Floral biology of almond (*Prunus amygdalus* L. Batsch) under cultivation in Kashmir valley

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**Abstract.** The almonds, cultivated in Kashmir, on the basis of relative time of flowering reveal early-, mid- and late flowering types. The late blooming types hold key to the isolation of lines that can escape the damage of spring-rains. Anther dehiscence and stigma receptivity overlap creating conditions suited to self-pollination which is however obviated by self-incompatibility.

**Keywords.** Floral biology; flowering period; anthesis; stigma receptivity; pollination.

1. **Introduction**

Though Kashmir valley holds monopoly in the country for production of almonds, the yield of nuts is very low (only 233 kg per hectare, Anon. 1969). The main reason for poor yield is the damage caused to the blossoms by spring rains and frosts. Only the late flowering types, that flower after the spring rains, escape this damage. Data on flowering periods assumes importance in this context. Knowledge about the time and duration of stigma receptivity vis-a-vis anther dehiscence is necessary for planning hybridization programmes. The present paper includes observations on some of these aspects.

Studies were conducted on 50 trees labelled at Jyoti Pvt. Ltd. Orchards, Srinagar, Kashmir.

2. **Results**

2.1 *Floral bud development and anthesis*

Floral buds differentiate in leaf axils in July (figure 1). By the middle of December, they develop thick pubescent scales and overwinter. The bud burst occurs the following year in March and anthesis ensues in 7 or 8 days. Most of the flowers open between 10:00 AM and 12 noon. Anther dehiscence usually begins on the very day the flower opens albeit majority of anthers dehisce a day after the anthesis.

2.2 *Time and duration of flowering*

The data on flowering period were collected for 3 consecutive years—1981–83. In the experimental orchards, like any other orchard, a few trees flower during the first week of March. Thereafter, the trees come to bloom one after the other. Some trees enter into bloom only in mid-April. As such flowering extends nearly for a month and a half. Individual trees remain in bloom for about two weeks. Since trees come
to bloom in a sequence, their flowering overlaps. There is no overlap between the early (those flowering in early March) and late (flowering in April) bloomers. Most of the trees flower in between and they represent the mid-bloomers. Data collected over 3 years period indicate that the relative timing of the bloom of various trees
remains constant, but the actual date of bloom of an individual tree fluctuates by a few days, from year to year.

2.3 Stigma receptivity

Data on stigma receptivity were collected by visual observation and pollen germination test (figure 6). In closed buds, the style is incurved and the stigma is dull green. On becoming receptive, the stigmas turn moist and shiny. When the receptivity is lost, the stigma turns brown and dries.

2.4 Pollination mechanism and breeding behaviour

Being showy and nectiferous, almond blossoms attract insects of many species. The insects belonging to families Apidae, Bombidae, Coreideae, Peridae and Coenagrionoidae are particularly very common. Honeybee is the chief pollen vector followed by the bumblebee. For purposes of determining the breeding behaviour of almonds, 508 floral buds from 8 trees were bagged a day before anthesis to make provision for self-pollination. Of the 508 buds, only 4 set fruit. Even these dropped no sooner they reached the peanut-stage.

3. Discussion

The time of floral bud initiation recorded in the present study agrees with reports made on almond varieties under cultivation in the Mediterranean region (Grigorov 1964; Gililov 1972). The sequence of flowering observed among different trees in the orchard is maintained year after year indicating that the relative timing of bloom is fixed. Griggs and Iwakiri (1964) and Dhillon et al (1982) have made similar observations on the varieties cultivated in California and Ludhiana respectively.

![Figure 6. Data on percentage stigma receptivity on different days ranging from two days before anthesis (−2) to 5 days after anthesis (+5).](image-url)
These studies indicate that flowering time is under genetic control and provides a possibility of raising late blooming types capable of escaping the damage caused by spring rains and frost. Variation of a few days in the actual date of bloom initiation is in all probability caused by variations in temperature regime and other climatic conditions. Atmospheric temperature prevailing a few days before the onset of bloom is suspected to determine the actual date of bloom initiation (Lawrinowver 1963; Tabuenca 1977).

The temporal distance between the onset and duration of stigma receptivity and anther dehiscence has profound influence on the breeding system of a species. In almonds stigma receptivity lasts for 4–5 days (Griggs and Iwakiri 1964; Dhillon et al 1982; present work). Maximum number of stigmas attain receptivity a day after anthesis when anther dehiscence is at its peak. This synchrony creates conditions for selfing which is never achieved due to self-incompatible nature of the species (Griggs 1953; Millela 1963; Nauriyal and Rana 1965; A S Soodan, A K Koul and B A Wafai, unpublished results).

The present findings that almond is mainly insect pollinated and honeybee being the chief pollen vector corroborate the earlier reports of Free (1962) and Griggs and Iwakiri (1964).

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References

Anonymous 1969 The wealth of India. Raw materials Vol. 8 (New Delhi: CSIR)
Dhillon A S, Dhat A S and Gill R P S 1982 Pollination studies in almonds (Prunus amygdalus Batsch) growing under subtropical conditions. I. Floral biology; Indian J. Hortic. 39 190–195
Free J B 1962 Studies on the pollination of fruit trees by honeybees; J. R. Hortic. Soc. 87 302–309
Gililov B K 1972 The differentiation of almond flower buds in Apsheron; Subtrop. Kult. 3 101–104
Griggs W H 1953 Pollination requirements of fruits and nuts; Calif. Exp. Sta. Ext. Serv. Cent. 424
Griggs W H and Iwakiri B T 1964 Timing is critical for cross-pollination of almond flower; Calif. Agric. 18 6–7
Grigorov J 1964 Flower bud formation in some peach varieties in the Sandauski-Petric region; Grad. Lotar. Nauke 1 17–24
Lawrinowver R 1963 Investigations on the relationship between the flowering of fruit trees and weather; Ber. Dtsch. Wetterdienstes 15 1–32
Millela A 1963 Flower bud drop in some peaches; Studi Sassar. Sez. 3 2 3–12
Nauriyal J P and Rana R S 1965 Pollination studies in almond; Indian J. Hortic. 22 1–9
Tabuenca M C 1977 Winter chilling requirements in almonds; Ann. Asia. Del. 11 325–329