4	July 26	Sept. 22	Oct. 20	—	
1961	Apr. 14	Apr. 17	Sept. 28	Oct. 24	Oct. 13	Oct. 28	June 25	July 20	Oct. 25	—	—	
1962	Apr. 21	Apr. 22	Sept. 1	—	Oct. 18	Nov. 3	July 12	July 24	Oct. 7	—	Nov. 5	
<i>Tilia mongolica</i> Maxim.												
1953	Apr. 4	Apr. 10	Sept. 19	Oct. 17	Sept. 28	Nov. 6	—	—	—	—	—	no flowering and fruiting
1954	May 4	May 7	Sept. 24	Oct. 15	Oct. 10	Oct. 20	July 13	July 30	Oct. 5	Oct. 18	Oct. 29	
1955	Apr. 30	May 2	Sept. 26	Oct. 15	Oct. 8	Nov. 2	July 24	Aug. 10	Oct. 8	Oct. 25	Oct. 18	
1956	May 5	May 9	Sept. 27	Oct. 20	Oct. 4	Oct. 31	July 19	Aug. 4	Oct. 15	—	Nov. 12	
1957	Apr. 5	Apr. 11	Sept. 4	Oct. 7	Oct. 5	Oct. 19	July 12	July 20	—	—	—	no fruiting
1958	May 5	May 9	Sept. 30	Oct. 18	Oct. 6	Oct. 22	July 19	Aug. 2	—	—	—	very poor fruiting
1959	Apr. 10	Apr. 15	Sept. 9	Oct. 8	Oct. 6	Nov. 8	July 4	July 15	Sept. 16	Oct. 4	Oct. 8	
1960	Apr. 15	Apr. 29	Sept. 16	Oct. 22	Oct. 18	Nov. 7	July 2	Aug. 2	Sept. 28	—	—	
1961	Apr. 8	Apr. 12	Sept. 4	—	—	Sept. 21	July 5	July 20	—	Oct. 16	—	
1962	Apr. 18	Apr. 19	Aug. 29	Oct. 11	Sept. 15	Nov. 7	July 21	Aug. 8	—	Oct. 17	—	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Tilia platyphyllos</i> Scop.												
1953	Apr. 4	Apr. 14	Sept. 15	Oct. 29	Oct. 17	Nov. 19	—	—	—	—	—	no flowering and fruiting
1954	May 6	May 9	Sept. 20	Oct. 15	Oct. 10	Oct. 20	June 23	July 17	Sept. 26	Oct. 8	Dec. 8	
1955	May 1	May 3	Sept. 30	Oct. 25	Oct. 13	Nov. 2	June 28	July 27	Sept. 20	Oct. 3	Nov. 17	
1956	May 5	May 8	Sept. 27	Oct. 24	Oct. 18	Nov. 14	June 29	July 14	Sdept. 18	Oct. 4	Nov. 25	
1957	Apr. 24	Apr. 29	Sept. 6	Oct. 12	Oct. 10	Oct. 29	June 20	July 6	Sept. 30	—	Nov. 20	
1958	May 6	May 10	Oct. 10	Oct. 30	Oct. 28	Nov. 18	June 26	July 14	Sept. 30	—	Nov. 25	
1959	Apr. 8	Apr. 10	Sept. 16	Oct. 20	Oct. 14	Oct. 28	June 10	July 1	Sept. 4	Oct. 6	Nov. 20	
1960	Apr. 24	May 4	Sept. 20	Oct. 28	Oct. 20	Nov. 7	June 18	July 10	Sept. 29	Oct. 20	—	
1961	Apr. 10	Apr. 14	Aug. 27	Oct. 14	Oct. 7	Nov. 19	June 19	June 27	Oct. 22	—	—	
1962	Apr. 18	Apr. 20	Aug. 29	—	Sept. 22	Nov. 17	June 22	July 10	—	Nov. 5	—	
<i>Tilia tomentosa</i> Moench.												
1953	Apr. 4	Apr. 16	Sept. 28	Oct. 22	Oct. 20	Nov. 6	—	—	—	—	—	no flowering and fruiting
1954	May 6	May 9	Oct. 10	Oct. 30	Oct. 10	Nov. 15	July 20	Aug. 3	Oct. 2	Nov. 6	Dec. 8	
1955	May 2	May 5	Oct. 10	—	Oct. 25	Nov. 17	July 24	Aug. 10	Oct. 8	Oct. 25	Nov. 20	
1956	May 8	May 13	Sept. 29	—	Oct. 28	Nov. 22	July 28	Aug. 12	Oct. 12	—	Nov. 23	
1957	Apr. 27	Apr. 30	Oct. 8	Oct. 20	Oct. 12	Oct. 29	July 14	July 30	—	—	—	no fruiting
1958	May 8	May 12	Oct. 18	Oct. 27	Oct. 20	Nov. 28	July 25	Aug. 9	—	—	—	very poor fruiting
1959	Apr. 18	Apr. 24	Sept. 9	Oct. 19	Oct. 4	Nov. 10	July 12	July 26	Oct. 28	—	Nov. 20	
1960	May 4	May 9	Sept. 20	Nov. 3	Oct. 20	Nov. 12	July 18	Aug. 6	Oct. 12	—	—	
1961	Apr. 15	Apr. 17	Aug. 28	—	Oct. 13	Nov. 10	July 17	July 27	—	—	Nov. 3	very poor fruiting
1962	Apr. 22	Apr. 24	Sept. 1	—	Sept. 18	Nov. 13	July 31	Aug. 9	—	—	Nov. 7*	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Tilia tuan</i>												
Szyscz.												
1953	Apr. 8	Apr. 30	Oct. 17	—	Nov. 6	Nov. 21	—	—	—	—	—	no flowering and fruiting
1954	May 21	May 24	Oct. 10	—	Oct. 10	Nov. 18	July 13	Aug. 3	Oct. 5	Oct. 20	Dec. 8	
1955	May 9	May 11	Oct. 1	—	Nov. 10	Nov. 25	July 19	Aug. 4	Oct. 8	Oct. 25	Dec. 8	
1956	Apr. 24	Apr. 26	Oct. 8	—	Oct. 31	Nov. 18	July 20	Aug. 6	Oct. 10	—	Dec. 12	
1957	May 7	May 11	Oct. 19	—	Oct. 17	Nov. 30	July 5	July 20	Sept. 28	—	Oct. 18*	
1958	May 10	May 13	Oct. 28	—	Oct. 30	Nov. 27	July 10	July 25	Sept. 30	—	Nov. 7*	
1959	Apr. 28	May 4	Sept. 16	—	Oct. 19	Nov. 10	July 3	July 15	Sept. 26	—	Oct. 1	
1960	May 10	May 15	Sept. 22	—	Nov. 6	—	July 12	July 26	—	—	—	
1961	Apr. 18	Apr. 24	Oct. 19	—	Oct. 25	Nov. 20	June 30	July 22	—	Nov. 3	—	
1962	Apr. 26	Apr. 29	Sept. 1	—	Sept. 18	Nov. 17	July 20	July 31	—	Nov. 17	—	
<i>Viburnum Carle-</i>												
<i>sii</i> Hemsl.												
1953	March 16	Apr. 2	Aug. 28	Oct. 25	Oct. 28	—	Apr. 24	May 8	—	—	—	no fruiting
1954	Apr. 22	Apr. 30	Sept. 2	Oct. 28	Oct. 24	—	May 15	May 26	—	—	—	no fruiting
1955	Apr. 29	May 1	Oct. 9	Oct. 31	Nov. 11	Feb. 29	May 14	June 4	—	—	—	leaf shedding in 1956
1956	Apr. 28	May 1	Oct. 3	—	Oct. 19	March 20	May 19	June 2	—	—	—	no fruiting
1957	March 25	Apr. 12	Sept. 21	Oct. 22	Oct. 8	Nov. 20	Apr. 29	May 18	—	—	—	no fruiting
1958	Apr. 19	Apr. 29	Sept. 17	—	Oct. 14	Dec. 10	May 16	May 29	—	—	—	no fruiting
1959	March 20	Apr. 1	Oct. 6	Oct. 30	Oct. 28	Nov. 25	Apr. 27	May 12	—	—	—	no fruiting
1960	Apr. 4	Apr. 19	Aug. 19	Oct. 25	Nov. 1	Nov. 16	May 11	May 26	—	—	—	no fruiting
1961	Feb. 28	March 18	Sept. 30	Oct. 28	Oct. 5	Nov. 20	Apr. 21	May 5	—	—	—	no fruiting
1962	Apr. 6	Apr. 15	Sept. 19	Oct. 11	Oct. 7	Nov. 16	Apr. 30	May 18	—	—	—	no fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Viburnum fragrans</i> Bge.												
1953	March 17	March 28	—	—	—	—	—	—	—	—	—	no flowering and fruiting
1954	Apr. 16	Apr. 26	—	—	—	—	Apr. 18	May 30	Aug. 4	Aug. 16	—	part of flowers froze
1955	Apr. 5	Apr. 20	Oct. 20	Nov. 4	Nov. 4	Dec. 1	Apr. 20	Apr. 30	June 11	July 21	July 28	
1956	May 4	May 9	Oct. 7	Nov. 21	Nov. 12	Dec. 23	—	—	—	—	—	no flowering and fruiting
1957	Feb. 10	March 7	Oct. 2	—	Oct. 16	Nov. 26	March 21	Apr. 12	June 17	—	—	fruit dropped
1958	March 24	Apr. 10	Oct. 14	Nov. 2	Oct. 19	—	Apr. 16	May 1	—	—	—	no fruiting
1959	March 15	Apr. 27	Sept. 23	—	Oct. 16	Nov. 25	March 18	Apr. 10	June 6	—	June 27*	
1960	March 20	Apr. 5	Aug. 23	—	Sept. 30	Nov. 8	Apr. 11	May 5	June 20	July 8	—	
1961	Feb. 21	Feb. 28	Sept. 21	—	Oct. 9	Nov. 20	March 13	March 28	—	—	—	fruits eaten by birds
1962	March 25	Apr. 6	Sept. 7	—	Oct. 3	Nov. 7	Apr. 9	Apr. 19	—	—	—	no fruiting
<i>Viburnum lantana</i> L.												
1953	March 23	May 25	Sept. 8	Oct. 16	Oct. 20	—	Apr. 22	May 4	July 10	—	—	
1954	Apr. 20	Apr. 26	Sept. 12	—	—	—	May 14	June 14	July 10	Aug. 11	—	profuse fruiting
1955	Apr. 29	May 1	Oct. 20	—	Oct. 25	Dec. 5	May 22	June 12	Aug. 4	Sept. 3	Sept. 15	
1956	Apr. 16	May 1	June 20	—	Oct. 12	Jan. 2	May 18	June 2	Aug. 18	Sept. 10	Sept. 27	leaf shedding in 1957
1957	Feb. 18	March 30	July 12	Oct. 23	Oct. 20	—	May 5	May 21	July 15	Aug. 30	—	
1958	Apr. 24	May 1	Oct. 10	—	Oct. 30	Nov. 10	May 19	May 28	Aug. 10	Sept. 20	Oct. 11	
1959	March 20	Apr. 8	Oct. 8	Nov. 4	Oct. 26	Nov. 17	Apr. 30	May 14	July 26	Aug. 13*	Sept. 30	
1960	Apr. 4	Apr. 19	Sept. 22	Oct. 10	Sept. 30	Nov. 21	May 14	May 24	Aug. 2	Aug. 24	—	



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	
<i>Viburnum lentago</i> L.	1961	March 3	March 31	Sept. 21	Oct. 27	Nov. 2	—	Apr. 27	May 12	July 18	Aug. 21	—	
	1962	Apr. 8	Apr. 17	Sept. 21	Oct. 20	Oct. 23	Nov. 29	May 6	May 30	Aug. 13	Sept. 10	—	
	1953	March 20	Apr. 2	Aug. 28	Oct. 16	—	—	May 10	May 29	July 28	Aug. 22	Sept. 10	
	1954	Apr. 20	May 2	—	Oct. 20	—	—	May 22	June 10	July 23	Aug. 16	—	
	1955	Apr. 28	May 1	Oct. 1	Oct. 14	Oct. 6	Dec. 3	Apr. 14	June 23	Sept. 18	Oct. 2	Oct. 13	
	1956	Apr. 17	May 2	Sept. 19	Oct. 7	Sept. 30	Dec. 12	June 1	June 9	Sept. 20	Oct. 4	Oct. 14*	
	1957	March 22	Apr. 1	Sept. 14	Oct. 7	Sept. 23	Nov. 3	May 20	June 7	Aug. 29	—	—	
	1958	Apr. 27	May 1	Sept. 21	Oct. 13	Sept. 24	Nov. 28	May 30	June 11	—	Oct. 6	—	
	1959	March 24	Apr. 8	Sept. 16	—	Oct. 6	Dec. 3	May 18	June 2	—	—	—	no fruiting
	1960	Apr. 15	Apr. 18	Aug. 23	Oct. 14	Sept. 30	Nov. 24	May 29	June 10	Sept. 17	Sept. 23	—	
<i>Viburnum prunifolium</i> L.	1961	March 12	March 19	Sept. 4	Oct. 20	Sept. 23	—	May 19	June 5	—	Sept. 27	—	
	1962	Apr. 4	Apr. 14	Sept. 5	Oct. 13	Sept. 9	Nov. 3	June 4	June 15	—	Oct. 7	—	
	1953	Apr. 2	Apr. 2	Oct. 2	Oct. 18	—	—	May 6	May 27	June 16	Aug. 20	Aug. 28	
	1954	May 1	May 4	Sept. 30	Oct. 14	—	Oct. 20	May 27	—	—	—	—	no fruiting
	1955	Apr. 13	May 2	Oct. 25	Nov 8	Nov. 15	Jan. 2	June 6	June 21	—	—	—	leaf shedding in 1956
	1956	May 1	May 9	Oct. 6	—	Nov. 2	Jan. 13	May 31	June 15	—	Oct. 24	Oct. 30	no fruiting leaf shedding in 1957
	1957	March 28	Apr. 2	Oct. 2	Nov. 4	Oct. 26	Nov. 29	May 18	June 5	—	—	—	no fruiting
	1958	Apr. 15	Apr. 29	Sept. 27	Nov. 24	Oct. 11	Jan. 4	May 28	June 11	—	—	—	leaf shedding in 1959
	1959	March 25	Apr. 9	Oct. 8	—	Oct. 28	Dec. 3	May 11	June 9	—	—	—	no fruiting
	1960	Apr. 5	Apr. 20	Sept. 25	Nov. 1	Oct. 29	Nov. 29	May 24	June 13	—	—	—	no fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	
<i>Viburnum Sargentii</i> Koehne	1961	March 9	March 22	Sept. 27	Oct. 25	—	—	May 14	June 7	—	—	—	no fruiting
	1962	Apr. 4	Apr. 17	Oct. 7	Oct. 23	Oct. 19	Oct. 29	May 21	June 13	—	—	—	no fruiting
	1953	Apr. 1	Apr. 6	—	—	—	—	—	—	—	—	—	no flowering and fruiting
	1954	Apr. 26	May 2	Sept. 14	—	—	—	May 20	June 14	Aug. 7	Sept. 14	—	
	1955	Apr. 8	Apr. 27	Oct. 1	Oct. 11	Oct. 6	Oct. 30	June 2	June 26	Aug. 28	Sept. 8	Oct. 4	
	1956	May 5	May 11	Sept. 21	Oct. 3	Oct. 4	Nov. 1	May 28	June 26	Aug. 15	Aug. 27	Sept. 27*	
	1957	Feb. 8	March 13	Sept. 14	Sept. 21	Sept. 25	Oct. 14	May 22	June 9	Aug. 2	Sept. 19	Nov. 19	
	1958	Feb. 11	Apr. 22	Sept. 17	—	Oct. 8	Oct. 21	May 29	June 20	Aug. 28	Sept. 20	Nov. 20	
	1959	March 24	Apr. 3	Sept. 10	Sept. 28	Sept. 23	Oct. 22	May 18	June 8	Aug. 20	Sept. 16	—	
	1960	Apr. 4	Apr. 17	Aug. 20	Sept. 27	—	Oct. 8	May 23	June 16	Aug. 10	Sept. 12	—	
<i>Viburnum tomentosum</i> Thunb.	1961	March 3	March 16	Sept. 1	Sept. 27	Sept. 18	Oct. 5	May 8	May 29	Aug. 8	Aug. 30	—	
	1962	March 31	Apr. 14	Sept. 2	Sept. 21	Sept. 21	Oct. 11	June 4	June 14	Aug. 24	Sept. 25	—	
	1953	March 5	Apr. 3	Aug. 31	Oct. 16	Oct. 20	—	May 12	May 24	July 14	—	—	
	1954	Apr. 30	May 5	Sept. 4	Oct. 14	—	—	May 27	June 11	—	—	—	
	1955	Apr. 18	May 6	Oct. 1	Oct. 31	Nov. 3	Nov. 29	June 2	July 11	—	—	Sept. 17	flowers a second time on Sept. 19, very poor fruiting
	1956	May 6	May 16	—	—	—	—	—	—	—	—	—	very few leaves, no flowering and fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1957	March 19	Apr. 3	Sept. 30	Nov. 27	Oct. 28	Feb. 12	May 16	June 3	—	—	—	leaf shedding in 1958
1958	March 17	Apr. 30	Sept. 21	—	Oct. 30	Jan. 21	May 21	June 10	—	—	—	no fruiting leaf shed- ding in 1959
1959	March 24	Apr. 4	—	Oct. 12	Nov. 4	Dec. 3	May 13	June 2	—	—	—	no fruiting
1960	Apr. 4	May 10	Sept. 25	Oct. 29	Sept. 30	Nov. 30	June 16	—	Aug. 5	—	—	no fruiting
1961	March 3	March 15	Sept. 21	Oct. 25	Oct. 27	—	May 15	June 3	—	—	—	no fruiting
1962	March 31	Apr. 14	Sept. 21	Oct. 20	Oct. 17	Nov. 29	May 28	June 13	Aug. 11	—	—	no fruiting
<i>Vitis amurensis</i>												
Rupr.												
1953	Apr. 25	Apr. 28	Aug. 26	Sept. 20	Oct. 6	Oct. 26	—	—	—	—	—	no flowering and fruiting
1954	May 16	May 20	Sept. 2	—	—	—	June 10	June 22	—	—	—	no fruiting
1955	May 5	May 11	Sept. 30	Oct. 13	Oct. 5	Oct. 28	June 26	July 8	Sept. 26	Oct. 6	Oct. 28	no fruiting
1956	May 9	May 22	Sept. 19	Oct. 3	Sept. 21	Oct. 19	June 8	July 1	—	—	—	no fruiting
1957	Apr. 29	May 9	Sept. 12	Sept. 30	Sept. 17	Oct. 15	June 10	June 21	Aug. 28	Sept. 21	—	no fruiting
1958	May 6	May 11	Sept. 13	Oct. 14	Oct. 6	Oct. 24	June 9	June 22	Sept. 15	Oct. 12	—	no fruiting
1959	Apr. 29	May 5	Sept. 28	—	Oct. 4	Nov. 4	—	—	—	—	—	no flowering and fruiting
1960	Apr. 20	May 7	Aug. 19	Sept. 30	Oct. 3	Nov. 1	June 2	June 11	—	—	—	no fruiting
1961	Apr. 15	Apr. 17	Aug. 25	Sept. 17	Oct. 2	Oct. 15	June 6	June 21	—	—	—	no fruiting
1962	Apr. 21	Apr. 23	Sept. 17	Sept. 27	Sept. 21	Oct. 20	June 13	June 23	Aug. 28	—	—	no fruiting
<i>Vitis vulpina</i> L.												
1953	Apr. 27	Apr. 29	Oct. 12	Oct. 18	Oct. 20	—	—	—	—	—	—	no flowering and fruiting
1954	May 18	May 21	—	—	—	—	June 8	June 30	—	—	—	no flowering and fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	3 12	13
1955	May 6	May 14	Oct. 11	Oct. 29	Oct. 24	Dec. 9	—	—	—	—	—	no flowering and fruiting
1956	May 11	May 23	Sept. 30	—	Oct. 10	Dec. 28	June 8	June 26	—	—	—	no fruiting
1957	Apr. 20	May 9	Sept. 15	Oct. 25	Sept. 30	—	June 9	June 25	—	—	—	no fruiting
1958	Apr. 27	May 14	Sept. 13	Oct. 25	Oct. 12	Dec. 12	June 12	June 24	—	—	—	no fruiting
1959	Apr. 28	May 8	—	—	Oct. 16	Nov. 12	—	—	—	—	—	no flowering and fruiting
1960	May 4	May 12	Sept. 25	Oct. 12	Oct. 7	Nov. 16	June 4	June 18	—	—	—	no fruiting
1961	Apr. 17	Apr. 21	Sept. 2	Oct. 15	Sept. 27	Nov. 17	June 7	June 23	—	—	—	no fruiting
1962	Apr. 22	Apr. 24	Sept. 19	Oct. 17	Oct. 5	Oct. 28	June 25	July 9	—	—	—	no fruiting
<i>Wistaria floribunda</i> DC.												
1953	May 28	June 4	Sept. 4	—	—	—	—	—	—	—	—	no flowering and fruiting
1954	May 15	May 18	Sept. 20	—	—	—	—	—	—	—	—	no flowering and fruiting
1955	May 5	May 11	Oct. 27	—	Oct. 26	Nov. 14	—	—	—	—	—	no flowering and fruiting
1956	—	—	—	—	—	—	—	—	—	—	—	badly injured by frost
1957	Apr. 28	May 13	Oct. 5	Oct. 29	Oct. 10	Nov. 14	—	—	—	—	—	no flowering and fruiting
1958	Apr. 25	May 15	Sept. 17	—	Oct. 1	Nov. 30	—	—	—	—	—	no flowering and fruiting
1959	Apr. 16	Apr. 30	Sept. 15	—	Oct. 26	Nov. 25	—	—	—	—	—	no flowering and fruiting
1960	May 2	May 11	Aug. 18	Oct. 30	Oct. 11	Nov. 24	—	—	—	—	—	no flowering and fruiting



1	2	3	4	5	6	7	8	9	10	11	12	13
1961	March 25	Apr. 20	Oct. 12	Oct. 28	Oct. 24	Nov. 20	—	—	—	—	—	no flowering and fruiting
1962	Apr. 19	Apr. 24	Sept. 26	Oct. 28	Oct. 7	Nov. 25	—	—	—	—	—	no flowering and fruiting
<i>Wistaria sinensis</i> Sweet.												
1953	Apr. 14	Apr. 18	Sept. 12	Sept. 28	Oct. 16	—	Apr. 28	May 20	—	—	—	no fruiting
1954	May 3	May 6	Sept. 15	—	Oct. 6	Oct. 22	May 18	June 8	—	—	—	no fruiting
1955	Apr. 30	May 5	Oct. 7	Nov. 5	Oct. 22	Nov. 18	May 19	June 26	—	—	—	no fruiting
1956	May 3	May 24	Sept. 30	—	Oct. 11	Dec. 3	—	—	—	—	—	no flowering and fruiting
1957	Apr. 2	Apr. 13	Sept. 22	Oct. 16	Oct. 7	—	—	—	—	—	—	no flowering and fruiting
1958	Apr. 24	May 16	Sept. 17	Nov. 5	Sept. 21	Jan. 4	—	—	—	—	—	no flowering and fruiting
1959	Apr. 10	Apr. 26	Sept. 23	—	Oct. 19	Dec. 20	May 6	May 26	—	—	—	no fruiting
1960	Apr. 20	May 11	Aug. 22	Oct. 22	Oct. 20	Nov. 24	May 15	June 10	—	—	—	no fruiting
1961	Apr. 10	Apr. 19	Sept. 13	Nov. 7	Sept. 17	—	May 3	May 18	—	—	—	no fruiting
1962	Apr. 3	Apr. 17	Oct. 5	—	—	Nov. 25	May 30	June 24	Aug. 10	Aug. 17	—	
<i>Zelkova serrata</i> Mak.												
1953	Apr. 11	Apr. 16	Sept. 26	Oct. 22	Oct. 16	Nov. 21	—	—	—	—	—	no flowering and fruiting
1954	May 8	May 10	Oct. 10	Oct. 26	Oct. 15	Oct. 30	—	—	—	—	—	no flowering and fruiting
1955	May 2	May 6	Oct. 15	Oct. 28	Oct. 25	Nov. 12	—	—	—	—	—	no flowering and fruiting
1956	May 7	May 12	Oct. 4	Oct. 24	Oct. 20	Nov. 5	—	—	—	—	—	no flowering and fruiting



Table 6 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13
1957	Apr. 24	Apr. 30	Sept. 26	Oct. 19	Oct. 10	Oct. 29	—	—	—	—	—	no flowering and fruiting
1958	May 10	May 14	Oct. 6	Nov. 3	Oct. 18	Dec. 12	—	—	—	—	—	no flowering and fruiting
1959	Apr. 20	Apr. 26	Sept. 12	Oct. 18	Oct. 4	Nov. 6	—	—	—	—	—	no flowering and fruiting
1960	Apr. 30	May 8	Oct. 10	Oct. 26	Oct. 18	—	May 12	May 18	—	—	—	no fruiting
1961	Apr. 6	Apr. 15	Sept. 30	Oct. 23	Oct. 11	Nov. 13	—	—	—	—	—	no flowering and fruiting
1962	Apr. 22	Apr. 24	Sept. 22	Oct. 18	Oct. 3	Nov. 15	Apr. 26	May 2	—	—	—	no fruiting

\* Fruit crop date,  
— no observations.



northern China (*Forsythia Giraldiana* and *Viburnum fragrans*) and central China (*Corylopsis platypetala*).

Much more numerous is the group of trees and shrubs for which opening of leaf buds in the early spring is characteristic:

<i>Aesculus hippocastanum</i>	<i>Lonicera alpigena</i>
<i>Aesculus pavia</i>	<i>Lonicera thibetica</i>
<i>Carpinus betulus</i>	<i>Lonicera xylosteum</i>
<i>Cornus alba</i> (starts to grow)	<i>Lonicera Maximowiczii</i>
<i>Cornus amomum</i> (starts to grow)	<i>Magnolia salicifolia</i>
<i>Cornus Hemsleyi</i> (starts to grow)	<i>Prunus padus</i>
<i>Cotoneaster horizontalis</i>	<i>Ribes alpinum</i>
<i>Cotoneaster obscura</i>	<i>Ribes aureum</i>
<i>Cotoneaster racemiflora</i>	<i>Schisandra chinensis</i>
<i>Eucommia ulmoides</i>	<i>Sorbus americana</i>
<i>Evonymus alata</i>	<i>Sorbus aucuparia</i>
<i>Evonymus europaea</i>	<i>Tilia tomentosa</i>
<i>Fagus grandifolia</i>	<i>Viburnum Carlesii</i>
<i>Hydrangea petiolaris</i>	<i>Viburnum lantana</i>
<i>Hydrangea radiata</i> (starts to grow)	<i>Viburnum prunifolium</i>
<i>Hydrangea xanthoneura</i>	<i>Viburnum tomentosum</i>
<i>Kolkwitzia amabilis</i>	

Among these 35 tree and shrub species, those belonging to the genera *Cornus*, *Cotoneaster*, *Hydrangea*, *Lonicera* and *Viburnum* prevail. Many of these species derive from western China (*Cotoneaster horizontalis*, *Cotoneaster obscura*, *Hydrangea xanthoneura*, *Lonicera thibetica*) and central China (*Cornus Hemsleyi*, *Eucommia ulmoides*, *Hydrangea petiolaris*, *Kolkwitzia amabilis* and *Viburnum tomentosum*). Noteworthy is also the contribution of trees and shrubs representing the genera *Aesculus*, *Evonymus*, *Prunus*, *Ribes* and *Sorbus*. The greatest phenological regularity, that is occurrence of the flowering or bud development phase always in the course of early spring was exhibited in the period 1953–1962 by two Euroasiatic species: *Lonicera xylosteum* and *Prunus padus* and one North American species — *Ribes aureum*. Their common trait is a very extensive area of natural spread and adaptation to a wide ecological amplitude (unfortunately the origin of the bushes growing in Kórnik is not known).

At the beginning of spring every year (in the ten-year period investigated) bursting and opening of leaf buds was observed on such trees as: *Acer monspessulanum*, *Acer nikoense*, *Acer pseudoplatanus*, *Carya cordiformis*, *Carya laciniata*, *Castanea sativa*, *Cercidiphyllum japonicum*, *Evodia Daniellii*, *Fagus japonica*, *Fagus sylvatica*, *Gleditsia triacanthos* (starts to grow), *Juglans nigra*, *Maclura pomifera* (starts to grow), *Magnolia acuminata*, *Magnolia kobus* var. *borealis*, *Rhus silvestris* (starts to grow), *Robinia pseudoacacia*, *Tilia cordata*, *Tilia Maximowicziana*.

Most of the above listed species originating from the Atlantic part of North America (*Carya cordiformis*, *Carya laciniata*, *Gleditsia triacanthos*, *Juglans nigra*, *Magnolia acuminata*, *Robinia pseudoacacia*) and from Japan (*Acer nikoense*, *Cer-*



*cidiphyllum japonicum*, *Magnolia kobus* var. *borealis*) have a high adaptation ability in the climatic conditions of Kórnik. As regards phenological regularity, the species: *Juglans nigra*, *Magnolia kobus* var. *borealis* and *Tilia cordata* should be mentioned particularly.

In the same phenological season of beginning spring the flowering of the following trees and shrubs was noted: *Carpinus betulus*, *Corylopsis platypetala* (end of flowering), *Evonymus alata* (begins flowering), *Fagus orientalis*, *Lonicera coerulea*, *Magnolia kobus* var. *borealis*, *Prunus fruticosa* (begins flowering), *Prunus padus* (begins flowering), *Ribes alpinum*, *Ribes aureum* (begins flowering), *Viburnum Carlesii* (begins flowering), *Vitis amurensis*, *Zelkova serrata*.

Among the more interesting species, as regards the range of occurrence and decorative qualities, should be mentioned the early flowering shrubs: *Lonicera coerulea* common on the area of the northern Eurasia hemisphere, classed to the elements of Siberian flora, *Evonymus alata* with an extensive north Asiatic range and the valuable decorative shrubs originating from the western part of North America (*Ribes aureum*) and eastern Asia (*Viburnum Carlesii*, *Vitis amurensis* and *Magnolia kobus* var. *borealis*).

During phenological spring opening of leaf buds was observed exclusively in *Gymnocladus canadensis*. On the other hand, nearly all the below listed shrubs and trees flowered regularly in this season: *Cladrastis tinctoria*, *Cornus alba* (beginning of flowering), *Cornus stolonifera* (beginning of flowering), *Evonymus alata* (further flowering), *Evonymus europaea* (beginning of flowering), *Evonymus latifolia* (beginning of flowering), *Elaeagnus multiflora*, *Halesia tetraptera*, *Juglans cinerea*, *Juglans mandshurica*, *Lonicera Maackii* (beginning of flowering), *Lonicera xylosteum*, *Lonicera Maximowiczii* (beginning of flowering), *Magnolia acuminata* (begins flowering), *Ribes aureum* (end of flowering), *Schisandra chinensis*, *Sorbus americana*, *Sorbus aucuparia*, *Viburnum Carlesii* (end of flowering), *Viburnum lantana*, *Viburnum prunifolium* (begins flowering), *Viburnum tomentosum*.

As seen, at this time of the year mainly shrubs representing the genera *Evonymus*, *Lonicera*, *Viburnum* and *Cornus*, and trees of the genera *Juglans* and *Sorbus* come into flower. Many of these trees and shrubs are very hardy and noteworthy for their attractive and profuse blossom. This concerns particularly the species: *Halesia tetraptera* from the southeastern part of North America and *Lonicera Maackii* originating from the area of Manchuria and Korea. *Lonicera xylosteum* common on the area of Europe and western Asia up to the Altai, known as early as in the Tertiary is characterized by the greatest phenological regularity as regards the time of growth and of flowering.

Ripening of the fruits of *Prunus subhirtella*, one of the most decorative Japanese cherries, begins in spring.

The concurrence of the phenophase of flowering with the period of early summer was observed in the species: *Cornus kousa*, *Cornus rugosa*, *Cotoneaster obscura* (begins flowering), *Gleditsia triacanthos*, *Hydrangea petiolaris*, *Hydrangea*



*xanthoneura*, *Juglans nigra*, *Liriodendron tulipifera*, *Maclura pomifera* (begins flowering), *Magnolia acuminata* (end of flowering), *Lonicera Maximowiczii* (end of flowering), *Phellodendron amurense* (end of flowering), *Pterostyrax hispida*, *Rhus silvestris* (begins flowering), *Robinia pseudoacacia*, *Tilia platyphyllos* (begins flowering).

Three species from the southeastern part of North America exhibit a high phenological regularity of this phase: *Gleditsia triacanthos*, *Liriodendron tulipifera* and *Robinia pseudoacacia* which in the environmental conditions of Poland exhibit a high viability and resistance to low temperatures.

During the same phenological season, that is early summer, in some species ripening of fruits was observed. This concerns: *Lonicera coerulea*, *Prunus subhirtella* (end of fruiting), *Prunus padus* (begins fructification) and *Vitis vulpina*.

The very short period of fruit growth between the phenophase of flowering and fruiting in *Lonicera coerulea* and *Prunus padus* seems to result from the adaptation of the Euroasiatic species to the low sum of heat in the course of the vegetation period.

The period of phenological summer coincides with the flowering of: *Aesculus parviflora*, *Ailanthus glandulosa*, *Cotoneaster obscura* (end of flowering), *Hydrangea radiata* (begins flowering), *Hydrangea Sargentiana* (begins flowering), *Maclura pomifera* (end of flowering), *Rhus silvestris* (end of flowering), *Sorbaria sorbifolia*, *Tilia cordata*, *Tilia tuan*, *Tilia americana*, *Tilia mongolica*, *Tilia platyphyllos* (end of flowering), and *Tilia Maximowicziana*.

The above named group includes numerous east-Asiatic trees particularly of Chinese provenience such as *Ailanthus glandulosa*, *Cotoneaster obscura*, *Hydrangea Sargentiana*, *Tilia tuan* and *Sorbaria sorbifolia* frequently found in our gardens, the range of which reaches from the Ural Mts. to the Sakhalin and Japan. The latter species is an object of interest because of its ecological plasticity. In the above group the proportion of lindens is rather larger; among them *Tilia cordata* and *Tilia tuan* exhibit a high phenological regularity. Fruit ripening in this period was noted in the species: *Cornus alba* (beginning of ripening), *Lonicera Maackii* (beginning of ripening), *Lonicera thibetica*, *Morus alba*, *Ribes alpinum*, *Ribes aureum* (beginning of ripening), *Sorbus aucuparia* (beginning of ripening).

Early autumn is very often associated with a complete change of color of the foliage and leaf shedding in *Juglans mandshurica* and with the beginning of change of leaf color in the following trees and shrubs: *Cercidiphyllum japonicum*, *Cornus rugosa*, *Gymnocladus canadensis*.

Early leaf fall in *Juglans mandshurica* may be evidence of the adaptation of this tree to the very short vegetation period in its native country. In early fall ripening of the fruits of: *Fagus silvatica* (beginning of ripening), *Pterostyrax hispida* (beginning of ripening), *Ribes aureum* (end of ripening) and *Robinia pseudoacacia* was most frequently observed in the investigated ten-year period.



Golden fall is the time of change of color of the leaves of the majority of the trees and shrubs observed. In view of the commonness of this phenomenon, there seems to be no point in enumerating the species.

Late fall is characterized by the phenophase of leaf shedding by numerous trees and shrubs. Nearly always in the course of the 10-year period foliage was shed at this time by: *Lonicera alpigena*, *Kolkwitzia amabilis*, *Maclura pomifera*, *Magnolia kobus* var. *borealis*, *Magnolia salicifolia*, *Phellodendron amurense*, *Prunus subhirtella*, *Pterocarya fraxinifolia* and *Rhus silestris*.

In the same phenological season fruits ripen on: *Hydrangea radiata*, *Magnolia kobus* var. *borealis*, *Phellodendron amurense*, *Fagus silvatica*, *Pterostyrax hispida*, *Robinia pseudoacacia*.

In winter, the period of vegetative rest for most of the trees and shrubs growing in our geographical region falls to the time of flowering of *Hamamelis mollis* and the end of ripening of the fruits of *Robinia pseudoacacia*.

To sum up this chapter, the observation should be mentioned that numerous trees and shrubs of foreign origin, the vegetation rhythm (phenophases of leaf bud opening and of flowering) of which is distinctly coordinated with the rhythm of the phenological seasons of the year show an excellent adaptation to the conditions of the Kórnik Arboretum environment. This fact should, not, however, be generalized to an affirmation that there is a distinct relation between the phenological regularity in trees and shrubs and their adaptive ability. There exist, namely many trees and shrubs, the vegetation rhythm of which is synchronized with the climatic rhythm, and their degree of adaptation to the environmental conditions is low (*Castanea sativa*, *Cornus kousa*, *Elaeagnus angustifolia*, *Fagus japonica*, *Pterostyrax hispida*, *Zelkova serrata* and others). By this is meant their incomplete cycle of generative development.

## 5. Discussion of Results of Phenological Observations

Analysis of the annual vegetation cycle of a great part of the trees and shrubs of foreign provenience growing in the Kórnik Arboretum consists of two parts.

In the first the species with different seasonal development rhythm are classified according to:

- (1) the duration of the period of vegetative activity,
- (2) the date of beginning of leaf bud opening and the end of shedding,
- (3) the length of the flowering period and the date of the beginning of this phenophase,
- (4) the length of the period of fruit growth from setting of primordia to the beginning of ripeness,
- (5) the differing generative development cycle (trees and shrubs which flower,



but do not bear fruit; do not flower or bear fruit; flower and fructify; are capable of producing normal seeds).

The large amount of material collected over a period of many years observations of the chosen 122 tree and shrub species made it possible to establish the relation between the seasonal rhythmicity of the vegetation and the provenience of the species (geographical latitude, degree of continentality, altitude above sea level) and between the rhythm of vegetation and the kind of range of occurrence (disjunction, small or wide ecological amplitude).

Particularly interesting seems to be the annual course of vegetation of relict species. Comparison of the phenological spectra of the selected trees and shrubs should also demonstrate certain regularities occurring between the seasonal development and various weather combinations. In many cases, for instance, the influence of low and extreme temperatures, of various sums of heat, of the length of the vegetation season, of the distribution of precipitation and of the negative water balance on the rhythm of the phenophases may be revealed.

The study of the annual development of trees and shrubs of foreign origin cultivated in our conditions and characterized by the greatest or poorest adaptive ability will allow to establish the factors or their combinations which are of major importance in the process of introduction. By adaptive ability is meant here the ability of going through the full vegetation cycle in the course of the year, of bearing of normal seeds, of production of a maximum of organic matter in the given habitat as well as the resistance to low temperatures.

Thus, the second part of the analysis consists in an attempt at elucidation of the rhythm of vegetation of the chosen trees and shrubs. It is not easy to establish the causes which decide whether the given plant in the given environment develops leaves at various times, flowers and sets fruit or does not flower or set fruit. These are, no doubt, complex phenomena which result from the characteristics of the environment and the biological properties of the given plant. In view of this and the risk of mistake, owing to a more or less subjective evaluation of the beginning and end of a phenophase, the phenological spectra of the trees and shrubs with the longest and shortest period of vegetative activity, the longest and shortest period of flowering etc. were investigated and so were other features of their rhythmicity taking into consideration the most extreme time intervals. Moreover, in the graphical synthesis of the results of phenological observations, the mean values for periods of many years were taken into account, therefore the possible errors in the particular years should be of no major importance. It is hoped that owing to such an elaboration of the materials collected for many years, it will be possible to single out from the large number of observations the most characteristic groups of species as regards seasonal rhythmicity and eliminate the less significant characteristics and factors.



It was assumed conventionally that the beginning of opening of the leaf buds and the state when most leaves have been shed determine the period of vegetative activity of most trees and shrubs. It is more difficult to establish the length of the vegetation period of trees and shrubs, since the border between the period of vegetation and the period of dormancy on the basis of a uniform criterion is not simple to establish in practice (flowering before leaf development, ripening of fruit after leaf shedding). As regards evergreen species, they should be treated with certain reservations, since the end of the period of vegetative activity is in this case dependent in the first place on a certain thermic threshold. In mild winters of Atlantic type there occur in evergreen shrubs vital processes which cease only when the diurnal temperature falls below the critical value.

In general, as far as the 122 trees and shrubs under investigation are concerned, the mean duration of vegetative activity was approximately 150–260 days (Fig. 2).

The shortest mean duration of this activity (150–191 days) was noted in successive order in the species: *Juglans mandshurica*, *Gymnocladus canadensis*, *Carya cordiformis*, *Acer rubrum*, *Vitis amurensis*, *Ailanthus glandulosa*, *Hamamelis virginiana*, *Acer nikoense*, *A. pseudoplatanus*, *Magnolia acuminata*, *Gleditsia triacanthos*, *Viburnum Sargenti*, *Phellodendron amurense*, *Tilia cordata*, *Rhus silvestris*, *Juglans Sieboldiana*, *J. nigra*, *Fagus orientalis*, *Carpinus orientalis* and *Tilia mongolica*. Is it possible to find any relation between the origin of these trees and their vegetation rhythm? The very short period of vegetative activity in such species as *Juglans mandshurica*, *Vitis amurensis*, *Acer Ginnala* and *Phellodendron amurense* shows the adaptation of these trees and shrubs to long and severe winter, a cold spring and a short vegetation period in their native land in northeastern Asia. The climate of these regions is characteristically continental, and this explains the hardiness of the trees growing there. The same trait of seasonal rhythmicity was observed in species originating from Japan and China (*Acer nikoense*, *Juglans Sieboldiana*, *Tilia Maximowicziana*, *T. mongolica*). This seems to be connected with the introduction of plants from temperate and cool zones. It should be added that in north Japan like in the remaining mountainous part of east Asia, a climate with a long severe, frequently dry winter and warm summer months (influence of polar-continental air masses and monsoons) prevails. Some North-American trees have a similar development cycle as for instance: *Gymnocladus canadensis*, *Carya cordiformis*, *Acer rubrum*, *Magnolia acuminata*, *Gleditsia triacanthos*, *Juglans cinerea*, *J. nigra* and *Fagus grandifolia*, represented in Kórník by specimens of probably northern provenience. Their seasonal rhythm developed under the influence of the severe climate of the Laurentian Highlands acting as a reserve of cold air which flows from the regions of the Arctic Sea and Hudson Bay and reaches as far south as the Gulf of Mexico.



Certain connections may also be found between the range of occurrence, or strictly speaking the type of climate within the range of occurrence, and the cyclic development in the group of shrubs characterized by a very long period of vegetative activity (average 225–260 days). To these belong in successive order: *Viburnum tomentosum*, *V. Carlesii*, *Kerria japonica*, *Viburnum fragrans*, *Cotoneaster obscura*, *Berberis vulgaris*, *Ribes aureum*, *R. alpinum*, *Lonicera thibetica*, *Hydrangea radiata*, *Viburnum prunifolium*, *Kolkwitzia amabilis*, *Lonicera xylosteum*, *Rhus trilobata*, *Corylopsis platypetala*, *Viburnum lantana*, *Hydrangea petiolaris*, *Pterostyrax hispida* and *Elaeagnus angustifolia*. This feature is characteristic of shrubs growing in low geographical latitudes in the regions of western and central China. They occur in the tropical and monsoon zones.

Typically representative of the flora of central China are the species: *Kolkwitzia amabilis* and *Corylopsis platypetala*. Both develop leaf buds very early and shed their leaves very late, they are sensitive to major temperature falls.

Small sums of heat seem to be sufficient in our conditions for shrubs from the extensive areas of Northern Asia, which start vegetation very early, to mention: *Sorbaria sorbifolia*, *Lonicera coerulea*, some Euroasiatic shrubs such as *Lonicera xylosteum*, *Elaeagnus angustifolia* and the shrubs growing in the European mountains: *Lonicera alpigena*, *Ribes alpinum* and *Forsythia europaea*. Noteworthy is also the long period of vegetative activity of *Lonicera thibetica*. It would seem that the above named species adapted themselves in their native country to small amounts of heat in the vegetation season. Owing to this they start growing early in our climatic conditions and lose their leaves late, thus they have a long period of vegetative activity.

These characteristic ecological conditions throw some light on the seasonal rhythm of shrubs brought to this country from Japan, in the northern part of which the climate of the moderate zone prevails with monsoon features (frosty and dry winters), and in the southern part the climate is characteristic of the tropical zone (cool winters, wet summer, mean annual temperature 15°–17°). The latter climatic type is also characteristic for the Korean peninsula. Frequently, however, the knowledge of the microclimate of the native land is not sufficient for explaining the vegetation rhythm of plants. More precise data are necessary informing on the extreme temperature values, the water balance, the length of the vegetation period, insolation and other factors connected for instance with the terrain relief and characteristic for a definite geographical region.

Calculation of the mean dates of leaf bud opening and leaf dropping shows a far going connection with the length of the period of vegetative activity of trees and shrubs. Evidence of this is found in the lists of species, in which in the course of the ten-year period bud opening (Fig. 3a) and leaf shedding (Fig. 3b) were earliest and latest observed.

A great number of species shows an average length of the period of vegetative activity. This is understandable if we consider their provenience from regions with



Genus and species	Flowering but no fruiting									
	53	54	55	56	57	58	59	60	61	62
1. <i>Acer circinatum</i>	○									
2. <i>Acer Gimmala</i>					○	○				
3. <i>Acer monspessulanum</i>	○		○		○	○	○			
4. <i>Acer nikoense</i>	○									
5. <i>Acer palmatum</i>										
6. <i>Acer platanoides</i>					○		○		○	
7. <i>Acer pseudoplatanus</i>			○		○		○		○	
8. <i>Acer rubrum</i>					○		○		○	
9. <i>Acer saccharinum</i>	○			○	○	○		○	○	○
10. <i>Acer tataricum</i>							○		○	
11. <i>Aesculus hippocastanum</i>										
12. <i>Aesculus parviflora</i>		○		○	○	○		○	○	○
13. <i>Aesculus pavia</i>										
14. <i>Aesculus turbinata</i>	○									
15. <i>Ailanthus glandulosus</i>										
16. <i>Berberis koreana</i>										
17. <i>Berberis vulgaris</i>										
18. <i>Calycanthus floriflora</i>	○	○	○				○		○	
19. <i>Carpinus betulus</i>					○		○		○	
20. <i>Carpinus japonica</i>	○									
21. <i>Carpinus orientalis</i>										
22. <i>Carya cordiformis</i>	○									
23. <i>Carya laciniosa</i>							○			
24. <i>Castanea sativa</i>		○				○	○	○	○	
25. <i>Cercidiphyllum japonicum</i>					○					○
26. <i>Cladrastis tinctoria</i>		○	○			○				
27. <i>Cornus alba</i>										
28. <i>Cornus amomum</i>										
29. <i>Cornus Hemsleyi</i>										
30. <i>Cornus kousa</i>					○	○	○	○		
31. <i>Cornus mas</i>					○					
32. <i>Cornus officinalis</i>										
33. <i>Cornus rugosa</i>										
34. <i>Cornus stolonifera</i>										
35. <i>Corylopsis platypetala</i>		○					○	○		
36. <i>Cotoneaster horizontalis</i>										
37. <i>Cotoneaster obscura</i>										
38. <i>Cotoneaster racemiflora</i>					○					
39. <i>Elaeagnus angustifolia</i>		○		○						
40. <i>Elaeagnus multiflora</i>	○		○	○	○				○	○
41. <i>Eucommia ulmoides</i>								○		
42. <i>Evodia Daniellii</i>	○	○	○	○	○	○	○	○	○	○
43. <i>Evonymus alata</i>		○								



No flowering and no fruiting												Flowering and fruiting												Germination power	
53	54	55	56	57	58	59	60	61	62	53	54	55	56	57	58	59	60	61	62	% of healthy seeds					
																				20	+				
																				—	—				
																				—	—				
																				20	+				
																				—	—				
																				90	+				
																				90	+				
																				20	+				
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																				20	+				
																				80	—				
																				100	+				
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																				—	—				
																				100	(+)				



Genus and species	Flowering but no fruiting										
	53	54	55	56	57	58	59	60	61	62	
44. <i>Evonymus europaea</i>			○	○							
45. <i>Evonymus latifolia</i>							○				
46. <i>Evonymus verrucosa</i>											
47. <i>Fagus japonica</i>											
48. <i>Fagus grandifolia</i>		○			○		○				
49. <i>Fagus orientalis</i>			○	○			○	○			
50. <i>Fagus sylvatica</i>	○										
51. <i>Forsythia europaea</i>				○	○		○	○			
52. <i>Forsythia Giraladiana</i>	○				○	○	○				
53. <i>Forsythia ovata</i>	○			○	○	○	○		○		
54. <i>Gleditsia triacanthos</i>					○	○	○	○			
55. <i>Gymnocladus canadensis</i>	○										
56. <i>Halesia tetraptera</i>											
57. <i>Hamamelis mollis</i>	○			○							
58. <i>Hamamelis virginiana</i>							○		○		
59. <i>Hydrangea petiolaris</i>					○	○					
60. <i>Hydrangea radiata</i>											
61. <i>Hydrangea Sargentiana</i>	○										
62. <i>Hydrangea xanthoneura</i>	○										
63. <i>Juglans cinerea</i>							○		○		
64. <i>Juglans mandshurica</i>				○		○	○		○		
65. <i>Juglans nigra</i>					○						
66. <i>Juglans Sieboldiana</i>							○		○		
67. <i>Kerria japonica</i>	○	○	○	○	○	○	○	○	○		
68. <i>Kolkwitzia amabilis</i>											
69. <i>Lindera aestivalis</i>	○	○	○	○		○	○	○	○	○	
70. <i>Liriodendron tulipifera</i>											
71. <i>Lonicera alpigena</i>											
72. <i>Lonicera coerulea</i>	○										
73. <i>Lonicera iberica</i>											
74. <i>Lonicera Maackii</i>				○							
75. <i>Lonicera Maximowiczii</i>	○										
76. <i>Lonicera tatarica</i>	○	○									
77. <i>Lonicera thibetica</i>										○	
78. <i>Lonicera xylosteum</i>	○										
79. <i>Maclura pomifera</i>	○	○		○		○		○	○		
80. <i>Magnolia acuminata</i>			○				○	○		○	
81. <i>Magnolia kobus borealis</i>	○			○							
82. <i>Magnolia salicifolia</i>	○		○	○	○		○				
83. <i>Magnolia tripetala</i>		○		○	○		○		○		
84. <i>Morus alba</i>											
85. <i>Pheadendron amurense</i>									○		
86. <i>Platanus acerifolia</i>							○	○		○	



Table 7 (continued)

No flowering and no fruiting												Flowering and fruiting										Germination power	
53	54	55	56	57	58	59	60	61	62	53	54	55	56	57	58	59	60	61	62	% of healthy seeds			
										○				○	○	○	○	○	○	100	+		
										○		○	○	○	○	○	○	○	○	100	(+)		
										○		○	○	○	○	○	○	○	○	100	(+)		
○	○	○	○	○	○	○	○	○												—	—		
○																				—	—		
○																				10	—		
																				80	+		
																				80	+		
																				80	+		
																				80	+		
																				100	+		
																				—	—		
																				30	+		
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																				90	+		
																				80	+		
																				100	+		
																				100	+		
																				50	(+)		
																				20-30	+		
																				100	+		
																				20	+		



Genus and species	Flowering but no fruiting									
	53	54	55	56	57	58	59	60	61	62
87. <i>Prunus fruticosa</i>	○		○	○	○					
88. <i>Prunus padus</i>	○									
89. <i>Prunus serotina</i>										
90. <i>Prunus subhirtella</i>	○									
91. <i>Pterocarya fraxinifolia</i>				○			○	○		
92. <i>Pterostyrax hispida</i>					○					
93. <i>Rhus sylvestris</i>		○	○	○	○	○	○	○	○	○
94. <i>Rhus trilobata</i>		○	○					○	○	
95. <i>Ribes alpinum</i>										
96. <i>Ribes aureum</i>	○									
97. <i>Ribes longiracemosum</i>	○	○	○	○	○	○	○	○	○	○
98. <i>Robinia pseudoacacia</i>										
99. <i>Schisandra chinensis</i>					○					
100. <i>Sorbus americana</i>			○							
101. <i>Sorbus aucuparia</i>										
102. <i>Sorbaria sorbifolia</i>									○	
103. <i>Tilia americana</i>					○					
104. <i>Tilia cordata</i>										
105. <i>Tilia Maximowicziana</i>										
106. <i>Tilia mongolica</i>					○					
107. <i>Tilia platyphyllos</i>					○					
108. <i>Tilia tomentosa</i>					○					
109. <i>Tilia tuan</i>										
110. <i>Viburnum Carlesii</i>	○		○	○	○	○	○	○	○	○
111. <i>Viburnum fragrans</i>						○				○
112. <i>Viburnum lantana</i>										
113. <i>Viburnum lentago</i>						○	○			
114. <i>Viburnum prunifolium</i>		○	○		○	○	○	○	○	○
115. <i>Viburnum Sargentii</i>										
116. <i>Viburnum tomentosum</i>					○	○	○		○	
117. <i>Vitis amurensis</i>								○	○	
118. <i>Vitis vulpina</i>				○	○	○		○	○	○
119. <i>Wistaria floribunda</i>										
120. <i>Wistaria sinensis</i>	○	○	○				○	○	○	
121. <i>Zelkova serrata</i>								○		○

+ seeds sown in nursery germinate

(+) according to reliable information seeds germinate

- seeds do not germinate in nursery



Table 7 (continued)

No flowering and no fruiting											Flowering and fruiting											Germination power	
53	54	55	56	57	58	58	60	61	62	53	54	55	56	57	58	59	60	61	62	% of healthy seeds			
																				100	(+)		
																				100	+		
																				50	(+)		
																				100	+		
																				50			
																				50			
																				—	—		
																				—	—		
																				100	+		
																				100	+		
																				—	—		
																				100	+		
																				50	+		
																				80	+		
																				80	+		
																				90-100	+		
																				50			
																				100	+		
																				50			
																				10			
																				100	+		
																				30			
																				10			
																				—	—		
																				80			
																				100	+		
																				80	+		
																				30			
																				50			
																				30			
																				80			
																				—	—		
																				—	—		
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																				—	—		



intermediate and not extreme types of climate, and the dependence of the seasonal rhythm of plant development on several or many factors.

In the further course of analysis of the results of phenological observations, the trees and shrubs were classified according to the shortest and longest period of flowering. The first group consists almost exclusively of trees. A mean time of flowering calculated from ten years of observations contained within an interval of 4–13 days is characteristic for this group. This group comprises the following species classified according to the duration of flowering: *Carpinus japonica*, *Fagus orientalis*, *Carpinus orientalis*, *Juglans cinerea*, *J. mandshurica*, *J. nigra*, *Fagus grandifolia*, *Pterocarya fraxinifolia*, *Juglans Sieboldiana*, *Carpinus betulus*, *Fagus sylvatica*, *Platanus acerifolia*, *Carya cordiformis*, *C. laciniosa*, *Prunus serotina*, *Cercidiphyllum japonicum*, *Phellodendron amurense*, *Schisandra chinensis*, *Acer monspessulanum* and *Rhus silvestris*.

The second group consisting mainly of shrubs has a mean time of flowering within 24–73 days. Here belong the species: *Calycanthus floridus*, *Hamamelis mollis*, *H. virginiana*, *Cornus alba*, *Kerria japonica*, *Evodia Daniellii*, *Cornus stolonifera*, *Hydrangea radiata*, *H. xanthoneura*, *H. Sargentiana*, *H. petiolaris*, *Lonicera thibetica*, *Liriodendron tulipifera*, *Aesculus pavia*, *Ribes longercemosum*, *Evoynymus verrucosa*, *E. alata*, *Aesculus parviflora*, *Cornus officinalis*, *Sorbaria sorbifolia*.

In the group of shrubs with a long period of flowering, the contribution of species from moderate and tropical climates of eastern Asia is most pronounced (*Hydrangea Sargentiana*, *Hamamelis mollis*), less numerous are those from North America (*Cornus amomum*). There are also North Asiatic species (*Sorbaria sorbifolia* and *Cornus alba*). It is possible that the strikingly long period of flowering of *Cornus alba* which grows on the extensive ranges of Siberia as far as Manchuria and Korea is connected with its adaptation to various climatic conditions.

Of no small importance for the characteristic of the seasonal rhythmicity of trees and shrubs is also the duration of the period of unripe fruits. It is the shortest (7 weeks) in the species: *Acer rubrum*, *Cornus alba*, *C. amomum*, *C. Hemsleyi*, *Cotoneaster racemiflora*, *Lonicera coerulea*, *L. iberica*, *L. tatarica*, *Morus alba*, *Prunus padus* and *Prunus subhirtella*, and longest (4–5 months) in the species *Cornus officinalis*. In the latter case it is difficult to establish the influence of the climate prevailing within the range of occurrence of these trees and shrubs.

Very important is also the knowledge of the ability of the plant to go through the full generative cycle, what is considered as one of the main indices of viability and of the degree of adaptation to the environmental conditions at the site of cultivation. The graphs of the phenological spectra of the chosen species made it easier to classify the introduced trees and shrubs into those which: (1) flower almost every year, bear fruit giving full normal seeds, (2) flower and fructify at several years intervals and (3) 39 species which in the ten-year period did not set fruit once or set fruit, but the seeds were sterile (Table 7).



(1) To the first group of trees and shrubs flowering almost every year and bearing fruit, with a high adaptive ability (setting 50–100% of full and normal seeds) belong:

<i>Acer tataricum</i>	<i>Hydrangea Sargentiana</i>
<i>Aesculus hippocastanum</i>	<i>Hydrangea xanthoneura</i>
<i>Aesculus pavia</i>	<i>Juglans cinerea</i>
<i>Aesculus turbinata</i>	<i>Juglans nigra</i>
<i>Ailanthus glandulosa</i>	<i>Juglans Sieboldiana</i>
<i>Berberis koreana</i>	<i>Lonicera alpigena</i>
<i>Carpinus orientalis</i>	<i>Lonicera coerulea</i>
<i>Carya cordiformis</i>	<i>Lonicera iberica</i>
<i>Carya laciniosa</i>	<i>Lonicera Maackii</i>
<i>Cornus alba</i>	<i>Lonicera Maximowiczii</i>
<i>Cornus amomum</i>	<i>Lonicera tatarica</i>
<i>Cornus Hemsleyi</i>	<i>Magnolia kobus</i> var. <i>borealis</i>
<i>Cornus mas</i>	<i>Phellodendron amurense</i>
<i>Cornus officinalis</i>	<i>Prunus serotina</i>
<i>Cornus rugosa</i>	<i>Prunus subhirtella</i>
<i>Cornus stolonifera</i>	<i>Ribes aureum</i>
<i>Cotoneaster horizontalis</i>	<i>Robinia pseudoacacia</i>
<i>Cotoneaster obscura</i>	<i>Sorbus americana</i>
<i>Cotoneaster racemiflora</i>	<i>Tilia Maximowicziana</i>
<i>Evonymus alata</i>	<i>Tilia mongolica</i>
<i>Evonymus latifolia</i>	<i>Tilia tomentosa</i>
<i>Halesia tetraptera</i>	<i>Viburnum lantana</i>
<i>Hamamelis mollis</i>	<i>Viburnum Sargentii</i>
<i>Hydrangea radiata</i>	

(2) The second group of trees and shrubs flowering and fruiting at 2–4-year intervals (setting 50–100% of full and normal fruits), and also characterized by a high adaptation ability comprises:

<i>Carpinus japonica</i>	<i>Maclura pomifera</i>
<i>Cercidiphyllum japonicum</i>	<i>Magnolia acuminata</i>
<i>Forsythia europaea</i>	<i>Magnolia salicifolia</i>
<i>Forsythia Giraldiviana</i>	<i>Magnolia tripetala</i>
<i>Forsythia ovata</i>	<i>Platanus acerifolia</i>
<i>Gleditsia triacanthos</i>	<i>Pterocarya fraxinifolia</i>
<i>Hamamelis virginiana</i>	<i>Viburnum fragrans</i>
<i>Lonicera tibetica</i>	

(3) The least numerous is the group of foreign trees and shrubs which in the period 1953–1962 did not flower or bear fruit, and those which flowered and set fruits, but their seeds were incapable of germination. Here belong:

<i>Acer palmatum</i>	<i>Lindera aestivalis</i> 1.
<i>Cladrastis tinctoria</i>	<i>Rhus silvestris</i>
<i>Cornus kousa</i>	<i>Rhus trilobata</i>
<i>Elaeagnus angustifolia</i>	<i>Ribes longiracemosum</i> 1.



*Elaeagnus multiflora*

*Evodia Daniellii* l.

*Fagus japonica*

*Fagus grandiflora* l.

*Wistaria floribunda*

*Wistaria sinensis*

*Zelkova serrata*

It should be stressed that the impossibility of producing seeds capable of germination may in some trees and shrubs be the result of selfpollination which could occur in species represented in the Kórník collection by a single specimen (species denoted by the number 1).

An interesting phenomenon should not be omitted here, shown in the phenological spectra of the Asiatic species *Cornus alba* (Siberia, from Manchuria to Korea) and the North-American species: *Cornus stolonifera* (New Foundland, Manitoba, Virginia, Nebraska) and *Calycanthus floridus* (Virginia up to Florida). It is characteristic for these shrubs that in some years the phenophases of flowering and fruiting overlapped on the graphs, that in some single specimens of *Cornus alba*, *C. stolonifera* and *Calycanthus floridus* flowers and ripe fruits could be found at the same time (in summer and early autumn). This property is seldom noted in this country, whereas it is common among trees and shrubs of the tropical zone.

Examination of the phenophases of flowering, fruiting and healthy seed setting in the species classified to the particular groups, and of the climate within the range of their occurrence revealed that to the same groups belong, beside species growing in the cold extremely continental and dry climates of Siberia and western China, trees and shrubs from warm moist climates of the tropical zone. The observation material did not allow more general conclusions.

A full generative cycle is mostly characteristic for plants adapted to the environment. One cannot, however, judge of the adaptation of plants on the basis of agreement between their vegetation rhythm and the combination of climatic factors at the site of introduction. The results of the present observations confirm the opinion of Paczowski [25] who found that in some plants the rhythm of vegetation does not occur in harmony with the changes in weather conditions, although these plants grow well in our conditions, bear normal seeds and propagate by self-seeding. Many trees and shrubs start their vegetation period very early without suffering from ground frost and they set fully normal seeds capable of germination (*Lonicera Maackii*, *Sorbaria sorbifolia*, *Ribes aureum*, *Cotoneaster racemiflora* etc). In many of these plants the period of fruit ripening is prolonged or leaf shedding occurs very late (*Viburnum lantana*, *Lonicera thibetica*, *Cotoneaster obscura*). These characteristics of the vegetation rhythm of some trees do not exert any unfavorable influence on their viability. It would seem that we are dealing here with a hardiness acquired by heredity; in trees starting vegetation very late hardiness is frequently only apparent [29].

It also appeared that there exist genera, several species of which pass every year or periodically through the complete generative cycle at the site of introduction in the Kórník Arboretum. Here belong species from the genera: *Cornus*, *Lonicera*,



*Evonymus*, *Tilia*, *Aesculus*, *Cotoneaster*, *Magnolia*, *Juglans*, *Hydrangea*, *Sorbus*, *Hamamelis* and *Carpinus*. There is reason to believe that the explanation of their adaptive ability should be sought in their phylogenetic development and the history of their geographical spread. The Holarctic, or more precisely Arctic-Tertiary, disjunctions of the ranges of certain species in east Asia and North America suggest a wider ecological amplitude of these trees and shrubs, connected with migration to the south owing to a change of the climate to more severe.

Noteworthy is also the full development cycle and high viability of Ternary relicts (*Forsythia europea*, *Aesculus hippocastanum*) derived from the refuge in the Balkans.

There exists some relation between the period of maximum vegetative activity and the taxonomic position of the chosen species. As seen from the graph, species from the genera: *Juglans*, *Acer* and *Tilia* exhibit the longest vegetation period, whereas those of the genera *Viburnum*, *Cotoneaster*, *Ribes*, *Hydrangea*, *Lonicera* and *Cornus* the shortest.

Noteworthy is, moreover, the very short period of flowering of the trees representing the genera: *Carpinus*, *Fagus*, *Juglans*, *Carya*, *Acer* and *Rhus* (4–13 days), whereas shrubs belonging to the genera: *Hamamelis*, *Cornus*, *Hydrangea*, *Aesculus* and *Evonymus* flower much longer (maximum 50 days).

#### Vegetation Rhythm of Trees and Shrubs as an Indicator of Their Sensitivity to Changes in Weather Conditions

Interesting conclusions may be drawn from the study of the extreme values of the period of vegetative activity of the trees and shrubs selected, and the extreme dates of the beginning of leaf bud opening, the end of leaf shedding, the period of flowering and the beginning of flowering (Fig. 2–4).

It is interesting that in the 10-year period investigated some species showed a high variability as regards the duration of vegetative activity, for instance from 200 to 356 days (an extreme example of a long vegetative period is *Cotoneaster obscura* in exceptionally favorable conditions) or from 170 to 290 days (*Prunus subhirtella*). Other species under the same local climatic conditions of Kórnik exhibit a considerable stability. The vegetation period lasts for instance 222–238 days (*Elaeagnus angustifolia*). Certain differences in the duration of vegetative activity are obviously connected with different weather combinations and different dates of the beginning of the phenological seasons. But how can the striking differences observed in some species and shown in the graph (Fig. 4) be explained? A small range of variation of the date determining the period of vegetative activity indicates a consistent development rhythm of trees and shrubs resulting from their biological properties. It is characteristic that among the most sensitive plants to various weather combinations are almost exclusively shrubs such as: *Cotoneaster obscura*, *C. racemiflora*, *C. horizontalis*, *Lonicera Maackii*, *L. tatarica*, *L. coerulea*,



*Cornus rugosa*, *C. alba*, *Viburnum tomentosum*, *V. Carlesii*, *V. Sargentii*, *V. prunifolium*, *Hydrangea xanthoneura*, *H. Sargentiana*, *Wistaria sinensis*, *Evonymus alata*. Most of them originate from north and central China, some are spread on the enormous expanses of north-eastern Asia (Siberia, Manchuria, Korea) and of North America in the Rocky Mountains Massif, and some in the Caucasus and Japan. It is not clear whether this variable vegetation rhythm of the above named species is connected with their special sensitivity to the changing intensity of some climatic factors or, whether it results from some other biological properties.

As seen from the foregoing list, species exhibiting the highest variability as regards vegetation rhythm, and endowed at the same time with a high adaptive ability occur mainly in the genera: *Cotoneaster*, *Viburnum*, *Lonicera*, *Hydrangea* and *Cornus*.

The species *Lonicera thibetica*, *Elaeagnus angustifolia*, *Hamamelis mollis*, *Forsythia europaea* and *Magnolia kobus* var. *borealis* are characterized by a high stability of the period of their vegetative activity.

If we consider the time of leaf bud opening, it is the shrubs starting growth early that show the highest variability in this phenophase, for instance: *Sorbaria sorbifolia*, *Lonicera coerulea*, *Viburnum fragrans*, *Ribes alpinum*, *Viburnum Sargentii*, *Lonicera Maackii*, *Cotoneaster obscura*, *Corylopsis platypetala*, *Lindera aestivalis* and *Hydrangea Sargentiana*. The lowest variability in the appearance of leaves characterizes *Fagus orientalis* and *Aesculus hippocastanum*. As regards the time of leaf shedding, most sensitive to the influence of the environment proved to be: *Tilia americana*, *Cornus rugosa*, *Lonicera tatarica*, *Lonicera xylosteum*, *Hydrangea xanthoneura*, *Wistaria sinensis*, *Rhus trilobata*, *Cotoneaster obscura*, *Viburnum prunifolium* and *V. tomentosum*.

Comparison of the varying length of the period of flowering of the trees and shrubs in the period 1953–1962 (Fig. 4a), as determined by the extreme values, shows that the shrub species *Calycanthus floridus* and *Cornus alba* with flowering periods of 25–155 and 12–148 days, respectively, are least stable. A high variability is also exhibited in this respect by: *Cornus stolonifera*, *Hamamelis mollis*, and *H. virginiana*, some of the *Hydrangea* species such as *Hydrangea radiata*, *H. petiolaris*, *H. Sargentiana* as well as *Lonicera thibetica* and *Sorbaria sorbifolia*. Small differences in the period of flowering are noted in the first place in trees: *Ailanthus glandulosa*, 13–17 days, *Juglans nigra*, 14–19 days and *Carpinus japonica*, 3–8 days. Late flowering trees and shrubs mostly show a greater variability of the flowering period.

The date of the beginning of flowering (Fig. 4b) frequently varies widely. This is true particularly of such trees and shrubs as: *Hamamelis mollis*, *Juglans nigra*, *Cornus amomum*, *Pterostyrax hispida*, *Lonicera iberica* and *Rhus trilobata* (up to 60 days). The same date is relatively stable in the species: *Schisandra chinensis*, *Fagus orientalis*, *Cornus alba*, *Morus alba* and *Ailanthus glandulosa* (differences of 12–18 days).



## Influence of Temperature, Precipitation and Insolation on the Vegetation Rhythm of Trees and Shrubs

The differences in the duration of the period of vegetative activity of the more important phenophases of trees and shrubs in the period 1953–1962 in the Arboretum (Figs. 2–4) also show the considerable influence of weather on the seasonal rhythm of vegetation. Evidence of this is found in the phenological spectra of the species with a very long period of vegetation ranging from 7–9 months, and those with a short period of 4–5.5 months (Tables 8–9).

The long term phenological observations thus presented prove that the seasonal development of plants is dependent, beside genetic factors, on the complex of conditions determined by the course of temperature, the sum of precipitation, the amount of insolation and the distribution of these factors.

Nearly each species reacts individually to a given combination of weather conditions in dependence on its ecological requirements. Nonetheless, some conditions exert a favorable influence on growth and reproduction of many species. Thus, it would seem that certain complexes of climatic factors can be characterized separately.

For instance the phenophase of leaf bud opening is connected in numerous trees and shrubs with the course of temperature in February, March and April. In certain species early growth was observed in 1961, that is when these months had the highest sum of temperatures in the 10-year period. In the winter of 1960/61 climatic features of Atlantic type prevailed. Moreover the year 1961 had the longest period without ground frost and the longest vegetation period. In the preceding year summer was cool with little sun, and fall rather warm. The above mentioned conditions caused in 1961 very early growth of trees and shrubs, independent of their provenience and the duration of their vegetative activity (*Juglans mandshurica*, *Gymnocladus canadensis*, *Carya cordiformis*, *Vitis amurensis*, *Ailanthus glandulosa*, *Hamamelis virginiana*, *Acer nikoense*, *Cladrastis tinctoria* and others). A similar effect of weather on early leaf bud opening in other shrubs was observed in 1957. It should be mentioned that the winter of 1956/57 was even warmer than that of 1960/61. Oddly enough, however, in 1953 when the early spring months were very warm (February colder than in 1961 and 1957) many trees started growth very early in spite of the long period of spring drought. In the record of trees from this year (Tables 8 and 9) there are more trees with a short period of vegetative activity: *Acer Ginnala*, *A. rubrum*, *A. pseudoplatanus*, *Fagus grandifolia*, *Juglans nigra*, *Tilia cordata*, *T. mongolica* and *T. Maximowicziana*.

As regards the duration of the vegetative activity, the observations compiled in 1961, 1959 and particularly in 1957 (Table 8) seem to prove that in these years weather conditions were most favorable for a prolongation of this period. It also appears that the combination of three factors: the annual sum of heat (counting not from 5° but from 0°C), the annual number of hours of sunshine and the



annual amount of precipitation. Moreover the influence of the duration and intensity of frost is visible. It is characteristic that the above mentioned factors compensate one another, for instance in 1957 the annual amount of precipitation was

Table 8

Trees and Shrubs with a Long Period of Vegetative Activity  
(over 7 Months) in 1953–1962

- 1953 — *Lonicera coerulea*, *Prunus serotina*, *Pterocarya fraxinifolia*, *Sorbaria sorbifolia*, *Sorbus americana*.
- 1954 — There are no trees and shrubs with long period of vegetative activity
- 1955 — *Berberis koreana*, *B. vulgaris*, *Cotoneaster horizontalis*, *Forsythia europaea*, *Hamamelis mollis*, *Kerria japonica*, *Lonicera thibetica*, *Ribes alpinum*, *R. longeracemosum*, *Viburnum fragrans*, *V. lentago*, *V. prunifolium*.
- 1956 — *Acer saccharinum*, *Berberis koreana*, *B. vulgaris*, *Cornus alba*, *C. amomum*, *C. officinalis*, *C. mas*, *Cotoneaster racemiflora*, *Halesia tetraptera*, *Hydrangea petiolaris*, *H. xanthoneura*, *Lonicera tatarica*, *L. thibetica*, *Rhus trilobata*, *Ribes alpinum*, *R. aureum*, *Viburnum Carlesii*, *V. fragrans*, *V. lantana*, *V. lentago*, *V. prunifolium*, *Vitis vulpina*.
- 1957 — *Acer saccharinum*, *Berberis koreana*, *B. vulgaris*, *Cornus mas*, *C. officinalis*, *C. alba*, *C. Hemsleyi*, *Corylopsis platypetala*, *Cotoneaster obscura*, *C. horizontalis*, *C. racemiflora*, *Elaeagnus angustifolia*, *E. multiflora*, *Evonymus europaea*, *Forsythia europaea*, *F. Girdaldiana*, *F. ovata*, *Hamamelis mollis*, *Hydrangea petiolaris*, *H. radiata*, *H. xanthoneura*, *Kerria japonica*, *Kolkwitzia amabilis*, *Liriodendron tulipifera*, *Lonicera alpigena*, *L. coerulea*, *L. Maackii*, *L. tatarica*, *L. thibetica*, *L. xylosteum*, *Pterostyrax hispida*, *Rhus trilobata*, *Ribes alpinum*, *R. aureum*, *Sorbaria sorbifolia*, *Viburnum Carlesii*, *V. fragrans*, *V. lantana*, *V. prunifolium*, *V. Sargentii*, *V. tomentosum*.
- 1958 — *Berberis koreana*, *B. vulgaris*, *Cotoneaster horizontalis*, *Elaeagnus angustifolia*, *E. multiflora*, *Hydrangea petiolaris*, *H. radiata*, *H. xanthoneura*, *Kerria japonica*, *Kolkwitzia amabilis*, *Lonicera alpigena*, *L. coerulea*, *Sorbaria sorbifolia*, *Viburnum Carlesii*, *V. prunifolium*, *V. Sargentii*, *V. tomentosum*, *Wistaria sinensis*.
- 1959 — *Berberis vulgaris*, *Cornus amomum*, *C. Hemsleyi*, *C. officinalis*, *Corylopsis platypetala*, *Cotoneaster horizontalis*, *C. obscura*, *Elaeagnus angustifolia*, *E. multiflora*, *Evonymus europaea*, *Forsythia europaea*, *F. Girdaldiana*, *Halesia tetraptera*, *Hydrangea Sargentiana*, *H. xanthoneura*, *Kerria japonica*, *Kolkwitzia amabilis*, *Lonicera alpigena*, *L. coerulea*, *L. Maximowiczii*, *L. thibetica*, *L. xylosteum*, *Prunus serotina*, *Ribes aureum*, *Viburnum Carlesii*, *V. fragrans*, *V. lantana*, *V. lentago*, *V. prunifolium*, *V. tomentosum*, *Wistaria sinensis*.
- 1960 — *Berberis vulgaris*, *Corylopsis platypetala*, *Cotoneaster horizontalis*, *C. obscura*, *Hydrangea radiata*, *Lonicera alpigena*, *L. iberica*, *L. thibetica*, *Ribes alpinum*, *Viburnum lantana*, *V. prunifolium*, *V. tomentosum*.
- 1961 — *Berberis koreana*, *B. vulgaris*, *Cornus amomum*, *C. Hemsleyi*, *C. mas*, *C. officinalis*, *Corylopsis platypetala*, *Cotoneaster racemiflora*, *Eucommia ulmoides*, *Forsythia europaea*, *F. Girdaldiana*, *F. ovata*, *Halesia tetraptera*, *Hydrangea petiolaris*, *H. radiata*, *Kolkwitzia amabilis*, *Lonicera alpigena*, *L. iberica*, *L. tatarica*, *L. xylosteum*, *Pterostyrax hispida*, *Ribes alpinum*, *R. aureum*, *R. longeracemosum*, *Sorbaria sorbifolia*, *Sorbus americana*, *Viburnum Carlesii*, *V. fragrans*, *V. lantana*, *Wistaria floribunda*.
- 1962 — *Cornus officinalis*, *Cotoneaster horizontalis*, *Hydrangea radiata*, *Kerria japonica*, *Lonicera thibetica*, *L. xylosteum*, *Ribes alpinum*, *Viburnum lantana*, *V. tomentosum*.



548.7 mm, and the sum of insolation 1636.6 hrs and in 1961 the respective values were 694.3 mm (the highest value in the 10-year period) and 1443.7 hrs (relatively low). It is difficult to explain why in 1959 which was characterized by periods of drought, a long period of vegetative activity was observed in many shrubs. It is possible that in this case the distribution of precipitation was decisive, the main bulk of precipitation falling to July and August. This year had the lowest sum of time the greatest amount of sunshine — 1847.0 hrs. It should be added that the mean annual temperatures in these three years (1957, 1959 and 1961) were among

Table 9

Trees and Shrubs with a Short Period of Vegetative Activity  
(up to 5 1/2 Months) in 1953–1962

- 1953 — *Ailanthus glandulosa*, *Carya cordiformis*, *Cotoneaster horizontalis*, *Gymnocladus canadensis*, *Hydrangea Sargentiana*, *Juglans mandshurica*.
- 1954 — *Acer circinatum*, *A. Ginnala*, *A. monspessulanum*, *A. nikoense*, *A. palmatum*, *A. pseudoplatanus*, *Ailanthus glandulosa*, *Calycanthus floridus*, *Carya cordiformis*, *Cornus kousa*, *C. rugosa*, *Evonymus verrucosa*, *Gymnocladus canadensis*, *Hamamelis virginiana*, *Juglans mandshurica*, *J. nigra*, *J. Sieboldiana*, *Lindera aestivalis*, *Lonicera tatarica*, *Prunus fruticosa*, *P. subhirtella*, *Rhus trilobata*, *Schisandra chinensis*, *Tilia americana*, *T. Maximowicziana*, *T. platyphyllos*, *Viburnum prunifolium*, *V. tomentosum*, *Wistaria sinensis*.
- 1955 — *Acer pseudoplatanus*, *Ailanthus glandulosa*, *Carya cordiformis*, *Elaeagnus angustifolia*, *Evonymus alata*, *Gymnocladus canadensis*, *Juglans mandshurica*, *Magnolia acuminata*.
- 1956 — *Acer circinatum*, *A. Ginnala*, *A. nikoense*, *A. palmatum*, *A. pseudoplatanus*, *Aesculus pavia*, *Ailanthus glandulosa*, *Cladrastis tinctoria*, *Cotoneaster horizontalis*, *Evodia Daniellii*, *Evonymus alata*, *Fagus grandifolia*, *Gymnocladus canadensis*, *Gleditsia triacanthos*, *Juglans cinerea*, *J. mandshurica*, *J. nigra*, *J. Sieboldiana*, *Liriodendron tulipifera*, *Maclura pomifera*, *Magnolia acuminata*, *M. tripetala*, *Phellodendron amurense*, *Platanus acerifolia*, *Rhus silvestris*, *Tilia Maximowicziana*, *Viburnum amurense*.
- 1957 — *Acer nikoense*, *A. rubrum*, *A. pseudoplatanus*, *Ailanthus glandulosa*, *Carya cordiformis*, *Cladrastis tinctoria*, *Fagus grandifolia*, *F. orientalis*, *Gleditsia triacanthos*, *Gymnocladus canadensis*, *Juglans cinerea*, *J. mandshurica*, *J. Sieboldiana*, *Rhus silvestris*, *Tilia mongolica*, *Vitis amurense*.
- 1958 — *Acer nikoense*, *A. rubrum*, *Aesculus pavia*, *Cornus alba*, *C. rugosa*, *Gymnocladus canadensis*, *Hamamelis virginiana*, *Juglans mandshurica*, *Tilia cordata*, *T. mongolica*, *Vitis amurense*.
- 1959 — *Ailanthus glandulosa*, *Gymnocladus canadensis*, *Juglans mandshurica*.
- 1960 — *Acer pseudoplatanus*, *A. rubrum*, *Ailanthus glandulosa*, *Cornus rugosa*, *Gymnocladus canadensis*, *Juglans mandshurica*.
- 1961 — *Gymnocladus canadensis*.
- 1962 — *Gymnocladus canadensis*, *Juglans mandshurica*, *Schisandra chinensis*, *Tilia mongolica*.

the highest, with 1959 as the warmest year. It is possible that species with a long precipitation in the 1953–1962 period, amounting to 346.2 mm, and at the same vegetation cycle recorded in that year are well adapted to the dry climates of northern and eastern Asia.



The greatest number of shrubs with a very long period of vegetative activity (7 to 9 months and more) were recorded in 1957 (Table 9). This list comprises 36 species:

*Berberis koreana*  
*Berberis vulgaris*  
*Cornus alba*  
*Cornus Hemsleyi*  
*Corylopsis platypetala*  
*Cotoneaster obscura*  
*Cotoneaster racemiflora*  
*Elaeagnus angustifolia*  
*Evonymus europaea*  
*Forsythia europaea*  
*Forsythia Giraladiana*  
*Forsythia ovata*  
*Hamamelis mollis*  
*Hydrangea petiolaris*  
*Hydrangea radiata*  
*Hydrangea xanthoneura*  
*Viburnum prunifolium*  
*Viburnum Sargentii*

*Kerria japonica*  
*Kolkwitzia amabilis*  
*Liriodendron tulipifera*  
*Lonicera coerulea*  
*Lonicera thibetica*  
*Lonicera Maackii*  
*Lonicera tatarica*  
*Lonicera xylostium*  
*Pterostyrax hispida*  
*Rhus trilobata*  
*Ribes alpinum*  
*Ribes aureum*  
*Sorbaria sorbifolia*  
*Viburnum Carlesii*  
*Viburnum fragrans*  
*Viburnum lantana*  
*Viburnum tomentosum*

The weather conditions were completely different in the years 1953 and 1954. Study of the phenological spectra shows that these years did not favor optimal development of trees and shrubs. In 1954 characterized by a dry and severe winter, a cold spring and a long-lasting period of severe autumn drought, no species exhibited a long period of vegetative activity (Table 9). In 1953 there were only five such species, probably owing to the long period of spring and autumn drought and the heavy ground frosts in April and May.

The leaf fall phonophase is correlated with the summer and fall temperature. This is confirmed by the very late date of leaf shedding by many trees and shrubs in 1958 which had a cool and short-lasting summer and a relatively warm and moist fall.

Let us now consider the annual course of generative plant development under the influence of various weather conditions. The beginning of flowering of a large part of trees and shrubs is mainly dependent on the temperature of the spring months. Many plants started to flower very early in 1953 in the very warm and rather dry spring period, and so did some in 1959. It is noteworthy that these years, beside high temperatures in early spring, the beginning of spring, spring and early summer were characterized by a long period of dry weather (1953) and drought (1959). Another group of trees and shrubs flowered earliest in 1961. It may be concluded from Walter's climatic diagrams (Fig. 5) that early flowering of the listed trees and shrubs requires, beside a large sum of heat, also profuse rainfall; in the period from January to April 1961, the highest amount of precipitation for the entire 10-year period was recorded.



The period of flowering is protracted, it would seem on the basis of the material accumulated, when May is cool, June warm and in July and the end of summer rainfall is abundant. It can also be concluded that a larger sum of heat and of sunshine in the vegetation period usually shortens the phenophases of growth and ripening of fruit.

It should be borne in mind, however, that the seasonal course of plant vegetation, fruiting and bearing of seed are very complex processes including the interaction of the biological properties of the given plant and many edaphic factors of the environment and the local climate.

Moreover, the selected trees and shrubs of foreign provenience react in different ways to various environmental factors, the more so as they are frequently cultivated in this country in different habitat conditions. Therefore it is difficult to find a synthetic answer to this problem.

## 6. Conclusions

(1) The phenophases of growth onset or flowering in many foreign species of trees and shrubs adapted to the conditions of Poland are rather regularly synchronized with the phenological season, these observations cannot, however, be generalized. It would seem, namely, that the adaptation ability of plants is not bound with their phenological regularity.

(2) The tree species with a short period of vegetative activity are adapted to the cool and mostly continental climate of their native country. No such connection with the climate can be established within the range of occurrence of shrubs characterized in the climate of Poland by a long period of vegetative activity.

(3) A great part of the trees and shrubs of foreign provenience (about 70 species) passes in the Kórnik Arboretum through the full cycle of generative development bearing normal seeds capable of germination. It is characteristic that species belonging to the following genera bear viable seeds and at the same time exhibit a high ability of adaptation: *Aesculus*, *Cornus*, *Cotoneaster*, *Hydrangea*, *Juglans*, *Lonicera* and *Magnolia*.

(4) Some species of foreign origin (e.g. *Cotoneaster obscura*, *Hamamelis mollis*, *Lonicera coerulea*, *Sorbaria sorbifolia*), in spite of certain discrepancies between their rhythm of vegetation and the rhythmicity of climatic factors, are frost resistant in the conditions of Poland, grow well, flower and fruit every year or periodically and bear seeds capable of germination.

(5) Part of the trees and shrubs investigated shows a stable seasonal rhythm of vegetation, e.g. *Elaeagnus angustifolia*, others, like *Cotoneaster racemiflora*, *Cornus alba*, *Hydrangea xanthoneura* are, on the contrary, sensitive to various weather combinations. Among these tree and shrub species most are adapted to the environmental conditions of this country.



(6) It seems that an elucidation of the adaptive abilities of numerous trees and shrubs of foreign provenience may be found in the history of their geographical spread and in their phylogenetic development.

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Translated by Maria Radziwiłł



## SUMMARY

(1) Several years of observations on the seasonal development of exotic trees and shrubs constitute a starting point for methodical studies on acclimatization. For these reasons the authors have taken up the task of compiling the phenological observations on trees and shrubs of class *Angiospermae* which were made in the Kórnik Arboretum in 1953–1962. The aim of the study was:

(a) to draw up the most important groups of trees and shrubs on the basis of their phenological and developmental characteristics and differing in their seasonal growth rhythms;

(b) to determine the connections which may occur between the growth rhythms and the origin, of the trees and shrubs growing in Kórnik under various weather conditions.

It is generally believed that information about the seasonal growth rhythms of trees and shrubs of various adaptability will help in the selection of factors that have the greatest importance in species introduction. When drawing up groups the phenological stability of the trees and shrubs, the length of the period of vegetative activity, flowering, the dates of shoot growth and flowering onset and the varieties in the cycle of generative development, have all been taken into consideration.

(2) The phenological observations were made from January to December of each year, on 295 trees and shrubs growing in the collections of the Kórnik Arboretum. For the purpose of this report 122 species were selected, coming from various geographical regions, primarily from the temperate zone. The dates of periodic changes in the plant vegetation that is the phenophases were recorded according to the pattern presented below. The course of vegetative development in trees and shrubs was described by the dates of: (1) leaf bud opening, (2) leaf blade opening, (3) onset of autumnal color changes, (4) peak of autumn colors development, (5) onset of leaf fall, (6) end of leaf fall.

The course of generative development of the trees and shrubs were described by the dates of: (1) onset of flowering, (2) end of flowering, (3) onset of fruit ripening, (4) end of fruit ripening, which is followed by fruit fall or seed discharge.

A necessary supplement of the above observations concerning floristic phenology was provided by several years of observations on the bioclimatic phenology which depends on the recording of certain fixed phenophases of indicator species according to Łastowski's method [21]. The selected indicator species act as an instrument for the measurement of the local climate. The mean dates of certain observations served to split the vegetative period into eight phenological seasons, the length of which fluctuated to a certain extent from year to year.

A compilation of phenological dates in tables permitted to draw up phenological spectra according to the simplified method of Szennikow [34].

(3) The seasonal development of trees and shrubs growing in the Kórnik Arboretum is to a large extent dependent on the fluctuating conditions of the climate. A general description of the climate in 1953–1962 was prepared on the basis of the diagram method of Gausse-Walter, which provides information about the occurrence of periods favorable or unfavorable to the growth of plants. Detailed graphs of daily temperature extremes and precipitation were drawn. On these graphs the lengths of the phenological seasons and the weather conditions according to Paczowski's [25] schemes were superimposed.

(4) Among the trees and shrubs characterized by the greatest phenological stability the following species should be mentioned: *Lonicera xylostemum*, *Magnolia kobus* var. *borealis*, *Gleditsia triacanthos*, *Liriodendron tulipifera*, *Juglans nigra*, *Prunus padus*, *Ribes aureum*, *Tilia cordata*, *Tilia tuan* and *Robinia pseudoacacia*.

The growth rhythms, particularly the phenophases of shoot growth and flowering of many exotic trees adapted to our conditions, are synchronized with the phenological season.



It is not possible, however, to generalize these observations and to speak of a definite connection between trees and shrubs phenologically stable and their adaptability.

(5) The period of vegetative activity is measured from the date of bud opening to the date of leaf fall (in evergreen species the end of this period is determined by the attainment of a certain low temperature). The period as well as time of flowering was calculated as an average over ten years.

The shortest period of vegetative activity (150–190 days) is characteristic primarily of the following trees: *Juglans mandshurica*, *Gymnocladus canadensis*, *Carya cordiformis*, *Acer rubrum*, *Vitis amurensis*, *Ailanthus glandulosa*, *Hamamelis virginiana*, *Acer nikoense*, *Magnolia acuminata*, *Phellodendron amurense*. It is possible to notice an adaptation to a cool, generally continental climate of their sites of origin (region of northeastern Asia, particularly Manchuria and the region of North America around the Great Lakes).

Among the shrubs with a very long period of vegetative activity (225–260 days) such species can be included as: *Viburnum tomentosum*, *V. fragrans*, *Kerria japonica*, *Cotoneaster obscura*, *Berberis vulgaris*, *Ribes aureum*, *R. alpinum*, *Lonicera thibetica*, *Hydrangea radiata*, *Kolkwitzia amabilis*, *Lonicera xylosteum*, *Rhus trilobata*, *Corylopsis platyptala*, *Viburnum lantana*, *Hydrangea petiolaris*. This characteristic does not appear to have any relation with the geographic distribution of these species (the climatic region), since in the group there are species from low latitudes characterized by warm and moist climates in Central and Western China as well as from the cold climates of North Asia and mountain regions.

(6) A group of species characterized by a very short flowering period (4 to 13 days) comprises: *Carpinus japonica*, *C. orientalis*, *Fagus orientalis*, *F. grandifolia*, *Juglans cinerea*, *J. nigra*, *J. Sieboldiana*, *Pterocarya fraxinifolia*, *Platanus acerifolia*, and *Carya cordiformis*. In this group notably a large number of tree species can be found from the temperate climatic region from the families *Betulaceae*, *Fagaceae* and *Juglandaceae*.

The following groups of species are characterized by the longest flowering period (24–73 days): *Calycanthus floridus*, *Hamamelis mollis*, *H. virginiana*, *Cornus alba*, *Kerria japonica*, *Evodia Danielli*, *Cornus stolonifera*, *Hydrangea radiata*, *H. xanthoneura*, *H. Sargentiana*. These are almost exclusively shrubs, coming from the temperate and subtropical climatic regions.

(7) It is worth noting that a large number of trees and shrubs of exotic origin (70) complete their full generative cycle in our conditions and yield healthy germinable seeds (Table 8). It is characteristic that there are genera having a few or several species completely adapted to the site conditions in the Kórník Arboretum. These genera are: *Cornus*, *Lonicera*, *Evonymus*, *Tilia*, *Aesculus*, *Cotoneaster*, *Magnolia*, *Juglans*, *Hydrangea*, *Prunus*, *Sorbus*, *Hamamelis*, and *Carpinus*. It appears that the reasons for the adaptability of several species of trees and shrubs can be found in the history of their geographic distribution.

(8) Some trees and shrubs of exotic origin (*Cotoneaster obscura*, *Lonicera Maackii*, *L. coerulea*, *Pterocarya fraxinifolia*, *Sorbaria sorbifolia*), in spite of certain maladjustments between their growth rhythm and rhythm of the climate in our cultivation conditions are characterized by frost resistance, grow well, flower annually or periodically and fruit, yielding seeds capable of germination.

(9) In many species significant differences were found over the years 1953–1962 during the vegetative activity, for example from 200 to 360 days in *Cotoneaster obscura* or from 170 to 290 days in *Prunus subhirtella*, while other species coming from the same regions of natural occurrence were characterized by stability in respect to this character. Among other species reacting most strongly to changes in the weather conditions there are almost exclusively shrubs. These are: *Cotoneaster racemiflora*, *C. horizontalis*, *L. tatarica*, *C. rugosa*, *Cornus alba*, *Viburnum tomentosum*, *V. Carlesii*, *Hydrangea xanthoneura*, *H. Sargentiana*,



