DOI 10.5958/0976-1926.2021.00043.7

RESEARCH ARTICLE

Genetic Diversity, Character Association and Path Coefficient Analysis in Kalanamak Advanced Lines of Rice (*Oryza sativa* L.)

Sudhir Kumar* and Indra Deo Pandey

Dept. of Genetics and Plant Breeding, GB Pant University of Agricultural and Technology, Pantnagar-263145, Uttarakhand, India

(Received: 30 January, 2017; Revised: 10 December, 2021; Accepted: 17 December, 2021)

Eighty-eight advanced lines of Kalanamak aromatic rice were studied to measure nature and magnitude of genetic divergence, character association and path analysis for 10 quantitative characters. The advanced lines have been generated from four different crosses of Kalanamak × Kalanamak accessions and Kalanamak × Basmati crosses. Pooled data analysis revealed, high order of divergence between cluster I and VII (252.04) followed by cluster I and VIII (219.35) and cluster III and VII (219.28). Maximum intra-cluster distance was observed among the advanced lines *viz.*, PMS-23, PMS-29, PMS-24, PMS-25, PMS-33, PMS-30 and these lines have been evolved from a cross of Kalanamak (3131-SN) and Basmati (PB-1). 1000-grain weight contributed maximum towards divergence (37.25%) followed by plant height (30.25%) and number of filled grains per panicle (10.66%). Character association studies revealed significant positive association of grain yield with number of effective tillers per plant, followed by number of filled grains per panicle, number of spikelets per panicle and 1000-grain weight. Path co-efficient analysis revealed the maximum direct and indirect effect towards grain yield with number of spikelets per panicle followed by 1000-grain weight and others. Number of spikelets per panicle and 1000-grain weight showed significant positive association and also had maximum positive direct effect on grain yield, indicating that direct selection through these traits would be greatly effective for the improvement of grain yield in high value Kalanamak aromatic rice background. Selection of yield component traits *viz*. spikelets per plant and 1000-grain weight significantly contribute towards the total genetic divergence as well as have positive significant association on grain yield and may be helpful in identifying genetically diverse Kalanamak aromatic advanced lines, particularly to be exploited in further hybridization to execute efficient selection in segregating generations.

Key Words: Aromatic, Correlation, Genetic divergence, Kalanamak, Path analysis

Introduction

Rice is the most important food crop in India contributing to more than 40 per cent of total food grain production and cultivated/consumed across the country (Anonymous, 2016). Aromatic rice is a special type of rice known for aroma, taste and fluffiness, and includes long grain basmati, jasmine rice and other short to medium grain scented rice of India and Pakistan. The biodiversity of long grain basmati and other short and medium grain scented rice in India is the largest in the world. The small and medium grain non-basmati scented rice has adapted to specific localities and are widely distributed in different parts of the country (Singh *et al*., 2000). Kalanamak is one of the most important non-basmati aromatic rice of India and exhibits wide range of variability in respect of grain quality, cooking quality and other economic traits. It is mostly grown in eastern Uttar Pradesh and has immense potential for domestic as well as international market. In recent years, Kalanamak area has declined sharply mainly due to its long duration growth cycle, tall stature, low yield deterioration in grain qualities, lack of domestic market support, policy interventions and others (Chaudhary *et al*., 2008; Kumar *et al*., 2018).

A dynamic breeding programme is essentially required to increase the production potential of Kalanamak rice suitable for specific agro-climatic regions. For scientific planning and execution of breeding programme, the most essential pre-requisite is the availability of sufficient desirable genetic variability for important economic traits in the elite germplasm or breeding lines (Pratap *et al.,* 2012). Although genetic variability for grain types and cooking quality traits are

*Present address of correspondence: ICAR–Indian Institute of Agricultural Biotechnology, Ranchi-834003, Jharkhand, India
*Author for Correspondence: Email- sudhiraaidu2006@gmail.com

available in native germplasm of Kalanamak but genetic variability for yield, duration and plant types are not adequate enough to select a high yielding Kalanamak rice. Further, genetic variability could be generated though hybridization of Kalanamak rice accession to promising basmati rice.

Keeping the above in view, present investigation was undertaken to unravel the genetic divergence, determination of genotypic and phenotypic association among grain yield components and their direct as well as indirect effects on grain yield in 88 advanced lines of Kalanamak emanated from four different crosses (Kalanamak × Kalanamak and Kalanamak × Basmati aromatic accessions).

Materials and Methods

The experimental material consisted of 88 advanced lines of Kalanamak aromatic rice with two different checks (3131-SN and PB-1). Thes lines were evaluated in two consecutive *kharif* seasons (2013 and 2014) in a randomized block design (RBD) with three replications at the Organic Farm of Breeder Seed Production Centre, GB Pant University of Agriculture and Technology, Pantnagar, Uttarakhand. Advanced lines have been developed through varietal hybridization of Kalanamak × Kalanamak (3131-SN × 3327-SN, 3131-SN × 3216-SN & 3216-SN × 3327-SN) accessions and Kalanamak × Basmati (3131-SN × Pusa Basmati-1) crosses (Table 1). The test plot consisted of 3 rows of 6 m length with row to row and plant to plant spacing of 20 cm and 15 cm, respectively. The recommended cultural practices were strictly followed under organic conditions. Data were recorded on various quantitative characters *viz*. plant height, days to 50% flowering, days to maturity, number of effective tillers per plant, panicle size (cm), number of filled grains per panicle, number of spikelets

Table 1. List of Kalanamak advanced lines of rice selected for the study along with their pedigree

S.No	Advanced Lines	Pedigree	S. No	Advanced Lines	Pedigree	S. No	Advanced Lines	Pedigree
1	PMS-1	3131-SN × 3327-SN	31	PMS-31	3131SN × PB-1	61	PMS-61	3131SN × PB-1
2	PMS-2	3131-SN × 3327-SN	32	PMS-32	3131SN × PB-1	62	PMS-62	3131SN × PB-1
3	PMS-3	3131-SN × 3327-SN	33	PMS-33	3131SN × PB-1	63	PMS-63	3131-SN × 3216-SN
4	PMS-4	3131-SN × 3327-SN	34	PMS-34	3131SN × PB-1	64	PMS-64	3131-SN × 3216-SN
5	PMS-5	3131-SN × 3327-SN	35	PMS-35	3216-SN × 3327-SN	65	PMS-65	3131SN × PB-1
6	PMS-6	3131-SN × 3327-SN	36	PMS-36	3131SN × PB-1	66	PMS-66	3131SN × PB-1
7	PMS-7	3216-SN × 3327-SN	37	PMS-37	3131SN × PB-1	67	PMS-67	3131-SN × 3216-SN
8	PMS-8	3131-SN × 3327-SN	38	PMS-38	3131SN × PB-1	68	PMS-68	3131-SN × 3216-SN
9	PMS-9	3216-SN × 3327-SN	39	PMS-39	3131SN × PB-1	69	PMS-69	3131-SN × 3216-SN
10	PMS-10	3216-SN × 3327-SN	40	PMS-40	3216-SN × 3327-SN	70	PMS-70	3131-SN × 3216-SN
11	PMS-11	3131-SN × 3327-SN	41	PMS-41	3216-SN × 3327-SN	71	PMS-71	3216-SN × 3327-SN
12	PMS-12	3131-SN × 3327-SN	42	PMS-42	3216-SN × 3327-SN	72	PMS-72	3216-SN × 3327-SN
13	PMS-13	3216-SN × 3327-SN	43	PMS-43	3216-SN × 3327-SN	73	PMS-73	3216-SN × 3327-SN
14	PMS-14	3216-SN × 3327-SN	44	PMS-44	3216-SN × 3327-SN	743	PMS-74	3216-SN × 3327-SN
15	PMS-15	3131-SN × 3327-SN	45	PMS-45	3131-SN × 3327-SN	75	PMS-75	3216-SN × 3327-SN
16	PMS-16	3131-SN × 3327-SN	46	PMS-46	3131-SN × 3327-SN	76	PMS-76	3216-SN × 3327-SN
17	PMS-17	3216-SN × 3327-SN	47	PMS-47	3131SN × PB-1	77	PMS-77	3216-SN × 3327-SN
18	PMS-18	3216-SN × 3327-SN	48	PMS-48	3131SN × PB-1	78	PMS-78	3216-SN × 3327-SN
19	PMS-19	3216-SN × 3327-SN	49	PMS-49	3131SN × PB-1	79	PMS-79	3216-SN × 3327-SN
20	PMS-20	3131SN × PB-1	50	PMS-50	3131SN × PB-1	80	PMS-80	3131-SN × 3327-SN
21	PMS-21	3131SN × PB-1	51	PMS-51	3131SN × PB-1	81	PMS-81	3131-SN × 3327-SN
22	PMS-22	3131SN × PB-1	52	PMS-52	3131SN × PB-1	82	PMS-82	3216-SN × 3327-SN
23	PMS-23	3131SN × PB-1	53	PMS-53	3216-SN × 3327-SN	83	PMS-83	3216-SN × 3327-SN
24	PMS-24	3131SN × PB-1	54	PMS-54	3216-SN × 3327-SN	84	PMS-84	3216-SN × 3327-SN
25	PMS-25	3131SN × PB-1	55	PMS-55	3216-SN × 3327-SN	85	PMS-85	3216-SN × 3327-SN
26	PMS-26	3131SN × PB-1	56	PMS-56	3216-SN × 3327-SN	86	PMS-86	3216-SN × 3327-SN
27	PMS-27	3131SN × PB-1	57	PMS-57	3216-SN × 3327-SN	87	PMS-87	3216-SN × 3327-SN
28	PMS-28	3131SN × PB-1	58	PMS-58	3216-SN × 3327-SN	88	PMS-88	3216-SN × 3327-SN
29	PMS-29	3131SN × PB-1	59	PMS-59	3216-SN × 3327-SN			
30	PMS-30	3131SN × PB-1	60	PMS-60	3131SN × PB-1			

Kalanamak Accessions: 3131-SN, 3216-SN and 3327-SN; Basmati: PB-1 (Pusa Basmati-1).

per panicle, spikelet fertility (%) and grain yield per plant (g). Ten randomly selected competitive plants in each row of each replication were recorded for all the traits under investigation except days to 50 per cent flowering and days to maturity which were recorded on whole plot basis. The pooled data of individual genotypes was used for statistical analysis. Data were subjected to multivariate analysis following Mahalanobis' D^2 statistics (Mahalanobis, 1928 & 1936) to measure the genetic divergence followed by the clustering of genotypes based on Ward's (1963) hierarchical grouping employing Windostat (Version 9.2, Indostat services) software. The estimates of phenotypic (rp) and genotypic (rg) correlation coefficients were estimated by the formula suggested by Miller *et al*. (1958). Path coefficient analysis for estimating the direct and indirect effect of independent traits on grain yield was performed as per Dewey and Lu (1959) for grain yield and its component characters.

Results and Discussion

Analysis of variance prepared by the pooled data of two years revealed high significant mean sum of square for all the characters used in this study. Based on relative magnitude of D^2 values, 88 advanced Kalanamak rice were grouped into ten distinct clusters (Table 2). Among these cluster IV was the largest with 20 genotypes, followed by cluster II with 16 entries and cluster III with 12 entries. Clusters V had only the genotypes evolved from cross of Kalanamak (3131-SN) × Pusa Basmati-1. Cluster VIII had only one genotype evolved from cross of Kalanamak accessions (3216-SN × 3327-SN), whereas remaining clusters contained advanced lines emanated from both Kalanamak x Kalanamak (3131-SN × 3327-SN, 3131-SN × 3216-SN & 3216-SN × 3327-SN) accessions and Kalanamak × Basmati (3131-SN × PB-1) crosses. There was a high degree of relative divergence of amongst the clusters indicating advanced lines are of genetically diverse in nature. The maximum inter-cluster distance was observed between cluster I and VII (252.04) followed by cluster I and VIII (219.35) and cluster III and VII (219.28). Minimum inter-cluster distance was observed between cluster I and II (25.22) followed by cluster I and III (27.66), cluster II and IV (32.89) and cluster II and III (34.79). The diverse genotypes could be used in hybridization programme for further improvement in yield and yield contributing traits. Crosses involving parents belonging to divergent clusters are expected to manifest maximum heterosis and also generate genetic variability for different yield and its component traits (Arunachalam, 1981). Maximum intra-cluster distance was observed in the cluster V, which had the advanced lines (PMS-23, PMS-29, PMS-24, PMS-25, PMS-33 and PMS-30) only emanated from Kalanamak × Pusa Basmati cross. Therefore, the present investigation indicates higher degree of divergence among the progenies derived from Kalanamak × Pusa Basamati-1 than Kalanamak × Kalanamak aromatic accessions cross.

Considerable variation in cluster mean values was observed for all the characters in the present study (Table 3). Genotypes included in clusters VIII showed earlier for days to 50% flowering, days to maturity and also recorded more number of effective tillers per plant, large panicle size and high grain yield per plant. Cluster III had more numbers of grains per panicle, number of spikelets per panicle and maximum spikelet fertility. Cluster IX and X were recorded for short plant height and cluster VII was recorded high for 1000-grain weight. Hence, these

Table 2. Cluster pattern, size and constituents of cluster involving 88 Kalanamak advanced lines of rice based on D^2-analysis

Clusters	No of genotypes	Name of genotypes
I	10	PMS-02, PMS-07, PMS-03, PMS-04, PMS-38, PMS-88, PMS-14, PMS-77, PMS-81, PMS-01
II	16	PMS-11, PMS-37, PMS-71, PMS-66, PMS-72, PMS-40, PMS-44, PMS-87, PMS-64, PMS-68, PMS-65, PMS-67, PMS-12, PMS-17, PMS-22, PMS-09
III	12	PMS-05, PMS-13, PMS-06, PMS-32, PMS-20, PMS-21, PMS-19, PMS-86, PMS-08, PMS-69, PMS-84, PMS-70
IV	20	PMS-16, PMS-76, PMS-10, PMS-82, PMS-73, PMS-75, PMS-18, PMS-83, PMS-15, PMS-57, PMS-85, PMS-78, PMS-54, PMS-31,PMS-41, PMS-51, PMS-55, PMS-58, PMS-80, PMS-63
V	6	PMS-23, PMS-29, PMS-24, PMS-25, PMS-33, PMS-30
VI	4	PMS-49, PMS-50, PMS-53, PMS-52
VII	3	PMS-28, PMS-36, PMS-35
VIII	1	PMS-56
IX	8	PMS-26, PMS-74, PMS-39, PMS-43, PMS-48, PMS-42, PMS-45, PMS-62
X	8	PMS-27, PMS-34, PMS-79, PMS-46, PMS-47, PMS-59, PMS-60, PMS-61

Table 3. Cluster mean for 10 quantitative characters in 88 Kalanamak advanced lines of rice

Cluster Number	Plant height (cm)	Days to 50% flowering	Days to maturity	No. of effective tillers/ plant	Panicle length (cm)	No. of filled grains/ panicle	No. of spikelets/ panicle	Spikelets fertility (%)	1000-grain weight (g)	Grain yield/ plant(g)
I	150.26	135.53	178.40	6.56	26.11	174.34	223.75	77.92	12.61	11.81
II	134.41	134.72	177.27	6.22	25.80	164.21	211.45	78.06	12.77	10.76
III	146.28	136.24	179.65	5.68	27.49	205.14	261.41	**78.51**	14.10	13.09
IV	135.19	135.30	176.83	7.14	26.16	161.70	208.59	77.64	14.94	14.01
V	131.92	132.53	174.50	5.47	30.12	132.45	177.24	75.62	19.00	12.85
VI	133.98	138.83	179.75	8.03	27.88	126.99	168.59	75.09	17.09	15.13
VII	112.24	124.94	172.44	6.04	26.44	98.09	131.27	74.77	19.97	9.78
VIII	127.72	118.00	158.67	9.90	30.10	118.80	161.97	73.32	19.02	15.44
IX	101.79	136.21	179.00	6.15	24.84	161.80	224.38	72.09	13.02	10.96
X	106.31	135.96	177.81	6.08	25.86	147.67	196.12	75.09	16.22	13.50
Mean	131.46	134.91	177.38	6.44	26.53	162.02	211.22	76.73	14.70	12.56

genotypes in the above concerned clusters hold great promise and could be used in hybridization programme to create further novel variability for selection.

The contribution of characters towards the total genetic divergence is important in deciding the characters for selection process. 1000-grain weight contributed maximum towards divergence (37.25%), followed by plant height (30.25%), number of filled grains per panicle (10.66%), number of effective tillers per plant (7.92%), panicle length (6.79%) and days to 50% flowering (5.43%). Remaining characters had very little or no contribution towards genetic divergence and hence were of less importance in this present materials. Similarly, Chakma *et al*. (2012) and Sandhya *et al*. (2014) also reported 1000-grain weight, number of spikelets per panicle and days to 50% flowering to have maximum contribution towards genetic divergence in rice genotypes.

Genotypic and phenotypic correlation coefficients of all the characters studied are presented in Table 4 In general, magnitude of genotypic correlations was higher than corresponding phenotypic correlations for

Table 4. Phenotypic and genotypic correlation coefficient among various yield and yield component traits of Kalanamak advanced lines of rice

Character		Plant height (cm)	Days to 50% flowering	Days to maturity	No. of effective tillers/ plant	Panicle length (cm)	No. of filled grains/ panicle	No. of spikelets/ panicle	Spikelets fertility (%)	1000-grain weight (g)
Plant height (cm)	P	1.000	0.110	0.117	0.020	0.265*	0.286**	0.216*	0.258*	-0.235*
	G	1.000	0.147	0.155	0.008	0.300**	0.360**	0.275**	0.451**	-0.264*
Days to 50% flowering	P		1.000	0.658**	-0.082	-0.212*	0.221*	0.216*	0.061	-0.263*
	G		1.000	0.896**	-0.127	-0.260*	0.285**	0.274**	0.121	-0.321**
Days to maturity	P			1.000	-0.149	-0.160	0.202	0.198	0.062	-0.285**
	G			1.000	-0.235*	-0.282*	0.288**	0.282**	0.107	-0.407**
No. of effective tillers/ plant	P				1.000	-0.091	-0.068	-0.101	0.053	0.039
	G				1.000	-0.113	-0.069	-0.114	0.128	0.048
Panicle length (cm)	P					1.000	-0.093	-0.067	-0.069	0.298**
	G					1.000	-0.126	-0.109	-0.064	0.368
No. of filled grains/ panicle	P						1.000	0.947**	0.286**	-0.411**
	G						1.000	0.974**	0.328**	-0.493**
No. of spikelets/ panicle	P							1.000	-0.027	-0.401**
	G							1.000	0.107	-0.482**
Spikelets fertility (%)	P								1.000	-0.115
	G								1.000	-0.196
1000-grain weight (g)	P									1.000
	G									1.000
Grain yield per plant	P	0.045	0.071	-0.031	0.471**	0.054	0.352**	0.334**	0.074	0.314**
	G	0.070	0.094	-0.053	0.535**	0.098	0.394**	0.372**	0.142	0.349**

(* & ** significant at 5% and 1% level respectively) all the characters indicating strong inherent association among the characters. At phenotypic level, grain yield per plant had significant positive correlation with number of effective tillers per plant (0.471), number of filled grains per panicle (0.352) number of spikelets per panicle (0.334) and 1000-grain weight (0.314). These observations were in agreement with the finding of Naseem *et al*. (2014), Das (2015) and Pradhan *et al*. (2015). Plant height had a significant positive correlation with number of filled grains per panicle (0.286), panicle length (0.265) and number of spikelets per panicle (0.216). Similar results were reported by Nayak *et al*. (2001), Madhavilatha *et al*. (2005) and Chandra *et al*. (2009). Days to 50% flowering showed significant and positive association with days to maturity (0.658), number of filled grains per panicle (0.221) and number of spikelets per panicle (0.216). However, it showed significant and negative association with panicle length (-0.212) and 1000-grain weight (-0.263). The results are in consonance with the findings of Swain and Reddy (2006) and Dhurai *et al*. (2016). Number of filled grains per panicle showed positive association with number of spikelets per panicle (0.947) and spikelet fertility percentage (0.286) while it showed negative correlation with 1000-grain weight (-0.411). Similarly, Bhuvaneswari *et al*. (2016) also observed significant positive association of number of filled grain per panicle with spikelet fertility in F_2 populations of black rice.

An estimate of simple correlation does not provide the clear picture of the characters towards the yield, therefore, it's worthwhile to understand the direct as well indirect effects of various components traits on grain yield. Path coefficient analysis partitions the estimates of simple correlation coefficient into direct and indirect effects and gives an idea about actual contribution of each independent character on dependent characters i.e. yield. Relative contribution (direct or indirect) of components characters to yield helps in assigning appropriate weightage for the purpose of selection. The estimates of direct and indirect effect of component characters on grain yield are presented in Table 5. At the phenotypic level, number of spikelets per panicle (0.597) had the highest positive direct effect on grain yield per plant followed by 1000-grain weight (0.577), number of effective tillers per plant (0.513) and days to 50% flowering (0.130). At genotypic level also, the above mentioned characters had positive direct effect on grain yield per plant however, the magnitude of the effect was greater than at phenotypic level. Grain yield per plant also had positive correlation with number of spikelets per panicle, number of effective tillers per plant and 1000-grain weight, which indicates that direct selection through these traits would be effective for the improvement of grain yield per plant. Our results are

Table 5. Phenotypic (P) and genotypic (G) path coefficient among various yield and yield component traits of Kalanamak advanced lines of rice

Characters		Plant height (cm)	Days to 50% flowering	Days to maturity	No. of effective tillers/ plant	Panicle length (cm)	No. of filled grains/ panicle	No. of spikelets/ panicle	Spikelets fertility (%)	1000-grain weight (g)	Correlation with grain yield/plant
Plant height (cm)	P	-0.005	0.014	0.001	0.010	0.002	-0.001	0.128	0.032	-0.136	0.045
	G	0.019	0.008	0.021	0.006	-0.045	-4.955	3.825	1.458	-0.267	0.070
Days to 50% flowering	P	-0.001	0.130	0.001	-0.042	-0.001	-0.001	0.129	0.008	-0.152	0.071
	G	0.003	0.053	0.120	-0.092	0.039	-3.916	3.820	0.391	-0.324	0.094
Days to maturity	P	-0.001	0.086	0.001	-0.077	-0.001	-0.001	0.118	0.008	-0.165	-0.031
	G	0.003	0.048	0.134	-0.171	0.043	-3.967	3.921	0.346	-0.410	-0.053
No. of effective tillers/ plant	P	0.000	-0.011	0.000	0.513	-0.001	0.000	-0.061	0.007	0.023	0.471
	G	0.000	-0.007	-0.032	0.726	0.017	0.953	-1.586	0.415	0.048	0.535
Panicle length (cm)	P	-0.001	-0.028	0.000	-0.047	0.006	0.000	-0.040	-0.009	0.172	0.054
	G	0.006	-0.014	-0.038	-0.082	-0.151	1.729	-1.517	-0.207	0.371	0.098
No. of filled grains/ panicle	P	-0.002	0.029	0.000	-0.035	-0.001	-0.003	0.565	0.036	-0.237	0.352
	G	0.007	0.015	0.039	-0.050	0.019	-13.761	13.560	1.063	-0.497	0.394
No. of spikelets/ panicle	P	-0.002	0.028	0.001	-0.052	0.000	-0.003	0.597	-0.003	-0.231	0.334
	G	0.005	0.015	0.038	-0.083	0.016	-13.402	13.923	0.346	-0.487	0.372
Spikelets fertility (%)	P	-0.001	0.008	0.000	0.027	0.001	-0.001	-0.017	0.125	-0.066	0.074
	G	0.009	0.007	0.014	0.093	0.010	-4.519	1.489	3.237	-0.198	0.142
1000-grain weight (g)	P	0.001	-0.034	0.000	0.020	0.002	0.001	-0.239	-0.014	0.577	0.314
	G	-0.005	-0.017	-0.055	0.035	-0.055	6.785	-6.713	-0.634	1.009	0.349

Residual effect. Phenotypic: 0.599, Genotypic: 0.244

more or less similar with findings of Khedikar *et al*. (2004), Zia-ul-Qamar *et al.* (2005) and Mohammad *et al.* (2013). Number of spikelets per panicle also had the highest indirect effect on grain yield *via* number of filled grains per panicle (0.565, 13.56), days to 50% flowering (0.129, 3.820), plant height (0.128, 3.825) and days to maturity (0.118, 3.921). Therefore, it may be considered that number of spikelets per panicle has maximum direct as well as indirect influence on grain yield per plant. Similar result was also reported by Cheema *et al*. (1998) in basmati rice. 1000-grain weight had positive indirect effect on grain yield per plant *via* panicle length (0.172, 0.371) and number of effective tiller per plant (0.023, 0.048). Days to 50% flowering had positive indirect effect on grain yield *via* days to maturity (0.086, 0.048), number of filled grains per panicle (0.029, 0.015) and number of spikelet per panicle (0.028, 0.015), however it had negative indirect effect *via* 1000-grain weight (-0.034, -0.017) and panicle length (-0.028, -0.014). The present finding is in conformity with result of Patil and Sahu (2009) who similarly reported days to 50% flowering had positive indirect effect on grain yield via number of filled grain per panicle and negative indirect *via* 100-seed weight in rice accessions. Number of effective tillers per plant had positive indirect effect on grain yield per plant *via* spikelet fertility percentage (0.027, 0.093) and 1000-grain weight (0.020, 0.035) and it showed negative indirect effect *via* days to maturity (-0.077, -0.171), number of spikelets per panicle (-0.052, -0.083), panicle length (-0.047, -0.082), days to 50% flowering (-0.042, -0.092) and number of filled grains per panicle (-0.035, -0.050). Spikelet fertility percentage had positive indirect effect on grain yield per plant *via* number of filled grains per panicle (0.036, 1.063), plant height (0.032, 1.458) and negative indirect effect *via* 1000-grain weight (-0.014, -0.634).

Selection of yield component traits having high contribution towards the total genetic divergence as well as positive significant association on grain yield may be helpful in identifying genetically diverse Kalanamak aromatic advanced lines, particularly to be exploited in further hybridization to execute efficient selection in segregating generations.

Acknowledgment

The authors are thankful to the Department of Biotechnology Govt. of India (DBT-PMS Phase-II, Project Code: 7003) for financial support to carry out the work.

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