

The Phenology of Woody Plants in Norman, Oklahoma, During the Spring Seasons of 1954, 1955 and 1956

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A study on the phenology of woody plants in Norman was initiated in January of 1954 and was continued through the spring seasons of 1954, 1955 and 1956. The objectives of the investigation were to provide a phenological calendar of woody plants, to compare the phenology of trees and shrubs and to determine the effects of weather on phenology. It is hoped that these data may be useful for interpolating other contemporaneous events of plants, to correct for early or late seasons by transplanting calendar dates into phenological dates and for predicting biological events in the life histories of animals.

In practice, field trips were made at least twice a week except during cold or rainy weather. An attempt was made to visit the same area, and the same plants, during the three years of observations. However, this was not fully realized due to the size of Norman and the impossibility of covering the entire city each week. Although a total of 190 taxa were encountered, acceptable phenological data were obtained on less than 100 species. In view of these facts, the current discussion is based on the 50 most abundant species (Table I). Detailed data on the other species may be had upon request.

Of the species presented (Table I) the first plants to flower were silver maple and winter jasmine. Approximately the same number of woody plants began to bloom in February and March (Table I). The highest percentage of species initiated anthesis in April (Tables I and II). Most of the trees had started to flower by May 1, but many of the shrubs and woody vines began to flower during May and a considerable number initiated flowering after the study was discontinued on May 31 (Tables I, II). The total number of species in flower at a given time increased gradually through February and March, reached a maximum in April and declined during May.

The order of flowering in Table I represents an average for the three years and was not the same, in all cases, during the three years of observation. As is well known, a given specimen may flower as much as two weeks before others of the same species. The possibility exists, therefore, that the order may be reversed, from one year to the next, merely because of chance sampling. It seems probable, therefore, that proper phenological sampling should be confined to labelled specimens which can be observed at successive observation periods.

Species varied considerably in the duration of a given phenological stage. This variation was notable in the period between the exertion of buds, or the appearance of staminate cones, and the shedding of pollen, which typically coincides with floral opening. In most species the exertion period was less than a week. However, in a few trees (oriental arborvitae, eastern redcedar, redbud, austrian pine, and pecan) the duration was two to four weeks. Shrubs with exertion periods of two to four weeks included early lilac, chinese privet, mockorange and trumpet honeysuckle. Of greater interest was the exertion period of 16 weeks for the spreading euonymus and the presence of staminate cones on Arizona cypress 26 weeks before the shedding of pollen (Table III).

The variation in the anthoperiod depended primarily on the weather. In general, the species which flowered early in the year (February) exhibited relatively long anthoperiods (four to seven weeks) whereas those which bloomed later had shorter flowering periods (two to four weeks). In

All names according to Kelsey and Dayton (1942). Identifications confirmed by Dr. G. J. Goodman and Prof. R. H. Rucker.

1955, flowering was terminated completely when all the flowers, and most of the young fruits, were destroyed by heavy freezes on March 21 and March 26. Since most of the fruit trees were in bloom at the time, the entire tree fruit crop was destroyed in the Norman area. Of interest, also, is the fact that the antheriod in trees (two and a half to four weeks) was less than that of shrubs (three to six weeks).

Species of woody plants differed widely with respect to fruiting periods. Several cultivated shrubs such as winter jasmine, forsythia, flowering quince, pink almond cherry, Thunberg spiraea and Vanhoutte spiraea produced few or no fruits. Woody plants with short fruiting periods, (six to ten weeks) comprised silver maple, siberian elm, American elm, cottonwood and black willow. Trees with long fruiting periods (12 or more weeks) comprised the fruit trees (apricot, plum, pear, peach and apple) and the nut trees (pin oak and pecan). Of the coniferous trees, oriental arborvitae and eastern redcedar required about 30 weeks, the Arizona cypress about 52 weeks and Austrian pine about 72 weeks to ripen their cones.

In general, deciduous woody plants flowered before leaves were produced. Of the total number, most of them (65 percent) flowered before leafing out, about 10 percent produced flowers and leaves simultaneously and several (25 percent) originated leaves before flowers. A greater number of trees, as compared to shrubs, produced flowers (and sometimes fruits) before leaves were evident. Most woody plants reached maximum anthesis two weeks before full foliage was attained. On the average, maximum anthesis was reached about April 15 whereas complete verdure was not attained until May 1.

DISCUSSION

In New Orleans, Louisiana, "The anthesis of trees is limited largely to the biological spring season (January, February, March, April), the height of flowering being reached at the spring equinox" (5). In north Alabama the flowering of trees began in early February, reached a peak about April 15 and terminated about May 1 (6). This corresponds very closely with the flowering of woody plants at Norman. In Iowa, the spring season was almost one month earlier than at Norman (2). According to Leopold and Jones (4) the spring season opened with silver maple as early as March 20 (1938) or as late as April 16 (1944). Their data suggest that the spring season is at least six weeks later than at Norman. In general, the initiation of the spring season, as compared with New Orleans, is four weeks later in North Alabama and Central Oklahoma, eight weeks later in Iowa, and at least ten weeks later in Southern Wisconsin. Gould (1) attempted to determine the lateness of the spring of 1928 at Norman by using first blooming dates of plants. As compared with 1927, she found that 68 percent were later, 29.7 percent were earlier and 2.3 percent appeared on the same day. In the present study, it was found that plants bloomed earlier in February, later in March and earlier in April of 1954, as compared with 1955. Apparently a given season is rarely early or late as a whole, but given segments of a season may be either early or late depending on the weather.

SUMMARY

1. The phenology of woody plants in Norman, Oklahoma, was investigated during the spring seasons of 1954, 1955 and 1956.
2. Renewed activity of woody species occurred in early February with the flowering of silver maple and winter jasmine.
3. The percentage of woody species initiating flowering, and the total number of species in flower, was low in February and March, high in April, and low again in May. Maximum flowering was reached (April 15) about two weeks before full verdure (May 1).

4. Species varied greatly in the period between exsertion of flowering buds, or the appearance of staminate cones, and the shedding of pollen. An exsertion period of one week or less was characteristic of most species, spans of two to four weeks were fairly common, and periods of more than four weeks occurred.
5. The duration of the flowering period varied with the weather and declined as the season progressed.
6. Several cultivated shrubs produced no fruits at all, many woody plants had short fruiting periods (6 to 10 weeks) whereas others (including the fruit and nut trees) possessed long fruiting periods (12 or more weeks).
7. Phenology of woody plants in Norman was governed primarily by temperature. Subnormal temperatures delayed flowering and increased total anthoperiods. Freezing temperatures destroyed many flowers and fruits, especially during the spring season of 1955.
8. The biological spring season in Norman begins about February 1 and ends May 1. Any given month may be early or late, when compared with the average year, depending on the weather.

LITERATURE CITED

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TABLE I

PHENOLOGICAL CALENDAR OF WOODY PLANTS OF NORMAN,
OKLAHOMA, BASED ON 50 MOST COMMON SPECIES

TREES	SHRUBS AND VINES
Initiating anthesis in February	
Silver maple Siberian elm American elm Oriental arborvitae Eastern redcedar Arizona cypress	Winter jasmine Winter honeysuckle Thunberg spiraea Forsythia Floweringquince
Initiating anthesis in March	
Apricot Plum Pear Peach Apple Redbud Cottonwood	Oregongrape Clove currant Pink almond cherry Trumpet honeysuckle
Initiating anthesis in April	
Sugar maple Pin oak Southern hackberry Black willow Green ash Austrian pine Sycamore Papermulberry Black locust Pecan	Chickasaw plum Vanhoutte spiraea Laland firethorn Mockorange Everblooming honeysuckle Japanese honeysuckle Early lilac Italian jasmine Autumn sage Hybird tea roses
Initiating anthesis in May	
Catalpa Treeofheaven	Chinese privet Poineiana Glossy abelia Nandina Trumpetvine American elder

TABLE II
PERCENTAGE OF WOODY SPECIES INITIATING ANTHESIS
IN THE SPRING SEASON AT NORMAN, OKLAHOMA. BASED
ON 50 MOST COMMON SPECIES

Item	Feb.	Mar.	Apr.	May
Trees, 1954	24	28	40	8
Trees, 1955	12	*36	40	12
Trees, 1956	20	40	28	†8
Shrubs, 1954	20	16	36	28
Shrubs, 1955	12	*24	32	32
Shrubs, 1956	28	12	36	24

* All flowers destroyed by freezes on March 21 and March 26.

† One species (sugar maple) produced no flowers in 1956.

TABLE III
DURATION OF PHENOLOGICAL STAGES OF REPRESENTATIVE
TYPES OF WOODY PLANTS IN NORMAN, OKLAHOMA. ALL
FIGURES IN WEEKS

Species	In bud	In flower	In fruit
Winter jasmine	1	7	None
Winter honeysuckle	1	7	7
American elm	1	4	6
Apple	2	3	20
Redbud	4	4	20
Spreading euonymus	16	4	6
Arizona cypress	36	4	52