

Variability in open pollinated seedlings of black pepper (*Piper nigrum* L.)¹

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ABSTRACT

Highly heterogeneous variances were observed for plant height, leaf number, leaf width, internode length and stem girth in open pollinated seedlings of three black pepper (*Piper nigrum*) cultivars. Collection 1344 had maximum range and coefficient of variation for all the characters followed by Panniyur - 1 and a Karimunda Selection KS-27. Eighteen distinct morphological variants were also recorded in the progeny of Coll. 1344. In some of the progenies, the initial variation sustained with growth for most of the morphological features. No such morphological variants were observed in the progenies of Panniyur - 1 and KS-27. The reason for this behaviour of the cultivar is discussed.

Key words : black pepper, homogeneity, morphological variants, open pollinated progenies, *Piper nigrum*, variability.

Introduction

Black pepper (*Piper nigrum* L.) is a predominantly self fertilized perennial vine (Sasikumar, George & Ravindran 1992). However, being a vegetatively propagated crop some amount of heterozygosity is inherent in the crop leading to considerable variation in the progenies. It has been suggested that black pepper originated as a natural hybrid between either diploids or tetraploids (Ravindran 1991). The presence of both sexual as well as vegetative propagation in the species led to the fixation of many segregants or variants

that occur in the population. The domestication of the species also led to the selection of better agronomic types, which gradually might have led to the present day cultivars (Ravindran & Babu 1988). The present day cultivars are propagated by vegetative cuttings, though seeds are fully fertile. An early study of seedling progenies of certain cultivars revealed high uniformity and even sporadic occurrence of lethal recessive mutants (Ravindran *et al.* 1986).

Selection in open pollinated (OP) progenies is an accepted method in the improvement of the crop. Ibrahim, Pillay

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& Sasikumaran (1986) reported high amount of variation for three quantitative characters in OP seedlings of six black pepper cultivars. Macrovariations so far observed in OP seedling populations are limited to few cases of albinism and some single cotyledonary seedlings. As a sequel to earlier studies on selection in OP progenies, an investigation was initiated on OP progenies of certain cultivars, and rich variability, hitherto unreported in the seedling progenies of a black pepper cultivar was observed. The cultivar (Coll.1344) was collected from Coorg district of Karnataka. The present investigation is an attempt to quantify and compare variability in open pollinated progenies of this cultivar and two other cultivars, including a hybrid.

Materials and methods

Fully ripened seeds of three black pepper cultivars viz., Coll. 1344, Panniyur-1 and an elite line of Karimunda (KS-27) were collected during March 1990 from field grown vines and sown immediately in sand filled basins in the nursery. Good germination (above 85%) was recorded in all the three cultivars. Seedlings were visually scored for morphological variation during July 1990 and some of the variants were later studied cytologically. Seedlings of all the cultivars were transplanted in polythene bags (25cm x 8cm, 250 gauge) filled with standard potting mixture during August 1990 and maintained in the nursery. All standard nursery management techniques were followed. Observations were recorded from 95 plants of each cultivar on plant height, leaf number, leaf length, leaf width, internode length and stem girth (maximum girth) during November 1990. Mean, range, variance and

coefficient of variation (CV%) was calculated for each of the recorded traits. Homogeneity of variances was tested by applying Bartlett's test of homogeneity (Panse & Sukhatme 1978).

Results and discussion

Mean, range, variance and CV% for the six characters studied are presented in Table 1. Mean plant height ranged from 7.28 (Coll.1344) to 15.62cm (KS-27). The mean leaf number was highest in KS-27 (6.63) and least in Coll.1344 (5.01). Maximum length and width of leaves were also recorded in KS-27 (9.07 and 6.64cm, respectively) followed by Panniyur-1 (7.35 and 6.28 cm, respectively) and Coll.1344 (5.92 and 3.59cm, respectively). The mean internode length ranged from 1.11 cm (Coll.1344) to 2.15 cm (KS-27). Stem girth was maximum in Panniyur-1 (1.22cm) and least in Coll.1344 (0.93 cm). Coll.1344 recorded maximum range and CV% for all the six traits studied followed by Panniyur-1 and KS-27.

Bartlett's test of homogeneity of variances revealed highly heterogeneous nature of all the variances barring the variance for leaf length. The contribution of environment to the variability is expected to be uniform for all the three cultivars in the nursery under uniform conditions. Hence, the observed variability can be considered mainly due to genotypes. Coll.1344 showed maximum coefficient of variation for all the traits. Seedlings of Coll.1344 had three distinct leaf shapes viz., round, oblong and elongated. About 18 types of distinctly different morphological variants were also observed in the progeny of this cultivar (Table 2). Some of these variants exhibited distinct morphological features

Table 1. Mean, range, variance and coefficient of variation (CV%) for six characters in open pollinated progenies of black pepper cutlivars

Cha- rac- ter	Cultivar												Bart- lett's test-X ² value (P=0.1)
	Coll. 1344				Panniyur-1				KS-27				
	Mean (cm)	Range	Vari- ance	CV%	Mean (cm)	Range	Vari- ance	CV%	Mean (cm)	Range	Vari- ance	CV%	
Plant height	7.28	2.6-18.0	10.82	45.19	9.13	4.8-25.5	15.21	42.72	15.62	6.2-30.0	31.13	35.72	28.09**
Leaf number	5.01	2.0-10.0	2.34	30.53	5.46	3.0-10.0	1.49	22.34	6.63	4.0-10.0	1.59	19.00	4.98**
Leaf length	5.92	3.0-12.8	3.76	32.77	7.35	4.0-13.0	3.42	25.17	9.07	4.6-14.2	3.53	20.72	0.06
Leaf width	3.59	1.0-8.9	2.53	44.28	6.28	3.5-10.0	2.19	23.57	6.64	3.8-9.9	1.59	13.89	4.98**
Internode length	1.11	0.3-2.9	0.37	54.41	1.19	0.5-2.6	0.21	38.66	2.15	1.1-3.4	0.26	23.72	6.39**
Stem girth	0.93	0.5-1.5	0.035	20.13	1.22	0.8-1.7	0.047	17.70	1.17	0.8-1.5	0.019	11.88	19.02**

** Highly significant

Table 2. Morphological variations in open pollinated progenies of black pepper cultivar Coll.1344

Sl. No.	Type of morphological variation
1.	Lanceolate and serrated leaves; thin stem
2.	Broom shaped seedlings
3.	Tall, etiolated type seedlings
4.	Mammoth cotyledon
5.	Three cotyledons
6.	Single cotyledon
7.	Very thick and small cotyledon
8.	Crinkled and shrivelled cotyledon
9.	Cotyledon fused at sides
10.	Petiolated cotyledon
11.	Thick cotyledons with bifurcated tip
12.	Fused and unfolded cotyledon
13.	Twisted and crooked seedlings
14.	Bold and very vigorous seedlings
15.	Multiple terminal shoots and appearing like <i>Peperomia</i>
16.	Multiple apical buds and shoots
17.	Long petiole, thick leaves; thick stem
18.	Very small, thick, round leaves; thin stem

later including features of related species of black pepper (Fig.1). Cytological examination of some of these morphotypes confirmed their differential ploidy levels (Nair, Sasikumar & Ravindran 1992). Such a high frequency of morphological variants has not been reported from OP progenies of black pepper. In the present study (barring 2-3 single cotyledonary seedlings) no

other form of morphological variation was observed in the seedling population of the other two cultivars.

Coll.1344 is a cultivar characterised by usually bold berries, loose spike, late maturity, large leaves and robust stem. This cultivar is found only in certain pockets of Coorg District. This observation coupled with high amount of variability

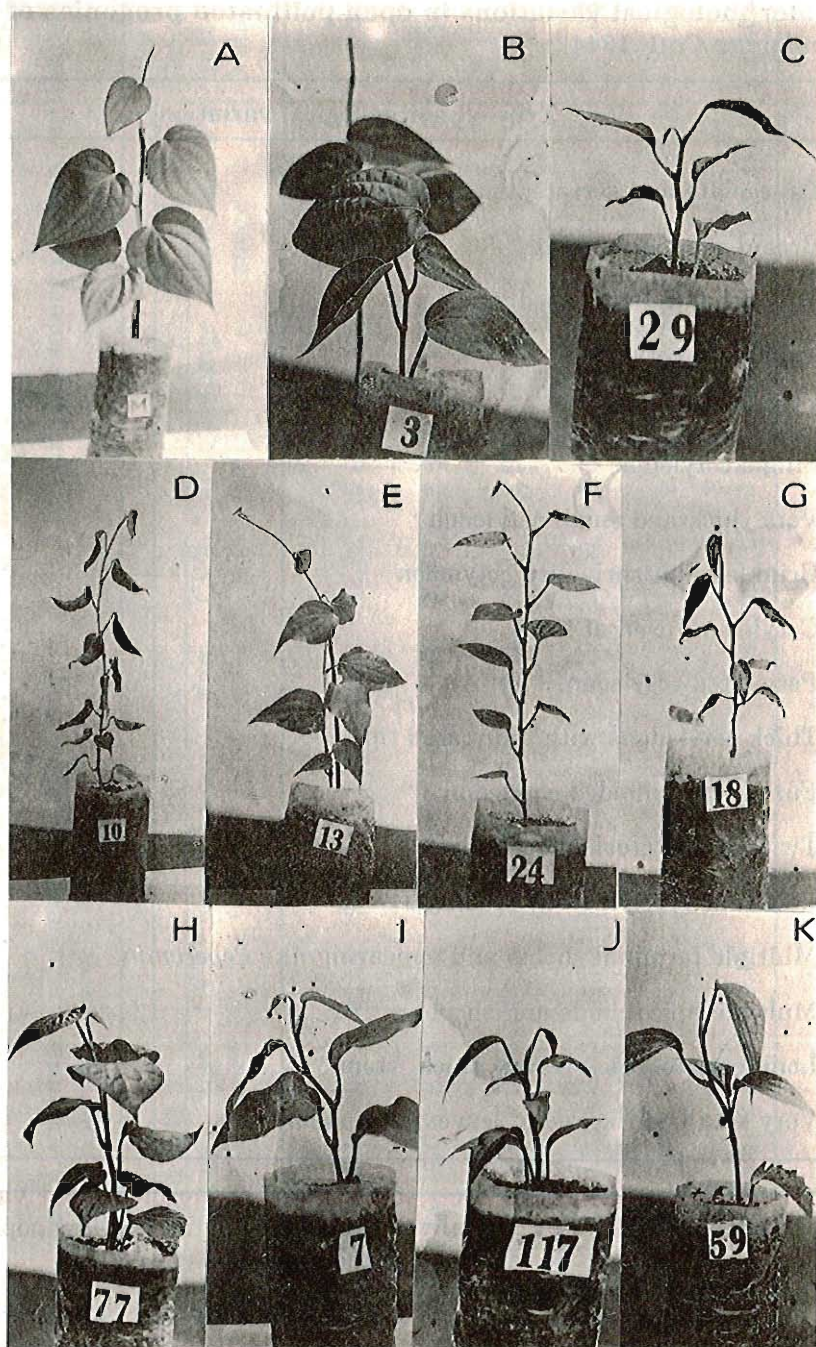


Fig. 1. Variations in open pollinated progenies of black pepper cultivar Coll. 1344.

A. Mother plant (Coll. 1344) B-K. Open pollinated progenies of mother plant showing distinct morphological features (morphotypes).

observed from different characters along with high frequency of morphological variations recorded in the progenies tend to show that Coll. 1344 might be a cultivar having higher ploidy level. A somatic chromosome number of $2n=78$ was also found in many of mitotic metaphase of this cultivar (Nair *et al.* 1992) whereas $2n=52$ in normal cases. Panniyur -1 is a hybrid between the cultivars Uthirancotta and Cheriakaniakadan. The higher amount of variation observed in this hybrid as compared to KS-27 which is a high yielding selection can be attributed to segregation in the F₂ generation.

Internode length in black pepper is an important economic trait as shorter internodes tend to increase the total number of spikes (Ibrahim *et al.* 1986). Considering the CV% and mean for this trait, it would be possible to select lines having shorter internodes among the progenies of Coll. 1344 and Panniyur -1. Seedling stem girth can be considered as an index of early vigour. Progenies of Panniyur -1 recorded maximum girth of stem. Panniyur -1 is also a robust stemmed variety. However, Coll.1344 had maximum variability for this character as well.

References

- Ibrahim K K, Sukumara Pillay V & Sasikumaran S 1986 Comparative genetic variability within the open pollinated seedlings of certain varieties of black pepper (*P. nigrum* L.). Agric. Res. J. Kerala 24 : 74-76.
- Nair R R, Sasikumar B & Ravindran P N 1992 Polyploidy in a cultivar of black pepper (*P. nigrum* L.) and its open pollinated progenies. Cytologia 58 : 27-31.
- Panase V G & Sukhatme P V 1978 Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research, New Delhi.
- Ravindran P N 1991 Studies on black pepper (*Piper nigrum* L.) and some of its wild relatives. PhD Thesis. Submitted to University of Calicut, Calicut.
- Ravindran P N, Nair M K & Muneer V M 1986 Seed germination studies in black pepper. J. Plant. Crops 13 : 132-153.
- Ravindran P N & Nirmal Babu K 1988 Black pepper cultivars suitable for various regions. Indian Cocoa, Arecanut & Spices J. 11 : 110-112.
- Sasikumar B, Johnson George K & Ravindran P N 1992 Breeding behaviour of black pepper. Indian J. Genet. 52 : 17-21.