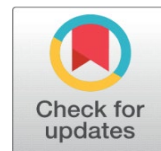


# STUDY OF PHENOLOGICAL BEHAVIOR OF PLANTS OF LOWER TANAWAL, ABBOTTABAD, PAKISTAN

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## ABSTRACT

The purpose of this research study to explore the phenological behavior of plants of Lower Tanawal, Pakistan. The phenology of the 286 plants species belonging to 86 families from 80 stands of the Lower Tanawal Pakistan were documented during the different season of the year. It was observed that maximum flowering was recorded in March-April whereas maximum fruiting was noted in June-July. Plant phenology provides knowledge about the effects of environment on flowering and fruiting behavior. This is the first research work on phenology of plants of Lower Tanawal because no work was done on the phenology in past.

**Keywords:** Phenology, Lower Tanawal, Environment

**Received** 16 November 2021  
**Accepted** 5 December 2021  
**Published** 31 December 2021

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**DOI**  
[10.29121/granthaalayah.v9.i12.2021.4415](https://doi.org/10.29121/granthaalayah.v9.i12.2021.4415)

**Funding:** This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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## 1. INTRODUCTION

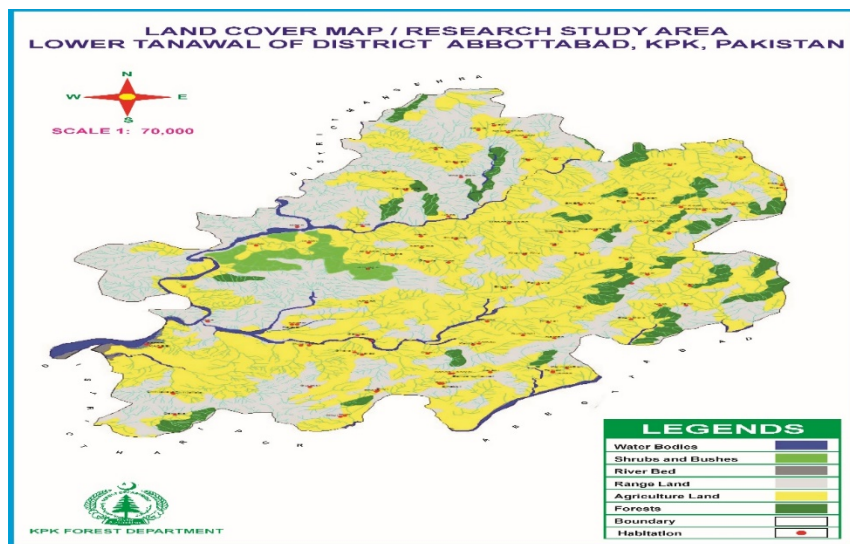
The Lower Tanawal located in District Abbottabad, Province Khyber-Pakhtunkhwa, Pakistan. The Lower Tanawal located between the Mansehra in the North and the Haripur to the South, and nearby to the Northeast of the Tarbela Lake (Figure 1). The border of Lower Tanawal starts from the village Paswal which is away from Abbottabad on short distance Bibi et al. (2019). The Lower Tanawal is part of the Lesser Himalayas Hussain and Illahi (1991), Gazetteer of the Hazara District (2000).

## 2. PLANT PHENOLOGY

Phenology receives much attention because of global and regional climate change on vegetation. Phenology can also be influenced by geographical factors. The timing of life-cycle of plants events plays an important role in environmental (Zhang et al., 2006).

Phenology is governed by numerous environmental factors, like temperature and moisture Dewald and Steiner (1986). Phenology of plants plays an important role in structured and function of ecosystems Cleland et al. (2007). Changes in plant phenology are due to the early response to global climate change. Because different plant species respond to climate change at different rates Parmesan (2007), Fitter and Fitter (2002), Root et al., 2003).





**Figure 1** Location Map of Lower Tanawal, Pakistan

The Lower Tanawal, District Abbottabad, Pakistan was chosen for the phenological behavior of plants of Lower Tanawal. This research study was conducted during 2016-2018. By using Line transect method the 80 localities of Lower Tanawal were selected for this purpose. The study area was frequently visited for collection of data. Data was documented in the field notebook.

#### 4. RESULTS AND DISCUSSION

This research study reveals that in past no such study has been conducted on phenology of Lower Tanawal as well as no proper records is present. Thus, our study provides complete information about phenological behavior of plant species of Lower Tanawal. The flowering and fruiting stages of 286 plant species were documented in different seasons. The maximum flowering was recorded in March-April (31.11%) followed by March-May (26.22%), while minimum flowering was documented in May-July (0.34%) (Figure 2). The maximum fruiting was noted in June-July (19.93%) then May-June (19.23%) while minimum fruiting was noted during August-October (1.04%) followed by September-October (0.34%) (Figure 3). The detail about phenology of plants is given in (Table-1).

S. No.	Plant Name	Family	Flowering	Fruiting
1.	<i>Acacia mearnsii</i> De wild.	Fabaceae	May-June	July-Aug
2.	<i>Acacia modesta</i> Wall.	Fabaceae	May-June	Apr-July
3.	<i>Acacia nilotica</i> (L.)	Fabaceae	Apr-May	June-July
4.	<i>Acer pseudoplatanus</i> L.	Sapindaceae	Mar-Apr	Apr-July
5.	<i>Achyranthes aspera</i> . L	Amaranthaceae	Mar-Apr	July-Aug
6.	<i>Adiantum capillus-veneris</i> L.	Pteridaceae	May-June	Sep-Oct
7.	<i>Aerva javanica</i> (Burn.f.) Juss.ex Shult.	Amaranthaceae	Mar-Apr	June-July

8.	<i>Aesculus indica</i> (Wall.ex cambss.) Hook.	Sapindaceae	May-June	June-Sep
9.	<i>Ajuga bracteosa</i> Wall. ex Benth.	Lamiaceae	Mar-May	June-Aug
10.	<i>Albizia lebbeck</i> (L.) Benth.	Fabaceae	Mar-May	May-Sep
11.	<i>Allium griffithianum</i> Boiss.	Amaryllidaceae	Mar-May	June-July
12.	<i>Alliaria petiolata</i> (M. Bieb.) Cavara	Brassicaceae	Mar-Apr	June-Aug
13.	<i>Allium stipitatum</i> Regel	Amaryllidaceae	Apr-May	June-July
14.	<i>Alnus nitida</i> (Spach.) Endl.	Betulaceae	June-July	Aug-Oct
15.	<i>Alternanthera pungens</i> Kunth.	Amaranthaceae	Apr-May	July-Aug
16.	<i>Amaranthus viridis</i> L.	Amaranthaceae	Mar-Apr	June-July
17.	<i>Anagallis arvensis</i> L.	Primulaceae	Mar-Apr	June-July
18.	<i>Anaphalis margaritacea</i> (L.) Benth. Hook.f.	Asteraceae	Apr-June	July-Sep
19.	<i>Anaphalis triplinervis</i> (Sims) Sims ex C.B.	Asteraceae	Apr-May	July-Aug
20.	<i>Angelica arguta</i> Nutt.	Apiaceae	Mar-June	June-Aug
21.	<i>Andrachne cordifolia</i> (Decne.) Müll.Arg	Euphorbiaceae	Apr-June	June-July
22.	<i>Androsace rotundifolia</i> Hardw.	Primulaceae	Mar-Apr	May-June
23.	<i>Anthriscus caucalis</i> M. Bieb.	Apiaceae	Apr-June	June-July
24.	<i>Argemone Mexicana</i> L.	Papaveraceae	May-July	Aug-Oct
25.	<i>Arisaema flavum</i> (Forssk.) Schott	Araceae	Apr-June	July-Aug
26.	<i>Aristida cyanantha</i> Steud.	Poaceae	Apr-June	June-July
27.	<i>Artemisia absinthium</i> L.	Asteraceae	Mar-Apr	May-June
28.	<i>Artemisia scoparia</i> Waldst. & Kitam.	Asteraceae	Apr-May	June-July
29.	<i>Arundo donax</i> L.	Poaceae	June- July	July-Sep
30.	<i>Asparagus adscendens</i> Roxb.	Asparagaceae	Apr-May	May-Aug
31.	<i>Asparagus officinalis</i> L.	Asparagaceae	Mar-June	June-Aug
32.	<i>Asphodelus tenuifolius</i> Cav.	Asphodelaceae	Apr-July	July-Sep
33.	<i>Asplenium ceterach</i> L.	Aspleniaceae	June-July	July-Aug
34.	<i>Asplenium trichomanes</i> L.	Aspleniaceae	June-July	July-Aug
35.	<i>Astragalus leucocephalus</i> Grah. ex Benth.	Fabaceae	Mar-May	June-July
36.	<i>Barleria cristata</i> L.	Acanthaceae	Mar-June	June-Sep
37.	<i>Bauhinia variegata</i> L.	Fabaceae	Mar-Apr	May-June
38.	<i>Berberis lycium</i> Royle	Berberidaceae	Mar-June	June-July

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39.	<i>Biden pilosa</i> L.	Asteraceae	Mar-June	July-Aug
40.	<i>Boerhavia diffusa</i> L.	Nyctaginaceae	Mar-Apr	Apr- May
41.	<i>Bothriochloa ischaemum</i> (L.) Keng.	Poaceae	Apr-May	June-July
42.	<i>Bromus tectorum</i> L.	Poaceae	Mar-Apr	Apr-July
43.	<i>Broussonetia papyrifera</i> L.	Moraceae	Apr-May	May-July
44.	<i>Buddleja asiatica</i> Lour.	Buddlejaceae	Mar-May	May-June
45.	<i>Caesalpinia pulcherrima</i> (L.) Sw.	Fabaceae	Mar-Apr	Apr-June
46.	<i>Calamintha hydaspidis</i> (Falconer ex Benth.)	Lamiaceae	Mar-Apr	Apr-June
47.	<i>Calamintha nepeta</i> L.	Lamiaceae	Mar-Apr	May-June
48.	<i>Calamagrostis acutiflora</i> (Schrad.) DC.	Poaceae	Mar-May	June-July
49.	<i>Campanula leucoclada</i> Boiss.	Campanulaceae	Apr-June	June-July
50.	<i>Cannabis sativa</i> L.	Cannabaceae	Mar-June	Mar-June
51.	<i>Canna indica</i> L.	Cannabaceae	Mar-Apr	Apr-July
52.	<i>Capsella bursa</i> Raf.	Brassicaceae	Mar-May	June-Aug
53.	<i>Cardamine hirsuta</i> L.	Brassicaceae	Mar-Apr	May-June
54.	<i>Carduus nutans</i> L.	Asteraceae	Apr-May	June-Sep
55.	<i>Carissa opaca</i> Stapf ex Haines	Apocynaceae	Apr-June	June-July
56.	<i>Caryopteris odorata</i> (Ham. ex Roxb.)	Verbenaceae	Mar-Apr	Apr-June
57.	<i>Carthamus oxyacantha</i> M. Bieb.	Asteraceae	Mar-Apr	May-June
58.	<i>Cedrela serrata</i> Royle	Meliaceae	Apr-May	June-July
59.	<i>Celtis australis</i> L.	Cannabaceae	Mar-Apr	Apr-June
60.	<i>Chenopodium album</i> L.	Chenopodiaceae	Mar-Apr	Apr-May
61.	<i>Chenopodium ambrosioides</i> L.	Chenopodiaceae	Mar-May	June-July
62.	<i>Chenopodium vulgare</i> L.	Chenopodiaceae	Mar-Apr	May-June
63.	<i>Chrysopogon serrulatus</i> Trin.	Poaceae	Mar-May	June-July
64.	<i>Cichorium intybus</i> L.	Asteraceae	Mar-Apr	May-June
65.	<i>Cirsium falconeri</i> (Hook.f.) Petr.	Asteraceae	Mar-May	May-June
66.	<i>Cissampelos pareira</i> L.	Menispermaceae	Apr-June	June-July
67.	<i>Citrullus colocynthis</i> (L.) Schrad.	Cucurbitaceae	Apr-June	June-Sep
68.	<i>Clematis grata</i> Wall.	Ranunculaceae	June-July	July-Sep
69.	<i>Clematis graveolens</i> Lindl.	Ranunculaceae	June-July	July-Sep
70.	<i>Colebrookea oppositifolia</i> Sm.	Lamiaceae	Apr-June	June-July
71.	<i>Commelina virginica</i> L.	Commelinaceae	Apr-June	June-Sep

72.	<i>Convolvulus arvensis</i> L.	Convolvulaceae	Mar-June	June-Sep
73.	<i>Conyza Canadensis</i> L.	Asteraceae	Mar-June	June-Sep
74.	<i>Cornus macrophylla</i> Wall.	Cornaceae	June-July	July-Aug
75.	<i>Coronopus didymus</i> (L) Sm.	Brassicaceae	Apr-May	June-Aug
76.	<i>Cotinus coggygria</i> Scop.	Anacardiaceae	Apr-June	June-July
77.	<i>Cotoneaster integerrimus</i> L.	Rosaceae	Apr-June	June-Sep
78.	<i>Cotoneaster melanocarpus</i> Fisch.	Rosaceae	Apr-May	May-July
79.	<i>Cotoneaster nummularius</i> Fisch. & C.A	Rosaceae	Mar-May	May-June
80.	<i>Crotalaria rotundifolia</i> J.F. Gimel.	Fabaceae	Mar-Apr	Apr-June
81.	<i>Cuscuta reflexa</i> Roxb.	Cuscutaceae	Mar-Apr	June-July
82.	<i>Cydonia oblonga</i> Mill.	Roaceae	Mar-June	June-July
83.	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	Mar-June	June-Sep
84.	<i>Cyclospermum leptophyllum</i> (Pers.)S prague	Apiaceae	Apr-May	June-July
85.	<i>Cyperus iria</i> L.	Cyperaceae	Mar-May	June-Aug
86.	<i>Cyperus niveus</i> Retz.	Cyperaceae	Mar-May	June-Aug
87.	<i>Cyperus esculentus</i> L.	Cyperaceae	Mar-May	June-Aug
88.	<i>Daphne mucronata</i> Royle	Thymelaeaceae	Mar-Apr	May-June
89.	<i>Debregeesia salicifolia</i> D. Don	Urticaceae	Mar-Apr	May-July
90.	<i>Delbergia sisso</i> Roxb.	Fabaceae	Mar-May	May-Aug
91.	<i>Delphinium grandiflorum</i> L.	Ranunculaceae	Mar-Apr	May-June
92.	<i>Delphinium roylei</i> Munz.	Ranunculaceae	Mar-Apr	Apr-June
93.	<i>Deschampsia cespitosa</i> L.	Poaceae	Mar-May	June-Aug
94.	<i>Desmodium elegan</i> DC.	Fabaceae	Apr-May	June-Sep
95.	<i>Desmodium gangeticum</i> L.	Fabaceae	Mar-May	June-July
96.	<i>Desmodium tortuosum</i> (Sw.) DC.	Fabaceae	Apr-May	June-July
97.	<i>Dicliptera bupleuroides</i> Nees	Acanthaceae	Mar-Apr	Mar-June
98.	<i>Digera muricata</i> (L). Mart.	Amaranthaceae	Mar-Apr	Apr-June
99.	<i>Diospyros lotus</i> L.	Ebenaceae	June-July	Sep-Oct
100.	<i>Dodonaea viscosa</i> (L.) Jacq.	Sapindaceae	Mar-Apr	Aug-Oct
101.	<i>Duchesnea indica</i> (Jacks.) Focke.	Rosaceae	Mar-Apr	Apr-May
102.	<i>Dryopteris marginalis</i> (L.) A. Gray.	Dryopteriaceae	May-June	June-july
103.	<i>Echinops echinatus</i> Roxb.	Asteraceae	Mar-May	June-Aug
104.	<i>Elaeagnus umbellata</i> Thumb	Elaeagnaceae	Mar-Apr	Mar-July
105.	<i>Eleusine indica</i> (L.) Gaertn.	Poaceae	Mar-Apr	Apr-June

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106.	<i>Eremostachys superba</i> Royle. ex Benth.	Lamiaceae	Mar-Apr	May-June
107.	<i>Eriobotrya japonica</i> (Thunb.) Lindl	Rosaceae	Mar-Apr	Apr-June
108.	<i>Eryngium billardieri</i> L.	Umbelliferae	Mar-Apr	May-June
109.	<i>Eucalyptus globulus</i> Labill.	Myrtaceae	Mar-Apr	Apr-May
110.	<i>Euphorbia hirta</i> L.	Euphorbiaceae	Mar-May	May-June
111.	<i>Euphorbia peplus</i> L.	Euphorbiaceae	Mar-May	June-July
112.	<i>Ficus benghalensis</i> L.	Moraceae	Mar-Apr	Apr-June
113.	<i>Ficus palmata</i> Forssk.	Moraceae	Apr-June	June-Sep
114.	<i>Ficus recemosa</i> L.	Moraceae	Apr-May	May-June
115.	<i>Fumaria indica</i> (Hauskn.) H.N	Fumariaceae	Apr-May	Mar-June
116.	<i>Gallium aparine</i> L.	Rubiaceae	Apr-May	June-July
117.	<i>Gallium circaezans</i> Michx.	Rubiaceae	Mar-May	May-June
118.	<i>Gallium spurium</i> L.	Rubiaceae	Apr-May	May-June
119.	<i>Gallium triflorum</i> Michx.	Rubiaceae	Apr-June	June-July
120.	<i>Gentiana argentea</i> Royle ex D. Don	Gentianaceae	Apr-June	June-July
121.	<i>Geranium ocellatum</i> Jacquem. ex Cambess.	Geraniaceae	Mar-Apr	Apr-June
122.	<i>Geranium rotundifolium</i> L.	Geraniaceae	Mar-May	May-Sep
123.	<i>Geranium robertianum</i> L.	Geraniaceae	Mar-May	May-Sep
124.	<i>Grewia optiva</i> J.R. Drumm. ex Burret	Tiliaceae	Mar-Apr	Apr-June
125.	<i>Gymnosporia royleana</i> Wall. ex M.A.	Celastraceae	Mar-June	June-July
126.	<i>Hedera helix</i> L.	Araliaceae	Mar-Apr	May-June
127.	<i>Heliotropium bacciferum</i> Forssk.	Boraginaceae	Apr-May	May-Aug
128.	<i>Heracleum sphondylium</i> L.	Apiaceae	Apr-May	May-Aug
129.	<i>Hypericum foliosum</i> Aiton	Hypericaceae	Mar-Apr	Apr-June
130.	<i>Hypericum perforatum</i> (L.) Schult.	Hypericaceae	Mar-Apr	May-Aug
131.	<i>Imperata cylindrica</i> L.	Poaceae	Apr-May	May-June
132.	<i>Impatien glandulifera</i> Royle	Balsaminaceae	Mar-Apr	June-July
133.	<i>Indigofera heterantha</i> Wall.	Fabaceae	Apr-May	May-June
134.	<i>Indigofera linifolia</i> (L.F.) Retz.	Fabaceae	Mar-Apr	Apr-June
135.	<i>Ipomoea carnea</i> Jacq.	Convolvulaceae	Mar-May	May-June
136.	<i>Ipomoea purpurea</i> (L.) Roth.	Convolvulaceae	Apr-May	June-July
137.	<i>Isodon rugosus</i> (Wall. ex Benth.) Codd	Lamiaceae	Mar-Apr	Apr-May
138.	<i>Jasminum humile</i> L.	Oleaceae	Mar-Apr	May-June

139.	<i>Juglan regia</i> L.	Juglandaceae	May-June	June-July
140.	<i>Justicia adhatoda</i> L.	Acanthaceae	Mar-Apr	Apr-May
141.	<i>Justicia pectoralis</i> Jacq.	Acanthaceae	Mar-Apr	May-June
142.	<i>Kickxia ramosissima</i> Wall.	Scrophulariaceae	Mar-May	May-June
143.	<i>Lactuca indica</i> L.	Asteraceae	Mar-Apr	Apr-May
144.	<i>Lactuca serriola</i> L.	Asteaceae	May-June	June-July
145.	<i>Lamium album</i> L.	Lamiaceae	Mar-May	May-June
146.	<i>Lansea coromandelica</i> (Houtt.) Merr	Anacardiaceae	Apr-June	July-Aug
147.	<i>Lantana camara</i> L.	Verbenaceae	Mar-Apr	Apr-June
148.	<i>Lappula barbata</i> (M. Bieb.) Gürke	Boraginaceae	Apr-May	May-June
149.	<i>Lathyrus aphaca</i> L.	Fabaceae	Apr-May	May-June
150.	<i>Launaea procumbens</i> (Roxb.) Ramayya & Rajagopal	Asteraceae	Mar-June	June-July
151.	<i>Lepidium didymium</i> L.	Brassicaceae	Mar-Apr	Apr-July
152.	<i>Leptodermis virgata</i> Edgew. ex Hook.f.	Rubiaceae	Mar-Apr	May-June
153.	<i>Lespedeza juncea</i> Linn.f	Fabaceae	Mar-June	June-July
154.	<i>Linum corymbulosum</i> Rchb.	Linaceae	Mar-Apr	Apr-June
155.	<i>Limonium echioides</i> (L.) Mill.	Plumbaginaceae	Mar-May	May-Sep
156.	<i>Lonicera quinquelocularis</i> Hard.	Carprifoliaceae	Mar-June	June-July
157.	<i>Malvastrum coromandelianum</i> (L.) Garcke	Malvaceae	Mar-May	May-Sep
158.	<i>Mallotus philippensis</i> (Lam) Muell.Arg.	Euphorbiaceae	Feb-Apr	Apr-May
159.	<i>Malva neglecta</i> Wallr.	Malvaceae	Mar-June	June-July
160.	<i>Marrubium vulgare</i> L.	Lamiaceae	Mar-May	June-July
161.	<i>Melia azedarach</i> L.	Meliaceae	Mar-Apr	Apr-July
162.	<i>Medicago denticulata</i> Willd.	Fabaceae	Apr-May	May-June
163.	<i>Medicago polymorpha</i> L.	Fabaceae	Mar-June	June-July
164.	<i>Melilotus indicus</i> (L.) All.	Fabaceae	Mar-May	May-July
165.	<i>Mentha arvensis</i> L	Lamiaceae	Mar-June	June-Sep
166.	<i>Mentha longifolia</i> (L.) Huds	Lamiaceae	Mar-Apr	Apr-July
167.	<i>Micromeria biflora</i> (Buch. D. Don) Benth.	Lamiaceae	Apr-May	May-June
168.	<i>Mirabilis jalapa</i> L.	Nyctaginaceae	Apr-May	May-June
169.	<i>Morus alba</i> L.	Moraceae	June-July	Aug-Sep

170.	<i>Morus nigra</i> L.	Moraceae	June-July	Aug-Sep
171.	<i>Myrsine africana</i> L.	Primulaceae	Mar-Apr	May-June
172.	<i>Nasturtium officinale</i> R.Br.	Brassicaceae	Mar-Apr	Apr-July
173.	<i>Nanorrhinum acerbianum</i> (Boiss.) Betsche	Plantaginaceae	Apr-July	Aug-Sep
174.	<i>Nannorrhop ritchiana</i> (Griff). Aitchison.	Areaceae	Apr-July	Aug-Sep
175.	<i>Nepeta cataria</i> L.	Lamiaceae	Mar-Apr	Apr-May
176.	<i>Nepeta ciliaris</i> Benth.	Lamiaceae	Mar-Apr	May-July
177.	<i>Notholirion thomsonianum</i> (Royle) Stapf	Liliaceae	Mar-Apr	Apr-May
178.	<i>Oenothera rosea</i> L. Her. ex Aiton	Onagraceae	Mar-Apr	Apr-July
179.	<i>Olea ferruginea</i> Royle.	Oleaceae	Apr-May	May-June
180.	<i>Onosma hispida</i> Wall. ex G. Don	Boraginaceae	Mar-May	May-July
181.	<i>Opuntia ovata</i> Pfeiff.	Cactaceae	Mar-Apr	Apr-July
182.	<i>Origanum vulgare</i> L.	Lamiaceae	Apr-May	June-Sep
183.	<i>Otostegia limbata</i> (Benth.) Boiss.	Lamiaceae	Mar-Apr	May-July
184.	<i>Oxalis corniculata</i> L.	Oxalidaceae	Mar-Apr	May-June
185.	<i>Parthenium hysterophorus</i> L.	Asteraceae	Mar-Apr	May-June
186.	<i>Pennisetum orientale</i> . Rich.	Poaceae	Mar-May	June-July
187.	<i>Pentanema vestitum</i> Wall.ex. DC	Asteraceae	Mar-Apr	May-June
188.	<i>Periploca aphylla</i> . Decne.	Apocynaceae	Mar-May	May-July
189.	<i>Perilla frutescens</i> (L) Britton.	Lamiaceae	Mar-May	June-July
190.	<i>Phleum alpinum</i> L.	Poaceae	Mar-June	June-July
191.	<i>Phleum arenarium</i> L.	Poaceae	Mar-Apr	May-July
192.	<i>Pimpinella stewartii</i> Nasir	Apiaceae	Mar-Apr	Apr-July
193.	<i>Pinus roxburghii</i> Sarg.	Pinaceae	Mar-Apr	Apr-July
194.	<i>Pistacia integerrima</i> J.L. Stewart. ex. Brands.	Anacardiaceae	Mar-May	May-July
195.	<i>Plantago lanceolata</i> L.	Plantaginaceae	Mar-May	May-June
196.	<i>Plumbago zeylanica</i> L.	Plumbaginaceae	Mar-Apr	Apr-July
197.	<i>Poa balfourii</i> Auct.	Poaceae	Apr-May	June-July
198.	<i>Poa poiiformis</i> Labill	Poaceae	Mar-May	May-July
199.	<i>Polygala abyssinica</i> R.Br.ex. Fresen.	Polygalaceae	Apr-May	May-June
200.	<i>Polygala vulgaris</i> L.	Polygonaceae	Mar-Apr	Apr-July
201.	<i>Polygonum plebeium</i> R.Br.	Polygonaceae	Mar-May	May-July



202.	<i>Polygonum viviparum</i> L.	Polygonaceae	Mar-May	May-June
203.	<i>Populus alba</i> L.	Salicaceae	Apr-May	May-July
204.	<i>Potentilla rivalis</i> Nutt. ex Torr. & A. Gray	Rosaceae	Mar-May	Mar-June
205.	<i>Prunus amricana</i> Marsh	Rosaceae	Mar-Apr	Apr-July
206.	<i>Prunus domestica</i> L.	Rosaceae	Mar-Apr	Apr-July
207.	<i>Prunus persica</i> (L.) Batsch.	Rosaceae	Mar-Apr	Apr-July
208.	<i>Psidium guajava</i> L.	Myrtaceae	Mar-May	May-June
209.	<i>Punica granatum</i> L.	Punicaceae	Mar-Apr	Apr-July
210.	<i>Pyrus pashia</i> L.	Rosaceae	Mar-May	May-Aug
211.	<i>Pyrus pyrifolia</i> (Burm) Nak.	Rosaceae	Mar-May	May-July
212.	<i>Pyrus communis</i> L.	Rosaceae	Mar-Apr	May-July
213.	<i>Quercus incana</i> Bartram	Fagaceae	Mar-Apr	Apr-May
214.	<i>Randia tetrasperma</i> (Wall. ex Roxb.) Benth.	Rubiaceae	Mar-Apr	Apr-July
215.	<i>Ranunculus muricatus</i> L.	Ranunculaceae	Mar-May	May-June
216.	<i>Ranunculus parviflorus</i> L.	Ranunculaceae	Mar-May	May-June
217.	<i>Reinwardtia trigyna</i> Planch.	Linaceae	Mar-May	May-June
218.	<i>Rhamnus virgata</i> Roxb.	Rhamnaceae	Mar-Apr	Apr-July
219.	<i>Rhynchosia tomentosa</i> (L) Hook & Arn.	Fabaceae	Mar-May	May-July
220.	<i>Ricinus communis</i> L.	Euphorbiaceae	Mar-May	June-July
221.	<i>Rosa brunonii</i> L.	Rosaceae	Mar-Apr	May-June
222.	<i>Rosa moschata</i> Herrm.	Rosaceae	Mar- May	May-July
223.	<i>Robinia pseudoacacia</i> L	Fabaceae	Mar-May	May-June
224.	<i>Rubia cordifolia</i> L.	Rubiaceae	Apr-June	July-Oct
225.	<i>Rubia manjith</i> Roxb.	Rubiaceae	Mar-May	July-Oct
226.	<i>Rubus ellipticus</i> Sm.	Rosaceae	Mar-June	June-July
227.	<i>Rubus fruticosus</i> Hook.f.	Rosaceae	Mar-Apr	Apr-June
228.	<i>Rubus sanctus</i> Schreb.	Rosaceae	Mar-Apr	Apr-July
229.	<i>Rumex dentatus</i> L.	Polygonaceae	Apr-May	May-June
230.	<i>Rumex hastatus</i> D. Don.	Polygonaceae	Mar-May	May-July
231.	<i>Rumex nepalensis</i> Spreng	Polygonaceae	Mar-June	June-Aug
232.	<i>Salix acmophylla</i> Boiss.	Salicaceae	Mar-May	May-July
233.	<i>Salvia coccinea</i> Buc'hoz ex Et.	Lamiaceae	Mar-Apr	Apr-June
234.	<i>Salvia moorcroftiana</i> Wall. ex Benth.	Lamiaceae	Mar-May	May-July

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235.	<i>Sapindus mukorossi</i> Gaertn	Sapindaceae	Mar-Apr	Apr-Aug
236.	<i>Saussurea heteromalla</i> (D. Don) Hand-	Asteraceae	Mar-May	May-July
237.	<i>Scabiosa candollei</i> Wall.	Dipsaceae	Mar-Apr	Apr-May
238.	<i>Scabiosa ochroleuca</i> L.	Caprifoliaceae	Mar-May	May-July
239.	<i>Scandix pecten-veneris</i> L.	Apiaceae	Mar-May	May-Aug
240.	<i>Scilla griffithii</i> Hochr.	Hyacinthaceae	Mar-Apr	May-July
241.	<i>Scrophularia dentata</i> Royle. ex. Bentham	Scrophulariaceae	Mar-May	May-Sep
242.	<i>Sedum sarmentosum</i> Bunge	Crassulaceae	Mar-Apr	Apr-June
243.	<i>Senecio aquaticus</i> Hill.	Asteraceae	Mar-May	June-July
244.	<i>Sida cordata</i> (Burm.f.) Borss.Waalk	Malvaceae	Mar-May	May-July
245.	<i>Sisymbrium irio</i> L.	Brassicaceae	Feb-Apr	Apr-May
246.	<i>Silene conoidea</i> L.	Caryophyllaceae	Mar-May	May-June
247.	<i>Smilax -bona-nox</i> L.	Smilacaceae	Mar-May	May-Sep
248.	<i>Smilax china</i> L.	Smilacaceae	Apr-May	May-Sep
249.	<i>Smilax rotundifolia</i> L.	Smilacaceae	Mar-May	May-Sep
250.	<i>Solanum erianthum</i> L.	Solanaceae	Apr-May	May-June
251.	<i>Solanum incanum</i> L.	Solanaceae	Mar-May	May-July
252.	<i>Solanum nigrum</i> L.	Solanaceae	Mar-May	May-June
253.	<i>Solanum surattense</i> L.	Solanaceae	Apr-May	May-July
254.	<i>Sonchus asper</i> (L.) Hill	Asteraceae	Apr-May	June-July
255.	<i>Sonchus oleraceus</i> (L.) Hill	Asteraceae	Mar-Apr	Apr-July
256.	<i>Sorbaria tomentosa</i> (Lindl.) Rehder	Rosaceae	Mar-May	June-Aug
257.	<i>Stachys emodi</i> . Hedge.	Lamiaceae	Apr-May	May-June
258.	<i>Spiraea vacciniifolia</i> D. Don	Rosaceae	Mar-Apr	May-July
259.	<i>Stellaria alsinoides</i> Boiss.	Caryophyllaceae	Mar-May	May-June
260.	<i>Stellaria media</i> (L.) Vill.	Caryophyllaceae	Mar-May	May-Sep
261.	<i>Strobilanthes efloraofindia</i> C.B. Clarke	Acanthaceae	Mar-May	May-Aug
262.	<i>Strobilanthes oliganthus</i> Miq.	Acanthaceae	Mar-Apr	Apr-Aug
263.	<i>Symplocos recemosa</i> Roxb.	Symplocaceae	Mar-May	May-July
264.	<i>Tagetes minuta</i> L.	Asteraceae	Apr-May	June-July
265.	<i>Taraxacum officinale</i> L.	Asteraceae	Mar-Apr	Apr-May
266.	<i>Tricholepis angustifolia</i> -DC	Asteraceae	Mar-Apr	Apr-Aug
267.	<i>Trichodesma indicum</i> (L)R. Br.	Boraginaceae	Mar-May	May-July

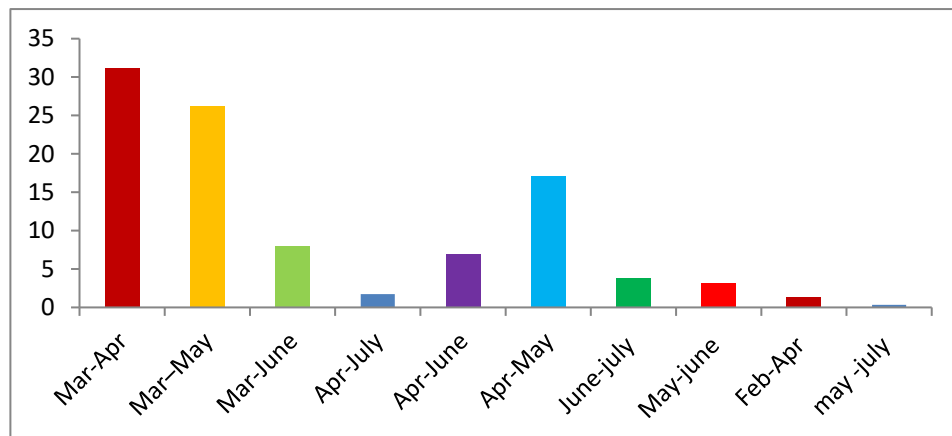
268.	<i>Tridax procumbens</i> L.	Asteraceae	Mar-May	May-June
269.	<i>Trifolium repens</i> L.	Fabaceae	Mar-Apr	May-Aug
270.	<i>Ulmus villosa</i> Brandes.ex. Gamble	Ulmaceae	Mar-May	May-Sep
271.	<i>Verbena officinalis</i> L.	Verbenaceae	Apr-May	June-July
272.	<i>Veronica stewartii</i> Pennel	Plantaginaceae	Apr-July	July-Sep
273.	<i>Verbena tenuisecta</i> Briq.	Verbenaceae	Mar-May	Mar-May
274.	<i>Verbascum Thapsus</i> L.	Scrophulariaceae	May-June	June-Sep
275.	<i>Viburnum cotinifolium</i> L.	Caprifoliaceae	Apr-May	May-July
276.	<i>Vicia hirsuta</i> (L.) Gray.	Fabaceae	Mar-June	July-Sep
277.	<i>Vicia sativa</i> L.	Fabaceae	Mar-May	Mar-June
278.	<i>Viola Odorata</i> L.	Violaceae	Mar-Apr	Apr-May
279.	<i>Vitex negundo</i> L.	Verbenaceae	Apr-May	May-Aug
280.	<i>Vitis vinifera</i> L.	Vitaceae	Mar-Apr	Apr-July
281.	<i>Woodfordia fruticosa</i> (L.) Kurz.	Lythraceae	Feb-Apr	Apr-June
282.	<i>Xanthium strumarium</i> L.	Asteraceae	Mar-May	Mar-June
283.	<i>Zanthoxylum armatum</i> Dc.	Rutaceae	Apr-May	May-June
284.	<i>Ziziphus oenopila</i> L.	Rhamnaceae	Feb-Apr	Apr-June
285.	<i>Ziziphus nummularia</i> (Burm.f.) Wight	Rhamnaceae	Mar-May	Mar-June
286.	<i>Ziziphus jujuba</i> Mill.	Rhamnaceae	Mar-Apr	May-June

These results are in line with the [Kikim and Yadava \(2001\)](#) they stated that in the Sub-tropical forests of Manipur India mostly flowers occur from April to September. The change in climatic conditions can affect the flowering period of plant species. These results are also in accordance with [Khan et al. \(2016\)](#) who indicated that maximum flowering was noted in the month of March-April in Sathan Galli Hill, Pakistan. Our findings are also agreed with [Amjad et al. \(2013\)](#) who described the phenological behavior of plants from Nikyal Valley, Pakistan and reported that maximum fruiting was observed in June.

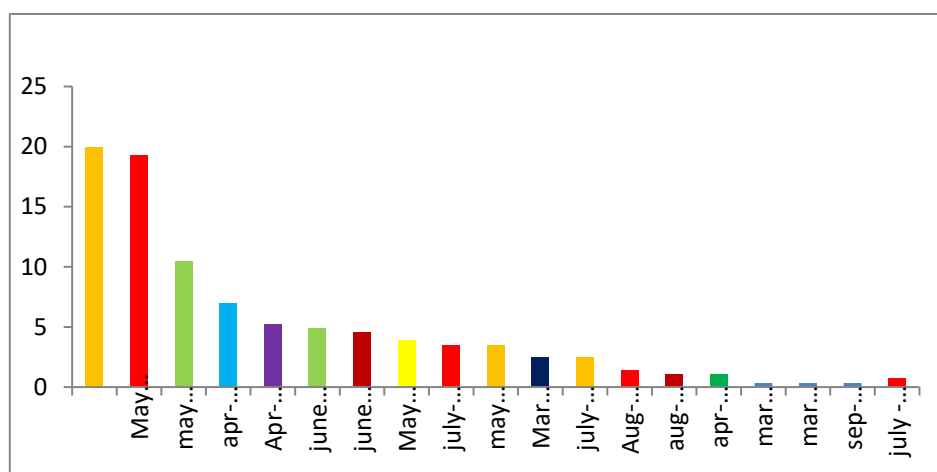
This study would be helpful in knowing the timing of different phenological phases of the plants which can be of interest to people of the area who wish to plan their gardens round the year. This study would also be helpful for making comparison over long time. For example, if there is any change in the phenological behavior of the same plant species in next 5 years. Then such study could not be possible at this time as no relative literature is available for this area.

The period of maximum flowering activity in the months of spring agreed with the observations of Pilar and Gabriel. Flower development periods of the same plant species seems to be important in increasing the chances of pollinations as proposed by Ollerton and Lack. The changes in phonological behavior of plants are due to the temperature and rainfall [Parmesan \(2007\)](#). The study provides information about change in climatic conditions which affect the flowering period of plant species.

People of the study area are usually unaware of the importance of phenology in their daily lives. The present understanding of phenology is significant to help people know how plant species respond to climate change.



**Figure 2** Graph showing flowering period of plant species



**Figure 3** Graph showing fruiting period of plant species

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