SEED AND PERICARP CORRELATION AND INFLUENCE OF GROWTH SUBSTANCES IN *BERBERIS ASIATICA* ROXB.

C. B. MALASI AND G. S. PALIWAL

Developmental Botany Laboratory, Department of Botany, University of Garhwal, Srinagar– 246 174.

ABSTRACT

The ratio between the pericarp and seed (s) as measured in terms of volume, fresh and dry-weights indicate highest ratio in the fruits which contain a single seed per fruit. The ratio for all the three parameters declines with the increase in the number of seeds set per fruit. Therefore, the fruits which have lowest number of seeds contain higher amount of edible pericarp. Application of growth substances markedly influences the number of seeds set per fruit. Treatments with IAA, IBA, NAA, and GA enhanced the percentage of one- and two-seeded fruits and decreased the three-, four- and five-seeded fruits whereas the reverse is true for the treatments with alar, ethrel, and CCC.

INTRODUCTION

Berberis asiatica Roxb.—the berberry—(Family Berberidaceae) is one of the common shrubs, distributed throughout tropical and temperate Himalayas in the lower hills at elevation range between 500—4,000 m. The small, deep violet-coloured fruits which come up during summer are a highly sought after delicacy with the villagers owing to their pleasant taste coupled with excellent digestive and medicinal properties. The present investigation has been carried out due to the realization that whereas the various aspects of the fruit development have been investigated in several cultivated temperate and tropical fruits, wild fruits, like-various species of *Berberis* have remained largely unexplored so far.

A review of literature reveals that the shape and size of the fruits depend on the number of viable seeds set per fruit in the multi-seeded fruits and there exists a correlation between the number of mature seeds and amount of the pericarp of the fruit (Nitsch, 1950; Visser, 1955; Moore *et al.*, 1974; Varga & Bruinsma, 1976; Chalfun *et al.*, 1976; Imanashi & Hiura, 1977; Krishnan *et al.*, 1980). A similar correlation was observed in *B. asiatica* in conjunction with the influence of growth substances which may alter the fruit size and contents by decreasing or increasing the number of seeds set per fruit (Prasad & Prasad, 1973; Singh *et al.*, 1976; Ghosh *et al.*, 1981).

MATERIAL AND METHOD

In order to observe the correlation between the number of seeds per fruit and the amount of the pericarp, 400 fruits from three different bushes were examined. The number of mature seeds and abortive seeds were counted. The volume, fresh- and dry-weights of the pericarp as well as the seeds in the mature fruits were measured. In order to investigate the influence of growth substances on the number of seeds set per fruit, three concentrations of 7 sets of these (IAA, IBA, NAA, GA, ethrel, alar, and CCC) have been tried using Teepol at 0.02 per cent concentration as surfactant.

The control specimens received only distilled water (D. W.) and 0.02 per cent Teepol mixture. The concentrations used were 50, 100, and 200 ppm each of IAA, IBA, NAA, and GA; 200, 400, and 800 ppm each of alar and ethrel; and 1000, 2000 and 4000 ppm of CCC. The experiment was so designed that separate bushes were selected for each type of growth substance and treatment with different hormonal concentrations as well as the controls were provided to separate branches of the same population. These were sprayed once at the time of full blooming period and then twice each at 15 days intervals. Mature fruits from these treated bushes were collected and the number of viable or well-formed seeds per fruit were recorded.

OBSERVATION

In the mature fruits, the number of seeds vary from 1-5. The volume, fresh- and dry-weights of pericarp as well as seeds in the mature fruits were measured and the findings have been summarized in table 1. A perusal of the table indicates that majority of the fruits contain 3 seeds per fruit and a few possess 5 seeds. The fruits with a single seed contain 75 per cent abortive ovules/seeds whereas the 5-seeded ones do not show such a situation. On the other hand, all the seeds from 1-and 2-seeded fruits are viable. The viability percentage of the seeds declines with the increase in the number

Table 1. *B. asiatica* statement of the number of seeds set per fruit and correlation between seed number and total quantity of the pericarp.

Type of fruit	Percentage	%of abortive seeds	% of viable seeds	Volume (CC)		Fresh weight (gm)		Dry weight (gm)		Ratio between pericarp to seed		
				Pericarp	Seed	Pericarp	Seed	Pericarp	Seed	Volume	Fresh weight	Dry weight
						1979						
1—seeded	4.00	75.00	100.00	0.176	0.050	0.205	0.027	0.022	0.008	3.52	7.59	2.75
2—seeded	29.60	26.70	100.00	0.166	0.056	0.190	0.036	0.022	0.012	2.96	5.28	1.75
3—seeded	48.00	8.75	86.25	0.168	0.066	0.196	0.048	0.019	0.016	2.55	4.08	1.19
4—seeded	15.80	2.60	76.35	0.160	0.070	0.188	0.054	0.016	0.018	2.29	3.48	0.89
5—seeded	2.60	0.00	69.67	0.150	0.078	0.172	0.060	0.014	0.018	1.92	2.87	0.78
						1980						
1—seeded	5.25	70.00	98.00	0.182	0.054	0.215	0.025	0.024	0.010	3.37	8.60	2.40
2—seeded	26.75	30.50	92.00	0.175	0.060	0.205	0.039	0.020	0.015	2.92	5.28	1.33
3—seeded	45.50	12.50	82.67	0.170	0.070	0.193	0.045	0.019	0.018	2.43	4.29	1.06
4—seeded	18.40	4.67	71.00	0.160	0.078	0.178	0.060	0.016	0.020	2.05	2.97	0.80
5—seeded	4.20	0.00	64.80	0.152	0.088	0.165	0.065	0.015	0.021	1.73	2.54	0.71

of seeds set per fruit. Although the volume, fresh-and dry-weights of the fruits as a whole increase with the number of seeds set per fruit, the values of these parameters vary when the seeds and pericarp are considered individually. However, the ratio between the pericarp and seed (s) as measured in terms of volume, fresh-and dry-weights, indicates highest ratio in the fruits which contain a single seed per fruit in both the years. The ratio for all the three parameters decreases with the increase in the number of seeds set per fruit. Thus the fruits with 5 seeds figured lowest in number. Therefore, the fruits with fewer seeds are ideal for consumption as these possess comparatively large amount of pericarp.

All the growth substances brought about variations in influencing the number of seeds set per fruit in the treated ones (Table 2). In IAA, IBA, alar and CCC-treated samples the number of seeds varied from 1-5; in NAA and GA-treated fruits

Table 2. *B. asiatica*, influence of growth substances on number of seeds set per fruit.

Growth substances	Concentrations	Fruits with degenerated seeds (%)	Percentage of fruit types				
			One-seeded	Two-seeded	Three-seeded	Four-seeded	Five-seeded
Control	D. W.	—	3.70	28.15	49.63	16.30	2.22
IAA	50	1.53	6.08	36.28	42.36	8.86	4.89
	100	4.74	9.84	35.56	40.38	6.29	2.80
	200	4.55	13.94	39.35	35.18	7.07	—
IBA	50	—	5.66	30.56	49.83	11.17	2.18
	100	—	6.96	36.66	43.35	9.62	3.41
	200	—	10.45	37.95	41.55	8.84	1.21
NAA	50	6.43	10.46	32.75	39.23	11.37	—
	100	3.66	16.88	38.56	32.18	8.72	—
	200	2.33	10.25	42.62	35.67	9.15	—
GA	50	6.88	8.76	33.78	36.85	13.82	—
	100	11.99	13.38	37.65	28.74	8.34	—
	200	12.67	18.86	38.68	24.24	5.79	—
Alar	200	—	5.75	29.49	40.75	17.58	6.43
	400	—	4.45	30.46	36.50	28.68	—
	800	—	—	33.29	32.48	34.28	—
Ethrel	200	—	—	28.57	44.36	23.56	3.
	400	—	—	21.69	46.50	26.85	4.96
	800	—	—	18.88	50.12	24.36	5.64
CCC	1000	—	4.25	26.85	45.38	20.65	2.85
	2000	—	2.68	28.96	48.84	19.49	—
	4000	—	—	28.76	51.89	19.35	—

there were 1-4 seeds per fruit whereas in the ethrel-treated ones 3-5 seeds were recorded per fruit. On such branches which has been sprayed with IAA, NAA and GA, a few fruits were also found to possess completely abortive/degenerated seeds. Of all the concentrations tried, 100 and 200 ppm of IAA and GA; 200 ppm of IBA and all the three concentrations of NAA enhanced the percentage of single-seeded fruits. The highest value (18.66%) was recorded for the 200 ppm GA-treated samples followed by 100 ppm NAA treatment (16.88%) as compared to those of control which possessed only 3.70 per cent single-seeded fruits. The different growth regulators favoured the production of 2-seeded fruits and reduced the percentage of 4-and 5-seeded fruits with enhancing concentrations. In IAA, IBA, NAA and GA treated branches, the maximum number of 2-seeded fruits were noticed in the samples sprayed with 200 ppm of NAA (42.62%) as compared to 28.15 per cent in the control. On the other hand, marked reduction in the percentage of 3- and 4-seeded fruits was observed with 100 and 200 ppm each of NAA and GA treatments. GA at 200 ppm exhibited maximum reduction with values as low as 24.24 per cent for 3-seeded ones and 5.79 for 4-seeded fruits. For control these values are 49.63 per cent and 16.30 per cent respectively. Alar treatments, on the other hand, favour a slight increase in the percentage of 2-seeded fruits but brought about a decline in the percentage of 3-seeded fr its. Contrarily, higher concentrations of ethrel decreased the percentage of 3-seeded fruits up to 18.88 (by treatment with 800 ppm). As compared to this. 28.15 per cent fruits belonged to the 3-seeded category in control. Both alar and ethrel favour the production of fruits possessing 4-seeds in each; maximum influence being brought about by 800 ppm of ethrel. None of the three concentrations of CCC exhibited any marked variation over the control.

DISCUSSION

In *B. asiatica* the number of fully formed seeds varies from 1-5 per fruit and to a certain extent the shape and size of the fruits depends on the number of seeds inside them. These results corroborate those of MOORE *et al.* (1974) in black berries; VARGA AND BRUINSMA (1976), CHALFUN *et al.* (1976), IMANASHI AND HIURA (1977) in tomato; and KRISHNAN *et al.* (1980) in *Catharanthus roseus*. VARGA AND BRUINSMA (1976) recorded that in such tomato fruits where more than 8 seeds were present the final fruit size having increased as the logarithm of the seed number. These observations are in agreement with IMANASHI AND HIURA (1977) who have noticed a close relationship between the number of seeds per fruit and the fruit weight. In *B. asiatica* also the volume of the fruits increased with the increase in the number of seeds per fruit. However, fruits containing the least number of seeds are ideal for human consumption since these contain the higher ratio of pericarp to seeds as measured by parameters like volume, fresh-and dry-weights.

The application of growth substances is also known to alter the number of well-formed seeds per fruit. In cauliflower, for example, SINGH *et al.* (1976) recorded an increase in the number of seeds per siliqua when treated with lower concentrations of ethrel (150 and 300 ppm); CCC having no influence whatsoever. In the present investigation in *B. asiatica* treatments with IAA, IBA, NAA and GA increased the percentage of 1-and 2-seeded fruits on the one hand and brought about reduction in the number of 3-, 4-, and 5-seeded fruits on the other. Reverse is true for the fruits treated with alar, ethrel and CCC. Similarly, a reduction in the number of seeds per berry was noticed in grapes by PRASAD AND PRASAD (1973) due to GA and NAA treat-

ments. More recently, GHOSH *et al.* (1981) have noticed that in cucurbits the application of HMO (an oxidation product of IAA) and IAA although improved the fruit development; the number of seeds in the developed fruits decreased significantly.

PRASAD AND PRASAD (1973) have recorded that in grapes, 100 ppm of GA not only decreased the number of seeds per berry but also resulted in the production of 41.85 per cent seedless berries.

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