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Phenological characteristics of Apple (*Malus × domestica* Borkh.) varieties in Kashmir

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Abstract

The study was conducted in the Experimental Orchards of Division of Fruit Science, Sher-e-Kashmir University of Agricultural Science & Technology of Kashmir, Srinagar, J&K, carried out over two consecutive years 2017 and 2018. Five varieties were used in the study namely Adam's Pearmain, Allington Pippin, Baldwin, Baleman's Cider and Cox's Orange Pippin. The investigation revealed significant differences in varieties regarding phenological characteristics. The results reveal that Cox's Orange pippin took maximum number of 22.84 and 27.11 days after reference date (DARD) to reach silver tip and green tip stage, respectively. Whereas, variety Allington Pippin took minimum number of 15.58 and 20.20 DARD to attain silver tip and green tip stage, respectively. Pink bud stage was observed earliest in Baleman's Cider (28.53 DARD) while latest was recorded in Cox's Orange pippin (38.97 DARD).

Keywords: Apple, varieties, stages, cluster, bloom

Introduction

Apple (*Malus × domestica* Borkh.) is an important temperate fruit crop of the world. In India, apple is commercially cultivated in the states of Jammu & Kashmir, Himachal Pradesh, Uttarakhand and Arunachal Pradesh. The proverb "An apple a day keeps the doctor away" addresses the beneficial effects of the fruit on human health. It belongs to the family Rosaceae and Sub-family Pomoidae. The primary centre of origin of apple is considered Asia Minor to Western Himalayas. Jammu and Kashmir have been pioneer in growing temperate fruits because of being endowed with natural advantages of climate, temperature, fertile land and with diversity of agro-climatic conditions, thus having vast scope for horticultural development. The fruit industry is the backbone of Jammu and Kashmir State's economy, especially to Kashmir region with Apple dominating the industry. Under Kashmir region, Apple covers an area of 0.14 million ha with a production of 1.64 million tonnes and productivity of 11.44 MT/ha (Anonymous, 2017) [1]. Despite being the largest apple producing region in the country, the productivity is very less than the horticultural advanced countries (30-62 MT/ha). There are many reasons behind this low productivity but one of the important factors is lack of knowledge and timing of phenological stages in varieties. Bloom synchronization and pollination is an important and inseparable component in respect of regular and consistent production. In a fruit crop like apple, pollination is of utmost significance and its proportion and magnitude is primarily based upon appropriate selection of varieties in orchard. Moreover, various orchard practices like spraying of pesticides, fungicides, growth regulators and foliar nutrients are effective at particular phenological stage. Therefore, the investigation was undertaken for comparative study of phenological characteristics of various apple varieties.

Materials and Methods

The study was conducted in the Experimental Orchards of Division of Fruit Science, Sher-e-Kashmir University of Agricultural Science & Technology of Kashmir, Srinagar, Jammu & Kashmir, carried out over two consecutive years 2017 and 2018. The climate is of Temperate type. Five varieties of uniform age on clonal rootstock were selected for experimentation in orchard. All recommended package of practices for apple cultivation of SKUAST-K were followed as per schedule. The trees were spaced at 4m x 4m distance and regularly weeded. The varieties undertaken for studies included Adam's Pearmain, Allington Pippin, Baldwin,

Baleman's Cider and Cox's Orange Pippin. The experiment was laid in Randomized Complete Block Design (RCBD) with three replications and two trees per treatment as plot size. Phenological characteristics viz. silver tip stage, green tip stage, pink bud stage was observed visually when the buds started showing the respective stages. Initial and final bloom in each variety was recorded when 10 and 80 percent of the flowers had opened, respectively. The duration of flowering

was worked out as the period (days) between the date of initial bloom to the date of full bloom of respective variety. Flowers per cluster (average number of flowers in clusters) and bloom density (number of flower cluster per meter of shoot length) was observed visually. The petal fall stage was recorded when 80% petal fall occurred. 1st March was taken as the reference date.

Table 1: Silver tip, green tip and pink bud stages of Apple varieties

S. No.	Variety	DARD: Days after reference date (1 st March)		
		Silver tip stage	Green tip stage	Pink bud stage
1	Adam's Pearmain	16.85	20.95	36.23
2	Allington Pippin	15.58	20.20	34.95
3	Baldwin	17.39	22.44	32.41
4	Baleman's Cider	15.74	20.83	28.53
5	Cox's Orange Pippin	22.84	27.11	38.97
C.D ($P \leq 0.05$)		1.35	1.05	1.06

Table 2: Initial bloom, full bloom and petal fall stages of Apple varieties

S. No.	Variety	DARD: Days after reference date (1 st March)		
		Initial bloom stage	Full bloom stage	Petal fall stage
1	Adam's Pearmain	39.28	45.31	53.98
2	Allington Pippin	37.26	42.87	51.82
3	Baldwin	35.50	40.98	51.72
4	Baleman's Cider	33.39	39.47	50.25
5	Cox's Orange Pippin	40.24	46.46	54.97
C.D ($P \leq 0.05$)		0.89	1.03	0.88

Table 3: Flowering duration, flowers per cluster and bloom density of Apple varieties

S. No.	Variety	Flowering duration (Days)	Flowers per cluster (No.)	Bloom density (No./m)
1	Adam's Pearmain	6.03	5.17	7.97
2	Allington Pippin	5.61	5.19	8.42
3	Baldwin	5.48	5.11	7.50
4	Baleman's Cider	6.08	5.15	9.16
5	Cox's Orange Pippin	6.22	5.14	5.81
C.D ($P \leq 0.05$)		0.24	0.01	1.02

Results and Discussion

Varieties showed significant differences with respect to all the traits in the investigation. Among the varieties, Cox's Orange pippin took maximum number of 22.84 and 27.11 days after reference date (DARD) to reach silver tip and green tip stage, followed by Baldwin (17.39 and 22.44 DARD), respectively (Table-1). Variety Allington Pippin took minimum number of 15.58 and 20.20 days after reference date (DARD) to reach silver tip and green tip stage, respectively (Table-1) and was at par with Baleman's Cider and Adam's Pearmain with respect to silver tip and green tip stages. Highest number of 38.97 DARD to reach pink bud stage was observed in Cox's Orange pippin, followed by Adam's Pearmain (36.23 DARD), whereas lowest (28.53 DARD) was observed in Baleman's Cider (Table-1). The differences in the silver tip, green tip and pink bud stages may be due to their genetic differences and differential chilling requirements. Initial and full bloom stage was earliest in variety Baleman's Cider at 33.39 and 39.47 DARD, respectively (Table-2). Variety Cox's Orange Pippin was latest for initial and full bloom stage at 40.24 and 46.46 DARD, respectively (Table-2). Flowering date and period may vary according to cultivar, altitude as well as ecological and cultural conditions (Facteau *et al.*, 1986) [3]. Late flowering in some cultivars may be due to their high chilling requirement (Taburence, 1983) [5]. Stability of the blooming order of eighty six varieties were investigated for twenty years and reported that beginning of blooming never shows same trend even under

similar circumstances (Soltesz, 2002) [4]. Further these varieties may be different in their photo sensitivity and response to temperature resulting in such variations. In the present study, maximum days (54.97 DARD) to attain petal fall stage was recorded in Cox's Orange Pippin and minimum (50.25 DARD) in Baleman's Cider (Table-2). Furthermore, varieties Allington Pippin and Baldwin were at par with each other. Variation in petal fall may be due to the genetic difference of varieties. Highest flowering duration was recorded in Cox's Orange Pippin (6.22 days) followed by Baleman's Cider (6.08 days), Adam's Pearmain (6.03 days) and were at par with each other while lowest was noticed in Baldwin (5.48 days) and was at par with Allington Pippin (Table-3). The differences observed regarding flowering duration may be due to the genetic constitution of the varieties. High spring temperature causes shorter blooming period (Bodor *et al.*, 2008) [2]. From the perusal of data from Table-3, maximum number of flowers per cluster was observed in Allington Pippin (5.19) and minimum in Baldwin (5.11). Besides, varieties Baleman's Cider and Cox's Orange Pippin were at par with each other. It is evident from the Table-3 that the highest bloom density was noticed in Baleman's Cider (9.16) followed by Allington Pippin (8.42) and were at par with each other. Similarly, varieties Adam's Pearmain, Allington Pippin and Baldwin were at par with each other. Lowest bloom density was recorded in Cox's Orange Pippin (5.81). These variations in bloom density may be due to genetic make-up of varieties.

Conclusion

It can be concluded from this investigation that the varieties differed significantly in all traits and therefore timing and features of different phenological traits at particular ecological conditions can be used for effective scientific practices in orchards for improving quality and productivity.

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