

Differential response of coriander (*Coriandrum sativum* L.) genotypes to selfing and sibmating

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Abstract

Differential response of coriander genotypes to selfing and sibmating on seed yield was assessed in a field trial conducted during *rabi* 2011-12 taking 13 genotypes having different morphology and maturity. Three conditions were taken into consideration for seed yield assessment selfing, sibmating, and open pollinated. Comparative analysis of seed yield in open conditions showed a yield decrease on selfing by 24.03 to 40.74 % for single plant, 22.51 to 35.80 % reduction in single plant yield under sib mating condition and 26.62 to 40.02 % reduction in plot yield for sibmating populations. Genotypic variation was observed for seed setting percentage. Genotype RKC 24 showed minimum yield loss due to selfing and sibmating, whereas, RKC 137 showed maximum yield loss by the events.

Key words : Coriander, selfing, sibmating, yield reduction

Coriander (*Coriandrum sativum* L.) is an important seed spice crop widely cultivated for its seed as well as leaf for flavoring and seasoning of the food and food products. It is a cross pollinated entomophilous crop with honey bees as the major pollinating agent (Baswana, 1984; Koul *et al.*, 1989). Ramanujam *et al.*, (1963) has reported 25.02 to 50.04 percent cross pollination in coriander. Looking to its pollination behaviour, cultivation under isolation is a prerequisite for maintaining the genetic purity of coriander variety. The isolation distance for foundation and certified seed of coriander is 400 m and 200 m respectively. It's quite clear that the yield under selfing/sibmating of this predominantly cross pollinated crop would be generally lower than open pollination due to absence of its pollinating agents. But it might also be interesting to find out further, whether there is any genotypic difference among the different varieties with respect to extent of selfing/sibmating and out crossing which thereby affect the resultant seed yield. The role of distinct morphological, physiological and biochemical features of plant in determining pollinating behaviour (inbreeding or outcrossing) and host plant resistance (antibiosis, non preference) towards insect - pest etc. is well understood. Therefore, if there's any genotypic difference existing among varieties with respect to selfing/sibmating or in other words, towards their preference for honey bee; it can be exploited to harvest higher yields in the crop. Keeping these facts in view, this investigation was planned to work out the genotypic differences among a set of coriander genotypes with respect to the extent of pollination, seed setting and seed yield under caged (selfing/sibmating) and open field conditions.

The experimental trial was conducted at Agricultural Research Station, Kota (Agriculture University, Kota) during *rabi* 2011 – 12 to study the difference in yield levels under natural conditions (open pollination) and artificial conditions (selfing/sibmating i.e. free from honey bees and other pollinating agents) and to study the differential response of various genotypes towards selfing/sibmating and open pollination. The experimental material comprised of thirteen coriander genotypes including popular varieties which were raised in randomized block design with three replications. Each genotype was accommodated in eight rows of 4 m length with spacing of 30 x 10 cm. Five single plants of each genotype were caged with single plant cages, as well as plot was caged with cage of size 5 x 2.5 x 1.5 mt cube. All the recommended package of practices were adopted to raise a good crop. Data on seed yield was recorded for all the three conditions i.e., selfing (caged single plant), sibmating (caging whole plot), and open pollinating. Any spray of chemical insecticide was deliberately avoided to maintain the natural population of pollinators.

In coriander 25 to 50 % cross pollination has been reported, honey bees are the major pollinating agents contributing to pollen migration for hybridization. In open conditions with high honey bee population, high seed set and in turn high yield is observed. Restricting honey bee visit over crop canopy by net bagging reduces the seed setting significantly due to less pollination intensity. In the present experiment, the comparative assessment of bagged (self) and open conditions in coriander genotypes depicted variation in seed setting percentage. The yield reduction under caged condition (selfing/sibmating) over open

Table 1. Seed yield of different coriander genotypes under self (caged) and open pollination.

S. No.	Entries	Days to maturity	Single plant yield under selfed/ sibmated and open conditions (g)					Plot yield under sibmated and open conditions (g)		
			Selfing	Sib-mating	Open	% decrease due to selfing	% decrease due to sib-mating	Sib-mating	Open	% decrease due to sib-mating
1	RKC 11	121	1.74	1.90	2.92	40.41	35.05	712.7	1107.3	35.64
2	RKC 21	117	1.71	1.88	2.53	32.41	25.65	903.7	1242.9	27.29
3	RKC 24	116	1.96	2.00	2.58	24.03	22.51	885.5	1206.8	26.62
4	RKC 36	118	1.77	1.95	2.98	40.60	34.66	725.1	1150.5	36.98
5	RKC 39	118	1.59	1.78	2.42	34.30	26.41	634.0	985.3	35.65
6	RKC 136	121	1.67	1.89	2.69	37.92	29.85	727.0	1042.5	30.26
7	RKC 137	121	2.24	2.44	3.78	40.74	35.41	861.5	1436.4	40.02
8	RKC 155	121	2.03	2.13	3.32	38.86	35.80	971.4	1545.3	37.14
9	RKD 18	115	2.23	2.30	3.21	30.53	28.45	955.4	1455.3	34.35
10	RCr 436	121	1.95	1.99	2.90	32.76	31.41	857.0	1339.8	36.04
11	CS - 6	120	1.68	1.73	2.55	34.12	32.14	675.0	1044.4	35.37
12	Hisar Anand	130	1.60	1.82	2.64	39.39	30.91	685.5	1013.9	32.39
13	RCr 728	135	2.16	2.40	3.15	31.43	23.89	863.5	1331.7	35.16
	Mean		1.87	2.02	2.90	35.19	30.16	804.41	1223.24	34.07

conditions was calculated to obtain percent yield decrease. The results are mentioned in table 1 and are presented and discussed in subheads below.

Single plants performance (selfing): The percent yield decrease ranged from 24.03 (RKC 24) to 40.74 (RKC 137). The mean seed yield under selfing was 1.87 g, whereas, mean yield reduction was 35.19 %. Five genotypes viz., RKC 137 (40.74), RKC 36 (40.60), RKC 11 (40.11), Hisar Anand (39.39) and RKC 136 (38.86) showed yield reduction above mean performance.

Single plant performance (sibmating): The percent yield decrease ranged from 22.51 (RKC 24) to 35.80 (RKC 155). The mean seed yield of single plant under sibmating was 2.01 g, whereas, mean yield reduction was 30.16 %. Seven genotypes viz., RKC 155 (35.80), RKC 137 (35.41), RKC 11 (35.05), RKC 36 (34.66), CS-6 (32.14), RCr 436 (31.41) and Hisar Anand (30.91) showed yield reduction above mean performance. As expected yield loss was less as compared to selfed plants due to increased pollination by pollen sharing among siblings.

Population performance (sibmating): The percent yield decrease ranged from 26.62 (RKC 24) to 40.02 (RKC 137). The mean yield of population under sibmating was 1223.23 g, whereas, mean yield reduction was 34.07 %. Nine genotypes viz., RKC 137 (40.02), RKC 155 (37.14), RKC 36 (36.98), RCr 436 (36.04), RKC 39 (35.65), RKC 11 (35.64), CS-6 (35.57), RCr 728 (35.16) and RKD 18 (34.35) showed yield reduction above population mean performance.

Chaudhary and Singh (2007) also observed a yield increase of 122.2 % in plots exposed to natural pollination (OP) and those caged with honey bee colony (BP) over WIP (without insect pollination) plots. There is a report (Butler *et al.*, online reference cited) also stated strong statistical difference in seed set between bagged and non bagged umbels. Seed set was reduced by an average of 76 percent for bagged umbels compared to non bagged umbels. These results suggests that genetic exploitation with respect to pollination percentage and genotype should be taken into consideration for its improvement and commercial cultivation for yield enhancement.

On the basis of these results, it can be said that there is a significant reduction in seed yield upon selfing/sibmating as compared to open pollination, thereby supporting the significant role of honeybees in percent pollination and seed setting in coriander (Kumar and Kumar, 2012). The variable response of coriander to cross pollination may be affected by numerous factors which may decides preference of honey bee. Earlier, Chaudhary and Singh (2007) also concluded that *Apis mellifera* being the most abundant and the only manageable pollinator should be recommended to be used as an input to increase productivity in coriander.

Besides yield, the effect of selfing and open pollination on other yield contributing and quality traits viz., germination percent, days to germination, early vigour, test weight, days to maturity and essential oil content should also be studied. Sihag (1986) reported heavier seed in caged plots as compared to open pollinated plots. However, this is a very preliminary study based on only single year data and, therefore, needs further assessment to draw conclusion. Floral morphology, umbel arrangement and floral maturity variation within and between higher order umbels, biochemical composition of floral parts etc., might be contributing to the genotypic variation for pollination behavior observed in the experiment. Further this study suggests that there may be possibility of getting plant type which may show very low or no yield reduction on selfing / sibmating. Genotypes showing low yield reduction percentage can be said to have higher potential of self mating thus low dependence on pollinators.

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