Pak. J. Bot., 6 (2): 109—115, 1974.

VARIATION AMONG FIVE VARIETIES OF CORIANDER, *CORIANDRUM SATIVUM* L.

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Abstract

Five locally available varieties of coriander were studied with regard to variation in morphological characters and some traits of economic importance. Conspicuous differences were observed in date of maturity, seed size, yield and lipid content of seeds. There was highly significant positive regression of fruit length on floral diameter. The chromosome number was confirmed to be n=11.

Introduction

Coriander (*Coriandrum sativum* L.) is widely used as a condiment and for flavouring confectionery and liquor. The essential oil extracted from the seeds is used in the manufacture of soaps, perfumes and cosmetics. Pakistani varieties of coriander are not used for oil on account of their low oil content. Breeding goals in this country would be high fruit and essential oil yield, strong flavour, earliness and resistance to disease, drought, lodging and shattering. Any full-fledged breeding programme would require an exhaustive study of the variability of the local germ plasm. The present study of variation was conducted on five varieties of coriander.

Coriander seed was obtained from local seed merchants, (Var. 1, foreign seed, var. 2, Sindhi seed, Var. 3) Kisan and Co., Lahore, (Var. 4 Dhanya Shatala) and from a landowner in Sind, who is both a cultivator and an exporter of coriander seed (Var.5). Each lot was considered to be a different variety.

Variation with regard to seed length, breadth and weight was studied. Seed germination was studied *in vitro* at 5, 11.5, 21.5, 29, and 31.5°C. The lipid content of seeds of all the varieties was estimated by petroleum ether extraction in the Soxhlet Apparatus. The essential oil content of a sample of variety 5 was determined by steam distillation of the petroleum ether extract.

A field experiment was conducted in a RCBD, in November 1973, at the Futehally farm near Gulshan-e-Iqbal, Karachi. The plant characters studied were length and breadth of cotyledonary leaves, flowering date, flower size, number of flowers per umbel (of various orders), fruit set per number of bisexual flowers, peduncle length, stem thickness, plant height, date of maturity and seed yield. All varietal means were compared by Duncan's Multiple Comparison test (Steel & Torrie, 1960). Coefficients of correlation were calculated among seed length, breadth and weight; and coefficients of regression were estimated for seed length on floral diameter and seed yield on number of branches (Snedecor, 1966).

Hourly observation of the number of emerging anthers was made and the fertility of pollen was determined by staining in Cotton blue. Buds were fixed in iron-mordanted Newcomer's fixative (Stringam, 1970) and the chromosome number counted in meiotic PMCs.

Results and Discussion

Of the five varieties which showed significant differences in many respects variety 5 differed greatly in most of the traits studied. Varieties 1 and 3 were very similar, and were more different from variety 5 than from varieties 2 and 4. This trend, however, was not observed for fruit set per number of bisexual flowers and seed yield per plant.

The length, breadth and weight of seeds was greatest in variety 5. Varieties 1 and 3 did not differ significantly in these characters (Table 1). There was high positive correlation between seed length and breadth, length and weight, and breadth and weight (Table 2).

Varietal differences in seed germination percentage and radicle length at various temperatures are represented graphically in Figure 1. On the whole, germination percentage was lowest at high temperatures, where variety 5 was the best performer. Varieties 2 and 4 agave their best performance at low temperatures. The minimum time required for the cotyledons to emerge from the pericarp was 9 days (at 30°C). The envi-

TABLE 1. Variation in seed and plant characters in five varieties of coriander.

Variable	Variety				
	1	2	3	4	5
Seed length (mm.)	*3.96 c	4.61 b	3.91 c	3.79 d	5.76 a
Seed breadth (mm.)	*3.03 c	3.14 b	3.06 c	2.81 d	3.62 a
100 seed weight (gm.)	*0.420 c	0.589 b	0.410 c	0.379 c	0.961 a
Lipid content of seeds (percentage)	**23.5 a	16.5 cd	22.8 ab	18.5 be	12.7 d
Cotyledonary leaf length (cm.)	**2.92 c	3.40 b	2.76 c	3.06 c	4.08 a
Cotyledonary leaf breadth (cm.)	**0.55 c	0.56 b	0.52 d	0.51 e	0.69 a
Leaf length (cm.)	**17.78 ab	19.42 a	19.05 a	20.15 a	14.65 b
Peduncle length (cm.)	*11.6 d	16.6 b	14.1 c	12.5 d	26.6 a
Plant height (cm.)	**78.5 ab	67.5 b	81.2 a	73.0 ab	54.2 c
Stem thickness (mm.)	**5.2 ab	4.5 b	5.7 a	4.5 b	3.4 c
Maturity (days after sowing)	**1.63 a	1.44 c	1.61 a	1.57 b	1.29 d
Seed yield per plant (gm.)	*2.38 b	2.05 b	2.92 b	6.65 a	3.22 b

In each row, values having the same or a common letter were not significantly different at .05 level of probability. Values with dissimilar letters were shown to be different by Duncan's range test at the

*.01 level of probability.

**.05 level of probability.

TABLE 2. Coefficients of regression and correlation between various characters.

	d.f.	Coefficient of correlation/ regression.
Correlation between seed length and seed weight	8	0.9956**
Correlation between seed length and seed breadth	8	0.9624**
Correlation between seed breadth and seed weight	8	0.9609**
Regression of seed length on floral diameter	38	0.72**
Regression of yield on number of branches	23	0.14 *n.s*

** Significant at the .01 level of probabiloty.

n.s. Norsignificant.

ronmental conditions in these experiments were apparently no t the optimum ones, for in the field seedlings emerged in 6 days. Coriander seeds have been observed to germinate at 15 to 25°C Sehgal (1968), and at 10 to 30°C, but not beyond this range (Cvetkov 1967). Growth was extremely slow wat 5°C, and the rate increased with temperature.

Lipid content of the seeds of the five varieties ranged from approximately 13 to 24 percent (Table 1). The general trend was that with decrease in seed size there was an increase in fat content. The same trend has been reported with regard to essential oil content by Wahab (1971), Fatty oil content of coriander seed was reported to be 21 percent by Chakravarti & Chakraborty (1964). The essential oil content of the seeds of Variety 5 was estimated to b 0.11 percent.

There were significant intervarietal differences in the length and breadth of the cotyledonary leaves (Table 1). As was expected from the seed size, the cotyledons of variety 5 were the largest ,followed by those of variety 2. Variety 5 produced fewer and smaller true leaves as compared to the other varieties (Table 1).

The pattern of flowering in the five varieties is presented graphically in Figure 2. The normal variations in coriander flowers include the absence of androecium and the enlargement of some petals. A few atypical plants were observed which had either tristylar or male sterile flowers. Temporary male sterility in coriander as induced chemically in known (Dubey & Singh, 1969).

There was an attack of powdery mildew at the peak flowering of variety 2. It is likely that fruit set and yield, and perhaps some other characters, were affected.

The ratio of the number of bisexual flowers to the total number of flowers decreases significantly with increasing order of the umbel (0.77 in the central umbels to 0.22 in the third order umbels). A similar trend has been reported by Sehgal (1968). Lukjanov (1963) stated that fruit size decreases in umbels of higher order. In the present study, this was generally observed to be true for flower size. The coefficient of regression of fruit length on floral diameter was 0.72 (Table 2). The number of fruit set per number

of bisexual flowers was significantly affected by variety and by umbel order, but the interaction of these two factors was nonsignificant.

Variety 5 was very early maturing (129 days from sowing), varieties 3 and 1 were the last to mature (161 to 163 days). The seed yield per plant was highest in Variety 4 (Table 1). The yield of variety 5 was much lower than was expected. Seed yield in Pakistan varies from 240 to 720 lbs. per acre (Sirajul-Hasan, 1974). Seed and essential oil yield are greatly affected by environment, as observed by Lorincz (1966). The specific factors involved include area per plant (Plytnikova, 1964), water supply (Ruminska, 1970), mineral fertilization (Zderkiewicz, 1964), sowing time (Chaudhry, 1957), and time of harvest (Tsvetkov, 1970). The coefficient of regression of yield on the number of primary branches (including canopies) was nonsignificant (Table 2). This was contradictory to the results obtained by Khan & Jalis (1957) who reported the significant positive regression of yield on number of primary branches.

Varietal differences in plant height and stem thickness were highly significant. Variety 5 had the shortest plants, with the narrowest stalks (Table 1). From visual observations it was apparent that the length of primary rays and peduncles of umbels of all orders was greatest in variety 5, followed by variety 2. This was confirmed by statistical analysis of the data on the length of peduncles of the central umbel (Table 1).

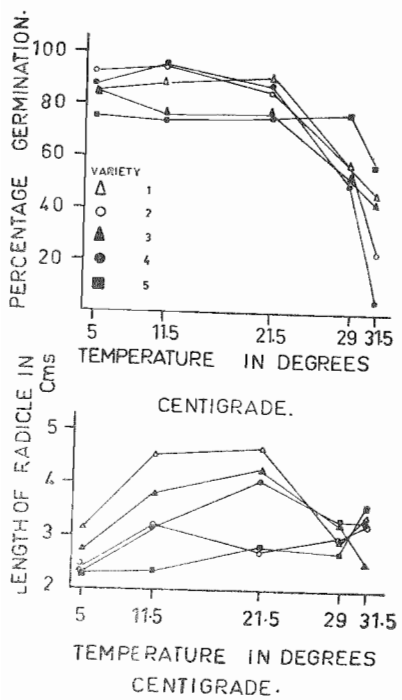

Figure 1. Seed germination in five varieties of coriander.

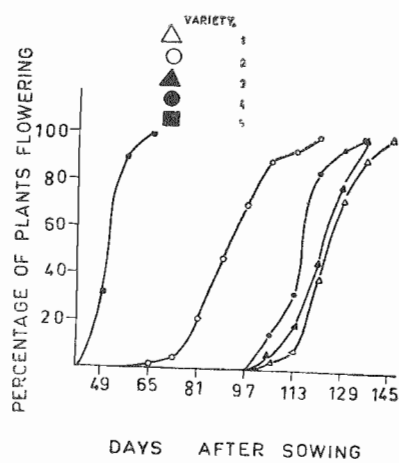

Figure 2. Varietal differences in flowering dates.

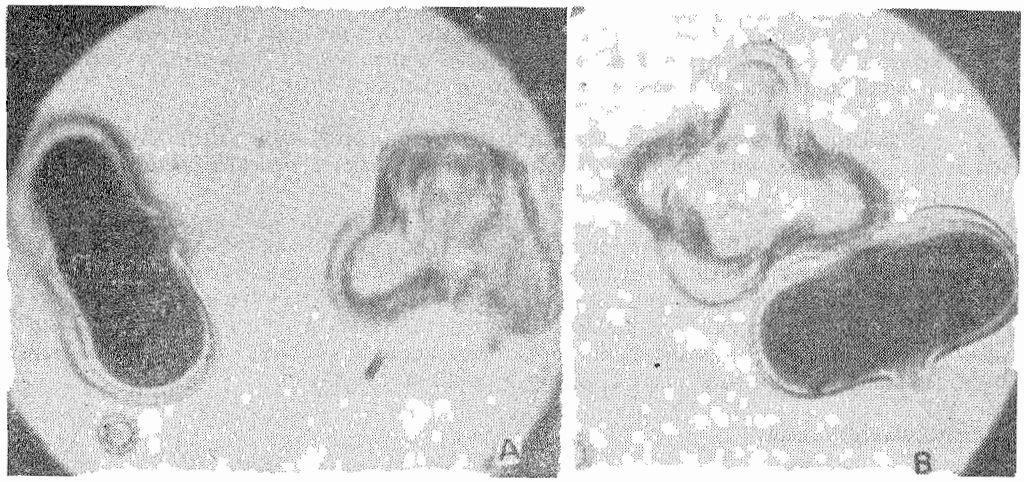

Fig. 3. Normal and abnormal pollen grains of coriander.
A : Triradiate and normal bipolar pollen grains.
B : Tetraradiate and normal bipolar pollen grains.

Coriander flowers do not open at any specific time of the day. All the five anthers of a flower were seen to take one or two days to emerge. The frequency of anthesis was lowest at the start and the end of the day. The percentage of non-staining pollen grains in fresh pollen was very low in the single count made, among 255 grains, only 1 was non-staining. The size of normal pollen grains was 30- 37×15 18u. Infertile (non-stained pollen grains were 27—30×13—15u. In some samples of pollen, approximately 0.06

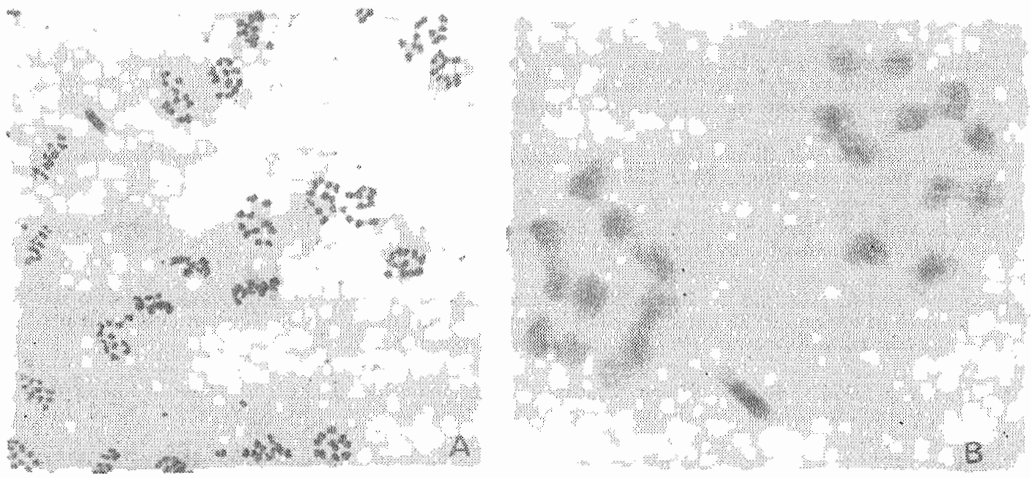

Fig. 4. Chromosomes of *Coriandrum sativum* (n = 11).
A : PMCs in meiosis.
B : The same under high magnification.

percent pollen grains of abnormal shape were observed. Depending on their position, they appeared to be triradiate or tetraradiate (Figure 3). Joshi & Raghuvanshi (1967) have referred to these two shapes as types E and G respectively. This pollen variability was reported in plants subjected to radiation or chemical treatment.

Suzuka (1956) reported the normal chromosome complement of *Coriandrum* spp. to be 2n = 22. Figure 4 shows the chromosomes of one of the varieties under study (n = 11) in PMC meiosis.

The results of this investigation reveal varieties 5 and 4 to be potentially the most promising. Variety 5 had the great advantage of earliness, and although the seed yield was not high, the seed size was very large. Variety 4 had the highest yield under the conditions of this experiment. The validity of this circumstance over a wider range of conditions would have to be established. If this were verified, a hybrid combining this trait with the earliness and seed size of variety 5 could be developed.

Acknowledgements

One of the authors (S.F.) wishes to express her gratitude to Mr. Maujud Husain for providing the seeds of variety 5 and to Mr. Danish for his kind help in the work on essential oil.

This work is a part of the thesis submitted by S.F. for the degree of Master of Science in Genetics at the University of Karachi, Karachi, Pakistan.

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