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Correlation and path analysis for oleoresin in chilli (*Capsicum* spp.)

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Abstract

Studies on the association between oleoresin yield and its components at genotypic level in *Capsicum annuum, C. chinense, C. frutescens* and *C. baccatum* revealed significant correlation between number of fruits per plant and oleoresin yield. The attributes of earliness had a negative correlation with oleoresin yield indicating that late varieties are rich sources of oleoresin.

Keywords: Chilli, *Capsicum annuum, C. chinense, C. frutescens, C. baccatum,* oleoresin, correlation, path analysis

Introduction

Of the five major spices, chilli ranks third, next only to black pepper and cardamom. In India, it is an indispensable spice cum vegetable in every household. Traditionally, the whole or ground chilli was used in food and beverage industries. But the use of this is now limited as they do not lend their full characteristic flavours. Spice extractives, such as oleoresins serve as alternatives to this and provide stability required in product formulation. Chilli oleoresin, which is prepared from dried chilli powder by solvent extraction, represents the complete flavour or true essence.

There exists considerable variability in chilli cultivars in respect of oleoresin yield. Oleoresin recovery is influenced by the season also. The data on oleoresin yield and related characters obtained on a number of promising chilli lines, were subjected to a correlation study and path analysis.

Materials and methods

Nine different types of chilli genotypes were used for the study:

1	*Capsicum annuum* (Gundu)	-	CA 653
2	*Capsicum annuum* (Pendulous)	-	Arka Lohit
3	*Capsicum annuum* (Cluster)	-	Ujwala
4	*Capsicum annuum* (Paprika)	-	KTPL-19
5	*Capsicum chinense*	-	CA 640
6	*Capsicum chinense*	-	CA 645
7	*Capsicum frutescens*	-	CA 671
8	*Capsicum frutescens*	-	CA 648
9	*Capsicum baccatum*	-	CA 670

These genotypes were evaluated in three seasons *viz.,* summer (January - March), rainy (May - July) and winter (September - November). The experiment was laid out in RBD with 27 treatments and three replications. The plot size was 3.6 x 2.7 m^2 with 48 plants spaced at 45x45 cm. All the operations were carried out as per package of practice recommendations of Kerala Agricultural University (KAU, 1993). From all the plots, 25 plants were randomly marked as observation plants.

Observations like days to flower, days to fruit set, days to harvest, fruits per plant, fruit yield per plant and oleoresin yield were recorded for three seasons and the mean values worked out (Table 1).

Fruits from all harvests were counted, average worked out and expressed as fruits per plant. Fruits from all harvests were weighed and the average expressed in grams as fruit yield per plant. Oleoresin was extracted by solvent extraction method using ethyl acetate and expressed as percentage.

Results and discussion

The association between oleoresin yield and its components was studied at genotypic level and the results are presented in Table 2. Among the component characters, only fruits per plant had positive genotypic correlation with oleoresin yield (r_g=0.26). When the fruit number increases, size is reduced and in small, sized fruits, the percentage of constituents is higher than that of large sized fruits. This is true with many other chemical constituents in vegetable crops. In bitter gourd, constituents like protein, fat, minerals, carbohydrate, calcium and iron are much higher in small sized fruits compared to large sized fruits (Gopalan *et al.,* 1982). The association of attributes of earliness *viz.*, days to flower, fruit set and harvest with oleoresin yield were negative. Days to fruit set had highest negative correlation with oleoresin yield. This indicates that late varieties are rich and better source of oleoresin. The late variety may get more time for the accumulation of chemical constituents by metabolic inter conversion than the early varieties. The correlation of fruit yield per plant with oleoresin yield was not significant, though positive (0.047). The highest yielding genotype, CA 645, had low oleoresin content and thus supporting the present findings. This suggests that increase in fruit yield need not result in an increase in oleoresin content.

Inter-correlation among different characters: Days to flower had significant and positive association with days to first fruit set (r_g=0.876), days to first harvest (r_g=0.733) and fruit yield/ plant (r_g=0.4). Days to fruit set had a significant and positive association with days to first harvest (r_g=0.99) and negative association with fruits/plant (r_g=-0.744). Days to harvest had significant negative association with fruits/plant (r_g=-0.625) and fruit yield/plant (r_g=0.844).

Path analysis: The direct and indirect contribution of the characters towards yield of oleoresin was found out by partitioning the correlation between yield and component characters into direct and indirect effects (Table 3). All the parameters were selected for path analysis.

Days to flower exhibited the highest positive direct effect on yield of oleoresin (0.029). This was followed by days to fruit set (0.009). The other two characters namely days to harvest and fruits per plant exhibited negative direct effect on yield of oleoresin (-0.786 and -0.022, respectively).

Days to flower had a positive and indirect effect on yield of oleoresin through days to fruit set and fruits per plant (0.008 and 0.012). The indirect effect of days to flower through days to harvest (-0.576) was negative and significant. Days to fruit set had a positive indirect effect on yield of oleoresin through days to flower (0.025) and fruits/plant (0.016). But this character had a significant and negative effect on oleoresin yield through days to harvest (-0.848). Days to harvest had low, positive effect on yield of oleoresin through days to flower (0.021), days to fruit set (0.010) and fruits/plant (0.013). Fruits/plant had a low and negative effect on yield of oleoresin through days to flower (-0.015) and days to fruit set (-0.007). But fruits/plant had, a high positive effect on yield of oleoresin through days to harvest (0.491).

The study revealed that oleoresin content is negatively associated with days to flower, days to fruit set and days to harvest suggesting low oleoresin content in genotypes requiring less number of days to flower and mature. Path analysis indicated the negative direct effect of days to harvest on oleoresin content.

References

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Table 1. Mean performance of cultivars over three seasons

Genotype	Days to flower	Days to fruit set	Days to harvest	Fruits per plant	Fruit yield per plant(g)	Oleoresin (%)
CA 653	91.89	124.78	171.11	4.92	8.96	16.96
	(9.57)	(11.13)	(13.04)	(2.17)	(2.87)	(4.31)
ArkaLohit	87.67	103.67	144.67	29.00	40.03	33.14
	(9.35)	(10.17)	(12.03)	(5.16)	(5.88)	(5.72)
Ujwala	75.78	91.11	134.00	40.22	52.79	23.82
	(8.64)	(9.51)	(11.56)	(6.15)	(7.05)	(4.70)
KTLP - 19	89.78	101.00	130.78	7.02	21.50	30.12
	(9.48)	(10.04)	(11.43)	(2.59)	(4.41)	(5.39)
CA 640	106.44	121.00	161.00	5.13	14.60	23.41
	(10.28)	(10.98)	(12.68)	(2.2)	(3.82)	(4.80)
CA 645	118.33	132.11	164.44	21.30	74.69	17.44
	(10.86)	(11.48)	(12.60)	(3.98)	(7.09)	(4.08)
CA 671	104.33	121.89	157.89	13.38	13.83	13.17
	(10.20)	(11.02)	(12.56)	(3.32)	(3.16)	(3.58)
CA 648	98.22	114.78	156.89	4.63	4.49	22.93
	(9.91)	(10.71)	(12.52)	(2.14)	(2.11)	(4.76)
CA 670	98.89	112.00	155.11	1.83	12.79	27.19
	(9.94)	(10.63)	(12.45)	(1.33)	(3.46)	(5.19)
Mean	96.81	113.40	151.95	14.16	27.50	23.38
	(9.83)	(10.65)	(12.33)	(3.76)	(5.24)	(4.89)

Values in parenthesis show the transformed values

Table 2. Genotypic correlation coefficient (r_g) among different parameters

Characters	Days to fruitset	Days to harvest	Fruits/ plant	Fruit yield/ plant	Oleoresin %
Days to flower	0.876	0.733	-0.535	0.400	-0.616
Days to fruitset		0.990	-0.744	0.016	-0.802
Days to harvest			0.625	-0.350	-0.664
Fruits/ plant				0.844	0.260
Fruit yield/ plant					0.047

Table 3. Direct and indirect effect of characters on oleoresin

Characters	Days to flower	Days to fruitset	Days to harvest	Fruits/ plant	Fruit yield/ plant
Days to flower	0.029	0.008	-0.576	0.012	-0.089
Days to fruitset	0.025	0.009	-0.848	0.016	-0.004
Days to harvest	0.021	0.010	-0.786	0.013	0.077
Fruits/ plant	-0.015	-0.007	0.491	-0.022	-0.187
Fruit yield/plant	0.011	0.002	0.275	-0.018	-0.221

The underlined diagonal values indicate direct effect. Residual = 0.5197